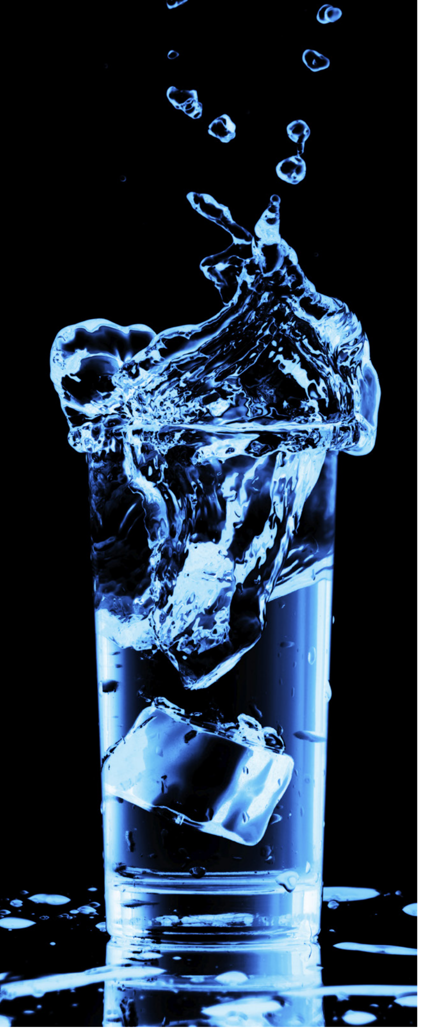

2016

City of Bellevue

Water System Plan

Volume 2 | Appendixes





Volume 2 – Appendixes

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Appendix A

SEPA Documentation

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DEVELOPMENT SERVICES DEPARTMENT
ENVIRONMENTAL COORDINATOR
450 110th Ave NE
BELLEVUE, WA 98009-9012

DETERMINATION OF NON-SIGNIFICANCE

PROPONENT: City of Bellevue Utilities Department

LOCATION OF PROPOSAL: City-wide

DESCRIPTION OF PROPOSAL: Update of City of Bellevue Utilities Department functional plan that evaluates the existing water system, identifies current and future needs, and develops a plan to meet those needs. Application has been re-noticed to extend the comment period from December 3, 2015 until December 18, 2015 to match prior notice provided by Utilities for other purposes. .

FILE NUMBERS: 15-126320-LM **PLANNER:** Michael N Paine

The Environmental Coordinator of the City of Bellevue has determined that this proposal does not have a probable significant adverse impact upon the environment. An Environmental Impact Statement (EIS) is not required under RCW 43.21C.030(2)(C). This decision was made after the Bellevue Environmental Coordinator reviewed the completed environmental checklist and information filed with the Land Use Division of the Development Services Department. This information is available to the public on request.

☐ There is no comment period for this DNS. There is a 14-day appeal period. Only persons who submitted written comments before the DNS was issued may appeal the decision. A written appeal must be filed in the City Clerk's office by 5:00 p.m. on _______________.

☒ This DNS is issued after using the optional DNS process in WAC 197-11-355. There is no further comment period on the DNS. There is a 14-day appeal period. Only persons who submitted written comments before the DNS was issued may appeal the decision. A written appeal must be filed in the City Clerk's Office by 5 p.m. on **2/11/2016**

☐ This DNS is issued under WAC 197-11-340(2) and is subject to a 14-day comment period from the date below. Comments must be submitted by 5 p.m. on _______. This DNS is also subject to appeal. A written appeal must be filed in the City Clerk's Office by 5:00 p.m. on ______________.

This DNS may be withdrawn at any time if the proposal is modified so as to have significant adverse environmental impacts; if there is significant new information indicating a proposals probable significant adverse environmental impacts (unless a non-exempt license has been issued if the proposal is a private project): or if the DNS was procured by misrepresentation or lack of material disclosure.

_______________________________________ **1/28/2016** __________
Environmental Coordinator Date

OTHERS TO RECEIVE THIS DOCUMENT:

☐ State Department of Fish and Wildlife / Stewart.Reinbold@dfw.gov; Christa.Heller@dfw.wa.gov;
☐ State Department of Ecology, Shoreline Planner N.W. Region / Jobu461@ecy.wa.gov; sepaunit@ecy.wa.gov
☐ Army Corps of Engineers Susan.M.Powell@nws02.usace.army.mil
☐ Attorney General ecyolyef@atg.wa.gov
☐ Muckleshoot Indian Tribe Karen.Walter@muckleshoot.nsn.us; Fisheries.fileroom@muckleshoot.nsn.us

ENVIRONMENTAL CHECKLIST

11/4/15

If you need assistance in completing the checklist or have any questions regarding the environmental review process, please visit or call the Permit Center (425-452-6864) between 8 a.m. and 4 p.m., Monday through Friday (Wednesday, 10 to 4). Our TTY number is 425-452-4636.

BACKGROUND INFORMATION

Property Owner: N/A

Proponent: City of Bellevue Utilities Department

Contact Person: Douglas Lane, PE

Address: Utilities Department
City of Bellevue
PO Box 90012
Bellevue, WA 98009-9012

Phone: (425) 452-6865

Proposal Title: City of Bellevue Draft Water System Plan

Proposal Location: N/A

Give an accurate, brief description of the proposal's scope and nature:

1. General description:

The City of Bellevue Draft Water System Plan (the Plan) is an update to the City of Bellevue's 2006 Water Comprehensive Plan, as required by Washington Administrative Code WAC 246-290-100 and consistent with Bellevue's Comprehensive Plan Policy UT-12. The general purpose of the Plan is to evaluate the existing water system, identify current and future needs, and develop a plan to meet those needs. Additionally, the Plan is intended to:

- *Disseminate information and develop consensus among stakeholders*
- *Document water utility-specific policies*
- *Serve as a reference document for City of Bellevue staff and for partner utilities*
- *Comply with, and demonstrate conformance with applicable regulations*

The Plan benefits Bellevue's water utility ratepayers by documenting policies and procedures, by characterizing trends in population, employment, and water use, and by identifying problems and opportunities for the water system. The Plan also allows for coordination with neighboring utilities.

Failure to develop a water system plan would leave the City vulnerable to future water supply shortages, increase the risks of system failure, negatively impact public safety and homeowners insurance rates (through the Washington Surveying & Ratings Bureau), and violate Washington state law.

Numerous studies and evaluations were completed during Plan development:

- *Review of system history, service area and assets*
- *Review of water utility general policies*
- *Review of water consumption patterns and system planning criteria;*
- *Revised service area population forecasts;*
- *Complete re-build and calibration of a water distribution system hydraulic model;*
- *Re-evaluation of system capacity and operating parameters;*
- *Evaluations to address specific issues:*
  - *LH520 Zone pressure alternatives*
  - *EOA-WOA Transmission Evaluation*
  - *SA270 Zone pressure and fire flow improvements*
  - *Location-specific analysis to improve fire flow and/or increase pressure*
- *System-Wide Storage Evaluation;*
- *Emergency Well Evaluation;*
- *Updated descriptions of water asset management and operational practices; and*
- *Updated recommendations for a 20-year planning horizon*

As part of planning to meet current and future needs, the Plan recommends specific programs and projects. The limited, generalized information that is currently known about these projects and programs is presented below. More detailed information would become available for each project during preliminary design studies, and provided in separate SEPA documentation for each specific project.

Recommended water system improvements fall into three general categories:

- ***Existing System Improvements**. These projects enhance emergency preparedness, improve system reliability, and/or address known deficiencies in the existing system.*
- ***System Capacity Expansion to meet Planned Growth**. These projects and programs add system capacity to meet the needs of forecasted future development.*
- ***Infrastructure Renewal and Replacement**: These projects and programs are intended to manage the number and severity of system failures due to age.*

Within each of these categories, some projects are recommendations that are currently funded in the City's Capital Investment Program (CIP), while others are proposed new recommendations to address emerging issues. For each project, detailed information would be provided in a project-specific SEPA review at the appropriate time.

2. Acreage of site: *The service area covers over 37 square miles.*
3. Number of dwelling units/buildings to be demolished: *0*
4. Number of dwelling units/buildings to be constructed: *0*
5. Square footage of buildings to be demolished: *Not applicable (N/A)*
6. Square footage of buildings to be constructed: *N/A*
7. Quantity of earth movement (in cubic yards): *N/A*
8. Proposed land use: *The Plan is based on existing zoning and comprehensive land use.*
9. Design features, including building height, number of stories, and proposed exterior materials: *N/A*
10. Other:

Estimated date of completion of the proposal or timing of phasing:

Timing for the various recommended projects varies, but would be consistent with the City's existing and future Capital Investment Plans (CIPs).

Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

Yes. Future recommended activity is described in Chapter 9 of the Plan and in the City's water CIP. Although other specific areas of expansion or timing cannot be precisely identified, in general the system would expand (1) for additional capacity to accommodate future growth as required by the City's Comprehensive Plan policies, (2) to address system deficiencies as required by applicable regulations and/or City policy, and (3) ongoing system renewal & replacement.

List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.

Geotechnical reports, wetlands evaluations, and other environmental information will be prepared for applicable projects, but are not yet available for most projects. These will be available as part of the project-specific SEPA process for all projects. Some information pertinent to emergency well development is provided in Appendix N.

Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain. List dates applied for and file numbers, if known.

Permit applications are not yet available, but will be available as part of the project-specific SEPA process for all projects.

List any government approvals or permits that will be needed for your proposal, if known. If permits have been applied for, list application date and file numbers, if known.

Future government approvals will be required for each recommended project. The type of approvals will generally be permits related to construction work such as building, right-of-way use and clearing and grading permits. Some projects in environmentally sensitive areas may require additional permits such as critical areas land use permits, shoreline substantial development permits and/or a range of state and federal permits for work below ordinary high water in streams and hydraulically connected wetlands, etc.

Please provide one or more of the following exhibits, if applicable to your proposal.
(Please check appropriate box(es) for exhibits submitted with your proposal):

☐ Land Use Reclassification (rezone) Map of existing and proposed zoning

N/A. The Draft Water System Plan supports the land use adopted as part of the City of Bellevue Comprehensive Plan.

☐ Preliminary Plat or Planned Unit Development
Preliminary plat map

N/A. No plats or planned unit developments are proposed as part of the Plan.

☐ Clearing & Grading Permit
Plan of existing and proposed grading
Development plans

N/A. Project-specific SEPA documents with this information will be prepared when appropriate.

☐ Building Permit (or Design Review)
Site plan
Clearing & grading plan

N/A. Project-specific SEPA documents with this information will be prepared when appropriate.

☐ Shoreline Management Permit
Site plan

N/A. Project-specific SEPA documents with this information will be prepared when appropriate.

A. ENVIRONMENTAL ELEMENTS

1. Earth

a. General description of the site: ☑ Flat ☑ Rolling ☑ Hilly ☑ Steep slopes ☑ Mountains ☑ Other

The Draft Water System Plan covers Bellevue's 37 square mile water service area.

b. What is the steepest slope on the site (approximate percent slope)?

Limited portions of the Bellevue water service area naturally exceed 40 percent grade. Most portions of the service area are flat to gently rolling.

c. What general types of soil are found on the site (for example, clay, sand, gravel, peat, and muck)? If you know the classification of agricultural soils, specify them and note any prime farmland.

A variety of soils are found throughout Bellevue's water service area. Information on specific sites would be gathered as part of early project planning, and would be provided in project-specific SEPA documentation.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

There are very limited areas of both unstable soils and coal mine hazards. Environmental review of projects designed to implement the Water System Plan, when adopted, would consider soil conditions during the early design phase.

e. Describe the purpose, type, and approximate quantities of any filling or grading proposed. Indicate source of fill.

Unknown (would be provided in project-specific SEPA checklists and grading permits)

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

Yes. Erosion potential would generally be minimal and limited to water main flushing for maintenance. For pipeline construction in road rights-of-way, ground disturbance is typically in paved areas with established stormwater controls, where erosion potential would be limited. Specific projects may have erosion potential, however (project-specific SEPA would provide additional detail not known at this time). All significant water system projects are subject to erosion and sedimentation control measures and include a Construction Storm Water Pollution Prevention Plan, CSWPPP.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

N/A. The Plan applies to the entire water service area. Where applicable, information would be provided in project-specific SEPA documentation for specific project sites.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

Water utility staff are trained to use stormwater and erosion control best management practices (BMPs) during water main flushing and maintenance activities. In general, each pipeline construction project would (1) implement stormwater BMPs, (2) restrict wet-season excavation work, (3) include spill response plans in case of accidental discharge, and (4) follow all applicable regulations and permit conditions. All significant water system projects are subject to erosion and sedimentation control measures and include a Construction Storm Water Pollution Prevention Plan, CSWPPP.

2. AIR

a. What types of emissions to the air would result from the proposal (i.e. dust, automobile odors, and industrial wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities if known.

Permanent Impacts: *Some increased diesel emissions (to air) would be likely as a result of adding standby generators at pump stations that do not already have them, and at well pumps if applicable. These emissions would only occur during periodic maintenance and testing, and continuously during electrical power outages.*

Temporary Impacts: *Some temporary increases in air pollution could occur during construction projects. Air pollution could result from diesel emissions from construction equipment.*

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

No

c. Proposed measures to reduce or control emissions or other impacts to the air, if any:

None. Impacts to air are generally minimal or temporary, and would typically only be created with the goal of increasing the reliability of critical water supply infrastructure. The City of Bellevue Utilities includes requirements in construction projects to use well maintained equipment and to turn off idling equipment when not in use. Dust control is required where appropriate.

3. WATER

a. Surface

(1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

Yes. The City's water service area borders Lake Washington and Lake Sammamish. The service area also includes Mercer Slough, approximately 82 miles of streams within the Bellevue city limits alone (not including neighboring cities in Bellevue's water service area), and 3 small lakes (Larsen Lake, Lake Bellevue, and Phantom Lake).

(2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If Yes, please describe and attach available plans.

Yes, the Plan identifies likely projects that would be within 200 feet of these water bodies. Each of these projects is subject to applicable local, state and federal permit reviews and conditions.

(3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

N/A

(4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

No.

(5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

There are 100-year floodplains within the Utility service area and known infrastructure in those floodplains. Any actions within the floodplains would be covered under individual project specific SEPA actions. No known projects would lie within the 100-year floodplain.

The vast majority of water infrastructure is not close to the 100-year floodplain. Some existing water lines are located in stream, wetland and shoreline areas subject to inundation during a one-hundred year event. Work would only occur in the flood plain if one of these existing mains were to break, requiring emergency repairs.

(6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

Yes. The Draft Water Plan supports continued water main flushing performed routinely by operations and maintenance staff results in direct, clean water discharges to storm drains, following dechlorination and implementation of stormwater best management practices (BMPs).

b. Ground

(1) Will ground water be withdrawn, or will water be discharged to ground water? Give general description.

No. The Plan does recommend perfecting existing water rights, however that would only occur after a master plan was developed with its own SEPA process and individual projects were developed from that Plan, each with their own permitting and SEPA process.

(2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals...; agricultural; etc.) Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

None.

c. Water Runoff (Including storm water)

(1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

N/A. Any proposed projects would be constructed in conformance with current stormwater code requirements, and would undergo a project-specific SEPA review.

(2) Could waste materials enter ground or surface waters? If so, generally describe.

N/A. Project-specific SEPA documents with this information will be prepared when appropriate.

d. Proposed measures to reduce or control surface, ground, and runoff water impacts, if any:

Stormwater BMPs and dechlorination are used to reduce or eliminate impacts to surface water during water main flushing.

Each construction project would undergo its own separate project-specific SEPA process. During that process, more detailed and specific information would be provided.

4. Plants

a. Check or circle types of vegetation found on the site:

- ☑ deciduous tree: alder, maple, cottonwood, other
- ☑ evergreen tree: fir, cedar, pine, other
- ☑ shrubs
- ☑ grass
- ☑ pasture
- ☑ crop or grain
- ☑ wet soil plants: cattail, buttercup, bulrush, skunk cabbage, other
- ☑ water plants: water lily, , milfoil, other
- ☑ other types of vegetation

A wide range of plants are found in the city.

b. What kind and amount of vegetation will be removed or altered?

Individual construction projects that may come out of the plan recommendations would be subject to applicable local, state and federal permit review that will identify impacts and mitigation measures in the SEPA checklist for each project. Vegetation retention and replacement are subject to the requirements of the City of Bellevue landscape code and codes of adjacent cities within the Utilities service area.

c. List threatened or endangered species known to be on or near the site.

The Draft Water Plan service area is within the range of three threatened or endangered fish species including Chinook, Steelhead and Bull Trout. Prior to any project within lakes or streams, potential impacts on resident populations are considered and subject to review through local, state and federal permit agencies.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

None for this Plan. Projects identified in the Draft Water System Plan are subject to the landscape code of each of the cities within the service area. Additionally, projects within sensitive wetland, stream or lakes is subject to native vegetation planting requirements.

5. ANIMALS

a. Check or circle any birds and animals which have been observed on or near the site or are known to be on or near the site:

☑ Birds: hawk, heron, eagle, songbirds, other:

☑ Mammals: deer, bear, beaver, raccoon other:

☑ Fish: bass, salmon, trout, other:

Most or all of the species listed are found in the City, except bear which only occasionally enter the City from wildlands outside of the City.

b. List any threatened or endangered species known to be on or near the site.

Bellevue is within the range of Chinook Salmon, Steelhead, and Bull Trout.

c. Is the site part of a migration route? If so, explain.

Migration routes of anadromous fish and wildfowl exist within the City.

d. Proposed measures to preserve or enhance wildlife, if any:

None at this time. Project-specific SEPA documents with this information will be prepared when appropriate. Construction timing (work windows) and vegetation replacement are required to mitigate impacts of specific projects constructed consistent with the Draft Water System Plan.

6. Energy and Natural Resources

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy need? Describe whether it will be used for heating, manufacturing, etc.

N/A. Project-specific SEPA documents with this information will be prepared when appropriate.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

No

c. What kinds of energy conservation features are included in the plans of the proposal? List other proposed measures to reduce or control energy impacts, if any:

N/A. Project-specific SEPA documents with this information will be prepared when appropriate.

7. Environmental Health

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste that could occur as a result of this proposal? If so, describe.

None.

(1) Describe special emergency services that might be required.

There are no known emergency services that would be required by the Plan.

(2) Proposed measures to reduce or control environmental health hazards, if any.

N/A. Project-specific SEPA documents with this information will be prepared when appropriate.

b. Noise

(1) What types of noise exist in the area which may affect your project (for example, traffic, equipment, operation, other)?

There are no known noises that would affect the water utility.

(2) What types and levels of noise would be created by or associated with the project on a short-term or long-term basis (for example, traffic, construction, operation, other)? Indicate what hours noise would come from the site.

N/A. Project-specific SEPA documents with this information will be prepared when appropriate.

(3) Proposed measures to reduce or control noise impacts, if any:

N/A. Project-specific SEPA documents with this information will be prepared when appropriate.

8. Land and Shoreline Use

a. What is the current use of the site and adjacent properties?

There is a variety of land uses throughout Bellevue's water service area, including multiple densities of residential, commercial and industrial use, as well public spaces such as parks and schools.

b. Has the site been used for agriculture? If so, describe.

Bellevue's water service area no longer includes significant agriculture, except for the Mercer Slough and Larsen Lake Blueberry Farms.

c. Describe any structures on the site.

Above-grade structures pertinent to Bellevue's existing and proposed water facilities typically include reservoirs, pump stations and on-site generator enclosures. Below-grade structures include vaults for pressure reducing valves, meters, and other underground equipment.

d. Will any structures be demolished? If so, what?

Five existing reservoirs are recommended for evaluation for demolition. Until site specific evaluations are conducted, demolition of existing structures cannot be certain. Each project will undergo its own site specific permit and SEPA process.

A small number (0-3) of City-owned pump station buildings may be demolished, however this not known at this time. Each project would undergo its own separate project-specific SEPA process.

At this time, there are no known dwelling units that would be demolished as a result of the Plan.

e. What is the current zoning classification of the site?

There is a variety of zoning classifications throughout Bellevue's water service area.

f. What is the current comprehensive plan designation of the site?

There is a variety of comprehensive plan designations throughout Bellevue's water service area.

g. If applicable, what is the current shoreline master program designation of the site?

There is a variety of shoreline designations throughout Bellevue's water service area.

h. Has any part of the site been classified as an “environmentally sensitive” area? If so, specify.

A variety of areas in Bellevue are classified as environmentally sensitive, particularly critical areas including streams, wetlands, steep slopes, shorelines and flood hazard areas.

I. Approximately how many people would reside or work in the completed project?

No housing is proposed at any water system structures or properties. Each reservoir or pump station site is typically visited by 2-3 utility staff on a weekly basis for routine maintenance, and as needed for repair or in response to alarms.

j. Approximately how many people would the completed project displace?

None.

k. Proposed measures to avoid or reduce displacement impacts, if any:

N/A

i. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

The City of Bellevue’s policies require the Utilities Department to support proposed land use and the City’s Comprehensive Plan. The Plan is compatible with the City’s Comprehensive Plan, as required by the City Council. See Comprehensive Plan policies UT-4 and ED-21.

9. Housing

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

Zero units would be provided. However, system expansion would occur to support development by others, in accordance with City Comprehensive Plan policies.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

None known at this time.

c. Proposed measures to reduce or control housing impacts, if any:

The only known impacts of the Plan on housing are positive (no known negative impacts). The Plan provides for adequate water supply for current and future housing.

10. Aesthetics

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

The Plan recommends replacing three reservoirs: Horizon View 1, Horizon View 2 and Pikes Peak. Although the height of replacement tanks is not known at this time, the tallest of these existing tanks is Horizon View 1, at less than 40-feet tall. Each replacement would be required to conduct a project level SEPA where the full description of impacts and mitigation would be detailed.

b. What views in the immediate vicinity would be altered or obstructed?

N/A

c. Proposed measures to reduce or control aesthetic impacts, if any:

The City makes each project known to the surrounding neighborhood, and considers community input for design of above-grade structures.

11. Light and Glare

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

N/A

b. Could light or glare from the finished project be a safety hazard or interfere with views?

Unknown. Project-specific SEPA documents with this information will be prepared when appropriate.

c. What existing off-site sources of light or glare may affect your proposal?

Unknown. Project-specific SEPA documents with this information will be prepared when appropriate.

d. Proposed measures to reduce or control light or glare impacts, if any:

N/A. Project-specific SEPA documents with this information will be prepared when appropriate.

12. Recreation

a. What designated and informal recreational opportunities are in the immediate vicinity?

There is a variety of recreational opportunities throughout Bellevue's water service area.

b. Would the proposed project displace any existing recreational uses? If so, describe.

No. As individual projects are developed, project specific SEPA documentation would identify all impacts and mitigation measures.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

N/A. Project-specific SEPA documents with this information will be prepared when appropriate.

13. Historic and Cultural Preservation

a. Are there any places or objects listed on, or proposed for, national, state, or local preservation registers known to be on or next to the site? If so, generally describe.

There is a variety of historic resources throughout Bellevue's water service area.

b. Generally describe any landmarks or evidence of historic, archeological, scientific, or cultural importance known to be on or next to the site.

N/A. Project-specific SEPA documents with this information will be prepared when appropriate.

c. Proposed measures to reduce or control impacts, if any:

N/A. Project-specific SEPA documents with this information will be prepared when appropriate.

14. Transportation

a. Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans, if any.

The water service area encompasses all of the City of Bellevue, Clyde Hill, and Medina, the Towns of Hunts Point and Yarrow Point, and small portions of the City of Issaquah (South Cove Area), the City of Kirkland (east of Watershed Park) and unincorporated King County.

b. Is site currently served by public transit? If not, what is the approximate distance to the nearest transit stop?

There is a variety public transit routes throughout Bellevue's water service area.

c. How many parking spaces would be completed project have? How many would the project eliminate?

N/A. Project-specific SEPA documents with this information will be prepared when appropriate.

d. Will the proposal require any new roads or streets, or improvements to existing roads or streets, not Including driveways? If so, generally describe (indicate whether public or private).

N/A. Project-specific SEPA documents with this information will be prepared when appropriate.

e. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

N/A. Project-specific SEPA documents with this information will be prepared when appropriate.

f. How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur.

N/A. Project-specific SEPA documents with this information will be prepared when appropriate.

g. Proposed measures to reduce or control transportation impacts, if any:

N/A. Project-specific SEPA documents with this information will be prepared when appropriate.

15. Public Services

a. Would the project result in an increased need for the public services (for example: fire protection, police protection, health care, schools, other)? If so, generally describe.

No

b. Proposed measures to reduce or control direct impacts on public services, if any.

Not applicable

16. Utilities

a. Circle utilities currently available at the site: electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other.

A variety of utility facilities are available throughout Bellevue's water service area.

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.

Water services would be provided by the Plan to customers in Bellevue's water service area.

Electricity would be required for reservoir, pump station, meters, wells, and other facilities, provided by Puget Sound Energy.

Signature

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature...

Date Submitted.....11/4/2015...

SUPPLEMENTAL SHEET FOR NONPROJECT ACTION

Continuation of the Environmental Checklist

4/18/02

Because these questions are very general, it may be helpful to read them in conjunction with the list of the elements of the environment (see Environmental Checklist, B. Environmental Elements). When answering these questions, be aware of the extent the proposal, or the types of activities likely to result from the proposal, would affect the item at a greater intensity or at a faster rate than if the proposal were not implemented. Respond briefly and in general terms. If you have any questions, please visit or call Development Services (425-452-6800) between 8 a.m. and 4 p.m., Monday through Friday (Wednesday, 10 to 4). Assistance for the hearing impaired: Dial 711 (Telecommunications Relay Service).

1. How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?

   The Water System Plan (the Plan) would not directly increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise. The Plan does identify water system deficiencies and recommends further evaluation and/or projects to address known concerns. For each project, detailed information on environmental impacts would be provided in a project-specific SEPA review at the appropriate time.

   Proposed measures to avoid or reduce such increases are:

   None.

2. How would the proposal be likely to affect plants, animals, fish, or marine life?

   The Water System Plan (the Plan) would not directly impact plants, animals, fish, or marine life. Most water infrastructure is buried (pipes, manholes, etc), so the system components typically have negligible effect on plants, animals, fish and marine life.

   Some temporary impacts to plants, animals, fish and marine life could potentially occur during construction projects. Most water projects occur in public rights-of-way, which are already impacted by streets and roads and do not support plant or animal habitat. Other projects are located on City-owned property that is already developed.

   Proposed measures to protect or conserve plants, animals, fish, or marine life are:

   For each project, detailed information on measures to protect or conserve plants, animals, fish, or marine life would be provided in a project-specific SEPA review at the appropriate time. Capital projects developed to meet the Water System Plan would be subject to appropriate local, state and federal permits. Projects with impacts are subject to mitigation requirements including follow-on monitoring.

3. How would the proposal be likely to deplete energy or natural resources?

   The Plan itself would not likely deplete energy or natural resources. Ongoing operations & maintenance activities use fossil fuels in vehicles to transport maintenance crews and equipment to system infrastructure. Spare parts and/or replacement piping are used when needed for maintenance. Operation of reservoirs, pump stations and wells require electricity.

   Construction projects would require fossil fuels to operate construction vehicles, as well as for the manufacture and delivery of construction materials. Construction materials themselves would require natural resources such as minerals (concrete additives, etc), rubber (pipe gaskets, tires, etc) metals (ductile iron pipe), petroleum products for plastics (PVC, paints, epoxies, etc), graded aggregate (sand, gravel, etc), and others.

   Some water system components, when installed, such as water pumps and emergency backup generators, would require energy during the life of those water system components.

   Proposed measures to protect or conserve energy or natural resources are:

   The Plan Volumes 2, 3 and 4 will only be printed in hard copy on request, to conserve resources.

   Operations & maintenance vehicles are well-maintained at Bellevue's Service Center to avoid leaks and optimize fuel economy. Maintenance crews only drive where needed to perform maintenance activities. Pumps are appropriately sized to provide reasonable efficiency in the pertinent operating conditions. The recommended pump station rehabilitations would improve efficiency to conserve energy.

   The water utility uses efficient pumps with advanced controls to minimize energy use. Regular maintenance of the equipment reduces energy use over the life time of the equipment.

4. How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands?

   The majority of the plan would have no effect on environmentally sensitive areas or areas designated for governmental protection..

   Proposed measures to protect such resources or to avoid or reduce impacts are:

   First, alternatives that avoid impacts to environmentally sensitive areas including parks, would be considered. Where project impacts to sensitive areas or parks become necessary, design features would be included to reduce impacts such as directional drilling. Project-specific SEPA documentation will detail this information as appropriate.

5. How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?

   The Water System Plan is designed to support the land use plan of the jurisdictions within the service area. The adopted land use plans are required to be consistent with the State Growth Management Act.

   Proposed measures to avoid or reduce shoreline and land use impacts are:

   Water system projects needed to support the land use plan in shoreline and other environmentally sensitive parts of the jurisdictions within the service area would first consider alternatives that do not include impacts to shorelines or other sensitive areas. Second, water system projects needed to support the densities and use within the GMA land use plans would consider design options that limit impacts to these same shoreline and other sensitive areas.

6. How would the proposal be likely to increase demands on transportation or public services and utilities?

   The Plan itself would not increase demands on water utilities, wastewater utilities, or on Public Services (Police, Fire, etc). In general the Plan is intended to respond to and <u>alleviate</u> increased demands on water utilities, and also to improve fire protection services.

   Construction projects would temporarily increase demands on the local and regional transportation networks, to allow for delivery of construction materials and equipment and for travel of construction workers.

   Proposed measures to reduce or respond to such demand(s) are:

   Consider project alignments and construction techniques that reduce impact on transportation networks during construction and for access to the water system facilities for ongoing maintenance.

7. Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.

   The Water System Plan has been developed to support and be consistent with the adopted GMA compliant land use plans of the jurisdictions within the service area. All construction projects needed to implement the plan and provide adopted water service levels are required to comply with applicable local, state and federal \ laws and permit requirements. Construction contracts for specific projects would require compliance with local, state, or federal laws or requirements for the protection of the environment.

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BY D. Lane DATE 1/21/2016 CHECKED BY ______ DATE ______

#	Name	Date	Comment	Response
1	James Bloomfield (14000 SE 45th Court)	11/2/2015	(paraphrased; see email for full comment) As a member of the Cascade Water Alliance Bellevue must insist on the development of moderate altitude reservoirs to catch seasonal rain water rather than letting it flood lands adjacent to rivers and flow uncollected to Puget Sound. Lake Keecheless is fine for the Yakima basin – what about the future needs of the eastside communities? We must start doing something now to be ready when the need is upon us.	Thanks for your email. We appreciate your concerns and are working with Cascade Water Alliance on short term and long term water supply needs. You might be interested in the proposed development of Bellevue's existing water rights for emergency wells, as backup supplies. (Inventory on pages 1-32 and 1-33; analysis in Section 4.9 / page 4-45; rights info in Appendix C; more analysis in Appendix N).
2	Diann Strom (ESC*)	11/17/2015	Page ES-8: "2000's" should be "2000s". AP style says you shouldn't have the apostrophe. That would be a change throughout the document.	Incorporated.
3	Diann Strom (ESC*)	11/17/2015	Page 4-9: Don't start sentences with numerals "70 flow tests were conducted…" Should be "Seventy flow tests were conducted…"	Incorporated, except in cases where the number is a year.
4	Diann Strom (ESC*)	11/17/2015	Page 6-20: This sentence doesn't make sense "Excessive different types of fire hydrants to maintain"	Re-worded to complete sentence, and added text to clarify the issue.
5	Diann Strom (ESC*)	11/17/2015	Page 7-17: Should "Long Term Lead and Copper Rule Revisions" font be a section header level?	Yes. Change incorporated.
6	Diann Strom (ESC*)	11/17/2015	What is an example of Bellevue's leadership in water policy and decision-making? "Take a leadership role in influencing regional water policy and decision-making, in the interests of the City and Bellevue's ratepayers"	O&M staff have been very active in crafting WA DOH guidance on main break response, and are now participating in development of rules regarding "premise isolation" backflow prevention, and how to protect customers that share a building with a "high hazard" water user (e.g. condos with a dentist office).
7	Diann Strom (ESC*)	11/17/2015	When was the last time the Emergency Management Plan was updated?	Annually

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8	Diann Strom (ESC*)	11/17/2015	How does the city determine whether to have an on-site or portable generator at pump stations?	We don't have a formal policy or procedure; it is up to engineering judgment. The WSP recommends an evaluation of the risks associated with long-term power outage.
9	Diann Strom (ESC*)	11/17/2015	What's the lifespan of a PRV? I noticed some date back to 1972.	PRVs used to wear out in 10-20 years due to corrosion. When they started coating them with epoxy, lifespan increased significantly.
10	Diann Strom (ESC*)	11/17/2015	Why was water use so high in 2009? Drought? [graphs in Chp 3]	See Figure 3-13. Max day demand correlates well with the highest observed temperature (hottest day), which in 2009 was over 103F at Sea-Tac. Average day demand was actually slightly higher in 2006; Figure 3-14 shows 2006 and 2009 were hot summers overall, as measured by cooling degree days. Drought (lack of rain or snowpack) and hot weather aren't necessarily correlated. During a drought we would actually anticipate less water usage due to public outreach and voluntary curtailment (see 1992 data in Figure 5-1).
11	Diann Strom (ESC*)	11/17/2015	Why is school water use so high? Fig. 3-19	Peaking factor is relative to average flow of each individual curve (not an absolute flow comparison). School peaking factors are high at lunchtime (relative to average flow at a school throughout the day) because there is almost no flow overnight or in the early morning, and kids are in class for most of the late morning and afternoon. Lunch and recess are water-intensive.
12	Diann Strom (ESC*)	11/17/2015	How long does it take to develop a storage facility? If our need is 2034…I assume the process would start as early as 2024.	If property already exists and limited distribution system improvements are needed, 2-4 years is a reasonable amount of time, depending on the size of reservoir. In our case, siting is not obvious so we would need to allow time for site selection and possibly public outreach.
13	Lisa Tompkins (PO Box 3233, 98009)	11/19/2015	I support the recommendation to explore and develop a plan to create an emergency water supply from the existing wells.	Noted.

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14	Loretta Lopez	11/19/2015	[paraphrased; verbal comment from ESC meeting]: I am concerned that the SEPA period is not long enough, and there is not enough information about Pikes Peak Reservoir. Will there be another SEPA period for Pikes Peak Reservoir?	This public comment period is on the overall Water System Plan and the specific recommendations made. The Plan identifies issues associated with Pikes Peak Reservoir and potential options, but does not recommend a specific solution. A separate SEPA process regarding Pikes Peak Reservoir will occur following alternatives analysis.
15	David Plummer	11/26/2015	Add an exhaustive listing of all references used to prepare, or referred to in the water system plan.	A reference list has been added.
16	David Plummer	11/26/2015	Chapter 1 should be revised to add a a new figure and short explanatory text to show that the Water System is one of three 'systems' within the Bellevue Water Works system; a chart similar to the attached should be included.	We did not add this because we feel it would be confusing. The Utilities organizational structure is mentioned in Sections 1.2, 2.7 (Waterworks Utility Financial Policies), and 6.2, and in the 2015 Utilities Business Profile (available on-line; excerpt included at the back of Chapter 10).
17	Craig Olson (City of Clyde Hill)	12/17/2015	Mains are shown being replaced in the north part of Clyde Hill in 2018. Didn't you guys replace the main on 98th from 34th to about 30th ten years ago? [Fig 4-12]	Our records indicate that these mains have not been replaced.
18	Calvin Wang (ESC*)	11/19/2015	Consider an emergency intertie with Issaquah's water system.	The portions of Issaquah's system fed by wells or the BIP are isolated from Bellevue's, so significant length of transmission main would need to be added to create an interie. Since we both purchase water from SPU's Tolt supply, we would both lose service in an outage, and Issaquah would probably need their wells to meet their own needs. We are open to opportunities though.
19	Aaron Morin (ESC*)	11/19/2015	Consider Lake Washington as a source of emergency water supply.	We are claiming the legacy rights associated with Water District #68's surface water supply in Meydenbauer Bay, to retain this as an option. Discussions with the Dept of Ecology will be ongoing. However, groundwater supplies appear to be more promising since they would not require a surface water treatment plant.
20	Diann Strom (ESC*)	11/19/2015	Add the summary of recommendations (Section 4.11) ot the executive summary.	Incorporated.
21	Diann Strom (ESC*)	11/19/2015	What are the tradeoffs associated with increasing emergency water storage?	See ESC discussion from May 2015.

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22	Dan Stroh (COB Planning Director)	10/14/2015	Land use and zoning assumptions in the Water System Plan are consistent with the City of Bellevue's adopted Comprehensive Plan and development regulations.	Noted.
23	Dan Stroh (COB Planning Director)	10/14/2015	Future growth projections in the Water System Plan are reasonably consistent with Bellevue's population and employment projections.	Noted.
24	Dan Stroh (COB Planning Director)	10/14/2015	Policies for utility service extension and provisions for new construction are both consistent with Bellevue's adopted Comprehensive Plan and development regulations.	Noted.
25	Mitchell Wasserman (Clyde Hill)	12/16/2015	Land use and zoning assumptions in the Water System Plan are consistent with the City of Clyde Hill's adopted Comprehensive Plan and development regulations.	Noted.
26	Mitchell Wasserman (Clyde Hill)	12/16/2015	Future growth projections in the Water System Plan are consistent with Clyde Hill's population and employment projections.	Noted.
27	Mitchell Wasserman (Clyde Hill)	12/16/2015	Policies for utility service extension and provisions for new construction are both consistent with Clyde Hill's adopted Comprehensive Plan and development regulations.	Noted.
28	Mitchell Wasserman (Clyde Hill)	12/16/2015	We have not cross-referenced the draft WSP with the WD68 Agreement. If the two documents are consistent, then the draft WSP is consistent with Clyde Hill's water policy as well.	Noted.
29	S. Schroeder and M. Green (Hunts Point)	1/7/2016	Bellevue's retail water service area is consistent with Hunts Point's adopted comprehensive plan and adopted development regulations and policies.	Noted.
30	S. Schroeder and M. Green (Hunts Point)	1/7/2016	The growth projections used to forecast water demand for Hunts Point are consistent with Hunts Point's adopted population and commercial growth projections.	Noted.

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31	S. Schroeder and M. Green (Hunts Point)	1/7/2016	Bellevue's water utility policies are consistent with Hunts Point's adopted comprehensive plan and development regulations.	Noted.
32	Christen Leeson (City of Issaquah)	12/7/2015	The zoning and land use designations are currently Single Family-Suburban (4.5 du/ac) and Multifamily-Medium (14.52 du/ac). These designations are not proposed to change within the 20-year planning period. Bellevue's plan does not include multifamily in the Lakemont area. Most of Lakemont is zoned Multifamily-Medium (12.52 du/ac).	I'll adjust estimated population for Lakemont in Tables 3-16, 3-17 and 3-18, assuming multi-family zoning. This will not affect projected water demands, since demands specific to this area were assumed separately, in the absence of population data (per comment below). Population shown for Lakemont and Glacier Ridge were back-calculated based on the assumed demands and assumed zoning, but were not actually used (unique procedure used only in these areas).
33	Christen Leeson (City of Issaquah)	12/7/2015	Issaquah does not have population and employment projections by subarea. It is assumed by Issaquah that Montreux and Lakemont are built-out and that the population and employment numbers are not anticipated to increase in any significant manner.	Noted. We will use existing consumption and assume zero growth.
34	Christen Leeson (City of Issaquah)	12/7/2015	Bellevue's future estimation for demand is significantly higher than Issaquah's estimation. It appears Bellevue's estimation is based on maximum demand allowed in the wheeling contract with Issaquah, rather than actual built ERUs.	Wheeling contract limits were used for future demand projections per direction from Issaquah's Engineering staff. Allowance was also added for localized non-revenue flows and leakage. In response to your comment, we'll reduce the "low" ADD projections to the actual 2014 volumes, and reduce the "high" estimate and MDD volumes proportionately. This will reduce future demand estimates by about 40%. The reduced flow will inform our water quality modeling and upcoming chlorine evaluation, but would not appear to impact any water supply, storage or transmission projects due to the low volumes relative to Bellevue's system.
35	Joan Lieberman-Brill (City of Kirkland)	11/9/2015	The land use and zoning assumptions for the portion of Kirkland within Bellevue's water system service area are consistent with the City of Kirkland's adopted Plan and development regulations.	Noted.

36	Joan Lieberman-Brill (City of Kirkland)	11/9/2015	Future growth projections in the Plan are reasonably consistent with Kirkland's population projections. Employment projections are not applicable since this area is designated residential.	Noted.
37	Joan Lieberman-Brill (City of Kirkland)	11/9/2015	Policies for utility service extension and provisions for new construction are both consistent with Kirkland's adopted Comprehensive Plan and development regulations.	Noted.
38	Robert J. Grumbach (Medina)	1/14/2016	Land use and zoning assumptions in the Water System Plan are consistent with the Medina Comprehensive Plan and development regulation.	Noted.
39	Robert J. Grumbach (Medina)	1/14/2016	Future growth projections in the Water System Plan are reasonably consistent with Medina's population and employment projections.	Noted.
40	Robert J. Grumbach (Medina)	1/14/2016	The goals and policies set forth in the Water System Plan do not conflict with Medina's adopted Comprehensive Plan and development regulations.	Noted.
41	S. Schroeder and M. Green (Yarrow Point)	11/10/2015	Bellevue's retail water service area is consistent with Yarrow Point's adopted comprehensive plan and adopted development regulations and policies.	Noted.
42	S. Schroeder and M. Green (Yarrow Point)	11/10/2015	The growth projections used to forecast water demand for Yarrow Point are consistent with Yarrow Point's adopted population and commercial growth projections.	Noted.
43	S. Schroeder and M. Green (Yarrow Point)	11/10/2015	Bellevue's water utility policies are consistent with Yarrow Point's adopted comprehensive plan and development regulations.	Noted.
44	Michael Gagliardo (Cascade)	1/12/2016	The Demand Projections in the Plan were prepared using a different methodology from the Cascade Transmission and Supply Plan (TSP)… The Demand Projections in the Plan are not inconsistent with the Cascade projection for Bellevue.	Noted. We'll continue to coordinate.

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45	Michael Gagliardo (Cascade)	1/12/2016	Section 2-4 Service Area: Any Service Area expansions must be handled consistent the provisions of the Joint Municipal Utility Services Agreement.	Noted.
46	Michael Gagliardo (Cascade)	1/12/2016	Regional Policies: A general statement that The City is a Member of Cascade and participates with and coordinates all regional activities through Cascade.	A general statement was added to Section 2.6.
47	Michael Gagliardo (Cascade)	1/12/2016	Page 5-4: The Built Green and WaterSense New Homes Initiative Program provides certifications for single and multi-family homes. Approximately 2500 higher efficiency fixtures were installed in 2014 (the figure for 2015 should be available in a few weeks).	The additional information has been added.
48	Michael Gagliardo (Cascade)	1/12/2016	Appendix R, Section 2.1 – reference should be the 2012 Joint Municipal Utility Services Agreement (section 7.3 of that Agreement is the appropriate shortage section)	Clarification has been added.
49	Michael Gagliardo (Cascade)	1/12/2016	Appendix R: The Block Contract was also amended in 2013 (section references are appropriate)	Clarification has been added.
50	Michael Gagliardo (Cascade)	1/12/2016	Please continue to coordinate Bellevue's request for a new inlet station on SPU's Tolt pipeline and potential development of existing wells with Cascade so that any changes in these areas are accomplished consistent with the Block Contract and the Joint Municipal Utility Services Agreement.	Noted. We'll continue to coordinate.
51	Robert Russell (Coal Creek Utility District)	1/7/2016	Todd and I reviewed the plan and did not find anything inaccurate and do not have any questions.	Noted.
52	Greg Neumann (City of Kirkland)	12/10/2015	Kirkland has no comments for Bellevue's draft WSP other than the potential emergency intertie at Points Dr and 96th Ave should probably be mentioned.	A new sub-section on emergency interties, including discussion of the proposed connection in Points Drive, has been added to Section 4.8.

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53	Joan Kersnar (Seattle Public Utilities)	1/6/2016	[Paraphrase] The plan recommends a new inlet from SPU's TESSL, which is bar wrapped pipe (BWP). BWP is difficult to tap, and requires specialized expertise. New taps on BWP are best avoided. SPU encourages Bellevue to locate the new inlet so it can receive flow from an existing, un-used prefabricated outlet on the pipeline, such as at SE 8th St, Main St, NE 8th St, or the cast iron 16" feeder line in Bel-Red Rd.	Bellevue intends to conduct a site alternatives evaluation that will consider these issues, along with cost, community impacts (environmental, temporary traffic control, etc), and suitability to supply the BV400 zone, where most growth is projected. Although a tap near NE 20th St appears to be ideal to feed the Bel-Red neighborhood, the suggested NE 8th and Main St locations appear to be hydraulically feasible based on preliminary evaluation, and will be included. Bellevue will coordinate with SPU and Cascade during the evaluation.
54	Joan Kersnar (Seattle Public Utilities)		The Coliform Monitoring Plan included in Appendix U is dated 2007/2008. Please provide an updated CMP for review when available.	The new CMP is currently being drafted and will be provided to SPU for review in 2016.
55	Joan Kersnar (Seattle Public Utilities)		Please include the disinfection by-product (DBP) sample locations on Figure 7-1.	The DBP sampling locations have been added.
56	Joan Kersnar (Seattle Public Utilities)		Please keep SPU apprised of the City's intended use and development of groundwater wells.	We'll coordinate as appropriate.
57	Joan Kersnar (Seattle Public Utilities)		New wholesale water sales outside of Bellevue's service area may be subject to terms and conditions in the [SPU-Cascade agreement].	Bellevue has no plans to expand water sales outside of our current service area.
58	Bob Trimble (KCWD#1)	11/5/2015	ILA and amendments show an address that we are no longer using. [current address provided]	We will update the District's address for our records, although the effort to update agreements with this information is not warranted.
59	Tom Gething (KCWD#117)	1/12/2016	We had no comments on the water system plan.	Noted.

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60	Richard Rodriguez and Robert James (DOH)	1/8/2016	Please provide determinations of local government consistency from the following local land use entities: (a) Cities of Clyde Hill and Medina, (b) Towns of Hunts Point and Yarrow Point, (c) King County.	Consistency statements from Clyde Hill, Medina, Hunts Point and Yarrow Point are provided in Appendix E. King County's consistency is affirmed by County Council's adoption of the Plan. We have also obtained consistency statements from the Cities of Kirkland and Issaquah, because small portions of those cities receive water exclusively through Bellevue, and therefore must be considered in our water system planning. Redmond provided the growth projections used in Bellevue's WSP for their Overlake area (served through jointly-owned facilities).
61	Richard Rodriguez and Robert James (DOH)		Has your supply entity, Cascade Water Alliance, reviewed your water demand forecast?	Yes. See Appendix Y. Cascade indicated "The Demand Projections in [Bellevue's Water System Plan] are not inconsistent with the Cascade projection for Bellevue."
62	Richard Rodriguez and Robert James (DOH)		Department of Ecology provided a review and assessment of the City's water rights in a letter dated December 11, 2015.	We received the letter.
63	Richard Rodriguez and Robert James (DOH)		We acknowledge that Bellevue's Coliform Monitoring Plan is being revised and will be submitted to us for review under a separate cover when completed.	The new CMP is currently being drafted and will be provided to DOH for review.
64	Richard Rodriguez and Robert James (DOH)		As part of your record keeping system, are construction completion reports for distribution main extensions and main replacement projects retained on file?	No. Bellevue was previously unaware of the WAC requirement. We will begin doing this in 2016.
65	Richard Rodriguez and Robert James (DOH)		W5-17: The Section should be re-titled Disinfection & Flushing of Water Mains and the term disinfection should be used instead of sterilization. Please review AWWA Standard C651-14 and determine whether any changes should be made to this section.	This section has been re-titled as indicated, and "sterilization" changed to "disinfection" globally throughout the City's Water Engineering Standards (Volume 4). This change will also be reflected in the City's 2017 Water Engineering Standards, following update in late 2016.

66	Richard Rodriguez and Robert James (DOH)		Provide a threshold determination for the WSP SEPA documentation.	See Appendix A.
67	Richard Rodriguez and Robert James (DOH)		The final WSP submittal must bear the seal of a professional engineer licensed in the State of Washington.	The WSP will be P.E. stamped and signed.
68	Richard Rodriguez and Robert James (DOH)		The water system must meet the consumer input process outlined in WAC 246-290-100(8). Please include documentation of a consumer meeting discussing the WSP, prior to DOH approval of the WSP.	Numerous public meetings discussing the WSP with the City's Environmental Services Commission were held in 2015. A public open house was held, as advertised in a news release, social media, the City's website and "Neighborhood News" newsletter, and as picked up by local media (Bellevue Reporter). The entire Draft Plan has been posted to the City's website since October 2015. See Appendix A.
69	Richard Rodriguez and Robert James (DOH)		Prior to DOH approval, the governing body of the City must approve and adopt the WSP.	The WSP will be brought to Bellevue City Council for adoption.
70	Richard Rodriguez and Robert James (DOH)		Please provide copies of any comments made by adjacent purveyors or other interested parties, along with the District's response to those comments.	See Appendix Y.
71	Sheldon Lynne (City of Issaquah)		[no response]	
72	Scott Thomasson (City of Redmond)	1/13/2016	Connections shown in Table 1-2 do not account for all connections with Redmond, such as joint-use mains.	Clarification has been added.

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73	Scott Thomasson (City of Redmond)	1/13/2016	Bellevue doesn't "supply" Redmond; we both are supplied by Cascade through joint-use facilities. "Wheeling" language doesn't capture this. See Redmond's Water System Plan for more appropriate language.	Clarification has been added.
74	Scott Thomasson (City of Redmond)	1/13/2016	Future demand projections look high; are they consistent with Cascade's?	Projections are based on (1) significant population and jobs growth forecasted by Puget Sound Regional Council, and (2) revised & reduced per capita water demands based on actual recent consumption (see Table 3-12). We have also added an assumed 6% non-revenue flow to the projections.
75	Scott Thomasson (City of Redmond)	1/13/2016	Redmond does not consider SPU's supply to be 2 sources (it would be difficult to get Cedar water up to Redmond), so we use 400 gal/ERU as emergency storage volume criteria for the in-town areas. Based on this criterion, Redmond's Overlake area has a storage deficiency. This is difficult to rectify with Bellevue's 200 gal/ERU storage criterion, since we share facilities in the Overlake area. This is unresolved.	Bellevue's storage criteria are consistent with DOH requirements and industry norms, were evaluated by a 3rd party engineering consultant, and have been discussed with Bellevue Fire and the Environmental Services Commission. The costs and community impacts associated with increased emergency storage do not appear to be justified.
76	King County Utilities Technical Review Committee	1/20/2016	[Phone conversation with Steve Hirschey] You did a fine job. UTRC has no technical comments, but will comment with reminders to obtain planning consistency statements, etc. We hope to get a letter out Friday 1/22.	Noted.
77	Jerry Liszak, Dept of Ecology	12/11/2015	[Paraphrase] KCWD97 Well 3 permit and certificate numbers, Qi and Qa are incorrect	These have been corrected.
78	Jerry Liszak, Dept of Ecology	12/11/2015	[Paraphrase] KCWD97 Well 6 non-additive Qa is not shown.	This has been added.

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79	Jerry Liszak, Dept of Ecology	12/11/2015	[Paraphrase] Refer to Okanogan Wilderness League, Inc. v. Town of Twisp, 133 Wn.2d 769, 781, 947 P.2d 732 (1997). Abandonment is a common law process, separate from statutory relinquishment. set forth in chapter 90.14 RCW. Although municipal water rights are exempt from statutory relinquishment laws, chapter 90.14 RCW, they may be lost by abandonment. Because the City of Bellevue does not know if the KCWD68 and WWSC wells are still in existence and the City no longer owns the properties the wells were located on, it appears to me that Bellevue may have abandoned these water rights.	We will work with Ecology to provide additional information and clarify the status of these water rights. We do not think the Twisp decision applies, because unlike Twisp, Bellevue never forgot about its wells and has maintained records. The history of wells has been mentioned in Water System Plans, and they are shown in mapping records. The City did not continually submit a Water Rights Self-Assessment because DOH did not require it, since Bellevue had adequate surface water supplies (through the City of Seattle) to meet domestic needs. Refer to Cornelius v. Washington Dep't of Ecology, 182 Wn.2d 574, 344 P.3d 199 (2015), in which legacy municipal water rights were upheld by the court.
80	Jerry Liszak, Dept of Ecology	12/11/2015	Bellevue's surface water rights appear to have been abandoned because decades ago the site of the surface water diversion was sold and a private home built on the site. Although the diversion pipe may reportedly lie under the property owner's pier, the surface water pumping and treatment plant no longer exists.	The treatment plant site was not sold. It is still owned and maintained by the City of Bellevue Utilities Department. The pump station wet well still exists and is under a homeowner's garage on a (separate) private site. The intake piping is still in the lake. We have noted the comment and will provide additional clarification.

Appendix B

Utilities Element, City of Bellevue Comprehensive Plan

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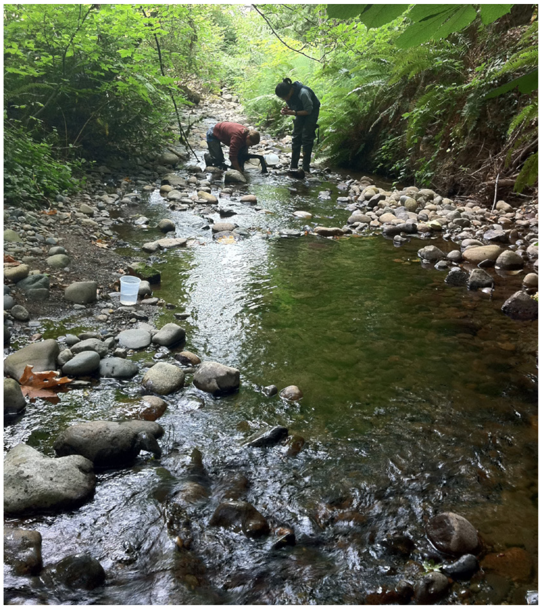


UTILITIES

WHAT YOU WILL FIND IN THIS CHAPTER

- An overview of utility systems in Bellevue and anticipated future trends.
- As required by the Growth Management Act, maps showing the general location of existing and proposed utilities, including, but not limited to, electrical lines, telecommunication lines, and natural gas lines.
- Policies to maintain utilities at appropriate levels of service to accommodate the city's expected growth while maintaining a balance with other community and environmental goals.
- A description of the city's planning framework for existing and proposed utilities, including water, sewer, stormwater, electrical lines, telecommunications, and natural gas.

UTILITIES VISION

BELLEVUE HAS THE PUBLIC AND PRIVATE UTILITIES THAT MEET THE NEEDS OF A GROWING ECONOMY.

Public and private utilities are building the systems to grow a 21st century economy. These services are resilient, efficient, and available to the entire community. Utilities are sited, designed, and operated in a manner that maintains community character.

INTRODUCTION

Utilities are the basic building blocks of urban living. While we may take for granted services such as clean drinking water, wastewater and stormwater management, electricity, natural gas, telephone, and internet, these facilities make living in cities possible.

This element works in concert with the Land Use Element to ensure that Bellevue will have adequate utilities to serve both existing development and future growth. Policies also address environmental impacts, facilities siting and construction, economics, and aesthetics in design and landscaping.

In Bellevue, as in many cities, utilities are provided by a combination of city-managed and non-city-managed providers, as shown in Figure UT-1. Depending on their service, these are state regulated, federally licensed and/or municipally franchised providers. Non city-managed utilities providers include Puget Sound Energy (electricity and natural gas), as well as providers of telecommunication services.

Figure UT-1. City-Managed and Non City-Managed Utilities

City-managed utilities:	Non city-managed utilities:
Water	Electricity
Sewer	Natural gas
Storm and surface water	Other petroleum gas
Solid waste	Telephone
	Wireless services
	Cable

The Growth Management Act's Public Facilities and Services Planning Goal ensures that those public facilities and services necessary to support development shall be adequate to serve the development at the time the development is available for occupancy and use, without decreasing current service levels below locally established minimum standards.

TODAY'S CONDITIONS AND TOMORROW'S PROJECTIONS

UTILITIES TODAY AND TOMORROW

City-Managed Utilities

The City of Bellevue manages the wastewater, water, and storm and surface water utilities, as well as solid waste management activities. The wastewater and water utilities serve the city and several jurisdictions outside the city limits and are self-supporting enterprise operations, separate from the city General Fund. Each city-managed utility is governed by a functional system plan that contains a system inventory, system management and operational policies, and level of service standards. While detailed information about each utility system is contained in the individual functional plans, an overview of each city-managed utility system is provided below.

Wastewater

Bellevue operates, maintains, and extends the sewage collection system to respond to the needs of residents and commercial establishments. The collection system discharges into larger pipes owned and operated by the King County Wastewater Treatment Division that transports the sewage for treatment and eventual discharge into Puget Sound.

Bellevue's wastewater collection system includes approximately 524 miles of mainline pipes, 130 miles of service stubs, and 46 pump and lift stations. The wastewater utility serves 35,800 customer accounts across 37 square miles, including Medina, Clyde Hill, Hunts Point, Yarrow Point, and Beaux Arts.

WHAT DOES IT MEAN?

- Utility systems in Bellevue are provided either as city-managed or non city-managed utilities. While the city does not control non-city managed utility facilities, it has authority to regulate how private utilities are developed in Bellevue.
- Each city-managed utility system is governed by a functional plan that contains a detailed system inventory, lists of planned improvement projects, and policies specific to that utility system. The role of this Utilities Element is to establish an overall strategy for providing adequate utility service to serve the growth projected in the Land Use Element.
- Utilities providers plan for the necessary infrastructure to manage aging systems, respond to growth, and adapt to changing consumer behavior.

Bellevue owns 15 miles of submerged wastewater pipeline in Lake Washington and 4 miles of submerged wastewater pipeline in Lake Sammamish. These "lake lines" were constructed in the late 1950s and 1960s and may be nearing the end of their useful life. The city maintains them and is evaluating their condition to determine when rehabilitation and/or replacement will be necessary. The cost for this work will be substantial. Management of the lake lines is critical to maintaining and protecting water quality in Lake Washington and Lake Sammamish.

Water

Bellevue's drinking water utility serves 37,300 customer accounts, operates 620 miles of water main pipes, and serves an area of over 37 square miles, including the adjacent communities of Clyde Hill, Hunts Point, Medina, Yarrow Point, and portions of the cities of Issaquah and Kirkland.

Bellevue purchases water from the Cascade Water Alliance, a regional supplier to several cities and special purpose districts. Water from Cascade is distributed through mains operated and maintained by the water utility to residential, commercial, and industrial users. The Cascade Water Alliance facilitates the development of a regional water supply system that balances regional water resources and regional water supply needs, and provides equitable participation in ownership and management. Bellevue works with Cascade to promote the efficient use of the public water supply to customers through education, technical assistance and incentive programs.

Storm and Surface Water

Bellevue's storm and surface water operations include stormwater runoff and flood control, protection of surface water quality, support of fish and wildlife habitats, and protection of the environment, and public education. Bellevue provides storm and surface water utility service to all properties within the city (32,900

customer accounts). There are 26 drainage basins in the city, most with year-round streams, over 19,000 public storm drains, 400 miles of pipes, and over 1,200 city and privately owned detention facilities.

Solid Waste

Solid waste management activities include solid waste planning, promotion, and monitoring the performance of private contractors who carry out collection of solid waste, recyclables, organics, and litter pick up. These services are financed through garbage rates that are set by the City Council. There are 29,000 single-family residential customer accounts, 330 multifamily accounts, and 1,600 commercial accounts in Bellevue. The city encourages waste reduction and recycling to manage demand for solid waste services.

Non-City Managed Utilities

Authority

The Washington Utilities and Transportation Commission (WUTC) regulates the services and defines the costs that a utility can recover, to ensure that the utility acts prudently and responsibly. With the adoption of the Growth Management Act, both the WUTC and the City of Bellevue have jurisdiction over the activities of electric, gas, and telephone utilities within Bellevue's city limits.

Bellevue has the authority to regulate land use and, under Growth Management Act, the requirement to consider the location of existing and proposed utilities and potential utility corridors in land use planning. The city must also plan for the adequate provision of utilities consistent with the goals and objectives of its Comprehensive Plan, taking into consideration the public service obligation of the utility involved.

Bellevue is entitled to reasonable compensation for use of its rights-of-way and leases of city-owned property, structures and conduits. The Telecommunications Act of 1996 established new

responsibilities for the Federal Communications Commission in licensing of wireless communication providers. The licenses allow the right to use a block or blocks of the radio frequency spectrum to provide wireless services. Section 704(a)(7) of the Act recognizes the authority of state and local governments over decisions regarding siting of wireless communication facilities, subject to certain limitations.

Electrical Service

Puget Sound Energy builds, operates, and maintains the electrical utility system serving Bellevue. Puget Sound Energy imports electrical energy from generation sources in Canada, on the Columbia River, and from other generation sites inside and outside of Puget Sound Energy's service territory.

Puget Sound Energy's goals are to meet future customer needs for electrical service, enhance system reliability, and maintain safe facilities. Puget Sound Energy builds, operates, and maintains the electric transmission and distribution systems serving the City of Bellevue. Puget Sound Energy is an investor-owned utility serving more than 1,097,500 electric customers in an eight county service area. As of the end of 2014, Puget Sound Energy served more than 63,900 electric customers within the City of Bellevue.Puget Sound Energy's 2013 Integrated Resource Plan forecasts growth in electric peak hour capacity 'need' (the gap between the effective capacity of existing resources and the peak hour capacity needed) to increase 12 MW by 2017, 100 MW by 2020 and 2,194 MW by 2033. For the shorter term and based on 2012 population, employment and development forecasts from its October 2013 Eastside Needs Assessment Report, Puget Sound Energy's corporate load forecast for winter under normal conditions and 100% conservation indicates load increases a total of about 138 MW from 2013 to 2022 or about 17 MW of increased load per year. This annual increase is significantly lower than previous forecasts and is much lower than the 2011 forecast of approximately 22 MW per year.

Actual load growth could vary from projections due to economic cycles, land use zoning changes and other drivers.

Several new system facilities including transmission lines and substations may need to be constructed to meet the projected increased demand for electrical service and to enhance reliability. Bellevue's knowledge-based economy is part of a community lifestyle that requires and expects sufficient and highly reliable electrical service.

The city maintains a list and schematic system map (Map UT7) of necessary electrical transmission, distribution, and substation facilities and administers policies that guide provision of adequate electrical power to serve the community. The city also has environmental review and permitting authority over the activities of the utility within the city's boundaries.

The potential for undergrounding existing aerial lines is addressed by Washington State's electrical utility regulatory framework including various tariff Schedules (73, 74 and 80). Bellevue relies on Comprehensive Plan and capital investment policy as well as its franchise agreement and memoranda of understanding with Puget Sound Energy to implement undergrounding of distribution facilities. The framework for undergrounding reflects the Utilities Element policies and the tradeoffs inherent in underground versus overhead distribution facilities. As a result of this the city takes an incremental approach to undergrounding electrical distribution facilities, and a mitigative approach to identified environmental and aesthetic impacts of other electrical facility infrastructure.

A future reliable electric grid may include emerging concepts such as non-wire, microgrid, or alternative technology solutions to the existing overhead system that better address the community's interest in mitigating impacts.

Natural Gas Service

Puget Sound Energy also builds, operates, and maintains the natural gas distribution system serving Bellevue. At the end of 2014, Puget Sound Energy served more than 33,500 natural gas customers within Bellevue.

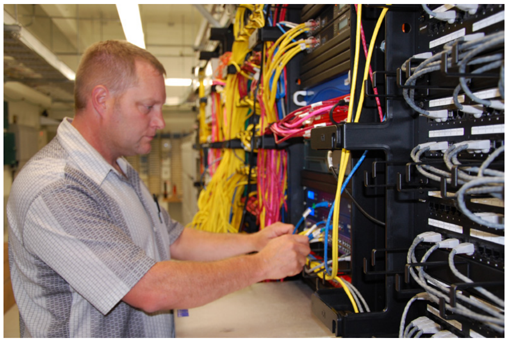
The Pacific Northwest receives natural gas from various regions of the United States and Canada. Natural gas is transported throughout the states of Washington, Oregon and Idaho via a network of interstate transmission pipelines owned and operated by Northwest Pipeline Corporation. Puget Sound Energy takes delivery of natural gas from Northwest's Williams Pipeline east of Lake Sammamish and distributes the gas to customers via Puget Sound Energy's distribution system. The distribution system serving Bellevue consists of both high pressure and intermediate pressure mains.

As of 2014, Puget Sound Energy's natural gas distribution system has sufficient capacity to serve existing demand for gas service in Bellevue. However, system capacity enhancements may be required in the next few years to provide service to new development. Thereafter, the need for additional system improvements will be driven by future development.

Telecommunication Services

Telecommunications is the transmission of information in the form of electronic signals or other similar means. Telecommunications services generally include the following categories:

- **Landline Telephone** – Telephone service in Bellevue is offered through two major providers, though local telephone service is now being offered by cable companies. It is anticipated that additional upgraded telephone facilities will be needed to handle a growing demand for advanced telecommunications services.



- **Wireless Communications** – A wide variety of cellular communications and wireless data services are available in Bellevue. Currently, these services rely on ground-based antennae located on towers or buildings. This element recognizes that providing wireless service involves adapting to changing technologies, which may make current forms of receivers obsolete.
- **Cable Television and Broadband Internet** - Multiple cable operators provide cable services in Bellevue. This service provides broadcasting via a network of overhead and underground coaxial cables and often includes broadband internet and telephone service.

Bellevue's central location and significant employment concentration will continue to attract new and evolving technologies in the field of telecommunications. The city supports increasing the availability of improved telecommunications services throughout the city. The city encourages new telecommunications technology that balances the costs and benefits of the following factors: health and safety, aesthetics, the environment and the economy.

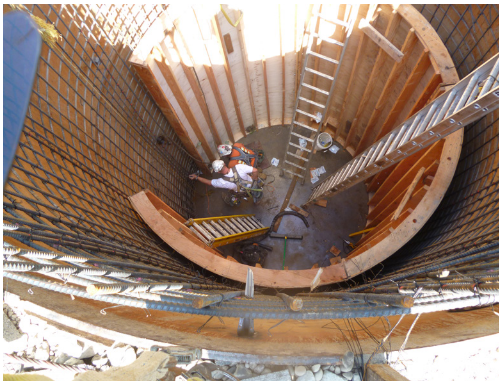
In most cases, telecommunications services will use existing utility corridors, public rights-of-way, and other city-owned properties, and will be able to provide services to all parts of the city. Bellevue encourages the shared use of space consistent with the city's service mission for telecommunication infrastructure projects within the street right-of-way and for telecommunication infrastructure opportunities on other city property. Bellevue's infrastructure investment and aesthetic quality should be protected from unnecessary degradation caused by the construction of telecommunications infrastructure.

The policies in this element address current technology recognizing that new communication technologies are constantly evolving. The city encourages new technology that is consistent with a balancing of the costs and benefits discussed above.

CHALLENGES AND OPPORTUNITIES

Development and Support of New Technologies

New technology offers new opportunities to bring high speed Internet access to more of the city. A "Smart City" strategy seeks to include high speed data options for businesses and residents by encouraging the deployment of broadband infrastructure. Ensuring that quality, affordable internet connectivity is available will further the city's goal of economic growth and competitiveness. As this system is deployed, the community will need to work to ensure that there are not excessive visual impacts and that access is not limited to select areas of the city. A balanced permitting process will help encourage deployment of high speed telecommunications infrastructure while protecting neighborhood character.



Condition of Utility Infrastructure

Some of Bellevue's utilities infrastructure is aging and will require repairs and replacement over the next twenty years. The costs of replacing utility infrastructure are substantial and take years for planning and implementation. Each city-managed utility has strategies and plans for funding and building the necessary improvements, which are scheduled and assigned funding in the city's seven-year Capital Investment Program.

For example, infrastructure for both drinking water and wastewater is aging, with most of the systems well past midlife. Slightly more than 40 percent of the city's water mains are made of asbestos cement pipe, generally the oldest pipe in Bellevue's water system and the type that wears out the fastest. Replacing asbestos cement pipe is the focus of Bellevue's water pipe replacement programs. For wastewater utility programs, the cost to repair or replace aging sewer mains, especially in-lake submerged wastewater pipes, will be substantial. The utility's asset management program is planning for timely replacement of pipes and other facilities to maintain reliable service and and protect the environment.

Accommodating Future Demand

Increased demand will require investment to build new facilities for water, wastewater, and stormwater services. Non-city utility providers will also experience increased demand for services and will need to plan for new or improved facilities.

Maintaining Neighborhood Character

While it is critically important to meet growing demand for utility services and further develop the reliability of Bellevue's utility systems, it is also important to ensure that new and expanding utility facilities are sensitive to neighborhood character. Map UT7 identifies planned electrical facilities that have the potential to create significant incompatibilities with Bellevue neighborhoods. It reflects an analysis of planned facility locations and manner of expansion anticipated by Puget Sound Energy's system plan. Such sensitivity factors as proximity to residential neighborhoods, visual access, and expansion within or beyond an existing facility border were considered in identifying potential incompatibilities. The early screening represented in Figure UT.7 identifies a list of facilities that will require special regulatory siting scrutiny. This is intended to increase transparency of the siting process for Puget Sound Energy and the public, while also ensuring the utility's ability to meet system needs.

BELLEVUE'S UTILITIES PLAN

Bellevue facilitates the development and maintenance of all utilities at the appropriate levels of service to accommodate the city's project growth. Bellevue facilitates the provision of reliable utility service in a way that balances the public's interest in safety and health, consumers' interest in paying no more than a fair and reasonable price for the utility's product, the natural environment, and the community's desire that utility projects be aesthetically compatible with surrounding land uses. Bellevue processes permits and approvals for utility facilities in a fair and timely manner and in accord with development regulations that encourage predictability. Bellevue encourages new technology that improves utility services and reliability while balancing health and safety, economic, aesthetics, and environmental factors. Bellevue provides policy guidance for each utility facility system specific to its city-managed or non-city-managed utility system status.

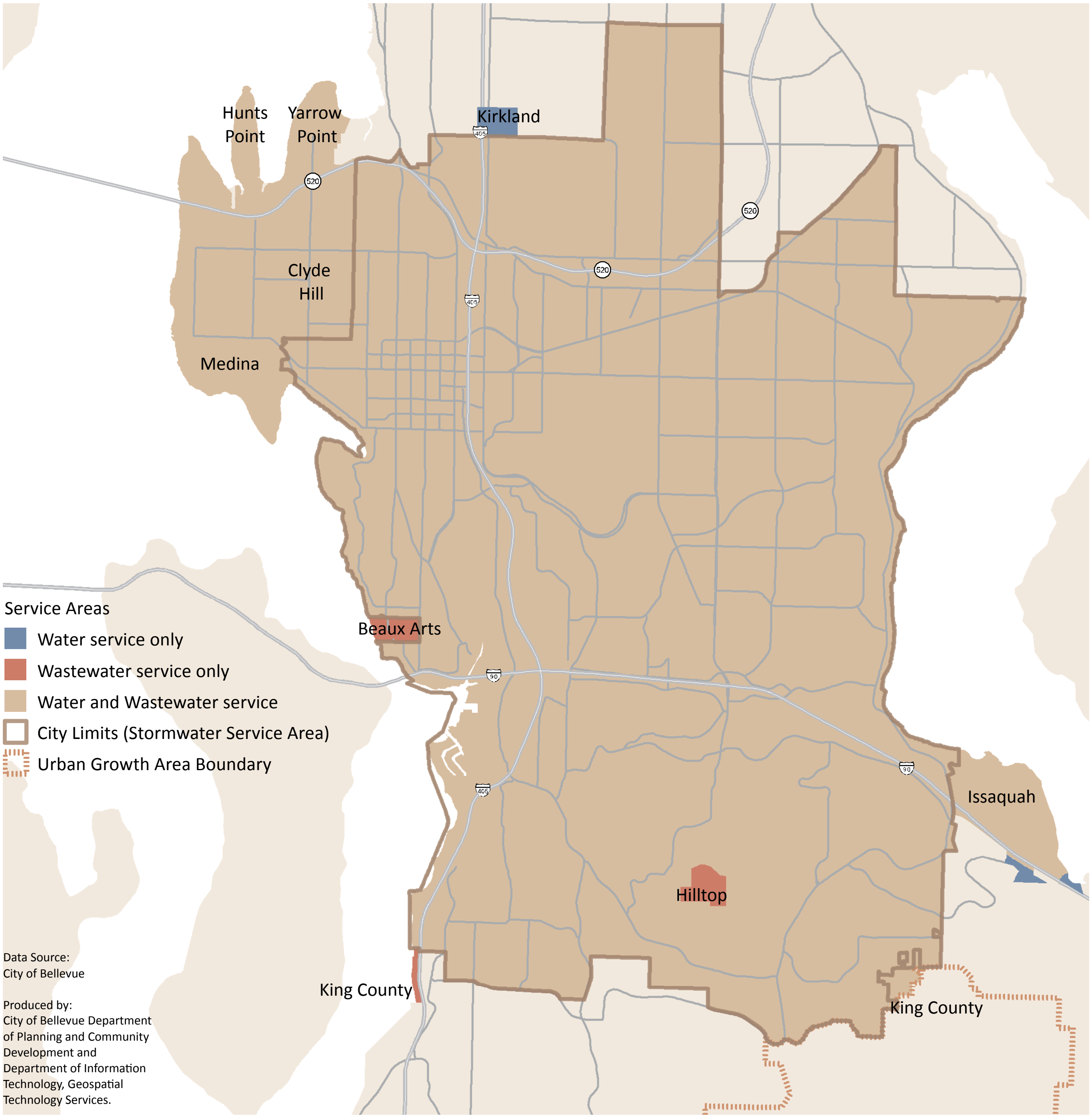
This Utilities Element acts as a "hub" for a collection of functional system plans. While each utility is governed by a detailed functional plan that provides specific policy guidance for that specific system, the Utilities Element provides guidance for all utilities in Bellevue in establishing the city's overall approach to providing safe, high-quality, and reliable utility services for residents and businesses.

WHAT DOES SUCCESS LOOK LIKE?

- Utilities are provided at appropriate levels of service to Bellevue residents and businesses.
- New technologies are used to enhance service, reduce costs, and reduce the impacts of utility service.
- Wide spread access to high speed internet.
- Utilities provide reliable, equitable service while avoiding and minimizing community impacts.

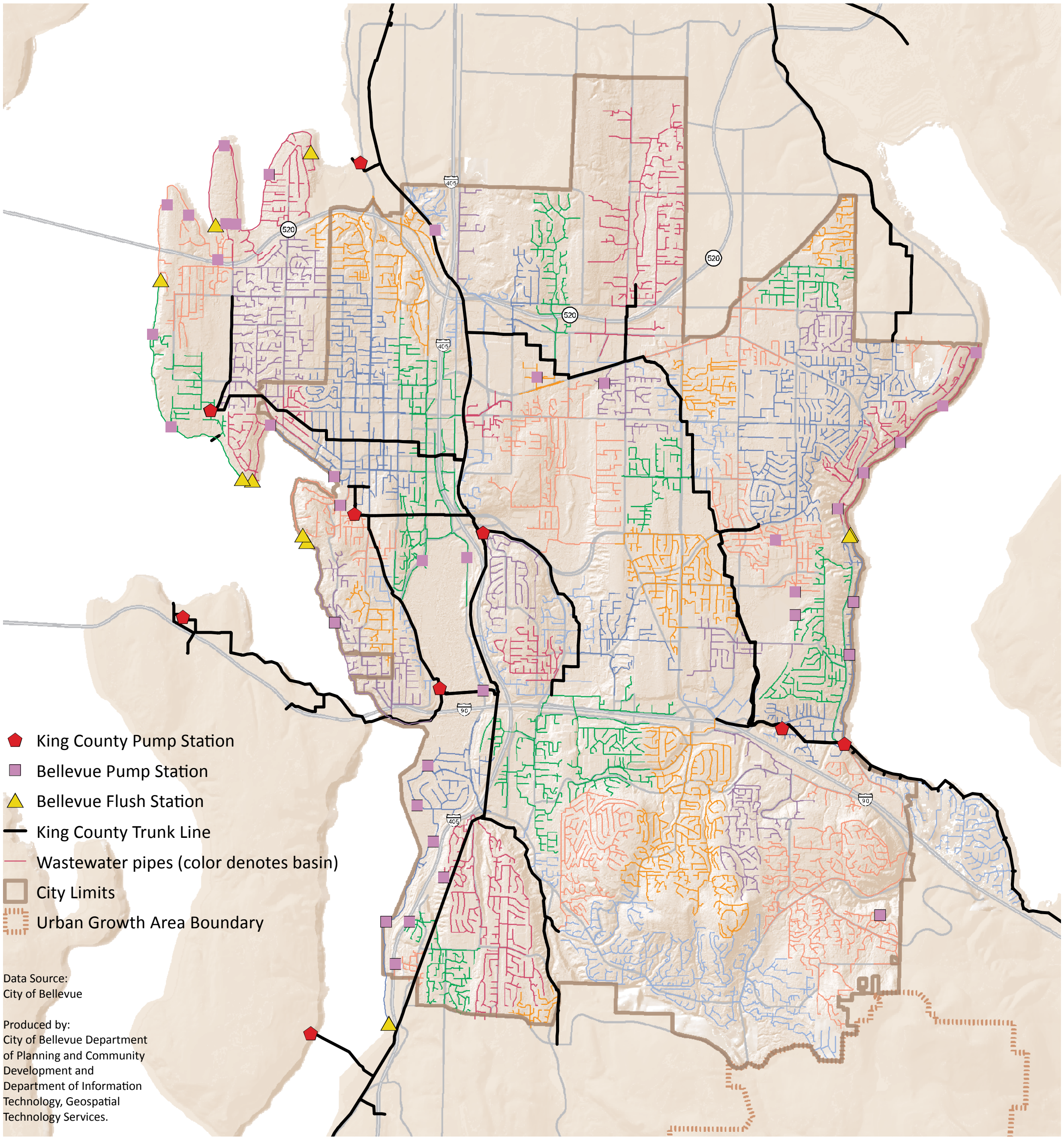
Map UT-1. Utility Service Areas

The City of Bellevue provides water, wastewater and stormwater services to all areas within Bellevue except in the Hilltop subdivision where water service is provided by Water District 117. The City also provides water and/or wastewater services to areas outside of Bellevue including the Points Communities, Beaux Arts, and parts of Issaquah, Kirkland and unincorporated King County as shown in the map below.



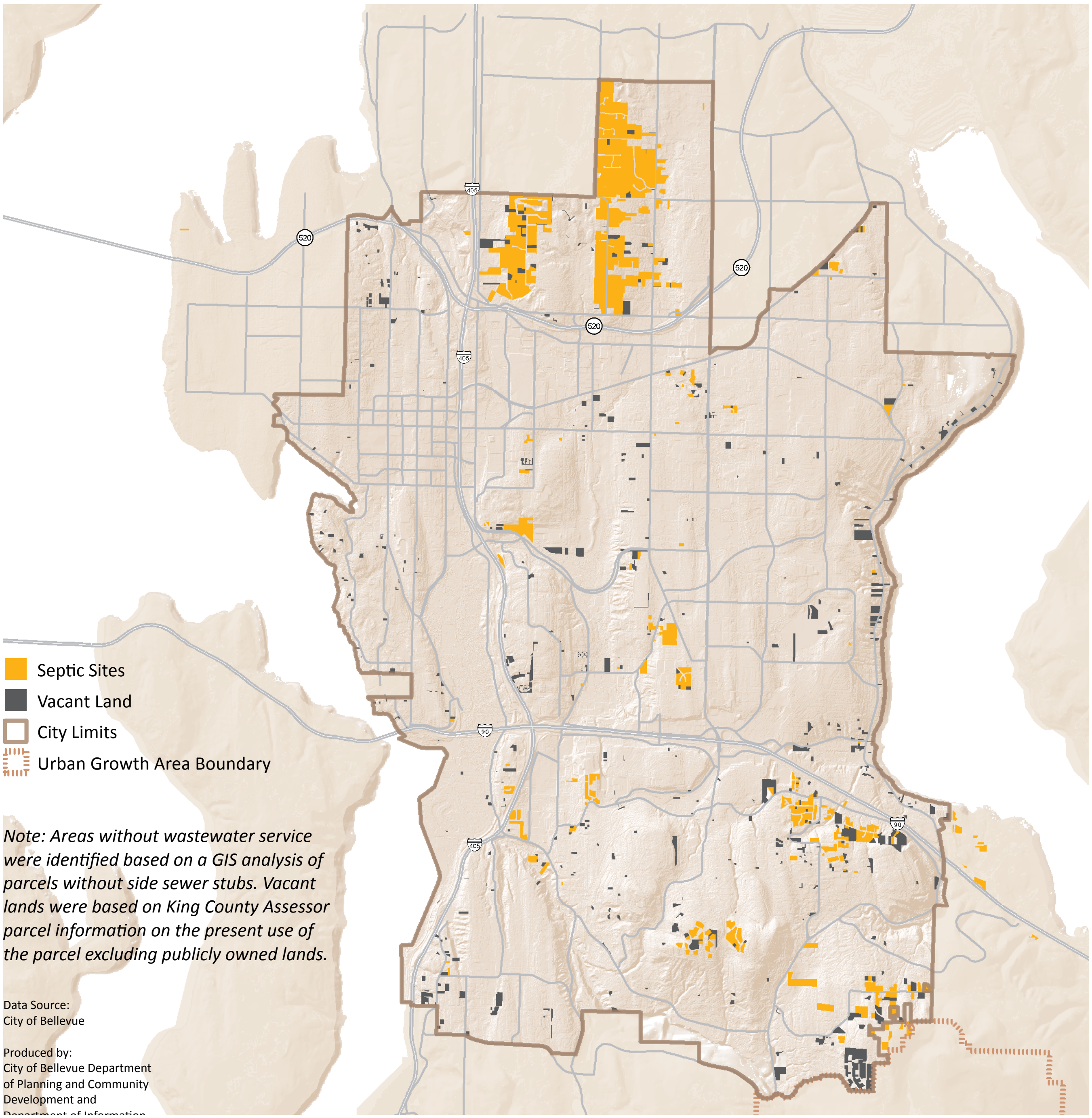
Map UT-2. Wastewater Collection System Facilities

This map shows the locations of wastewater pump and flush stations as well as sewer pipes. Wastewater basins are depicted by different colors of pipe. Bellevue's wastewater collection system includes over 650 miles of mainline pipes and service stubs, and 46 wastewater pump and lift stations. Wastewater flows through city-owned and maintained pipes into King County's regional trunk lines where it is conveyed to Renton or Brightwater Wastewater Treatment Plants for treatment. See Bellevue's **Wastewater System Plan** for details.



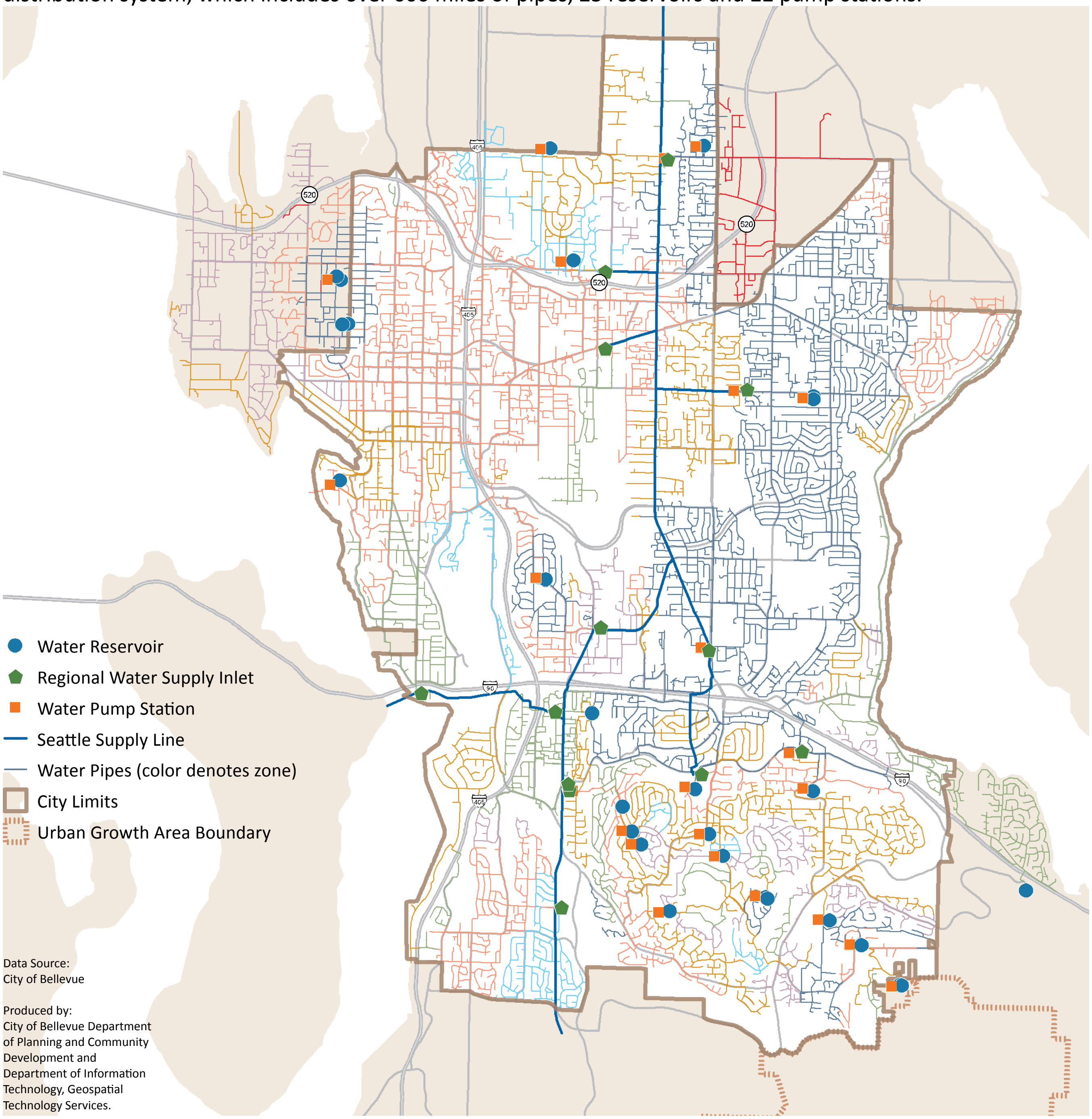
Map UT-3. Property without Wastewater Service

Non-sewered areas relying on septic tanks for wastewater treatment and vacant lands are shown on the map below. The King County Health Department regulates the use of septic systems in King County, including Bellevue. See the City of Bellevue's [Wastewater System Plan] for more information regarding the use of septic tanks.



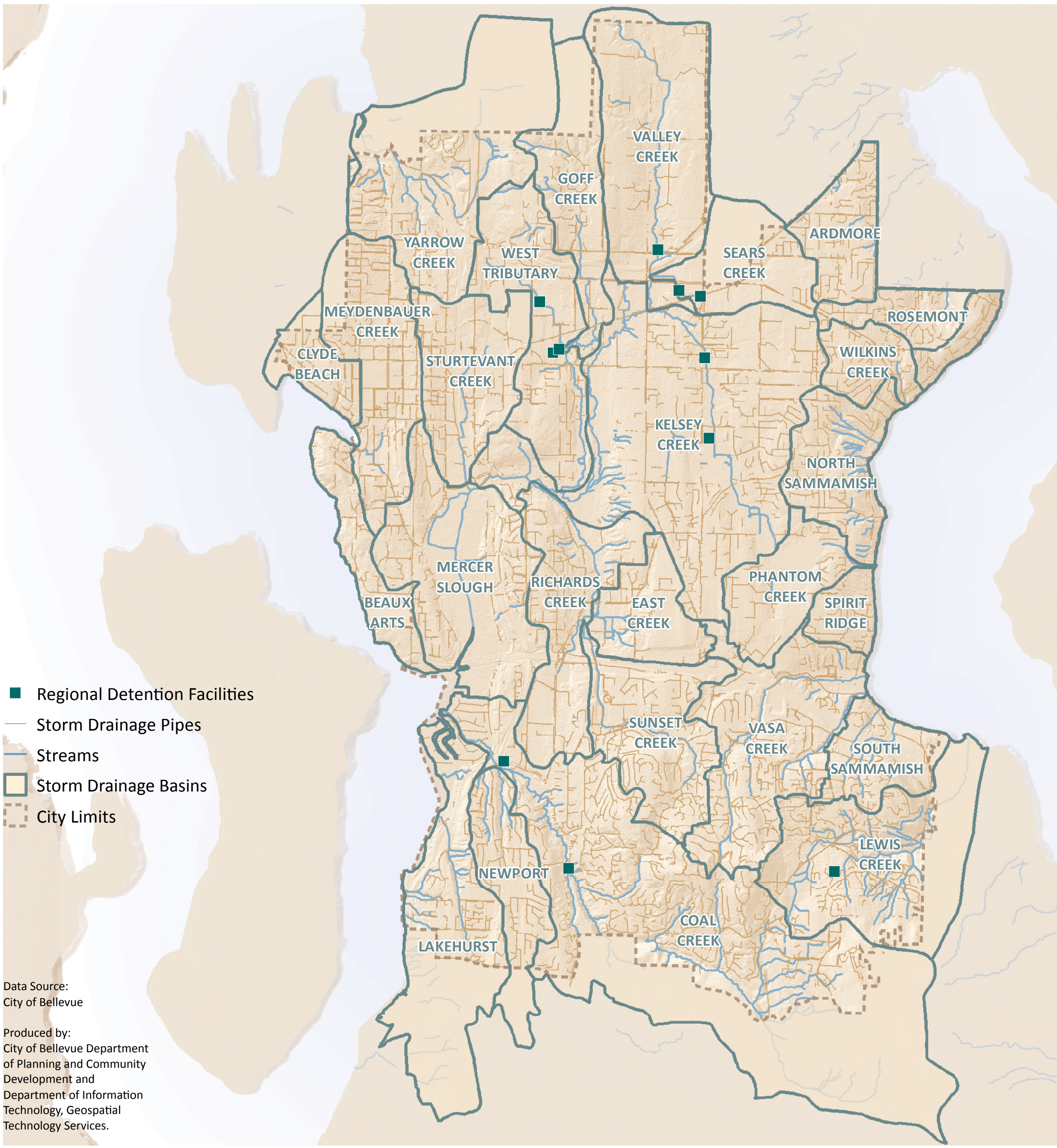
Map UT-4. Major Water Facilities

Bellevue's drinking water is acquired through the Cascade Water Alliance, an association of water districts and cities, including Bellevue, which serves as a regional water supply agency and wholesale water provider. This map shows locations of water reservoirs, pump stations, and supply inlet meters along with the main supply line and water pipes. Pressure zones are depicted by different colors of pipe. Bellevue is responsible for the local water distribution system, which includes over 600 miles of pipes, 25 reservoirs and 22 pump stations.



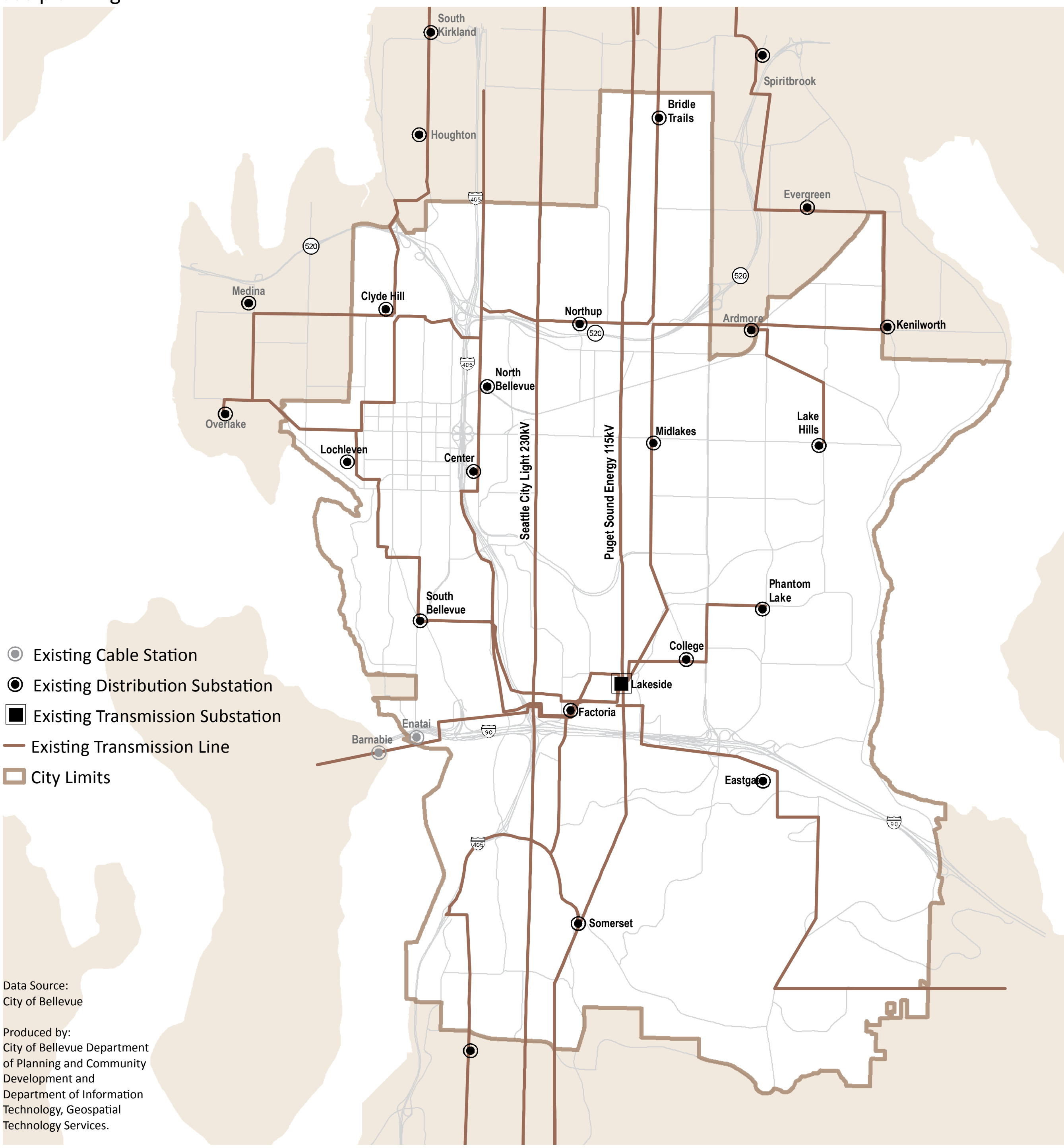
Map UT-5. Storm and Surface Water Facilities

This map shows storm water drainage basins within Bellevue along with regional detention facilities, and pipes. The stormwater system in Bellevue is a combination of streams, lakes, wetlands, pipes, catch basins and flood control sites--private and public systems that eventually drain into either Lake Washington or Lake Sammamish. Storm and surface water facilities help manage storm water runoff during storm events. See Bellevue's **Storm and Surface Water System Plan** for more detail.



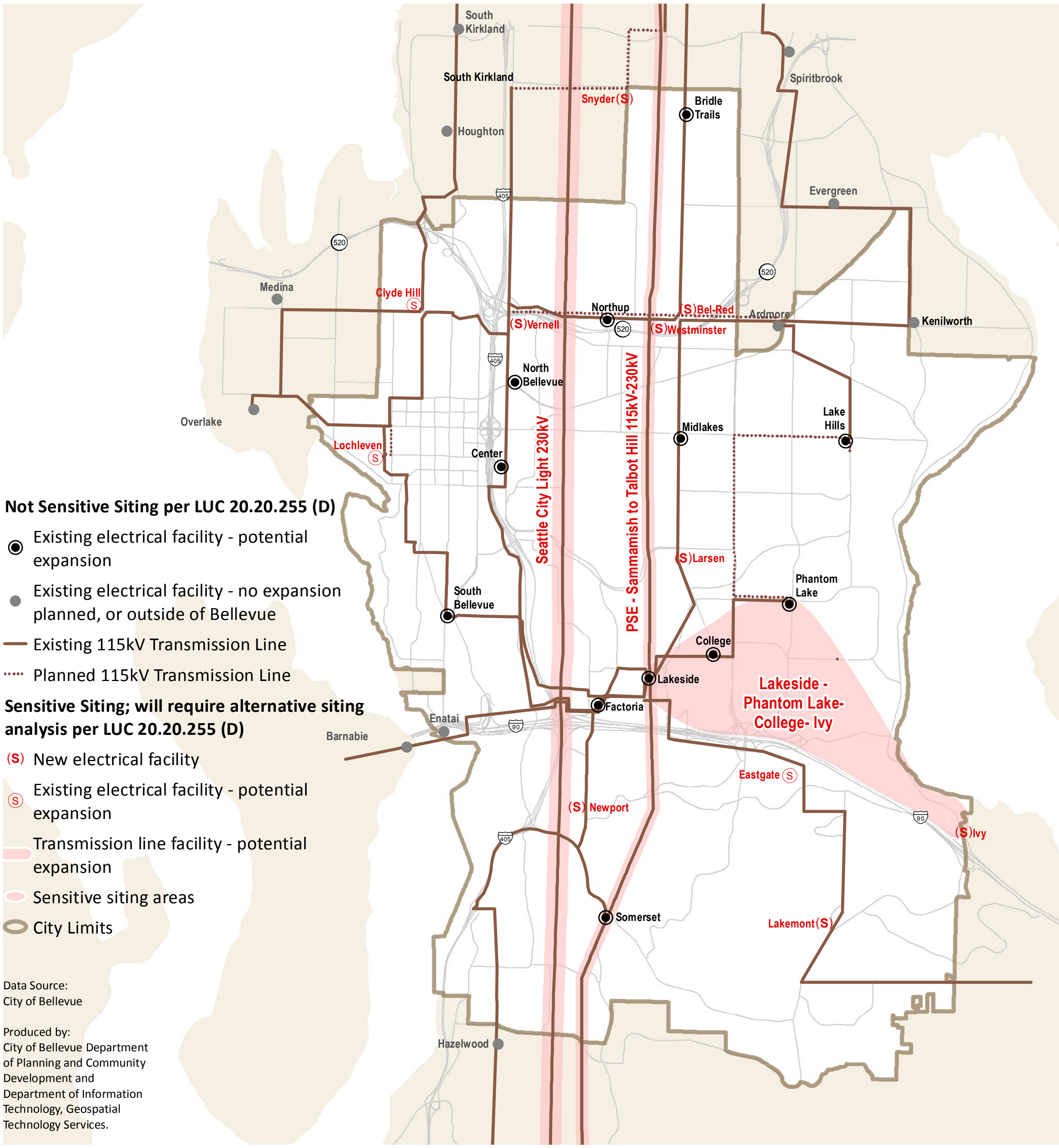
Map UT-6. Existing Electrical Facilities

This map and the following map of new and expanded facilities together guide the siting of electric facility utilities in the city, requiring the city under GMA to consider the location of existing and proposed utilities in land use planning.



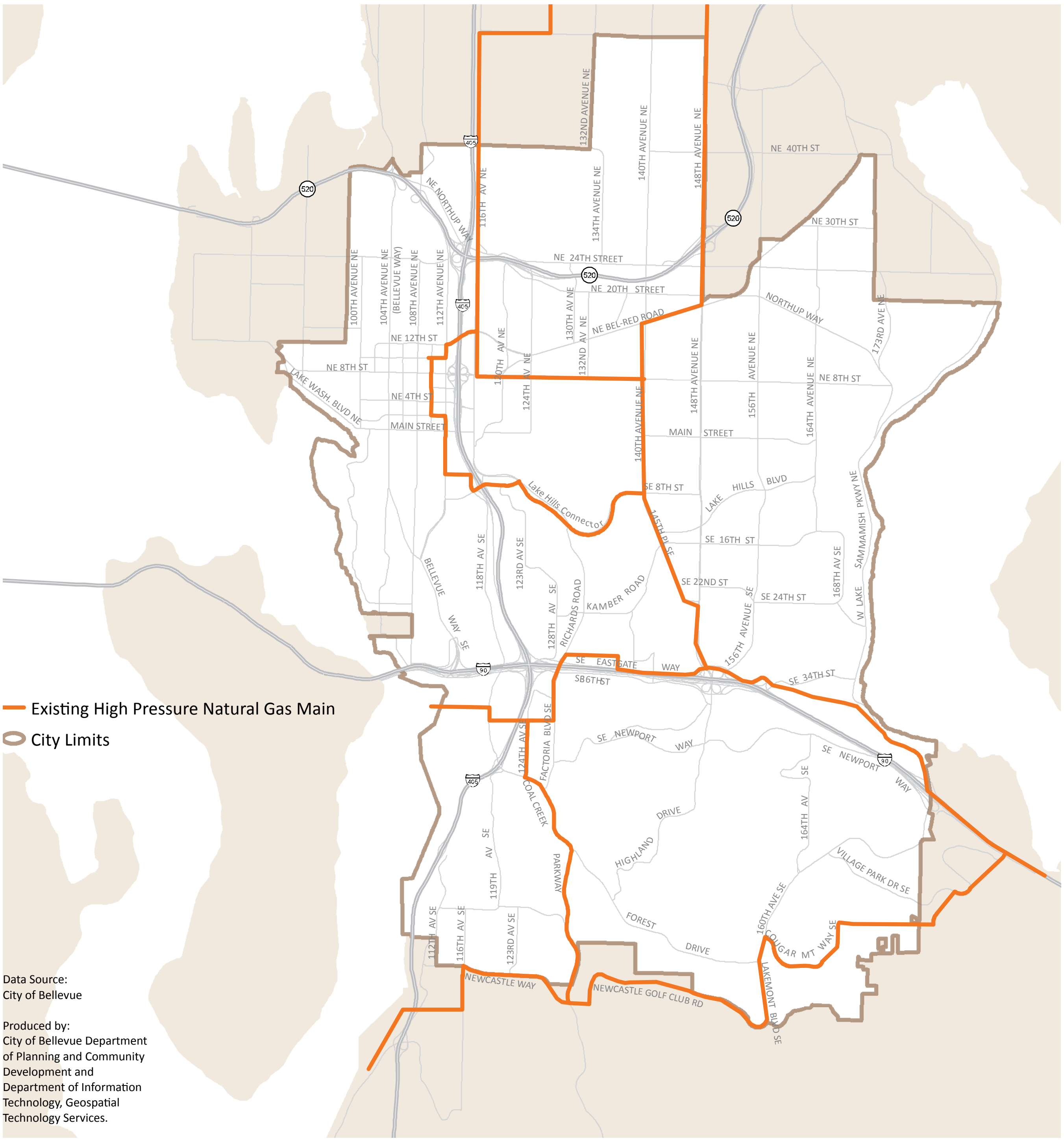
Map UT-7. New or Expanded Electrical Facilities

This map shows the general locations and conceptual alignments of Puget Sound Energy's planned facilities together with the city's sensitive siting classifications. These locations, alignments and classifications guide the review of the actual location of transmission lines, routes, and substations subject to the Conditional Use Permit and other city review processes. The actual locations may ultimately differ from those depicted here.



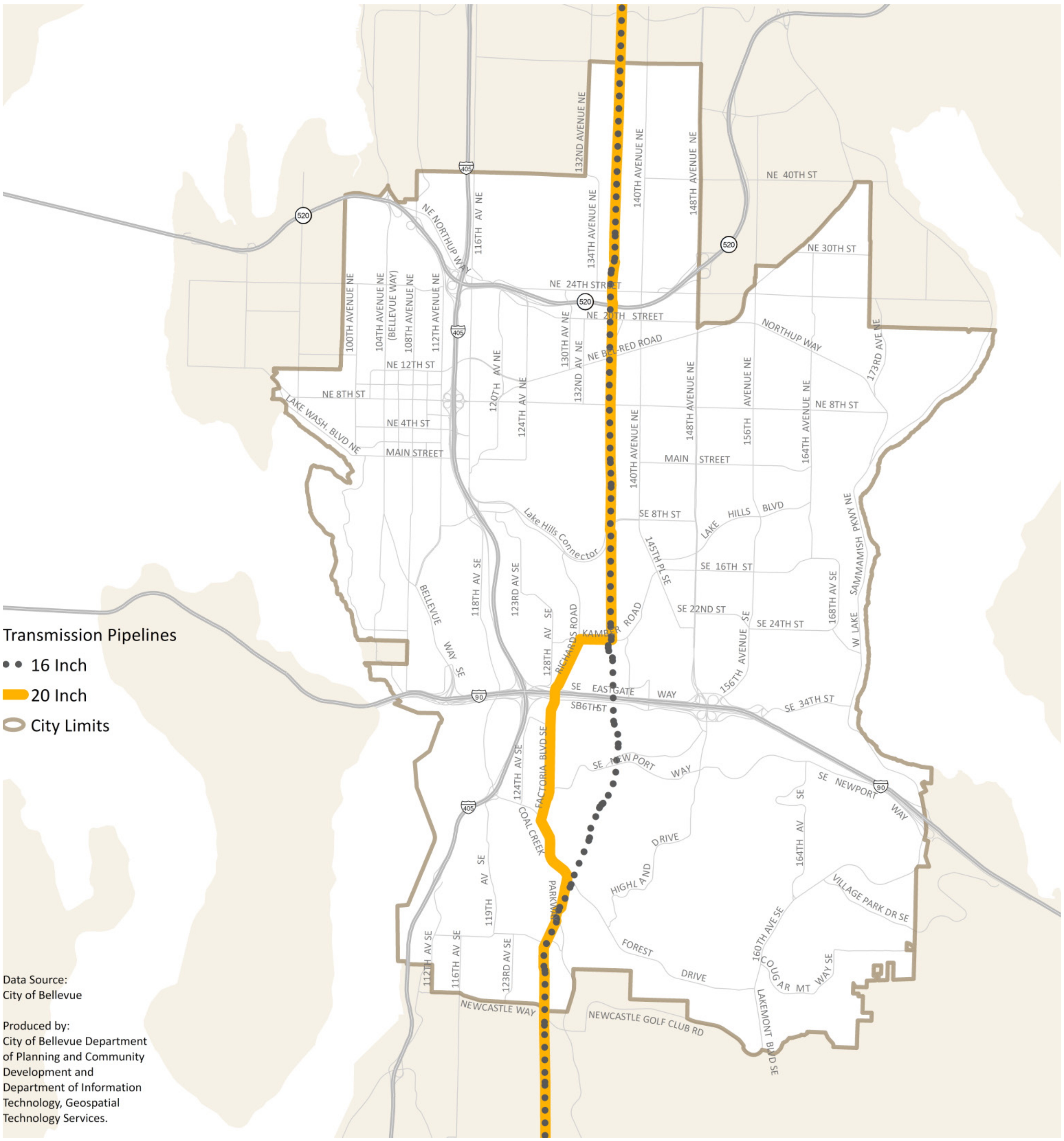
Map UT-8. Puget Sound Energy Natural Gas Mains

This map shows the locations of the Puget Sound Energy's existing high pressure natural gas mains.



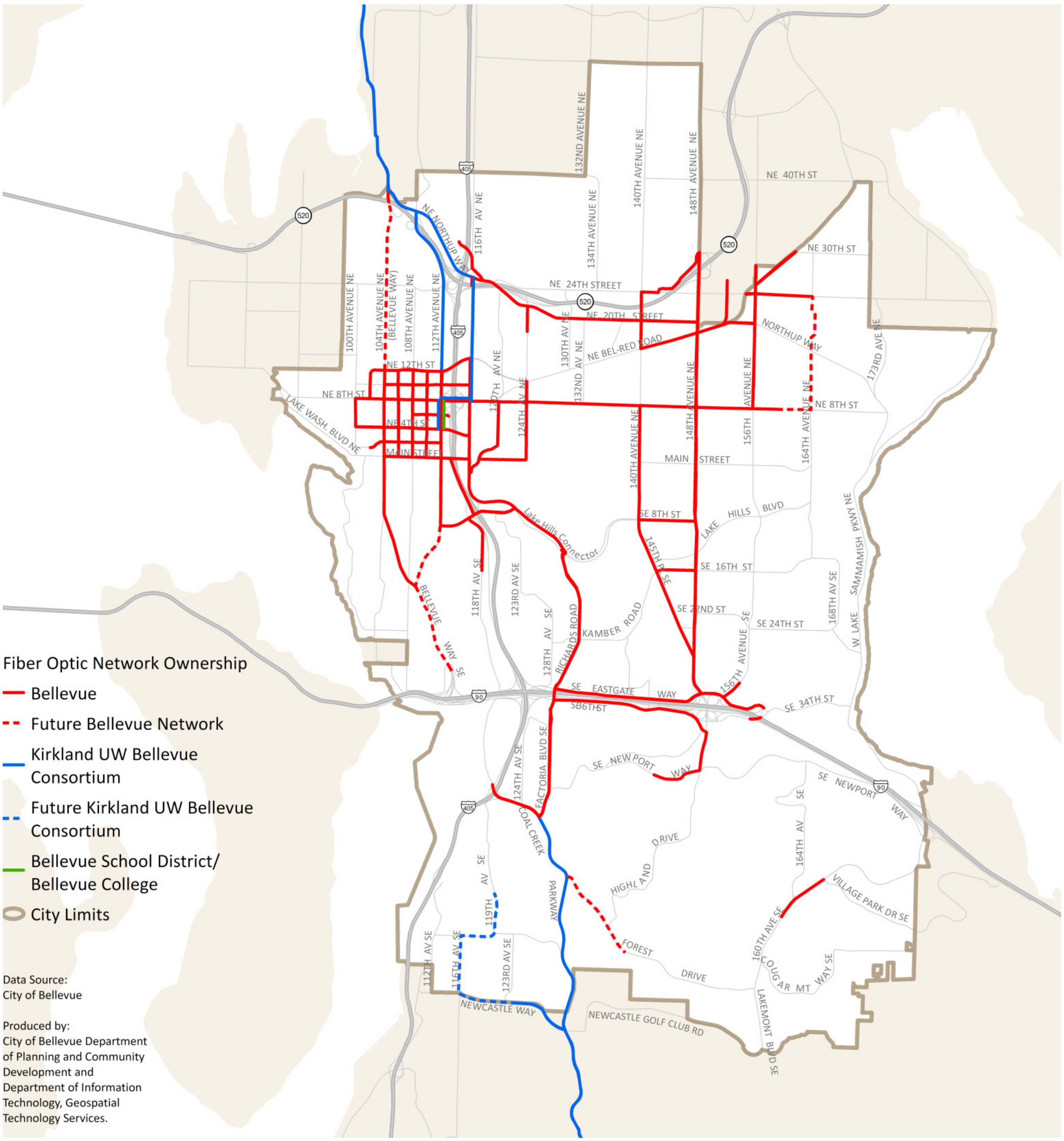
Map UT-9. Olympic Pipeline Company Transmission Pipeline

This map shows the locations of the Olympic Pipeline Company's liquid petroleum transmission pipelines within Bellevue.



Map UT-10. Fiber Optic Network

This map shows the location of Bellevue's existing and future fiber optic network by ownership.



GOALS & POLICIES

GOAL

- To develop and maintain all utilities at the appropriate levels of service to accommodate the city's projected growth.
- To ensure reliable utility service is provided in a way that balances public concerns about infrastructure safety and health impacts, consumer interest in paying a fair and reasonable price for service, potential impacts on the natural environment, and aesthetic compatibility with surrounding land uses.
- Utility facilities are permitted and approved by the city in a fair and timely manner and in accord with development regulations, to encourage predictability.
- New technology to improve utility services and reliability is used in balance with health and safety, economic, aesthetics, and environmental factors.

POLICIES

General Utility System

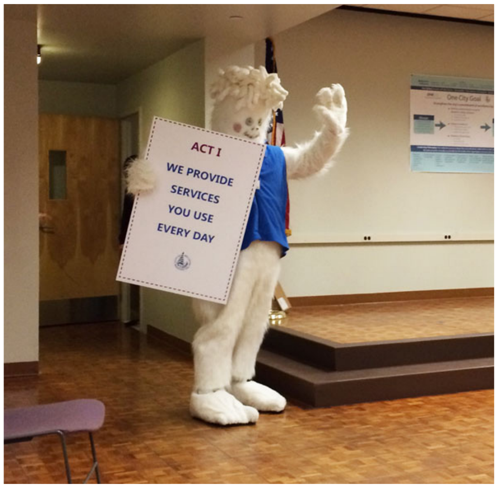
UT-1. Manage utility systems effectively in order to provide reliable, sustainable, quality service.

UT-2. Build and manage city-owned utility infrastructure assets to reduce the likelihood of risks to public safety, property and environment, and disruption due to asset failure.

UT-3. Use design and construction standards that are environmentally sensitive, safe, cost-effective, and appropriate.

UT-4. Encourage public-private partnerships to take advantage of the city's fiber optic network to facilitate innovation, service delivery, and competition for broadband deployment throughout the city.

UT-5. Encourage new and cost-effective emerging information and telecommunications technologies that would benefit city utility users and improve utility service and efficient water and energy use.



UT-6. Ensure that the location, type, and size of all public facilities is determined and/or approved by the city.

UT-7. Base the extension and sizing of system components on the land use plan of the area. System capacity will not determine land use.

UT-8. Design, construct, and maintain facilities to minimize their impact on surrounding neighborhoods.

UT-9. Encourage the joint use of public facilities such as the development of a storm and surface water detention area as passive recreation.

UT-10. Emphasize cost effective management of city utility systems over their lifetime, including planning for their renewal and replacement, balancing risk, and maintaining desired service levels. Forecast future capital and maintenance costs and manage rates so that customer rate revenue funds the cost of ownership equitably across generations.

UT-11. Educate and inform utility providers, consumers and the community about the costs and benefits of emerging technologies.

UT-12. Develop and periodically update functional utility system plans that forecast system capacity and needs for at least a 20 year planning horizon.

UT-13. Consider Low Impact Development principles to minimize impervious surfaces and native vegetation loss on all infrastructure improvement projects.

UT-14. Make the city's utility service areas coincide with the Potential Annexation Area.

UT-15. Extend the service area boundaries only if landowners requesting service have begun the annexation process or have made prior agreements with city.

UT-16. Use pre-annexation agreements only if immediate annexation cannot be required or is not reasonable.

Utility Coordination

UT-17. Extend water and wastewater utility service to unserved areas of the utility service area, including extensions into potential annexation areas, if the city's costs are reimbursed and provided that service will be extended only upon annexation to the city.

UT-18. Coordinate with other jurisdictions and governmental entities in the planning and implementation of multi-jurisdictional utility facility additions and improvements.

UT-19. Coordinate with the appropriate jurisdictions to ensure that utility facilities that are to be constructed in potential annexation areas are designed and built in accord with City of Bellevue standards.

UT-20. Coordinate emergency preparedness and response with local and regional utility partners.

Hazardous Waste

UT-21. Cooperate with other private and public agencies in the region to manage and control hazardous waste and moderate risk waste, including medical wastes and hazardous household substances.

UT-22. Educate the public in the proper handling and disposal of hazardous household waste and on the use of alternative products or practices which result in reducing the use and storage of hazardous materials in homes and businesses.

UT-23. Provide for the safe and convenient disposal of hazardous household waste through a permanent and conveniently located collection facility for Bellevue residents.

Solid Waste

UT-24. Promote the recycling of solid waste materials by providing opportunities for convenient recycling and by developing educational materials on recycling, composting, and other waste reduction methods.

Discussion: Waste reduction and source separation are the city's preferred strategies for managing solid waste. Materials remaining after effective waste reduction and source separation should be handled in accordance with the King County Solid Waste Plan.

UT-25. Encourage and actively seek an effective regional approach to solid waste management.

UT-26. Use a public review process in the selection and approval of sites for any disposal facility, to study and consider sensitivity to aesthetics, health effects and the environment.

UT-27. Maintain a safe, cost-effective and responsive solid waste collection system that provides convenient, efficient, environmentally-friendly and visually unobtrusive components and services.

UT-28. Manage solid waste collection to minimize litter and neighborhood disruption.

UT-29. Work with King County to maintain a geographically balanced system of solid waste transfer and disposal facilities and avoid disproportionate impacts to any individual community.

UT-30. Explore transfer and disposal options for the period after the city's current contract with King County terminates in mid-2028.

Wastewater Utility

UT-31. Provide a reliable wastewater disposal system that ensures public health and safety, and protects the environment.

UT-32. Require wastewater connections for all new development, including single family plats, unless otherwise allowed by state or county regulations.

UT-33. Allow existing single family homes with septic systems to continue to use septic systems, provided they remain in compliance with Seattle-King County Public Health requirements. Homeowners are encouraged to connect to wastewater systems where available. If existing septic systems fail to maintain compliance with Seattle-King County Public Health standards and cannot be brought into compliance, homeowners should be required to connect to the wastewater system.

Storm and Surface Water Utility

UT-34. Provide a storm and surface water system that controls damage from storms, protects surface water quality, provides for the safety and enjoyment of citizens, supports fish and wildlife habitat, and protects the environment.

UT-35. Participate in regional watershed based efforts with the goals of achieving local drainage basin health and addressing Endangered Species Act issues. Manage the storm and surface water system within a system wide, watershed based context.

UT-36. Design context appropriate stormwater management facilities that reflect the unique character of the neighborhood in which the site is situated.

UT-37. Educate the public about water quality issues.

UT-38. Encourage the use of low impact development and stormwater best management practices to manage stormwater runoff, which may result in smaller facilities constructed on- and off-site for flow control, conveyance, and water quality.

Water Utility

UT-39. Provide a reliable, cost-effective supply of safe, secure, high quality drinking water that meets the community's water needs in an environmentally responsible manner.

UT-40. Provide a water supply that meets all federal and state drinking water quality standards.

UT-41. Provide reliable water service for domestic use, fire flow protection, and emergencies.

UT-42. Promote conservation and the wise and efficient use of the public water supply and discourage the waste of this valuable resource.

UT-43. Improve the quality and quantity of the water supply of well water users by allowing access to the city water system as contained in the Water System Functional Plan, and provided that at least the fair share costs are paid by the benefiting parties.

UT-44. Serve as a role model for the community in the efficient use of water.

NON CITY-MANAGED UTILITIES

General Non City-Managed Utilities

UT-45. Coordinate with non-city utility providers to ensure planning for system growth consistent with the city's Comprehensive Plan and growth forecasts.

UT-46. Support new and emerging information and telecommunications technologies that would benefit utility service delivery by being sustainable, appropriate and viable.

UT-47. Defer to the serving utility the implementation sequence of utility plan components.

UT-48. Coordinate with the appropriate jurisdictions and governmental entities in the planning and implementation of multi-jurisdictional utility facility additions and improvements.

UT-49. Require effective and timely coordination of all public and private utility activities including trenching and culvert replacements.

UT-50. Encourage widespread, affordable, high-speed internet access, including access to competing telecommunications services and new forms of technology to provide the community with choice and to facilitate innovation.

UT-51. Maintain Bellevue's competitive advantage and attraction as a highly connected community.

UT-52. Assess the coverage and quality of residential and business access to internet and telecommunication services and explore opportunities to enhance service to areas of need.

UT-53. Ensure a permitting process that achieves a balance between encouraging deployment of advanced high-speed telecommunications infrastructure and protecting neighborhood character.

UT-54. Facilitate coordination between telecommunications providers as a key consideration in city street right of way infrastructure projects to ensure opportunities to install facilities in common trenches.

UT-55. Limit the amount of disturbance to city infrastructure by encouraging co-location of telecommunications conduit in the public right-of-way.

UT-56. Inform telecommunications companies authorized to provide services within Bellevue about the schedule for capital projects and opportunities to install telecommunications infrastructure.

UT-57. Require notification to the city prior to a utility's maintenance or removal of vegetation in city right-of-way.

UT-58. Require the undergrounding of all new electrical distribution lines except that interim installation of new aerial facilities may be allowed if accompanied by a program to underground through coordination with the city and other utilities. Require the undergrounding of all existing electrical distribution lines where a change in use or intensification of an existing use occurs, unless delayed installation is approved as part of a specific program to coordinate undergrounding of several utilities or in conjunction with an undergrounding program for several sites or when related to street improvements.

UT-59. When implementing street projects, determine whether the relocation of distribution facilities underground is required. If so, determine the manner of payment: tariff schedule, capital improvement program, or the formation of a local improvement district.

UT-60. Work with Puget Sound Energy, telecom providers, state regulatory agencies, and other responsible parties to develop funding tools that enable full mitigation of the neighborhood impacts of deploying electrical and telecommunications infrastructure.

UT-61. Allow new aerial telecommunication lines on existing systems provided that they shall be designed to address visual impacts and are required to be placed underground at the time of undergrounding electrical distribution lines.

UT-62. Support neighborhood efforts to underground existing electrical transmission and distribution lines.

UT-63. Support neighborhood efforts to form financial arrangements, such as local improvement districts, to cover the non-utility share of project costs for undergrounding electrical lines.

UT-64. Require the reasonable screening and/or architecturally compatible integration of all new utility and telecommunication facilities.

UT-65. Protect Bellevue's aesthetic quality and infrastructure investment from unnecessary degradation caused by the construction of telecommunication infrastructure.

UT-66. Encourage directional pruning of trees and phased replacement of improperly located vegetation in the right-of-way. Perform pruning and trimming of trees in an environmentally sensitive and aesthetically acceptable manner and according to professional arboricultural specifications and standards.

UT-67. Encourage consolidation on existing facilities where reasonably feasible and where such consolidation leads to fewer impacts than would construction of separate facilities. Examples of facilities which could be shared are towers, electrical, telephone and light poles, antenna, substation sites, trenches, and easements.

UT-68. Encourage the use of utility corridors as non-motorized trails. The city and utility company should coordinate the acquisition, use, and enhancement of utility corridors for pedestrian, bicycle and equestrian trails and for wildlife corridors and habitat.

UT-69. Avoid, when reasonably possible, locating overhead lines in greenbelt and open spaces as identified in the Parks and Open Space System Plan.

UT-70. Facilitate the conversion to cost-effective and environmentally sensitive alternative technologies and energy sources.

UT-71. Facilitate and encourage conservation of resources.

Discussion: Items the city should consider in implementing this policy include conserving the use of electric energy in its own facilities, and adopting practical and cost-effective energy building codes.

CO-LOCATING UTILITIES

Aesthetic impact of utilities can be reduced by using existing facilities, where feasible. Examples of facilities that might be shared are towers; electrical, telephone and light poles; substation sites; trenches; and easements.

TRAILS AND UTILITIES

Coordination between the city and utilities on the acquisition, use, and enhancement of utility corridors can allow for greater opportunities for pedestrian, bicycle and equestrian trails and for wildlife corridors and habitat.

UT-72. Encourage cooperation with other jurisdictions in the planning and implementation of multi-jurisdictional utility facility additions and improvements. Decisions made regarding utility facilities shall be made in a manner consistent with, and complementary to, regional demand and resources, and shall reinforce an interconnected regional distribution network.

UT-73. Encourage communication among the city, the WUTC, and utilities regulated by the WUTC about the distribution of costs for existing and proposed utility facilities; especially requirements for the undergrounding of transmission, distribution, and communication lines exceeding statewide norms.

UT-74. Encourage system practices intended to minimize the number and duration of interruptions to customer service.

UT-75. Prior to seeking city approval for facilities, encourage utilities service providers to solicit community input on the siting of proposed facilities which may have a significant adverse impact on the surrounding community.

UT-76. Encourage utility providers to erect limited on-site signage on all sites purchased for future major utility facilities to indicate the utility's intended use of the site.

UT-77. Require all utility equipment support facilities to be aesthetically compatible with the area in which they are placed by using landscape screening and/or architecturally compatible details and integration.

UT-78. Support federal or state actions that would preserve local government authority to regulate time, manner and place of construction in the right-of-way.

Non City-Managed Utilities - Additional Wireless Communication Facilities

UT-79. Require the placement and design of wireless communication facilities in a manner that minimizes the adverse impacts on adjacent land uses.

UT-80. Require permit applicants to submit an area wide plan that demonstrates the lowest land use impacts consistent with telecommunication customer needs.

UT-81. Allow exchanges ("swaps") between providers of permitted wireless communication facilities sites, to encourage industry cooperation and coordination.

UT-82. Require wireless equipment constructed in public rights of way in residential areas to be under 30 inches high.

UT-83. Recognize that wireless communication facilities will be deployed in all areas of the city to provide coverage and capacity consistent with the changing use of wireless technology. Minimize the attendant impacts, particularly the visual impacts of, wireless communication facility towers, lattice towers and structures by utilizing criteria for the design and location of such facilities that appropriately balance the need for wireless services and the impacts of the necessary facilities.

UT-84. Minimize visual impacts of wireless communication facilities by encouraging deployment in land use districts in the following preferred and descending order when possible, considering the provider's coverage needs:

1. Nonresidential land use districts, except Transition Areas;
2. Transition Areas;
3. Multifamily (R-20 and R-30) districts; and
4. Park sites and Residential districts.

UT-85. Minimize visual impacts of wireless communication facilities by encouraging system designs in the following preferred and descending order:

1. Attached to public facility structures, building mounted, or integrated with utility poles, light standards, and signal supports;
2. Co-located on utility poles, light standards, signal supports; and
3. Free standing towers.

UT-86. Require timely removal of abandoned facilities that are visually intrusive whenever facilities are replaced or upgraded.

UT-87. Encourage wireless equipment to be installed in a manner compatible with other utility functions.

UT-88. For infrastructure opportunities on city property, other than street rights-of-way, encourage the use of appropriate city owned properties for lease to install wireless communications equipment that is compatible with existing city uses of the sites and consistent with land use requirements.

UT-89. Encourage the co-location of telecommunications equipment on city sites that reduce total impact of antennas on the community.

UT-90. Periodically review and update wireless facility regulations to respond to changes in technology and community conditions to balance impacts with the need for service.

Non City-Managed Utilities - Additional Electrical Facilities Policies

UT-91. Encourage the public to conserve electrical energy through public education.

UT-92. Encourage city and utility involvement with regional or statewide agencies when and if they are developing policies regarding exposure to electric and magnetic fields (EMF) or other utility issues.

UT-93. Review new accepted scientific research of potential health impacts associated with electrical and telecommunications facilities and make changes to policies if the situation warrants.

UT-94. Require in the planning, siting, and construction of all electrical facilities, systems, lines, and substations that the electrical utility strike a reasonable balance between potential health effects and the cost and impacts of mitigating those effects by taking reasonable cost-effective steps.

UT-95. Work with Puget Sound Energy to implement the electrical service system serving Bellevue in such a manner that new and expanded transmission and substation facilities are compatible and consistent with the local context and the land use pattern established in the Comprehensive Plan.

Discussion: Where feasible, electrical facilities should be sited within the area requiring additional service. Electrical facilities primarily serving commercial and mixed use areas should be located in commercial and mixed use areas, and not in areas that are primarily residential. Further, the siting and design of these facilities should incorporate measures to mitigate the visual impact on nearby residential areas. These considerations must be balanced with the community's need to have an adequate and reliable power supply.

UT-96. Require siting analysis through the development review process for new facilities, and expanded facilities at sensitive sites, including a consideration of alternative sites and collocation.

Discussion: Sensitive facility sites are those new facilities and existing facilities proposed to be expanded where located in or in close proximity to residentially-zoned districts such that there is potential for visual impacts absent appropriate siting and mitigation. The city will update Map UT-7 to the extent needed to stay current with changes in Puget Sound Energy's system planning.

UT-97. Avoid, minimize, and mitigate the impacts of new or expanded electrical facilities through the use of land use regulation and performance standards that address siting considerations, architectural design, site screening, landscaping, maintenance, available technologies, aesthetics, and other appropriate measures.

UT-98. Discourage new aerial facilities within corridors that have no existing aerial facilities.

UT-99. Work with and encourage Puget Sound Energy to plan, site, build and maintain an electrical system that meets the needs of existing and future development, and provides highly reliable service for Bellevue customers.

Discussion: Providing highly reliable service is a critical expectation for the service provider, given the importance of reliable and uninterrupted electrical service for public safety and health, as well as convenience. Highly reliable service means there are few and infrequent outages, and when an unavoidable outage occurs it is of short duration and customers are frequently updated as to when power is likely to be restored. A highly reliable system will be designed, operated and maintained to keep pace with the expectations and needs of residents and businesses as well as evolving technologies and operating standards as they advance over time.

UT-100. Encourage the prioritization of restoring electrical service to water and wastewater utility facilities following power outages.

UT-101. Administer applicable regulations and franchise agreement authority over the Seattle City Light and Olympic Pipeline infrastructure located in Bellevue.

POLICY CONNECTIONS

The Utilities Element addresses the location of municipal and non-municipal utilities and anticipates the amount and distribution of utilities to meet community needs and growth. Other elements of the Comprehensive Plan also help to plan for utilities infrastructure to help meet the needs of growth.

The **Environment** Element addresses the stewardship of natural resources including ground and surface water.

The **Capital Facilities** Element includes an inventory and financing policies for municipal utilities.

Utility services must keep pace with growth; the **Land Use** Element includes policies and information about Bellevue's projected growth.

The **Urban Design and the Arts** Element contains policies that address design and visual impacts that might result from utility infrastructure.

IMPLEMENTATION

Bellevue implements the Comprehensive Plan through numerous actions, including day-to-day operations, capital investments, strategic partnerships, and review of new development projects. Both municipal and non-municipal utilities in Bellevue generally have their own planning processes to ensure future facilities meet the city's needs. The following list shows some of the relevant plans that implement the Utilities Element.

Implementation Program	Type
Capital Investment Program This is the city's six-year financing and implementation plan in which needed capital improvements to the city's public facilities and infrastructure are identified and prioritized.	**Funding:** updated biennially.
Water System Plan This plan provides a basis for capital improvement planning for six years and forecasts anticipated needs to a 20-year planning horizon.	**Functional Plan:** updated on a 6-10 year cycle, as needed.
Wastewater System Plan This plan addresses aging infrastructure, system expansion to accommodate development, revised policies and practices, data, finances, revised growth forecasting, and recommended improvements.	**Functional Plan:** updated on a 6-10 year cycle, as needed.
Storm and Surface Water System Plan This plan establishes the city's storm and surface water policy.	**Functional Plan:** updated on a 6-10 year cycle, as needed.
Redmond Water System Plan The Redmond water utility serves a small portion of Bellevue in the Overlake area.	**Functional Plan:** updated on a 6-10 year cycle, as needed.
King County Comprehensive Solid Waste Management Plan This plan presents proposed strategies for managing King County's solid waste over a six-year period.	**Functional Plan:** updated on a 6-10 year cycle, as needed
Land Use Code Work Program The Land Use Code work program includes a number of initiatives to update or draft new development regulations.	**Land Use Code:** updates conducted annually.
Development Review Review of utilities projects to ensure they conform to the Land Use Code.	**Project review:** on-going

ADDITIONAL RESOURCES

- Puget Sound Energy Bellevue, Washington
- Local cable and broadband service providers
- Local wireless telecommunications service providers

Appendix C

Water Rights Self-Assessment and Certificates

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Table C-1

WATER SYSTEM PLAN
WATER RIGHTS SELF ASSESSMENT – EXISTING STATUS

PERMIT CERTIFICATE OR CLAIM # Permit/certificates	NAME ON DOCUMENT	PRIORITY DATE (List oldest first)	SOURCE NAME/ NUMBER	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	EXISTING WATER RIGHTS		EXISTING CONSUMPTION		CURRENT WATER RIGHT STATUS (Excess/Deficiency)	
					Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
1. 7 3936	KCWD97	01/17/56	Well 3	Emergency supply	850 gpm	1,360 af/yr	emergency	emergency	400gpm	450 af/yr
2. 06041 / 04391	KCWD97	06/20/62	Well 7	Emergency supply	700 gpm	1,120 af/yr	emergency	emergency	700gpm	1,120 af/yr
3. 06128 / 04454	KCWD97	09/13/62	Well 5	Emergency supply	500 gpm	800 af/yr	emergency	emergency	500gpm	800 af/yr
4. 06129 / 04453	KCWD97	09/13/62	Well 6	Emergency supply	600 gpm	960 af/yr Δ	emergency	emergency	600gpm	960 af/yr
5. 00232 / 00518	KCWD68	03/20/46	Well 1	Not currently in use	300 gpm	487 af/yr	none	none	300 gpm	487 af/yr
6. 00437 / 00360	KCWD68	03/25/47	Well 2	Not currently in use	700 gpm	780 af/yr	none	none	700 gpm	780 af/yr
7. 00528 / 00521	KCWD68	07/09/47	Well 3	Not currently in use	700 gpm	780 af/yr	none	none	700 gpm	780 af/yr
8. 03807 / 02539	KCWD97	07/11/55	Well 1	Not currently in use	400 gpm	450 af/yr	none	none	400 gpm	450 af/yr
9. 03043 / 02429	WWSC	06/02/53	Well 1	Not currently in use	300 gpm	480 af/yr	none	none	300 gpm	480 af/yr
10. 01077 / 02630	WWSC	08/31/49	Hill-Aire	Not currently in use	80 gpm	40 af/yr	none	none	80 gpm	40 af/yr
11. 07269 / 05820	KCWD68	01/24/51	Lake Wash.	Not currently in use	6.7 cfs	---	none	none	6.7 cfs	---
12. 08726 / 06489	KCWD68	06/27/52	Lake Wash.	Not currently in use	13.0 cfs	---	none	none	13.0 cfs	---
TOTAL	**************	*********	*********	****************	13,500 gpm/ 30.1 cfs/ 19.5 MGD	---				

INTERTIE NAME/ IDENTIFIER	NAME OF PURVEYOR PROVIDING WATER	EXISTING LIMITS ON INTERTIE USE		EXISTING CONSUMPTION THROUGH INTERTIE		CURRENT INTERTIE SUPPLY STATUS (Excess/Deficiency)	
		Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
1. 77050Y/SEATTLE/CWA (15)	SEATTLE PUBLIC UTILITIES	NA	Varies‡	25,600 gpm^ (28,100 gpm)*	5,270 MG (5,790 MG)*	Varies‡	Varies‡
2. 42250T/KIRKLAND (3)	CITY OF KIRKLAND	NA	NA	155 gpm†	13 MG	NA	NA
3. 41750C/CCUD (8)	COAL CREEK UTILITY DISTRICT	NA	NA	1,970 gpm†	168 MG	NA	NA
TOTAL	**			27,700 gpm (30,200 gpm)*	5,450 MG (5,970 MG)*		

PENDING WATER RIGHT APPLICATION (New/Change)	NAME ON APPLICATION	DATE SUBMITTED	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	PENDING WATER RIGHTS	
				Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested
1.					

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

^ Estimated 2014 (low-demand year) MDD with 1.16 Peaking Factor (typical observed). Bellevue equalizing storage meets remaining peak.

* Values in parentheses (#) include wheeled flows. Values not in parentheses are for Bellevue's service area only.

† Estimated. 2014 (low-demand year) ADD x 2.2 MDD/ADD x 2.8 Peaking Factor for SF (Figure 3-17). Kirkland/CCUD provide equalizing storage.

‡ Annual SPU inlet volume is limited by SPU-Cascade block contract amount, minus volume use by other Cascade Members

TABLE C-2
WATER SYSTEM PLAN
WATER RIGHTS SELF ASSESSMENT – 6-Year Forecast (2020)

PERMIT CERTIFICATE OR CLAIM #	NAME ON DOCUMENT	PRIORITY DATE (List oldest first)	SOURCE NAME/ NUMBER	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	EXISTING WATER RIGHTS		EXISTING CONSUMPTION		CURRENT WATER RIGHT STATUS (Excess/Deficiency)	
Permit/certificates					Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
1. 7 3936	KCWD97	01/17/56	Well 3	Emergency supply	850 gpm	1,360 af/yr	emergency	emergency	400gpm	450 af/yr
2. 06041 / 04391	KCWD97	06/20/62	Well 7	Emergency supply	700 gpm	1,120 af/yr	emergency	emergency	700gpm	1,120 af/yr
3. 06128 / 04454	KCWD97	09/13/62	Well 5	Emergency supply	500 gpm	800 af/yr	emergency	emergency	500gpm	800 af/yr
4. 06129 / 04453	KCWD97	09/13/62	Well 6	Emergency supply	600 gpm	960 af/yr Δ	emergency	emergency	600gpm	960 af/yr
5. 00232 / 00518	KCWD68	03/20/46	Well 1	See Pending Below	300 gpm	487 af/yr	none	none	300 gpm	487 af/yr
6. 00437 / 00360	KCWD68	03/25/47	Well 2	See Pending Below	700 gpm	780 af/yr	none	none	700 gpm	780 af/yr
7. 00528 / 00521	KCWD68	07/09/47	Well 3	See Pending Below	700 gpm	780 af/yr	none	none	700 gpm	780 af/yr
8. 03807 / 02539	KCWD97	07/11/55	Well 1	See Pending Below	400 gpm	450 af/yr	none	none	400 gpm	450 af/yr
9. 03043 / 02429	WWSC	06/02/53	Well 1	See Pending Below	300 gpm	480 af/yr	none	none	300 gpm	480 af/yr
10. 01077 / 02630	WWSC	08/31/49	Hill-Aire	See Pending Below	80 gpm	40 af/yr	none	none	80 gpm	40 af/yr
11. 07269 / 05820	KCWD68	01/24/51	Lake Wash.	Not currently in use	6.7 cfs	---			6.7 cfs	---
12. 08726 / 06489	KCWD68	06/27/52	Lake Wash.	Not currently in use	13.0 cfs	---			13.0 cfs	---
TOTAL	**************	*********	*********	****************	13,500 gpm/ 30.1 cfs/ 19.5 MGD					

INTERTIE NAME/ IDENTIFIER	NAME OF PURVEYOR PROVIDING WATER	EXISTING LIMITS ON INTERTIE USE		FORECASTED CONSUMPTION THROUGH INTERTIE		FORECASTED INTERTIE SUPPLY STATUS (Excess/Deficiency)	
		Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
1. 77050Y/SEATTLE/CWA (15)	SEATTLE PUBLIC UTILITIES	NA	Varies‡	31,300 gpm^ (37,400 gpm)*	6,470 MG (7,730 MG)*	Varies‡	Varies‡
2. 42250T/KIRKLAND (3)	CITY OF KIRKLAND	NA	NA	176 gpm†	14 MG	NA	NA
3. 41750C/CCUD (8)	COAL CREEK UTILITY DISTRICT	NA	NA	3,180 gpm†	272 MG	NA	NA
TOTAL	**			34,600 gpm (40,700 gpm)*	6,760 MG (8,020 MG)*		

PENDING WATER RIGHT APPLICATION (New/Change)	NAME ON APPLICATION	DATE SUBMITTED	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	PENDING WATER RIGHTS	
				Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested
1. Future rights transfer application	Not Yet Applicable	Unknown	Unknown	Unknown	Unknown

Δ 750 Acre-Feet/Year Additive, 210 Acre-Feet/Year Non-Additive
^ Estimated high-demand (hot) year per Table 3-16, with 1.16 Peaking Factor (approx. observed). Bellevue equalizing storage meets remaining peak.
* Values in parentheses (#) include wheeled flows. Values not in parentheses are for Bellevue's service area only.
† Estimated high-demand (hot) year per Table 3-16, with 2.8 Peaking Factor for SF areas (Figure 3-17). Kirkland/CCUD provide equalizing storage.
‡ Annual SPU inlet volume is limited by SPU-Cascade block contract amount, minus volume use by other Cascade Members

Table C-3
WATER SYSTEM PLAN
WATER RIGHTS SELF ASSESSMENT – 10-Year Forecast (2024)

PERMIT CERTIFICATE OR CLAIM # Permit/certificates	NAME ON DOCUMENT	PRIORITY DATE (List oldest first)	SOURCE NAME/ NUMBER	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	EXISTING WATER RIGHTS		EXISTING CONSUMPTION		CURRENT WATER RIGHT STATUS (Excess/Deficiency)	
					Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
1. 7 3936	KCWD97	01/17/56	Well 3	Emergency supply	850 gpm	1,360 af/yr	emergency	emergency	400gpm	450 af/yr
2. 06041 / 04391	KCWD97	06/20/62	Well 7	Emergency supply	700 gpm	1,120 af/yr	emergency	emergency	700gpm	1,120 af/yr
3. 06128 / 04454	KCWD97	09/13/62	Well 5	Emergency supply	500 gpm	800 af/yr	emergency	emergency	500gpm	800 af/yr
4. 06129 / 04453	KCWD97	09/13/62	Well 6	Emergency supply	600 gpm	960 af/yr Δ	emergency	emergency	600gpm	960 af/yr
5. 00232 / 00518	KCWD68	03/20/46	Well 1	Not currently in use	300 gpm	487 af/yr	none	none	300 gpm	487 af/yr
6. 00437 / 00360	KCWD68	03/25/47	Well 2	Not currently in use	700 gpm	780 af/yr	none	none	700 gpm	780 af/yr
7. 00528 / 00521	KCWD68	07/09/47	Well 3	Not currently in use	700 gpm	780 af/yr	none	none	700 gpm	780 af/yr
8. 03807 / 02539	KCWD97	07/11/55	Well 1	Not currently in use	400 gpm	450 af/yr	none	none	400 gpm	450 af/yr
9. 03043 / 02429	WWSC	06/02/53	Well 1	Not currently in use	300 gpm	480 af/yr	none	none	300 gpm	480 af/yr
10. 01077 / 02630	WWSC	08/31/49	Hill-Aire	Not currently in use	80 gpm	40 af/yr	none	none	80 gpm	40 af/yr
11. 07269 / 05820	KCWD68	01/24/51	Lake Wash.	Not currently in use	6.7 cfs	---			6.7 cfs	---
12. 08726 / 06489	KCWD68	06/27/52	Lake Wash.	Not currently in use	13.0 cfs	---			13.0 cfs	---
TOTAL	**************	*********	*********	****************	13,500 gpm/ 30.1 cfs/ 19.5 MGD					

INTERTIE NAME/ IDENTIFIER	NAME OF PURVEYOR PROVIDING WATER	EXISTING LIMITS ON INTERTIE USE		FORECASTED CONSUMPTION THROUGH INTERTIE		FORECASTED INTERTIE SUPPLY STATUS (Excess/Deficiency)	
		Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
1. 77050Y/SEATTLE/CWA (15)	SEATTLE PUBLIC UTILITIES	NA	Varies‡	32,400 gpm^ (39,200 gpm)*	6,710 MG (8,100 MG)*	Varies‡	Varies‡
2. 42250T/KIRKLAND (3)	CITY OF KIRKLAND	NA	NA	178 gpm†	14 MG	NA	NA
3. 41750C/CCUD (8)	COAL CREEK UTILITY DISTRICT	NA	NA	3,220 gpm†	275 MG	NA	NA
TOTAL	**			35,800 gpm (42,600 gpm)*	7,000 MG (8,390 MG)*		

PENDING WATER RIGHT APPLICATION (New/Change)	NAME ON APPLICATION	DATE SUBMITTED	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	PENDING WATER RIGHTS	
				Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested
1. Future rights transfer application	Not Yet Applicable	Unknown	Unknown	Unknown	Unknown

Δ 750 Acre-Feet/Year Additive, 210 Acre-Feet/Year Non-Additive
^ Estimated high-demand (hot) year per Table 3-16, with 1.16 Peaking Factor (approx. observed). Bellevue equalizing storage meets remaining peak.
* Values in parentheses (#) include wheeled flows. Values not in parentheses are for Bellevue's service area only.
† Estimated high-demand (hot) year per Table 3-16, with 2.8 Peaking Factor for SF areas (Figure 3-17). Kirkland/CCUD provide equalizing storage.
‡ Annual SPU inlet volume is limited by SPU-Cascade block contract amount, minus volume use by other Cascade Members

Table C-4
WATER SYSTEM PLAN
WATER RIGHTS SELF ASSESSMENT – 20-Year Forecast (2034)

PERMIT CERTIFICATE OR CLAIM # Permit/certificates	NAME ON DOCUMENT	PRIORITY DATE (List oldest first)	SOURCE NAME/ NUMBER	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	EXISTING WATER RIGHTS		EXISTING CONSUMPTION		CURRENT WATER RIGHT STATUS (Excess/Deficiency)	
					Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
1. 7 3936	KCWD97	01/17/56	Well 3	Emergency supply	850 gpm	1,360 af/yr	emergency	emergency	400gpm	450 af/yr
2. 06041 / 04391	KCWD97	06/20/62	Well 7	Emergency supply	700 gpm	1,120 af/yr	emergency	emergency	700gpm	1,120 af/yr
3. 06128 / 04454	KCWD97	09/13/62	Well 5	Emergency supply	500 gpm	800 af/yr	emergency	emergency	500gpm	800 af/yr
4. 06129 / 04453	KCWD97	09/13/62	Well 6	Emergency supply	600 gpm	960 af/yr Δ	emergency	emergency	600gpm	960 af/yr
5. 00232 / 00518	KCWD68	03/20/46	Well 1	Not currently in use	300 gpm	487 af/yr	none	none	300 gpm	487 af/yr
6. 00437 / 00360	KCWD68	03/25/47	Well 2	Not currently in use	700 gpm	780 af/yr	none	none	700 gpm	780 af/yr
7. 00528 / 00521	KCWD68	07/09/47	Well 3	Not currently in use	700 gpm	780 af/yr	none	none	700 gpm	780 af/yr
8. 03807 / 02539	KCWD97	07/11/55	Well 1	Not currently in use	400 gpm	450 af/yr	none	none	400 gpm	450 af/yr
9. 03043 / 02429	WWSC	06/02/53	Well 1	Not currently in use	300 gpm	480 af/yr	none	none	300 gpm	480 af/yr
10. 01077 / 02630	WWSC	08/31/49	Hill-Aire	Not currently in use	80 gpm	40 af/yr	none	none	80 gpm	40 af/yr
11. 07269 / 05820	KCWD68	01/24/51	Lake Wash.	Not currently in use	6.7 cfs	---			6.7 cfs	---
12. 08726 / 06489	KCWD68	06/27/52	Lake Wash.	Not currently in use	13.0 cfs	---			13.0 cfs	---
TOTAL	**************	*********	*********	****************	13,500 gpm/ 30.1 cfs/ 19.5 MGD					

INTERTIE NAME/ IDENTIFIER	NAME OF PURVEYOR PROVIDING WATER	EXISTING LIMITS ON INTERTIE USE		FORECASTED CONSUMPTION THROUGH INTERTIE		FORECASTED INTERTIE SUPPLY STATUS (Excess/Deficiency)	
		Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
1. 77050Y/SEATTLE/CWA (15)	SEATTLE PUBLIC UTILITIES	NA	Varies‡	35,800 gpm^ (44,200 gpm)*	7,390 MG (9,120 MG)*	Varies‡	Varies‡
2. 42250T/KIRKLAND (3)	CITY OF KIRKLAND	NA	NA	186 gpm†	14 MG	NA	NA
3. 41750C/CCUD (8)	COAL CREEK UTILITY DISTRICT	NA	NA	3,290 gpm†	281 MG	NA	NA
TOTAL	***			39,300 gpm (47,700 gpm)*	7,690 MG (9,420 MG)*		

PENDING WATER RIGHT APPLICATION (New/Change)	NAME ON APPLICATION	DATE SUBMITTED	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	PENDING WATER RIGHTS	
				Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested
1. Future rights transfer application	Not Yet Applicable	Unknown	Unknown	Unknown	Unknown

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

^ Estimated high-demand (hot) year per Table 3-16, with 1.16 Peaking Factor (approx. observed). Bellevue equalizing storage meets remaining peak.

* Values in parentheses (#) include wheeled flows. Values not in parentheses are for Bellevue's service area only.

† Estimated high-demand (hot) year per Table 3-16, with 2.8 Peaking Factor for SF areas (Figure 3-17). Kirkland/CCUD provide equalizing storage.

‡ Annual SPU inlet volume is limited by SPU-Cascade block contract amount, minus volume use by other Cascade Members

2539

S.P. No. [illegible]

Certificate Record No. 6 Page No. 2539-A

State of Washington, County of King

Certificate of Ground Water Right

Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the State Supervisor of Water Resources thereunder.

This Is to Certify That KING COUNTY WATER DISTRICT NO. 97

of Bellevue, Washington, has made proof

to the satisfaction of the State Supervisor of Water Resources of Washington, of a right to the use of the ground waters of a well

located within the NW¼NW¼ (fractional), sec. 2, T. 24 N., R. 5 E.W.M.

for the purpose of domestic supply for community

under and subject to provisions contained in Ground Water Permit No. 2602 issued by the State Supervisor of Water Resources and that said right to the use of said ground waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the State Supervisor of Water Resources of Washington and entered of record in Volume 6 at page 2539-A; that the right hereby confirmed dates from July 11, 1955; that the quantity of ground water under the right hereby confirmed for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed 400 gallons per minute, 450 acre-feet per year for domestic supply for community. ~~[illegible]~~

A description of the lands to which such ground water right is appurtenant, and the place where such water is put to beneficial use, is as follows:

King County Water District No. 97

The right to the use of the ground water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in Sections 6 and 7, Chapter 122, Laws of 1929.

WITNESS the seal and signature of the State Supervisor of Water Resources affixed this 10th day of April, 1956.

M. W. Walker

State Supervisor of Water Resources.

[illegible]

[illegible]

S. P. No. 1341—5-50—3M. 62306.

CERTIFICATE RECORD NO. 8 PAGE NO. 4391-A

STATE OF WASHINGTON, COUNTY OF King

Certificate of Ground Water Right

Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the State Supervisor of Water Resources thereunder.

THIS IS TO CERTIFY That KING COUNTY WATER DISTRICT NO.97

of Bellevue, Washington, has made proof to the satisfaction of the State Supervisor of Water Resources of Washington, of a right to the use of the ground waters of a well

located within Lot 8, Block 1 of Hill-Aire, Vol.43-34

Sec. 35, Twp. 25 N., R. 5 E., W. M.,

for the purpose of municipal supply

under and subject to provisions contained in Ground Water Permit No. 6041 issued by the State Supervisor of Water Resources and that said right to the use of said ground waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the State Supervisor of Water Resources of Washington and entered of record in Volume 8 at page 4391-A; that the right hereby confirmed dates from June 20, 1962; that the quantity of ground water under the right hereby confirmed for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed 700 gallons per minute; 1120 acre-feet per year for municipal supply.

Special provisions required by the Supervisor of Water Resources:

A description of the lands to which such ground water right is appurtenant:

Area served by King County Water District No.97, King County, Washington.

The right to the use of the ground water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in Sections 6 and 7, Chapter 122, Laws of 1929.

WITNESS the seal and signature of the State Supervisor of Water Resources affixed this 31st day of December, 1962.

M. G. Walker

State Supervisor of Water Resources.

ENG. VERIF.

S. P. No. 7111—3-61—3M. 6206.

CERTIFICATE RECORD No. 9 PAGE No. 4453-A

STATE OF WASHINGTON, COUNTY OF King

Certificate of Ground Water Right

Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the State Supervisor of Water Resources thereunder.

THIS IS TO CERTIFY THAT KING COUNTY WATER DISTRICT NO. 97 of Bellevue, Washington, has made proof to the satisfaction of the State Supervisor of Water Resources of Washington, of a right to the use of the ground waters of a well (No. 6) located within Lot 8, Block 1, Plat of Hill-Aire Addition Sec. 35, Twp. 25 N., R. 5 E. W. M., for the purpose of community domestic supply under and subject to provisions contained in Ground Water Permit No. 6129 issued by the State Supervisor of Water Resources and that said right to the use of said ground waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the State Supervisor of Water Resources of Washington and entered of record in Volume 9 at page 4453-A; that the right hereby confirmed dates from September 13, 1962; that the quantity of ground water under the right hereby confirmed for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed 600 gallons per minute; 960 acre-feet per year for community domestic supply.

Special provisions required by the Supervisor of Water Resources: The total annual withdrawal under all rights will be limited to 4480 acre-feet per year.

A description of the lands to which such ground water right is appurtenant:

To supply land served by Water District #97, King County, Washington

The right to the use of the ground water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in Sections 6 and 7, Chapter 122, Laws of 1929.

WITNESS the seal and signature of the State Supervisor of Water Resources affixed this 4th day of March, 19 63.

[signature]

State Supervisor of Water Resources.

O.K.

S. P. No. 1151—5-60—551. 6250.

CERTIFICATE RECORD No. 9 PAGE No. 4454-A

STATE OF WASHINGTON, COUNTY OF King

Certificate of Ground Water Right

Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the State Supervisor of Water Resources thereunder.

THIS IS TO CERTIFY That KING COUNTY WATER DISTRICT NO. 97

of Bellevue, Washington, has made proof to the satisfaction of the State Supervisor of Water Resources of Washington, of a right to the use of the ground waters of a well (No. 5)

located within Plat of Hill-Aire addition in

Sec. 35, Twp. 25 N., R. 5 E. W.M.,

for the purpose of community domestic supply

under and subject to provisions contained in Ground Water Permit No. 6128 issued by the State Supervisor of Water Resources and that said right to the use of said ground waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the State Supervisor of Water Resources of Washington and entered of record in Volume 9 at page 4454-A; that the right hereby confirmed dates from September 13, 1962; that the quantity of ground water under the right hereby confirmed for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed 500 gallons per minute; 800 acre-feet per year for community domestic supply.

Special provisions required by the Supervisor of Water Resources:

A description of the lands to which such ground water right is appurtenant:

Land served by King County Water District #97.

The right to the use of the ground water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in Sections 6 and 7, Chapter 122, Laws of 1929.

WITNESS the seal and signature of the State Supervisor of Water Resources affixed this 4th day of March, 1963.

M. G. Walker

State Supervisor of Water Resources.

O.K.

2630

D. P. No. 1121—5-53—[illegible] 2100.

CERTIFICATE RECORD No. 6 PAGE No. 2630-A

STATE OF WASHINGTON, COUNTY OF King

Certificate of Ground Water Right

Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the State Supervisor of Water Resources thereunder.

THIS IS TO CERTIFY That WASHINGTON WATER SERVICE CO., INC.

of Bellevue, Washington, *has made proof to the satisfaction of the State Supervisor of Water Resources of Washington, of a right to the use of the ground waters of a* well

located within Lot 4, Block 2, Hill-Aire Addition to King County, sec.35, T.25 N.,R.5 E.W.M.

for the purpose of domestic supply for community

under and subject to provisions contained in Ground Water Permit No. 1077 *issued by the State Supervisor of Water Resources and that said right to the use of said ground waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the State Supervisor of Water Resources of Washington and entered of record in Volume* 6 *at page* 2630-A*; that the right hereby confirmed dates from* August 31, 1949*; that the quantity of ground water under the right hereby confirmed for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed* 80 gallons per minute; 40 acre-feet per year for domestic supply for community. ~~for irrigation of xxxxxxxxxxxxxxxxxxxxxx acres~~

A description of the lands to which such ground water right is appurtenant, and the place where such water is put to beneficial use, is as follows:

Block 2, Hill-Aire Addition, Volume 43 of Plats, page 34, records of King County Auditor.

The right to the use of the ground water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in Sections 6 and 7, Chapter 122, Laws of 1929.

WITNESS the seal and signature of the State Supervisor of Water Resources affixed this 17th *day of* August, 1956.

H. B. Hodgkins
State Supervisor of Water Resources.

[illegible]

[illegible]

S. F. No. 7301—1-49—1M. 20415.

CERTIFICATE RECORD No. 2 PAGE No. 518-A

STATE OF WASHINGTON, COUNTY OF King

Certificate of Ground Water Right

Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and the rules and regulations of the State Supervisor of Hydraulics thereunder.

THIS IS TO CERTIFY THAT KING COUNTY WATER DISTRICT NO. 68 of Bellevue, Washington, *has made proof to the satisfaction of the State Supervisor of Hydraulics of Washington, of a right to the use of the ground waters of a* well *located within* the SE¼ of the SW¼ of Sec. 29, Twp. 25 N., Rge. 5 E.W.M.

for the purpose of municipal supply *under Ground Water Permit No.* 232 *issued by the State Supervisor of Hydraulics, and that said right to the use of said ground waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the State Supervisor of Hydraulics of Washington and entered of record in Volume* 2 *at page* 518-A; *that the right hereby confirmed dates from,* March 20, 1946; *that the quantity of ground water under the right hereby confirmed for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed* 300 gallons per minute; 487 acre-feet per year. ~~for irrigation of xxxxxxxxxxxx acres~~

A description of the lands to which such ground water right is appurtenant, and the place where such water is put to beneficial use, is as follows:

Bellevue and community (King County Water District No. 68), Washington

The right to the use of the ground water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in Sections 6 and 7, Chapter 122, Laws of 1929.

WITNESS the seal and signature of the State Supervisor of Hydraulics affixed this 8th *day of* December, 1950.

Chas J Bartholet
State Supervisor of Hydraulics

Conditions Unit
OK MM

S. P. No. 7361—10-47—1M. 1000

360

CERTIFICATE RECORD No. 1 PAGE No. 360-A

STATE OF WASHINGTON, COUNTY OF King

Certificate of Ground Water Right

Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and the rules and regulations of the State Supervisor of Hydraulics thereunder.

THIS IS TO CERTIFY That KING COUNTY WATER DISTRICT NO. 68 of Bellevue, Washington, has made proof *to the satisfaction of the State Supervisor of Hydraulics of Washington, of a right to the use of the ground waters of a* Well *located within* the $SW\frac{1}{4}$ of $SW\frac{1}{4}$ of Sec. 32, Twp. 25 N., Rge. 5 E.W.M. (Portion of Lots 36 & 37 of Bellevue Acre and One-Half Acre Tracts)

for the purpose of Domestic supply for community

under Ground Water Permit No. 437 *issued by the State Supervisor of Hydraulics, and that said right to the use of said ground waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the State Supervisor of Hydraulics of Washington and entered of record in Volume* 1 *at page* 360-A*; that the right hereby confirmed dates from* March 25, 1947*; that the quantity of ground water under the right hereby confirmed for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed* 700 gallons per minute; 780 acre-feet per year

~~for irrigation of xx xxxx xxxx xxxxx~~

A description of the lands to which such ground water right is appurtenant, and the place where such water is put to beneficial use, is as follows:

Town of Bellevue, King County, Washington, and community.

The right to the use of the ground water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in Sections 6 and 7, Chapter 122, Laws of 1929.

WITNESS the seal and signature of the State Supervisor of Hydraulics affixed this 21st *day of* October*, 19*49

Chas J Bartholet

State Supervisor of Hydraulics

521

S. F. No. 7341—1-42—1M. 2015.

CERTIFICATE RECORD NO. 2 PAGE NO. 521-A

STATE OF WASHINGTON, COUNTY OF King

Certificate of Ground Water Right

Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and the rules and regulations of the State Supervisor of Hydraulics thereunder.

THIS IS TO CERTIFY That KING COUNTY WATER DISTRICT NO. 68 of Bellevue, Washington, *has made proof to the satisfaction of the State Supervisor of Hydraulics of Washington, of a right to the use of the ground waters of a* drilled well *located within* the SE¼ of the NW¼ of Sec. 20, Twp. 25 N., Rge. 5 E.W.M.

for the purpose of domestic supply *under Ground Water Permit No.* 529 *issued by the State Supervisor of Hydraulics, and that said right to the use of said ground waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the State Supervisor of Hydraulics of Washington and entered of record in Volume* 2 *at page* 521-A*; that the right hereby confirmed dates from* July 9, 1947*; that the quantity of ground water under the right hereby confirmed for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed* 700 gallons per minute; 780 acre-feet per year ~~xxxxxxxxxxxxxxxxxxxxxxxxxx~~.

A description of the lands to which such ground water right is appurtenant, and the place where such water is put to beneficial use, is as follows:

Bellevue and community (King County Water District No. 68), Washington.

The right to the use of the ground water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in Sections 6 and 7, Chapter 122, Laws of 1929.

WITNESS the seal and signature of the State Supervisor of Hydraulics affixed this 8th *day of* December*, 19*50.

ENGINEERING DATA
O.K. [signature]

Chas J. Bartholet
State Supervisor of Hydraulics

2539

S.P. No. 1111—9-50—5M. 2100.

CERTIFICATE RECORD No. 6 PAGE No. 2539-A

STATE OF WASHINGTON, COUNTY OF King

Certificate of Ground Water Right

Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the State Supervisor of Water Resources thereunder.

THIS IS TO CERTIFY THAT KING COUNTY WATER DISTRICT NO.97

of Bellevue, Washington, *has made proof to the satisfaction of the State Supervisor of Water Resources of Washington, of a right to the use of the ground waters of a* well

located within the NW¼NW¼ (Fractional), Sec. 2, T. 24 N., R. 5 E.W.M.

for the purpose of domestic supply for community

under and subject to provisions contained in Ground Water Permit No. 2602 *issued by the State Supervisor of Water Resources and that said right to the use of said ground waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the State Supervisor of Water Resources of Washington and entered of record in Volume* 6 *at page* 2539-A*; that the right hereby confirmed dates from* July 11, 1955*; that the quantity of ground water under the right hereby confirmed for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed* 400 gallons per minute; 450 acre-feet per year for domestic supply for community.

A description of the lands to which such ground water right is appurtenant, and the place where such water is put to beneficial use, is as follows:

King County Water District No. 97

The right to the use of the ground water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in Sections 6 and 7, Chapter 122, Laws of 1929.

WITNESS the seal and signature of the State Supervisor of Water Resources affixed this 10th *day of* April, *19*56.

M. Walker

State Supervisor of Water Resources.

RWR

2429

G.P. No. [illegible]

CERTIFICATE RECORD No. 5 PAGE No. 2429-A

STATE OF WASHINGTON, COUNTY OF King

Certificate of Ground Water Right

Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the State Supervisor of Water Resources thereunder.

THIS IS TO CERTIFY That WASHINGTON WATER SERVICE CO., INC.

of Bellevue, Washington, has made proof to the satisfaction of the State Supervisor of Water Resources of Washington, of a right to the use of the ground waters of two (2) wells

located within the SW¼ of SW¼ of Sec. 11, Twp. 24 N., Rge. 5 E.W.M.

for the purpose of domestic supply for community

under and subject to provisions contained in Ground Water Permit No. 3043 issued by the State Supervisor of Water Resources and that said right to the use of said ground waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the State Supervisor of Water Resources of Washington and entered of record in Volume 5 at page 2429-A; that the right hereby confirmed dates from June 2, 1953; that the quantity of ground water under the right hereby confirmed for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed 300 gallons per minute; 480 acre-feet per year for domestic supply for community.

A description of the lands to which such ground water right is appurtenant, and the place where such water is put to beneficial use, is as follows:

Community of Eastgate, King County, Washington

The right to the use of the ground water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in Sections 6 and 7, Chapter 122, Laws of 1929.

WITNESS the seal and signature of the State Supervisor of Water Resources affixed this 13th day of December, 1955.

M.G. Walker
State Supervisor of Water Resources.

ENGINEERING [illegible]

on [illegible]

S. F. No. 339—3-51—75C 17755

CERTIFICATE RECORD No. 12, PAGE No. 5020

STATE OF WASHINGTON, COUNTY OF King

CERTIFICATE OF SURFACE WATER RIGHT

(In accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the State Supervisor of Water Resources thereunder.)

This is to certify that KING COUNTY WATER DISTRICT #68 *of* Bellevue, *State of* Washington, *has made proof to the satisfaction of the State Supervisor of Water Resources of Washington, of a right to the use of the waters of* Lake Washington [illegible] *with point or points of diversion within* [illegible] Government Lot 4 of *Sec.* 6, *Twp.* 24 *N., R.* 5 E., *W. M., under and subject to provisions contained in* Appropriation *Permit No.* 7259 *issued by the State Supervisor of Water Resources, and that said right to the use of said waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the State Supervisor of Water Resources of Washington and entered of record in Volume* 12, *at Page* 5020, *on the* 16th *day of* August, *19*54, *that the priority date of the right hereby confirmed is* January 24, 1951; *that the amount of water under the right hereby confirmed, for the following purposes is limited to an amount actually beneficially used and shall not exceed*

6.7 cubic feet per second for the purpose of domestic supply for water district.

A description of the lands under such right to which the water right is appurtenant, and the place where such water is put to beneficial use, is as follows:

King County Water District #68, King County, Washington.

The right to the use of the water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in Sections 6 and 7, Chapter 122, Laws of 1929.

WITNESS the seal and signature of the State Supervisor of Water Resources affixed this 16th *day of* August, *19*54.

[illegible signature]
State Supervisor of Water Resources.

RHR

S. P. No. 341-3-51—7SC. 2753.

CERTIFICATE RECORD No. 13, PAGE No. 6489

STATE OF WASHINGTON, COUNTY OF King

CERTIFICATE OF SURFACE WATER RIGHT

(In accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the State Supervisor of Water Resources thereunder.)

This is to certify that WATER DISTRICT NO. 68, KING COUNTY *of* Bellevue, *State of* Washington, *has made proof to the satisfaction of the State Supervisor of Water Resources of Washington, of a right to the use of the waters of* Lake Washington ~~xxxxxxxxxx~~, *with point or points of diversion within* ~~the~~ Government Lot 7 *Sec.* 31, *Twp.* 25 *N., R.* 5 E., *W. M., under and subject to provisions contained in* Appropriation *Permit No.* 8726 *issued by the State Supervisor of Water Resources, and that said right to the use of said waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the State Supervisor of Water Resources of Washington and entered of record in Volume* 13, *at Page* 6489, *on the* 16th *day of* May, 1956, *that the priority date of the right hereby confirmed is* June 27, 1952; *that the amount of water under the right hereby confirmed, for the following purposes is limited to an amount actually beneficially used and shall not exceed*

13.0 cubic foot per second for the purpose of municipal water supply.

A description of the lands under such right to which the water right is appurtenant, and the place where such water is put to beneficial use, is as follows:

Water District No. 68, King County.

The right to the use of the water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in Sections 6 and 7, Chapter 122, Laws of 1929.

WITNESS the seal and signature of the State Supervisor of Water Resources affixed this 16th *day of* May, 1956.

State Supervisor of Water Resources.

ENGINEERING DATA

O.K.

Appendix D

City of Bellevue Water Utility Code

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Chapter 24.02
WATER UTILITY CODE

Sections:

24.02.010 Title.

This chapter shall be known as the water utility code and shall be referred to herein as the "code." (Ord. 5963 § 1, 2010.)

24.02.020 Purpose.

This code is enacted as an exercise of the city of Bellevue's ("city") police power as set forth in Section 11 of the Washington Constitution to protect and preserve the public health, safety and welfare. The purpose of this code shall be liberally construed to:

A. Provide for the planning, security, design, construction, use, maintenance, repair and inspection of public and private water systems;

B. Establish programs and regulations to provide for the appropriate use of public and private water systems;

C. Provide for the enforcement of the provisions of this code, the engineering standards and related city manuals and code provisions; and

D. Provide for and promote the health, safety and welfare of the general public and not to create, establish, or designate any particular class or group of persons who may be especially protected or benefitted. (Ord. 5963 § 1, 2010.)

24.02.030 Applicability and compliance with other laws.

A. This code supplements and references certain provisions of the Bellevue City Code, including but not limited to Chapter 1.18 BCC, and other city ordinances and regulations regarding protection of the public and private water systems.

B. Approvals, decisions, and permits granted under this code are not waivers of the requirements of any other laws, nor do they indicate compliance with any other laws. Compliance is still required with all applicable federal, state, and local laws and regulations.

C. Compliance with the provisions of this code, the engineering standards, permits or other approvals, or rules promulgated by the director do not necessarily mitigate all impacts to the environment. The primary obligation for compliance with such regulations and standards is prevention of environmental harm, which ultimately is placed upon property owners and responsible parties as defined in this code and Chapter 1.18 BCC. (Ord. 5963 § 1, 2010.)

24.02.040 City not liable.

A. Nothing contained in this code is intended to nor shall be construed to create or form the basis for any liability on the part of the city, or its officers, employees or agents, for any injury or damage resulting from the failure of property owners or responsible parties to comply with the provisions of this code, engineering standards, or related manuals, or by reason or in consequence of any inspection, notice, order, certificate, permission or approval authorized or issued in connection with the application or enforcement of this code, engineering standards, or related manuals, or by reason of any action or inaction on the part of the city related in any manner to the application or enforcement of this code, engineering standards, or related manuals by the city, its officers, employees, or agents.

B. Nothing in this code, engineering standards, or related manuals shall impose any liability on the city or any of its officers, employees, or agents for cleanup or any harm relating to sites containing hazardous materials, wastes or contaminated soil.

C. Nothing contained in this code, engineering standards, or related manuals shall require city involvement or enforcement of this code for private disputes occurring between property owners. (Ord. 5963 § 1, 2010.)

24.04.041 Conflict of provisions.

Should a conflict occur between the provisions of this code, the engineering standards or manuals adopted by the city in relation to this code, or between this code, the engineering standards and related manuals with laws, regulations, codes or rules promulgated by other authority having jurisdiction within the city, the most restrictive requirement shall be applied, except when constrained by federal or state law, or where specifically provided otherwise in this code. (Ord. 5963 § 1, 2010.)

24.04.042 Severability.

If any provision of this code, engineering standards, or related manuals, or its application to any person or circumstance, is held invalid by a court of competent jurisdiction, the remainder of the code, engineering standards, or related manuals, or the application of the provision to other persons or circumstances is not affected, and to this end the provisions of this code are declared to be severable. (Ord. 5963 § 1, 2010.)

24.02.050 Definitions.

Except where specifically defined herein, all words used in this code shall carry their customary meanings. Words used in the present tense include the future, and the plural includes the singular; the word “shall” is always mandatory, whereas the word “may” denotes a use of discretion in making a decision. The following words and phrases, when used in this code, shall have the following meanings:

A. A Definitions.

“As-built” means a final drawing of the actual installation of structures, materials and equipment.

B. B Definitions.

“Backflow” means the flow of contaminated water or other liquids, gases or substances into the potable water supply.

“Backflow prevention assembly” means an assembly which prohibits the backflow of water into the potable water supply.

C. C Definitions.

“Capital recovery charge” means a monthly charge imposed on improvements, developments, redevelopments or existing structures that place additional demand on each utility system after January 1, 1997. The capital recovery charge shall be based on an allocation of the utility plant in-service costs plus interest and the number of single-family equivalents served by each utility.

"Connection charges" means charges imposed as a condition of providing utility service so that each connecting property bears its equitable share of the costs of the public water system and the utility's share of the cost of any regional water supply system and of the costs of facilities that benefit the property. Connection charges include latecomer charges, capital recovery charges, regional water supply system charges and direct facilities charges.

"Cross-connection" means any physical arrangement in a public or private water system or plumbing system where the potable water supply is connected, directly or indirectly, with a real or potential source of contamination.

"Cross-connection control" means a backflow prevention assembly, air gap or other control designed to prevent backflow from a cross-connection.

D. D Definitions.

"Director" means the director of the city's utilities department, or his/her designated representative, or other person designated by the city manager.

E. E Definitions.

"Emergency" means any natural or human-caused event or set of circumstances which disrupts or threatens to disrupt or endanger the operation, structural integrity or safety of the public water system; constitutes an immediate health hazard to the potability of the utility's water supply or endangers the health and safety of the public; or otherwise requires immediate action by the utility.

"Emergency management plan" provides the foundation, framework and guidelines for initiating and maintaining direction and control of the utility's response efforts during all emergency or disaster scenarios. The emergency management plan is consistent with and supports the city of Bellevue emergency operations plans and emergency response plans maintained at the regional, state and federal levels of government.

"Emergency operation plan" provides guidance for mitigation, preparedness, response and recovery operations including disaster and emergency responsibilities and procedures, training and community education. The plan provides for the coordination of operations throughout the city during emergencies and disasters, and the best utilization of the city's resources. The plan meets the requirements of a comprehensive emergency management plan as described in Chapter 118-30 WAC.

"Engineering standards" means the city's utility engineering standards, which include standards for the design and construction of water, storm and surface water drainage and sanitary sewer facilities.

F. F Definitions.

"Fire hydrant assembly" means a fire hydrant and the piping and valve to connect it to a water main.

"Fire protection system" means a privately owned and maintained system used for fire extinguishment only, including piping and appurtenances inside and outside a building beyond the valve on the public water main, regardless whether within or outside of the right-of-way.

G. G Definitions (Reserved).

H. H Definitions (Reserved).

I. I Definitions.

“Irrigation system” means an assembly of component parts that is permanently installed for the controlled distribution and conservation of water to irrigate any type of landscape vegetation in any location, and/or to reduce dust or control erosion.

J. J Definitions (Reserved).

K. K Definitions (Reserved).

L. L Definitions.

“Latecomer agreement” means a contract that provides for the reimbursement of costs to developers who construct facilities that directly benefit other properties.

“Low-volume irrigation systems” means automatic irrigation systems, such as drip systems, micro-spray bubblers and soaker hoses, that apply water directly to the root zone(s) of landscape plants only, in contrast to irrigation systems, such as those with overhead or broadcast nozzles, that apply water to all surfaces within the landscape.

M. M Definitions (Reserved).

N. N Definitions (Reserved).

O. O Definitions (Reserved).

P. P Definitions.

“Potable water system” means any part of the public water system or of a private water system that carries potable water.

“Private water system” means any part of the water system that is not part of the public water system.

“Procedure” means a procedure adopted by the utility, by and through the director, to implement this code, or to carry out other responsibilities as may be required by this code, engineering standards, related manuals, or other codes, ordinances, or resolutions of the city or other agencies. “Procedure” as defined herein is often referred to as a standard operating procedure or SOP.

“Property owner” means any individual, company, partnership, joint venture, corporation, association, society or group that owns or has a contractual interest in the subject property or has been authorized by the owner to act on his/her behalf, including but not limited to an agent, contractor, applicant, or developer.

“Public water system” means all pipes, pump stations, reservoirs, valves and appurtenances that are owned by the utility for the delivery of potable water. The public water system does not include those facilities located on the customer side of meters, or fire protection systems as defined herein.

Q. Q Definitions (Reserved).

R. R Definitions.

"Redevelopment" means any site improvement that requires installation of water facilities greater than two inches in diameter to meet fire and/or domestic water pressure and flow requirements, or relocation of such existing facilities, except that facilities for the sole purpose of upgrading a backflow prevention assembly or retrofitting an internal fire protection system are exempt. Construction of any new building(s) or any property subdivision is defined as new development rather than redevelopment, regardless of prior use of the site.

"Regional water supply system" means any existing or planned water supply facilities or other assets which are owned by a regional water supply agency and which are utilized to provide water supply to the utility.

S. S Definitions.

Service Connection. See "water service."

Standard Operating Procedure or SOP. Refer to the definition of "procedure."

"Structure" means a combination of materials constructed and erected permanently on or under the ground or attached to something having permanent location on or under the ground. Not included are residential fences, retaining walls less than 30 inches in height, rockeries less than 30 inches in height and similar improvements of a minor character.

T. T Definitions (Reserved).

U. U Definitions.

"Unsafe condition" means any condition on any premises, or in any private water system thereon, that is a hazard to public health, safety, welfare, or environment that does or may impair or impede the operation or functioning of any portion of the public water system, or that may cause damage thereto.

"Utility" means the water utility component of the waterworks utility of the city of Bellevue, administered as a part of the Bellevue utilities department, pursuant to Chapter 3.38 BCC.

"Utility developer extension agreement" means a contract between the utility and a property owner and/or developer that provides for plan review and inspection of water system facilities that satisfy all applicable code requirements.

"Utility service area" means that service area defined in the East King County Coordinated Water Supply Plan (EKCCWSP) adopted by King County in June 1990, and approved by the city council pursuant to Resolution No. 5249, and as may be expanded through subsequent interlocal agreements, annexations and special utility district assumptions.

V. V Definitions (Reserved).

W. W Definitions.

“Water emergency” means that period of time during which water is not available or its availability is limited due to shortages in supply, interruptions in the water transmission or distribution systems, contamination of water supplies, or other conditions where use restrictions or prohibitions are necessary in order to efficiently and effectively safeguard the safety and health of the general public and to provide water for essential public uses.

“Water facility” means any facility for the conveyance or storage of water and related appurtenances, whether part of the public water system or a private water system that is connected to or intended to be connected to the public water system.

“Water main” means a water pipe that is part of the public or private water system used for the transmission and distribution of potable water, excluding service connections, backflow assemblies, fire hydrant assemblies and fire protection systems.

“Water service” (also called a “service,” “water service connection” or “service connection”) means the pipe and appurtenances used to provide potable water to an individual building or irrigation system, including the water service line (the pipe extending from the water main to the meter setter), meter setter, meter box, meter and miscellaneous fittings.

“Water system” means the entire water system within the utility service area comprised of the public water system and the private water system.

“Water system plan” means the most current water system comprehensive plan for the utility as adopted by the city council.

X. X Definitions (Reserved).

Y. Y Definitions (Reserved).

Z. Z Definitions (Reserved). (Ord. 5963 § 1, 2010.)

24.02.060 Authority of the utility.

The utility, by and through its director or his designee, including enforcement officers, shall have the authority to:

A. Develop, adopt and carry out procedures as needed to implement this code and to carry out other responsibilities of the utility, including, but not limited to, emergency management and operations plans, procedures pertaining to the billing and collection of water consumption charges, water service charges and all other fees and charges imposed pursuant to this code, and procedures for periodic adjustment of fees and charges imposed pursuant to this code;

B. Prepare, adopt, update, administer and enforce, as needed, engineering standards to establish minimum requirements for the design and construction of water facilities and requirements for protecting existing facilities during construction. The engineering standards shall be consistent with this code and adopted city policies;

C. Administer and enforce this code and all procedures relating to the planning, acquisition, security, design, construction, inspection, maintenance, management, operation and alteration of the public water system, including capital improvements, and relating to the design, construction and inspection of private water systems;

D. Enter into any contracts pursuant to Chapter 35.91 RCW, the Municipal Water and Sewer Facilities Act, including contracts which provide for the reimbursement of owners constructing facilities (latecomer agreements) and agreements with private property owners for the extension of the public water system (utility developer extension agreements);

E. Advise the city council, city manager and other city departments and commissions on matters relating to the utility;

F. Initiate and manage programs to further the water quality requirements and objectives of the utility, including inspection of public and private property to identify and eliminate potential sources of contamination of the public water system and including inspection of backflow prevention assemblies installed to separate or isolate premises from the public water system;

G. Develop and implement programs and restrictions related to water use, including the comprehensive water conservation program, landscape water budgeting requirements, irrigation system design and performance requirements, and a water shortage contingency plan to be implemented during water shortages caused by weather or by system failure;

H. Prepare and recommend the water system plan referenced in BCC 24.02.070, and revisions thereto, for adoption by the city council and implementation by the utility;

I. Carry out other responsibilities as required by this code or other city codes, ordinances or regulations consistent with the Bellevue comprehensive plan;

J. Shut off water to any utility customer who is violating any provision of this code to the extent permitted by law;

K. Perform or direct the performance of financial review and analysis of the utility's revenues, expenses, indebtedness, rates and accounting and recommend budgets, rates and financial policy for adoption by the city council; and

L. Take enforcement action, to the extent allowed by law pursuant to Chapter 1.18 BCC. (Ord. 5963 § 1, 2010.)

24.02.065 Duty to serve.

The utility is responsible for providing water service to all customers within the utility service area subject to the requirements of this code, other provisions of the Bellevue City Code and applicable state law. This responsibility is separate from contractual obligations to provide water service outside the utility service area. (Ord. 5963 § 1, 2010.)

24.02.067 Service interruptions.

Notwithstanding BCC 24.02.065, the utility does not guarantee that water will be continuously available within the utility service area. Water may be temporarily unavailable due to a system failure, emergency, construction or maintenance or other unforeseen circumstance. The utility is not responsible for costs or damages incurred by property owner, tenant or customer due to an interruption in service, whether planned or unplanned. (Ord. 5963 § 1, 2010.)

24.02.070 Water system plan.

A water system plan, also referred to as the city's water comprehensive plan, shall be developed by the utility for review and adoption by the city council as required by state law. The utility shall recommend supplements or updated plans for adoption by the city council as needed. (Ord. 5963 § 1, 2010.)

24.02.080 Reserved.

(Ord. 5963 § 1, 2010.)

24.02.090 Water shortage contingency plan.

The utility shall develop, maintain and implement as necessary a water shortage contingency plan to respond to anticipated or actual water supply shortages resulting from weather conditions, regional water system failure and/or local public water system failure. The director is authorized to implement the water shortage contingency plan at such times as the city's water supply is threatened by or experiencing a water supply shortage. Within the framework of the water shortage contingency plan, the director may impose restrictions and/or limitations on the use of water by type of use, customer class or geographic area depending upon the nature and extent of the water supply shortage. A rate surcharge may be imposed pursuant to BCC 24.02.270(F). (Ord. 5963 § 1, 2010.)

24.02.100 Connections or modifications to the water system.

Connections or modifications to the public water system or to a private water system, including, but not limited to, extension of water mains, new service, meter size, location and grade changes, abandonment or removal of any structure connected to the public water system, and temporary connections to a fire hydrant, shall be allowed only if:

A. Approval has been received from the utility (see BCC 24.02.120);

B. All applicable requirements of this code and utility procedures have been met;

C. All applicable engineering standards have been met or alternate standards have been approved by the utility as substantially equal;

D. The property owner has paid all applicable fees and charges;

E. The water is delivered from the utility to the user via a meter owned by the utility, except for fire protection systems over two inches in diameter and except for authorized temporary use of fire hydrants through adapters under two inches in diameter;

F. Any private wells serving the property are disconnected from the potable water supply;

G. Any existing nonreusable water services are abandoned; and

H. The property is within the utility service area or within an area served by the utility through agreement with another jurisdiction. (Ord. 5963 § 1, 2010.)

24.02.115 System ownership.

A. Utility Ownership of Water Facilities.

1. The utility owns all water facilities in public rights-of-way and in easements dedicated to the public and accepted by the utility, up to and including the meter, except to the extent that private ownership is otherwise indicated as a matter of record. Such facilities typically include:

a. Meters and all facilities connecting meters with water mains;

b. Water mains;

c. Reservoirs, pumping stations, inlet meters, pressure reducing valve stations and other appurtenances intended to serve the general public;

d. The valve separating the public water system from a private fire protection system.

2. The utility may acquire existing private facilities; provided, that:

a. Ownership of the facility would provide a public benefit;

b. Necessary and appropriate property rights are offered by the property owner at no cost to the utility;

c. The facility substantially meets current code and engineering standards, as determined by the utility, or is brought up to current code and engineering standards by the owner;

d. The utility has adequate resources to maintain the facility; and

e. The facility is transferred to the utility by bill of sale at no cost to the utility.

B. Private Ownership of Water Facilities. Water facilities located on private property are exclusively owned by the underlying property owner(s), unless otherwise assigned or dedicated by easement to the city, except to the extent that public ownership is otherwise indicated as a matter of record. Property owners shall be responsible for the development, maintenance, and repairs of all private water facilities. (Ord. 5963 § 1, 2010.)

24.02.120 Permits – Approvals.

A. General. The utility shall administratively develop submittal requirements for the various utility permits/approvals.

B. Application for Water Service.

1. Any approval of an application for water service is required to initiate a new or upgraded connection to the public water system or a meter set that is two inches in diameter or smaller; and

2. If required, a water service application shall be made submitted and attested to by the property owner or their licensed and bonded contractor.

C. Utility Developer Extension Agreement.

1. The property owner and the utility shall enter into a utility developer extension agreement whenever any of the water facilities that must be installed to serve the property are greater than two inches in diameter, or require multiple water services two inches in diameter or smaller. The utility developer extension agreement shall provide for the property owner to build all the water facilities needed to serve the property. These facilities may include meters and water services of any size, fire hydrant assemblies, fire protection systems, water main extensions and/or other system components.

2. The utility shall approve constructed facilities as complete once the facilities have been built according to the approved plans and specifications, as confirmed by utility inspectors; as-built drawings have been completed as specified in the engineering standards; and all applicable fees and charges have been paid.

3. The property owner shall be required to provide surety devices, in a form approved by the city: for water system extensions in city right-of-way; for connections to the water main during construction and for a one-year warranty period following acceptance by the city.

4. When a utility developer extension agreement is required to serve a proposed commercial or multifamily building, the utility will not approve the building permit until the system extension agreement has been initiated. When a utility developer extension agreement is required to relocate a water main from under a proposed building, the utility will not approve the building permit until the developer extension has been completed and has been accepted by the utility, unless the building permit is conditioned to require relocation prior to site construction.

D. Fire Hydrant Use Permit. A fire hydrant use permit is required to use water provided through fire hydrants. Each fire hydrant use permit expires at the end of the calendar year and must be renewed annually. A fire hydrant use permit will be issued only if the applicant demonstrates need and agrees in writing to the following conditions:

1. Water may be drawn from the fire hydrant only through hydrant meters or adapters owned by the utility, except the customer may supply his/her own hydrant adapter for tank lot sales. Appropriate backflow protection shall be provided by the customer as necessary and as determined by the utility.

2. Truck or tank backflow assemblies for tank lot sales are subject to utility approval. The customer must pass a utility cross-connection inspection prior to permit issuance.

3. Persons issued fire hydrant use permits shall:

a. Return utility-owned equipment in good condition by the date specified and compensate the utility for any loss or damage; and

b. For tank lot sales, the customer shall report the quantity of water purchased.

4. Tank trucks may only draw water from fire hydrants designated by the utility for this purpose.

5. The utility may suspend fire hydrant use permits during water emergencies or if the customer violates any of the conditions listed under this subsection D.

E. Approvals for Landscape Water Budgets and Irrigation System Design. When required by BCC 24.02.200 and/or 24.02.205, the owner's landscape and/or irrigation designer shall submit calculations and certification statements for utility review and approval.

F. Other Permits. It is the property owner's responsibility to identify and obtain all permits/approvals required for any proposed work.

G. Temporary Water Service Agreement. Any single-family residential property owner may request temporary water service if permanent facilities, that is, facilities that meet all code requirements (such as for system gridding), are not available. The utility may provide temporary single-family residential water service through a temporary water service agreement, which shall:

1. Calculate and collect the property owner's "fair share" costs for installing permanent water facilities. When the property is not fully developed and therefore is subject to redevelopment, the city shall collect only the developed portion's fair share cost at that time. When the property redevelops, the property owner must build the permanent water facilities or, if they are already built, must pay the remaining fair share costs. If a private property owner builds the permanent facilities, he/she will be paid the fair share costs that were collected under the temporary water service agreement plus accrued interest. Interest will be at a rate set by the director or his designee, based on appropriate standard cost indices. Total interest may not exceed the principal amount of the charge;

2. Establish a time limit for connecting to the permanent service once it is available;

3. Indicate that the temporary water service agreement does not guarantee the availability of water for fire protection;

4. Specify that the agreement is a covenant which runs with the land and is binding on the owners and their successors; and

5. Be recorded with King County against the real property on which the facilities are located. (Ord. 5963 § 1, 2010.)

24.02.125 Reserved.

(Ord. 5963 § 1, 2010.)

24.02.130 Engineering and design requirements.

A. General.

1. The property owner is responsible for water system design.

2. The water system designer shall be a civil engineer licensed in the state of Washington and qualified by both experience and educational background in the design of water facilities.

3. Engineering and design shall conform to the engineering standards.

4. Water facilities in a designated coal mine area are subject to additional design requirements; see the coal mine area subdivision, development and building permit regulations adopted by Resolution No. 5712.

B. Water Facility Requirements.

1. Whenever property is developed or redeveloped in any way such that water demand or use is altered, new water facilities shall be required whenever necessary to:

a. Meet fire flow and other fire protection requirements, including the number and location of fire hydrants and fire sprinkler components, as determined by the fire marshal's office of the jurisdiction in which the project is located;

b. Meet domestic and irrigation flow requirements. See the engineering standards;

c. Meet pressure requirements. See the engineering standards; or

d. Replace or relocate existing facilities as required or authorized by the utility.

2. Whenever property is developed or redeveloped, water mains shall be extended through and to the extremes of the property being developed as required by the utility when needed for the orderly extension or efficient gridding of the public water system.

C. Water Service Design.

1. Water services shall be designed in accordance with the engineering standards.

2. Each separate building is required to have its own water service, except detached garages, sheds and guest houses on the same single-family residential parcel, as specified in the engineering standards.

D. Cross-Connection Control. All connections to the public water system, including those located in any water districts located within the city of Bellevue's jurisdictional limits shall comply with the backflow prevention requirements of BCC 24.02.190. (Ord. 5963 § 1, 2010.)

24.02.140 Installation responsibility.

A. Utility Installation.

1. The utility shall install meters two inches or less in diameter provided the owner pays all applicable costs, fees and charges pursuant to BCC 24.02.250.

2. The utility may install water services two inches and smaller in diameter, where services are not provided through a utility developer extension agreement pursuant to BCC 24.02.120(C), provided the owner agrees to pay all costs, fees and charges pursuant to BCC 24.02.250.

B. Property Owner Installation. The property owner shall install all water facilities required by this code to serve the property when any of the required facilities are larger than two inches in diameter. The property owner may install water services two inches and smaller in diameter upon approval by the utility. Installation shall be authorized by execution of a utility developer extension agreement. See BCC 24.02.120(C).

C. Costs. The property owner shall be responsible for all installation costs regardless of whether the work is done by the utility or by the owner; provided, that:

1. If the utility requires a property owner to construct a water facility beyond the scope of city code and engineering standards requirements, the utility shall compensate the property owner for the difference in cost between the normally sized water facility and the additional water facility, based on the lowest of three bids from reputable licensed contractors furnished by the property owner. Extending the water system to the extreme of the property, per BCC 24.02.130 (B)(2), is a development requirement and is specifically not subject to reimbursement by the utility.

2. An owner who constructs a water system extension that directly benefits a property in addition to the owner's may request a latecomer agreement in order to be reimbursed from benefitting properties that connect to the extension during the agreement's duration. See BCC 24.02.150 regarding latecomer agreements.

3. If the utility chooses to install water facilities to facilitate development, coordinate with other city projects, or for other utility purposes, it may recover its costs, including interest, through a connection charge. (Ord. 5963 § 1, 2010.)

24.02.150 Latecomer agreements.

A. General. The utility may enter into any contracts authorized by Chapter 35.91 RCW, the Municipal Water and Sewer Facilities Act, including contracts which provide for the reimbursement of property owners constructing public facilities, commonly known as latecomer agreements.

B. Requesting a Latecomer Agreement. A property owner may request a latecomer agreement if the owner constructs a public water facility that benefits property in addition to the owner's property and it is not feasible for the owner to include such other property owner in the utility developer extension agreement. The request must be made in writing and unit costs must be provided before the utility accepts the public water facility.

C. Zone of Benefit. The utility shall determine what properties benefit from the public water facility that shall be subject to the latecomer agreement.

D. Method of Cost Allocation. The utility shall determine the method of cost allocation used.

E. Recording. The utility shall record the latecomer agreement with King County against the benefitting properties, at the property owner's expense.

F. Cost to Latecomer. As a condition of connection to the public water facility, each latecomer shall pay, at the time of connection, his/her pro rata share of the construction costs of the water facility, which are determined by the utility and specified in the latecomer agreement. Construction costs shall include but are not limited to design, installation, inspection, construction management, interest and the utility's project management costs.

G. Agreement Duration. Latecomer agreements may be in effect for up to 20 years following acceptance of the water facility.

H. Forwarding Latecomer Payment. While the latecomer agreement is in effect, the utility will collect the latecomer payments and forward them to the property owner who paid for the water facility, as specified in the agreement. (Ord. 5963 § 1, 2010.)

24.02.160 Water easement requirements.

A. When Required. An easement is required whenever:

1. A public water facility will be built on private property;

2. A private water facility will be built on property owned by a different private party; or

3. A private water facility will serve two or more properties.

B. Requirements. All of the following requirements shall be met before the utility will accept, approve, or execute an easement:

1. Clear title in the grantor shall be demonstrated;

2. The proposed easement shall be compatible with utility clearance standards and setback standards and with other utilities, structures, buildings, or easements. The utility may require the easement to exclude other utilities and uses if necessary to protect the public water system and shall contain provisions for long-term maintenance;

3. The easement shall provide access to the facility for repair and maintenance. When deemed necessary by the utility, the easement shall contain provisions for long-term maintenance;

4. The easement shall prohibit all buildings and structures within the easement area except those which can readily be removed, as determined by the utility, by the property owner at the owner's expense when access to the water facility is required by the utility. If such buildings or structures are within the easement area, an agreement with the utility to have the owner remove the building or structure upon request by the utility, approved by the city, shall be recorded; and

5. The easement dimensions and other requirements shall be consistent with the engineering standards.

C. Costs. The property owner shall pay all costs of providing or obtaining and recording the easement.

D. Relinquishment of Easement. An easement granted to the utility may be relinquished only if the utility determines it is no longer needed and the city council authorizes the relinquishment. (Ord. 5963 § 1, 2010.)

24.02.170 Construction requirements.

A. General. When constructing or modifying water facilities, compliance is required with this code, the engineering standards, the approved permit, plans and specifications, the terms of any utility developer extension agreement, the recommendations of the manufacturer of the materials or equipment used and any applicable local, state or federal requirements.

B. Safety Requirements. Utility staff may perform inspections only if shoring and other site conditions conform with WISHA safety standards and other safety requirements, as applicable.

C. Failure to Complete Work or Meet Requirements.

1. The utility may complete water facility construction begun by a property owner or contractor, or take steps to restore the site (such as backfilling trenches and restoring the public way) if the work does not meet the requirements of this code, the engineering standards and other applicable utility requirements; provided the property owner or contractor fails to rectify the problem following notification by the utility; and the work, in the opinion of the utility, constitutes a hazard to public safety, health or the public water system.

2. Utility costs incurred pursuant to subsection (C)(1) of this section shall be calculated pursuant to BCC 24.02.250(B) and charged to the property owner or contractor in charge of such work. The property owner or contractor shall pay the utility immediately after written notification is delivered to the responsible parties or posted at the location of the work. Such costs shall constitute a civil debt owing to the utility jointly and severally by such persons who have been given notice as herein provided. The debt shall be collectable in the same manner as any other civil debt owing the utility. In addition, if the city collected an assurance device, it may collect the debt from the assurance device by use of all means available under the law.

3. If, in the opinion of the director, the work being performed is not in accordance with these codes or engineering standards and the responsible person is unwilling to change or correct the deficiencies, the director may issue a stop work order until the deficiencies are corrected as authorized by Chapter 1.18 BCC.

D. Utility Relocations – Developer Initiated.

1. Public Water System Relocations. To the extent authorized by law, when relocations of the public water system are necessary to accommodate any development or redevelopment, the property owner, applicant or project proponent for such development or redevelopment, including any governmental or regional entity, shall relocate at its sole cost and expense the affected facilities in accordance with all city codes, standards, permit conditions, and pursuant to any existing franchise or other agreement.

2. Nonmunicipal Utility Relocations. To the extent authorized by law and except as provided in BCC 14.60.230, when relocations of nonmunicipal utility facilities are necessary to accommodate any public water facility associated with development or redevelopment, the property owner, applicant or project proponent for such development or redevelopment, including any governmental or regional entity shall, at its sole cost and expense, arrange for the relocation of such nonmunicipal utilities in accordance with all city codes, standards, permit conditions and pursuant to any existing franchise or other agreement. (Ord. 5963 § 1, 2010.)

24.02.175 Construction and warranty inspections and tests.

A. Construction/Installation Inspection.

1. All projects permitted or approved by the utility under a utility developer extension agreement or other permit are subject to utility inspection to ensure compliance with the code and permit/approval conditions. As a condition of permit issuance or execution of a utility developer extension agreement, the property owner shall consent to inspection and testing.

2. Newly installed water facilities shall be inspected, tested, and documentation completed according to the permit requirements or developer extension agreement conditions, the engineering standards, and procedures.

3. Newly installed or relocated backflow prevention assemblies shall be inspected, tested, and certified pursuant to the requirements of BCC 24.02.190(D).

4. The quality, taste and odor of water drawn from new water mains shall be the same as the quality, taste and odor of water in the existing facility classed as acceptable for use by the utility. Should the water not be acceptable in quality, taste or odor, required steps as approved by the utility shall be taken to attain acceptable water quality standards.

B. Warranty Inspections and Tests. Facilities and equipment accepted by the utility under specific warranties may be reinspected at the utility's discretion and, if necessary, retested prior to the expiration of the warranty period. (Ord. 5963 § 1, 2010.)

24.02.180 Water quality programs.

A. General Requirements. The utility shall initiate and carry out any water quality testing, monitoring, maintenance, corrective activities or other activities necessary to ensure that the city's public drinking water meets or exceeds drinking water standards and other requirements of Chapter 246-290 WAC, the Washington State Health Department's rules that govern Group A public water systems, the federal Safe Drinking Water Act and any other applicable federal, state or local requirement for public drinking water, as now or hereafter amended.

B. Implementation of Water Quality Programs. To maintain water quality in the most effective and efficient manner, the utility may initiate, implement and carry out any required or necessary water quality testing, monitoring, maintenance, or corrective activities or programs locally, jointly with other local or regional water purveyors; or jointly with other federal, state or local agencies having jurisdiction within the city's water service area. (Ord. 5963 § 1, 2010.)

24.02.190 Cross-connection abatement and control.

A. General.

1. The utility shall initiate and carry out a cross-connection abatement and control program in conformance with state law by establishing and maintaining minimum requirements for the installation, inspection, testing, certification and maintenance of backflow prevention assemblies. The program shall meet the minimum requirements of WAC 246-290-490 and the latest edition of the Uniform Plumbing Code adopted by the city.

2. The utility hereby adopts by reference the standards and requirements of WAC 246-290-490, as now or hereafter amended.

B. Approved Backflow Prevention Assemblies. Only those backflow prevention assemblies and controls identified in the most recent current edition of Approved Cross Connection Control Assemblies, published by the Washington State Department of Health, shall be approved for installation.

C. New or Upgraded Cross-Connection Control Requirements.

1. In situations where there is an existing water service or use and the water supply is protected from cross-connection by a nonconforming backflow prevention assembly (i.e., an assembly that does not meet the current standards and requirements of WAC 246-290-490 or this code), the existing nonconforming backflow prevention assembly shall, at the property owner's risk, be allowed to remain in service only if:

a. At the time the backflow prevention assembly was installed, the assembly was a state-approved backflow prevention assembly;

b. At the time the backflow prevention assembly was installed, its installation was approved by the city as appropriate for the degree of hazard; and

c. The backflow prevention assembly does not meet the criteria for upgrading as required in subsection (C)(2) of this section.

2. All existing nonconforming backflow prevention assemblies shall be replaced and upgraded to current standards at such time as any of the following conditions exist:

a. The assembly fails to operate properly;

b. The assembly fails required annual testing and certification;

c. The assembly requires continual and excessive repair or maintenance;

d. The degree of hazard at the premises increases from that which existed at the time the assembly was installed; or

e. The water service, fire protection system, landscape irrigation system or plumbing is, or has been, modified.

3. When the utility discovers previously unknown and/or unprotected cross-connections, the utility shall notify the property owner of the cross-connection, the degree of hazard, and the cross-connection abatement and control measures required. The property owner shall make provision to implement all required abatement and control measures within the time frame specified by the utility subject to the enforcement provisions of BCC 24.02.250 or state law.

D. Inspection, Testing and Certification Requirements.

1. Inspection of all newly installed or relocated backflow prevention assemblies shall be completed by the city. Testing and certification shall be done by a private backflow prevention assembly tester certified by the Washington State Department of Health.

2. All backflow prevention assemblies shall be tested and certified annually by a private backflow prevention assembly tester certified by the Washington State Department of Health.

E. Costs and Fees. The property owner or developer shall be responsible for paying all utility costs and fees associated with the installation, inspection, testing, certification, repair, replacement or upgrade of backflow prevention assemblies. See BCC 24.02.250 regarding fees. (Ord. 5963 § 1, 2010.)

24.02.200 Water conservation – Waste of water.

The waste of water supplied by the utility is prohibited at all times. Waste of water includes, but is not limited to, continuous application of water to lawns or landscaping that results in excessive puddling or runoff of water, failure to repair leaking water service lines and irrigation systems, application of water to impervious surfaces other than for cleaning purposes, and all other applications of domestic water that do not result in a beneficial use of the city's public water supply. (Ord. 5963 § 1, 2010.)

24.02.205 Landscape and irrigation water budgeting requirements.

A. Applicability. The water budgeting requirements of this section shall apply to new or modified landscaping whenever new or modified landscaping is required by the Land Use Code or proposed by the property owner except that the following shall be exempt from such requirements:

1. Single-family residential lots; provided, that community area landscaping installed by the developer is not exempt.

2. Any project with a total landscape area of less than 500 square feet. If a project is constructed in phases, the total landscape area shall include the total area of all phases.

3. Those portions of a site irrigated with water that is not supplied by the utility.

4. Turf portions of public athletic facilities where turf provides a playing surface and turf portions of public access land used for purposes of public recreation and activities, such as but not limited to outdoor assemblies, picnicking, unstructured sports fields and sunbathing. However, this exemption applies only if the applicant submits a statement designating such turf areas and specifying additional water needs above the irrigation water budget. The additional irrigation water needs shall be based upon the evapotranspiration information for the turf-grass species or species mix designated for the turf area.

5. Those portions of privately owned properties where athletic and recreation facilities, as identified by subsection (A)(4) of this section, are installed for use by the general public. However, this exemption applies only if the applicant submits a statement designating such area (s) as open to the public.

B. Water Budget Requirements. For each proposed landscape design not exempted by subsection A of this section, a state-registered landscape architect, Washington-certified nurseryman (WCN) or

Washington-certified landscaper (WCL) shall certify that the estimated annual water use will not exceed the irrigation water budget, as calculated pursuant to the methodology contained in the engineering standards. Copies of the supporting calculations shall be submitted to the utility.

C. Landscape Management. All landscaped areas designed to meet water budget requirements shall be installed, operated and maintained such that the allowed annual water use is not exceeded.

D. All proposed new irrigation systems that will be connected to the public water system shall be designed in accordance with the engineering standards. (Ord. 5963 § 1, 2010.)

24.02.210 Reserved.

(Ord. 5963 § 1, 2010.)

24.02.215 Maintenance of water system.

The utility has responsibility for maintenance of the public water system unless otherwise provided by agreement, local ordinance or state law. Owners of private water systems are solely responsible for maintenance and operation of such private systems, including but not limited to fire protection and landscape irrigation systems. Private water system owners must comply with engineering standard requirements for operation, maintenance, and notification to the city about testing of private water distribution and fire systems. (Ord. 5963 § 1, 2010.)

24.02.220 Right of entry for inspection.

A. An authorized representative of the utility may enter private property at all reasonable times to conduct inspections, tests or to carry out other duties imposed by the code, provided the utility shall first notify the proper owner or person responsible for the premises. If entry is refused, the director shall have recourse to every remedy provided by law to secure entry.

B. For inspection programs authorized by the director or his designee, the utility may provide advance mailings of its intent to inspect properties consistent with such inspection programs.

C. If the utility has reason to suspect that conditions on a premises where access has been denied may pose an unsafe condition to the public water system, the director or his designee may discontinue water service to the property, as allowed by state law, or may gain access to the property pursuant to WAC 246-994-090 as adopted or thereafter amended. (Ord. 5963 § 1, 2010.)

24.02.230 Interconnection with adjacent water systems.

The utility may provide water service to adjacent public or private water systems when needed in case of failure of physical system components such as pump failure or a reservoir out of service or similar temporary circumstance, where facilities exist for such interconnection. In such case, the utility shall bill for and be paid for the water used pursuant to the established rate structure as it exists or as otherwise updated from time to time. All requirements of this code regarding water quality and cross-connection control shall be met. The utility shall not serve as a backup supply source to neighboring water systems in case of well failure or other supply disruption unless the neighboring system compensates the utility under separate contractual agreement as a backup supply source, or unless the neighboring water system becomes a permanent utility customer, and makes payment of all appropriate fees and charges. (Ord. 5963 § 1, 2010.)

24.02.240 Regulations of other agencies.

A. General. The responsibility for determining the existence and application of local, state and federal laws and regulations pertaining to water facilities and water use remains solely with the affected property owner.

B. Regulations of King County and Other Cities and Towns. Utility customers outside the city of Bellevue are subject to city of Bellevue requirements related to water utilities unless more stringent requirements of the local jurisdiction in which such customers are located are applicable. (Ord. 5963 § 1, 2010.)

24.02.250 Fees for permits/approvals – Specific services.

A. General.

1. The applicable city director shall develop for city council review and adoption a schedule of fees and charges for all permits and other specific services provided by the utility, including:

a. Utility developer extension agreements;

b. Water service and meter installation, modifications or repairs;

c. Fire hydrant use permits;

d. Backflow prevention assembly inspections and tests;

e. Disconnections of unauthorized connections;

f. Turn-on and turn-off services;

g. Inspections;

h. Abandonment of existing nonreusable water services;

i. Temporary lawn watering permits during water shortages;

j. Miscellaneous maps, plans, drawings, copies and documents provided by the utility; and

k. Tank lot users.

2. The fees referenced in this section are in addition to applicable rates for water service and connection charges.

B. Fee Amount. The fee amount for each permit, approval or specific service shall cover all the utility costs associated with that permit, approval or service, including all of the following that apply:

1. Labor, including any and all time spent on engineering, plan review, installation, properly abandoning any existing facilities, site restoration, inspection, testing, certification, creating an

as-built of the project and legal review. Inspections and other work requested beyond normal working hours are charged based on the utility's overtime pay practices;

2. Fees for materials or equipment issued by the utility, such as water services and meters;

3. Refundable deposits for utility-owned equipment such as fire hydrant wrenches and adapters;

4. Expenses including, but not limited to, supplies (not including office supplies), materials, equipment and tool rental, applicable state and federal taxes and any fees for permits the utility must obtain;

5. Water use, in the case of fire hydrant use permits, or estimated water use in the case of unauthorized connections or unreported use; and/or

6. Overhead, at a rate to be established by the utility pursuant to written procedures.

C. Fee Schedule. The applicable city director may adjust the schedule of fees and charges without further city council action to the extent necessary to reflect actual changes in the utility's cost of providing the service. (Ord. 5963 § 1, 2010.)

24.02.260 Connection charges.

A. General.

1. The utility shall collect connection charges in order that each connecting property shall bear its equitable share of the cost of the public water system and the utility's share of the cost of any regional water supply system providing water supply to the utility.

2. Connection charges shall be paid:

a. Before a property is allowed to connect to the public water system; and/or

b. At the time of redevelopment of the property, if connection charges apply that have not yet been paid, such as charges for new facilities that directly benefit the property.

3. Connection charges that have been paid as a result of prior development activities or through participation in a LID or ULID shall not be reassessed.

4. The utility may enter into contracts with property owners of single-family homes and with the owners of redevelopment projects that meet criteria specified by the utility for payment of connection charges over time instead of as a lump sum. The utility will charge interest at a rate set by the director or his designee on any outstanding debt covered by a payment contract. A contract shall be payable in full at the time of closing upon sale of the property.

B. Direct Facilities Charges.

1. The utility shall collect direct facilities charges from property owners that directly benefit from utility-built or privately built water service facilities, except property owners who previously paid their fair share through an LID or ULID. Facilities that may be covered in a direct facilities charge

include, but are not limited to, lines built from the water main to the property line, fire hydrant assemblies, pump stations, reservoirs and distribution and transmission mains.

2. The direct facilities charge is the property owner's equitable share of the established costs of the facilities he/she benefits from. The equitable share shall include interest charges applied from the date of construction acceptance of the facility until the property connects, or for a period not to exceed 10 years, whichever is less, at a rate commensurate with the rate of interest applicable at the time of construction of the facility to which the property owner is seeking to connect but not to exceed 10 percent per year; provided, that the aggregate amount of interest shall not exceed the equitable share of the cost of the facility allocated to such property owner.

3. The facilities' costs shall be allocated to benefitting property owners based on the number of single-family equivalents. The director may, however, make such allocation based on front footage or other reasonably based methodology if the director determines that such alternate basis or methodology better assures equitable sharing of cost by all properties benefitting from the facilities.

C. Administrative Procedures – Adjustment of Charges. The director is authorized to adopt administrative procedures for the purpose of administering the provisions of this section, and to adjust the charges established by subsections A and B of this section from time to time to reflect the actual cost of the facilities for which the charges are made. (Ord. 5963 § 1, 2010.)

24.02.270 Water rates.

A. General. The city council shall establish rates for water service and consumption; such rates are in addition to connection charges and fees for specific services. The utility may establish classifications of customers or service, using any method or methods authorized by law.

B. Rate Basis. Water rates shall be based on revenue requirements necessary to cover all costs of the utility, as authorized by the city council by the adoption of the biennial budget and subsequent amendments, and shall be guided by adopted financial policies and bond covenants.

C. Rate Adjustments. Rates shall be evaluated periodically as part of the review and adoption of the biennial budget. Rate adjustments shall be recommended as needed to meet revenue requirements. The recommendation shall consider equity, adequacy, costs and other factors allowed by law.

D. Billing and Collection. The utility shall develop and implement procedures and systems pertaining to the billing and collection of water service charges and fees in accordance with state law.

E. Rate Relief. The city council may establish water rate relief measures for specific customer classes as authorized by state law.

F. Rate Surcharge. Upon the city manager's declaration of a water shortage emergency pursuant to the city's adopted water shortage contingency plan, the utility may impose a rate surcharge of 10 percent without further city council action. (Ord. 5963 § 1, 2010.)

24.02.275 Capital recovery charges.

A. The utility shall establish and collect a monthly capital recovery charge so that each new improvement, development, redevelopment or existing structure that places an additional demand on the public water system bears its equitable share of the cost of said system.

B. Right-of-way and unirrigated nonbuilding tracts shall be exempt from the capital recovery charge.

C. The capital recovery charge shall be based on the cost of the water utility plant-in-service, less the cost of donated facilities, less the cost of city-built local facilities for which direct facilities charges are imposed, plus recoverable interest divided by the customer base as quantified by single-family equivalent units.

D. The capital recovery charge shall be placed on affected properties as a monthly charge for a period of 10 years.

E. The director or his designee is authorized to adjust the capital recovery charge value based upon updated values of the above-described elements. (Ord. 5963 § 1, 2010.)

24.02.280 Code violations, enforcement, and penalties.

The enforcement procedures and penalties associated with violations of this code are set forth in BCC 1.18.075. (Ord. 5963 § 1, 2010.)

Appendix E

Local Planning Consistency Statements

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City of Bellevue
Post Office Box 90012 • Bellevue, Washington • 98009 9012

October 14, 2015

Doug Lane, P.E.
City of Bellevue Utilities
P.O. Box 90112
Bellevue, WA 98009-9012

Dear Mr. Lane,

Our department has reviewed Bellevue's Draft Water System Plan for consistency with Bellevue's Comprehensive Plan and regulations and can attest to the following:

1. Land use and zoning assumptions in the Water System Plan are consistent with the City of Bellevue's adopted Comprehensive Plan and development regulations;
2. Future growth projections in the Water System Plan are reasonably consistent with Bellevue's population and employment projections; and
3. Policies for utility service extension and provisions for new construction are both consistent with Bellevue's adopted Comprehensive Plan and development regulations.

Please let me know if you have any questions or need any additional information.

Sincerely,

Dan Stroh
Planning Director

CITY OF
Clyde Hill

9605 NE 24th Street • Clyde Hill, Washington 98004
425-453-7800 • Fax: 425-462-1936 • mitch@clydehill.org

December 16, 2015

Doug Lane, P.E.
City of Bellevue Utilities
PO Box 90112
Bellevue, WA 98009-9012

Dear Mr. Lane,

The City received your request to review the City of Bellevue's draft Water System Plan for consistency with the City of Clyde Hill's local planning and zoning regulations.

Craig Olson, City Engineer, reviewed the draft Plan for consistency with Clyde Hill's Comprehensive Plan and regulations and therefore I can attest to the following:

1. Land use and zoning assumptions in the Water System Plan are consistent with the City of Clyde Hill's adopted Comprehensive Plan and development regulations;

2. Future growth projections in the Water System Plan are consistent with Clyde Hill's population and employment projections; and

3. Policies for utility service extensions and provisions for new construction are both consistent with Clyde Hill's adopted Comprehensive Plan and development regulations. Another key document governing water policy with Bellevue and Clyde Hill is the February 2973 Water District No. 68 City of Bellevue Agreement. We have not cross referenced the draft Water System Plan with this Agreement. If the two documents are consistent, then the draft Plan is consistent with Clyde Hill's water policy as well.

Please let me know if you need any further clarification.

Very truly yours,

M. Wasserman

Mitchell Wasserman
City Administrator

CC: Craig Olson, City Engineer

Town of
Serving Our Residents
Hunts Point

3000 Hunts Point Road
Hunts Point, WA 98004-1121
425.455.1834
Fax: 425.454.4586
www.huntspoint-wa.gov

January 7, 2016

Douglas Lane, PE
City of Bellevue Utilities Dept.
PO Box 90012
Bellevue, WA 98012

RE: Draft Water Comprehensive Plan

Dear Mr. Lane:

The Town of Hunts Point has reviewed the City of Bellevue's Draft Water Comprehensive Plan and certifies that:

1.) Bellevue's retail water service area is consistent with Hunts Point's adopted comprehensive plan and adopted development regulations and policies.
2.) The growth projections used to forecast future water demand for Hunts Point are consistent with Hunts Point's adopted population and commercial growth projections.
3.) Bellevue's water utility policies (Chapter 2 of the Plan) are consistent with Hunts Point's adopted comprehensive plan and development regulations.

If you have any questions please do not hesitate to contact us.

Sincerely,

Stacia Schroeder

Stacia Schroeder, PE
Hunts Point – Town Engineer
Phone: 206-276-8922
Email: engineer@huntspoint-wa.gov

Mona H Green

Mona Green
Hunts Point – Town Planner
Phone: 425-890-2197
Email: planner@huntspoint-wa.gov

CITY OF ISSAQUAH WASHINGTON

Development Services
1775 – 12th Ave. NW | P.O. Box 1307
Issaquah, WA 98027
425-837-3100
issaquahwa.gov

December 7, 2015

Doug Lane, P.E.
City of Bellevue Utilities
P.O. Box 90112
Bellevue, WA 98009-9012

Dear Mr. Lane,
The City of Issaquah Development Service and Public Works Engineering Departments have reviewed Bellevue's Draft Water System Plan for consistency with Issaquah's Comprehensive Plan, Water System Plan and regulations and have found the following.

1. The zoning and land use designations are currently Single Family-Suburban (4.5 du/ac) and Multifamily-Medium (14.52 du/ac). These designations are not proposed to change within the 20-year planning period. *Bellevue's plan does not include multifamily in the Lakemont area. Most of Lakemont is zoned Multifamily-Medium (12.52 du/ac).*

2. Issaquah does not have population and employment projections by subarea. It is assumed by Issaquah that Montreux and Lakemont are built-out and that the population and employment numbers are not anticipated to increase in any significant manner.

3. Bellevue's future estimation for demand is significantly higher than Issaquah's estimation. It appears Bellevue's estimation is based on maximum demand allowed in the wheeling contract with Issaquah, rather than actual built ERUs.

If you have any questions or need additional information, please contact me or Kerry Ritland (kerryr@issaquahwa.gov).

Sincerely,

Christen Smith Leeson

Christen Leeson
Senior Planner

Cc: Sheldon Lynne, Director, Public Works Engineering
Trish Heinonen, Policy Planning Manager
Kerry Ritland, Surface Water Manager

Lane, Douglas

From: Lane, Douglas
Sent: Tuesday, December 08, 2015 3:31 PM
To: 'Christen Leeson'
Cc: Trish Heinonen; Sheldon Lynne; Kerry Ritland
Subject: RE: Issaquah Consistency with Bellevue Water Plan
Attachments: RE: Issaquah Land Use Served by Bellevue Water; Bellevue Water Plan consistency 071215.pdf

Christen:

Thanks very much for the planning consistency letter, regarding portions of Issaquah served through Bellevue's water system (South Cove, Lakemont Triangle and Glacier Ridge). I'm responding to close the loop for documentation purposes (no response necessary; I assume Sheldon will have separate comments).

I'll revise the future projections as indicated below, based on your feedback. These adjustments will not change any of our capital planning recommendations for water supply, storage or transmission, since Bellevue has no capacity improvements planned that would serve those areas of Issaquah. However, the revised demands may improve the accuracy of water quality modeling and the criteria for our chlorine demand evaluation.

1. I'll adjust estimated population for Lakemont in Tables 3-16, 3-17 and 3-18, assuming multi-family zoning. This will not affect projected water demands, since demands specific to this area were assumed separately, in the absence of population data (per #3 below). Population shown for Lakemont and Glacier Ridge were back-calculated based on the assumed demands and assumed zoning, but were not actually used (unique procedure used only in these areas).
2. Noted. We will use existing consumption and assume zero growth.
3. Wheeling contract limits were used for future demand projections per direction from Todd Christensen in Issaquah's Engineering Dept (see attached). I also added an allowance for localized non-revenue flows (flushing, fire fighting, etc) and for distribution system leakage. In response to your letter, I'll reduce the "low" ADD projections to the actual 2014 volumes, and reduce the "high" estimate and MDD volumes proportionately. This will reduce future demand estimates by about 40%. The reduced flow will inform our water quality modeling and upcoming chlorine evaluation, but would not appear to impact any water supply, storage or transmission projects due to the low volumes relative to Bellevue's system.

Thanks again for your time.

Douglas Lane, PE
Water & Sewer Systems Senior Engineer
City of Bellevue
(425)452-6865
dlane@bellevuewa.gov

November 9, 2015

Doug Lane, P.E.
City of Bellevue Utilities
P.O. Box 90112
Bellevue, WA 98009-9012

Dear Mr. Lane,

Subject: Bellevue Draft Water System Plan

The City of Kirkland has reviewed the Draft Water System Plan for consistency with our population and employment projections and confirms the following:

1. The land use and zoning assumptions for the portion of Kirkland within Bellevue's water system service area are consistent with the City of Kirkland's adopted Plan and development regulations. The area's low density residential zoning is equivalent to one dwelling unit per acre and this subdivision and has no further development potential;

2. Future growth projections in the Plan are reasonably consistent with Kirkland's population projections. Employment projections are not applicable since this approximate 40 acre area is designated for residential development, and

3. Policies for utility service extension provisions for new construction are both consistent with Kirkland's adopted Comprehensive Plan and development regulations.

Sincerely,

PLANNING AND BUILDING DEPARTMENT

Joan Lieberman-Brill

Joan Lieberman-Brill, AICP
Senior Planner

Document1

CITY OF MEDINA
501 Evergreen Point Road, Medina WA 98039
425.233.6400 (phone) 425.451.8197 (fax) www.medina-wa.gov

January 14, 2016

Doug Lane, P.E.
City of Bellevue Utilities
P.O. Box 90112
Bellevue, WA 98009-9012

Re: City of Bellevue Water System Plan 2015 Update

Dear Mr. Lane,

Medina City staff has reviewed Bellevue's Draft Water System Plan for consistency with Medina's Comprehensive Plan and can attest to the following:

1. Land use and zoning assumptions in the Water System Plan are consistent with the Medina Comprehensive Plan and development regulation;

2. Future growth projections in the Water System Plan are reasonably consistent with Medina's population and employment projections; and

3. The goals and polices set forth in the Water System Plan do not conflict with Medina's adopted Comprehensive Plan and development regulations.

Please let me know if you have any questions, or need any additional information. I can be contacted at (425) 233-6416 or email: rgrumbach@medina-wa.gov.

Sincerely,

Robert J. Grumbach, AICP
Director of Development Services

TOWN OF YARROW POINT
4030 - 95th Avenue NE
Yarrow Point, WA 98004

(425) 454-6994 Fax: (425) 454-7899

November 10, 2015

Douglas Lane, PE
City of Bellevue Utilities Dept.
PO Box 90012
Bellevue, WA 98012

RE: Draft Water Comprehensive Plan

Dear Mr. Lane:

The Town of Yarrow Point has reviewed the City of Bellevue's Draft Water Comprehensive Plan and certifies that:

1.) Bellevue's retail water service area is consistent with Yarrow Point's adopted comprehensive plan and adopted development regulations and policies.
2.) The growth projections used to forecast future water demand for Yarrow Point are consistent with Yarrow Point's adopted population and commercial growth projections.
3.) Bellevue's water utility policies (Chapter 2 of the Plan) are consistent with Yarrow Point's adopted comprehensive plan and development regulations.

If you have any questions please do not hesitate to contact us.

Sincerely,

Stacia Schroeder, PE
Yarrow Point – Town Engineer
Phone: 206-276-8922
Email: sschroeder@ci.yarrow-point.wa.us

Mona Green
Yarrow Point – Town Planner
Phone: 425-890-2197
Email: mhgreen@ci.yarrow-point.wa.us

Appendix F

Summer Diurnal Demands Study

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City of
Bellevue

MEMORANDUM

Date: October 10, 2014

To: Bellevue Utilities Technical Team

From: Douglas Lane, P.E.

Subject: 2014 Summer Diurnal Demands Study

Executive Summary

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

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

Diurnal patterns are typically graphed as a “Peaking Factor” (PF) in relation to the average hourly demand for the same set of data on the same day. The average hourly demand during a 24-hour period (total daily volume divided by 24) corresponds to a PF of 1.0, and the actual flow at each hour equals the average hourly demand times the PF. Figures 1 and 2 show diurnal patterns and PFs for particular customers and days.

Diurnal water demand patterns of a limited number of customers were observed for the period of June 30 through August 27, 2014, to assist in system modeling. Attachment A shows the customer locations and user classes.

This assessment made use of the data logging capability of Sensus Omni-Meters, which the City of Bellevue has required for all new meters 3” in diameter and larger since 2009, and more recently all 1.5” and larger meters. Prior to installation of Omni-Meters, the City did not have the capability to directly record hourly water usage. Although the sample size is limited, the City’s Omni-Meters comprise the best currently available information, and reflect actual customer demands.

The data collected represents an approximation of summer diurnal patterns in Bellevue’s water service area, during warm weather. A separate study was conducted during winter 2013-2014 months to estimate diurnal patterns during low demand periods.

Figure 1 shows the aggregate peaking factors for all user classes studied on the maximum demand day (July 16, 2014). These PFs are higher than for average summer days, and are recommended for equalization storage calculations and maximum day extended period simulation (EPS) modeling scenarios. These PFs are based on a limited sample set and should not be used for design purposes or for facility sizing, because they may not reflect localized demand patterns.

Figure 1 - Observed Maximum Demand Day Diurnal Patterns

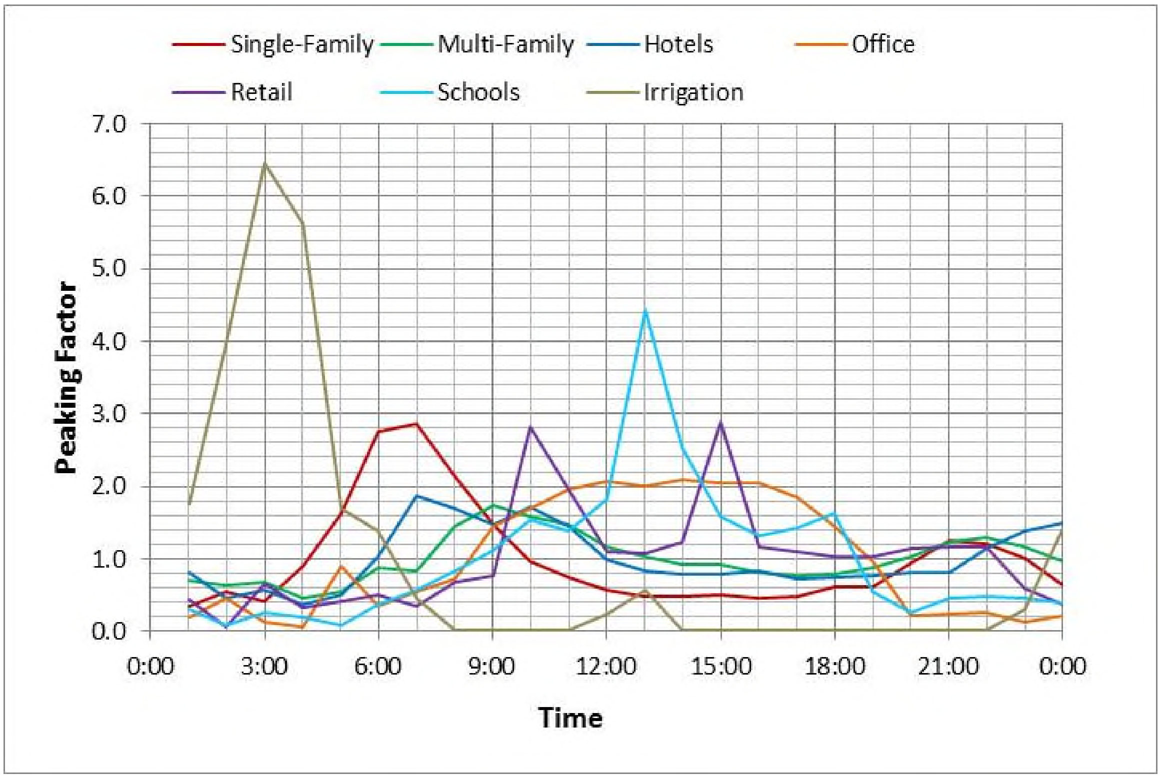


Figure 2 shows the average aggregate peaking factors for all user classes studied during the entire study period (all days).

Figure 2 – Average Observed Summer Diurnal Patterns

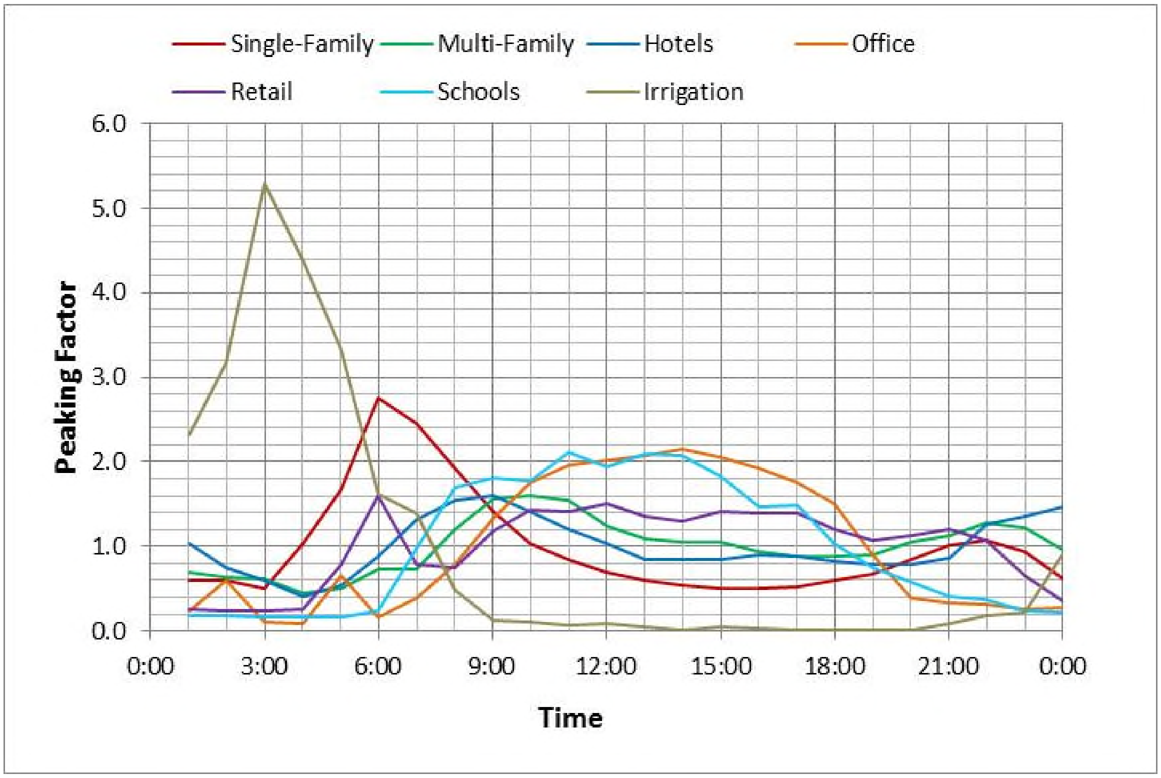


Table 1 shows observed maximum summer PFs by customer class. The aggregate data is based on the total flow for all meters. Individual meters are also shown, to demonstrate that significant localized variations in both peak flow and peak time exist, even within the same customer class, as sample sizes get smaller.

Table 1 – Maximum Observed Summer Peaking Factors

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

Data was also recorded and analyzed for some unique, very large water customers. That data is not presented herein, and should be used only for modeling those specific customers in the hydraulic model.

The following is recommended as a result of this study:

- This information reflects water use patterns of Bellevue's customers only. No representations are made, implicitly or explicitly, about the applicability of this information to customers outside Bellevue's water service area.
- Use the observed maximum demand day diurnal patterns (Figure 1) for water distribution system model EPS simulations in peak demand scenarios.
- Use the average observed summer diurnal patterns (Figure 2) for summer EPS simulations lasting longer than 7 days.
- Develop a composite diurnal pattern for all customers, for estimating equalization storage needs across large portions of the water service area.
- Data included in this memorandum should not be used for design or sizing of water distribution, supply or storage facilities, because it may not reflect peak localized demand conditions. Use peak diurnal patterns specific to the area served for sizing water facilities.
- When weighing the costs and benefits of Advanced Metering Infrastructure (AMI) as a potential investment for the utility, the City should consider the substantial engineering value provided by AMI data for diurnal flow monitoring in both the water and sewer systems.

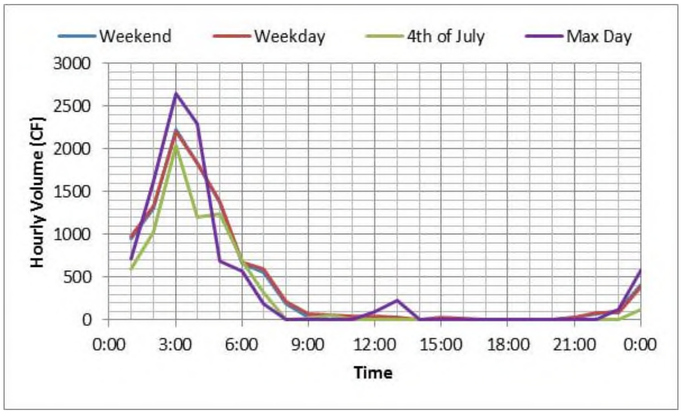
More detailed information for each user class is provided below.

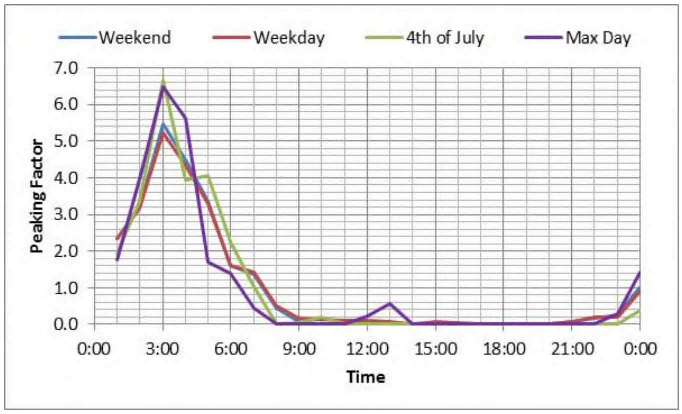
Irrigation

A limited number of irrigation meters in Bellevue's service area are equipped with Sensus Omni meters, which log 31 days of hourly water volumes. Twelve of these meters were read, including dedicated irrigation meters at Tam O'Shanter golf course, 2 City parks, one school, 5 office complexes, one senior living center, one single-family homeowners association, and one retail shopping center. This represents a sample of roughly 8% of dedicated irrigation-only meter volumes in Bellevue's water service area. This data represents dedicated irrigation meters only, and does not include the substantial volume of irrigation supplied through domestic water meters.

Tam O'Shanter golf course alone represents roughly 4% of dedicated irrigation-only demand, but has been considered separately due to highly unique demand patterns, as described below. Figures 3 and 4 show the observed volumes and diurnal patterns for the other 11 meters analyzed (roughly 4% of irrigation only demand). Attachment B shows this information in a table format.

Figure 3 - Observed Irrigation Volume/Hour **Figure 4 - Estimated Irrigation PF**





Observed irrigation patterns have consistent peaks in the very early morning, and do not differ discernibly between weekdays, weekends or holidays. This pattern suggests the use of programmable irrigation controllers by most, if not all large irrigation customers. Peak flows occurred in the hour ending 3:00 am, with a peaking factor of 6.67 on July 4th (PF = 6.47 on the maximum day).

In addition to field Omni meter reading and data analysis, the Utilities Department met with Parks Department water conservation irrigation staff to discuss the park irrigation control strategy. The Bellevue Parks Department is the largest irrigation customer in the water service area, and accounts for roughly 8%-10% of irrigation volumes. Parks Department staff indicated that they have a centrally-controlled system using Rain Bird Maxicom software, which calculates evapotranspiration rates based on temperature, wind conditions, humidity, rainfall and solar radiation, and uses this to apportion irrigation volumes. This system is programmed to irrigate between 12:00-4:00 am depending on the number of zones at each site, which corroborates field Omni meter observations, and confirms that it is appropriate to extrapolate these observations to all City parks. The exception to this general pattern is that for very large parks, particularly Downtown Park, irrigation starts sooner (as early as 10:00 pm am, depending on weather conditions) due to the large number of zones and time it takes to cycle through all of them.

Figures 5 and 6 show observed data at Tam O'Shanter golf course. Golf course maintenance staff indicated that they manually open their City supply valve in the late morning and fill ornamental ponds with City-supplied water. They then pump water from those ponds overnight to supply irrigation, such that their actual pattern of irrigation is similar to those observed above at other locations, despite different patterns at the actual meter. Demand patterns at this water meter do not correspond to actual usage patterns due to on-site storage. This location should be considered uniquely for the purpose of hydraulic model simulations, but also highlights the need to consider how manual irrigation may affect demand patterns at other sites.

Figure 5 - Observed Tam O'Shanter Flow

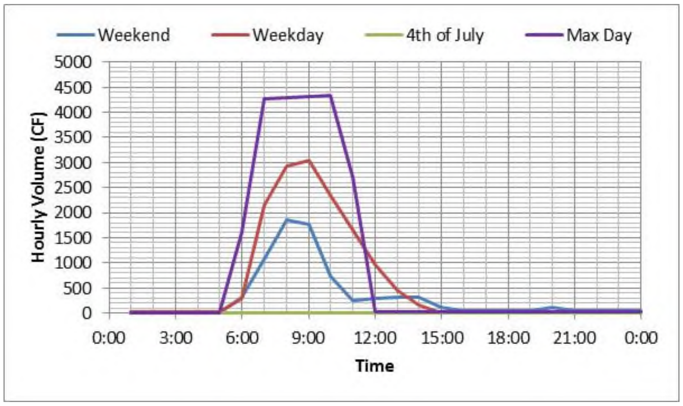
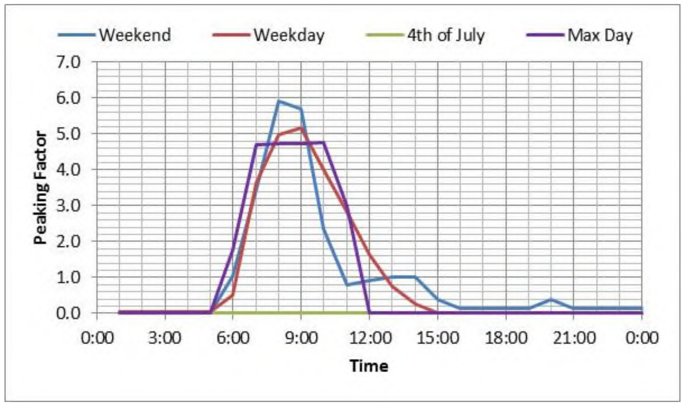


Figure 6 - Estimated Tam O'Shanter PF



Single-Family Residential

The City of Bellevue does not currently have a feasible method of directly measuring diurnal flow patterns for single-family (SF) households. However, the Clyde Hill 500 pressure zone (CL500) allows indirect estimation of single-family diurnal demands, and was therefore selected as the sample set for this study. CL500 accounts for approximately 2.5% of single-family housing population in Bellevue's water service area.

CL500 is unique among Bellevue's service area in that it has no unmetered PRVs flowing into or out of the zone, and the pump station does not re-circulate, so therefore all inflows and outflows (except for leakage) are metered. CL500 demand can be measured by adding the Clyde Hill pump station flows plus Clyde Hill 465 standpipe outflows (outflows are negative during tank filling).

Land use in CL500 is almost exclusively single-family housing, with the exception of 4 schools, two large churches, some municipal parks, and a nominal number of small commercial parcels. To estimate single-family diurnal patterns, demands into the zone need to be corrected to account for other users. For the purpose of this study, the following adjustments were made:

- **Schools**: Observed June-July 2014 water demands at Clyde Hill Elementary, Bellevue Christian School, Chinook Middle School and Sacred Heart School were multiplied by the typical observed school diurnal pattern (described below) and subtracted from total flow into the zone.
- **Churches**: 2013 average daily domestic demands at First Presbyterian and Sacred Heart churches were multiplied by the observed diurnal pattern at another large church (described below) and subtracted from total flow into the

zone. Irrigation at First Presbyterian Church was neglected, because it has a separate irrigation meter served off the 400 Zone (no need to correct).

- **Parks**: Observed June-July 2014 water demands at Clyde Hill municipal parks were multiplied by the typical observed irrigation diurnal pattern (described above) and subtracted from total flow into the zone.
- **Commercial**: Commercial demands were neglected due to the marginal number of commercial water customers.

Figures 7 and 8 show the estimated single family demand volumes and diurnal patterns (including both domestic and single-family irrigation uses). Attachment C shows this information in a table format. This data also includes any system leakage in CL500, since it estimated from total zone demand. Peak flows typically occurred in the hour ending 6:00 am on weekdays, with a peaking factor of 2.81. However, higher peaks occurred on July 4 (PF 3.12 at 6:00 am) and on the maximum day (PF 2.86 at 7:00).

Figure 7 - Estimated CL500 Hourly Volume

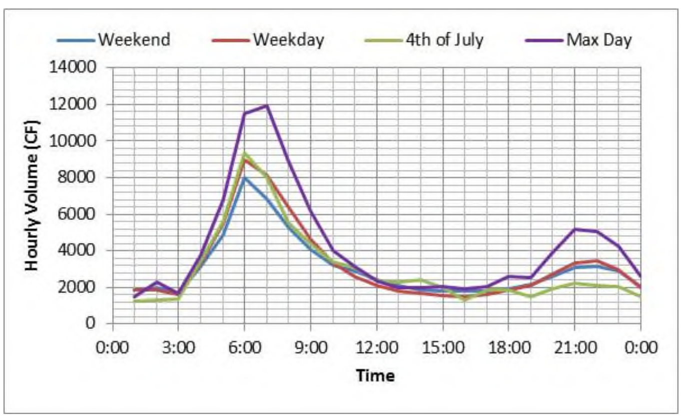
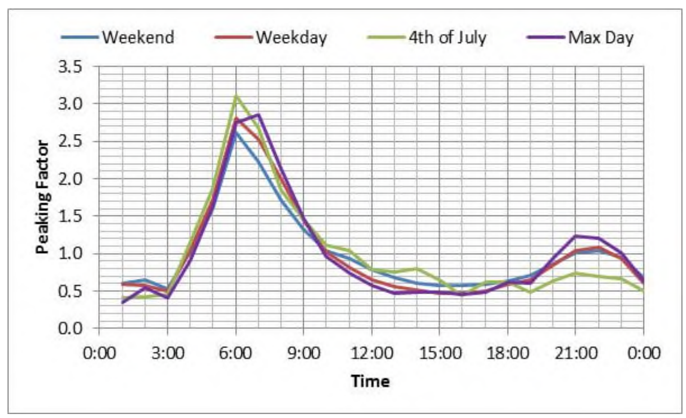


Figure 8 - Estimated SF Peaking Factor



Single-family diurnal patterns appear to have a consistent morning peak on all days, with a smaller peak in the late evening. Unlike during winter, the summer weekday, weekend and holiday patterns generally peak at the same time in the morning, suggesting that much of the peak may be due to irrigation, rather than domestic demands typically correlated to work schedules.

The observed single-family residential morning peak is substantially higher than the observed Winter weekday peak (PF 1.85). This is significant, because unlike commercial, multi-family and park irrigation systems with programmable controllers that typical peak at 3:00 am, single-family irrigation appears to be cumulative with the domestic demand peak between 5:00-7:00 am.

Multi-Family Residential

A limited number of multi-family residential buildings in Bellevue's service area are equipped with domestic (non-irrigation) Omni meters, which log 31 days of hourly water volumes. 12 of these meters were read, representing roughly 3.3% of multi-family domestic water use in the service area. Figures 9 and 10 show the observed volumes and diurnal patterns. Attachment D shows this information in a table format.

Figure 9 - Observed MF Hourly Volume (CF)

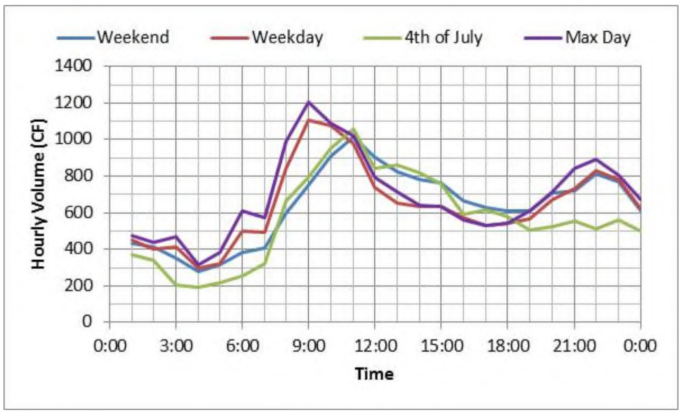
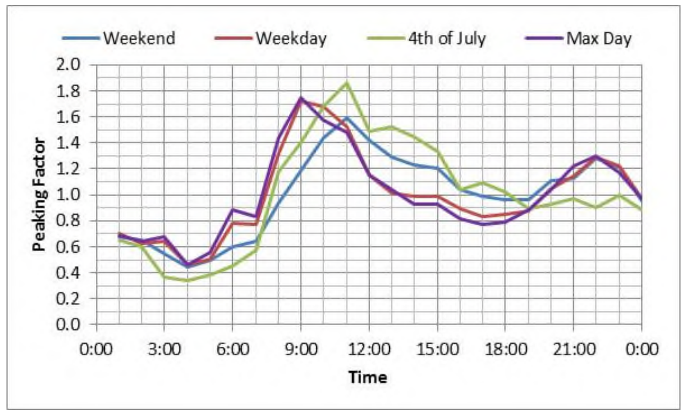


Figure 10 - Estimated MF Peaking Factor



Observed MF patterns have significantly lower peaks than single-family diurnal curves. Peaking factors are also slightly lower than observed winter MF patterns, possibly due to the presence of some irrigation usage (through the domestic meter) during non-peak hours. Typical peak flows occurred in the hour ending 9:00 am on weekdays, with a peaking factor of 1.72, but observed peaks were 1.75 on the maximum day (9:00 am) and 1.86 on July 4 (11:00am).

One of the observed multi-family buildings had sharp, daily 3:00 am and 6:00 peaks with roughly 4 and 6 times the typical 8:00-9:00 am morning peak flows at this meter. The timing of these exceptionally large peaks is consistent with usage typically observed with automatic irrigation systems. Billing data confirms that this building does not have a separate irrigation meter, so it is assumed that the meter provides both domestic and irrigation service for the customer.

Hotels

Omni meters at three hotels were read, representing roughly 16% of typical domestic hotel water demands in Bellevue's water service area. Results are shown in Figures 11 and 12, and Attachment E. Typical peak flows occurred in the hour ending 7:00, 8:00 or 9:00 depending on the day of the week. The highest peak of 1.92 occurred in the hour ending 7:00 on the 4th of July and the max demand day (July 16).

Figure 11 - Observed Hotel Hourly Volume

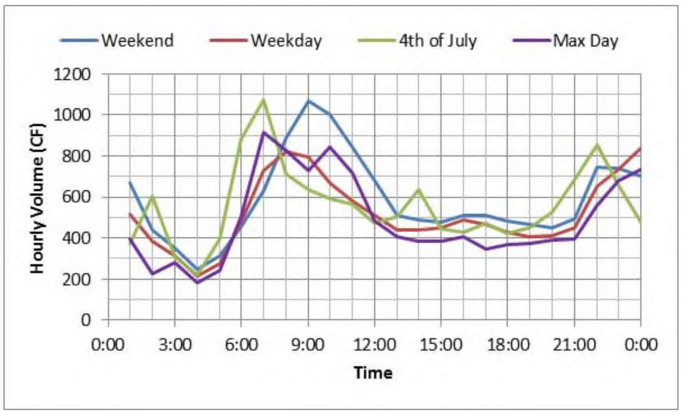
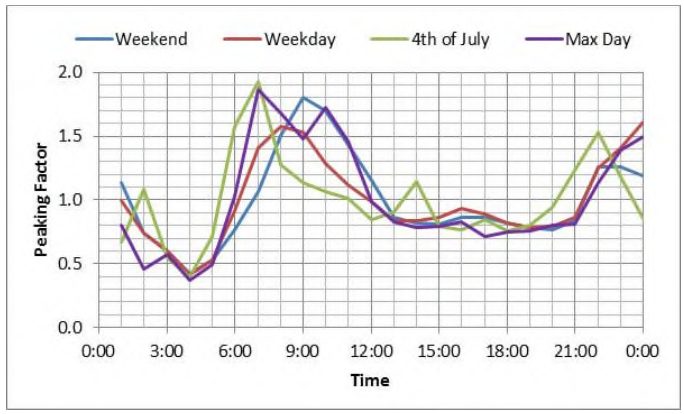


Figure 12 - Estimated Hotel Peaking Factor



Hotel diurnal patterns resemble multi-family diurnal curves, but with a later night-time peak. Summer hotel peaking factors are significantly lower than observed Winter hotel PFs. Another substantial difference between summer and winter hotel diurnal patterns is that holidays and weekends generally have higher PFs than weekdays (the opposite occurred in winter), suggesting more leisure travel in summer versus more business travel during winter.

Office Buildings

Seven office building Omni meters were read, representing roughly 0.5% of typical domestic commercial water demands in Bellevue's water service area. Results are shown in Figures 13 and 14. Diurnal patterns were consistently similar for 6 of the locations; the seventh location was removed from the data as discussed below. Peak flows plateaued on weekdays for approximately 4-6 hours during mid-day at a peaking factor of approximately 2.1. Attachment F shows this information in a table format.

Figure 13 - Observed Office Hourly Volume

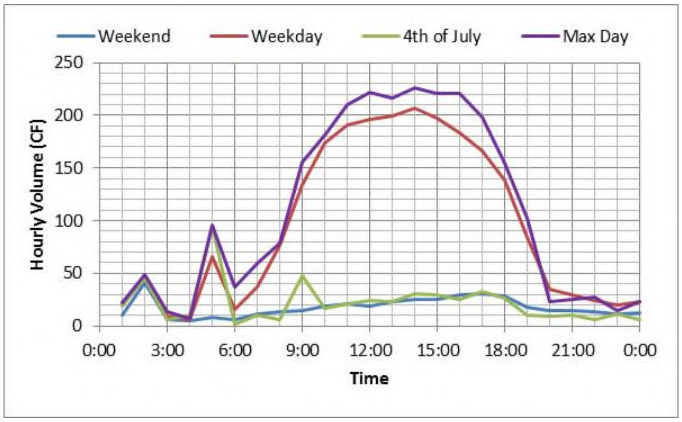
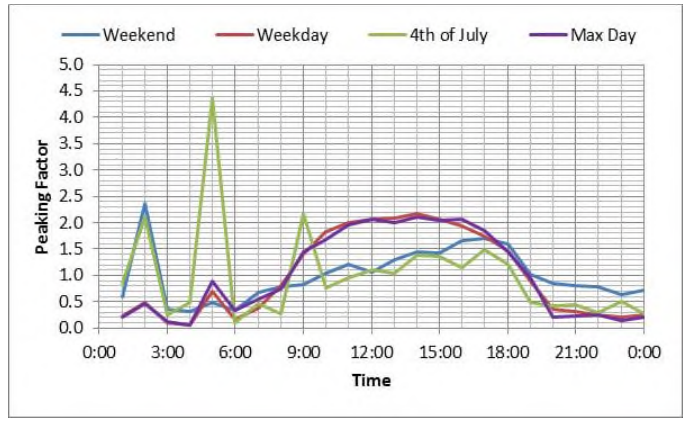


Figure 14 - Estimated Office Peaking Factor



Hidden Valley Office Park (HVOP) meter data shows a long daily peak from 2:00-4:00 am with roughly 4-6 times the typical mid-day peak flows, or roughly equal to the mid-day peak of all 7 office meters combined. HVOP data is shown in Figures 15 and Figure 16. The timing of this exceptionally large volume is consistent with usage typically observed with automatic irrigation systems, and the diurnal pattern is similar to domestic supply at other office buildings after removing the early-morning peak. Billing data confirms that HVOP does not have a separate irrigation meter, so it is assumed that the meter provides both domestic and irrigation service. Although some other office buildings also show some apparent irrigation usage (evident in small 2:00 am and 5:00 am peaks), the apparent irrigation volumes were so large at HVOP that it was excluded from data in Figures 13 and 14 to avoid skewing the domestic data for all offices.

Figure 15 - Observed Flow at HVOP (CF)

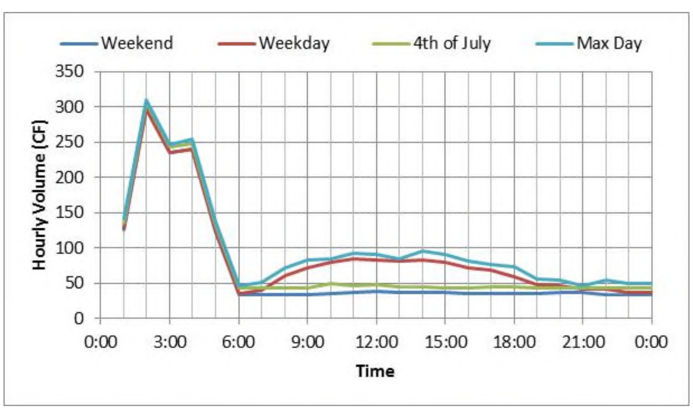
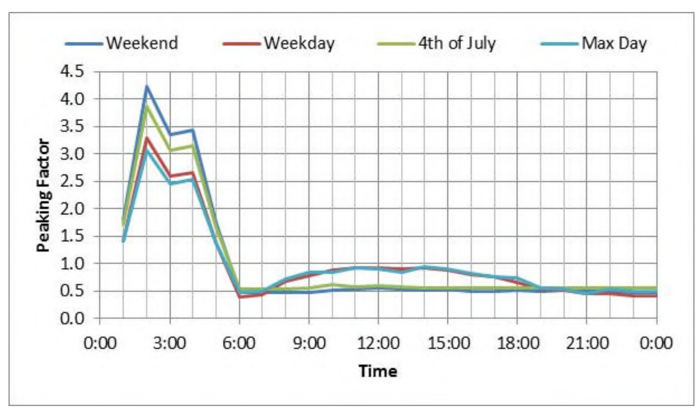


Figure 16 - Estimated HVOP Peaking Factor



Figures 15 and 16 suggest that irrigation demands should be considered separately from domestic for the purpose of estimating diurnal patterns at large commercial sites.

Retail Shopping Centers

Two retail shopping center Omni meters were read, representing roughly 0.5% of typical domestic commercial water demands in Bellevue's water service area. Both shopping centers consist of a large grocery store, a large pharmacy, and one or more various other retail shops. Results are shown in Figures 17 and 18, and Attachment G.

Observed retail summer domestic diurnal patterns generally resemble winter retail demands, except for the maximum day. Both locations consistently show a plateau with PF about 1.5 from late morning through early evening, except for a noon weekend peak and extremely erratic flows only on holidays. Normally, peaks occurred at lunchtime on weekends, at a peaking factor of 1.89, however very sharp PFs of 2.81 and 2.89 occurred at the 10:00 am and 3:00 pm hours on the maximum demand day. Very high flows also occurred on July 4th, at 6:00 am at one meter.

Figure 17 - Observed Retail Hourly Volume

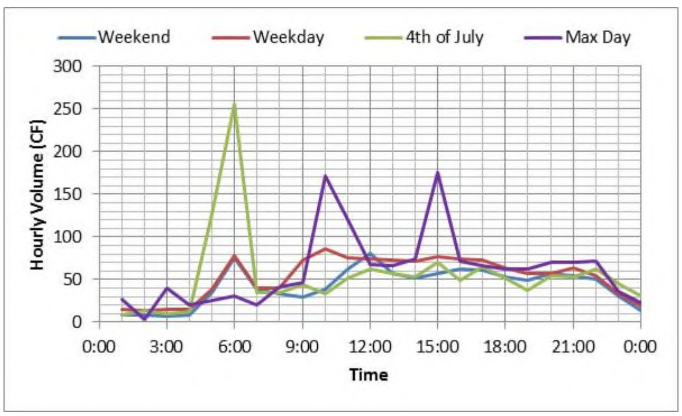
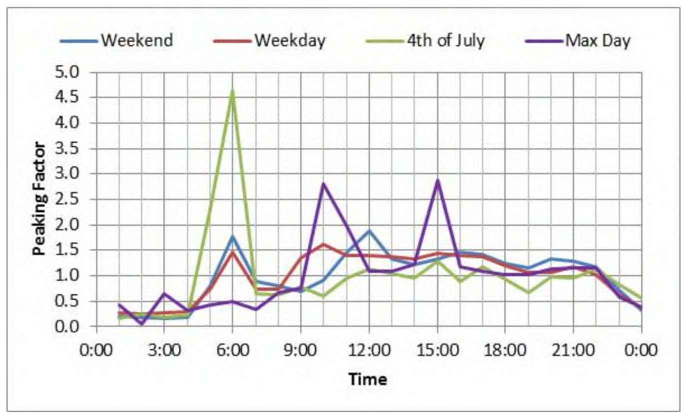


Figure 18 - Estimated Retail Peaking Factor



Schools

Domestic water meters serving five schools were read, including one major public high school, 2 public middle schools, and 2 public elementary schools. Average flows represented less than 1% of summer municipal flows in Bellevue's water service area, compared to nearly 9% for the same meters during winter, demonstrating the significant seasonal demand fluctuations at schools. Results are shown in Figures 19 and 20. Attachment H shows this information in a table format.

Observed school PFs during summer are generally unpredictable and do not correlate well with winter school PFs, reflecting the variety of summer school programs, lack of regular classes, and significantly reduced total demand. The average summer weekday diurnal pattern for schools actually resembles a typical office building, with a long plateau during business hours rather than a peak. However, the school diurnal pattern on the maximum day did closely resemble a winter school day, with a sharp lunchtime peak, although with much lower total flows. Peak flows occurred on the maximum day during the hour ending 1:00 pm, with a peaking factor of 4.44.

Figure 19 - Observed School Hourly Volume

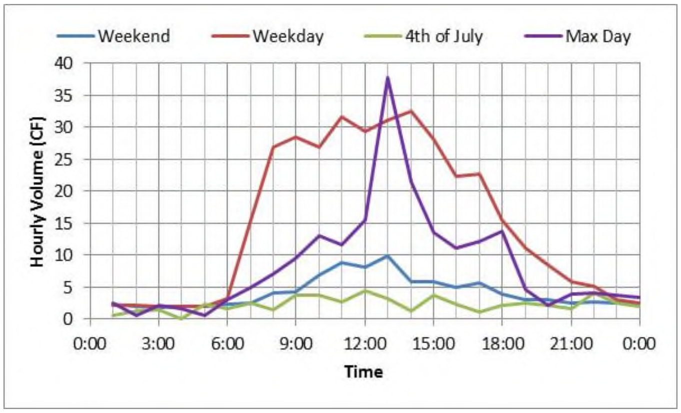
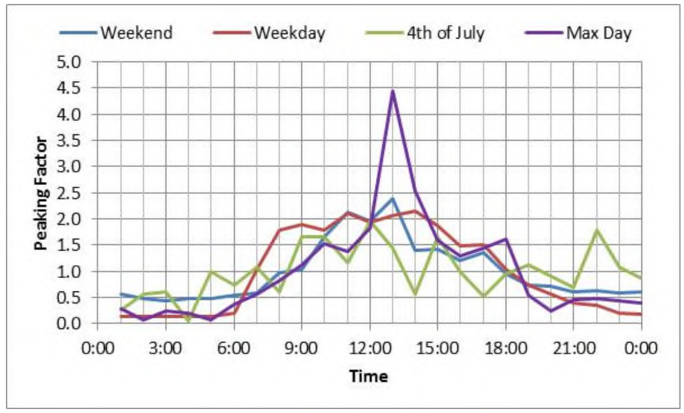


Figure 20 - Estimated School Peaking Factor



It should be noted that the observed volume of demand during summer was substantially lower than winter at all schools. The peak lunchtime flow observed on the maximum day was roughly 10% of the average weekday peak hour demand observed at these schools. Average total 24-hour demands at four of the schools were 18%-26% of average winter demand (including Winter break). The fifth school has a popular community gymnasium that is open all summer, but summer demands there were still only 43% of the average winter demand.

Churches

The meter serving one large church near I-90 was read. Although this sample size is small, it is the only data available, and the results seem reasonable given a typical Sunday worship service schedule. Results are shown in Figures 21 and 22.

Observed church flows are characterized by relatively very high flows during late-morning on Sundays, relatively low flows during the rest of the week, and virtually zero overnight flows on all days. Peak flows occurred on Sunday mornings during the hour ending 11:00 am, with a peaking factor of 6.94.

Figure 21 - Observed Church Hourly Volume

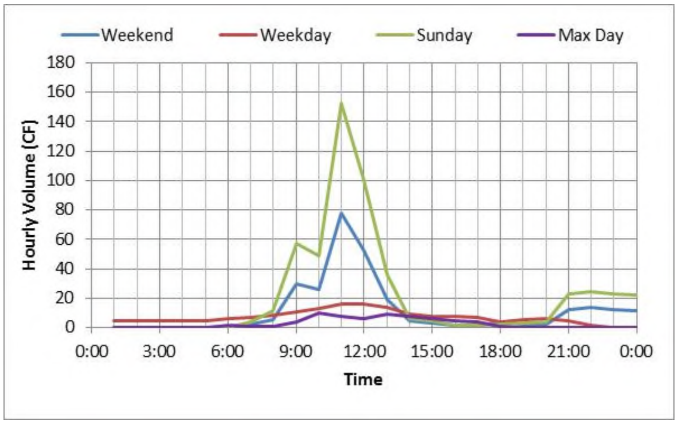
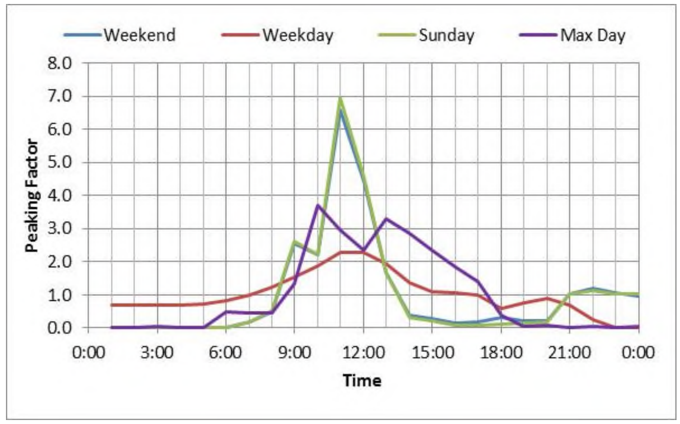


Figure 22 - Estimated Church Peaking Factor



Methodology

Peaking factors (PFs) are normalized to the average flow on similar days, so they only reflect the diurnal fluctuations with respect to baseline flow for the same particular type of day (weekday, weekend, or holiday). The average PF for each 24 hour period is 1.0:

PF = hourly flow ÷ average hourly flow on similar days

Meter clocks were not well synchronized with true time, and were also inconsistent with each other, so the data for each meter required a time adjustment. Time correction was applied based on the difference between the actual time the data was downloaded versus the latest apparent reading in the data. For instance, data was obtained at one multi-family residential meter at 8:20 am, but the meter provided hourly data through 11:00 am, roughly 3 hours in the future. For this meter, all readings were corrected by minus 3 hours.

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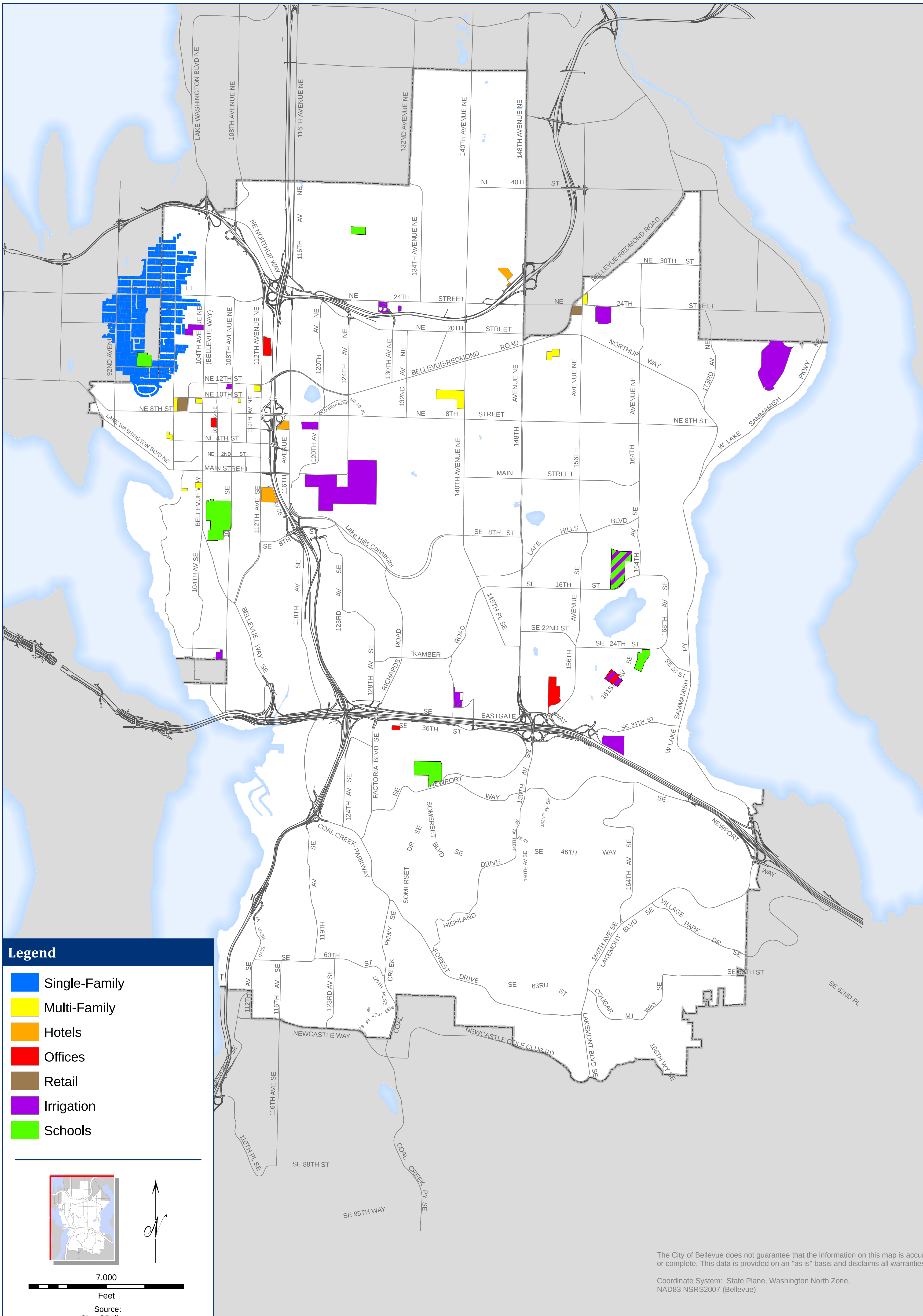
2014 Summer Diurnal Demand Study

Attachment A: Sample Locations Labeled by Customer Class

City of Bellevue



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

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

IT Department

Date: 9/5/2014 File Name: J:\Water System Plan (2015)\Consumption Data\Diurnal Patterns\Summer Study\Omni-meter map.mxd

City of Bellevue

MEMORANDUM

Attachment B: Estimated Summer PFs at Dedicated Irrigation-Only Meters

	Total Average (All Days)	Weekday Average	Weekend Average	4^{th} of July	Max Day (July 16)
1:00	2.33	2.33	2.33	1.94	1.75
2:00	3.18	3.17	3.20	3.36	3.97
3:00	5.30	5.21	5.47	6.67	6.47
4:00	4.38	4.34	4.50	3.92	5.61
5:00	3.32	3.29	3.36	4.06	1.69
6:00	1.62	1.61	1.61	2.26	1.39
7:00	1.39	1.41	1.37	1.03	0.45
8:00	0.49	0.51	0.45	0.01	0.02
9:00	0.14	0.16	0.06	0.05	0.01
10:00	0.10	0.14	0.01	0.20	0.01
11:00	0.08	0.10	0.01	0.01	0.01
12:00	0.08	0.11	0.01	0.01	0.23
13:00	0.05	0.06	0.01	0.01	0.57
14:00	0.02	0.02	0.01	0.01	0.02
15:00	0.06	0.08	0.01	0.01	0.01
16:00	0.03	0.04	0.01	0.01	0.01
17:00	0.01	0.02	0.01	0.01	0.01
18:00	0.01	0.01	0.01	0.01	0.01
19:00	0.01	0.01	0.01	0.01	0.01
20:00	0.01	0.01	0.01	0.01	0.01
21:00	0.08	0.08	0.08	0.01	0.01
22:00	0.18	0.18	0.17	0.01	0.01
23:00	0.21	0.20	0.26	0.01	0.29
24:00	0.93	0.90	1.02	0.39	1.43
Average	1.00	1.00	1.00	1.00	1.00

Max Flow

Attachment C: Estimated Single-Family Residential Summer PFs
(Including Domestic and Irrigation Demand)

	Total Average (All Days)	Weekday Average	Weekend Average	4th of July	Max Day (July 16)
1:00	0.59	0.59	0.61	0.41	0.35
2:00	0.60	0.58	0.65	0.43	0.54
3:00	0.51	0.50	0.54	0.46	0.41
4:00	1.04	1.04	1.03	1.15	0.90
5:00	1.68	1.71	1.59	1.86	1.62
6:00	2.76	2.81	2.61	3.12	2.75
7:00	2.45	2.53	2.23	2.67	2.86
8:00	1.92	2.00	1.72	1.85	2.13
9:00	1.42	1.45	1.32	1.46	1.48
10:00	1.04	1.03	1.05	1.12	0.97
11:00	0.85	0.82	0.94	1.04	0.75
12:00	0.69	0.65	0.79	0.79	0.57
13:00	0.60	0.57	0.68	0.76	0.48
14:00	0.55	0.52	0.60	0.80	0.48
15:00	0.51	0.48	0.58	0.66	0.49
16:00	0.50	0.48	0.58	0.44	0.46
17:00	0.53	0.51	0.59	0.62	0.49
18:00	0.60	0.59	0.63	0.62	0.62
19:00	0.67	0.66	0.72	0.49	0.60
20:00	0.84	0.84	0.86	0.64	0.93
21:00	1.02	1.03	1.01	0.74	1.24
22:00	1.07	1.08	1.04	0.70	1.21
23:00	0.93	0.93	0.95	0.67	1.02
24:00	0.63	0.61	0.67	0.50	0.63
Average	1.00	1.00	1.00	1.00	1.00

Max Flow

City of Bellevue

MEMORANDUM

Attachment D: Observed Multi-Family Residential Summer Domestic PFs

	Total Average (All Days)	Weekday Average	Weekend Average	4th of July	Max Day (July 16)
1:00	0.69	0.70	0.68	0.65	0.69
2:00	0.63	0.62	0.65	0.60	0.64
3:00	0.61	0.64	0.55	0.37	0.68
4:00	0.46	0.46	0.44	0.34	0.46
5:00	0.50	0.50	0.50	0.38	0.56
6:00	0.73	0.78	0.60	0.45	0.88
7:00	0.73	0.77	0.65	0.57	0.83
8:00	1.21	1.32	0.94	1.18	1.44
9:00	1.57	1.72	1.18	1.40	1.75
10:00	1.61	1.67	1.44	1.68	1.58
11:00	1.55	1.52	1.59	1.86	1.48
12:00	1.23	1.16	1.42	1.49	1.15
13:00	1.10	1.02	1.29	1.52	1.04
14:00	1.06	0.99	1.23	1.44	0.93
15:00	1.05	0.98	1.20	1.34	0.92
16:00	0.94	0.90	1.04	1.04	0.82
17:00	0.88	0.83	0.99	1.09	0.77
18:00	0.88	0.85	0.96	1.03	0.79
19:00	0.90	0.88	0.96	0.90	0.89
20:00	1.06	1.04	1.11	0.92	1.04
21:00	1.14	1.14	1.13	0.97	1.22
22:00	1.28	1.29	1.28	0.90	1.30
23:00	1.21	1.22	1.21	0.99	1.17
24:00	0.97	0.97	0.96	0.89	0.97
Average	1.00	1.00	1.00	1.00	1.00

Max Flow

City of Bellevue

MEMORANDUM

Attachment E: Observed Hotel Summer Domestic PFs

	Total Average (All Days)	Weekday Average	Weekend Average	4th of July	Max Day (July 16)
1:00	1.03	0.99	1.13	0.67	0.80
2:00	0.74	0.74	0.74	1.08	0.46
3:00	0.60	0.60	0.60	0.55	0.57
4:00	0.42	0.42	0.42	0.40	0.37
5:00	0.53	0.53	0.53	0.71	0.50
6:00	0.88	0.92	0.77	1.58	1.03
7:00	1.31	1.41	1.06	1.92	1.86
8:00	1.55	1.58	1.50	1.27	1.69
9:00	1.61	1.53	1.80	1.14	1.48
10:00	1.41	1.28	1.70	1.07	1.72
11:00	1.21	1.12	1.43	1.01	1.46
12:00	1.03	0.99	1.16	0.85	0.98
13:00	0.85	0.84	0.87	0.91	0.83
14:00	0.84	0.84	0.82	1.14	0.79
15:00	0.85	0.87	0.81	0.79	0.79
16:00	0.91	0.94	0.86	0.77	0.83
17:00	0.88	0.89	0.86	0.84	0.71
18:00	0.82	0.82	0.82	0.76	0.75
19:00	0.79	0.79	0.79	0.80	0.76
20:00	0.79	0.79	0.77	0.95	0.80
21:00	0.86	0.86	0.84	1.23	0.81
22:00	1.26	1.25	1.26	1.53	1.14
23:00	1.36	1.41	1.26	1.18	1.39
24:00	1.47	1.61	1.19	0.86	1.50
Average	1.00	1.00	1.00	1.00	1.00

Max Flow

Attachment F: Observed Office Summer Domestic PFs

	Total Average (All Days)	Weekday Average	Weekend Average	4th of July	Max Day (July 16)
1:00	0.25	0.23	0.60	0.86	0.20
2:00	0.59	0.49	2.37	2.11	0.46
3:00	0.11	0.10	0.36	0.26	0.13
4:00	0.08	0.07	0.31	0.48	0.06
5:00	0.65	0.69	0.49	4.38	0.89
6:00	0.16	0.16	0.33	0.09	0.34
7:00	0.39	0.39	0.67	0.45	0.56
8:00	0.78	0.80	0.78	0.28	0.73
9:00	1.34	1.41	0.83	2.18	1.44
10:00	1.75	1.83	1.04	0.76	1.68
11:00	1.96	2.01	1.22	0.95	1.95
12:00	2.02	2.07	1.07	1.10	2.06
13:00	2.07	2.09	1.29	1.04	2.01
14:00	2.14	$\boxed{2.17}$	1.45	1.39	2.10
15:00	2.05	2.08	1.41	1.37	2.05
16:00	1.92	1.93	1.65	1.15	2.05
17:00	1.76	1.75	1.71	1.50	1.84
18:00	1.50	1.46	1.59	1.21	1.44
19:00	0.91	0.89	1.01	0.48	0.95
20:00	0.38	0.36	0.85	0.43	0.21
21:00	0.34	0.31	0.81	0.45	0.23
22:00	0.32	0.25	0.78	0.29	0.25
23:00	0.26	0.21	0.64	0.52	0.13
24:00	0.27	0.24	0.73	0.28	0.21
Average	1.00	1.00	1.00	1.00	1.00

$\boxed{\text{Max Flow}}$

Attachment G: Observed Retail Summer Domestic PFs

	Total Average (All Days)	Weekday Average	Weekend Average	4th of July	Max Day (July 16)
1:00	0.26	0.28	0.21	0.16	0.44
2:00	0.24	0.25	0.19	0.26	0.05
3:00	0.25	0.27	0.18	0.19	0.65
4:00	0.26	0.29	0.20	0.23	0.32
5:00	0.78	0.73	0.80	2.31	0.42
6:00	1.60	1.47	1.77	4.65	0.50
7:00	0.78	0.75	0.89	0.64	0.34
8:00	0.75	0.74	0.80	0.63	0.67
9:00	1.19	1.36	0.69	0.79	0.76
10:00	1.43	1.61	0.92	0.61	2.81
11:00	1.42	1.41	1.48	0.95	1.97
12:00	1.51	1.41	1.89	1.14	1.10
13:00	1.36	1.37	1.34	1.04	1.08
14:00	1.30	1.34	1.21	0.96	1.23
15:00	1.41	1.43	1.32	1.29	2.89
16:00	1.40	1.39	1.47	0.89	1.17
17:00	1.39	1.38	1.42	1.18	1.09
18:00	1.20	1.19	1.24	0.94	1.04
19:00	1.08	1.06	1.17	0.68	1.02
20:00	1.13	1.06	1.34	0.99	1.15
21:00	1.20	1.19	1.28	0.96	1.15
22:00	1.06	1.03	1.18	1.14	1.17
23:00	0.65	0.62	0.71	0.83	0.59
24:00	0.35	0.36	0.31	0.56	0.38
Average	1.00	1.00	1.00	1.00	1.00

Max Flow

City of Bellevue

MEMORANDUM

Attachment H: Observed School Summer Domestic PFs

	Total Average (All Days)	Weekday Average	Weekend Average	4th of July	Max Day (July 16)
1:00	0.18	0.14	0.56	0.26	0.29
2:00	0.18	0.15	0.48	0.57	0.07
3:00	0.17	0.14	0.44	0.61	0.25
4:00	0.17	0.14	0.48	0.04	0.20
5:00	0.17	0.13	0.47	1.00	0.07
6:00	0.24	0.21	0.55	0.74	0.36
7:00	0.98	1.03	0.59	1.09	0.58
8:00	1.70	1.79	0.98	0.61	0.82
9:00	1.81	1.90	1.04	1.66	1.12
10:00	1.77	1.78	1.67	1.66	1.53
11:00	2.11	2.11	2.14	1.18	1.38
12:00	1.95	1.95	1.97	1.96	1.82
13:00	2.10	2.07	2.38	1.44	4.44
14:00	2.08	2.16	1.40	0.57	2.53
15:00	1.83	1.87	1.42	1.66	1.59
16:00	1.46	1.49	1.21	1.00	1.31
17:00	1.49	1.51	1.36	0.52	1.44
18:00	1.03	1.04	0.95	0.96	1.62
19:00	0.75	0.74	0.74	1.13	0.54
20:00	0.58	0.57	0.73	0.91	0.25
21:00	0.41	0.39	0.60	0.70	0.46
22:00	0.38	0.34	0.64	1.79	0.48
23:00	0.24	0.21	0.59	1.09	0.45
24:00	0.22	0.17	0.61	0.87	0.40
Average	1.00	1.00	1.00	1.00	1.00

Max Flow

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Appendix G

Winter Diurnal Demands Study

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City of Bellevue

MEMORANDUM

Date: October 10, 2014

To: Bellevue Utilities Technical Team

From: Douglas Lane, P.E.

Subject: 2013-2014 Winter Diurnal Demands Study

Executive Summary

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

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

Diurnal patterns are typically graphed as a “Peaking Factor” (PF) in relation to the average hourly demand for the same set of data on the same day. The average hourly demand during a 24-hour period (total daily volume divided by 24) corresponds to a PF of 1.0, and the actual flow at each hour equals the average hourly demand times the PF. Figures 1 and 2 show diurnal patterns and PFs for particular customers and days.

Diurnal water demand patterns of a limited number of customers were observed for the period of December 15, 2013 through January 19, 2014, to assist in system modeling. Attachment A shows the customer locations and user classes.

This assessment made use of the data logging capability of Sensus Omni meters, which the City of Bellevue has required for all new meters 3” in diameter and larger since 2009. Prior to installation of Omni meters, the City did not have the capability to directly record hourly water usage. Although the sample size is limited, the City’s Omni meters comprise the best currently available information, and reflect actual customer demands.

The data collected represents an approximation of winter diurnal patterns in Bellevue’s water service area, during a low-usage period. A separate study has been conducted during the summer months to understand diurnal patterns during peak demand periods.

Figure 1 shows the aggregate weekday peaking factors for all user classes studied. These PFs are higher than for average winter days, and are recommended for calibrating winter weekday hydrant test data and for winter extended period simulation (EPS) modeling scenarios lasting less than 7 days. These PFs should not be used for water system design purposes or for facility sizing.

Figure 1 - Observed Winter Weekday Diurnal Patterns

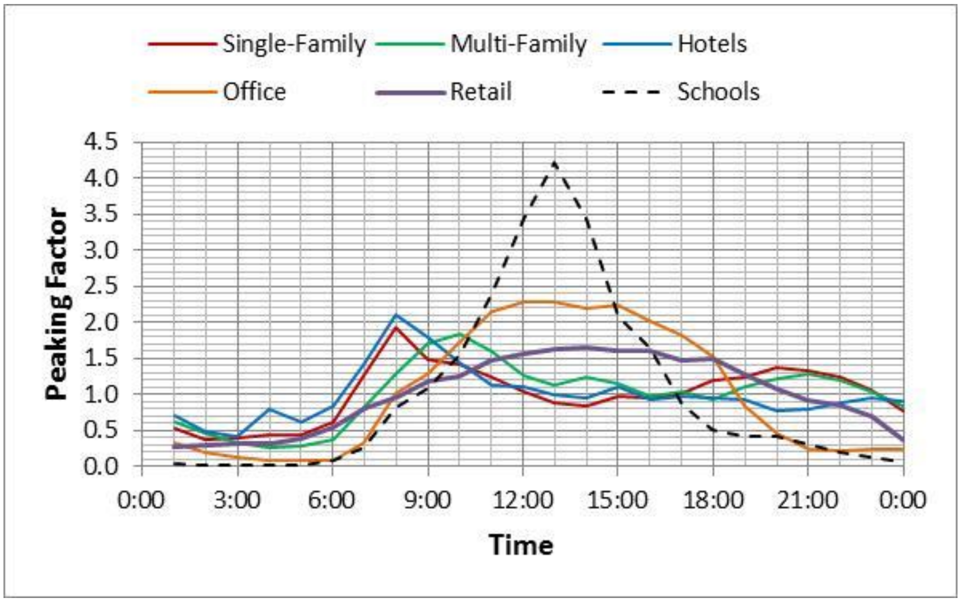


Figure 2 shows the overall aggregate peaking factors for an average day over the entire study period, for several customer classes. These PFs are recommended only for use in Winter EPS modeling scenarios lasting 7 days or longer, because they average all days (holidays, weekends, and weekdays).

Figure 2 - Average Observed Winter Diurnal Patterns (All Days)

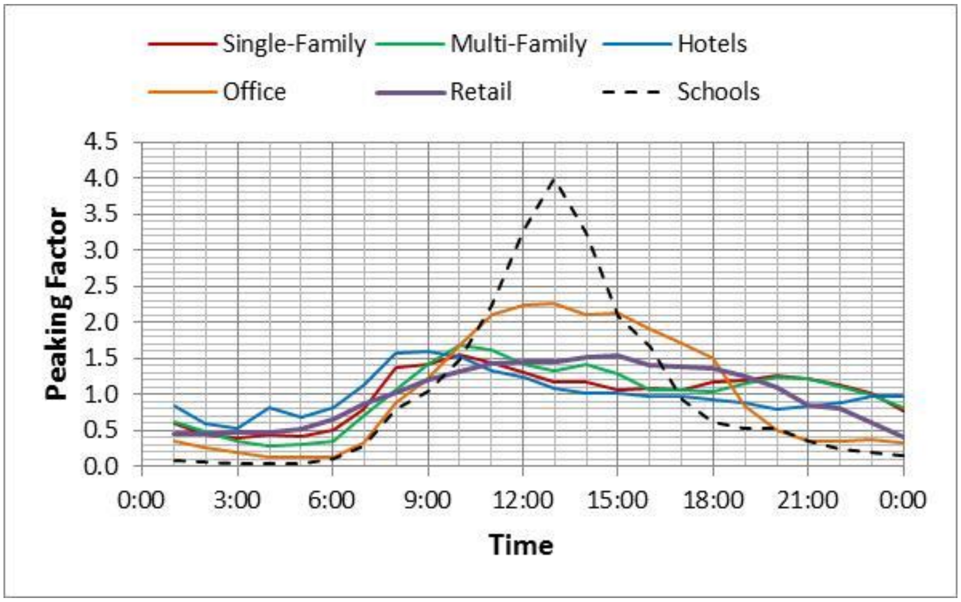


Table 1 shows observed maximum winter weekday PFs by customer class. The aggregate data corresponds to the data in Figure 1, and is based on the total flow for all meters. Individual meters are also shown, to demonstrate that significant localized variation exists even within the same customer class, as sample sizes get smaller.

Table 1 – Maximum Observed Weekday Winter Peaking Factors

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

1. Retail peak PF occurred on Christmas, but on a very low-flow day. Peak retail flow *rate* occurred Christmas Eve.

Winter diurnal water demand patterns are also useful for the purpose of forecasting sanitary sewage flows, because it can be reasonably assumed that irrigation is negligible and nearly all water demands are drained to the sewer. It is important to also consider inflow and infiltration (I&I) when analyzing sewer flows. An additional safety factor should also be added to observed values prior to use in sewer design.

Data was also recorded and analyzed for some unique, very large water customers. That data is not presented herein, and should be used only for modeling those specific customers in the hydraulic model.

The following is recommended as a result of this study:

- This information reflects water use patterns of Bellevue's customers only. No representations are made, implicitly or explicitly, about the applicability of this information to customers outside Bellevue's water service area.
- Use the observed winter normal weekday diurnal patterns (Figure 1) for water distribution system model calibration of winter weekday hydrant tests, and for Winter EPS water quality or storage analysis simulations lasting less than 7 days.
- Use the average observed winter diurnal patterns (Figure 2) for Winter EPS water quality or storage analysis simulations lasting longer than 7 days.
- Data included in this memorandum should not be used for design or sizing of water distribution, supply or storage facilities, because it does not reflect summer peaks or localized demand conditions. Use appropriate seasonal peak diurnal patterns specific to the area served for sizing water facilities.
- Use observed winter normal weekday diurnal patterns (Figure 1) to estimate diurnal customer flows for the year-round sanitary sewage flow component (not including I&I) in EPS sewer modeling simulations. I&I flows should be added as a separate flow component to any sewer model. When modeling for design purposes, an additional sanitary flow safety factor should also be added to account for localized variations in diurnal patterns.
- When weighing the costs and benefits of Advanced Metering Infrastructure (AMI) as a potential investment for the utility, the City should consider the substantial engineering value provided by AMI data for diurnal flow monitoring in both the water and sewer systems.

More detailed information for each user class is provided below, including PFs for other specific types of days (weekends, holidays, and weekdays during holiday weeks).

Single-Family Residential

The City of Bellevue does not currently have a feasible method of directly measuring diurnal flow patterns for single-family (SF) households. However, the Clyde Hill 500 pressure zone (CL500) allows indirect estimation of single-family diurnal demands, and was therefore selected as the sample set for this study. CL500 accounts for approximately 2.5% of single-family housing population in Bellevue's water service area.

CL500 is unique among Bellevue's service area in that it has no unmetered PRVs flowing into or out of the zone, and therefore all inflows and outflows (except for leakage) are metered. CL500 demand can be measured by adding the Clyde Hill pump station flows plus Clyde Hill 465 standpipe outflows (outflows are negative during tank filling).

Land use in CL500 is almost exclusively single-family housing, with the exception of 4 schools, two large churches, some municipal parks, and a nominal number of small commercial parcels. To estimate single-family diurnal patterns, demands into the zone need to be corrected to account for other users. For the purpose of this study, the following adjustments were made:

- **Schools**: Typical 2011-2013 Winter demands at Clyde Hill Elementary, Bellevue Christian School and Sacred Heart School were multiplied by the typical observed school diurnal pattern (described below) and subtracted from total flow into the zone. Chinook Middle School was neglected because the school was closed for remodeling at that time (classes met at the Ringdall campus).
- **Churches**: 2013 average daily domestic demands at First Presbyterian and Sacred Heart churches were multiplied by the observed diurnal pattern at another large church (described below) and subtracted from total flow into the zone. Irrigation accounts at these churches were neglected, similar to parks.
- **Parks**: Parks were neglected, assuming zero winter irrigation usage.
- **Commercial**: Commercial demands were neglected due to the marginal number of commercial water customers.

Figures 3 and 4 show the estimated single family demand flows and diurnal pattern. This data includes any system leakage in CL500, since it estimated from total zone demand. Peak flows occurred in the hour ending 8:00 am on weekdays, with a peaking factor of 1.92.

Figure 3 - Estimated CL500 Hourly Volume

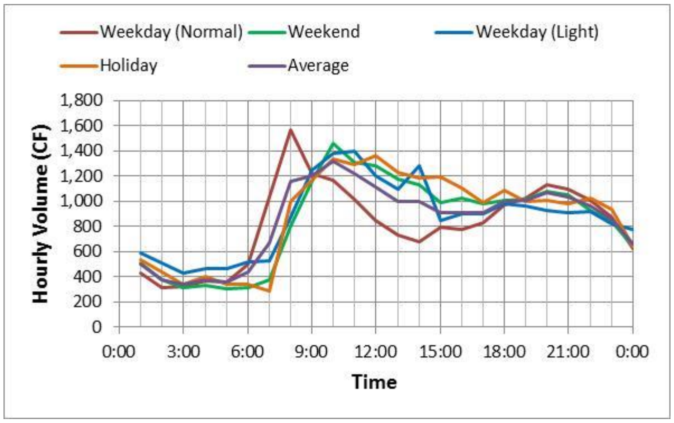
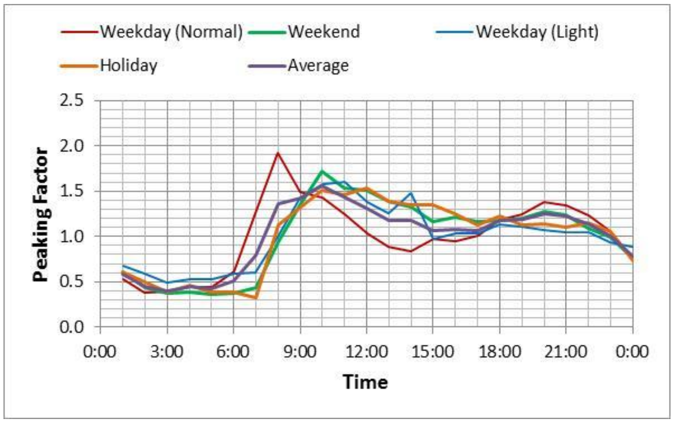


Figure 4 - Estimated SF Peaking Factor



Single-family diurnal patterns appear to have a consistent morning peak on weekdays, with a smaller peak in the evening. Weekends and holidays consistently show a lower peak occurring later in the morning, with flow tapering off gradually for the rest of the day (no apparent evening peak).

Multi-Family Residential

A limited number of multi-family residential buildings in Bellevue's service area are equipped with Omni meters, which log 31 days of hourly water volumes. 12 of these meters were read, representing roughly 3.3% of multi-family water use in Bellevue's water service area. Figures 5 and 6 show the observed volumes and diurnal patterns.

Figure 5 - Observed MF Hourly Volume (CF)

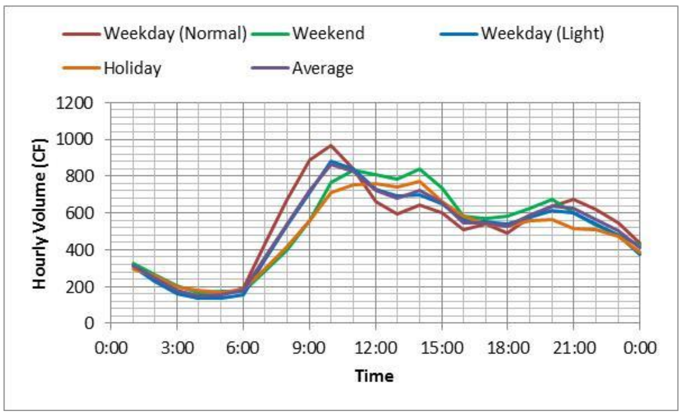
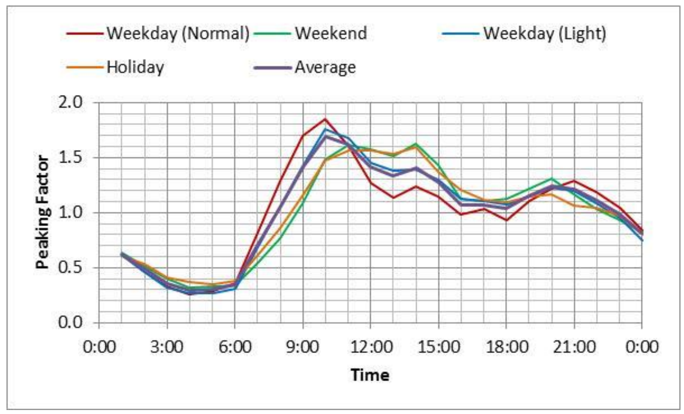


Figure 6 - Estimated MF Peaking Factor



Observed MF patterns resemble single-family diurnal curves, but with peaks occurring slightly later in the morning, and with an evening peak on weekends. Peak flows occurred in the hour ending 10:00 am on weekdays, with a peaking factor of 1.85.

Hotels

Three hotel Omni meters were read, representing roughly 16% of typical winter hotel water demands in Bellevue's water service area. Results are shown in figures 7 and 8. Peak flows occurred in the hour ending 8:00 on weekdays, with a peaking factor of 2.11.

Figure 7 - Observed Hotel Hourly Volume

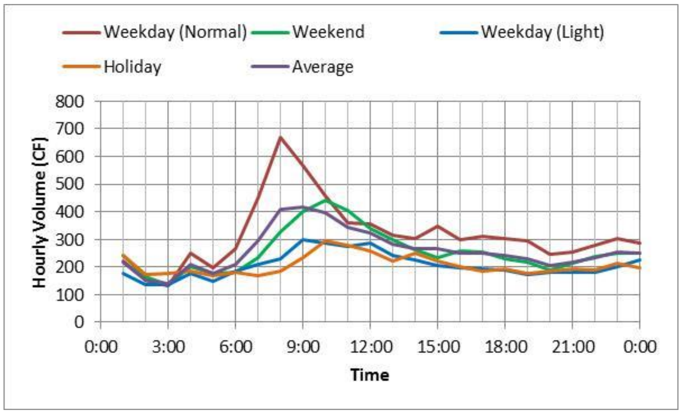
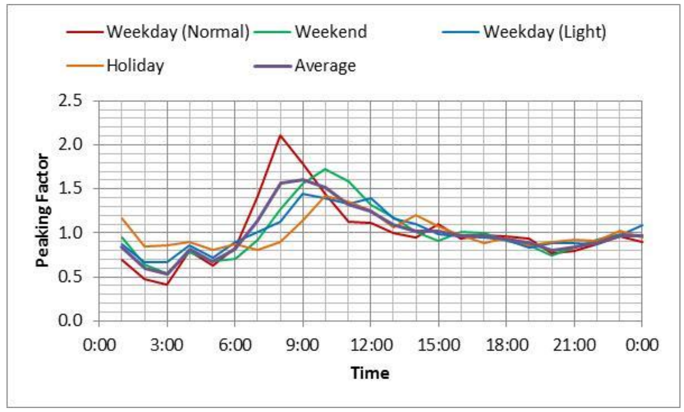


Figure 8 - Estimated Hotel Peaking Factor



Hotel diurnal patterns resemble single-family diurnal curves, but with a slightly higher morning peak, no apparent evening peak (even on weekdays), and significantly lower weekend flows.

Office Buildings

Four office building Omni meters were read, representing roughly 0.3% of typical winter commercial water demands in Bellevue's water service area. Results are shown in Figures 9 and 10. Diurnal patterns were consistently similar for all 4 locations. Peak flows occurred on weekdays for approximately 4 hours during mid-day at a peaking factor of approximately 2.3.

Figure 9 - Observed Office Hourly Volume

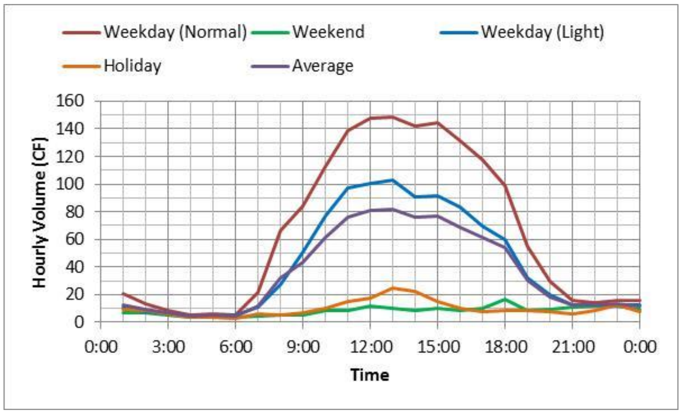
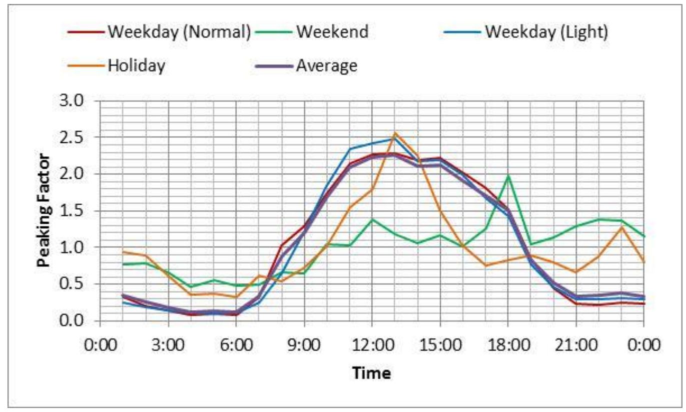


Figure 10 - Estimated Office Peaking Factor



Retail Shopping Centers

Two retail shopping center Omni meters were read, representing roughly 0.5% of typical winter commercial water demands in Bellevue's water service area. Both shopping centers consist of a large grocery store, a large pharmacy, and one or more various other retail shops. Results are shown in Figures 11 and 12.

Observed retail diurnal patterns were consistently similar for both locations, except for extremely erratic flows only on holidays. Normally, peaks occurred on weekdays in the early afternoon, at a peaking factor of 1.64. Very high flows occurred at one meter in the very early morning of Christmas Eve, while very high PFs (but at low overall flow rates) as high as 5.78 occurred at the other meter on Christmas and New Year's Day.

Figure 11 - Observed Retail Hourly Volume

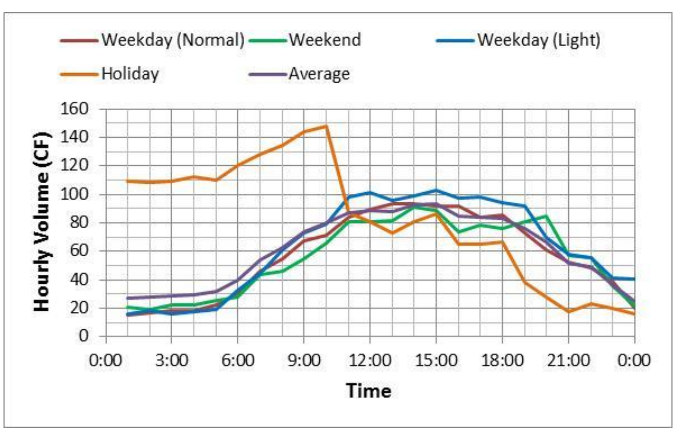
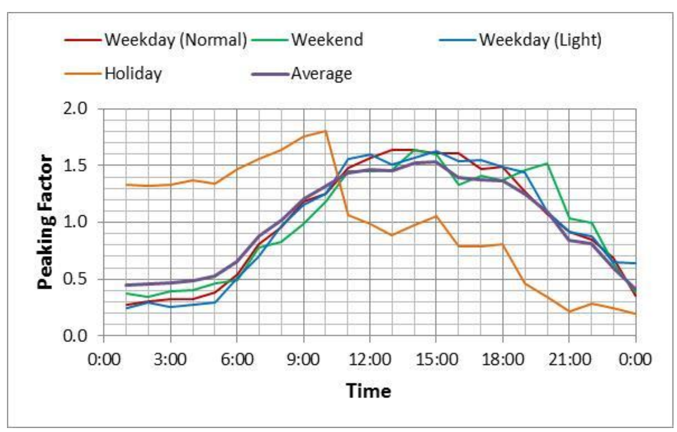


Figure 12 - Estimated Retail Peaking Factor



Schools

Water meters serving six schools were read, including one major public high school, 2 public middle schools, 2 public elementary schools, and one parochial K-8 school. Average flows represented approximately 9% of winter municipal flows in Bellevue's water service area. Results are shown in Figures 13 and 14.

Observed school flows are characterized by relatively very high flows during school days, and nominal flows on weekends, holidays, and weekdays during Winter Break. Peak flows occurred on school days during the hour ending 1:00 pm, with a peaking factor of 4.22.

Figure 13 - Observed School Hourly Volume

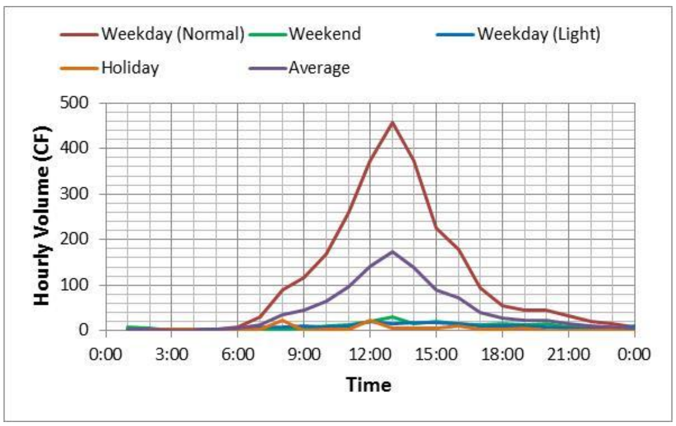
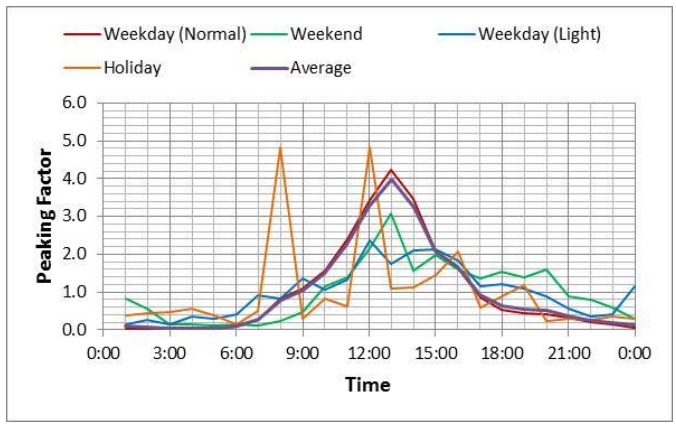


Figure 14 - Estimated School Peaking Factor



EPS modeling scenarios should consider the potential for school peaking factors to be skewed by extended summer and Winter break periods with relatively nominal demands.

Churches

The meter serving one large church near I-90 was read. Although this sample size is small, it is the only data available, and the results seem reasonable given a typical Sunday worship service schedule. Results are shown in Figures 15 and 16.

Observed church flows are characterized by relatively very high flows during late-morning on Sundays, relatively low flows during the rest of the week, and virtually zero overnight flows on all days. Substantial flows occurred in the evening on Christmas Eve. Saturdays have a similar diurnal pattern as Sundays, but much lower volumes. Peak flows occurred on Sunday mornings during the hour ending 11:00 am, with a peaking factor of about 9.

Figure 15 - Observed Church Hourly Volume

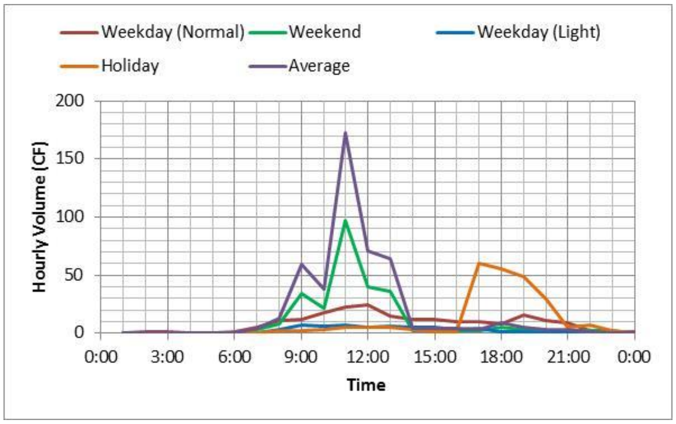
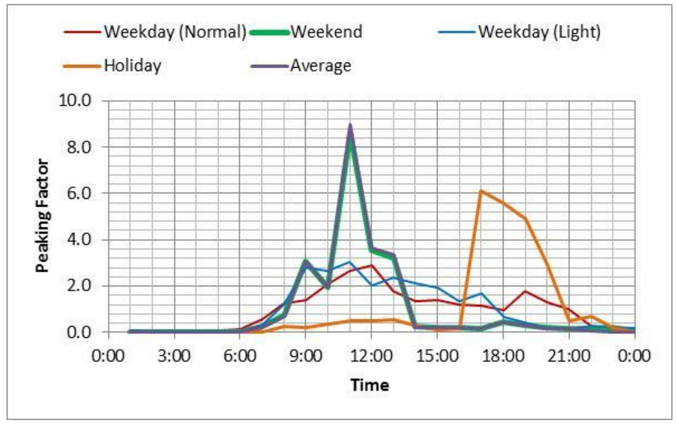


Figure 16 - Estimated Church Peaking Factor



Methodology

Peaking factors (PFs) are normalized to the average flow on similar days, so they only reflect the diurnal fluctuations with respect to baseline flow for the same particular type of day (weekday, weekend, or holiday). The average PF for each 24 hour period is 1.0:

PF = hourly flow ÷ average hourly flow on similar days

Meter clocks were not well synchronized with true time, and were also inconsistent with each other, so the data for each meter required a time adjustment. Time correction was applied based on the difference between the actual time the data was downloaded versus the latest apparent reading in the data. For instance, data was obtained at one multi-family residential meter at 8:20 am, but the meter provided hourly data through 11:00 am, roughly 3 hours in the future. For this meter, all readings were corrected by minus 3 hours.

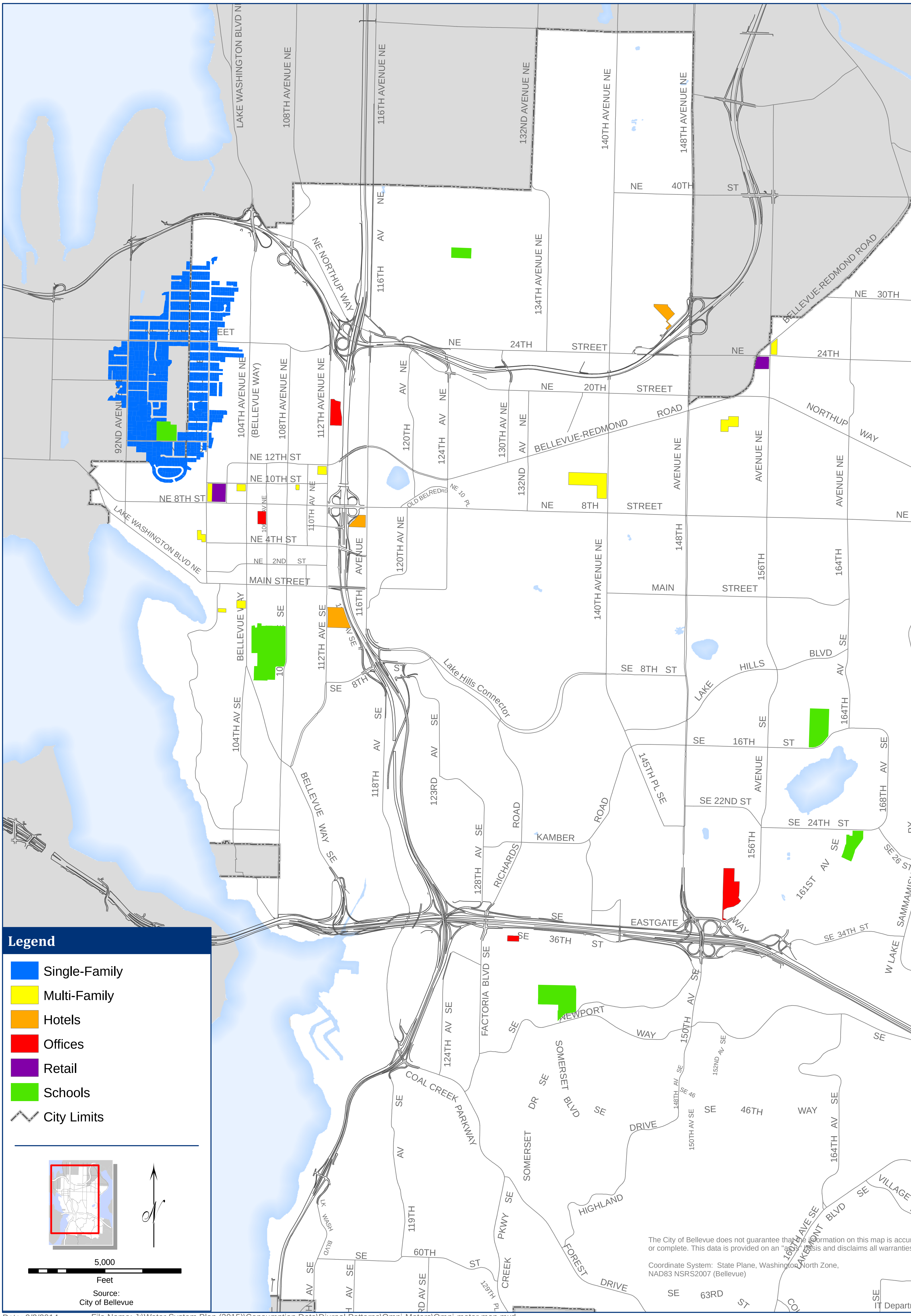
Weekdays during short holiday weeks were separated from weekdays during full weeks, to account for extended vacation times adjacent to major holidays. Weekdays during short holiday weeks are denoted “Weekday (Light)” in Figures 3 through 16. Christmas 2013 and New Year’s Day 2014 both occurred on Wednesdays, and water demands during Monday, Tuesday, Thursday and Friday of those weeks were substantially lower than water demands during full weeks. Full weeks are denoted “Weekday (Normal)”.

Christmas Eve, Christmas Day, and New Years Day were all considered holidays for the purpose of this study. The Martin Luther King Jr. holiday (MLK) was only recorded for a subset of meters, due to the time the data was downloaded. MLK is an unusual holiday in that it is not observed by all businesses and residents, so it is ambiguous where to categorize it among other days. MLK was neglected for these reasons.

2013-2014 Winter Diurnal Demand Study

Attachment A: Sample Locations Labeled by Customer Class

City of Bellevue



Date: 2/3/2014 File Name: J:\Water System Plan (2015)\Consumption Data\Diurnal Patterns\Omni-Meters\Omni-meter map.mxd

Attachment B: Estimated Single-Family Residential Winter PFs

	Total Average (All Days)	Weekday Average (Holiday Weeks)[1]	Weekday Average (Full Weeks Only)[2]	Weekend Average	Holiday[3]
1:00	0.58	0.68	0.53	0.60	0.61
2:00	0.45	0.58	0.38	0.44	0.50
3:00	0.40	0.50	0.39	0.37	0.38
4:00	0.44	0.53	0.44	0.39	0.46
5:00	0.42	0.53	0.44	0.36	0.38
6:00	0.51	0.60	0.61	0.37	0.38
7:00	0.79	0.60	1.26	0.44	0.32
8:00	1.36	1.00	1.92	0.94	1.13
9:00	1.42	1.42	1.49	1.36	1.32
10:00	1.55	1.58	1.43	1.72	1.51
11:00	1.43	1.60	1.24	1.54	1.46
12:00	1.31	1.38	1.03	1.51	1.54
13:00	1.18	1.25	0.89	1.39	1.39
14:00	1.17	1.47	0.83	1.33	1.34
15:00	1.07	0.97	0.97	1.17	1.35
16:00	1.07	1.03	0.95	1.21	1.25
17:00	1.07	1.04	1.01	1.16	1.12
18:00	1.17	1.13	1.19	1.18	1.23
19:00	1.19	1.11	1.25	1.20	1.13
20:00	1.26	1.07	1.38	1.27	1.14
21:00	1.22	1.05	1.34	1.23	1.11
22:00	1.14	1.05	1.23	1.09	1.16
23:00	1.01	0.94	1.06	0.99	1.06
24:00	0.78	0.89	0.76	0.75	0.73
Average	1.00	1.00	1.00	1.00	1.00

Max Flow

1. Weekdays in holiday weeks include Dec 23, 26-27, 30-31 and Jan 1-2.
2. Weekdays in full weeks include Dec 18-20, Jan 6-10, and Jan 13-17, as applicable.
3. Holidays include Christmas Eve, Christmas, and New Year's Day.

Attachment C: Observed Multi-Family Residential Winter PFs

	Total Average (All Days)	Weekday Average (Holiday Weeks)[1]	Weekday Average (Full Weeks Only)[2]	Weekend Average	Holiday[3]
1:00	0.62	0.61	0.61	0.63	0.61
2:00	0.49	0.46	0.47	0.52	0.53
3:00	0.35	0.32	0.33	0.40	0.41
4:00	0.29	0.27	0.26	0.32	0.37
5:00	0.30	0.27	0.29	0.33	0.35
6:00	0.35	0.31	0.36	0.34	0.38
7:00	0.70	0.69	0.82	0.55	0.62
8:00	1.06	1.06	1.29	0.77	0.86
9:00	1.42	1.42	1.70	1.08	1.15
10:00	1.69	1.76	1.85	1.48	1.48
11:00	1.62	1.67	1.60	1.62	1.56
12:00	1.42	1.45	1.26	1.57	1.57
13:00	1.33	1.38	1.14	1.52	1.54
14:00	1.41	1.39	1.23	1.63	1.59
15:00	1.28	1.30	1.15	1.43	1.37
16:00	1.07	1.12	0.98	1.13	1.20
17:00	1.07	1.10	1.04	1.10	1.11
18:00	1.03	1.07	0.94	1.13	1.10
19:00	1.15	1.15	1.10	1.21	1.15
20:00	1.24	1.22	1.22	1.31	1.17
21:00	1.22	1.20	1.29	1.17	1.07
22:00	1.11	1.08	1.19	1.03	1.05
23:00	0.98	0.95	1.04	0.93	0.97
24:00	0.81	0.74	0.84	0.82	0.80
Average	1.00	1.00	1.00	1.00	1.00

Max Flow

1. Weekdays in holiday weeks include Dec 23, 26-27, 30-31 and Jan 1-2.
2. Weekdays in full weeks include Dec 18-20, Jan 6-10, and Jan 13-17, as applicable.
3. Holidays include Christmas Eve, Christmas, and New Year’s Day.

Attachment D: Observed Hotel Winter PFs

	Total Average (All Days)	Weekday Average (Holiday Weeks)[1]	Weekday Average (Full Weeks Only)[2]	Weekend Average	Holiday[3]
1:00	0.84	0.87	0.70	0.95	1.17
2:00	0.59	0.66	0.48	0.64	0.84
3:00	0.53	0.67	0.41	0.53	0.85
4:00	0.81	0.86	0.79	0.78	0.89
5:00	0.68	0.72	0.63	0.69	0.81
6:00	0.81	0.89	0.83	0.70	0.88
7:00	1.14	1.02	1.41	0.92	0.81
8:00	1.57	1.12	2.11	1.27	0.90
9:00	1.60	1.45	1.80	1.56	1.14
10:00	1.52	1.39	1.44	1.72	1.42
11:00	1.33	1.33	1.13	1.59	1.35
12:00	1.24	1.39	1.12	1.32	1.25
13:00	1.09	1.17	1.00	1.17	1.06
14:00	1.02	1.10	0.95	1.02	1.20
15:00	1.02	0.99	1.10	0.91	1.07
16:00	0.96	0.96	0.94	1.01	0.97
17:00	0.97	0.95	0.98	1.00	0.88
18:00	0.93	0.92	0.96	0.90	0.94
19:00	0.88	0.83	0.93	0.85	0.85
20:00	0.79	0.89	0.77	0.74	0.89
21:00	0.84	0.89	0.80	0.84	0.93
22:00	0.89	0.88	0.87	0.93	0.91
23:00	0.97	0.97	0.96	0.98	1.03
24:00	0.96	1.09	0.90	0.98	0.95
Average	1.00	1.00	1.00	1.00	1.00

Max Flow

1. Weekdays in holiday weeks include Dec 23, 26-27, 30-31 and Jan 1-2.
2. Weekdays in full weeks include Dec 18-20, Jan 6-10, and Jan 13-17, as applicable.
3. Holidays include Christmas Eve, Christmas, and New Year's Day.

City of Bellevue

MEMORANDUM

Attachment E: Observed Office Winter PFs

	Total Average (All Days)	Weekday Average (Holiday Weeks)[1]	Weekday Average (Full Weeks Only)[2]	Weekend Average	Holiday[3]
1:00	0.35	0.26	0.32	0.77	0.94
2:00	0.26	0.19	0.20	0.78	0.89
3:00	0.19	0.14	0.14	0.67	0.62
4:00	0.13	0.11	0.08	0.47	0.36
5:00	0.13	0.10	0.09	0.56	0.37
6:00	0.13	0.12	0.08	0.48	0.32
7:00	0.33	0.25	0.33	0.49	0.62
8:00	0.88	0.66	1.02	0.66	0.55
9:00	1.21	1.21	1.29	0.64	0.73
10:00	1.69	1.85	1.73	1.05	1.01
11:00	2.10	2.34	2.14	1.03	1.56
12:00	2.23	2.42	2.27	1.38	1.79
13:00	2.27	2.48	2.28	1.18	2.55
14:00	2.11	2.17	2.19	1.05	2.25
15:00	2.12	2.20	2.23	1.17	1.51
16:00	1.91	2.00	2.02	1.02	1.03
17:00	1.71	1.67	1.82	1.25	0.75
18:00	1.51	1.43	1.52	1.98	0.83
19:00	0.84	0.76	0.84	1.05	0.90
20:00	0.52	0.47	0.45	1.13	0.80
21:00	0.34	0.29	0.24	1.29	0.66
22:00	0.34	0.29	0.22	1.38	0.87
23:00	0.37	0.31	0.25	1.36	1.28
24:00	0.33	0.29	0.24	1.15	0.80
Average	1.00	1.00	1.00	1.00	1.00

Max Flow

1. Weekdays in holiday weeks include Dec 23, 26-27, 30-31 and Jan 1-2.
2. Weekdays in full weeks include Dec 18-20, Jan 6-10, and Jan 13-17, as applicable.
3. Holidays include Christmas Eve, Christmas, and New Year's Day.
4. The highest PF occurred on holidays, but at relatively very low flow.

Attachment F: Observed Retail Winter PFs

	Total Average (All Days)	Weekday Average (Holiday Weeks)[1]	Weekday Average (Full Weeks Only)[2]	Weekend Average	Holiday[3]
1:00	0.44	0.25	0.27	0.37	1.33
2:00	0.46	0.30	0.30	0.35	1.32
3:00	0.47	0.26	0.32	0.40	1.33
4:00	0.48	0.28	0.32	0.41	1.37
5:00	0.52	0.30	0.39	0.46	1.34
6:00	0.65	0.52	0.54	0.50	1.47
7:00	0.88	0.70	0.81	0.78	1.56
8:00	1.02	0.96	0.96	0.83	1.64
9:00	1.21	1.15	1.18	0.98	1.76
10:00	1.31	1.25	1.25	1.18	1.81[(4)]
11:00	1.43	1.55	1.48	1.45	1.06
12:00	1.46	1.59	1.57	1.45	0.98
13:00	1.45	1.51	1.64	1.46	0.88
14:00	1.53	1.57	1.64	1.64	0.98
15:00	1.53	1.63[(5)]	1.61	1.59	1.05
16:00	1.40	1.54	1.61	1.33	0.79
17:00	1.38	1.55	1.47	1.41	0.79
18:00	1.36	1.49	1.49	1.37	0.81
19:00	1.25	1.44	1.28	1.46	0.46
20:00	1.09	1.10	1.07	1.52	0.34
21:00	0.85	0.92	0.92	1.03	0.21
22:00	0.81	0.88	0.85	1.00	0.28
23:00	0.60	0.65	0.69	0.64	0.24
24:00	0.41	0.64	0.35	0.38	0.19
Average	1.00	1.00	1.00	1.00	1.00

Max Flow

1. Weekdays in holiday weeks include Dec 23, 26-27, 30-31 and Jan 1-2.
2. Weekdays in full weeks include Dec 18-20, Jan 6-10 & 13-17 as applicable.
3. Holidays include Christmas Eve, Christmas, and New Year’s Day.
4. The highest flow rate occurred on Christmas Eve morning, but in extreme conditions unique to that one day, at only one location. It is assumed that this is not representative of retail shopping centers overall (should be neglected).
5. Weekday flows were higher during holiday weeks, but at almost identical PF compared to normal weekdays, at roughly the same time. A Normal weekday diurnal pattern and PF should be used in most circumstances.

Attachment G: Observed School Winter PFs

	Total Average (All Days)	Weekday Average (Holiday Weeks)[1]	Weekday Average (Full Weeks Only)[2]	Weekend Average	Holiday[3]
1:00	0.09	0.13	0.03	0.81	0.37
2:00	0.07	0.26	0.02	0.54	0.43
3:00	0.03	0.15	0.01	0.13	0.46
4:00	0.04	0.35	0.01	0.13	0.54
5:00	0.04	0.29	0.02	0.12	0.37
6:00	0.10	0.42	0.08	0.14	0.15
7:00	0.29	0.90	0.27	0.11	0.50
8:00	0.79	0.81	0.83	0.24	4.83
9:00	1.04	1.36	1.08	0.46	0.28
10:00	1.49	1.06	1.56	1.15	0.83
11:00	2.25	1.32	2.39	1.38	0.61
12:00	3.28	2.35	3.43	2.16	4.83
13:00	3.99	1.75	4.22	3.07	1.09
14:00	3.23	2.09	3.45	1.56	1.13
15:00	2.08	2.12	2.08	1.98	1.43
16:00	1.66	1.84	1.63	1.60	2.07
17:00	0.92	1.15	0.87	1.35	0.59
18:00	0.63	1.20	0.51	1.54	0.89
19:00	0.53	1.10	0.42	1.39	1.17
20:00	0.52	0.89	0.41	1.60	0.24
21:00	0.36	0.56	0.31	0.88	0.28
22:00	0.24	0.35	0.19	0.78	0.26
23:00	0.18	0.41	0.13	0.58	0.35
24:00	0.14	1.15	0.07	0.30	0.30
Average	1.00	1.00	1.00	1.00	1.00

Max Flow

1. Weekdays in holiday weeks include Dec 23, 26-27, 30-31 and Jan 1-2.
2. Weekdays in full weeks include Dec 18-20, Jan 6-10, and Jan 13-17, as applicable.
3. Holidays include Christmas Eve, Christmas, and New Year’s Day.

Appendix H

Letter Regarding Cascade's Contractual Commitment

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CASCADE
WATER ALLIANCE

October 9, 2015

Nav Otal
Director, Utilities Department
City of Bellevue
410 110th Avenue NE
Bellevue. WA 98012

Dear Nav,

This letter is in response to your request for a description of Cascade Water Alliance's ("Cascade's") contractual commitment to the City of Bellevue and how the water supply agreement between the City of Seattle and Cascade supports that commitment. We understand this letter will be used in support of the City of Bellevue's Water System Plan, which will be reviewed by the Washington State Department of Health.

Cascade Water Alliance is a municipal corporation comprised of eight Member cities and special districts in King County, Washington, including the City of Bellevue. Cascade's primary role is to contract, plan and develop regional water supplies on behalf of its Members.

Cascade Members are parties to an agreement that created Cascade as a municipal corporation under Chapter 39.106 RCW. The *CASCADE WATER ALLIANCE JOINT MUNICIPAL UTILITIES SERVICES AGREEMENT*[1], dated March 28, 2012, ("Joint Agreement") replaced the *INTERLOCAL AGREEMENT*, which was first entered among the Members in 1999. The Joint Agreement contains Cascade's water supply commitment to the Members.

Individual Members own, operate and maintain their own water distribution systems. This includes, as applicable, water treatment for their independent water sources; maintenance of water quality within their reservoirs and distribution piping systems; and local monitoring of water quality conditions.

Cascade policies regarding service to the Members, set forth in Section 5.2 of the Joint Agreement, may be summarized as follows:

520 112th Avenue NE — Suite 400 — Bellevue, WA 98004
Phone: 425.453.0930 — Fax: 425.453.0953
Website: www.cascadewater.org

[1] http://www.codepublishing.com/WA/cascadewateralliance/

- Cascade must provide a full supply commitment to each of the current Members. This means Cascade must fully meet each Member's water needs, except for the portion met by the Member's independent supply and subject to certain limitations (as outlined below).

- Cascade is obligated to provide water supply to the entire service area of each Member (as that service area in the Member's adopted and approved Water System Plan as of the effective date of the Joint Agreement, March 28, 2012) whether or not some of that service area is within the Member's current jurisdictional boundaries and/or within the current urban growth boundary.

- Cascade is not obligated to provide water supply to service area expansions in or outside the urban growth boundary, unless Cascade agrees to such expanded service area. Cascade is not obligated to provide increased water supply to any Member if it is determined that the Member's planning process or plans are materially out of compliance with the requirements of applicable state law.

- Cascade's full supply commitment to the Members is subject to water shortages, Cascade's ability to implement its Water Supply Plan, and each Member's audited independent supply. If Cascade cannot fully meet its Members' needs during a shortage, the Members share the shortage in accordance with Cascade's Shortage Management Plan.

- Cascade must provide for Supply System development to meet the needs of additional water customers of Members, subject to consistency with applicable state law, Cascade's Water Supply Plan, orderly asset development, reasonable cost and financing capacity.

In 2012, Cascade adopted the 2012 TRANSMISSION AND SUPPLY PLAN ("TSP")[2] as the Cascade Water Supply Plan required by the Joint Agreement. Under the TSP, Cascade evaluated a wide range of water supply options to meet long-term needs, including additional or expanded contracted supplies from existing sources within the Central Puget Sound region, new surface water supplies, new ground water supplies and reclaimed water. Under the preferred portfolio set forth in the TSP, available supplies are expected to exceed Cascade's water demand throughout the 50-year planning period.

One important component of Cascade's portfolio is the contract with the City of Seattle for delivery of water. The *2ND AMENDED AND RESTATED DECLINING BLOCK WATER SUPPLY AGREEMENT BETWEEN THE CITY OF SEATTLE AND CASCADE WATER ALLIANCE*, dated July 15, 2013 ("Block Contract")[3], provides for a base block supply of 30.3 MGD through 2023 that will be reduced in five-year increments to 24.3 MGD by 2046 and thereafter in annual increments until reaching 5.3 MGD in 2063, with a right to purchase up to 5.3 starting in 2064. In addition, under Block Contract, Seattle will make available a supplemental block through 2044.

Section 4.1.B. of the Block Contract anticipated that the City of Seattle and Cascade might periodically change the location, hydraulic gradient and instantaneous flows

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[2] http://cascadewater.org/supply_plans_2012.php.

[3] http://cascadewater.org/water_purchase.php

as each Cascade Point of Deliver ("POD") by a Management Agreement. *MANAGEMENT AGREEMENT NO. 9* (attached) was entered into in May 2014 to amend Exhibit II of the Block Contract. This revision updated information about the PODs to each Member, the minimum hydraulic gradient upstream of the Seattle meter at each POD, and the maximum flow that Seattle is willing to guarantee under the Block Contract at each POD. Anticipating that non-Members and non-parties to the Block Contract, such as the Department of Health, might misunderstand the purpose of the information, Seattle and Cascade added footnote 3 providing:

> 3. These minimum hydraulic gradients and maximum flows relate to contractual conditions under the Agreement, but do not necessarily reflect practical or operational limits at particular PODs.

While Seattle must only provide a contractual guarantee of a maximum flow at a specific POD, the actual operation of a POD may actually exceed that maximum flow. In other words, the limitation on Seattle's obligation under the Block Contract does not necessarily reflect actual operation. In addition, Seattle and Cascade agreed to provide more flexibility within a Pipeline Segment and documented this intention in footnote 4, which states:

> 4. Except as provided in Note 7 below, all or some of the maximum flows allocated to each POD may be reallocated to another POD on the same Pipeline Segment Number, including those PODs designated as Backup Services. In that case, minimum hydraulic gradients are not guaranteed.

For example, POD #58, #60 and #182 serve Bellevue and are all within Pipeline Segment #3. The maximum flow may be reallocated between those three PODs. If actual delivery constraints develop, Cascade will work with Seattle and the Member to take the necessary actions (contract amendment or facility changes) to resolve the issues.

Finally, Seattle's contractual guarantee to Cascade does not act as a limit to Cascade's obligation to provide a full supply commitment to each of the current Members. As described above, Cascade is obligated under the Joint Agreement to provide water supply to the entire service area of each Member. Under the preferred portfolio set forth in the TSP, available supplies are expected to exceed Cascade's water demand throughout the 50-year planning period.

I trust that this explanation will be helpful to you.

Sincerely,

Chuck

Chuck Clarke
Chief Executive Officer

Attachments: Block Contract and Management Agreement No.9

2ND AMENDED AND RESTATED

DECLINING BLOCK

WATER SUPPLY AGREEMENT BETWEEN

THE CITY OF SEATTLE

AND

THE CASCADE WATER ALLIANCE

July 15, 2013

TABLE OF CONTENTS

LIST OF SECTIONS

LIST OF EXHIBITS

2nd AMENDED AND RESTATED DECLINING BLOCK WATER SUPPLY AGREEMENT BETWEEN THE CITY OF SEATTLE AND THE CASCADE WATER ALLIANCE

This 2nd amendment to and restatement of the Declining Block Water Supply Agreement between the City of Seattle, a municipal corporation ("Seattle"), and the Cascade Water Alliance, a joint municipal utility services authority formed under authority of Chapter 39.106 RCW ("Cascade"), is dated and effective this 15th day of July, 2013 ("Agreement").

Whereas, Seattle is a regional water supplier currently providing service to numerous water utilities in King County, Washington; and

Whereas, the Cascade Water Alliance was formed for the purpose of providing water supply to its Members; and

Whereas, in 2004, the Cascade Water Alliance and Seattle entered into a 50-year Declining Block Water Supply Agreement, which was amended and restated in 2008; and

Whereas, in 2012, Cascade converted from a non-profit corporation formed under the Interlocal Cooperation Act to a municipal corporation under the Joint Municipal Utility Services Act, Chapter 39.106 RCW; and

Whereas, regional municipal water supply forecasts show a demand growing more slowly than previously forecast over the next 50 years resulting in an opportunity to reconsider future supply planning by both Parties; and

Whereas, after meeting the demands of its existing retail and wholesale customers, Seattle has water supply available to sell for a defined period with minimal risk of triggering the need for new supply development prior to 2060; and

Whereas, Cascade has determined that it can defer development of its Lake Tapps water right by purchasing additional block water from Seattle for a defined period and using its members' independent supplies; and

Whereas, temporary sales of additional block water from Seattle to Cascade would bring additional revenue into the Seattle system and allow Cascade to defer substantial capital investment to develop its Lake Tapps water right into the future; and

Whereas, Cascade and Seattle desire to amend the 2008 Amended and Restated 50-year Declining Block Supply Water Supply Agreement to restructure the supplemental block of water through 2023, to extend the total block of water from 2024 through 2044 and to restructure the declining block increments, all of which are mutually beneficial to the Parties and their respective customers by maximizing existing resources and stabilizing rate paths; and

Whereas, the Parties intend that this amendment to the Agreement continue the existing structure as a declining block contract based on the expectation that Cascade will develop its own independent supply and that Seattle will have no further obligation to provide additional water to Cascade during or beyond the amended term of this Agreement.

Now therefore, Seattle and Cascade agree to the following terms and conditions for the provision and purchase of a declining block water supply.

ARTICLE I - AGREEMENT

Seattle agrees to sell to Cascade and Cascade agrees to purchase from Seattle, according to the terms of this Agreement, a wholesale supply of water and the transmission capacity sufficient to deliver such water supply to Cascade.

The term of this Agreement is January 1, 2004 through December 31, 2063.

Beginning January 2020, and again each January at 5-year intervals, either Cascade or Seattle may request consideration of further extension of the supply commitment. Neither Party is obligated to agree to such discussion or any related extension or other amendment; and any extension or amendment would be subject only to terms negotiated at the time of such written amendment to this Agreement in accordance with Section 9.4.

Apart from the contract right to purchase water from Seattle under the terms of this Agreement, neither Cascade nor any Cascade Member has any right or claim to the Seattle Water System, the Cedar and Tolt Rivers and to the Seattle Well Fields, or to any other water right or claim held by Seattle. Likewise, Seattle shall have no right or claim to the Cascade Water System or to any groundwater right or claim held by any Cascade Member, or to any future source of supply developed by Cascade or by any of its Members. At the termination of this Agreement, Seattle shall have no further obligation to supply Cascade or any Cascade Member with water, with the exception of Cascade's right to purchase up to 5.3 MGD as set forth in Section 3.5.

ARTICLE II – DEFINITIONS

8 MGD Wholesale Water Supply. All or any portion of the 8 MGD Wholesale Water Supply as that term is defined in the Amended and Restated Agreement for the Sale of Wholesale Water between Cascade and the City of Tacoma, dated December 31, 2012. The Parties understand and agree that the 4 MGD and 6 MGD Wholesale Water Supplies under that same agreement are not covered by this Agreement as they would be wholesale sales by the City of Tacoma, not Cascade.

Average Daily Demand ("ADD"). The amount of water supplied by the Seattle Water System to Cascade in a calendar year divided by the number of days in that calendar year.

Base Block. The amount of water Seattle commits to supply Cascade beginning on January 1, 2004 through the termination date of this Agreement, as specifically scheduled in Section 3.4 A.

Cascade Block. The total amount of water Seattle commits to supply Cascade under this Agreement, composed of the Base Block and the Supplemental Block, as more fully expressed in Article III.

Cascade Member. A Member of Cascade as that term is defined in the Cascade Water Alliance Joint Municipal Utility Services Agreement, dated March 28, 2012, as it may be amended from time to time.

Cascade Points of Delivery. Seattle owned and operated specific metered delivery locations serving Cascade Members as listed in Exhibit II, at which Seattle provides a defined level of service, beginning from the outlet from the supply pipeline to the end of the Seattle meter vault, including the water meter and associated appurtenances.

Cascade Sub-regional System. Seattle owned and operated Transmission System assets serving Cascade Members as listed in Exhibit VII.

Cascade Water System. Tangible and intangible assets owned or operated by Cascade useable in connection with the provision of water supply.

Existing Supply System Facilities. Seattle owned and operated Supply System assets as listed in Exhibit IV.

Existing Transmission System Facilities. Seattle owned and operated Transmission System assets as listed in Exhibit V.

Firm Yield. The estimated amount of water that Seattle's Supply System can provide according to Seattle's supply reliability standard and expressed in annual average MGD. For purposes of this Agreement, Seattle's Firm Yield is 171 MGD, unless modified pursuant to Section 3.2.

Full or Partial Requirements Customer Commodity Charge. The rate charged per 100 cubic feet (ccf) to wholesale customers served under Full or Partial Requirements Contracts in accordance with Seattle Municipal Code (SMC) 21.04.440.E.2, as it may be amended from time to time.

Management Agreement. A written agreement, pertaining to subjects authorized by this Agreement, between the Director, Seattle Public Utilities, and the Chief Executive Officer ("CEO"), Cascade Water Alliance.

MGD. Million gallons per day.

Party (ies). Seattle and/or Cascade, as well as their respective successors and assigns.

Peak Month. The consecutive thirty- (30) day period during a calendar year in which Cascade puts its maximum demand upon the Seattle Water System.

Peak Month Factor. Average Daily Demand multiplied by 1.69

Peak Season. June 1 through September 30.

Peak Season Factor. Average Daily Demand multiplied by 1.35

Rate of Return on Investment. The average cost of debt of the Seattle water system plus 1.5 percent.

Seattle's Service Area Boundary. Seattle's then-current designated place of use of Seattle's water certificates, permits, claims or service area under Seattle's approved water system plan at the time of the sale in accordance with applicable state law.

Seattle Water System. All Seattle owned and operated water rights and claims and all Seattle owned and operated facilities, including the Seattle Existing Supply System Facilities as listed in Exhibit IV, the Seattle Existing Transmission System Facilities as listed in Exhibit V, Cascade and other Sub-regional Facilities and Points of Delivery, together comprise the Seattle Water System.

Sub-regional Facilities. Any facilities owned and operated by Seattle that are not identified as Existing Supply System Facilities (Exhibit IV), Existing Transmission System Facilities (Exhibit V), or Cascade Sub-regional System (Exhibit VII).

Supplemental Block. The amount of water Seattle commits to supply Cascade beginning on January 1, 2009 through December 31, 2044, as specifically scheduled in Section 3.4 B.

White River – Lake Tapps Reservoir Project. Cascade's project to develop a new municipal drinking water supply in the future from the White River and Lake Tapps under water rights issued in 2010 under Permit Nos. S2-29920(A) and (B), S2-29934, R2-29935, and Claim No. 160822, as more particularly defined in Cascade's approved Transmission and Supply Plan.

ARTICLE III - SUPPLY

3.1 A. Each calendar year from the effective date of this Agreement, Seattle shall make available to Cascade the Base Block, according to the schedule set forth in Section 3.4 A.

B. Each calendar year commencing January 1, 2009 and terminating on December 31, 2044, Seattle shall make available to Cascade the Supplemental Block, according to the schedule set forth in Section 3.4 B.

3.2 In the event the Firm Yield of the Seattle Supply System is reduced, the Cascade Block will be reduced in proportion to such reduction in Firm Yield only if the Firm Yield is reduced by order of a State or Federal regulatory agency with appropriate jurisdiction or as the result of updated climatic data utilized in the hydraulic model used to calculate Firm Yield, unless the Parties mutually agree by Management Agreement to a different reduction or no reduction to the Cascade Block if it is in each their best interests at the time. In the event of any reduction to the Cascade Block, the Base and Supplemental Blocks will be reduced in the same proportion, as appropriate. Cascade shall be notified of any potential change in Firm Yield as far in advance as possible, but in no event less than 180 days prior to the effective date of an adjustment to Firm Yield that affects the Cascade Block.

3.3 Seattle will supply the Cascade Block during the Peak Season and Peak Month as follows below and will be adjusted proportionately in relation to the decreases identified in Section 3.4:

A. During the Peak Season, Seattle shall make available the Cascade Block multiplied by the Peak Season Factor.

B. During the Peak Month, Seattle shall make available the Cascade Block multiplied by the Peak Month Factor.

3.4

A. The Base Block shall be supplied in accordance with the following schedule:

1. Beginning January 1, 2004 through December 31, 2023, Seattle shall make available to Cascade 30.3 MGD Average Daily Demand.
2. Beginning January 1, 2024 through December 31, 2029, Seattle shall make available to Cascade 29.3 MGD Average Daily Demand.
3. Beginning January 1, 2030 through December 31, 2034, Seattle shall make available to Cascade 26.8 MGD Average Daily Demand.
4. Beginning January 1, 2035 through December 31, 2045, Seattle shall make available to Cascade 24.3 MGD Average Daily Demand.
5. Beginning January 1, 2046, Seattle shall make available to Cascade 23.3 MGD Average Daily Demand, and on each January 1 thereafter through December 31, 2063, the amount will decline by 1 MGD Average Daily Demand until it reaches5.3 MGD Average Daily Demand.
6. Beginning January 1, 2064, Seattle shall make available to Cascade up to 5.3 MGD Average Daily Demand in accordance with Section 3.5.

B. The Supplemental Block shall be supplied in accordance with the following schedule:

1. Beginning January 1, 2009 through December 31, 2023, Seattle shall make available to Cascade 3.0 MGD Average Daily Demand.
2. Beginning January 1, 2024 through December 31, 2029, Seattle shall make available to Cascade 4.0 MGD Average Daily Demand.
3. Beginning January 1, 2030 through December 31, 2034, Seattle shall make available to Cascade 6.5 MGD Average Daily Demand.

4. Beginning January 1, 2035 through December 31, 2039 Seattle shall make available to Cascade 9.0 MGD Average Daily Demand.
5. Beginning January 1, 2040 through December 31, 2040 Seattle shall make available to Cascade 7.0 MGD Average Daily Demand.
6. Beginning January 1, 2041 through December 31, 2041 Seattle shall make available to Cascade 5.0 MGD Average Daily Demand.
7. Beginning January 1, 2042 through December 31, 2042 Seattle shall make available to Cascade 3.0 MGD Average Daily Demand.
8. Beginning January 1, 2043 through December 31, 2043 Seattle shall make available to Cascade 2.0 MGD Average Daily Demand.
9. Beginning January 1, 2044 through December 31, 2044 Seattle shall make available to Cascade 1.0 MGD Average Daily Demand.

3.5 Beginning January 1, 2064, Cascade shall have the right to purchase up to 5.3 MGD for the sole purpose of serving Cascade Members that cannot be economically served by any other means than the Seattle Transmission System. The right to purchase up to 5.3 MGD shall be exercised by Cascade by providing written notice to Seattle by December 31, 2062, specifying the Block of water from zero to 5.3 MGD and the Cascade Members to be served by that Block. If Cascade exercises this right, the parties shall enter into a separate agreement.

3.6

A. All water supplied to Cascade under this Agreement is provided with the intent to serve Cascade Members' retail customers without limitation.

B. Cascade or Cascade Members may sell water supplied under this Agreement, or water from their respective independent supplies offset by water supplied under this Agreement, for wholesale purposes to non-Cascade Members only as follows:

1. For temporary emergency purposes under those specific emergency intertie agreements identified in Exhibit I.

2. To wholesale customers of Cascade or a Cascade Member, as of January 31, 2013. The parties will amend Exhibit I by Management Agreement by August 1, 2013 to reflect all of the non-Cascade Members being served under this provision.

3. Within Seattle's Service Area Boundary, except for then-current Seattle Wholesale Customers, provided that: (a) Cascade obtains Seattle's prior written consent; and (b) an equivalent amount of the Base Block will be converted to Supplemental Block and charged in accordance with Section 8.8 from the effective date of the sale. Seattle's consent may be subject to conditions Seattle deems reasonably necessary to protect the Seattle Regional Water Supply System. This provision

will not apply to any wholesale sales authorized under other provisions of this Section 3.6.

4. Outside of Seattle's Service Area Boundary, provided that: (a) Cascade provides advance written notice to Seattle in a form mutually agreed by the Parties by Management Agreement; and (b) an equivalent amount of the Base Block will be converted to Supplemental Block and charged in accordance with Section 8.8 from the effective date of the sale.

5. From the 8 MGD Wholesale Water Supply from the City of Tacoma or water supplies from Cascade's White River - Lake Tapps Reservoir Project, except not to then-current Seattle Wholesale Customers, provided that: (a) Cascade provides advance written notice to Seattle in a form mutually agreed by the Parties by Management Agreement; and (b) an equivalent amount of the Base Block will be converted to Supplemental Block and charged in accordance with Section 8.8 from the effective date of the sale.

6. To then-current Seattle Wholesale Customers provided that: (a) Cascade obtains Seattle's prior written consent; and (b) the full amount of the Base Block will be converted to Supplemental Block and charged in accordance with Section 8.8 from the effective date of the sale. Seattle's consent may be subject to conditions Seattle deems reasonably necessary to protect the Seattle Regional Water Supply System.

7. Offsets. For the purposes of this Section 3.6 B, the Parties understand and agree that any wholesale sales made by Cascade or a Cascade Member prior to the full implementation and delivery of water supplies from Phase 2 of Cascade's White River – Lake Tapps Reservoir Project, as more particularly defined in Cascade's 2012 Transmission and Supply Plan, are made with water supplied under this Agreement or water from Cascade or Cascade Member's respective independent supplies offset by water supplied under this Agreement and that the applicable provisions of this Section 3.6 B apply to such wholesale sales. After the full implementation and delivery of water supplies from Phase 2 of Cascade's White River – Lake Tapps Reservoir Project, the Parties understand and agree that the applicable provisions of this Section 3.6 B will apply unless Cascade demonstrates and Seattle agrees that a particular wholesale sale by Cascade or a Cascade Member is from surplus independent supplies without offset by water supplied under this Agreement.

3.7 All water supplied under this Agreement must be used within Seattle's Service Area Boundary.

3.8 During the term of this Agreement, if a Seattle Wholesale Customer identified in Exhibit III becomes a Cascade Member, Seattle will release that customer from its obligations under its existing water supply contract with Seattle in accordance with the provisions of such contract and the Supplemental Block will be increased by the allocated block of water identified in Exhibit III for that customer, with a corresponding proportional increase to any adjustments or limitations to the Cascade Block under Sections 3.3, 3.4 and 3.14. If that entity takes delivery of all or a portion of its water through a Sub-regional Facility, Cascade and Seattle shall enter into a Management Agreement to include the costs of such facility under this Agreement prior to increasing the Supplemental Block.

3.9 For the purpose of determining the consecutive 30-day period, which constitutes the Peak Month, a daily average delivery may be calculated so long as meter readings occur no fewer than 26 days apart. In such cases, daily average delivery shall be calculated by dividing the total deliveries by the actual number of days between meter readings. Periods less than 26 days shall not be applicable for determining the Peak Month.

3.10 Daily average delivery during the Peak Season may be calculated using meter readings taken closest to June 1 and September 30 each year and dividing the total delivery during such time by the actual number of days between meter readings. Periods less than 110 days shall not be applicable for determining the Peak Season.

3.11 Average Daily Demand for a calendar year may be calculated by using the monthly meter readings around the 20th of each month from February through December of that calendar year plus a prorated amount for the number of days in January from the January meter read in that calendar year plus a prorated amount for the number of days in December from the January meter read in the following calendar year and dividing the total deliveries during such time by the actual number of days in that calendar year. The year-end prorations used to calculate ADD may be adjusted by Management Agreement based on changed meter reading procedures.

3.12 Seattle shall endeavor to read the meters at all Cascade Points of Delivery on the same day. In the event that meters at any Cascade Point of Delivery cannot be read on the same day, all meter reads for that metering period shall be considered to occur on the day on which the meters measuring the majority of the Cascade volume for that metering period were read.

3.13 Normal operation of the water system includes the periodic shutdown of various facilities for routine maintenance, rehabilitation and replacement. Seattle and Cascade shall cooperate in the timing of such activities. Cascade shall not use such activities as evidence of the unavailability of supply or transmission services provided by Seattle under this Agreement so long as Seattle proceeds in good faith to restore such facilities to service.

3.14 Nothing in this Agreement, including, but not limited to, any penalties for exceedance of the Cascade Block, shall be construed to require Seattle to sell or deliver water in excess of the following amounts:

A. Total deliveries during a calendar year in the amount of the Cascade Block multiplied by 365 days (366 in leap years);
B. Total deliveries during the Peak Season in the amount of the Cascade Block multiplied by 165 days;
C. Total deliveries during the Peak Month in the amount of the Cascade Block multiplied by 51 days;
D. Total deliveries during any consecutive 30-day period from October 1 to May 30 in the amount of the Cascade Block multiplied by 30 days;
E. Total deliveries during any consecutive 7-day period in the amount the Cascade Block multiplied by 13 days;
F. Total deliveries within any one-day period in the amount of the Cascade Block multiplied by 2 days.

Upon notice by Seattle of exceedance of these limits, Cascade must immediately reduce its deliveries of Seattle water. Upon the failure of Cascade to reduce its demand, Seattle may install and operate devices that limit deliveries to Cascade to these amounts, all at Cascade's expense.

ARTICLE IV - TRANSMISSION

4.1 Each calendar year during the term of this Agreement, Seattle shall sell to Cascade and Cascade shall purchase from Seattle capacity in the Seattle Transmission System according to the following terms and conditions:

A. Seattle shall provide capacity sufficient to supply the Cascade Block to Cascade at Cascade Points of Delivery. Adjustments in the Cascade Block shall result in an equivalent adjustment in Seattle's Transmission capacity commitment. The specific Cascade Points of Delivery that are to be adjusted and the adjustment for each Cascade Point of Delivery shall be determined by Management Agreement so long as a determination is made that there is no adverse impact on the overall Seattle Water System.

B. Cascade Points of Delivery are specifically identified in Exhibit II. The Parties may amend the location, hydraulic gradient and instantaneous flows at each Cascade Point of Delivery by Management Agreement.

C. Seattle shall supply water at the inlet side of each Cascade Point of Delivery meter at a hydraulic gradient no less than the minimum identified in Exhibit II provided that the instantaneous flow does not to exceed that set forth in the same exhibit. Seattle may change the minimum hydraulic gradient at any Cascade Point of Delivery once during any fifteen-year period, provided that four years prior notice is given to Cascade. Under emergency conditions or other unusual short-term operating situations Seattle shall not be obligated to meet minimum hydraulic gradients.

D. Cascade may request changes to existing or additional Cascade Points of Delivery from the Existing Transmission System Facilities, which Seattle may approve or reject at its sole discretion. Seattle shall establish the minimum hydraulic gradient for any new Cascade Point of Delivery at its sole discretion, after consultation with Cascade. The Parties may amend Exhibit II to reflect the changes in or additional Cascade Points of Delivery under this section by Management Agreement.

E. No provision of this Agreement shall be construed to require Seattle to provide flows greater than those identified in Exhibit II. Upon notice by Seattle, Cascade shall immediately reduce Cascade deliveries at a Cascade Point of Delivery to not more than those identified in Exhibit II. In the event that Cascade is unwilling or unable to reduce deliveries as required under this provision, Seattle may install and operate flow restricting devices at non-compliant Cascade Points of Delivery, all at Cascade expense.

4.2 Cascade is served, in part, by transmission facilities referred to as the Cascade Sub-regional System listed in Exhibit VII. The costs of operating, maintaining, repairing and replacing these facilities shall be the responsibility of Cascade as outlined in Sections 8.6 and 8.7 below. The Parties may amend Exhibit VII by Management Agreement.

4.3 Nothing herein shall restrict Cascade's authority to construct an independent water transmission system for its own water supply.

4.4 Cascade Members have interties, listed in Exhibit I, with adjacent water utilities that are non-Cascade members. The Parties may amend Exhibit I by Management Agreement. Any existing agreements related to the billing and meter reading arrangements for these interties are assumed as a part of this Agreement. If new interconnections between Cascade or Cascade Members and non-Cascade members require similar billing and meter reading arrangements, such arrangements shall be defined in an agreement to be entered into by Cascade, Seattle and the non-Cascade member.

4.5 A. Transmission Wheeling. Seattle, at its discretion, may make excess transmission capacity available for a fee and under conditions it deems reasonable, for purposes of wheeling other water supply between points within the Seattle Water System to Cascade or others.

B. Interconnection/Intertie.

1. In the event Cascade requests an interconnection to the Seattle Water System to take delivery of any other water supplied to Cascade under separate water supply contracts or arrangements, Cascade shall, at its expense, be responsible for the design, engineering, permitting and construction of any and all infrastructure necessary to interconnect to the Seattle Water System. Any interconnection to the Seattle Water System or intertie between the Seattle Water System and another water supply system will be subject to Seattle's review, approval and such conditions and requirements as Seattle and the other

water supply system owner may determine to be reasonably necessary in order to provide and maintain the safe and efficient design, function, capacity, water quality, integrity and reliability of their respective water supply systems.

2. Seattle may request that the interconnection allow for joint use for Seattle's purposes subject to mutually agreed upon terms.

ARTICLE V - WATER QUALITY

Seattle shall be responsible for water quality within the Seattle Water System, and it shall supply water to Cascade, that meets or exceeds federal and state drinking water quality standards, as those standards may change from time to time.

ARTICLE VI - CONSERVATION

Each Party is committed to the principles of water conservation and each intends to achieve its anticipated savings by implementing water conservation programs either unilaterally or in partnership with other agencies. Cascade understands and agrees that as an existing wholesale customer of Seattle, this commitment includes good faith efforts in meeting the intent of Part 1, Section B.1.5 of the Settlement Agreement between the Muckleshoot Indian Tribe and the National Marine Fisheries Services and the City of Seattle (Civ. No. 03-3775JLR), by implementing, through its own water conservation program(s), conservation measures that provide comparable savings to those implemented by Seattle within the Seattle Retail Distribution System.

ARTICLE VII - PLANNING AND SHORTAGE MANAGEMENT

7.1 Each Party recognizes its obligation to plan for water supply and distribution in compliance with the State Department of Health water system planning regulations. Each Party shall develop a water system plan for its service area and the Parties shall coordinate those elements of overlapping responsibilities.

7.2 Cascade and Seattle shall coordinate the development, adoption and implementation of their respective Water Shortage Management Plans. Before invoking its Water Shortage Management Plan, the Parties shall communicate with each other concerning current and projected water supply conditions.

7.3 Seattle has negotiated agreements with federal agencies, state agencies and tribes for the long term preservation and enhancement of watersheds and in-stream beneficial uses and habitat. Such agreements have direct bearing on decisions to curtail the amount of water available for municipal and industrial water supply in any given season. Any water use restrictions imposed under the terms of such agreements shall be borne proportionately by Seattle, its other wholesale customers, and Cascade with respect only to the size of the

Cascade Block at the time curtailment is required. In that event, the Base and Supplemental Blocks will be reduced or restricted in the same proportion, as appropriate.

ARTICLE VIII - COST RECOVERY

8.1 The provisions of this Article shall apply to the establishment of fees and charges for water supply and related services. The parties understand and agree that the cost allocation and recovery provisions were specifically negotiated and based on specific consideration of the circumstances of this extended and restructured declining block contract, including but not limited to the limitations and restrictions applied in this Agreement, recognition of protection against stranded costs in the Seattle Water System, and recognition of the anticipated savings from Cascade's deferred capital project expenditures.

8.2 For the purposes of allocating costs of water supply, there shall be two water supply cost pools consisting of an existing Seattle water supply assets cost pool ("Existing Supply Cost Pool") and a new Seattle water supply assets cost pool (the "New Supply Cost Pool").

A. Existing Supply Cost Pool. The costs of infrastructure, including operation, maintenance, repair and replacement of Existing Supply System Facilities listed in Exhibit IV shall be included in the Existing Supply Cost Pool. The Parties may amend Exhibit IV by Management Agreement.

B. New Supply Cost Pool. The costs of water supply resources developed in the future ("New Supply Resources") that expand the capacity of the Seattle Supply System, including the costs of the Regional Conservation Program shall be included in the New Supply Cost Pool. If any portion of a New Supply Resource project enhances reliability of Existing Supply System Resources, the costs thereof may be allocated to the Existing Supply Cost Pool by Management Agreement.

8.3 For purposes of determining the cost of the transmission of water to the Wholesale Customers there shall be three transmission cost pools consisting of an existing transmission cost pool ("Existing Transmission Cost Pool"), a new transmission cost pool ("New Transmission Cost Pool"), and a Cascade transmission cost pool ("Cascade Sub-regional System Cost Pool").

A. Existing Transmission Cost Pool. Costs to be allocated to the Existing Transmission Cost Pool shall consist of the following: operation, maintenance, repairs and replacements to the Existing Transmission System Facilities listed in Exhibit V and may include costs related to Cascade Points of Delivery in accordance with this Agreement or as mutually agreed by Management Agreement to address third party claims arising from a Cascade Point of Delivery. Costs incurred for purposes of transmission reliability may be included in the Existing Transmission Cost Pool by

Management Agreement. The Parties may amend Exhibit V by Management Agreement.

B. New Transmission Cost Pool. The cost of new transmission facilities shall be included in the New Transmission Cost Pool. A portion of the renewal, replacement or modification of Existing Transmission System Facilities which create an expansion of transmission capacity may be allocated to the New Transmission Cost Pool.

C. Cascade Sub-regional System Cost Pool. The costs of operating, maintaining, repairing and replacing the Cascade Sub-Regional System facilities owned by Seattle and listed in Exhibit VII shall be included in the Cascade Sub-regional System Cost Pool, in an amount proportionate to the use of the facilities by Cascade, together with any other costs Cascade and Seattle agree to include by Management Agreement. In the event that Cascade ceases to receive water through one or more of the facilities in the Cascade Sub-regional System, these facilities may be decommissioned at Seattle's sole discretion, and Cascade shall pay Seattle for the remaining Net Book Value of the decommissioned facilities in an amount proportionate to the use of the facilities by Cascade together with any decommissioning costs.

8.4 A. If Seattle determines that changing the location of a Cascade Point of Delivery is required for the improved operation of the Seattle Transmission System then such costs shall be included in the Existing Transmission Cost Pool. Seattle shall notify Cascade of any proposed changes to a Cascade Point of Delivery and consult with Cascade to ensure minimal impact on the affected Cascade Member's distribution system and appropriate coordination of operation and construction activities.

B. The costs of operating, maintaining, repairing, replacing, relocating, adding or improving Cascade Points of Delivery for any reason other than Section 8.4.A shall be borne by Cascade, except to the extent that such costs are due to the negligence of Seattle. Costs will be invoiced and due in 30 days upon receipt or as otherwise provided for by Management Agreement as provided in Article X. Seattle shall notify Cascade of any proposed improvements to a Cascade Point of Delivery and consult with Cascade to ensure minimal impact on the affected Cascade Member's distribution system and appropriate coordination of operation and construction activities. Allocation of costs related to third party claims arising from Cascade Points of Delivery may be handled pursuant to a Management Agreement.

8.5 Seattle shall maintain a cost accounting system consistent with the provisions of this Agreement and generally accepted accounting principles consistently applied in developing the financial information for determining the costs of construction, replacement, maintenance and operation of the facilities in each cost pool.

A. Asset Accounts. An asset account shall be maintained for each facility and within that account Seattle shall record the original cost of that facility plus betterments and less retirements.

B. Depreciation. Facilities shall be depreciated according to Standard Water System Asset Lives and a record of life-to-date depreciation shall be maintained for each facility. No depreciation shall be recorded in the first calendar year of operation of a facility. A full year's depreciation shall be recorded in every subsequent year.

C. Net Book Value. The net book value of any facility shall be its original cost plus betterments and less retirements as recorded in its facility asset account, less life-to-date depreciation.

8.6 Costs in each cost pool shall be calculated as follows:

A. Infrastructure Costs. Each cost pool shall include the infrastructure costs for its respective facilities, calculated on a utility, cash or other basis depending upon the facility and the cost pool as set forth below.

1. Utility Basis. The utility basis shall be used to calculate the infrastructure costs for all Existing Supply System Facilities, all Existing Transmission System Facilities, and all Cascade Sub-Regional System facilities, as well as their replacements and betterments. Under the utility basis, the infrastructure cost for a facility in any year shall be the sum of (i) the annual depreciation expense recorded for that facility and (ii) the product of the net book value of that facility and the Rate Of Return On Investment. At Seattle's discretion, interest costs may be considered current infrastructure costs during the construction of a facility. However, any such interest costs must then be considered contributions in aid of construction, and not included in the Net Book Value of the facility for purposes of calculating Utility Basis costs in future years.

B. Operations Costs. The costs of operating the assets assigned to a cost pool shall be included in the cost pool. The annual operations costs of a cost pool shall be the labor, materials, equipment and other direct costs required for the operation and maintenance of the facilities in that cost pool, together with any net profit or expense from the disposition of facilities in that pool. Operations costs shall include the cost of general and administrative overhead applied in a manner consistent with its application to facilities construction projects.

1. Existing Supply Operations Costs. The Parties agree that an efficient way of handling operations costs for the Existing Supply Cost Pool shall be as follows: The Operations Cost base in the Existing Supply Cost Pool for the year 2001 shall be $17,780,262.00. In each succeeding year, the amount from the previous year shall

be adjusted by the percentage change in the total cost of all the supply cost centers identified in Exhibit VI, as it may be updated from time to time by Management Agreement, except that the increase in treatment operations costs caused by the first full year start-up of the Cedar Treatment Plant at Lake Youngs in or around 2005 shall not be included in the percentage adjustment. Any increase in Cedar Treatment operations costs for the first full year of operation of the plant shall instead be added directly to the Operations Cost total from the prior year as adjusted by the index. For each year after the first full year of operation, increases in Cedar Treatment operations costs shall be included in the adjustment index.

2. Existing Transmission Operations Costs. The Parties agree that an efficient way of handling operations costs for the Existing Transmission Cost Pool shall be as follows: the Operations Costs base in the Existing Transmission Cost Pool for the year 2001 shall be $4,531,931.00. In each succeeding year, the amount of these costs from the previous year shall be adjusted by the percentage change in the total cost of all the transmission cost centers identified in Exhibit VI, as it may be updated from time to time by Management Agreement.

3. Cascade Sub-regional System Cost Pool Operating Costs. Cascade Sub-regional System Cost Pool Operating Costs shall include: (i) the actual costs of operating the facilities listed in Exhibit VII in proportion to the actual use of such facilities by Cascade; (ii) the electricity costs paid by Seattle after the effective date of this Agreement, in accordance with certain contracts effective on or before January 1, 2002 identified in Exhibit I, for pump stations owned and operated by Cascade Members and connected to the Tolt East Side Supply Line; and, (iii) any other costs approved by Management Agreement shall be Cascade Sub-regional System Cost Pool Operating Costs.

C. Disposition Costs. The costs of disposing of assets within a cost pool shall be included in the cost pool. Net disposition costs shall be calculated as follows:

1. Disposition under the Utility Basis. The net book value of the facility, less any sales, salvage, or other revenues derived from the disposition of that facility.

8.7 For the Base Block, the costs in cost pools shall be allocated to Cascade as follows:

A. Allocation of Existing Supply Cost Pool. Cascade shall pay one hundred two percent (102%) of the product of the Base Block and the costs in the Existing Supply Cost Pool divided by the Firm Yield. In the event the 171 MGD Firm Yield is modified downward in accordance with Section 3.2 , this allocation formula will use the Base Block, whether reduced or not, and the modified Firm Yield. In the event the 171 MGD Firm Yield is modified upward (with no change in the Base Block), this allocation formula will continue to use the existing 171 MGD Firm Yield. The Parties understand and agree the intent of this provision is that Cascade will pay a consistent percentage of system costs regardless of modifications of Firm Yield unless the parties subsequently mutually agree to an alternative reduction to the Cascade Block pursuant to Section 3.2.

B. Allocation of New Supply Cost Pool. Cascade shall pay none of the costs in the New Supply Cost Pool.

C. Allocation of Existing Transmission Cost Pool. Cascade shall pay one hundred two percent (102%) of the product of the Base Block and the costs in the Existing Transmission Cost Pool divided by the Firm Yield. In the event the 171 MGD Firm Yield is modified downward in accordance with Section 3.2, this allocation formula will use the Base Block, whether reduced or not, and the modified Firm Yield. In the event the 171 MGD Firm Yield is modified upward (with no change in the Base Block), this allocation formula will continue to use the existing 171 MGD Firm Yield. The Parties understand and agree the intent of this provision is that Cascade will pay a consistent percentage of system costs regardless of modifications of Firm Yield unless the parties subsequently mutually agree to an alternative reduction to the Cascade Block pursuant to Section 3.2.

D. Allocation of New Transmission Cost Pool. Cascade shall pay none of the costs in the New Transmission Cost Pool.

E. Allocation of the Cascade Sub-regional System Cost Pool. Cascade shall pay costs in the Cascade Sub-regional System Cost Pool as follows:

1. 100% of the costs associated with all facilities listed in Exhibit VII.A.
2. A proportionate share of those facilities listed in Exhibit VII.B. based on flows of Cascade Members. Costs will be allocated based on Peak 7 Day flows through each segment. In the event that Peak 7 Day flow data is not available, Peak Month flows may be substituted.

8.8 For the Supplemental Block, Cascade shall pay the then current Full or Partial Requirements Customer Commodity Charge. The Full or Partial Requirements Customer Commodity Charge shall be applied to the annual volume of the Supplemental Block allocated by month in accordance with the schedule in Section 8.10 C. Seattle will provide Cascade 30 days' advance notice of any proposed changes to the Full or Partial Requirements Customer Commodity Charges. For months that include a rate change, the charge shall be prorated in accordance with the effective date of the rate change.

8.9 Cascade shall pay the costs of penalties for exceeding the Cascade Block, as defined in Section 8.11 and any other costs requiring invoice by Seattle within 30 days of invoice by Seattle. Overdue balances shall bear interest at the rate of 1% per month.

8.10 Cascade shall pay the annual costs allocated to Cascade in accordance with Section 8.7 for the Base Block and 8.8 for the Supplemental Block as follows:

A. Prospective Cost Estimate for the Base Block. Seattle may conduct a cost estimating study to revise estimates of the annual costs allocable to Cascade for the Base Block upon 120 days notice to Cascade. Cascade shall pay Seattle for the Base Block according to the estimated annual costs in such study, provided that not more than five years has elapsed from the time a study is conducted to the year in which the estimates from that study are used. Each study shall estimate the annual costs for the Base Block not less than the five following years.

B. Statement of Annual Costs. On or before October 1st of each year, Seattle shall provide Cascade with its best, non-binding estimate of the annual costs for the Base and Supplemental Blocks for the next year. On or before December 1st of each year, Seattle shall notify Cascade of Cascade's annual costs for the Base and Supplemental Blocks for the next year. For the Base Block, such annual cost shall be the sum of the prospective cost estimate determined in accordance with Section 8.10 A and the amount of excess or deficit identified in the most recent cost audit performed in accordance with Section 8.10 D. For the Supplemental Block, such annual cost shall be in accordance with Section 8.8. In the event the Full or Partial Requirements Customer Commodity Charges change during the year, Seattle will provide Cascade with an updated cost estimate for the Supplemental Block for the remainder of that year.

C. Payment Distribution. On or before the last day of each month, Cascade shall pay Seattle that portion of Cascade's annual cost for that year, calculated pursuant to Section 8.10 B for the Base Block and Section 8.8 for the Supplemental Block, according to the following schedule:

January 5%
February 5%
March 6%
April 6%
May 6%
June 12%
July 13%
August 15%
September 13%
October 7%
November 6%
December 6%

Overdue balances shall bear interest at the rate of 1% per month. In no event shall Cascade be required to pay Seattle a monthly payment during a year until at least 30 days after Seattle provides Cascade with a statement of annual costs for that year, and such payments shall not be considered overdue, until 30 days after such statement is provided to Cascade.

D. Cost Audit for the Base Block. No later than August 1 of each year, Seattle shall provide a statement of actual costs for the Base Block allocated to each cost pool and other costs and revenues received during the prior year, which statement shall be examined by an external auditor in an "agreed-procedures" engagement. In addition, Cascade may have the statement audited by an external auditor of its choice, solely at Cascade's expense. This statement shall clearly identify the amount by which payments for the Base Block made by Cascade during the prior year were in excess of, or insufficient to meet the actual costs allocable to Cascade for the Base Block for the prior year. This surplus or deficit shall earn interest at the Rate of Return on Investment, and shall be reduced in accordance with Section 8.10 B. No later than December 31 of the year following the termination of the contract, any remaining surplus or deficit balance shall be paid in cash by the Party owing the balance to the party to whom the balance is owed.

E. Payment from Gross Revenues. Cascade shall pay the Base Block and Supplemental Block charges out of its gross revenues. Except for the Transition Payments in Section 8.10 G below, Cascade's payments to Seattle pursuant to this Agreement and payments otherwise required or provided for by this Agreement shall be maintenance and operation expenses of Cascade, payable prior to and superior to any charge or lien of any revenue bond issued by Cascade that are payable from the revenues of Cascade. Cascade shall establish rates and collect fees and charges for wholesale water service sufficient to pay for the maintenance and operation of its Cascade Water System, including payments to Seattle, and the principal and interest on any and all Cascade revenue obligations that constitute a charge against the revenue of Cascade.

F. Emergency Surcharge. In the event of a catastrophe or other extraordinary condition that requires emergency expenditures to maintain a sufficient water supply, Seattle may impose an emergency surcharge proportionately on all of its retail and wholesale customers, including Cascade in order to pay for such expenditures. Any such emergency surcharge shall be presented to Cascade prior to adoption by Seattle. Seattle shall consider Cascade's comments but shall nevertheless have the full authority to adopt the charge.

G. Transition Payments. In consideration for entering into this 2nd Amended and Restated Declining Block Water Supply Agreement, Cascade will pay to Seattle, three transition payments of the following amounts and on the following schedule:

1. Payment of $5 million due on or before July 31, 2013
2. Payment of $12 million due on or before December 31, 2018
3. Payment of $5 million due on or before December 31, 2024

Seattle will consider these transition payments as revenue to offset costs in the Existing Supply Cost Pool allocated to the Full and Partial Requirements customer class under the provisions of those contracts.

8.11 A. Charges will be imposed for exceeding the Cascade Block for Annual Average Daily Demand, Peak Month Factor and Peak Season Factor limitations, based on daily averages measured according to Sections 3.9-3.11. These charges will be determined by multiplying the appropriate multiplier(s) from the following tables times the then current Full or Partial Requirements Customer Commodity Charge(s) for the period(s) in which the exceedance occurred, the result multiplied by the full amount of the exceedance over the applicable limit (in MGD) and then multiplied by the actual number of days in the calendar year, 30 days for Peak Month or 122 days for Peak Season, whichever is applicable.

For the first instance in any five-year period, the following multipliers will apply:

	Multipliers for Charges for Water in Excess of Annual Average Daily Demand, Peak Season and Peak Month Block Limitations - First Instance in 5-Year Period			
Category	**0 to 1 MGD**	**>1 to 2 MGD**	**>2 to 3 MGD**	**>3 MGD**
ADD	1.0	1.0	1.1	1.2
Month	1.0	1.0	9.1	16.7
Season	1.0	1.0	3.1	4.7

The multipliers for the first 2 MGD in the table above reflect a buffer before penalty charges begin. Cascade agrees not to plan or rely on this buffer as available firm supply.

B. For any additional instances of water in excess of the average annual and peak supply limitations in any five-year period, the following multipliers will apply.

	Multipliers for Charges for Water in Excess of Annual Average Daily Demand, Peak Season and Peak Month Block Limitations - Additional Instances in 5-Year Period			
Category	**0 to 1 MGD**	**>1 to 2 MGD**	**>2 to 3 MGD**	**>3 MGD**
ADD	1.0	1.1	1.1	1.2
Month	1.5	9.1	9.1	16.7
Season	1.5	3.1	3.1	4.7

C. In the event of a charge for exceeding the block occurs in more than one category in either a single year or in multiple years during any consecutive five-year period, only the category that results in the highest charge will be assessed.

8.12 Except in the case of an emergency, the provisions of Section 8.11 shall be applied reciprocally to Seattle to calculate credits to Cascade, should Seattle fail to deliver the Cascade Block as required by this Agreement.

ARTICLE IX - ADMINISTRATION

9.1 Seattle shall own and maintain appropriate metering devices to measure the water flowing from the Seattle Water System to each Point of Delivery. At Cascade's request and sole expense, Seattle will install and maintain equipment selected by Cascade and approved by Seattle to transmit signals to recording equipment of Cascade or its Members (located elsewhere) of the amount of water delivered, as measured by Seattle's meters.

9.2 Seattle shall keep full and complete books of accounts for the Seattle Water System and Seattle's retail distribution system in compliance with current standards required by the State Auditor. Cascade, at its own expense, may at any time audit Seattle's book of accounts using the services of a public accounting firm and Seattle shall make the books and records of the Seattle Water System and Seattle's retail distribution system available to such auditors during reasonable business hours upon reasonable notice at the place where such records are normally kept. Seattle shall provide adequate facilities; i.e., room and workspace, so the audit can be performed. Seattle shall have reciprocal rights to audit Cascade books and accounts.

9.3 This Agreement shall be interpreted according to the laws of the State of Washington and the venue for any litigation between the Parties concerning its terms shall be in the Superior Court of King County at Seattle. The Parties shall be entitled to specific performance of the terms of this Agreement.

9.4 This Agreement shall inure to the benefit of and be binding upon successors of interest and assigns of the Parties. Neither this Agreement nor obligations to perform hereunder may be voluntarily assigned by either Party without the other Party's written consent, which shall not be unreasonably withheld; provided however, that a change in Cascade's corporate form to another form of organization authorized by Washington law, shall not be considered an assignment. Seattle may not convey the Seattle Water System in its entirety or any of its component parts used to meet the obligations of this Agreement without providing for an assumption of this Agreement and the obligations contained herein by the conveyee. The Parties do not intend to confer rights or benefits upon any third party. Only a writing executed by the Parties may modify this Agreement.

9.5 All notices relating to this Agreement shall be sent to the following addresses, certified mail, return receipt requested, unless the other Party is previously notified in writing of a change in recipient or address:

To Seattle:	To Cascade:
Director	Chief Executive Officer
Seattle Public Utilities	Cascade Water Alliance

700 Fifth Avenue, 49th Fl. Seattle, WA 98104	520 112th Avenue NE, Suite 400 Bellevue, WA 98004

9.6 If any provision of this Agreement or its application is determined by a court of law to be illegal, invalid, or void without rendering performance of this Agreement impossible or infeasible, then the Parties intend that the validity of the remaining provisions of this Agreement or their application shall not be affected and shall continue in full force and effect.

9.7 This Agreement is a contract for the purchase and sale of water and transmission services related to that water and no provision hereof shall be construed to make the Parties partners or joint ventures. Neither Party is the agent of the other nor shall either Party be held liable for the acts of the other on a theory of agency or any other representative capacity.

9.8 In the event of default of any provision of this Agreement, the non-defaulting Party shall issue written notice to the other Party setting forth the nature of the default. If the default is for a monetary payment due hereunder, the defaulting Party shall have thirty (30) days to cure the default. In the event of other defaults, the defaulting Party shall use its best efforts to cure the default within ninety (90) days. If such default cannot be reasonably cured within such ninety (90) day period, the defaulting party shall, upon written request prior to the expiration of the ninety (90) day period be granted an additional sixty (60) days to cure the default.

9.9 In the event of a default in payment by Cascade, Seattle shall have the right to compensation from the constituent Cascade Members up to the proportionate share of each Member's use of the Cascade Block which shall be established by the most recent annual report of Cascade Member's proportionate use of the Cascade Block, which proportionate use shall total 100 percent of the Cascade Block. Cascade's annual proportionate use report shall be completed and delivered to Seattle no later than March 31 of each year. Each Cascade Member must acknowledge and accept this individual, contingent liability to Seattle in writing at the time that Cascade enters into this Agreement. Cascade shall require those agencies that later join Cascade as a Cascade Member to convey such written acknowledgment and acceptance to Seattle within one month of joining Cascade. Without waiving any other remedies available under this Agreement or applicable law, should any Cascade Member required to do so fail to convey such written acknowledgement and acceptance, Seattle shall have the unilateral right, upon written notice to Cascade, to reduce the Cascade Block by the amount allocated to such Cascade Member as set by Cascade's most recent annual proportionate use report, until such written acknowledgement and acceptance is provided to Seattle.

ARTICLE X - TECHNICAL COMMITTEE

Technical Committees comprising of Seattle staff and other affected parties will address day to day operational issues related to the Seattle Water System. Finance cost and rate issues will be addressed independently between the Director of Seattle Public Utilities and the CEO of Cascade Water Alliance, or their respective designees as provided for in written notice to the other. It is recognized that daily operation of the Seattle Water System and implementation of this Agreement may require direct communication and coordination between Seattle staff and the staff of Cascade or Cascade Members and accommodation of Cascade's insurers with respect to claims. The Parties may establish any desired communication or coordination and claim protocols by Management Agreement.

ARTICLE XI - DISPUTE RESOLUTION

11.1 Cascade and Seattle shall make good faith efforts to resolve by informal discussion any dispute arising under or in connection with this Agreement. If at any time a Party to a dispute determines that such informal discussions will not result in a resolution, such Party may initiate non-binding mediation of any dispute arising under or in connection with this Agreement. Within ten (10) days of receiving written notice of initiation of non-binding mediation by one or both Parties, each Party shall designate in writing not more than five (5) candidates it proposes to act as a non-binding mediator. The Parties shall within an additional five (5) days select one of the mediators from either list to serve as mediator. Should the Parties be unable to agree upon a mediator, a mediator shall be chosen from one of the two lists by the presiding judge of the King County Superior Court at Seattle. Upon selection of the mediator, the Parties shall use reasonable efforts to resolve the dispute within thirty (30) days with the assistance of the mediator. The cost of mediation shall be shared by Cascade and Seattle equally.

11.2 If mediation fails to resolve the dispute within thirty (30) days of selection of the mediator, the Parties may thereafter seek redress in court.

11.3 Pending the decision in any mediation or litigation process pursuant to this section, the Parties to such process shall continue to fulfill their respective duties under this Agreement.

ARTICLE XII - UNFORESEEN AND UNAVOIDABLE EVENTS

12.1 The Parties recognize that unforeseen and unavoidable events may occur which would require Seattle to act unilaterally for what it deems to be in the best interest of the general public served by the Seattle Water System; including water shortages resulting from drought circumstances and temporary reduction in water supply associated with turbidity events. Upon the occurrence of an unforeseen or unavoidable event, Seattle shall, to the extent practicable, treat its wholesale and retail customers equally and any curtailment of supply shall be imposed proportionately among those customers. This authority to act unilaterally carries with it a unilateral responsibility of Seattle to restore, expeditiously, the Seattle Water System to its pre-emergency capability to supply the region.

12.2 Upon occurrence of an unforeseen or unavoidable event that adversely impacts the Cascade Water System, Cascade may request Seattle to temporarily modify or suspend operational or supply provisions of this Agreement and Seattle shall make reasonable efforts to grant such request. Cascade will act expeditiously to restore the Cascade Water System to its pre-emergency capability.

12.3 The time periods for Seattle's performance under any provisions of this Agreement shall be extended for a reasonable period of time during which Seattle's performance is prevented, in good faith, due to fire, flood, drought, turbidity events, earthquake, lockouts, strikes, embargoes, acts of God, war and civil disobedience. If this provision is invoked, Seattle agrees to immediately take all reasonable steps to alleviate, cure, minimize or avoid the cause preventing such performance.

ARTICLE XIII - EXHIBITS

Exhibits I through VII are attached hereto and are hereby incorporated by reference into the Agreement as if set forth in full herein.

ARTICLE XIV - COMPLETE AGREEMENT

This Agreement, as amended and restated herein, represents the entire agreement between the Parties concerning the subject matter hereof and will supercede Amended and Restated 50-Year Declining Block Water Supply Agreement between the City of Seattle and the Cascade Water Alliance, dated December 17, 2008 upon the effective date noted herein. This Agreement may not be amended except as provided in Section 9.4.

THE CITY OF SEATTLE, a municipal corporation:

By: Ray Hoffman DATE: 7/15/13
DIRECTOR, SEATTLE PUBLIC UTILITIES

THE CASCADE WATER ALLIANCE, a joint municipal utility services authority:

BY: Chuck Clarke DATE: 7/12/13
CHIEF EXECUTIVE OFFICER

REPLACED BY MANAGEMENT AGREEMENT NO. 7

EXHIBIT I

Other Agreements

A. List of documents, commitments, adjustments, reductions, agreements, and/or written approvals by Seattle regarding the supply, purchase and/or resale of water according to Section 4.4 of this Agreement:

1. Interties and associated agreements with other agencies as referenced in Section 4.4:

   a) Redmond/Union Hill Water Association Water Service Agreement
   b) Redmond/Union Hill Water Association Agreement for Water System Interties
   c) Redmond/Woodinville Water District Interlocal Agreement
   d) Redmond/Woodinville Water District Agreement for Water System Interties
   e) Redmond/Northeast Sammamish Water & Sewer District Agreement for Water System Interties
   f) Skyway / WD 125
   g) Bellevue/Coal Creek

2. Other pertinent Agreements:

   a. List of electric contracts for pump stations owned and operated by Cascade Members and connected to the Tolt Eastside Supply Line according to Section 8.6.B.3 of this Agreement:

      1. Between the City of Bellevue and the City of Seattle, effective August 1983, pursuant to Ordinance #111276 for SE 28th pumping station (50% / 50%) and N.E. 8th pumping station (Bellevue 60% / Seattle 40%)

EXHIBIT II

CASCADE POINTS OF DELIVERY, MINIMUM HYDRAULIC GRADIENTS, AND MAXIMUM FLOW RATES OF WATER SUPPLIED

METER SERVICE				MINIMUM HYDRAULIC GRADIENT AT STATION UPSTREAM OF METER (FEET NAVD-88 Datum)	FLOW UP TO WHICH THE MINIMUM HYDRAULIC GRADIENT IS GUARANTEED (gpm)
LOCATION	STATION NUMBER (1)	PIPELINE SEGMENT NUMBER (1)	SIZE OF METER (IN.)		
Bellevue (* Redmond)					
132nd Ave. SE & SE 26th Street	59	8	8	425	1,300
128th Ave. SE & Newport Way	56	8	8	435	850
Mercer Is. Pipeline & 108th Ave. SE	66	9	8	420	700
140th Ave. NE & 40th Street	65	2	10	500	3,500
132nd Ave. NE & NE 14th St.	62	2	12	470	4,500
132nd Ave. NE & NE 24th Street	63	2	10	455	4,500
152nd Ave. NE & NE 8th Street	61	2	24	460	3,500
145th Pl. SE & SE 28th Street	58	3	12	470	3,000
14509 SE Newport Way (2)	60	3	10	525	4,600
14509 SE Newport Way (6)(7)	TBD	3	10	525	2,900
128th Ave SE & SE 56th ST (3)	47	8	8	440	Backup to Sta. 55 (5)
128th Ave SE & Newport Way (3)	55	8	6	435	800
120th Ave SE & SE 35th ST (3)	46	9	6	425	Backup to Sta. 124 (5)
I-90 & Lake Washington Boulevard (3)	50	9	6	425	Fire flow backup only

124th Ave SE & SE 38 PL [3]	124	9	8	425	1,500
128th Ave SE & SE 70th ST [4]	52	8	12	445	1,020
METER SERVICE				**MINIMUM HYDRAULIC GRADIENT AT STATION UPSTREAM OF METER (FEET NAVD-88 Datum)**	**FLOW UP TO WHICH THE MINIMUM HYDRAULIC GRADIENT IS GUARANTEED (gpm)**
LOCATION	**STATION NUMBER [1]**	**PIPELINE SEGMENT NUMBER[1]**	**SIZE OF METER (IN.)**		
Kirkland / Redmond 132nd Ave. NE & NE 113th Street	74	1	10	555	4,500
132nd Ave. NE & NE 85th Street	75	1	16	535	4,080
140th Ave. NE & NE 70th Street	72	2	12	520	1,240
Redmond 160th Ave NE & NE 104th Street	165	28	10	515	1,000 (combined with following planned new location)
NE 172nd Street & Tolt Pipeline No. 2	TBD	28	TBD	515	planned new location
Trilogy Parkway NE & NE 125 Street	164	26	10	610	2,000 (combined with following planned additional meter)
Trilogy Parkway NE & NE 125 Street	TBD	26	10	610	Planned additional meter
Skyway 84th Ave. S & S 134th Street	1	10	6	455	210
Beacon Ave S & S 124th Street	5	10	8	455	720
Cornell Ave S & S 112th Street	172	4	6	375	Backup service
Tukwila 39th Ave S & S 112 Street	11	15	10	460	Backup service

South Center Parkway & Tukwila Parkway	13	13	10	460	2,200
West Valley Hwy & S 162nd Street	14	13	8	460	Backup emergency service
Christensen Rd. & Baker Rd	15	13	8	460	480
METER SERVICE				**MINIMUM HYDRAULIC GRADIENT AT STATION UPSTREAM OF METER (FEET NAVD-88 Datum)**	**FLOW UP TO WHICH THE MINIMUM HYDRAULIC GRADIENT IS GUARANTEED (gpm)**
LOCATION	**STATION NUMBER (1)**	**PIPELINE SEGMENT NUMBER(1)**	**SIZE OF METER (IN.)**		
53rd Ave S & S 160th Street	16	13	6	460	20
E Marginal Way & S 112th Street	168	15	12	445	810
51st Ave S & S Leo Street	169	12	8	455	60
W. Marginal Place & s 102nd St.	170	5	12	300	80
47th Ave S & S Victor Street	173	12	6	425	Backup service
				TOTAL:	**50,070**

Notes:

(1) Station and Pipeline Segment Numbers pertain to the Demand Metering program.

(2) Assumes existing 16-inch sonic meter is replaced with a 10-inch Protectus meter as planned.

(3) These stations to be fully transferred from Coal Creek Utility District to Bellevue.

(4) This station supplies to Coal Creek Utility District directly. Assumes Coal Creek sub-meters 40 percent of total flow (average, peak) through this station to Bellevue.

(5) Maximum combined flow of primary and backup stations shall not exceed the flow for the primary station as shown on this Exhibit.

(6) Assumes a new 10-inch Protectus meter is installed as planned.

(7) If another supply source of equal or higher capacity is provided into the Issaquah - Sammamish Plateau area by any party other than Seattle to serve Cascade members, Seattle's supply obligation at this station will terminate. Seattle's delivery obligation at this station is not transferable to any other station.

Block Allocations of Water by Individual SPU Wholesale Water Customers

Water Utility	Annual Block (110%)	Peak Season Factor	Peak Season Block	Peak Month Factor	Peak Month Block
Bothell	1.77	1.35	2.39	1.69	2.99
Cedar River	3.05	1.35	4.11	1.69	5.15
Coal Creek	1.02	1.35	1.38	1.69	1.73
Duvall	0.73	1.35	0.98	1.69	1.23
Edmonds	0.00	1.35	0.00	1.69	0.00
Highline	6.02	1.35	8.12	1.69	10.17
Mercer Island	2.24	1.35	3.03	1.69	3.79
Northshore	6.36	1.35	8.58	1.69	10.75
Olympic View	0.56	1.35	0.76	1.69	0.95
Shoreline WD	1.96	1.35	2.64	1.69	3.31
Soos Creek	5.03	1.35	6.79	1.69	8.50
Woodinville	5.01	1.35	6.76	1.69	8.46
WD 20	2.60	1.35	3.50	1.69	4.39
WD 45	0.33	1.35	0.45	1.69	0.56
WD 49	1.39	1.35	1.87	1.69	2.34
WD 85	0.00	1.35	0.00	1.69	0.00
WD 90	0.91	1.35	1.23	1.69	1.54
WD 119	0.46	1.35	0.62	1.69	0.78
WD 125	2.15	1.35	2.90	1.69	3.63
Existing Purveyor Totals	**41.57**		**56.12**		**70.25**

EXHIBIT IV

Seattle Supply System Facilities

1. **Cedar Source**
   - All roads, buildings, structures, water supply facilities, recreational and educational facilities, and fisheries enhancement and mitigation facilities located within or close to the Cedar River Hydrographic Watershed boundary as defined by Seattle land ownership, including the land itself, and any capitalized studies related to the above. Excepted are facilities solely owned by Seattle City Light for the purpose of power generation. Facilities shared by Seattle City Light and Seattle Public Utilities shall be part of the Seattle Supply System only to the extent of SPU share or responsibility.
   - All facilities located within the Lake Youngs Reservation as defined by Seattle ownership of the land except for conveyance facilities used to transport finished water during non-emergency operation
   - All facilities located within the Lake Youngs Aqueduct, the Landsburg Tunnel, and the Lake Youngs Supply Lines right-of-way, including the right-of-way itself
   - Existing Morse Lake Floating Pump Stations

2. **Tolt Source**
   - All roads, buildings, structures, water supply facilities, recreational and educational facilities, and fisheries enhancement and mitigation facilities located within or close to the South Fork Tolt River Hydrographic Watershed boundary as defined by Seattle land ownership, including the land itself, and any capitalized studies related to the above. Excepted are facilities solely owned by Seattle City Light for the purpose of power generation. Facilities shared by Seattle City Light and Seattle Public Utilities shall be part of the Seattle Supply System only to the extent of SPU share or responsibility.
   - Tolt Treatment Facility

3. **Seattle Wellfields**
   - Riverton Wells, including all pumping and treatment equipment, original yard piping, to the connection to CRPL4, and the low flow piping to Riverton Reservoir
   - Boulevard Well, including all pumping and treatment equipment, and all piping up to the connection to CRPL4

4. **Other**
   - One Percent Conservation Program through December 31, 2003
   - Commercial Incentive Program through December 31, 2003
   - Commercial Toilet Retrofit Program through December 31, 2003
   - Showerhead retrofit Program through December 31, 2003
   - The Seattle Forecasting Model (SEAFM Model)
   - GIS Projects related to facilities identified herein as part of the Seattle Supply System

EXHIBIT V

Seattle Transmission System Facilities

1. Pipelines

- Tolt Pipeline No. 1 from the outlet of the Tolt Treatment Facility (TTF) to Lake Forest Reservoir, including any transfer and ancillary small diameter parallel pipes *(Note: Includes TPL1 and TPL2 between the Reg. Basin and TTF in Supply!)*
- Tolt Pipeline No. 2 (where constructed), including any transfer and ancillary small diameter parallel pipes
- Tolt Tieline
- Tolt Eastside Supply Line (from TESS Junction to the intersection of SE 16th ST and 145th Place SE)
- Tolt Eastside Line Extension (from the intersection of SE 16th ST and 145th Place SE to Eastside Reservoir)
- The 540 head Pipeline from Maple Leaf Reservoir to Lake Forest Reservoir
- Lake Youngs Bypass No. 4 from the outlet of each of the Cedar Treatment Facility clearwells to Control Works
- Lake Youngs Bypass No. 5 from the outlet of each of the Cedar Treatment Facility clearwells to the Lake Youngs Tunnel
- The Lake Youngs Tunnel (from the original lake outlet to Control Works)
- The Maple Leaf Pipeline (from the intersection of 18th Avenue E. and E. Prospect Street to Maple Leaf Reservoir)
- Cedar River Pipeline No. 1 from Control Works to the intersection of 18th Avenue E. and E. Prospect Street
- Cedar River Pipeline No. 2 from Control Works to the intersection of 12th Avenue E. and E. Olive Street
- Cedar River Pipeline No. 3 from Control Works to the intersection of 18th Avenue E. and E. Prospect Street
- 30" intertie between Cedar River Pipelines 2 and 3 in east Olive Street
- Cedar River Pipeline No. 4 from Control Works to the West Seattle Pipeline
- Cedar Eastside Supply Line (from the Cedar Wye to the intersection of SE 16th St and 145th Place SE)
- West Seattle Pipeline from Augusta Gatehouse to Cedar River Pipeline 4
- The 8th Avenue S. Pipeline between S. 146th Street and S. 160th Street
- The Bow Lake Pipeline (between 8th Avenue S. and CRPL 4, and as relocated outside runways at Seatac Airport)
- The Burien Feeder (in S. 146th Street between 8th Avenue S. and CRPL 4)
- The Fairwood Line (between Fairwood Pump Station and Soos Reservoirs)
- The 24-inch discharge pipeline of Lake Youngs Pump Station up to Soos Reservoirs
- The 12-inch discharge pipeline of Lake Youngs Pump Station up to Soos Reservoirs
- The 630 head pipeline between Lake Youngs Pump Station and the Cedar River WSD pump station at the eastern boundary of the Lake Youngs Reservation

2. Reservoirs, Tanks, and Standpipes, including overflow pipes, all valves, appurtenances, and disinfection facility located on the premises of each storage facility, unless otherwise noted

- Lake Forest Reservoir
- Eastside Reservoir
- Riverton Reservoir
- Maple Leaf Reservoir (excluding Roosevelt Way Pump Station and its suction and discharge piping, Maple Leaf Tank and 520 zone piping, except where solely serving the disinfection facility)
- Soos Reservoirs

3. Pump Stations, Major Valve Structures, and other Facilities

- TESS Junction Pump Station
- Lake Hills Pump Station
- Maplewood Pump Station
- Maple Leaf Pump Station
- Bothell Way Pump Station
- Fairwood Pump Station
- Lake Youngs Pump Station
- The Control Works
- Augusta Gatehouse
- Eastgate Pump Station

4. Certain costs related to Cascade Points of Delivery

Cascade Points of Delivery are generally not considered part of the Existing Transmission System Facilities, however, certain costs may be included in the Existing Transmission Cost Pool as follows:

- The costs of existing meters, vaults and related equipment at all Cascade Points of Delivery installed prior to 2004 to the extent those costs were unamortized as of December 31, 2003.
- Any costs related to Cascade Points of Delivery that are included in the Existing Transmission Cost Pool in accordance with the Agreement.

The facilities include the appurtenances to the transmission lines including but not limited to rights of way, line valves, system meters and remote automation devices.

EXHIBIT VI

Cost Centers Used for Operations Cost Indices

The following costs centers or successor cost centers that capture the direct costs of operation of Existing Supply Facilities, Existing Transmission Facilities and the Regional Conservation Program shall be used as the indices for operations cost in the Existing Supply Cost Pool, Existing Transmission Cost Pool and for the Regional Conservation Program in the New Supply Cost Pool.

Supply

Program	Project	Project Name	Activity
Communications	N1203	Communications Activity Group	N120304 Purveyor Relations
Audit & Accounting	N3303	Customer Audit	N330303 Purveyor Audit
Watershed Management	N5401	Program Management	N540194 Department Support
Watershed Management	N5401	Program Management	N540195 General Expense
Watershed Management	N5401	Program Management	N540196 General Management
Watershed Management	N5401	Program Management	N540197 Training
Watershed Management	N5401	Program Management	N540198 Safety
Watershed Management	N5401	Program Management	N540199 Personnel
Watershed Management	N5401	Program Management	N540289 Capital Purchase
Watershed Management	N5403	Support Services	N540301 Modified Duty
Watershed Management	N5403	Support Services	N540302 Procuring/Paying/Receiving
Watershed Management	N5403	Support Services	N540303 Vehicle Equipment Downtime
Watershed Management	N5404	Watershed Protection	N540401 Hydrological Data Collection
Watershed Management	N5404	Watershed Protection	N540402 Fire Protection
Watershed Management	N5404	Watershed Protection	N540403 Inspection
Watershed Management	N5404	Watershed Protection	N540404 Boundaries
Watershed Management	N5405	Facility Management	N540501 WS Grounds
Watershed Management	N5405	Facility Management	N540502 WS Buildings
Watershed Management	N5405	Facility Management	N540503 WS Facilities & Roads
Watershed Management	N5406	Watershed Road Maintenance	N540601 Grade/Gravel/Ditching
Watershed Management	N5406	Watershed Road Maintenance	N540602 Bridges/Streams Culvert
Watershed Management	N5406	Watershed Road Maintenance	N540603 Roads/Row/Vegetation Cutting
Watershed Management	N5406	Watershed Road Maintenance	N540604 Tolt Roads & Streams
Watershed Management	N5407	Watershed Operations Support	N540701 Veh/Equipment Management
Watershed Management	N5407	Watershed Operations Support	N540702 Veh/Equip/Tool Repair
Watershed Management	N5408	Water Quality & Hydrology	N540801 Water Quality Monitoring
Watershed Management	N5408	Water Quality & Hydrology	N540802 Hydrological Monitoring
Watershed Management	N5409	Public/Cultural Programs	N540901 Recreation Planning
Watershed Management	N5409	Public/Cultural Programs	N540902 Management & Research
Watershed Management	N5409	Public/Cultural Programs	N540903 Watershed Education
Watershed Management	N5409	Public/Cultural Programs	N540904 Watershed Public Information
Watershed Management	N5410	Wildlife & Fisheries Programs	N541001 Program Planning & Evaluation
Watershed Management	N5410	Wildlife & Fisheries Programs	N541002 Interagency/Public Involvement
Watershed Management	N5410	Wildlife & Fisheries Programs	N541003 Ecological Monitoring & Research
Watershed Management	N5410	Wildlife & Fisheries Programs	N541004 Habitat & Species Inventory
Watershed Management	N5410	Wildlife & Fisheries Programs	N541005 Habitat Enhancement/Restoration
Watershed Management	N5411	Resource Information Mgmt	N541101 Program Plan/Evaluation
Watershed Management	N5411	Resource Information Mgmt	N541102 Information Maintenance

Watershed Management	N5411	Resource Information Mgmt	N541103 Information Services
Watershed Management	N5412	Special Projects	N541202 Silviculture
Watershed Management	N5412	Special Projects	N541205 Land Exchanges/Acquisitions
Program	**Project**	**Project Name**	**Activity**
Watershed Management	N5415	Cedar HCP	N541501 ASSESS OF EXPAND FOREST STAND
Watershed Management	N5415	Cedar HCP	N541502 ASSESS EXPAND FOREST ATTRIBUTE
Watershed Management	N5415	Cedar HCP	N541503 AUGMENT FOREST HABITAT INV
Watershed Management	N5415	Cedar HCP	N541504 LONG-TERM FOREST HABITAT
Watershed Management	N5415	Cedar HCP	N541505 OLD-GROWTH CLASSIFICATION
Watershed Management	N5415	Cedar HCP	N541506 RIPARIAN RESTOR PROJECT MONIT
Watershed Management	N5415	Cedar HCP	N541507 UP0LAND FOREST RESTOR PROJ MONT
Watershed Management	N5415	Cedar HCP	N541515 GIS DATA COMPATIBILITY STUDY
Watershed Management	N5415	Cedar HCP	N541516 FOREST HABITAT MODELING
Watershed Management	N5415	Cedar HCP	N541517 SPECIE HABITAT RELATION MODEL
Watershed Management	N5416	Cedar HCP	N541601 CRHCP GIS SUPPORT
Watershed Management	N5416	Cedar HCP	N541603 CRHCP TECHNICAL SUPPORT
Watershed Management	N5417	Cedar HCP	N541701 ROAD MAINTENANCE
Watershed Management	N5418	Cedar HCP	N541801 EXPERIMENTAL STREAM MONITORING
Watershed Management	N5418	Cedar HCP	N541802 LONG-TERM STREAM MONITORING
Watershed Management	N5418	Cedar HCP	N541803 AQUATIC RESTORATION MONITORING
Watershed Management	N5418	Cedar HCP	N541804 BULL TROUT SURVEYS (ADULT)
Watershed Management	N5418	Cedar HCP	N541805 BULL TROUT SPAWNING SURVEY
Watershed Management	N5418	Cedar HCP	N541806 BULL TROUT FRY/JUVENILE SURVEY
Watershed Management	N5418	Cedar HCP	Riparian Zone Studies
Watershed Management	N5418	Cedar HCP	N541809 BULL TROUT STREAM DISTRIBUTION
Watershed Management	N5418	Cedar HCP	N541810 BULL TROUT REDD INUNDATION STU
Watershed Management	N5418	Cedar HCP	N541811 COMMON LOON MONITORING
Water Quality & Supply	N5503	Water System Operations	N550301 Water Management
Water Quality & Supply	N5503	Water System Operations	N550302 Water System Control
Water Quality & Supply	N5503	Water System Operations	N550303 Anadromous Fishery Mgmt
Water Quality & Supply	N5503	Water System Operations	N550304 SCADA Management
Water Quality & Supply	N5503	Water System Operations	N550305 Highline Well Field
Water Quality & Supply	N5503	Water System Operations	N550306 Morse Lake PS
Water Quality & Supply	N5503	Water System Operations	N550307-SAFETY PROCESS MGMT COMPLIANCE
Water Quality & Supply	N5503	Water System Operations	N550308-EPA RISK MGMT COMPLIANCE
Water Quality & Supply	N5504	Water System Analysis	N550401 Eng Analysis/Modeling
Water Quality & Supply	N5504	Water System Analysis	N550402 Water Rights Mgmt

Water Quality & Supply	N5504	Water System Analysis	N550403 DEMAND METERING
Water Quality & Supply	N5505	Surface Water Trtmnt Rule	N550501 Monitoring, Reporting & Admin
Water Quality & Supply	N5505	Surface Water Trtmnt Rule	N550502 Cholrination Facilities O&M
Water Quality & Supply	N5505	Surface Water Trtmnt Rule	N550503 Watershed Management
Water Quality & Supply	N5506	Total Coliform Rule Compl.	N550601 Monitoring, Reporting & Admin
Program	**Project**	**Project Name**	**Activity**
Water Quality & Supply	N5508	Lead & Copper Rule Compl.	N550801 Monitoring, Reporting & Admin
Water Quality & Supply	N5508	Lead & Copper Rule Compl.	N550802 Corrosion Trtmnt Facil O&M
Water Quality & Supply	N5509	Fluoridation Program	N550901 Fluoridation Program O&M
Water Quality & Supply	N5510	Other Reg Comp/Monitoring	N551001 Otr Reg/Operational Analysis
Water Quality & Supply	N5510	Other Reg Comp/Monitoring	N551002 Disinfection By-Product Rule
Water Quality & Supply	N5510	Other Reg Comp/Monitoring	N551003 Limnology
Water Quality & Supply	N5510	Other Reg Comp/Monitoring	N551005 WQ Lab
Water Quality & Supply	N5510	Other Reg Comp/Monitoring	N551006 DW Reg Dev & App Research
Water Quality & Supply	N5510	Other Reg Comp/Monitoring	N551007 Public Information/Notification
Water Quality & Supply	N5511	Special Projects	N551104 LIMS & QA/QC
Water Quality & Supply	N5512	Cedar HCP	N551201 INTERIM CHINOOK COHO
Water Quality & Supply	N5513	Cedar HCP	N551301 HCP STREAMFLOW GAUGING
Water Quality & Supply	N5513	Cedar HCP	N551302 SWITCHING CRITERIA STUDY
Water Quality & Supply	N5513	Cedar HCP	N551303 STEELHEAD REDD MONITORING
Water Quality & Supply	N5513	Cedar HCP	N551304 CHINOOK STUDIES
Water Quality & Supply	N5513	Cedar HCP	Salmonid Studies
Water Quality & Supply	N5514	WQ Monitoring	N551403 DRINKING WATER QUALITY MONITOR
Water Quality & Supply	N5515	HCP Fisheries	N551501 FRY CONDITION AT RELEASE
Water Quality & Supply	N5515	HCP Fisheries	N551502 FRY MARKING & EVALUATION
Water Quality & Supply	N5515	HCP Fisheries	N551503 FRY TRAPPING & COUNTING
Water Quality & Supply	N5515	HCP Fisheries	N551504 FISH HEALTH
Water Quality & Supply	N5515	HCP Fisheries	N551505 SHORT-TERM FRY REARING
Water Quality & Supply	N5515	HCP Fisheries	N551506 LAKE WASHINGTON PLANKTON STUDY
Water Quality & Supply	N5515	HCP Fisheries	N551508 ADULT SURVIVAL DISTRIBUTION
Water Quality & Supply	N5515	HCP Fisheries	N551509 PHENOTYPIC & GENETIC STUDY
Water Quality & Supply	N5516	Tolt DBO	N551601-CONTRACTOR PAYMENTS
Water Quality & Supply	N5516	Tolt DBO	N551603-MANAGEMENT COSTS
Resource Planning	N5609	Water Resource & Habitat Issues	N560903-ESA

Transmission

Program	Project	Project Name	Activity
Water Operation	N6540	WT - Headwork/Storage	N654001 Program Maintenance
Water Operation	N6540	WT - Headwork/Storage	N654002 Event Driven Repairs
Water Operation	N6541	WT - Transmission Pipeline Maint	N654101 Program Maintenance
Water Operation	N6541	WT - Transmission Pipeline Maint	N654102 Event Driven Repairs
Water Operation	N6542	WT - Value Op/Maint - Water Tran	N654201 Program Maintenance
Water Operation	N6542	WT - Value Op/Maint - Water Tran	N654202 Event Driven Repairs
Water Operation	N6543	WT - Grounds/Roads/ROW	N654301 Grade/gravel roads - P
Water Operation	N6543	WT - Grounds/Roads/ROW	N654302 Grade/gravel roads - E
Water Operation	N6543	WT - Grounds/Roads/ROW	N654303 Bridges/culverts - P
Water Operation	N6543	WT - Grounds/Roads/ROW	N654304 Bridges/culverts - E
Water Operation	N6543	WT - Grounds/Roads/ROW	N654305 Fences/gates - P
Water Operation	N6543	WT - Grounds/Roads/ROW	N654306 Fences/gates - E
Water Operation	N6543	WT - Grounds/Roads/ROW	N654307 Mow ROW - P
Water Operation	N6543	WT - Grounds/Roads/ROW	N654308 Mow ROW - E
Water Operation	N6543	WT - Grounds/Roads/ROW	N654309 Mow Other
Water Operation	N6544	WT - Facility Maintenance	N654401 Program Maintenance
Water Operation	N6544	WT - Facility Maintenance	N654402 Event Driven Repairs
Water Operation	N6545	WT - Castings	N654501 Casting Adjustments
Water Operation	N6546	WT - Customer Services	N654601 Communications/Dispatch
Water Operation	N6546	WT - Customer Services	N654602 Locating/Marking
Water Operation	N6547	WT - Damage by Others	N654701 P/L/ROW/Facility
Water Operation	N6548	WT - Transmission Shops	N654801 Shops/Fabrication
Water Operation	N6549	WT - General Expenses	N654905 Tools/small equipment
Water Operation	N6549	WT - General Expenses	N654906 Standy
Water Operation	N6549	WT - General Expenses	N654907 Truck Inventory
Water Operation	N6549	WT - General Expenses	N654908 Downtime - Job Related
Water Operation	N6549	WT - General Expenses	N654909-DISASTER-EMERG RESPONSE

1% Program

Program	Project	Project Name	Activity
Community Services	N5303	Resource Conservation	N530301 1% Conservation

EXHIBIT VII

Cascade Sub-regional System

The facilities included in this Exhibit incorporate all appurtenances including but not limited to rights of way, line valves, system meters, and remote automation devices.

A. Facilities used by Cascade:

- The NE 8th Street Feeder, from the Cedar Eastside Supply Line to the Bellevue pump station near the intersection of 151st PL NE and NE 8th Street
- The Bel-Red Road Feeder, from the Cedar Eastside Supply Line to the Cascade Point of Delivery in Bellevue at the intersection of Bel-Red Road and 132nd Ave NE
- The NE 24th Street Feeder, from the Cedar Eastside Supply Line to the Cascade Point of Delivery in Bellevue near the intersection of NE 24th Street and 132nd Ave NE

B. Other Sub-regional Transmission Facilities used in part by Cascade:

- SEGMENT 1 – Includes use by Bellevue, Coal Creek, Mercer Island, and Seattle and consists of:
  1. The portion of the of the original Mercer Island Pipeline from the tee off the Cedar Eastside Supply Line in Factoria Boulevard SE to the west flange of the main line tee at the east end of the 16-inch Mercer Slough Bridge Pipeline (30-inch).
- SEGMENT 2 – Includes use by Bellevue, Mercer Island, and Seattle and consists of:
  1. The portion of the of the original Mercer Island Pipeline from the west flange of the main line tee at the east end of the 16-inch Mercer Slough Bridge Pipeline to the west flange of the 20-inch valve west of the Enatai service to Bellevue (30-inch).
  2. The entire 16-inch Mercer Slough Bridge Pipeline (16-inch).
- SEGMENT 3 – Includes use by Tukwila and Seattle and consists of:
  1. The 20-inch pipeline in West Marginal Way from the West Seattle Pipeline to South Director Street.

Seattle may from time to time eliminate facilities from this list provided that it secures the written consent of Cascade in the event that Cascade is served by a tap or meter installation on the facility being eliminated. Seattle shall provide Cascade with 180 days prior written notice of any proposed change.

SEATTLE PUBLIC UTILITIES & CASCADE WATER ALLIANCE
MANAGEMENT AGREEMENT No. 7

REVISIONS TO EXHIBIT I

This Management Agreement No. 7 is entered into pursuant to Sections 3.6 B and 4.4 of the 2nd Amended and Restated Declining Block Water Supply Agreement between the City of Seattle ("Seattle") and the Cascade Water Alliance ("Cascade"), dated July ___, 2013 ("Agreement").

<u>**Management Agreement**</u>

1. The revised exhibit attached and incorporated herein as "Revised Exhibit I" replaces the existing Exhibit I in the Agreement in its entirety.
2. The Parties understand and agree that changes to any of the agreements listed in the Revised Exhibit 1 or new agreements involving supply, purchase or resale of water that Cascade or any Cascade Member enters into with a non-Cascade Member during the term of the Agreement should be reviewed by the Parties to determine which provision of 3.6 B applies to the situation and whether an update to the Revised Exhibit 1 by Management Agreement is necessary. The Parties also understand and agree that this will include a review of new agreements, or existing agreements that may remain in effect, between Cascade or a Cascade Member and a withdrawing Cascade Member at the time of the withdrawal in the event a current Cascade Member withdraws its membership from Cascade. Cascade agrees that it will promptly notify and provide copies of such agreements to Seattle as appropriate.
3. The Parties understand and agree that additional updates to the Revised Exhibit I may be required to address the electric contracts for pump stations included in Section 3.a of the Revised Exhibit I, which the parties will endeavor to complete by December 31, 2013.

Agreed to:

Ray Hoffman 7/15/13
Ray Hoffman, Director — Date
Seattle Public Utilities

Chuck Clarke 7/12/13
Chuck Clarke, CEO — Date
Cascade Water Alliance

Attachment: Revised Exhibit I, dated July 11, 2013

2. **Those agreements providing wholesale water supply to Non-Cascade Member wholesale customers as of January 31, 2013 as referenced in Section 3.6 B.2**:

   a) Bellevue to WD 1 (Yarrow Point)

   @ NE 38th & 92nd Ave NE
   @ NE 42nd & 92nd Ave NE

   b) Bellevue to KC WD 22 (Beaux Arts)[6]

   @ 108th Ave SE & SE 28th St

   c) City of Issaquah to Issaquah Highlands Community Assoc for the Grand Ridge Drive Water Utility

   @ NE Harrison Dr & Grand Ridge Dr

   d) Sammamish Plateau W&SD to Overdale Water Assoc[7]

   @ 5215 229th Ave SE near SE 52nd St

3. **Other relevant Agreements as referenced in Section 4.4**:

   a) List of electric contracts for pump stations owned and operated by Cascade Members and connected to the Tolt Eastside Supply Line according to Section 8.6 B.3 of this Agreement:

      1. Between the City of Bellevue and the City of Seattle, effective August 1983, pursuant to Ordinance #111276 for SE 28th pumping station (50% / 50%) and N.E. 8th pumping station (Bellevue 60% / Seattle 40%)

   b) Sammamish Plateau W&SD to/from Northeast Sammamish W&SD[8]

   @ 216th Ave NE & NE 17th
   @ 1910 226th Ave NE

   c) Redmond/Woodinville Water District Interlocal Agreement and 7 Amendments[9]

      1. East of 184th Ave NE
      2. Blakely Ridge (Trilogy)
      3. 177th Ave NE & 184th Ave NE
      4. 167th Ave NE & 172nd Ave NE
      5. Shadowbrook Phase II
      6. Redmond Assembly Plat
      7. East of 176th Ave NE

d) Skyway from Renton[10]

@ 80th Ave S & S 116th St

e) Interlocal Agreement Implementing the City of Bellevue's Partial Assumption of the Coal Creek Utility District[11]

@ Hazelwood Ln
@ SE 64th & Lake Washington Blvd
@ 114th Ave SE
@ 119th Ave SE
@ 123rd Ave SE
@ Newcastle & 126th Ave SE
@ Newcastle & 128th Ave SE
@ Coal Creek & SE 66th ST

Notes:

[1] No agreement exists for this intertie connection. Cascade reported as emergency intertie.
[2] See Section 5 of the Agreement for Joint Operation of Water Storage Facilities.
[3] See Section 5 of the Agreement for Joint Lease, Construction and Operation of Water Storage and Transmission Facilities, generally for wheeling.
[4] Emergency purposes includes meeting peak demand. Any agreement for use for purposes other than emergency under Section 4 of the Agreement not included here.
[5] Emergency purposes, max quantity 2.7 MGD.
[6] Cascade reported as seasonal supplemental supply.
[7] Cascade reported that by resolution, converted from emergency supply to continuous wholesale supply pending assumption of the Overdale service area expected within a year.
[8] Cascade reported as continuous supply through "zero-net exchange".
[9] Interlocal agreement establishes common service area boundary, provisions for District to supply water to Redmond for certain service areas, and to determine on case by case basis which entity will serve developments that straddle common service boundary line.
[10] See Section 4 and Exhibit B of Contract for Water Supply and Joint Storage and Transmission.
[11] See Section XIV of the Interlocal Agreement.

SEATTLE PUBLIC UTILITIES & CASCADE WATER ALLIANCE
MANAGEMENT AGREEMENT No. 9

REVISIONS TO EXHIBIT II

This Management Agreement No. 9 is entered into pursuant to Section 4.1 of the 2nd Amended and Restated Declining Block Water Supply Agreement between the City of Seattle ("Seattle") and the Cascade Water Alliance ("Cascade"), dated July 15, 2013 ("Agreement").

Management Agreement

1. The revised exhibit attached and incorporated herein as "Revised Exhibit II" replaces the existing Exhibit II in the Agreement in its entirety.

Agreed to:

Ray Hoffman	5/24/14	Chuck Clarke	5/27/14
Ray Hoffman, Director Seattle Public Utilities	Date	Chuck Clarke, CEO Cascade Water Alliance	Date

Attachment: Revised Exhibit II, dated March 27, 2014

Exhibit II

CASCADE POINTS OF DELIVERY[(1)], MINIMUM HYDRAULIC GRADIENTS, AND MAXIMUM FLOW RATES OF WATER SUPPLIED

POINT OF DELIVERY (POD)							MINIMUM HYDRAULIC GRADIENT UPSTREAM OF SEATTLE METER (FEET NAVD-88 Datum) [(2)]	MAXIMUM FLOW UP TO WHICH HYDRAULIC GRADIENT IS GUARANTEED UNDER THE AGREEMENT [(3)(4)] (gpm)
SEATTLE METER LOCATION	CASCADE MEMBER OPERATING DOWNSTREAM OF POD	SEATTLE STATION NUMBER	SEATTLE PIPELINE SEGMENT NUMBER	SEATTLE METER SIZE (IN.)	CASCADE MEMBERS SERVED	SIZE OF CASCADE MEMBER METER(S), (IN.) [(2)]		
132nd Ave. NE & NE 113th Street	Kirkland	74	1	10"	Kirkland, Redmond	12"	555	3,540
132nd Ave. NE & NE 85th Street	Kirkland	75	1	16"	Kirkland, Redmond	None	535	4,890
140th Ave. NE & NE 70th Street	Kirkland	72	2	12"	Kirkland, Redmond	12"	520	1,430
140th Ave. NE & 40th Street	Bellevue	65	2	10"	Bellevue, Redmond	18"	500	3,800
132nd Ave. NE & Bel-Red Road	Bellevue	62	2	12"	Bellevue	12"	470	4,200
132nd Ave. NE & NE 24th Street	Bellevue	63	2	10"	Bellevue	12"/8" [(5)]	455	3,900
152nd Ave. NE & NE 8th Street	Bellevue	61	2	24"	Bellevue, Redmond	16"	460	3,000
145th Pl. SE & SE 28th Street	Bellevue	58	3	12"	Bellevue	16"	470	2,700
14509 SE Newport Way	Bellevue	60	3	10"	Bellevue, Issaquah	12"	525	2,300
14509 SE Newport Way	Bellevue	182	3	10"	Bellevue, Issaquah, Sammamish Plateau	12"/8"/8" [(6)]	525	5,810
132nd Ave SE & SE 26th ST	Bellevue	59	8	8"	Bellevue	8"	425	1,300
128th Ave. SE & Newport Way	Bellevue	56	8	8"	Bellevue	8"	435	800
128th Ave SE & SE 56th ST	Bellevue	47	8	8"	Bellevue	6"	440	Backup service
128th Ave SE & Newport Way	Bellevue	55	8	6"	Bellevue	6"	435	625
128th Ave SE & SE 70th ST	N/A	52	8	12"	Bellevue		445	1700 [(7)]

POINT OF DELIVERY (POD)							MINIMUM HYDRAULIC GRADIENT UPSTREAM OF SEATTLE METER (FEET NAVD-88 Datum) [2]	MAXIMUM FLOW UP TO WHICH HYDRAULIC GRADIENT IS GUARANTEED UNDER THE AGREEMENT [3] [4] (gpm)
SEATTLE METER LOCATION	CASCADE MEMBER OPERATING DOWNSTREAM OF POD	SEATTLE STATION NUMBER	SEATTLE PIPELINE SEGMENT NUMBER	SEATTLE METER SIZE (IN.)	CASCADE MEMBERS SERVED	SIZE OF CASCADE MEMBER METER(S), (IN.) [2]		
Mercer Is. Pipeline & 108th Ave. SE	Bellevue	66	9	8"	Bellevue	8"	420	800
124th Ave SE & SE 38 PL	Bellevue	124	9	8"	Bellevue	8"	425	1,400
Cornell Ave S & S 112th Street	Skyway	172	4	6"	Skyway	None	375	Backup service [8]
84th Ave. S & S 134th Street	Skyway	1	10	8"	Skyway	None	455	210
Beacon Ave S & S 124th Street	Skyway	5	10	8"	Skyway	8"	455	720
W Marginal Place & S 102nd ST	Tukwila	170	5	12"	Tukwila	12"	300	300
51st Ave S & S Leo Street	Tukwila	169	12	8"	Tukwila	8"	455	70
47th Ave S & S Victor Street	Tukwila	173	12	6"	Tukwila	6"	425	Backup service
South Center Parkway & Tukwila Parkway	Tukwila	13	13	10"	Tukwila	10"	460	800
West Valley Hwy & S 162nd Street	Tukwila	14	13	8"	Tukwila	8"	460	Backup service
Christensen Rd. & Baker Rd	Tukwila	15	13	8"	Tukwila	10"	460	840
53rd Ave S & S 160th Street	Tukwila	16	13	6"	Tukwila	6"	460	20
E Marginal Way & S 112th Street	Tukwila	183	15	12"	Tukwila	12"	445	900
7749 E Marginal Way S	Tukwila	168	20	12"	Tukwila	12"	N/A	Backup service [8]
Trilogy Parkway NE & NE 125 Street (East meter)	Redmond	164	28	10"	Redmond, Sammamish Plateau	16"	610	2900 [9]
Trilogy Parkway NE & NE 125 Street (West Meter)	Redmond	186	28	10"	Redmond, Sammamish Plateau	16"	610	Redundant Supply [9]
160th Ave NE & NE 104th Street	Redmond	165	28	10"	Redmond	16"	515	2420 [10]
NE 172nd Street & Tolt Pipeline No. 2	Redmond	185	28	6"	Redmond	16"	515	Redundant Supply [10]
							TOTAL:	51,375

POINT OF DELIVERY (POD)							MINIMUM HYDRAULIC GRADIENT UPSTREAM OF SEATTLE METER (FEET NAVD-88 Datum) [3]	MAXIMUM FLOW UP TO WHICH HYDRAULIC GRADIENT IS GUARANTEED UNDER THE AGREEMENT [3][4] (gpm)
SEATTLE METER LOCATION	CASCADE MEMBER OPERATING DOWNSTREAM OF POD	SEATTLE STATION NUMBER	SEATTLE PIPELINE SEGMENT NUMBER	SEATTLE METER SIZE (IN.)	CASCADE MEMBERS SERVED	SIZE OF CASCADE MEMBER METER(S), (IN.) [2]		

Notes:

1. All Points of Delivery (PODs) provide a wholesale level of service. Seattle bears no responsibility for retail service level obligations, such as fire flow or emergency backup.
2. This column is for informational purposes only, i.e., there are no related terms or conditions under the Agreement. Cascade will be responsible for providing Seattle with updated Cascade Member information from time to time.
3. These minimum hydraulic gradients and maximum flows relate to contractual conditions under the Agreement, but do not necessarily reflect practical or operational limits at particular PODs.
4. Except as provided in Note 7 below, all or some of the maximum flows allocated to each POD may be reallocated to another POD on the same Pipeline Segment Number, including those PODs designated as Backup Services. In that case, minimum hydraulic gradients are not guaranteed.
5. Flow branches into two metered Bellevue pipelines downstream of Station 63.
6. The 12" Bellevue meter is located at 4112 161st Ave SE. The two 8" meters that each serve Issaquah and the Sammamish Plateau are located at 16104 SE Newport Way in a single meter vault.
7. The maximum flow shown is the portion serving Bellevue via Coal Creek Utility District. All or a portion of this maximum flow may be reallocated from this POD to other PODs on the same Pipeline Segment Number, but additional flows from other PODs may not be reallocated to this POD.
8. When a Backup Service is the only POD on a Pipeline Segment Number, the Cascade Member operating the Backup Service can re-allocate all or portions of the maximum flows from other PODs it operates to that Backup Service, regardless of Pipeline Segment Number. In that case minimum hydraulic gradients are not guaranteed.
9. The maximum flow that can be shared between Stations 164 and 186 is 2,900 gpm.
10. The maximum flow that can be shared between Stations 165 and 185 is 2,420 gpm.

Appendix I

Proposed SA270 Improvements

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City of Bellevue

MEMORANDUM

Date: June 12, 2015

To: Paul Bucich, P.E., Utilities Assistant Director, Engineering

Cc: Andrew Lee, P.E., Utilities Deputy Director

From: Douglas Lane, P.E.

Subject: South Cove Pressure Reducing Valve Station

Executive Summary

The intent of this memorandum is to document the existing Sammamish 270 pressure zone (SA270) mode of operation, and propose a solution to mitigate low pressure and fire flow. Installation of a new pressure reducing valve (PRV) station in the South Cove area, coupled with a pressure increase in the western portion of the SA270, could resolve most low pressure concerns under normal operation and improve fire flows in both Bellevue and Issaquah. It would also enable the City of Issaquah to have full control over the operation of Sammamish Reservoir following Issaquah's assumption of the South Cove water assets in 2016. Figure 1 shows a vicinity map.

Observations:

- The location of Sammamish Reservoir relative to water sources tends to limit water turnover, and subsequently increase water age and chlorine degradation.
- The Sammamish Reservoir overflow elevation limits static pressure in SA270.
- Bellevue has implemented a control strategy to create more turnover in the reservoir. A side effect of this strategy is even lower pressure in SA270.
- Within SA270, high points with less than 30 psi static pressure have been identified in Issaquah and in Bellevue.
- Available fire flow over large areas of SA270 (in Bellevue and Issaquah) are below the City's standard of 1,000-gpm, due to the need to maintain 20-psi at the high points with low static pressure.

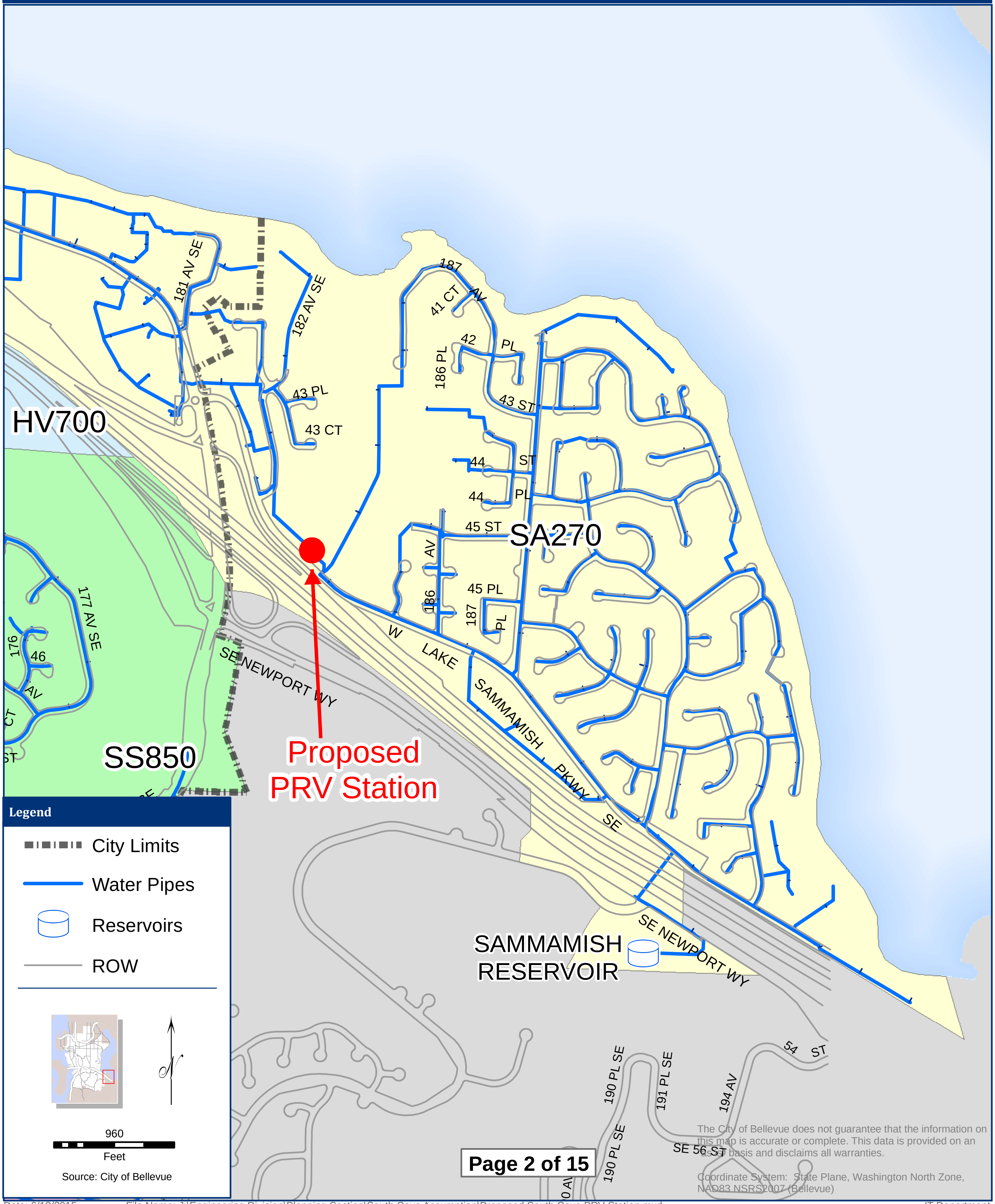
Recommendations:

- Install a PRV station in the 12" water main at 4500 W Lake Sammamish Pkwy.
- Gradually increase pressure in SA270 from roughly 250 ft HGL up to 270 ft HGL.
- Prior to increasing pressure, evaluate associated risks (AC main breaks, saddle failures, need to install individual PRVs, etc) and mitigate as appropriate.

Proposed South Cove PRV Station

Figure 1

City of Bellevue GIS Services



Legend

- City Limits
- Water Pipes
- Reservoirs
- ROW

960 Feet

Source: City of Bellevue

Page 2 of 15

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

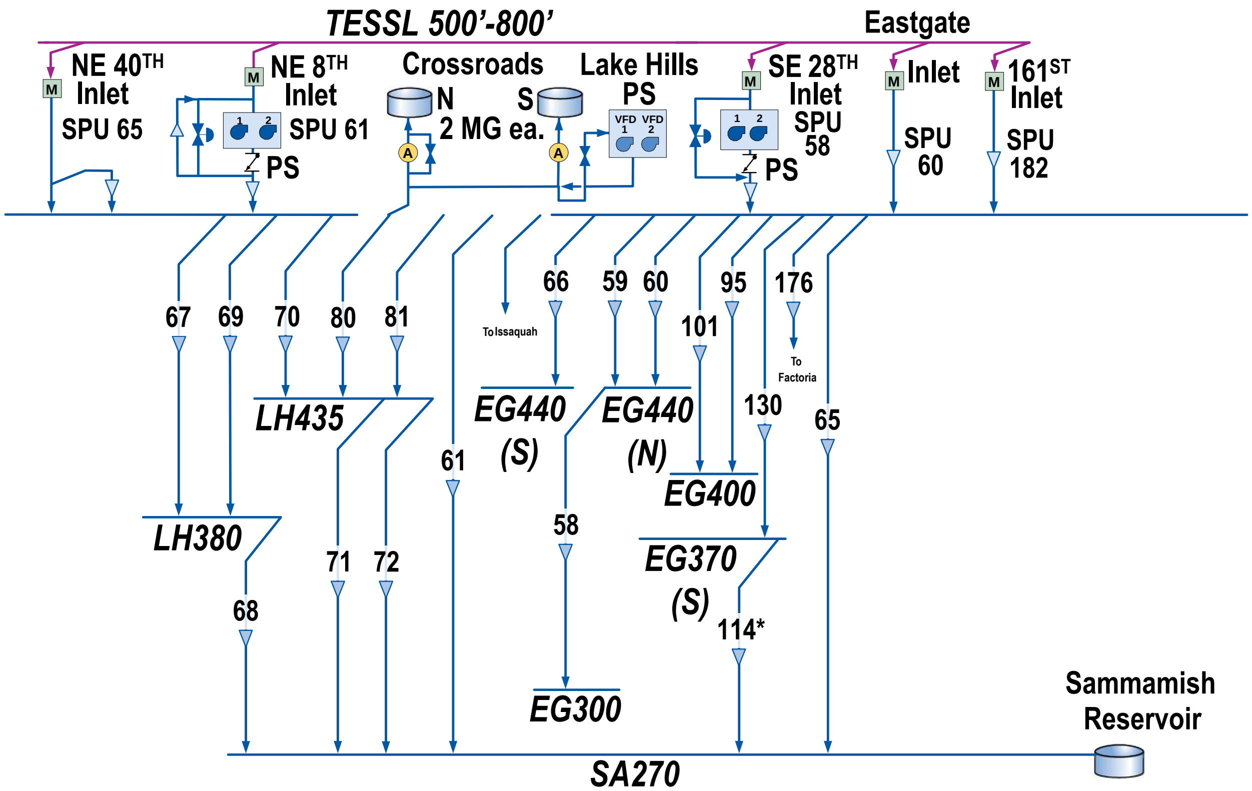
Coordinate System: State Plane, Washington North Zone, NAD83 NSRS2007 (Bellevue)

Date: 6/12/2015 File Name: J:\Engineering Division\Planning Section\South Cove Assumption\Proposed South Cove PRV Station.mxd IT Department

Current Operation

Sammamish Reservoir and SA270 are fed by gravity from Bellevue's Lake Hills 520 pressure zone (LH520) and ultimately SPU's Tolt Eastside Supply Line (TESSL) through various PRVs and intermediate pressure zones. Figure 2 shows a partial hydraulic profile of the existing local water system feeding SA270.

Figure 2: Partial Existing System Hydraulic Profile



Due to the remote location of Sammamish Reservoir and its long, 12" inlet/outlet pipe, low turnover and subsequently low chlorine residuals have been observed at the reservoir. To induce more turnover, Bellevue uses telemetry controls at PRV station #65 to force fill/draw cycles in the reservoir.

PRV station #65 is the closest PRV station to South Cove. It is equipped with two PRVs (8" and 3"), and a solenoid that controls the 8" PRV based on time of day and Sammamish Reservoir level. When active, the 8" PRV fills Sammamish Reservoir. When the 8" PRV is closed, system demands drain the reservoir. The 8" valve is set to fully close automatically at approximately 6:00 a.m. to force the reservoir level to drop. When the reservoir drops to the low-level setpoint (typically a depth of 22-feet or 246.5-feet HGL; but recently increased to 26-feet or 250.5-feet HGL) the 8" PRV opens and is free to modulate at its setting (currently 27 psi, or 264 HGL).

The current mode of operation, intended to mitigate low chlorine residuals, also causes low pressures at multiple higher-elevation locations in SA270. Pressures are low due to the low reservoir overflow elevation (259.5-feet), a buffer left at the top of the reservoir to avoid overflows, and the necessary range of elevation to induce turnover (described above). Figures 3 and 4 show observed static pressures at hydrant #108011 (913 170th Pl SE in Bellevue) and hydrant #103805 (4402 W Lake Sammamish Pkwy in Issaquah) during normal operating conditions. Customers near both locations use private booster pumps due to inadequate service pressure.

Figure 3: Hydrant #108011 in Bellevue Observed Pressure

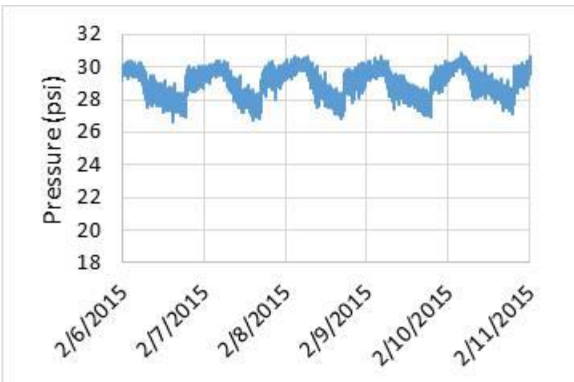
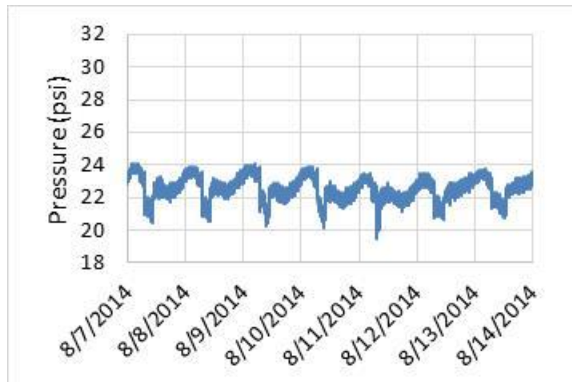


Figure 4: Hydrant #103805 in Issaquah Observed Pressure



Bellevue has a goal of providing a minimum 30-psi throughout the entire water distribution system[1], and the Washington State Department of Health requires that at least 30-psi be available for new construction[2]. The Utilities Department has a performance measure to regularly report progress toward this goal.

Bellevue's adopted Fire Flow Improvement Program policy stipulates "The Utility shall implement a program with the objective of meeting a minimum standard fire flow of 1,000 gpm throughout the distribution system." Additionally, the Utilities Department has a performance measure to regularly report progress toward this goal. Although no timeline has been established for meeting this criterion, the Utilities Department has policy direction to make system improvements necessary to provide at least 1,000-gpm available fire flow.

As a result of low static pressures (21-22 psi) at high points in SA270, available fire flows are restricted throughout the zone, below 1,000-gpm in most locations, and as low as about 300 gpm at 4334 West Lake Sammamish Pkwy SE. Available fire flow is the hydrant flow that drops pressure to 20-psi at any location (Bellevue also applies a 10-ft/s maximum velocity for design purposes).

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[1] 2006 City of Bellevue Water Comprehensive Plan, Page 2-4.
[2] Washington Administrative Code 246-290-230.

Proposed Improvements

Figure 1 and Figure 5 show the potential physical location and revised SA270 hydraulic profile with the proposed addition of a PRV station in South Cove. This improvement coupled with a pressure increase in the west end of SA270 would mitigate low pressure areas and improve fire flows throughout SA270. It would also enable the City of Issaquah to have full control of Sammamish Reservoir water levels without the assistance of Bellevue staff.

Figure 5: Partial Proposed System Hydraulic Profile

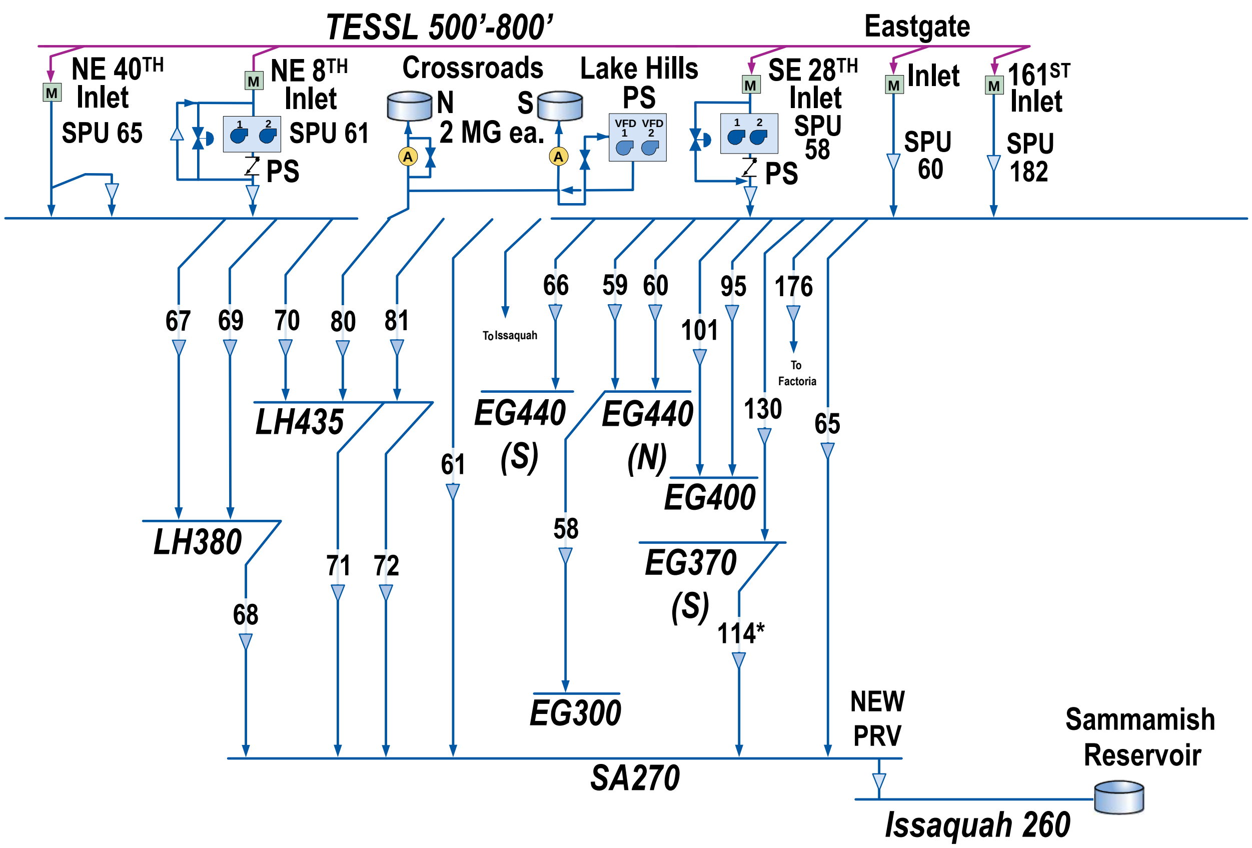


Figure 6 shows a map of SA270 following installation of the proposed PRV Station and increased settings at PRV stations #61, 65, 68, 71, 72 and 114.

Figure 6: SA270 Modeled Pressure

Existing Conditions | Proposed Conditions

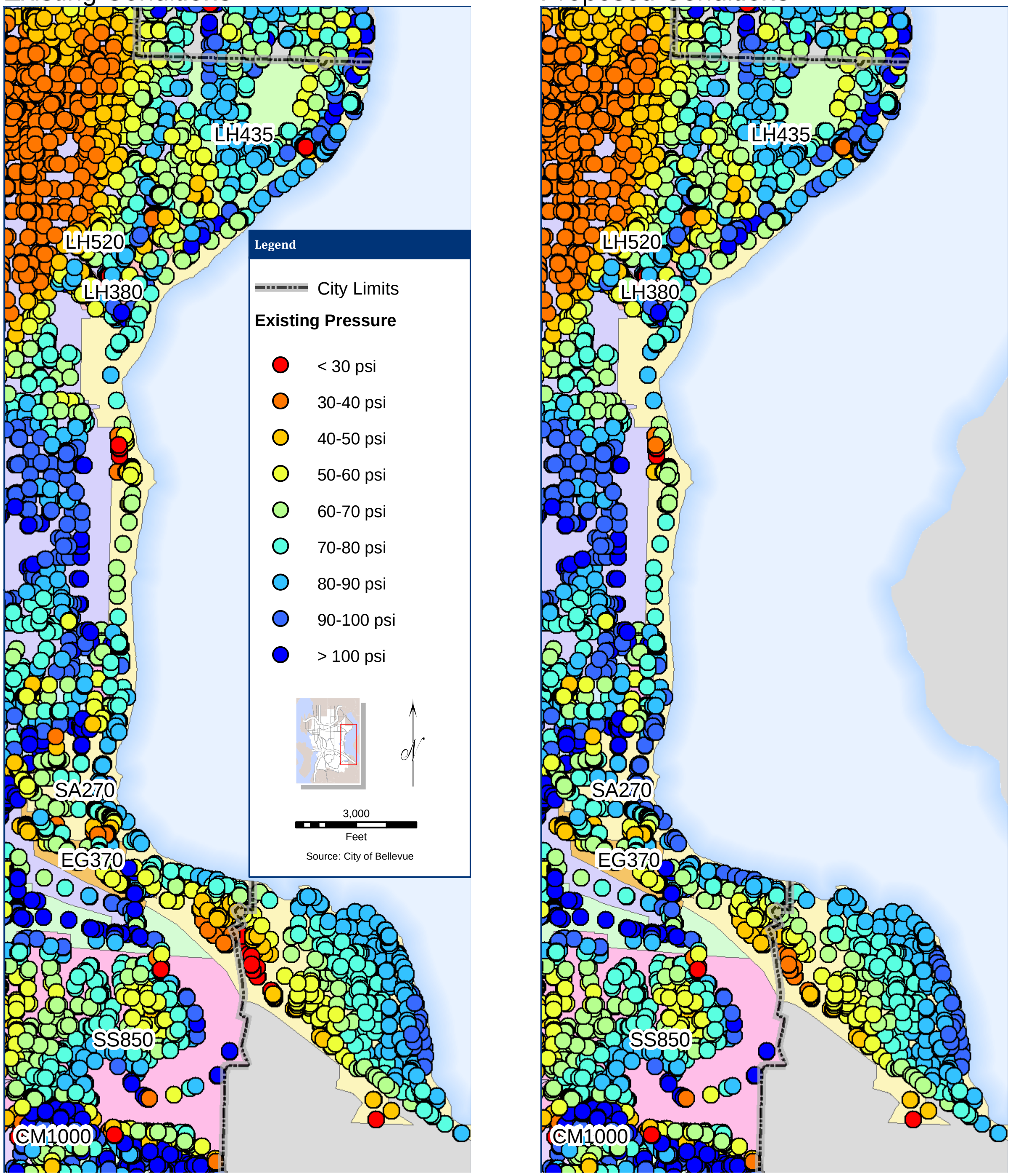


Table 1 (attached) and Figure 7 show available fire flows at each hydrant in SA270, under existing conditions and following the proposed improvements. This analysis only considers the 20-psi minimum, and not Bellevue's 10-ft/s maximum velocity criterion, which is used for design purposes but not for analyzing the fire flow performance measure.

The proposed operating strategy would substantially improve fire flow availability in SA270 south of SE 26th Street, providing >1,000-gpm to nearly all customers in that area. Fire flow availability near Weowna park in Bellevue would improve somewhat, but would still be limited temporarily until the 6" AC main serving the vicinity is replaced (tentatively proposed for 2017-2018).

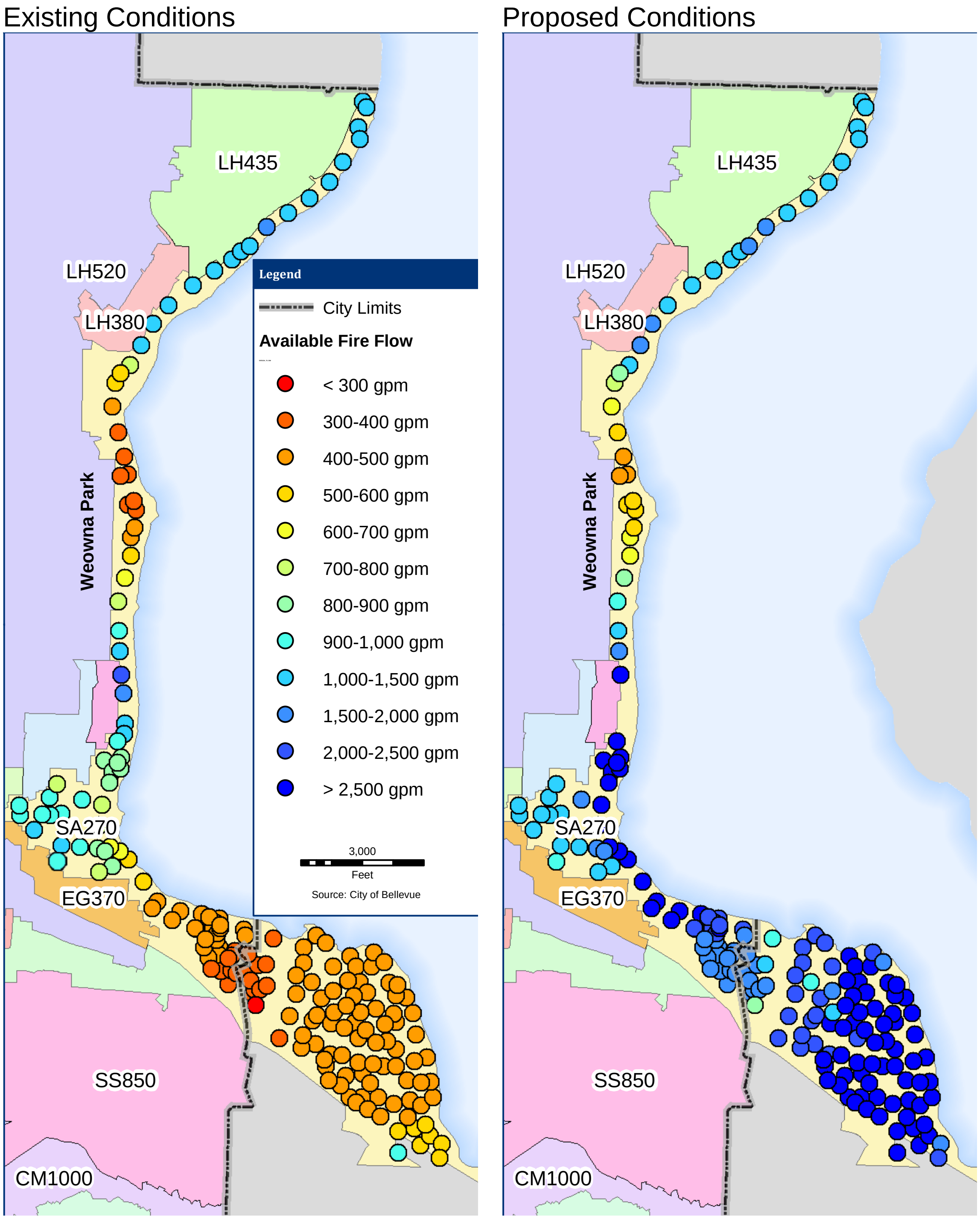
Potential Impacts of Improvements

The proposed improvements and subsequent increase in SA270 static pressure would increase some risks and possibly require ancillary costs associated with higher pressure. These risks and costs should be understood prior to implementation of the proposed strategy.

Increasing pressure could increase the likelihood of failure in existing asbestos cement (AC) water mains. This increased risk is most significant for the 6" AC main along W Lake Sammamish (from approximately SE 18th St to NE 8th St), due the high potential consequence of failure at that location. A landslide and main break farther south resulted in closure of W Lake Sammamish Pkwy for a period of months, as well as private property damage and significant erosion.

Household plumbing is typically designed for up to 80-psi pressure. Individual PRVs may be needed at some connections that have historically been below this threshold, but would have 80+ psi following the proposed operational changes. Based on initial modeling analysis, this could affect up to approximately 50-100 connections in Bellevue, but only a marginal number in Issaquah, if any. This number would be reduced if it is found that these customers already have individual PRVs, or if it is demonstrated that the zone was actually operated at higher pressure in the past. A typical individual PRV station could cost $500-$1,000 each, depending on site-specific circumstances.

Figure 7: SA270 Modeled Fire Flow Availability



Jurisdictional Control

The current control strategy requires modification of PRV settings in Bellevue to regulate the water level in Sammamish Reservoir (in Issaquah) and the pressure at South Cove (Issaquah) customer connections. After the proposed assumption of South Cove infrastructure by the City of Issaquah, the existing controls would require Issaquah to request action by Bellevue to implement any operational changes in South Cove.

If a PRV station is installed in South Cove, Issaquah would assume full control over downstream pressure and level fluctuation in Sammamish Reservoir. This would enable Issaquah to provide better customer service and avoid operational inefficiencies for Bellevue staff.

Conclusions

It is recommended that a PRV station be installed in W Lake Sammamish Blvd and the pressure in the western portion of SA270 be increased. These improvements would mitigate known low pressure and fire flow problems, and provide Issaquah full control of Sammamish Reservoir operation after assumption of South Cove water assets in 2016.

Table 1: SA270 Available Fire Flow @ 20 psi Minimum[3]

Hydrant #	Current Available Fire Flow (gpm)	Proposed Available Fire Flow (gpm)	Improvement (gpm)	Municipality
101745	750	990	240	BELLEVUE
101933	1,200	1,510	310	BELLEVUE
101770	930	1,190	260	BELLEVUE
101746	670	890	220	BELLEVUE
101747	520	700	180	BELLEVUE
101958	850	4,690	3,840	BELLEVUE
101960	1,100	5,780	4,680	BELLEVUE
101953	1,810	6,500	4,690	BELLEVUE
101955	2,430	3,090	660	BELLEVUE
101772	840	2,620	1,780	BELLEVUE
101959	1,000	5,290	4,290	BELLEVUE
104843	830	4,120	3,290	BELLEVUE
101766	1,000	930	-70[4]	BELLEVUE
101735	990	1,590	600	BELLEVUE
101728	930	1,290	360	BELLEVUE
101832	930	1,300	370	BELLEVUE
101709	830	3,920	3,090	BELLEVUE
101829	970	1,500	530	BELLEVUE
101732	770	3,440	2,670	BELLEVUE
101831	1,180	1,420	240	BELLEVUE
101777	720	3,280	2,560	BELLEVUE
101839	350	470	120	BELLEVUE
101840	370	510	140	BELLEVUE
108031	390	520	130	BELLEVUE
108005	450	600	150	BELLEVUE
108012	340	450	110	BELLEVUE
108023	390	520	130	BELLEVUE
108009	430	570	140	BELLEVUE
108011	320	430	110	BELLEVUE
104796	380	500	120	BELLEVUE
108048	520	3,250	2,730	BELLEVUE
108036	410	1,920	1,510	BELLEVUE
108067	390	1,770	1,380	BELLEVUE
108039	490	3,180	2,690	BELLEVUE

[3] Analyzed without using Bellevue's 10-ft/s maximum velocity design criterion.
[4] Hydrant 101766 is limited by a critical node in the EG370 zone upstream of PRV #114

Hydrant #	Current Available Fire Flow (gpm)	Proposed Available Fire Flow (gpm)	Improvement (gpm)	Municipality
108042	460	3,120	2,660	BELLEVUE
108051	440	2,940	2,500	BELLEVUE
105311	430	2,180	1,750	BELLEVUE
108045	430	2,210	1,780	BELLEVUE
108068	400	1,810	1,410	BELLEVUE
108060	400	1,850	1,450	BELLEVUE
108062	400	1,870	1,470	BELLEVUE
108037	410	1,920	1,510	BELLEVUE
108032	410	1,980	1,570	BELLEVUE
108049	420	2,100	1,680	BELLEVUE
104140	420	2,150	1,730	BELLEVUE
104790	440	2,350	1,910	BELLEVUE
108038	440	2,380	1,940	BELLEVUE
108034	470	3,420	2,950	BELLEVUE
108010	440	2,330	1,890	BELLEVUE
104215	1,110	1,130	20	BELLEVUE
104214	1,230	1,240	10	BELLEVUE
103762	440	2,090	1,650	ISSAQUAH
103813	440	970	530	ISSAQUAH
103790	370	1,550	1,180	ISSAQUAH
103759	400	1,790	1,390	BELLEVUE
103784	420	2,390	1,970	ISSAQUAH
103783	380	990	610	ISSAQUAH
103812	410	2,010	1,600	BELLEVUE
103765	370	1,570	1,200	ISSAQUAH
103794	440	1,520	1,080	ISSAQUAH
103760	400	1,820	1,420	BELLEVUE
103761	390	1,740	1,350	BELLEVUE
103758	390	1,690	1,300	BELLEVUE
103781	380	1,650	1,270	ISSAQUAH
103763	390	1,620	1,230	ISSAQUAH
103789	370	1,530	1,160	ISSAQUAH
103786	390	1,660	1,270	ISSAQUAH
103788	380	1,590	1,210	ISSAQUAH
103827	430	2,410	1,980	ISSAQUAH
103771	420	2,380	1,960	ISSAQUAH
103921	450	2,120	1,670	ISSAQUAH
103815	440	2,610	2,170	ISSAQUAH

Hydrant #	Current Available Fire Flow (gpm)	Proposed Available Fire Flow (gpm)	Improvement (gpm)	Municipality
103793	430	2,480	2,050	ISSAQUAH
103800	430	2,480	2,050	ISSAQUAH
103804	430	2,500	2,070	ISSAQUAH
103803	390	2,230	1,840	ISSAQUAH
103798	440	2,540	2,100	ISSAQUAH
103797	440	1,480	1,040	ISSAQUAH
103835	450	2,590	2,140	ISSAQUAH
103834	440	2,530	2,090	ISSAQUAH
103829	440	2,540	2,100	ISSAQUAH
103846	450	2,620	2,170	ISSAQUAH
103837	450	2,610	2,160	ISSAQUAH
103839	440	2,540	2,100	ISSAQUAH
103840	450	2,560	2,110	ISSAQUAH
103891	480	2,800	2,320	ISSAQUAH
103893	490	2,860	2,370	ISSAQUAH
103882	460	2,740	2,280	ISSAQUAH
103871	440	2,660	2,220	ISSAQUAH
104300	480	2,800	2,320	ISSAQUAH
103868	460	2,700	2,240	ISSAQUAH
103873	480	2,790	2,310	ISSAQUAH
103869	460	2,710	2,250	ISSAQUAH
103870	470	2,760	2,290	ISSAQUAH
103791	450	2,610	2,160	ISSAQUAH
103778	450	2,620	2,170	ISSAQUAH
103779	450	2,620	2,170	ISSAQUAH
103777	460	2,650	2,190	ISSAQUAH
103764	480	2,790	2,310	ISSAQUAH
103875	460	2,690	2,230	ISSAQUAH
103865	460	2,710	2,250	ISSAQUAH
104129	460	2,710	2,250	ISSAQUAH
103830	460	2,680	2,220	ISSAQUAH
103867	450	2,680	2,230	ISSAQUAH
103879	450	2,630	2,180	ISSAQUAH
103811	450	2,660	2,210	ISSAQUAH
103866	480	2,790	2,310	ISSAQUAH
104124	500	2,910	2,410	ISSAQUAH
104135	490	2,890	2,400	ISSAQUAH
104137	510	2,950	2,440	ISSAQUAH

Hydrant #	Current Available Fire Flow (gpm)	Proposed Available Fire Flow (gpm)	Improvement (gpm)	Municipality
104133	500	2,890	2,390	ISSAQUAH
104444	940	4,620	3,680	ISSAQUAH
104145	500	2,750	2,250	ISSAQUAH
104130	1,110	1,070	-40	BELLEVUE
104121	1,060	1,160	100	BELLEVUE
104146	1,240	1,280	40	BELLEVUE
104136	510	1,760	1,250	ISSAQUAH
104132	510	2,680	2,170	ISSAQUAH
104900	510	2,400	1,890	ISSAQUAH
103881	450	2,050	1,600	ISSAQUAH
104125	480	2,800	2,320	ISSAQUAH
103805	250	890	640	ISSAQUAH
103795	430	2,450	2,020	ISSAQUAH
103769	410	1,980	1,570	BELLEVUE
100630	430	2,180	1,750	BELLEVUE
108050	410	1,980	1,570	BELLEVUE
108035	400	1,840	1,440	BELLEVUE
108043	400	1,830	1,430	BELLEVUE
101985	850	3,910	3,060	BELLEVUE
103818	390	1,740	1,350	ISSAQUAH
103843	450	2,600	2,150	ISSAQUAH
104127	470	2,750	2,280	ISSAQUAH
103841	440	2,530	2,090	ISSAQUAH
103780	450	2,640	2,190	ISSAQUAH
103877	460	2,690	2,230	ISSAQUAH
103842	450	2,600	2,150	ISSAQUAH
103772	1,240	1,260	20	BELLEVUE
103899	450	2,600	2,150	ISSAQUAH
104138	460	2,710	2,250	ISSAQUAH
104126	460	2,710	2,250	ISSAQUAH
103792	430	2,540	2,110	ISSAQUAH
103776	440	2,570	2,130	ISSAQUAH
103796	420	2,360	1,940	ISSAQUAH
101830	1,290	1,260	-30	BELLEVUE
104131	450	2,600	2,150	ISSAQUAH
103876	450	2,040	1,590	ISSAQUAH
108385	980	1,360	380	BELLEVUE
100858	420	2,340	1,920	ISSAQUAH

Hydrant #	Current Available Fire Flow (gpm)	Proposed Available Fire Flow (gpm)	Improvement (gpm)	Municipality
100755	410	2,320	1,910	ISSAQUAH
100341	410	2,280	1,870	ISSAQUAH
101765	580	3,450	2,870	BELLEVUE
103806	450	2,670	2,220	ISSAQUAH
103856	1,290	1,300	10	BELLEVUE
103767	1,410	1,420	10	BELLEVUE
103773	1,460	1,560	100	BELLEVUE
103770	1,270	1,770	500	BELLEVUE
101844	730	1,020	290	BELLEVUE
101841	430	600	170	BELLEVUE
101853	530	740	210	BELLEVUE
103880	450	2,640	2,190	ISSAQUAH
100912	420	2,400	1,980	ISSAQUAH
104178	420	2,450	2,030	ISSAQUAH
100961	960	1,320	360	BELLEVUE
422463	590	830	240	BELLEVUE
108046	490	3,100	2,610	BELLEVUE
101110	910	1,270	360	BELLEVUE
101782	950	1,320	370	BELLEVUE
103774	460	2,660	2,200	ISSAQUAH
103878	440	2,590	2,150	ISSAQUAH
103757	460	2,670	2,210	ISSAQUAH
104134	530	3,020	2,490	ISSAQUAH
104306	480	2,810	2,330	ISSAQUAH
104192	460	2,690	2,230	ISSAQUAH
104287	440	1,840	1,400	ISSAQUAH
103787	380	1,350	970	ISSAQUAH
108061	430	2,970	2,540	BELLEVUE
108047	430	2,200	1,770	BELLEVUE
100937	620	3,450	2,830	BELLEVUE
101743	650	3,260	2,610	BELLEVUE
101764	860	4,470	3,610	BELLEVUE
101734	940	4,930	3,990	BELLEVUE
370436	810	1,720	910	BELLEVUE
370448	810	1,500	690	BELLEVUE
370554	810	1,170	360	BELLEVUE
370605	760	1,020	260	BELLEVUE
103897	450	2,630	2,180	ISSAQUAH

Hydrant #	Current Available Fire Flow (gpm)	Proposed Available Fire Flow (gpm)	Improvement (gpm)	Municipality
435262	1,490	1,510	20	BELLEVUE
435305	1,570	1,560	-10	BELLEVUE
435314	1,500	1,490	-10	BELLEVUE
435344	1,410	1,410	0	BELLEVUE
435348	1,300	1,330	30	BELLEVUE
435363	1,270	1,300	30	BELLEVUE
435374	1,250	1,260	10	BELLEVUE
438338	760	1,060	300	BELLEVUE

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Appendix J

New Crossroads Pressure Zone Evaluation

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WASHINGTON LOCATIONS

BOTHELL
MAIN OFFICE
22722 29th Drive SE, Suite 210
Bothell, WA 98021

BELLINGHAM

EAST WENATCHEE

ISSAQUAH

RICHLAND

TACOMA

OREGON LOCATIONS

NORTHERN OREGON
MAIN OFFICE
6500 SW Macadam Avenue, Suite 125
Portland, OR 97239

SOUTHERN OREGON
Central Point

COASTAL OREGON
North Bend

January 10, 2014

Mr. Bill Heubach
Utilities Department/Engineering Division
City of Bellevue
450 110th Avenue NE
PO Box 90012
Bellevue, WA 98009-9012

Sent via: US Mail and Email

Subject: Phase 3 – New Crossroads Pressure Zone Evaluation

Dear Bill:

This letter report contains the results of hydraulic analyses performed for Phase 3 of RH2 Engineering, Inc.'s (RH2) evaluation of alternatives for increasing low service pressures in the City of Bellevue's (City) Crossroads area by creating a new pressure zone. These analyses were performed using a computer model of the City's existing water system and were based on the original analyses presented to you in our letter report dated September 13, 2012. This letter report summarizes the results of the Phase 3 analyses and the operational conditions used in the hydraulic model.

BACKGROUND

Customers in the Crossroads area of the City's Lake Hills 520 Zone currently experience service pressures below 40 pounds per square inch (psi). Under peak hour demand (PHD) conditions, some service pressures may be reduced below the Washington State Department of Health's (DOH) minimum pressure standard of 30 psi. Phase 1 and 2 of this evaluation utilized a model based on the City's existing EPANET model to identify alternatives to resolve the pressure deficiencies by creating a new Crossroads 560 Zone.

RH2 recently developed and calibrated a hydraulic model of the City's East Operating Area that was based on the City's existing GIS mapping of the water system. The purpose of Phase 3 is to utilize the calibrated hydraulic water model to perform analyses to update improvement Alternatives 2, 3, and 4 that were developed in Phase 2. Similar to the Phase 2 analyses criteria, the Phase 3 criteria were based on maintaining the existing fire flow in the Crossroads commercial, office, and multi-family areas shown in **Figure 1**. However, in single-family areas where the existing fire flow currently exceeds 2,000 gpm, the fire flow under the Phase 3 analyses may be reduced to 2,000 gallons per minute (gpm) following the completion of the pressure zone conversion. For Alternative 4, in the commercial, office, and multi-family areas where the existing fire flow currently exceeds 3,500 gpm, the fire flow under the Phase 3 analyses may be reduced to 3,500 gpm following the completion of the pressure zone conversion. The options for providing supply to the proposed 560 Zone are discussed in the

Phase 2 letter report and are unchanged for the Phase 3 analyses.

A portion of the City of Redmond's (Redmond) water system is directly connected to and served by the City of Bellevue's system. The area of Redmond's system that is served by the Lake Hills 520 Zone will be affected by the pressure zone conversion. Improvements to resolve pressure and fire flow deficiencies in the Redmond system were not evaluated in these analyses but should be addressed with Redmond in subsequent phases of this project.

HYDRAULIC ANALYSES DESCRIPTION

The WaterGEMS hydraulic water model that was developed and calibrated for the LH520 Zone Hydraulic Grade Increase Analysis was used to perform the analyses for Phase 3. The Phase 3 analyses were performed in accordance with the requirements of Washington State Administrative Code (WAC) Chapter 246-290, in which pressures shall be evaluated under PHD conditions, with the operational and equalizing storage component of the reservoirs depleted. For fire flow analyses, the WAC requires the analyses be performed under maximum day demand (MDD) conditions, with the operational, equalizing, and fire flow storage components of the reservoirs depleted. The required buildout equalizing and fire flow storage volumes from Table 8-1b of the City's 2006 *Water System Plan* (WSP), along with operational reservoir levels provided by the City, were used to estimate the water level for the storage facilities in the hydraulic model. The WSP's projected buildout demands were used in the analyses, which are estimated to increase by 1.5 percent from the projected year 2011 demands.

The available fire flow reported in the results for the fire flow analyses were based on a residual pressure of 20 psi in the water main adjacent to the hydrant and water velocities in the distribution system of 10 feet per second (fps) or less. The maximum available derated fire flow computed in the analyses was limited to 5,500 gpm. This is based on the requirement stated in Table 4-7 of the WSP that for a flow greater than 5,500 gpm, "… the City should require onsite fire protection improvements…"

A summary of the hydraulic model operational conditions used in the analyses is shown in **Table 1**.

Table 1 – Hydraulic Analyses Operational Conditions

Description	PHD Pressure Analyses	Fire Flow Analyses
East Operating Area Demand	Buildout PHD (22,435 gpm)	Buildout MDD (12,464 gpm)
Lake Hills North Reservoir	510.0 ft	500.0 ft
Lake Hills South Reservoir	510.0 ft	500.0 ft
NE 40th Reservoir	395.2 ft	390.4 ft
Newport Reservoir	508.1 ft	505.5 ft
Parksite Reservoir	501.9 ft	496.6 ft
Sammamish Reservoir	247.7 ft	247.7 ft
Lake Hills BPS	OFF	OFF
NE 8th Inlet	ON	ON
NE 40th Inlet	ON	ON
SE 28th Inlet	ON	ON
Eastgate Inlet	ON	ON
161st Inlet	ON	ON
Pressure Reducing Stations	Operating at Normal Setpoints	Operating at Normal Setpoints

HYDRAULIC ANALYSES RESULTS

Existing System Analyses

The existing system pressure and fire flow analyses were run with the calibrated model to determine the baseline level of service to customers in the Crossroads area. As shown in **Figure 2**, under PHD conditions, and according to the hydraulic model, a portion of the Crossroads commercial district and the single-family residential area east of 164th Avenue NE currently experience pressures below the DOH minimum pressure requirement of 30 psi. Compared to 30 psi, a more widespread area in this vicinity currently experiences pressures below 45 psi. The existing available derated fire flow is shown in **Figure 3** and ranges from less than 1,000 gpm on small diameter dead-end mains to up to 5,500 gpm in some areas of the Crossroads commercial district.

Alternative 2 Hydraulic Analyses

The proposed 560 Zone boundary for Alternative 2 was updated to encompass locations of the Lake Hills 520 Zone within the Bellevue city limits with existing pressures below 45 psi. The proposed Phase 3 560 Zone boundary for Alternative 2 is shown in **Figure 4**. The water main and other improvements identified in Phase 2 for Alternative 2 were re-evaluated with the calibrated hydraulic model. The improvements were selected to maintain the existing derated fire flow in commercial, office, and multi-family areas following the completion of the pressure zone conversion. In single-family residential areas where the existing derated fire flow currently exceeds 2,000 gpm, improvements were only identified to increase the fire flow to 2,000 gpm. The improvements and resulting pressure identified for Alternative 2 under Phase 3 are shown in **Figure 4** and summarized in **Table 2**.

Table 2 – Summary of Alternative Improvements

Proposed Improvement	Alternative 2	Alternative 3	Alternative 4
8" Water Main	7,700 ft	9,000 ft	9,400 ft
12" Water Main	31,900 ft	17,500 ft	11,200 ft
16" Water Main	5,000 ft	4,900 ft	4,500 ft
Total Water Main	44,600 ft	31,400 ft	25,100 ft
Zone Valves	26	23	23
Check Valves	2	2	2
PRV Stations	2	3	3
Individual Service PRVs	722	391	391

As shown in **Figure 4**, the completion of the proposed Alternative 2 improvements resolves the existing pressure deficiencies in the Crossroads area by increasing the system pressures to greater than 45 psi. Some locations along pressure zone boundaries, for example along 156th Avenue NE from NE 15th Street to Northup Way, will continue to have marginally low pressures. At these locations, however, parallel water main in the higher pressure zone will provide sufficient pressures to services along these alignments. The proposed 560 Zone will create some additional high pressure areas. Approximately 722 services under this scenario will have static pressures in excess of 80 psi and may require individual pressure reducing valves.

The proposed Alternative 2 improvements will increase the available derated fire flow at most locations within the Crossroads area. However, at several locations the proposed pressure zone conversion will decrease the available fire flow below what is currently being provided by the water system as shown in **Figure 5**. Within the commercial, office, and multi-family areas, the acceptable reduction in available derated fire flow is limited to 100 gpm. Within the single-family areas, the reduction in available fire flow exceeds 100 gpm in some areas. Where the reduction in available fire flow in single-family areas is greater than 100 gpm, the available derated fire flow still exceeds 2,000 gpm with the Alternative 2 improvements, which meets the intended criteria. Similar to the pressures along pressure zone boundaries, an inadequate reduction in fire flow may be indicated along some pressure zone boundaries. However, the proposed parallel water main along these alignments should provide the required fire flow in the adjacent pressure zone. The available derated fire flow with the Alternative 2 improvements is shown in **Figure 6.**

Check valves were evaluated as a cost-effective alternative to additional water main at the proposed 520/560 Zone boundary. The check valves would be normally closed but would provide emergency supply to the proposed 560 Zone in the event that the hydraulic grade of the zone is suppressed to 520 feet or less. To create the 560 Zone, the existing mains that cross the proposed zone boundary either need to be cut at that location, or more likely, have a zone valve installed. Alternatively, a check valve could be installed that would be more expensive than a zone valve. Providing check valves at all of these locations would result in the fire flow availability in the 560 Zone being close to what is being provided by the existing system. However, in the event of a fire in the 520 Zone, the check valve would remain closed, preventing 560 Zone water from being conveyed to the fire, and therefore, reducing the fire flow availability in the 520 Zone, specifically at nodes adjacent to the proposed 520/560 Zone boundary. With the reduction of available derated fire flow limited in all land uses, the widespread use of check valves along the proposed 520/560 pressure zone boundary is not a viable alternative. Pressure reducing valve (PRV) stations with check valves could be installed to allow flow in both directions, therefore minimizing the required water main improvements. However, the number of PRV stations required would be excessive due to their proximity to each other. This would also cause operational challenges.

Additional improvements within the Redmond system may be necessary to resolve the existing low pressures and the reduction in available derated fire flow in the area of the Lake Hills 520 Zone outside of the Bellevue City Limits. The impact of the Alternative 2 improvements on Redmond's water system should be discussed with Redmond in subsequent phases of this project.

Alternative 3 Hydraulic Analyses

The minimum pressure target was reduced to 40 psi to establish the proposed Phase 3 560 Zone boundary for Alternative 3, as shown in **Figure 7**. The water main and other improvements identified in Phase 2 for Alternative 3 were re-evaluated with the calibrated model. The improvements identified under Alternative 3 to increase service pressures to a minimum of 40 psi and to meet the same fire flow criteria as Alternative 2 are summarized in **Table 2** and shown schematically in **Figure 7**.

The anticipated pressures following the completion of the Alternative 3 improvements are also shown in **Figure 7** and indicate that all pressure deficiencies in the Crossroads area will be resolved with the proposed improvements. Approximately 391 services under this scenario will have static pressures in excess of 80 psi and may require individual pressure reducing valves. The reduction in available derated fire flow with the Alternative 3 improvements, shown in **Figure 8**, is limited to a maximum of 100 gpm in the commercial, office, and multi-family areas near Crossroads. In the single-family areas where the reduction in the available derated fire flow exceeds 100 gpm, the improvements will maintain a minimum fire flow of 2,000 gpm. The available derated fire flow following the completion of the Alterative 3 improvements is shown in **Figure 9**.

As with Alternative 2, the Redmond system may require additional improvements to resolve the existing low pressures and the reduction in available derated fire flow in the area of the Lake Hills 520 Zone outside of the Bellevue city limits. The impact of the Alternative 3 improvements on Redmond's water system should be discussed with Redmond in subsequent phases of this project.

Alternative 4 Hydraulic Analyses

Similar to Alternative 3, the minimum pressure target for Alternative 4 was 40 psi. The improvements were selected to maintain the existing derated fire flow following the completion of the pressure zone conversion. However, in commercial, office, and multi-family areas where the existing derated fire flow currently exceeds 3,500 gpm, improvements were only identified to increase the fire flow to 3,500 gpm. In single-family residential areas where the existing derated fire flow currently exceeds 2,000 gpm, improvements were only identified to increase the fire flow to 2,000 gpm. The improvements identified under Alternative 4 to increase service pressures to a minimum of 40 psi are shown schematically in **Figure 10**. As shown in the figure, the 560 Zone boundary for Alternative 4 is the same as the Alternative 3 boundary.

The anticipated pressures following the completion of the Alternative 4 improvements are also shown in **Figure 10** and indicate that all pressure deficiencies in the Crossroads area will be resolved with the proposed improvements. Approximately 391 services under this scenario will have static pressures in excess of 80 psi and may require individual pressure reducing valves. The reduction in available derated fire flow with the Alternative 4 improvements is shown in **Figure 11** and the available derated fire flow is shown in **Figure 12**.

As with Alternative 2 and 3, the Redmond system may require additional improvements to resolve the existing low pressures and the reduction in available derated fire flow in the area of the Lake Hills 520 Zone outside of the Bellevue city limits. The impact of the Alternative 4 improvements on Redmond's water system should be discussed with Redmond in subsequent phases of this project.

COST ESTIMATE

A preliminary cost estimate for the proposed water main and supply improvements was developed based on costs of similar, recently constructed projects around the Puget Sound area, and are presented in 2013 dollars. The cost estimates include the estimated construction cost of the proposed improvement and indirect costs estimated at 35 percent of the construction cost for engineering preliminary design, final design, and construction management services, permitting, legal, and administrative services. The construction cost estimates include a 20 percent contingency and sales tax of 9.5 percent.

Water Main Alternatives

Construction cost estimates for water main improvements were determined from the water main unit costs (i.e., costs per foot length) shown in **Table 3**. The unit costs for each water main size are based on estimates of construction related improvements, such as materials and labor for water main installation, water services, fire hydrants, fittings, valves, connections to the existing system, trench restoration, asphalt surface restoration, and other work for a complete installation. The unit costs also include a contingency, sales tax, and indirect costs such as engineering. The location of each of the proposed water mains was assessed to determine the surface restoration and trench requirements, and this is reflected in the water main unit costs. For example, a water main in 156th Avenue NE or NE 8th Street would have a larger asphalt overlay than a water main in a low volume residential street. The following is a list of overlay assumptions.

- 2-lane overlay
  - 156th Avenue NE
  - 148th Avenue NE
  - Northup Way
  - Bel-Red Road
  - NE 8th Street
  - NE 20th Street
  - NE 24th Street
  - NE 40th Street
- No overlay
  - Parking lots
  - Unimproved areas
- 1-lane overlay
  - All other locations

Table 3– Water Main Unit Costs

Water Main Diameter	Construction Cost Per Foot Length
8" Water Main	$289-$336
12" Water Main	$312-$358
16" Water Main	$346-$397

The cost of other required improvements such as zone valves, check valves, PRV stations, and individual service PRVs were estimated and included in the total costs of the three water main alternatives shown in **Table 4.**

Table 4 – Water Main Alternative Cost Estimate

Proposed Improvement	Alternative 2		Alternative 3		Alternative 4	
	Quantity	Cost	Quantity	Cost	Quantity	Cost
8" Water Main	7,700 ft	$ 3,262,680	9,000 ft	$ 3,852,360	9,400 ft	$ 4,043,520
12" Water Main	31,900 ft	$ 14,771,970	17,500 ft	$ 8,044,920	11,200 ft	$ 5,211,000
16" Water Main	5,000 ft	$ 2,672,865	4,900 ft	$ 2,591,730	4,500 ft	$ 2,404,890
Total Water Main	44,600 ft	$ 20,707,515	31,400 ft	$ 14,489,010	25,100 ft	$ 11,659,410
Zone Valves	26	$ 284,521	23	$ 251,691	23	$ 251,691
Check valves	2	$ 30,642	2	$ 30,642	2	$ 30,642
PRV Stations	2	$ 65,661	3	$ 98,492	3	$ 98,492
Individual Service PRVs	722	$ 473,704	391	$ 256,535	391	$ 256,535
Total Cost		$ 21,600,000		$ 15,200,000		$ 12,300,000

CONCLUSION

The results of the Phase 3 analyses indicate that significantly more water main improvements are necessary to implement the pressure zone improvements than identified in the Phase 1 or 2 analyses. This is due to the more accurate and detailed model that now represents the actual interconnectivity of the water mains at intersections. It is the water main velocity at these intersections and the change in the flow direction from the pressure zone conversion that is limiting the fire flow availability under the presented improvement alternatives.

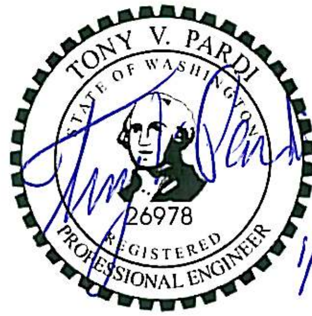
Alternatives 2 and 3 may be implemented to increase the service pressures above 45 and 40 psi, respectively, and to maintain the existing level of fire flow service within the commercial, office, and multi-family land uses of the Crossroads area. In single-family areas with more than 2,000 gpm of fire flow currently available, a minimum fire flow of 2,000 gpm will be maintained in both alternatives. To increase the service pressures to 40 psi and above, and allow a reduction in fire flow to 3,500 gpm within the commercial, office, and multi-family land uses of the Crossroads area, Alternative 4 may be implemented. Alternative 4 requires the shortest total length of water main improvements.

As discussed in the Phase 2 letter report, a new 560 Zone booster pump station (BPS) or expansion of the Lake Hills BPS to pump from the 520 Zone to the 560 Zone is required as part of the pressure zone conversion. The capacity of the 560 Zone BPS can be reduced if the minimum contract head of the TESSL at the NE 8th Inlet is increased to 520 feet, which would allow the 520 Zone to be constantly supplied by gravity and the existing NE 8th Inlet BPS to pump to the proposed 560 Zone.

If you have any questions regarding the analyses, please call me at (425) 951-5312. Thank you for the opportunity to assist you with this project.

Sincerely,

RH2 ENGINEERING, INC.



1/10/14

Tony V. Pardi, P.E.
President

1/10/14

Michele R. Campbell, P.E.
Project Manager

RMW/MRC/TVP/jq/ms

Enclosures: Figures 1 through 12

Appendix K

Storage Evaluation Technical Memoranda

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CITY OF BELLEVUE

WATER SYSTEM PLAN UPDATE

TECHNICAL MEMORANDUM NO. 2B
RESERVOIR SIZING AND STORAGE VOLUME ANALYSIS

FINAL
October 2015

1218 THIRD AVENUE, SUITE 1600 • SEATTLE, WASHINGTON 98101 • P. 206.684.6532 • F. 206.903.0419

CITY OF BELLEVUE

WATER SYSTEM PLAN UPDATE

TECHNICAL MEMORANDUM
NO. 2B
RESERVOIR SIZING AND STORAGE VOLUME ANALYSIS

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Appendix B Operational Storage for Each Reservoir

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RESERVOIR SIZING AND STORAGE VOLUME ANALYSIS

ES.1 EXECUTIVE SUMMARY

The City of Bellevue (City) is updating its Water System Plan, which includes an updated system analysis. As part of the system analysis update, the City is reviewing its storage criteria and evaluating potential storage needs. The existing storage criteria were reviewed and benchmarked to similar utilities both in- and out-of-state, which is documented in Technical Memorandum (TM) 2A. Based on this review, the City updated its storage criteria that were the basis for the reservoir sizing and storage volume analyses. The analyses identified the required storage volumes in each pressure zone and evaluated whether existing infrastructure could provide these required volumes. The latest reservoir infrastructure data and updated demand projections were used for the analyses. Where storage deficiencies have been identified, improvement options were recommended as presented in this TM. This section summarizes the methodology and findings of the analyses.

ES.1.1 Storage Components

The five components of storage required by the Washington State Department of Health (DOH) were evaluated:

1. **Operational Storage**: Used for day-to-day operation of reservoir.
2. **Equalizing Storage**: Provide storage for peaking above the maximum day demand (MDD).
3. **Fire Storage**: Required to deliver rate and duration of fire flows prescribed by local fire protection authorities.
4. **Emergency Storage**: Supply system demands during a water supply emergency.
5. **Dead Storage**: Unusable volume at bottom of reservoir.

Each storage component was evaluated separately as part of the storage analyses.

ES.1.2 Storage Criteria

The City updated its storage criteria to reflect the City's current requirements and expected level of service, which are presented in Table ES.1. The criteria meet or exceed the regulatory requirements of Washington Administrative Code (WAC) 246-290 and the DOH Water System Design standards. The criteria were based on DOH requirements, the findings of an industry survey, which establish benchmarks to in-state and out-of-state utilities, as well as City Staff input. The Industry survey found that the existing storage criteria meet DOH criteria and was similar to other in-state utilities.

Table ES.1 Storage Criteria
Reservoir Sizing And Storage Volume Analysis
City of Bellevue

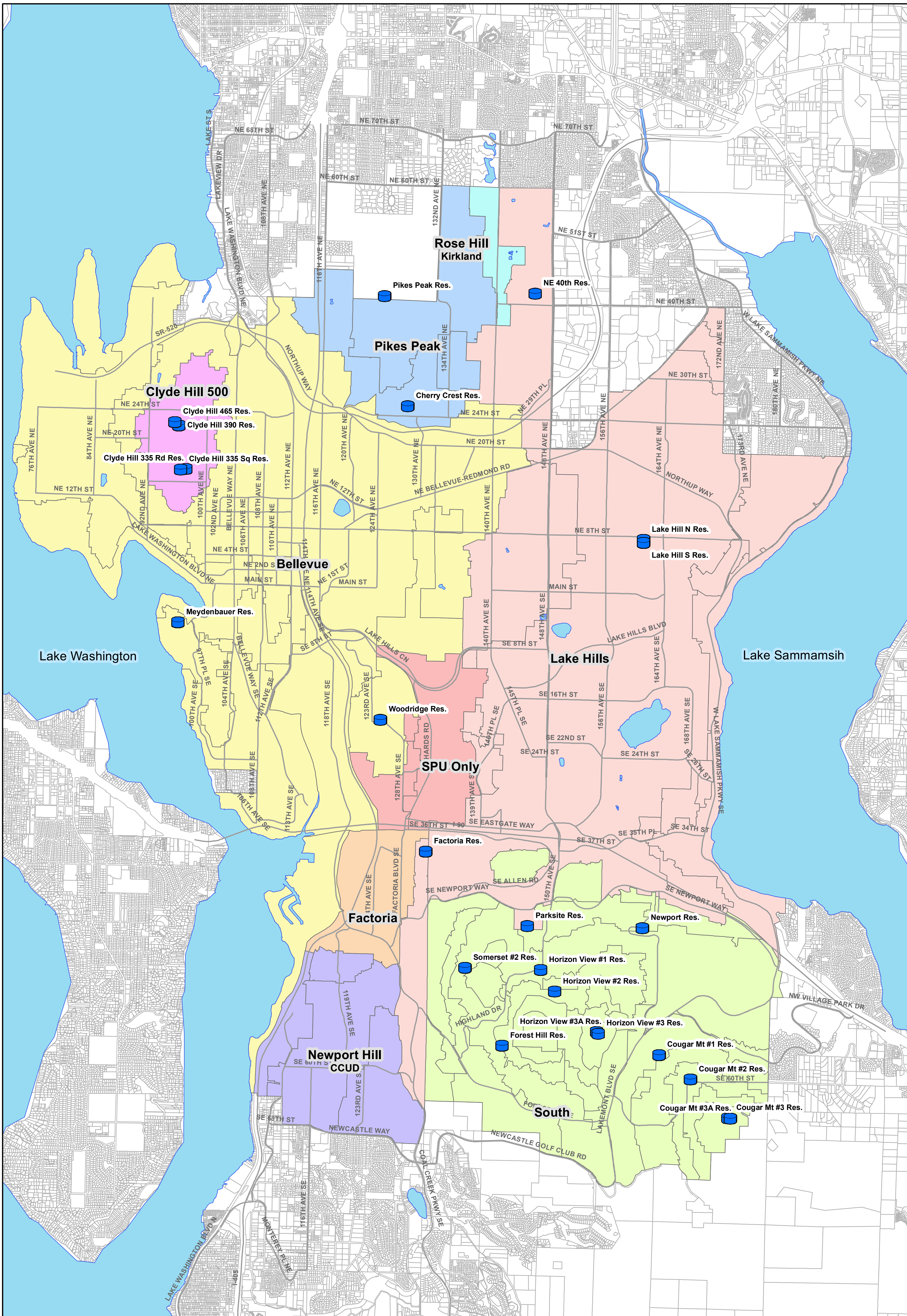
Storage Type	Criteria
Operational	Per existing City operations
Equalizing	10 percent of the MDD for mixed land use; 25 percent of MDD in largely single-family residential regions
Fire Suppression	Highest fire flow in storage region. Fire Suppression and Emergency storage are maintained as separate volumes (stacked)
Emergency	200 gal/ERU
Dead	Per hydraulic analysis

ES.1.3 Storage Regions

The City generally has the ability to move water between pressure zones within its three Operating Areas. Based on this ability, the previous Water System Plans evaluated storage assuming it was uniformly available to all pressure zones within each Operating Area. However, a detailed review determined that transmission capacity limited the ability to move storage between some pressure zones even within Operating Areas. Therefore, Storage Regions, a new system unit reflecting pressure zones with shared access to storage, were created so that storage requirements of these regions could be evaluated. The Storage Regions are shown in Figure ES.1. The analysis of reservoir storage was conducted for nine Storage Regions.

ES.1.4 Reservoir Sizing

Reservoir sizing or the required storage for each Storage Region was calculated based on the criteria presented in the above section. Storage requirements were calculated for the 6-year (2020), 10-year (2024), and 20-year (2034) planning years, which corresponds to DOH's required Water System Plan planning period. The analysis considered each of the five storage components. City staff, in conjunction with the Fire Marshal and Carollo, collected and shared data to ensure the best available information was used for the storage requirements.



Legend

- Reservoirs
- Arterials
- Water Bodies

Water Storage Region

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

0 2,500 5,000 Feet

Water Storage Regions
Figure ES.1
Reservoir Resizing and Storage Volume Analysis
City of Bellevue

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The storage requirements were compared to the existing storage volume to identify projected storage excesses or deficiencies. The excesses or deficiencies for each Storage Region in 2034 are presented in Table ES.2. Storage Regions in the West Operating Area (Bellevue, Clyde Hill 500, and Pikes Peak) were identified as being deficient in 2034, while the East Operating Area (Lake Hills and Rose Hill (Kirkland)) and South Operating Area (South, Factoria, and Newport Hills (CCUD)) were identified as having excess storage in 2034. The storage needs for pressure zones (WD340, WD400, and RV300) in the West Operating Area served directly from SPU were not evaluated.

Wheeled demands to Issaquah's Lakemont Triangle and Montreux/Glacier Ridge areas have been included in the analysis. Bellevue is responsible for providing storage for these areas per agreement.

Table ES.2 Storage Excess or Deficiency in 2034 by Storage Region
Reservoir Sizing And Storage Volume Analysis
City of Bellevue

Storage Region (mg) (1)	Existing Storage (mg)	Total Required Storage (mg)	Storage Excess or Deficiency (mg)
Bellevue	12.0	14.1	-2.1
Clyde Hill 500	0.7	1.1	-0.4
Pikes Peak	0.8	1.2	-0.4
Lake Hills (2)	13.3(3)	10.8	2.5
Rose Hill	0.5(3)	0.5	0.0
South (2)	8.4	7.7	0.7
Factoria	2.3	2.2	0.1
Newport Hills	3.1	3.1	0.0
Total	**41.1**	**40.7**	**0.4**

Notes:
(1) SPU Only Storage Region does not have dedicated storage.
(2) Includes wheeled demands to Issaquah Lakemont Triangle and Montreux/Glacier Ridge areas. Bellevue is responsible for providing storage for these areas per agreement.
(3) Rose Hill provides 1 MG of emergency storage to Lake Hills; see Sections 4.2.4 and 4.2.5.

ES.1.5 Storage Analysis and Recommended Improvement Options

The detailed storage analysis was conducted to better understand the storage requirements and deficiencies. The analysis considered major contributing factors to aid in identifying possible improvements. Improvement options were recommended where storage deficiencies were identified, which are summarized in Table ES.3. Multiple options were provided to resolve deficiencies to allow flexibility in implementation. Improvements should be combined with other City needs, when possible, to reduce overall Capital Investment

Program costs. The implementation of these improvements will provide sufficient storage to meet the City's needs through the planning period.

For new reservoirs, a reservoir siting study is recommended to determine the preferred location and size of the new reservoir. Dead storage and site-specific operational requirements may increase the new reservoir volume beyond what is stated in this TM.

In addition to the storage improvements, additional hydraulic modeling recommended to support the analyses presented in this TM. The City may benefit from the following:

- Confirm the transmission capacity to convey fire flows between pressure zones in a given Storage Region, especially where reservoirs are being rehabilitated, replaced, or abandoned.
- Evaluate hydraulics between Storage Regions to ensure adequate transmission capacity during peak demand periods and during emergencies.

Table ES.3 Recommended Storage Improvement Options
Reservoir Sizing And Storage Volume Analysis
City of Bellevue

Storage Region	Option 1		Option 2
Bellevue Storage Region	Construct or make available 2.5 mg of additional storage volume	AND/OR	Transmission improvements to utilize excess volume in Lake Hills Storage Region
Clyde Hill 500 Storage Region	Clyde Hill Pump Station Improvements to use Dead Storage	AND/OR	Clyde Hill Pump Station Improvements to use storage from Bellevue Storage Region
Pikes Peak Storage Region	Replace existing 1.0 mg reservoir with new 1.25 mg reservoir	OR	Improvements to Cherry Crest PS to use storage from Bellevue Storage Region
SPU Only Storage Region	Review upon completion of inlet capacity evaluation		

1.0 INTRODUCTION

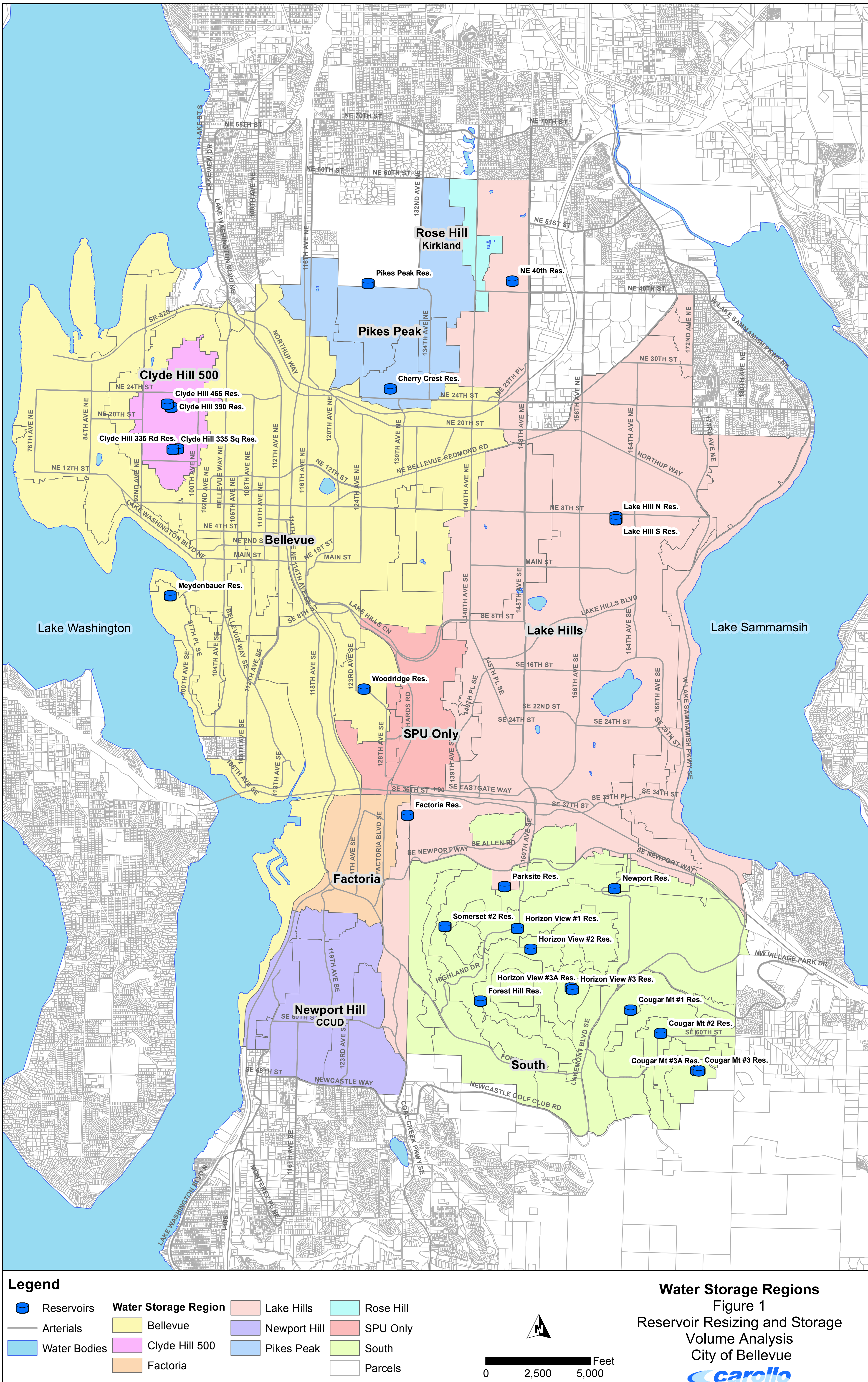
The City of Bellevue (City) is updating its Water System Plan, which includes an updated system analysis. As part of the system analysis update, the City is reviewing its minimum storage criteria and evaluating potential storage needs. Prior to the analysis, the City reviewed and updated its storage criteria, which provide the basis for the reservoir sizing and storage volume analyses. The analyses used the latest reservoir infrastructure data and updated demand projections from the current Water System Plan update. This technical memorandum (TM) identifies the minimum required storage volumes and evaluates whether existing infrastructure can provide this required volume. Where storage deficiencies have been identified, improvements were recommended.

2.0 STORAGE REGIONS

The City generally has the ability to move water between pressure zones within its three Operating Areas. Based on this ability, the previous Water System Plans evaluated storage assuming it was uniformly available to all pressure zones within each Operating Area. However, a detailed review determined that transmission capacity limits the ability to move storage between some pressure zones even with Operating Areas. Therefore, Storage Regions, a new system unit reflecting access to storage, were created so that storage requirements of these regions could be evaluated. The Storage Regions are shown in Figure 1. The analysis of reservoir storage was conducted for nine Storage Regions.

All storage reservoirs within a given Storage Region are able to provide water throughout the entire Storage Region. Therefore, the storage within a Storage Region was treated as a single volume, as presented in Table 1. This value reflects the total volume of the reservoirs in the Storage Region, referred to as nominal storage. Unavailable storage volume is accounted for in the City's storage criteria. As discussed in the Existing System Chapter of the current Water Plan Update, the nominal storage volume of the Pikes Peak and Factoria reservoirs hold less than the total reservoir volume due to seismic constraints.

The City's ability to move storage between pressure zones often requires the use of a pump station. A separate analysis was conducted by the City to identify deficiencies and improvements for pump stations. The storage analysis assumes sufficient pump capacity will be available to move water between pressure zones, except where noted.



Water Storage Regions
Figure 1
Reservoir Resizing and Storage
Volume Analysis
City of Bellevue

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Table 1 Storage Region Pressure Zones and Reservoirs
Reservoir Sizing And Storage Volume Analysis
City of Bellevue

Operating Area	Storage Region	Pressure Zones	Reservoirs	Existing Storage (mg)
West	Bellevue	BV400, BF220, CL335, EN300, HP250, KC300, MB252, MD230, NS200, WD450, YB300, and YP220	Clyde Hill 390, Cherry Crest, Woodridge, Clyde Hill 335 Round, Clyde Hill 335 Square, and Meydenbauer	12.0
	Clyde Hill 500	CL500	Clyde Hill 465	0.72
	Pikes Peak	PP550, PP600, & PP670	Pikes Peak	0.76
East	Lake Hills	LH520, CO380, CO440, EG300, EG370, EG400, EG440, FA460, KC450, LH380, LH435, RM330, RM400, SH450, and SA270	Newport, Parksite, NE 40th, Crossroads North, and Crossroads South	14.9
	Rose Hill	RH545	Kirkland	1.50
South	South	SS850, CM1000, CM1150, CM1300, CM1465, CM1575, EG590E, EG590W, EG630, FH1100, FH465, HV1080, HV1115, HV1175E, HV1175W, HV1175H, HV700, HV940, SS1000, SS550, SS700, SS940, SU1060, SU1100, and SU1350	Forest Hills, Cougar Mountain 1, Somerset 2, Cougar Mountain 2, Cougar Mountain 3, Cougar Mountain 3A, Horizon View 1, Horizon View 2, Horizon View 3, and Horizon View 3A	8.45
	Factoria	FA293	Factoria	2.28
	Newport Hills	NH320, NH380, NH470, & NH580	CCUD 440 Reservoir, CCUD 1MG 580 Reservoir, CCUD 2.5 MG 580 Reservoir	3.05
	SPU Only	RV300, WD340, & WD400	None	0.00

3.0 STORAGE CRITERIA

The presented storage criteria were reviewed and updated through a detailed investigation that is documented in TM2A – Storage Criteria provided in Appendix A. The storage criteria were updated based on the best available data, to address potential water supply disruptions, and to meet benchmarks from comparable utilities on a regional and national basis. The resulting storage criteria are presented in Table 2 and meet or exceed the regulatory requirements of Washington Administrative Code (WAC) 246-290 and the DOH Water System Design standards.

The resulting criteria considers each of the five DOH required components of storage:

1. Operational Storage.
2. Equalizing Storage.
3. Fire Storage.
4. Emergency Storage.
5. Dead Storage.

Additional details for each storage component are presented below.

Table 2 City's Storage Criteria
Reservoir Sizing And Storage Volume Analysis
City of Bellevue

Storage Type	Criteria
Operational	Per existing City operations
Equalizing	10 percent of the MDD for mixed land use; 25 percent of MDD in largely single-family residential regions
Fire Suppression	Highest fire flow in storage region. Fire Suppression and Emergency storage are maintained as separate volumes (stacked)
Emergency	200 gal/ERU (1)
Dead	Per hydraulic analysis

Note:
(1) ERU = Equivalent Residential Unit

3.1 Operational Storage

Operational Storage is the volume of the reservoir devoted to supplying the water system while, under normal operating conditions, the sources of supply are in “off” status” (WAC 246-290-010). For the City, most sources are operated continuously without an “off status”; therefore, the City previously did not consider operational storage. For the current Plan update, the City has updated their criteria to consider Operational Storage. Operational storage was determined for each reservoir based on pump ON/OFF set points, plus the unused depth below overflow during normal operating conditions; in general, this reflects volume kept normally empty for operational purposes. Operational storage for each reservoir is provided in Appendix B.

Additionally, in the South Storage Region the City typically chooses to operate Cougar Mountain Reservoir 3 at half full (1.11 mg) and Cougar Mountain Reservoir 3A at empty (0.30 million gallons (mg)) for water quality purposes. While similar to operational storage, a distinction was made since this storage may be used to meet any storage components if required. However, to maintain consistency with the five components required by DOH, the 1.41 mg of combined water quality storage was included in the operational storage band, labeled Operational/Water Quality storage for the South Region.

3.2 Equalizing Storage

Equalizing Storage is the volume needed to satisfy peak hour demands (PHD) above that provided by supply sources. Ideally, the City would receive continuous supply on the maximum day equal to the MDD; therefore, the City’s equalizing storage should supply the volume of water in excess of the MDD during the PHD. Consistent with DOH recommendations, the City updated the equalization storage criteria based on a detailed review of diurnal supply/demand data. The City’s detailed analysis found that predominately single-family residential pressure zones used up to 25 percent of the MDD for equalizing. Mixed-use pressure zones used up to 10 percent of the MDD for equalizing.

The equalizing criteria were assigned to each Storage Region based on the predominant customer type, as shown in Table 3. The Bellevue, Lake Hills, and Factoria Storage Regions used the mixed-use criteria, which represents the majority of the demand in the system. All other Storage Regions were considered predominantly single-family residential. The combined Equalizing Storage criterion (demand weighted) was approximately 13 percent of the MDD. Therefore, the updated criterion was overall lower than the previous Plan’s criteria of 20 percent.

Table 3	Equalizing Storage Criteria by Storage Region Reservoir Sizing And Storage Volume Analysis City of Bellevue	
Storage Region	**Customer Type**	**Equalizing Criteria (Percent of MDD (1))**
Bellevue	Mixed-use	10%
Clyde Hill 500	Predominately single-family residential	25%
Pikes Peak	Predominately single-family residential	25%
Lake Hills	Mixed-use	10%
Rose Hill	Predominately single-family residential	25%
South	Predominately single-family residential	25%
Factoria	Mixed-use	10%
Newport Hills	Predominately single-family residential	25%
SPU Only	Predominately single-family residential	25%

Notes:
(1) MDD = Maximum Day Demand.

3.3 Emergency Storage

Emergency Storage, also referred to as Standby Storage, is the volume of storage required to supply reasonable system demands during a system emergency, such as disruption of the water supply. Disruptions could be caused by transmission pipeline or equipment failure, power outage, valve failure, or other system interruptions. The City has chosen to use the DOH recommend minimum Emergency Storage criterion of 200 gallons per equivalent residential unit (gal/ERU). This criterion is consistent with previous Plans.

3.4 Fire Suppression Storage

Fire Suppression Storage is the volume of storage required to deliver rate and duration of fire flows prescribed by local fire protection authorities, while maintaining a minimum pressure of 20 psi during MDD conditions. The City stacks Fire Suppression and Emergency Storage, which maintains separate volumes for each component. The City's criterion for fire suppression storage is to meet the largest fire flow in each Storage Region (except where dictated otherwise by City policy), as presented in Table 4. Table 4 provides the largest fire flow and duration based on the International Building Code (IBC), and the resulting Fire Suppression Storage. In total, the City reserved a total of 9.80 mg of fire suppression storage, which is substantially more than reserved in previous Plans (4.95 mg in total; 1.65 mg in each operating area).

The reported fire flows were based on the current fire code, as determined by the City and Fire Marshal. Fire flows were based on Tax Assessor data, where there was missing data, such as presence of fire sprinklers. Conservative assumptions were made to fill in missing data. However, the City's policy is to provide fire flows equal the value agreed upon at the time of construction, which may be less than current requirements for older buildings.

Therefore, the City is not obliged to increase storage or transmission capacity to meet fire flow needs for existing buildings and the reported fire flows are intended to only inform discussion on storage requirements.

Table 4 Largest Fire Flow by Storage Region
Reservoir Sizing And Storage Volume Analysis
City of Bellevue

Storage Region	Pressure Zone with Largest Fire Flow	Largest Fire Flow (gpm)	Duration (hours)	Fire Suppression Storage (mg)
Bellevue	BV400	8,000	4	1.92
Clyde Hill 500	CL500	2,000	2	0.24
Pikes Peak	PP550	3,500	3	0.63
Lake Hills	LH520	6,500	4	1.56
Rose Hill	RH545	2,000	2	0.24
South	SS850	6,500	4	1.56
Factoria	FA293	4,750	4	1.14
Newport Hills	NH470	8,000	4	1.92
SPU Only	WD400	3,250	3	0.59

Note, the storage analysis did not include evaluation of transmission system capacity to convey fire flows within or between zones. It is recommended that the transmission system capacity be evaluated as part of the 2015 Water System Plan, especially for reservoirs that are being rehabilitated, replaced, or abandoned.

3.5 Dead Storage

Dead Storage is the volume of water at the bottom of a storage reservoir that is unusable. Storage volume is considered dead if it is located below the outlet pipe and cannot be used because of system hydraulic limitations, or if it is located below the lowest water surface elevation that meets the minimum design pressure for all customers (WAC 246-290-230(5) and (6)). Dead storage was calculated for each reservoir based on the following criteria:

- Maintaining 20 psi at the highest service elevation in the Storage Region.

- Minimum water level requirements based on pump suction requirements.

Five reservoirs were found to have dead storage, as shown in Table 5. There was a total of 1.10 mg of dead storage, which represents approximately 3 percent of the total system storage. Dead storage was not included in the previous Plan.

Table 5 Dead Storage Reservoir Sizing And Storage Volume Analysis City of Bellevue

Reservoir	Reason for Dead Storage	Dead Storage (mg)	Dead Storage (%)
Clyde Hill 465	Highest Customer	0.53	74%
Crossroads North and South	Pump Suction	0.22	5%
NE 40th St	Pump Suction	0.34	6%
Horizon View #1	Friction Loss during fire	0.01	5%

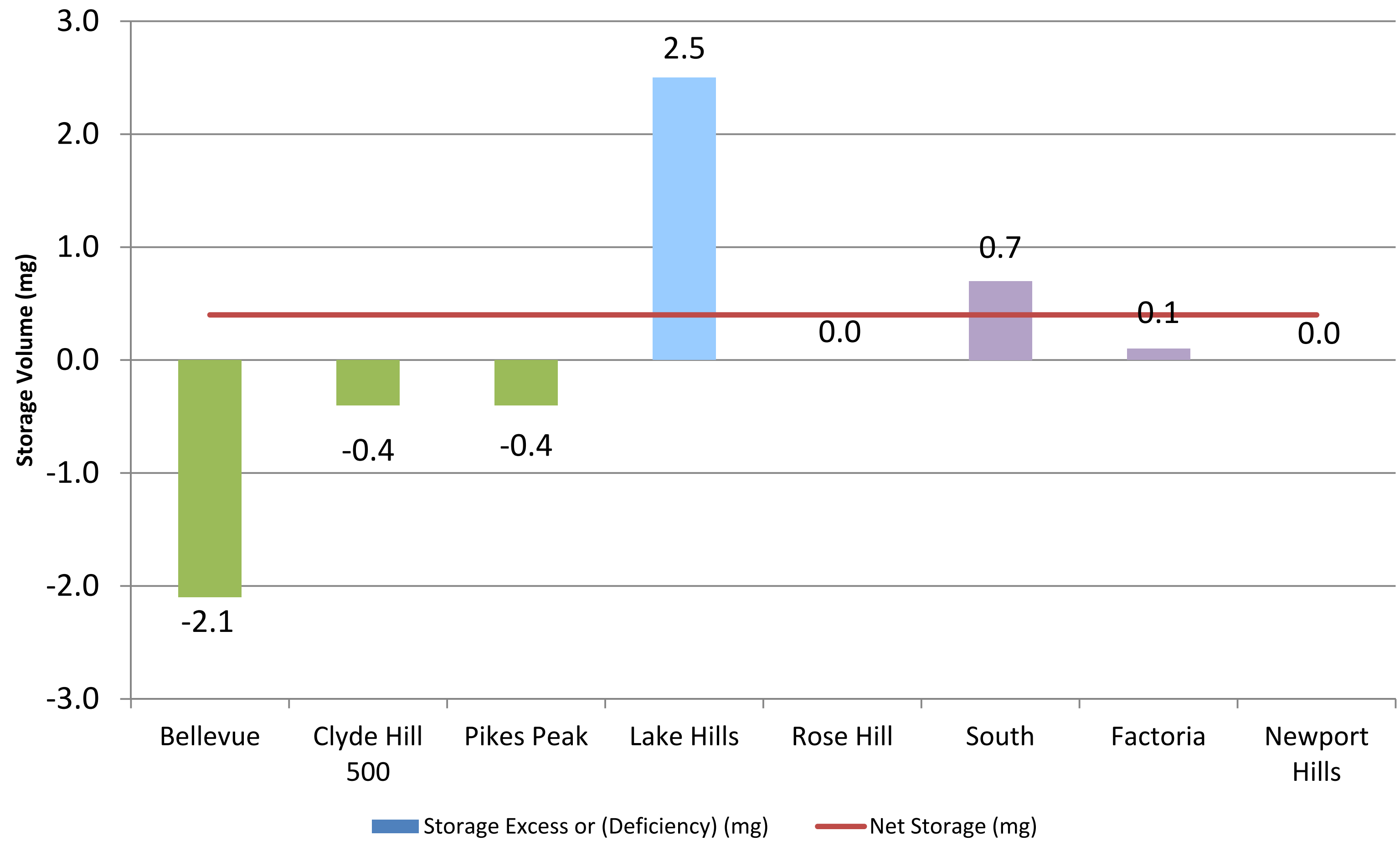
4.0 RESERVOIR SIZING AND STORAGE ANALYSIS

Reservoir sizing and storage analysis were conducted based on the storage criteria presented above. The total required reservoir sizing, presented as a volume, was calculated for each Storage Region. Based on the required volume, the total required reservoir sizing was compared to the existing storage to determine storage excesses or deficiencies.

4.1 Reservoir Sizing

Reservoir sizing or the required storage for each Storage Region was calculated based on the criteria presented in the above section. Storage requirements were calculated for the 6-year (2020), 10-year (2024), and 20-year (2034) planning years, which correspond to the City's updated CIP. The analysis considered each of the five storage components. Operational, Fire Suppression, and Dead Storage were based on the existing reservoirs and remained constant over the planning period. Equalizing and Emergency Storage were calculated based on the demand projections and increased throughout the planning period.

The storage requirements were compared to the existing storage volume to identify projected storage excesses or deficiencies. The excesses or deficiencies for each Storage Region in 2020, 2024, and 2034 are presented in Table 6, Table 7, and Table 8, respectively. Note, totals are rounded to reflect the conceptual nature of the analysis. Additionally, the 2034 results are shown graphically in Figure 2. As shown, there is a mix of storage excesses and deficiencies. Storage Regions in the West Operating Area (Bellevue, Clyde Hill 500, and Pikes Peak) were identified as being deficient in 2024 and remain deficient through 2034.



STORAGE RESERVOIR EXCESS AND DEFICIENCY IN 2034

FIGURE 2

CITY OF BELLEVUE
RESERVOIR SIZING AND STORAGE VOLUME ANALYSIS

carollo

Storage Regions in East Operating Area (Lake Hills and Rose Hill (Kirkland)) and South Operating Area (South, Factoria, and Newport Hills (CCUD)) were identified as having excess storage in 2020 and maintain sufficient storage volumes through 2034, with the Lake Hills Storage Region having the largest surplus.

Overall, the City has surplus storage volume through 2034, where the total tank volume exceeds the total required storage. Due to demand growth, the overall surplus storage decreases to 0.7 mg in 2034, or about 2 percent of the total storage volume. This indicates the City will need to increase the available storage shortly after the end of the planning period. Individual Storage Region's deficiencies may be eliminated through new expanded reservoirs or distribution improvements to utilize existing dead storage in existing reservoirs. A detailed analysis was conducted to better understand the storage requirements and identify possible improvements, which is presented in the following section.

Table 6 Storage Excess or Deficiency in 2020 by Storage Region
Reservoir Sizing And Storage Volume Analysis
City of Bellevue

Storage Region (mg) (1)	Existing Storage (mg)	Total Required Storage (mg)	Storage Excess or Deficiency (mg)
Bellevue	12.0	11.7	0.3
Clyde Hill 500	0.7	1.1	-0.4
Pikes Peak	0.8	1.2	-0.4
Lake Hills (2)	13.3(3)	10.4	2.9
Rose Hill	0.5(3)	0.5	0.0
South (2)	8.4	7.6	0.8
Factoria	2.3	2.1	0.2
Newport Hills	3.1	3.0	0.1
Total	**41.1**	**37.6**	**3.5**

Notes:

(1) SPU Only Storage Region does not have dedicated storage.
(2) Includes wheeled demands to Issaquah Lakemont Triangle and Montreux/Glacier Ridge areas. Bellevue is responsible for providing storage for these areas.
(3) Rose Hill provides 1 MG of emergency storage to Lake Hills; see Sections 4.2.4 and 4.2.5.

Table 7	Storage Excess or Deficiency in 2024 by Storage Region Reservoir Sizing And Storage Volume Analysis City of Bellevue		
Storage Region (mg) (1)	**Existing Storage (mg)**	**Total Required Storage (mg)**	**Storage Excess or Deficiency (mg)**
Bellevue	12.0	12.3	-0.3
Clyde Hill 500	0.7	1.1	-0.4
Pikes Peak	0.8	1.2	-0.4
Lake Hills (2)	13.3(3)	10.5	2.8
Rose Hill	0.5(3)	0.5	0.0
South (2)	8.4	7.7	0.7
Factoria	2.3	2.1	0.2
Newport Hills	3.1	3.0	0.1
Total	**41.1**	**38.4**	**2.7**

Notes:
(1) SPU Only Storage Region does not have dedicated storage.
(2) Includes wheeled demands to Issaquah Lakemont Triangle and Montreux/Glacier Ridge areas. Bellevue is responsible for providing storage for these areas.
(3) Rose Hill provides 1 MG of emergency storage to Lake Hills; see Sections 4.2.4 and 4.2.5.

Table 8	Storage Excess or Deficiency in 2034 by Storage Region Reservoir Sizing And Storage Volume Analysis City of Bellevue		
Storage Region (mg) (1)	**Existing Storage (mg)**	**Total Required Storage (mg)**	**Storage Excess or Deficiency (mg)**
Bellevue	12.0	14.1	-2.1
Clyde Hill 500	0.7	1.1	-0.4
Pikes Peak	0.8	1.2	-0.4
Lake Hills (2)	13.3(3)	10.8	2.5
Rose Hill	0.5(3)	0.5	0.0
South (2)	8.4	7.7	0.7
Factoria	2.3	2.2	0.1
Newport Hills	3.1	3.1	0.0
Total	**41.1**	**40.7**	**0.4**

Notes:
(1) SPU Only Storage Region does not have dedicated storage.
(2) Includes wheeled demands to Issaquah Lakemont Triangle and Montreux/Glacier Ridge areas. Bellevue is responsible for providing storage for these areas.
(3) Rose Hill provides 1 MG of emergency storage to Lake Hills; see Sections 4.2.4 and 4.2.5.

4.2 Storage Analysis and Improvements

Storage analysis considered each Storage Region in detail. Where deficiencies were found, improvements were identified to resolve the deficiencies. Multiple options were provided to resolve deficiencies to allow flexibility in implementation. When possible, improvements should be combined with other City needs to reduce overall Capital Improvement Plan costs. For example, a reservoir can be replaced to address both size and seismic issues. The implementation of these improvements will provide sufficient storage to meet the City's needs through the planning period.

Note, storage values have been carried to three significant figures to accurately reflect calculations. Rounded values are used in summary tables to reflect the conceptual nature of the analysis.

4.2.1 Bellevue Storage Region

The Bellevue Storage Region is the largest in the system and includes downtown Bellevue. The Storage Region is served by six reservoirs with a total of 12.0 mg of storage. These reservoirs provide the City's largest fire flow (8,000 gpm for 4 hours) and substantial equalizing storage and emergency storage. By 2024 the required storage volume exceeds the existing storage by 0.3 mg as shown in Table 9. The deficiency grows to 2.1 mg by 2034 due to increasing equalizing and emergency storage requirements that are driven by the projected demand growth.

It is recommended that storage deficiencies be addressed by adding additional storage to the Storage Region or through accessing excess storage in other Storage Regions. The City may develop a new reservoir with 2.5 mg of storage volume by 2024 to address deficiencies. A reservoir siting study should be conducted to determine the preferred location and size of the reservoir. Alternatively, the City may share excess storage in other Storage Regions. The City is currently developing connections between the Lake Hills and Bellevue Storage Regions, which would address the identified storage deficiencies. It is recommended that the City conduct a detailed hydraulic analysis to ensure sufficient transmission capacity is available during peak demand periods and during emergencies.

Table 9	Bellevue Storage Region Analysis Reservoir Sizing And Storage Volume Analysis City of Bellevue		
Parameter	**2020**	**2024**	**2034**
Demands			
ERUs	35,183	37,547	44,668
MDD (mgd)	18.0	19.2	22.8
Existing Reservoir Volume (mg)			
Clyde Hill 390	4.1	4.1	4.1
Cherry Crest	3.0	3.0	3.0
Woodridge	2.1	2.1	2.1
Clyde Hill 335 Rd.	1.0	1.0	1.0
Clyde Hill 335 Sq.	0.5	0.5	0.5
Meydenbauer	1.3	1.3	1.3
Total Volume (mg)	12.0	12.0	12.0
Required Storage			
Operational	1.0	1.0	1.0
Equalizing	1.8	1.9	2.3
Fire Suppression	1.9	1.9	1.9
Emergency	7.0	7.5	8.9
Dead	0.0	0.0	0.0
Total Required (mg)	11.7	12.3	14.1
Excess or (Deficit) Storage with Existing Infrastructure (mg)	**0.3**	**-0.3**	**-2.1**
Recommended Improvements			
Additional Storage (1)	0.0	2.5	2.5
Excess or (Deficit) Storage with Improvements (mg)	**0.3**	**2.2**	**0.4**

Notes:

(1) Additional storage may be achieved through a new reservoir or shared storage from other Storage Regions.

4.2.2 Clyde Hill 500 Storage Region

The Clyde Hill 500 Storage Region serves the Clyde Hill 500 Pressure Zone. The pressure zone is supplied by the Clyde Hill Pump Station, which is on the same site as the Clyde Hill 465 reservoir. Approximately 0.53 mg, or 74 percent, of the 0.72 mg reservoir is dead due to high service elevations in the Storage Region. The Storage Region is expected to be

0.40 mg deficient in storage by 2020, as shown in Table 10. The storage deficiency remains, but does not increase significantly, through 2034 due to low demand growth.

Additional storage may be obtained through improvements to the Clyde Hill Pump Station, rather than a larger reservoir. The improved Clyde Hill Pump Station should be capable of supplying both domestic and fire flows. The Clyde Hill Pump Station may be improved to utilize the Clyde Hill 465 Reservoir dead storage and/or pump from the Bellevue Storage Area. Upon completion of the pump station improvements, the City should evaluate if the Clyde Hill 500 Storage Region may be combined with the Bellevue Storage Region.

The Bellevue Storage Region was identified as deficient in storage. Multiple options were proposed to resolve the deficiencies. If storage is taken from the Bellevue Storage Region, then the needed 0.40 mg of storage for the Clyde Hill 500 Storage Region would need to be added to the Bellevue Storage Region.

Table 10 Clyde Hill 500 Storage Region Analysis
Reservoir Sizing And Storage Volume Analysis
City of Bellevue

Parameter	2020	2024	2034
Demands			
ERUs	1,067	1,067	1,068
MDD (mgd)	0.54	0.54	0.55
Existing Reservoir Volume (mg)			
Clyde Hill 390	0.72	0.72	0.72
Total Volume (mg)	0.72	0.72	0.72
Required Storage			
Operational	0.00	0.00	0.00
Equalizing	0.14	0.14	0.14
Fire Suppression	0.24	0.24	0.24
Emergency	0.21	0.21	0.21
Dead	0.53	0.53	0.53
Total Required (mg)	1.12	1.12	1.12
Excess or (Deficit) Storage (mg)	**-0.40**	**-0.40**	**-0.40**
Recommended Improvements			
Utilize Dead Storage (mg)	0.53	0.53	0.53
Excess or (Deficit) Storage with Improvements (mg)	**0.13**	**0.13**	**0.13**

4.2.3 Pikes Peak Storage Region

The Pikes Peak Storage Region is primarily supplied from the Cherry Crest Inlet by gravity to the 550 Pressure Zone, but can also be supplied to the 550 Pressure Zone via the Cherry Crest Reservoir and Pump Station (BV400 Pressure Zone) and to the 670 Pressure Zone via the NE 40th/670 Pump Station. Pikes Peak Pump Station provides flows from the Pikes Peak Reservoir (550 Pressure Zone) to the 670 Pressure Zone. Pikes Peak Reservoir provides 0.76 mg of usable storage and is located in the Bridle Trails State Park. The reservoir was constructed as a 1.00 mg welded steel tank; however, seismic deficiencies limit the amount of usable storage in the reservoir. The Storage Region is expected to be 0.46 mg deficient in storage before 2020, which will increase by 0.01 mg by 2034 due to demand growth, as shown in Table 11.

Table 11 Pikes Peak Storage Region Analysis
Reservoir Sizing And Storage Volume Analysis
City of Bellevue

Parameter	2020	2024	2034
Demands			
ERUs	1,789	1,799	1,825
MDD (mgd)	0.91	0.92	0.93
Existing Reservoir Volume (mg)			
Pikes Peak (1)	0.76	0.76	0.76
Usable Volume (mg)	0.76	0.76	0.76
Required Storage			
Operational	0.00	0.00	0.00
Equalizing	0.23	0.23	0.23
Fire Suppression	0.63	0.63	0.63
Emergency	0.36	0.36	0.37
Dead	0.00	0.00	0.00
Total Required (mg)	1.22	1.22	1.23
Excess or (Deficit) Storage with Existing Infrastructure(mg)	**-0.46**	**-0.46**	**-0.47**
Recommended Improvements			
Additional usable storage volume (mg) (2)	0.25	0.25	0.25
Additional total storage volume (mg) (3)	0.24	0.24	0.24
Excess or (Deficit) Storage with Improvements (mg)	**0.03**	**0.03**	**0.02**

Notes:

(1) Pikes Peak reservoir has 1.0 mg capacity, but only 0.76 mg of usable storage due to seismic deficiencies of the existing tank.
(2) Additional storage may be achieved through a new reservoir or shared storage from the Bellevue Storage Region and additional storage constructed in the Bellevue Storage Region.
(3) Includes 0.24 mg of unusable storage in existing reservoir.

The storage deficiency may be addressed through increased storage or a combination of increased storage and pump station capacity. Replacing the existing 1.0 mg tank (0.76 mg usable) with a new 1.25 mg reservoir (additional 0.49 mg useable storage) would meet the long-term deficiency, as well as meet current seismic design standards.

Alternatively, the City may rehabilitate or replace the existing Pikes Peak Reservoir to resolve seismic issues at its current volume of 1 mg; however, BPS capacity and reliability upgrades would also be needed. To resolve the storage deficiencies, the Cherry Crest Pump Station would need additional capacity plus improvements to provide reliable emergency flows from the Bellevue Storage Region, including the addition of an on-site backup generator.

4.2.4 Lake Hills Storage Region

The Lake Hills Storage Region is the second largest in the system and serves most of the East Operating Area. The Storage Region is served by five reservoirs with a total of 12.3 mg of storage, as well as the ability to use 1.0 mg of emergency storage in the Rose Hill (Kirkland) Tank. The reservoirs provide large fire flows (6,500 gpm for 4 hours) and substantial equalizing storage and emergency storage. The existing storage is more than sufficient to meet the required storage through 2034, as shown in Table 12. The 2.4 mg surplus may be used to resolve deficiencies in other Storage Regions, including the Bellevue Operating Storage Region. The use of this surplus storage may vary based on available transmission capacity between the Storage Regions, as well as chosen improvements in other Storage Regions.

Wheeled demands to Issaquah's Lakemont Triangle area have been included in analysis, because Bellevue is responsible for providing storage for those customers per agreement. Wheeled demands to Redmond have not been included, because Redmond provides storage for Overlake. Sammamish Reservoir volume and future wheeled flows to Issaquah's South Cove area have been excluded from analysis, because it is assumed Issaquah will assume the local water system and operate its own storage with Sammamish Reservoir.

4.2.5 Rose Hill (Kirkland) Storage Region

The Rose Hill Storage Region is served by the City of Kirkland from their South Reservoir. The City has a 13.4 percent stake in the reservoir, equating to 1.50 mg. The Rose Hill Storage Region has the least demand in the system. The joint-use facilities have more than sufficient storage to meet the required storage through 2034, as shown in Table 13. Lakeland Hills has been reserved 1.0 mg of the excess storage to be used in case of emergencies. No improvements are recommended to this Storage Region.

Table 12	Lake Hills Storage Region Analysis Reservoir Sizing And Storage Volume Analysis City of Bellevue		
Parameter	**2020**	**2024**	**2034**
Demands			
ERUs	27,502	27,890	28,018
MDD (mgd)	14.0	14.2	14.8
Existing Reservoir Volume (mg)			
Newport	3.0	3.0	3.0
Parksite	2.0	2.0	2.0
NE 40th	3.2	3.2	3.2
Crossroads North	2.0	2.0	2.0
Crossroads South	2.0	2.0	2.0
Total Volume (mg)	12.2	12.2	12.2
Required Storage			
Operational	1.3	1.3	1.3
Equalizing	1.4	1.4	1.5
Fire Suppression	1.6	1.6	1.6
Emergency	5.5	5.6	5.8
Dead	0.6	0.6	0.6
Total Required (mg)	10.4	10.5	10.8
Excess or (Deficit) Storage (mg) with Existing Infrastructure	**1.8**	**1.7**	**1.4**
Shared Storage			
Emergency Storage from Rose Hill (mg)	1.0	1.0	1.0
Excess or (Deficit) Storage with Shared Storage (mg)	**2.8**	**2.7**	**2.4**

Notes:

(1) Includes wheeled demands to Issaquah Lakemont Triangle equal to 426 ERUs and MDD of 0.217 mgd. Bellevue is responsible for providing storage for this area.

Table 13	Rose Hill Storage Region Analysis Reservoir Sizing And Storage Volume Analysis City of Bellevue		
Parameter	**2020**	**2024**	**2034**
Demands			
ERUs	80	82	89
MDD (gpd)	40,701	41,711	45,317
Existing Reservoir Volume (mg)			
Kirkland's South (1)	1.50	1.50	1.50
Required Storage			
Operational	0.21	0.21	0.21
Equalizing	0.01	0.01	0.01
Fire Suppression	0.24	0.24	0.24
Emergency	0.02	0.02	0.02
Dead	0.00	0.00	0.00
Total Required (mg)	0.48	0.48	0.48
Excess or (Deficit) Storage with Existing Infrastructure (mg)	1.02	1.02	1.02
Shared Storage			
Emergency Storage for Lake Hills (mg)	-1.00	-1.00	-1.00
Excess or (Deficit) Storage with Shared Storage (mg)	**0.02**	**0.02**	**0.02**

Notes:

(1) Consistent with City of Kirkland's 2014 Agency Review Draft Comprehensive Water System Plan.

4.2.6 South Storage Region

The South Storage Region is the third largest in the system and serves most of the South Operating Area. This Storage Region is served by ten reservoirs with a total of 8.45 mg of storage. The reservoirs provide large fire flows (6,500 gpm for 4 hours), as well as the other storage components. The existing storage is sufficient to meet the required storage through 2034, as shown in Table 14. No improvements are recommended for this Storage Region.

Wheeled demands to Issaquah's Montreux/Glacier Ridge area have been included in the analysis. Bellevue is responsible for providing storage for this area per agreement.

Table 14 South Storage Region Analysis Reservoir Sizing And Storage Volume Analysis City of Bellevue			
Parameter	**2020**	**2024**	**2034**
Demands			
ERUs	10,559	10,659	10,867
MDD (mgd)	5.39	5.44	5.55
Existing Reservoir Volume (mg)			
Forest Hills	1.99	1.99	1.99
Cougar Mountain 1	0.50	0.50	0.50
Somerset 2	0.10	0.10	0.10
Cougar Mountain 2	1.00	1.00	1.00
Cougar Mountain 3	2.03	2.03	2.03
Cougar Mountain 3A	0.30	0.30	0.30
Horizon View 1	0.18	0.18	0.18
Horizon View 2	0.15	0.15	0.15
Horizon View 3	1.99	1.99	1.99
Horizon View 3A	0.21	0.21	0.21
Total Volume (mg)	8.45	8.45	8.45
Required Storage			
Operational	2.59	2.59	2.59
Equalizing	1.35	1.36	1.39
Fire Suppression	1.56	1.56	1.56
Emergency	2.11	2.13	2.17
Dead	0.01	0.01	0.01
Total Required (mg)	7.62	7.65	7.72
Excess or (Deficit) Storage with Existing Infrastructure (mg)	**0.83**	**0.80**	**0.73**

Notes:

(1) Includes wheeled demands to Issaquah's Montreux/Glacier Ridge area. Bellevue is responsible for providing storage for this area. Wheeled demands grow from 646 ERUs (MDD of 0.33 mgd) in 2020 to 745 ERUs (MDD of 0.38 mgd) in 2034.

4.2.7 Factoria Storage Region

The Factoria Storage Region serves the Factoria regional shopping mall and surrounding neighborhoods. The Storage Region is served by the 2.28 mg Factoria reservoir. The reservoir provides large fire flows (4,750 gpm for 4 hours) for the mall, as well as other storage components. The existing storage is sufficient to meet the required storage through 2034, as shown in Table 15. No improvements are recommended for this Storage Region.

Table 15 Factoria Storage Region Analysis
Reservoir Sizing And Storage Volume Analysis
City of Bellevue

Parameter	2020	2024	2034
Demands			
ERUs	2,108	2,146	2,241
MDD (mgd)	1.08	1.10	1.14
Existing Reservoir Volume (mg)			
Factoria	2.28	2.28	2.28
Total Volume (mg)	2.28	2.28	2.28
Required Storage			
Operational	0.50	0.50	0.50
Equalizing	0.11	0.11	0.11
Fire Suppression	1.14	1.14	1.14
Emergency	0.42	0.43	0.45
Dead	0.00	0.00	0.00
Total Required (mg)	2.17	2.18	2.20
Excess or (Deficit) Storage with Existing Infrastructure (mg)	**0.11**	**0.10**	**0.08**

4.2.8 Newport Hills (CCUD) Storage Region

Reservoirs serving Newport Hills Storage Region are operated by the Coal Creek Utility District (CCUD). The City has partial ownership in the infrastructure required to serve the Newport Hills Storage Region. The City has 3.05 mg of storage available from three CCUD reservoirs, as well as a share of the required supply infrastructure. As shown in the table, the available infrastructure is sufficient to meet the required demands. The City will continue to work with CCUD to maintain the level of service in the Newport Hill Storage Region through 2034.

Table 16	Newport Hills (CCUD) Storage Region Analysis Reservoir Sizing And Storage Volume Analysis City of Bellevue		
Parameter	**2020**	**2024**	**2034**
Demands			
ERUs	3,309	3,347	3,426
MDD (mgd)	1.69	1.71	1.74
Existing Reservoir Volume (mg)			
CCUD 440 Res. (1)	1.65	1.65	1.65
CCUD 1MG 580 Res. (1)	0.40	0.40	0.40
CCUD 2.5MG 580 Res. (1)	1.00	1.00	1.00
Total Volume (mg)	3.05	3.05	3.05
Required Storage			
Operational (2)	NA	NA	NA
Equalizing	0.42	0.43	0.44
Fire Suppression	1.92	1.92	1.92
Emergency	0.66	0.67	0.69
Dead	0.00	0.00	0.00
Total Required (mg)	3.00	3.02	3.05
Excess or (Deficit) Storage Volume (mg)	**0.05**	**0.03**	**0.00**

Notes:
(1) Consistent with Coal Creek Utility District's 2013 Water Plan.
(2) Not applicable. Reservoir operated by CCUD.

4.2.9 Seattle Public Utilities (SPU) Only Storage Region

The SPU Only Storage Region consists of three pressure zones (RV300, WD340, and WD400) that are served directly from the Richard's Road Inlet of the Seattle Public Utilities (SPU) Cedar River Supply Pipeline. The pressure zones do not have storage and receive all supplied from SPU, except the RV300 zone that has two emergency PRV's with the Lake Hills Storage Regions and WD400 zone that has one emergency PRV with the Bellevue Storage Region. The required storage, excluding Operational and Dead Storage, was calculated to aid the City; however, no storage analysis was conducted. Table 17 provides the required storage and other parameters that may be of use to the City. It is recommended that the City review its documentation that it has contractual right and infrastructure capacity to provide the needed emergency and fire flow to the SPU Only Storage Region. This may include:

- Documentation of contractual right to peaking flows above the MDD.

- Documentation of the contractual right to use flow for fire flows and emergency supplies.
- Documentation that the Richard's Road Inlet has the physical capacity to supply the required domestic and fire flows.

No improvements were recommended; however, storage improvements should be reviewed upon completion of contractual and infrastructure capacity.

Table 17 SPU Only Storage Region Required Storage Volumes Reservoir Sizing And Storage Volume Analysis City of Bellevue

Parameter	2020	2024	2034
Demands			
ERUs	1,734	1,746	1,771
MDD (mgd)	0.88	0.89	0.90
PHD (mgd)	2.22	2.23	2.26
Maximum Fire Flow (mgd)	4.68	4.68	4.68
Existing Reservoir Volume (mg)			
Not Applicable	-	-	-
Total Volume (mg)	-	-	-
Required Storage			
Operational	0.00	0.00	0.00
Equalizing	0.22	0.22	0.23
Fire Suppression	0.59	0.59	0.59
Emergency	0.35	0.35	0.35
Dead	0.00	0.00	0.00
Total Required Storage with Existing Infrastructure (mg)	**1.16**	**1.16**	**1.17**

4.3 Summary of Storage Improvements

An analysis of reservoir storage was conducted for nine Storage Regions, encompassing the entire City's distribution system. The analysis identified the required storage volumes for each Storage Region based on the City's updated storage criteria. The existing reservoirs volumes and required storage volumes are compared. Where storage deficiencies were identified, improvements were recommended. The recommended improvements are summarized in Table 18. Multiple options were provided to resolve deficiencies to allow flexibility in implementation. When possible, improvements should be combined with other City needs to reduce overall Capital Improvement Plan costs. For example, a pump station can be replaced to aid in the storage analysis and address aging infrastructure. The implementation of these improvements will provide sufficient storage to meet the City's needs through the planning period.

Table 18 Recommended Storage Improvement Options
Reservoir Sizing And Storage Volume Analysis
City of Bellevue

Storage Region	Option 1		Option 2
Bellevue Storage Region	New Reservoir with 2.5 mg of storage volume	OR	Transmission improvements to utilize excess volume in Lake Hills Storage Region
Clyde Hill 500 Storage Region	Clyde Hill Pump Station Improvements to use Dead Storage	AND/OR	Clyde Hill Pump Station Improvements to utilize storage from Bellevue Storage Region
Pikes Peak Storage Region	New Reservoir with 1.25 mg of storage volume	OR	Improvements to Cherry Crest PS to utilize storage from Bellevue Storage Region
SPU Only Storage Region	Review upon completion of inlet capacity evaluation		

For new reservoirs, a reservoir siting study is recommended to determine the preferred location and size of the new reservoir. Dead storage and site-specific operational requirements may increase the new reservoir volume beyond what is stated in this TM.

In addition to the storage improvements, additional hydraulic modeling recommended to support the analyses presented in this TM. The City may benefit from the following:

- Confirm the transmission capacity to convey fire flows between pressure zones in a given Storage Region, especially where reservoirs are being rehabilitated, replaced, or abandoned.
- Evaluate hydraulics between Storage Regions to ensure adequate transmission capacity during peak demand periods and during emergencies.

APPENDIX A – TM2A STORAGE CRITERIA

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CITY OF BELLEVUE

WATER SYSTEM PLAN UPDATE

TECHNICAL MEMORANDUM NO. 2A
STORAGE CRITERIA

FINAL
July 2014

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CITY OF BELLEVUE

WATER SYSTEM PLAN UPDATE

TECHNICAL MEMORANDUM
NO. 2A
STORAGE CRITERIA

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1.0 INTRODUCTION

The City of Bellevue (City) is updating its Water System Plan. As part of this update, the City is reviewing the criteria used to evaluate the minimum storage volume needs. The purpose of this Technical Memorandum (TM) is to provide background information on storage criteria, industry benchmarks, and alternative criteria to be considered. The City will revise their storage criteria, as necessary, and the revised criteria will be used to determine the required storage volumes in subsequent analyses.

The five components of storage required by the Washington State Department of Health (DOH) are summarized in this TM. An industry survey was conducted to establish benchmarks to evaluate the City's current storage criteria and provide examples of alternate criteria. To further aid in the selection of storage criteria, potential water supply disruptions were reviewed to provide an indication of the type and likelihood of emergencies. Based on the Industry Survey and potential water supply disruptions, multiple criteria options for each of the storage components are presented for the City's review and consideration.

2.0 ELEMENTS OF STORAGE

2.1 Storage Components

The DOH[1] requires consideration of the following five components of storage for any water system:

1. Operational Storage.
2. Equalizing Storage.
3. Fire Storage.
4. Emergency Storage.
5. Dead Storage.

The five types of storage are shown graphically in Figure 1. The volume of each component in a given storage facility is typically defined in terms of gallons and the volume can be allocated to a range of tank depths, also called a band. Figure 1 shows both stacked and nested components. A description of each storage component is presented in the following sections. As part of the description, the City's existing storage criteria and DOH's criteria are discussed and summarized in Table 1.

[1] WAC 246-290-235(3) and Water System Design Manual, Chapter 9

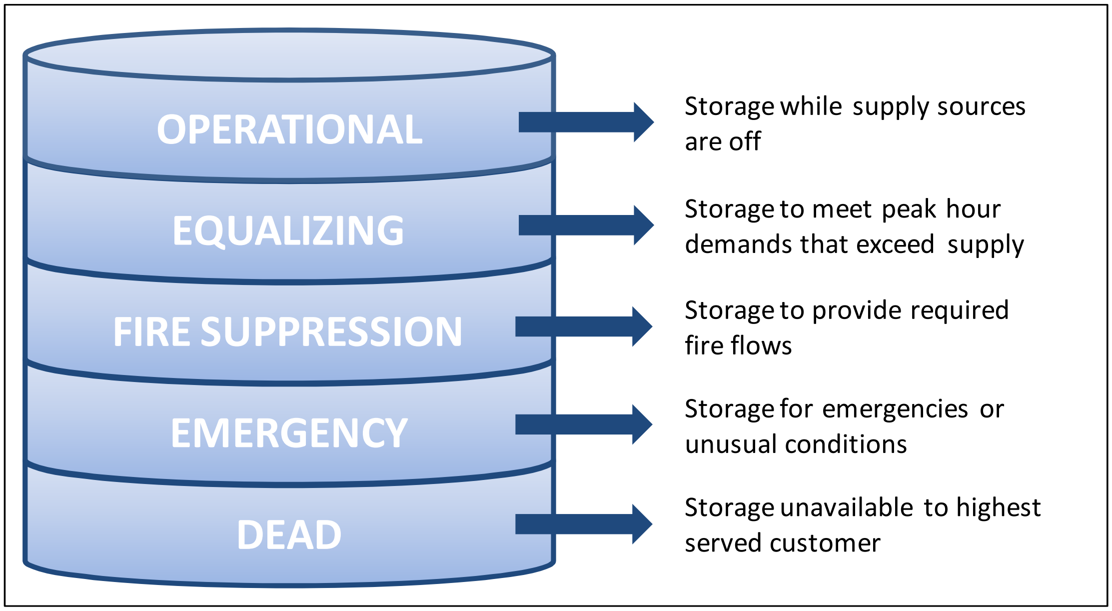
Table 1 Current City and State Storage Criteria
Water System Plan Update
City of Bellevue

Consideration	**Bellevue**	**DOH**
Storage Components		
Operational	None	Per City preference
Equalizing	20% of MDD	(PHD – Qs[1])*150 minutes or Calculate based on diurnal curve
Emergency	200 gal/ERU	Suggests: Largest of 200 gal/ERU or (2 days)[(ADD)(N) - 1440 (QS - QL[2])]
Fire Suppression	5,500 gpm per Operating Area	Per local fire protection authority
Dead	None	Per hydraulic analysis
Additional Considerations		
Nested Emergency/Fire	No	City's preference
Fire Suppression Storage Distribution Area	Operating Area	-
Limited cascading from higher to lower areas	None	-
Sharing Storage	Between pressure zones in a given Operating Area	-

Notes:

(1) Qs = Total Source Pumping Capacity in gpm.
(2) QL = the largest capacity source available to the water system in gpm.

STACKED



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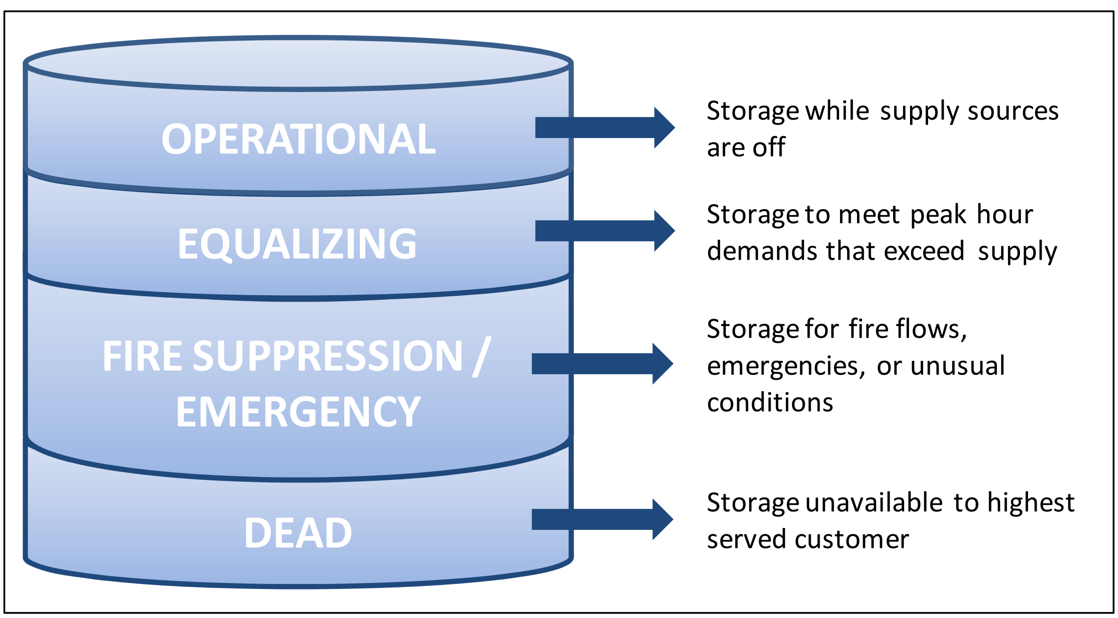

5 TYPES OF STORAGE REQUIRED BY DOH

FIGURE 1

CITY OF BELLEVUE
WATER PLAN UPDATE

2.1.1 Operational Storage

Operational Storage is "the volume of the reservoir devoted to supplying the water system while, under normal operating conditions, the sources of supply are in "off" status" (WAC 246-290-010). From a practical perspective, this volume is frequently empty and therefore unavailable for other storage needs. Operational Storage is estimated based on the amount each reservoir drops prior to calling on pumped supply sources, such as wells or pumps in lower elevation pressure zones. The volume is measured by the amount stored between the pump off and pump on level setpoints. This volume is dependent on the settings of the water level sensors controlling the pumps and is designed to prevent excess cycling of pump motors. For the City, most sources are operated continuously; sources are not typically "called" based on the tank level. Therefore, no operational storage is currently considered by the City.

Utilities with continuous sources may maintain a band of empty volume at the top of reservoirs to avoid overflows. Additionally, the City operates several isolated reservoirs at low levels or empty to maintain water quality. This storage is not included in the DOH definitions of the storage components. A utility may elect to represent these volumes as Operational Storage or as Equalizing Storage.

2.1.2 Equalizing Storage

Equalizing Storage is the volume needed to satisfy the peak hour demand (PHD) that exceeds the normal flow rate of the supply source. Cascade Water Alliance members are expected to provide storage for peaking above the maximum day demand (MDD). DOH recommends that Equalizing Storage for systems with continuous supplies be calculated based on a utility specific diurnal demand curve for the MDD. The volume is calculated as the difference between supply and demand over the course of the day, as shown in Figure 2. The City's current criterion is 20 percent of the MDD is rounded up from approximately 18 percent of the MDD that was determined from historical diurnal patterns. Using the percent of the MDD is a common method of relating storage to demands. Equalizing Storage volumes must be available at system pressure of 30 pounds per square inch (psi) or higher throughout the system for the PHD.

2.1.3 Emergency Storage

Emergency Storage, also referred to as Standby Storage, is the volume of storage required to supply reasonable system demands during a system emergency, such as disruption of the water supply. Disruptions could be caused by transmission pipeline or equipment failure, power outage, valve failure, or other system interruptions. Emergency Storage volumes are not typically sized for long-term water disruptions. These types of major emergencies should be covered under emergency system operation planning. Typically, Emergency Storage volumes maintain at least 20 psi or higher throughout the system for the MDD, however DOH does not specify a specific criteria.

DOH recommends a minimum of 200 gallons per equivalent residential unit (gal/ERU) of Emergency Storage. The City has set this minimum recommendation as the Emergency Storage criteria. Additional storage is recommended by DOH when two times the average day demand (ADD) less system supplies with the largest source out of service is greater than 200 gal/ERU. DOH describes a number of methods in the Water System Design Handbook (DOH 2008) to decrease Emergency Storage. They include:

- Development of additional sources.
- Community expectations are amenable to lower volumes.
- Using booster pumps to make use of dead storage.

The Industry Survey provides multiple examples of Emergency Storage criteria that are acceptable to DOH and differ from the recommended criteria.

2.1.4 Fire Suppression Storage

Fire Suppression Storage is the volume of storage required to deliver rate and duration of fire flows prescribed by local fire protection authorities, while maintaining a minimum pressure of 20 psi during MDD conditions. Since a fire can occur at any time during the day, the fire storage must be in addition to the equalizing and operational storage.

Fire flow demand, or flows, is the quantity of water required for fire fighting as defined by applicable water system criteria and fire codes. The City currently provides 1.65 million gallons (MG) of Fire Suppression Storage in each operating area, which provides 5,500 gpm for five hours. Fighting fires often places the largest instantaneous flow demands on the distribution system because a high volume of water must be supplied over a short time.

2.1.5 Nesting or Stacking Emergency or Fire Suppression Storage

The City currently stacks their Fire Suppression and Emergency Storage. Stacking Emergency and Fire Suppression storage maintains separate volumes. For example, stacked Emergency Storage of 1 MG and Fire Suppression Storage of 0.5 MG would require 1.5 MG of storage volume. DOH allows the Fire Storage and Emergency Storage volumes to be combined by nesting these required volumes. Nesting can be conceptualized as planning for one emergency, while stacking plans for two emergencies. Nesting allows the same volume to be used for both fire and emergency storage, where the volume of the combined storage is equal to the largest of the two storage components. For example, nested Emergency Storage of 1 MG and Fire Suppression Storage of 0.5 MG would require 1 MG of storage volume. As described in the Industry Survey, utilities may choose a combination of nesting and stacking depending on customer type.

2.1.6 Dead Storage

Dead Storage is the volume of water at the bottom of a storage tank that is unusable. Storage volume is considered dead if it is located below the outlet pipe and cannot be used because of system hydraulic limitations, or if it is located below the lowest water surface elevation that meets the minimum design pressure for all customers (WAC 246-290-230(5) and (6)). Typically, the minimum design pressure is defined by the Fire Suppression storage (20 psi of pressure during the MDD and a fire flow event). Booster pump stations may allow dead storage to be used as long as they do not cause system pressures to fall below the minimum pressure. The City historically has not considered dead storage.

2.1.7 Additional Considerations

The volume of storage required is calculated based on the criteria presented for each of the storage components. The required storage can be allocated in a variety of ways, which can create localized storage surpluses or deficiencies. These additional considerations are presented in the second half of Table 1. As shown in the Table, DOH does not regulate these additional considerations. A short explanation of each consideration is provided below.

- **Nested Emergency/Fire**: Nesting is discussed above in Section 2.1.4.
- **Fire Suppression Storage Distribution Area**: Considers the ability to use fire suppression storage in the system. Fire Suppression storage may be used for an operating area, all pressure zones served by a reservoir (typically a large zone and multiple smaller zones served by pressure reducing valves [PRV]), or a single pressure zone.
- **Limited cascading from higher to lower areas**: Cascading refers to moving storage outflows from a higher pressure zone to a lower pressures zone, which may require the flow to move through a series of PRVs. These mechanical devices may fail; therefore, some utilities limit the number zones storage may cascade.
- **Sharing Storage**: Considers sharing storage between pressure zones or operating areas. Sharing storage allows reservoirs with excess storage to be used to meet areas with storage deficiencies.

The Fire suppression storage is shared between pressure zones in a given operating area. The City applies no limits on cascading from higher to lower pressure zones. The City currently has limited infrastructure to share between operating areas; however, some of this infrastructure may be improved in the coming years. As infrastructure becomes available, City staff expressed a preference to allow storage to be shared between operating areas.

2.2 Industry Survey

An industry survey was conducted to establish benchmarks for relevant storage criteria from comparable utilities on a regional and national basis.

The industry survey was divided into in-state and out-of-state utilities. Selected in-state utilities have similar features to the City, such as regional supply. The selected utilities demonstrate alternative storage criteria and the breadth of available criteria allowed by DOH. Out-of-state utilities provide a national perspective on storage. The information discussed for all utilities represent approaches accepted by the appropriate regulatory

Table 2 Washington State Industry Survey
Water System Plan Update
City of Bellevue

Consideration	Utility A - WA	Utility B - WA	Utility C - WA	City D - WA
Storage Components				
Operational	Hydraulic Model	None	0.5 ft to 1 ft	2 ft to 3 ft
Equalizing	(PHD - $Qs_{\text{Firm, reliable sources}}$), Separate storage volume was calculated for 30 psi band [1]	(PHD - Qs)*150 min	(PHD - Qs)*150 min	25% of MDD
Emergency	200 gal/ERU	Residential: 200 gal/ERU Commercial: 100 gal/ERU	200 gal/ERU	Largest of 2X MDD with the largest supply out of service OR 2X MDD using only reliable sources and pump stations
Fire Suppression	Per local fire protection authority, Storage offset from redundant, reliable BPS	Per local fire protection authority	Per local fire protection authority	Per local fire protection authority
Dead	Per hydraulic analysis	Per hydraulic analysis	Per hydraulic analysis, Separate available storage calculated for 30 psi and 20 psi bands.	Per hydraulic analysis
Additional Considerations				
Nested Emergency/Fire	Yes	Yes	Stacked for Single-Family Residential Nested for Commercial and Multi-family with Fire Flow greater than 3,5000 gpm	No
Fire Suppression Storage Distribution Area	Pressure zones served by reservoir	Operating Area	Pressure zones served by reservoir	Pressure zones served by reservoir
Limited cascading from higher to lower areas	No	NA	3 Pressure Zones (2 mechanical devices)	No
Sharing Storage between areas	Between Operating Areas and Pressure Zones	NA	Between Pressure Zones	Between Pressure Zones

agency. However, out-of-state approaches may not meet Washington's regulatory requirements.

2.2.1 In-State Utilities

Storage Criteria for four comparable in-state utilities are summarized in Table 2. Each utility is located in the Puget Sound region and shares similar traits with the City. Table 2 provides details on storage component criteria, and additional considerations for allocating the storage.

2.2.1.1 Utility A – WA

Utility A serves large industrial/commercial customers and large areas of single-family residential. Its service area has a large range of elevations and the system contains cascading pressure zones to serve customers on hillsides. Of note is that Utility A has found that they have less dead storage (more available volume) at 20 psi (Emergency and Fire Suppression Storage), than at 30 psi (Operational and Equalizing Storage). Typically, dead storage is largest at 20 psi and therefore used to define the active storage volume. However, Utility A considers the available volume of each reservoir to serve customers at 30 psi and 20 psi separately. By incorporating this additional information, the Utility was able to identify distribution system improvements that increase the available storage and add operational flexibility.

2.2.1.2 Utility B – WA

Utility B serves large industrial/commercial areas and is served by a constant regional water source. The storage criteria are similar to DOH criteria with a notable exception for Emergency Storage. Utility B reserves the recommended 200 gal/ERU for residential customers. However, it reserves 100 gal/ERU for its non-residential customers. The Utility's position that non-residential water use will likely be greatly reduced during water outages that extends past a single day; therefore, 200 gal/ERU was overly conservative for non-residential customers.

2.2.1.3 Utility C – WA

Utility C serves a large range of elevation and the system contains cascading pressure zones to serve customers on hillsides. Utility C partially stacks and partially nests Emergency and Fire Suppression Storage based on customer type and fire flows. Non-residential customers with fire flows greater than 3,500 gpm are nested. Storage for residential and all other non-residential customers are stacked. Like Utility A, the Utility C considers available reservoir storage at 30 psi (Operational and Equalizing Storage) and 20 psi (Emergency and Fire Suppression Storage). Additionally, it limits the number of pressure zones that storage can be cascaded to three zones. This ensures the storage water needs to travel through no more than two mechanical devices, which reduces the risk of a valve failure.

2.2.1.4 Utility D – WA

Utility D serves a mix of residential, industrial, and commercial customers. The utility is supplied by both regional water supplies and groundwater wells. Of note is the Utility D's Emergency Storage criteria. Utility D Emergency Storage criteria is based on two times the MDD, which is reduced based on the ability to supply water from multiple supplies or redundant and reliable (those with backup power) sources and pumps stations. By incorporating the Utility's investments in supply infrastructure, the utility greatly reduced its Emergency Storage needs.

2.2.2 Out-of-State Utilities

Storage Criteria for four comparable out-of-state utilities are summarized in Table 3. Each utility shares similar traits with the City. Table 3 provides details on storage component criteria, and additional considerations for allocating the storage.

2.2.2.1 Ten-State Standards

"Recommended Standards for Water Works" by The Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers (2012 Edition), or Ten-State Standards, are the basis for much of the surveyed out-of-state storage sizing criteria. The standards provide design criteria that are used throughout the countryand referenced in the DOH Design Manual. The Ten-state standards do not provide detailed storage criteria, but establish minimum criteria. The Ten-State Standards reservoir sizing criteria results in less storage than typically provided in Washington. Additionally, in the Ten-State Standards do not address all of the storage components required by Washington statutes.

2.2.2.2 Utility E – Oregon

Utility E serves approximately a half a million people in the Portland metropolitan area in Oregon. The Utility is supplied by regional surface water sources. The storage criteria of Utility E and the City are quite similar. Utility E does have some minor differences in implementation. The Fire Suppression volume is calculated for each major pressure zone as defined by the presence of reservoir(s). Additionally, it shares storage between operating areas as infrastructure allows.

2.2.2.3 Utility F – Colorado

Utility F is located in the Denver Metropolitan area in Colorado. Utility F serves largely residential customers using surface water supplies. The Denver area and Utility F is relatively flat with low, gradual hills. Utility F has reservoir booster pumps to make full use of their storage reservoirs. Of note is the additional considerations incorporated into determining the volume of storage made available by the reservoir booster pumps. Reservoir booster pump stations must be redundant and reliable to be considered. If less than 50 percent of storage in the reservoir can be delivered by gravity, then at least two independent, redundant, and reliable supplies must be able to fill the reservoir.

2.2.2.4 Utility G – California

Utility G is located in Northern California. Utility G is representative of many utilities in across the country that has less Emergency Storage than what is recommended in Washington. Similar to other utilities surveyed, Equalizing Storage criteria is between 20 and 30 percent of MDD.

2.3 Water Supply Disruptions

The City's largest existing component of storage is Emergency Storage. Revisions to the City's existing emergency storage criteria may result in substantial changes in required storage. Therefore, three water supply disruption scenarios were developed to aid the City in evaluating potential Emergency Storage criteria. The water supply disruptions scenarios present short-term events that can be expected to occur within normal planning contingencies. The scenarios do not represent major system emergencies, such as earthquakes, or long-term emergencies, such as drought. Additionally, the City's emergency wells could provide supplies during a water supply disruption; however, supply and distribution infrastructure are currently limited.

The water supply disruption scenarios represent a type of emergency and the likely result of each being a reduction in service. However, system infrastructure can limit the potential for water supply disruptions. The water supply disruptions include:

- Failure of the Cedar or Tolt supplies (reduction of supply).
- Power Outage.
- Mechanical or Pipe Failure.

Emergency storage is sized to provide for short-term disruptions. The Water Shortage Contingency Plan provides strategies to mitigating long-term water supply disruptions, such as earthquakes, landslides, sabotage, contamination, drought, etc. It is recommended that the City maintain up-to-date operational plan to address potential vulnerabilities and its Water Supply Contingency Plan to continue to limit the risk from mechanical or pipe failures. The water supply disruptions mentioned above would likely cause short-term disruptions and are discussed in detail below.

2.3.1 <u>Failure of the Cedar or Tolt Supplies</u>

Failure of the Cedar or Tolt supplies has occurred three times in the last thirty years, as described in the City's Water Shortage Contingency Plan. The Tolt Pipeline broke in 1987 and 1988 creating short-term outages. In both cases, supplies from the Cedar River were used and customers voluntarily cut back on water use. Cedar River supplies were

Table 3 Nationwide Industry Standard
Water System Plan Update
City of Bellevue

Consideration	Ten State Standards	Utility E - OR	Utility F - CO	Utility G - CA
Storage Components				
Operational	-	Combined with Equalizing	Combined with Equalizing	Combined with Equalizing
Equalizing	-	25% of MDD	30% of MDD	25% of MDD
Emergency	ADD, reduced with reliable sources	2X ADD	ADD	50% of MDD
Fire Suppression	Per State Insurance Office	Per local fire protection authority	Per local fire protection authority	Per local fire protection authority
Dead	Excessive Storage Capacity to be avoided	Per hydraulic analysis	None	-
Additional Considerations				
Nested Emergency/Fire	-	No	No	No
Fire Suppression Storage Distribution Area	-	Pressure zones served by reservoir	Operating area	Pressure zones served by reservoir
Limited cascading from higher to lower areas	-	No	No	-
Sharing Storage between areas	-	Yes, as infrastructure allows	Yes, 50% of storage requirement from gravity storage. Remainder supplied by redundant and reliable pump stations. If less than 50% of storage from gravity storage, then at least two independent redundant and reliable pump stations must be able to supply storage.	-

unavailable due to unacceptable water quality due to historic flooding in 1990. Cedar and Tolt supplies are now treated, which greatly reduces the likelihood of similar supply disruptions. While it has not occurred in the last 30 years, there remains the potential for a break in the Cedar River pipeline.

It is recommended that the City consider potential disruptions to the Cedar or Tolt supplies once every 10 years based on historical frequency of major supply disruptions the City has experienced.

2.3.2 Power Outage

Widespread Power outages are a regular, though relatively infrequent, occurrence in the City, typically associated with windstorms or major winter storms. Wind, trees, and ice can cause substantial damage to power lines, transformers, and other power infrastructure. Flooding may also cause localized power outages. The City has booster pump stations associated with most reservoirs, which are used to maintain water quality and utilize the storage volume that cannot be delivered by gravity. The inability to use these pumps during emergency events should be considered a water supply disruption.

The City has the ability to operate its reservoir booster pumps on either permanent backup generators or portable generators. From a storage criteria perspective, the City has effectively eliminated the risk of water supply disruptions during normal planning conditions; therefore, water supply disruption are not likely from this scenario.

2.3.3 Mechanical or Pipe Failure

Mechanical device, such as a pump or PRVs, failure may cause water supply disruptions. Failure of an SPU supply valve, PRV, or break in a distribution main may create a localized water supply disruption. The City's vulnerability analysis indicates that under most operational scenarios system adjustments can be made to overcome the loss of a single facility. Therefore, these were not considered to be a likely water supply disruption scenarios.

2.4 Storage Criteria Options

The City's existing storage criteria meet DOH criteria and are similar other utilities summarized in the Industry Survey. The Industry Survey and review of water supply disruption scenarios identified additional criteria for the City to consider. These criteria may maintain or improve the City's existing level of service. All criteria meet the minimum requirements and recommendations set by DOH and WAC 246-290.

Preferred criteria is needed for each storage component. The City is encouraged to review the selected criteria or develop other preferred criteria. Multiple criteria have been selected for the City to consider for each storage component (Operational Storage, Equalizing Storage, etc.). The criteria and their benefits, challenges, and ramifications are presented in subsections below. The criteria are also summarized in Table 4. For ease of reference, the options are labeled 1, 2, or 3.

The City is encouraged to review and incorporate the additional considerations provided in the Industry Survey into their storage policies and criteria. Nesting and stacking of Fire Suppression and Emergency Storage are incorporated into the Fire Suppression storage criteria options. While not included in an option, the City should consider incorporating a formal policy to transfer storage between operating areas as infrastructure becomes available. Other considerations may be added based on the City's preferences.

2.4.1.1 Operational Storage

The City does not currently have operational storage. City staff have indicated that reservoirs are not operated completely full; therefore, it is recommended that this empty volume be accounted for as Operational Storage. Two options have been selected for consideration:

1. Determine Operational Storage based on the maximum level during normal operating conditions; typically less than three feet below the overflow.
2. Use the hydraulic model to determine the Operational Storage required to meet demands during changes in the rate of supply.

The benefit of Option 1 is that it bases storage volumes on the City's existing operational strategy; however, this existing strategy may use more volume than is required. The benefit of Option 2 is that it provides the minimum Operational Storage volume required, which would increase the normal operating volume. Therefore, the reaction time to avoid overflows may be decreased would be . Both options will increase the City's required storage volume relative to the previous criteria.

Additionally, it is recommend the City develop a policy to define to account for isolated reservoirs that are maintained at low levels or empty. The volume may be accounted for as operational storage or as reduced nominal storage.

2.4.1.2 Equalizing Storage

The City's Equalizing Storage is calculated as 20 percent of the MDD. This criterion is within the typical range identified in the Industry Survey and is included as Option 1. However, the City may benefit from considering alternative approaches. Three options have been selected for consideration:

1. No Change; 20 percent of the MDD.
2. Update percent of the MDD based on City's latest diurnal curves.
3. Provide 30 percent of MDD based on conservative Industry Benchmark.

The benefit of Option 1 is that it is consistent with the City's existing policies and operational strategy. The benefit of Option 2 is that the volume will reflect current operations; however, it may require additional storage volume. Option 3 provides a conservative approach; however, it will result in additional storage volumes.

2.4.1.3 Emergency Storage

Emergency Storage is the City's largest existing storage volume. The volume is based on the DOH recommendation of 200 gal/ERU and is included as Option 1. The Industry Survey identified two alternative criteria that may meet the City's and its customers expectations, while reducing the volume required. The City's existing criteria and these alternative criteria are:

1. No change – DOH Recommendation of 200 gal/ERU.
2. Residential: 200 gal/ERU, Non-Residential: 100 gal/ERU.
3. Provide two (2) times the ADD minus the available supply with the largest source out of service.

The benefit of Option 1 is that it is consistent with the DOH recommendation and the City's existing policies; however it may require more storage than needed. The benefit of Option 2 is that it continues to provide the DOH recommended storage for residential customers, while reducing the emergency storage volume for non-residential customers. However, this option may not meet City or non-residential customers' expectations. Option 3 accounts for the likelihood of water supply disruptions based on the City's past experience. This option could allow the City to consider storage alternatives if the largest source was one of the Regional Supply's lines.

2.4.1.4 Fire Suppression Storage

The City currently provides 1.65 million gallons of Fire Suppression Storage in each operating area, which provides 5,500 gpm for 5 hours. This criterion meets or exceeds the Fire Marshal's requirements and is included as Option 1. However, several customers require fire flows greater than 5,500 gpm. Option 2 provides Fire Suppression Storage equal to these larger fire flow requirements in each Operating Area. In both options Fire Suppression storage is stacked with Emergency Storage. Nesting would result in a substantial change in the level of risk (planning for one versus two emergencies) accepted by the City and therefore not suggested. The criteria selected for consideration are:

1. No change – Stacked Fire Suppression volume providing 5,500 gpm for five hours in each Operating Area.
2. Stacked Fire Suppression volume based on largest fire flow in the Operating Area.

The benefit of Option 1 is that it does not require a change to City storage volumes or policies. Option 2 may require greater Fire Suppression volumes; however, these volumes are not required by the City's Fire Marshal.

2.4.1.5 Dead Storage

The City's existing policy considers that reservoirs with booster pumps to be fully available (i.e. no dead storage). This criterion is reasonable, since the City's existing reliable booster pump stations are able to utilize nearly all reservoir volumes. This approach is included as Option 1. Implicit in this approach is that the City will be able to deliver the storage throughout the Operating Area. Option 2 would use the hydraulic model to verify the distribution system has the necessary capacity. The criteria options selected for consideration are:

1. No change – No dead storage.
2. Verify Dead Storage using hydraulic modeling and pump suction submergence requirements.

The benefit of Option 1 is that it does not require a change to City storage volumes or policies. It neglects a small volume of water between the reservoir outlet and the bottom of the tank; however, this is likely a relatively small volume. Option 2 requires additional analysis and may result in increased Dead Storage volumes or additional distribution system improvements.

Table 4 Storage Criteria Recommended Options
Water System Plan Update
City of Bellevue

		Operational Storage			
Options:	1) Up to 3 ft buffer based on normal operations	OR	2) Calculated from hydraulic modeling		
		Equalizing Storage			
Options:	1) No change – 20% of MDD	OR	2) Updated % of MDD based on City's latest diurnal curve	OR	3) 30% of MDD
		Emergency Storage			
Options:	1) No change – DOH Recommendation of 200 gal/ERU	OR	2) Residential: 200 gal/ERU Non-Residential: 100 gal/ERU	OR	3) 2 X ADD - Qs with the largest source out of service

Table 4	Storage Criteria Recommended Options Water System Plan Update City of Bellevue			
	Fire Suppression Storage-			
Options:	1) No change – Stacked Fire Suppression volume providing 5,500 gpm for 5 hours in each Operating Area.	OR	2) Stacked Fire Suppression volume based on largest fire flow in Operating Area.	
	Dead Storage			
Options:	1) No change – No Dead Storage	OR	2) Verify Dead Storage using hydraulic modeling and pump suction submergence requirements	

APPENDIX B – OPERATIONAL STORAGE FOR EACH RESERVOIR

Table B.1 Operational and Dead Storage
Water System Plan Update
City of Bellevue

Rectangular
Altitude valve level controls

Service Area	**East**						**West**					
Facility	Newport	Parksite	NE 40th [1]	Crossroads North	Crossroads South	Kirkland	Clyde Hill 390	Cherry Crest	Woodridge	Clyde Hill 335 Rd.	Clyde Hill 335 Sq.	Meydenbauer
Storage Zone:	Lake Hills	Lake Hills	Lake Hills	Lake Hills	Lake Hills	Rose Hill	Bellevue	Bellevue	Bellevue	Bellevue	Bellevue	Bellevue
Direct Pressure Zone	LH520	LH520	LH520	LH520	LH520	RH545	BV400	BV400	BV400	CL335	CL335	MB252
Nominal Diameter (ft)	160	91	170	68	68		150	160	71	84	65*65	38*116
Base Level (ft)	499.42	480.4	376.5	445	445		358.6	384	326	311	319	232
Overflow Height (ft)	20	40	18.975	75	75		31	20	70	24	16	20
Elevation of Overflow (ft)	519.42	520.4	395.475	520	520		389.6	404	396	335	335	252
Nominal Volume (MG)	**3.01**	**1.95**	**3.22**	**2.04**	**2.04**	**1.50**	**4.10**	**3.01**	**2.07**	**0.99**	**0.51**	**1.32**
Operational Storage												
Outlet or Pump Suction Requirements (ft)	1	1	1	1	1	NA	1	1	1	1	1	1
Max Fill (ft)	17	37	15.975	72	72	NA	27	18	65	23	15	18
Pump Off Set Point	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Max Fill SCADA (ft)	17.8	36.9	33.5	71.8	72.4	NA	26.1	17.0	67.0	21.2	NA	18.0
Operational Storage (ft)	3.0	3.0	3.0	3.0	3.0	0	4.0	2.0	5.0	1.0	1.0	2.0
Operational Storage Volume (gallon)	0.45	0.15	0.51	0.08	0.08	0.21	0.53	0.30	0.15	0.04	0.004	0.01
Dead Storage												
Max Elevation of Model Demand Nodes (ft)	453.67	453.67	453.67	453.67	453.67	NA	314.9	314.9	314.9	246.6	246.6	155.0
Min HGL Required by Highest Customer (20 psi) (ft)	499.9	499.9	395.5	499.9	499.9	NA	361.1	361.1	361.1	292.8	292.8	201.2
Gravity (Live) Storage (ft)	19.6	20.5	0.0	20.1	20.1	NA	28.5	20.0	34.9	24.0	16.0	20.0
Dead Storage Limitation	None	None	Pump Intake	Pump Intake	Pump Intake	NA	None	Highest Elev.	None	Highest Elev.	Highest Elev.	Highest Elev.
Dead Storage (ft)	0.00	0.00	2.00	4.00	4.00	NA	0.00	0.00	0.00	0.00	0.00	0.00
Dead Storage (%)	0%	0%	11%	5%	5%	NA	0%	0%	0%	0%	0%	0%
Dead Storage Volume (Gallons)	0.00	0.00	0.34	0.11	0.11	0	0.00	0.00	0.00	0.00	0.000	0.00

Note:
1. Bellevue has 55 percent share of NE 40th Reservoir.

Table B.1 Operational and Dead Storage
Water System Plan Update
City of Bellevue

Rectangular
Altitude valve level controls

Service Area	**West**		**South**									
Facility	Clyde Hill 465	Pikes Peak	Forest Hills	Cougar Mountain 1	Somerset 2	Cougar Mountain 2	Cougar Mountain 3	Cougar Mountain 3A	Horizon View 1	Horizon View 2	Horizon View 3	Horizon View 3A
Storage Zone:	Clyde Hill 500	Pikes Peak	South	South	South	South	South	South	South	South	South	South
Direct Pressure Zone	CL500	PP550	SS850	SS850	SS700	CM1150	CM1465	CM1465	HV700	SS850	HV1175	HV1175
Nominal Diameter (ft)	36	85	120	61	70*19	73	130	50	31	29.6	130	60*15
Base Level (ft)	365	526	822	822	690	1118	1445.25	1445.25	666.3	821	1155	1159.5
Overflow Height (ft)	93.92	18	23.5	23	10	32	20.45	20.45	31.1	29.1	20	15.25
Elevation of Overflow (ft)	458.92	544	845.5	845	700	1150	1465.7	1465.7	697.4	850.1	1175	1174.75
Nominal Volume (MG)	**0.72**	**0.76**	**1.99**	**0.50**	**0.10**	**1.00**	**2.03**	**0.30**	**0.18**	**0.15**	**1.99**	**0.21**
Operational Storage												
Outlet or Pump Suction Requirements (ft)	1	1	1	1	1	1	1	*1*	1	1	1	1.5
Max Fill (ft)	93.92	18	17.5	17.6	8.5	29	9.3	*9.3*	29	22	17.3	12.25
Pump Off Set Point	NA	NA	17	16	7	27	9	9	22	18	17	17
Max Fill SCADA (ft)	97.0	22.0	20.5	18.5	8.6	30.2	11.0	1.6	31.2	26.5	18.0	13.3
Operational Storage (ft)	0.0	0.0	6.5	7.0	3.0	5.0	11.5	11.5	9.1	11.1	3.0	3.0
Operational Storage Volume (gallon)	0.00	0.00	0.55	0.15	0.004	0.16	1.14	0.17	0.05	0.06	0.30	0.0027
Dead Storage												
Max Elevation of Model Demand Nodes (ft)	388.2	470.9	764.8	764.8	607.6	1040.0	1363.7	1363.7	612.8	764.8	1100.0	1100.0
Min HGL Required by Highest Customer (20 psi) (ft)	434.4	517.1	811.0	811.0	653.8	1086.2	1409.9	1409.9	659.0	811.0	1146.2	1146.2
Gravity (Live) Storage (ft)	24.5	18.0	23.5	23.0	10.0	32.0	20.5	20.5	31.1	29.1	20.0	15.3
Dead Storage Limitation	Highest Elevation	Highest Elevation	Highest Elev.	Highest Elev.	Highest Elev.	Highest Elev.	Highest Elev.	Highest Elev.	Friction Loss	Highest Elev.	Highest Elev.	Highest Elev.
Dead Storage (ft)	69.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	0.00	0.00	0.00
Dead Storage (%)	74%	0%	0%	0%	0%	0%	0%	0%	5%	0%	0%	0%
Dead Storage Volume (Gallons)	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00

Table B.1 Operational and Dead Storage
Water System Plan Update
City of Bellevue

Rectangular	
Altitude valve level controls	

Service Area	**South**			
Facility	CCUD 440 Res.(1)	CCUD 1MG 580 Res.(1)	CCUD 2.5MG 580 Res.(1)	Factoria
Storage Zone:	Newport Hills	Newport Hills	Newport Hills	Factoria
Direct Pressure Zone	NH470	NH580	NH580	FA293
Nominal Diameter (ft)	118.34	41.74	65.78	130
Base Level (ft)	420	540	540	270
Overflow Height (ft)	20	40	40	23
Elevation of Overflow (ft)	440	580	580	293
Nominal Volume (MG)	**1.65**	**0.40**	**1.00**	**2.28**
Operational Storage				
Outlet or Pump Suction Requirements (ft)	1	1	1	1
Max Fill (ft)	*14*	*36*	*36*	22
Pump Off Set Point	NA	17.8	17.8	18
Max Fill SCADA (ft)	NA	NA	NA	22.0
Operational Storage (ft)	6.0	22.2	22.2	5.0
Operational Storage Volume (gallon)	0.49	0.23	0.56	0.50
Dead Storage				
Max Elevation of Model Demand Nodes (ft)	NA	NA	NA	210.0
Min HGL Required by Highest Customer (20 psi) (ft)	NA	NA	NA	256.2
Gravity (Live) Storage (ft)	NA	NA	NA	23.0
Dead Storage Limitation	NA	NA	NA	Highest Elev.
Dead Storage (ft)	NA	NA	NA	0.00
Dead Storage (%)	NA	NA	NA	0%
Dead Storage Volume (Gallons)	0.00	0.00	0.00	0.00

Note:
1. Diameters correspond to the portion allocated from CCUD to Bellevue

Appendix L

Equalizing Storage Component Sizing

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City of
Bellevue

MEMORANDUM

Date: February 11, 2015

To: Bellevue Utilities Technical Team
Dan Reisinger, P.E., Carollo Engineers, Inc.

From: Douglas Lane, P.E.

Subject: Equalizing Storage Component Sizing

Executive Summary

Equalizing (EQ) storage is used to accommodate the difference between water supply flows and variable customer demand patterns. The Washington State Department of Health (DOH) requires that EQ volume for peak demand conditions be considered when sizing reservoirs.

Under ideal conditions, water supply would be constant, demand fluctuations would be buffered ("equalized") by flow into and out of reservoirs, and the volume of water in the system would return to its initial level after 24 hours.

Historically, Bellevue assumed that EQ volume equal to 18% of maximum day demand (MDD) was required, and rounded this to 20%. This was estimated based on a generalized demand pattern presented in the 1992 Water Comprehensive Plan, before significant changes in customer demand patterns. EQ storage assumptions are being re-evaluated for the 2015 Water System Plan based on current data.

Hourly system-wide water demand (Water supply inlet flow +/- reservoir outflow/inflow) telemetry was analyzed for each maximum demand day from 2007-2014, to estimate the ideal volume required to equalize the maximum day demand (MDD). Ideal EQ volume was compared with actual volume used, which varies to meet other operational needs. Ideal system-wide EQ storage required averaged 7.6% over this period and never exceeded 10%. Actual storage used averaged 7.9% and exceeded 10% only once (10.5% in 2010).

Further analysis of the 2014 maximum day was conducted to evaluate localized demands for various customer classes. Analysis showed that areas with predominately single-family housing have significantly higher EQ storage needs (23% of local MDD observed). A "predicted" EQ volume was also estimated based on the specific diurnal curves and proportional flows for various user classes. The predicted EQ volume (11.9% did not correlate well with actual demands, likely due to the limited sample set and assumptions made.

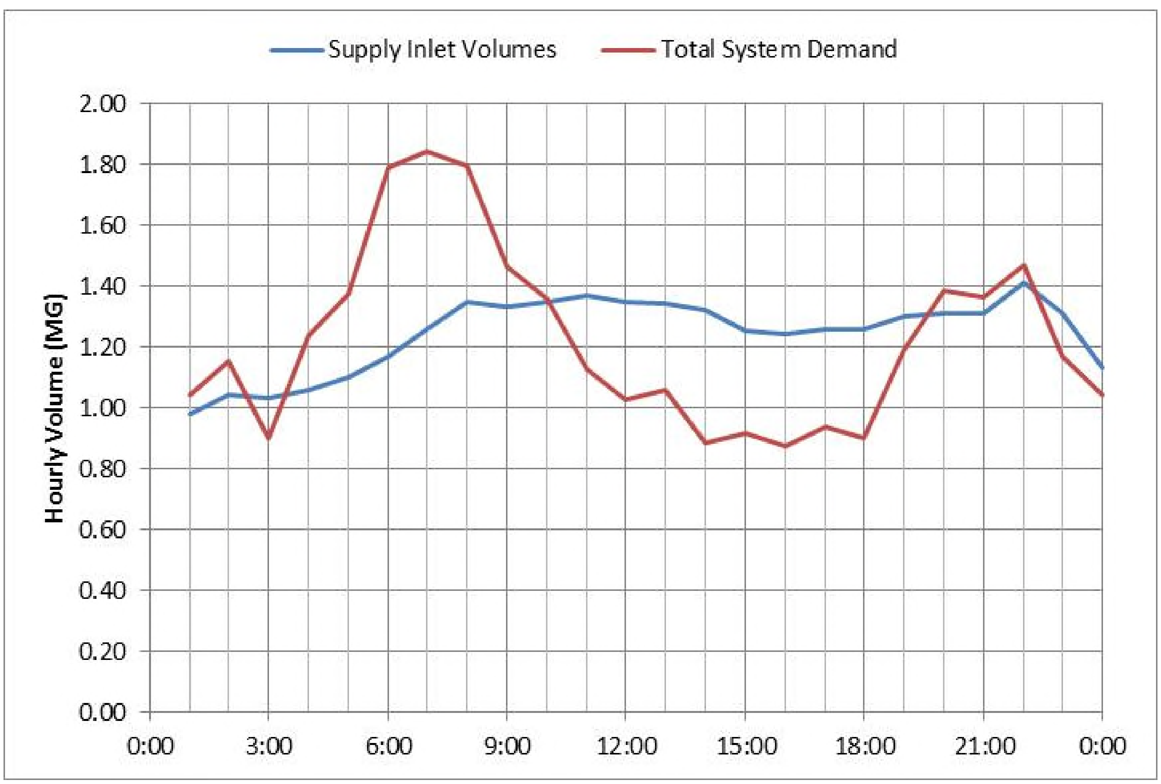
The following is recommended as a result of this study:

- For zones that include primarily single-family residential water customers, plan to provide equalizing storage of 25% of local MDD.
- For zones with a diverse customer base representative of the entire system, provide 10% of local MDD as equalizing storage.
- Review inlet and reservoir telemetry in future years to confirm volume estimates

2014 MDD Observed Equalizing Storage

Figure 1 shows observed hourly supply inlet volumes and the total system demand on the 2014 maximum day, including water wheeled to Redmond and Issaquah, but excluding the NH320, NH380, NH470, NH580 and RH545 pressure zones, which are served by CCUD and Kirkland. MDD was 29.29 million gallons (MG), or 1.22 MG/hour. Areas of Bellevue's water service area that are primarily served by Coal Creek Utility District or Kirkland supply inlets and reservoirs are excluded due to the lack of hourly telemetry for those areas.

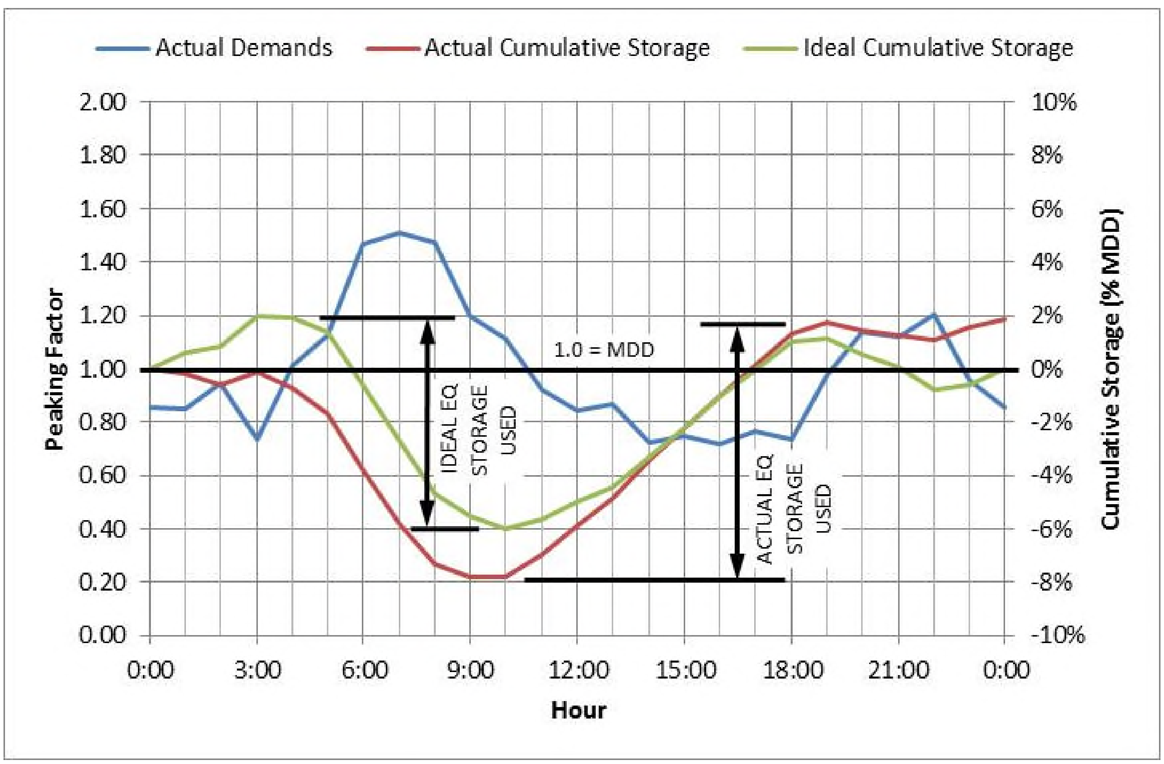
Figure 1 – Maximum Day Inlet Supply Flow versus Total System Demand



The difference between the curves in Figure 1 is reservoir inflow/outflow (estimated using hourly water level fluctuations and known tank geometry). Figure 1 demonstrates graphically how reservoir volume partially equalizes supply and demand. Equalizing is not ideal, however, as inlet flows still varied from roughly 80% of MDD (1:00 AM) to 116% of MDD (10:00 PM). Ideally, inlet flows would equal MDD continuously.

Figure 2 shows the ideal storage volume to equalize the observed system demands (7.9%), and the actual EQ storage used (9.7%) on the maximum day. EQ storage is calculated as the difference between maximum and minimum cumulative storage volumes, assuming water supply with constant flow. Graphically, the ideal storage curve represents the negative cumulative area between the diurnal demand curve and the theoretical constant supply (PF = 1.0), similar to an integration in calculus. The “ideal” EQ volume would be used if the net volume of water stored in the system return to its initial level after 24-hours.

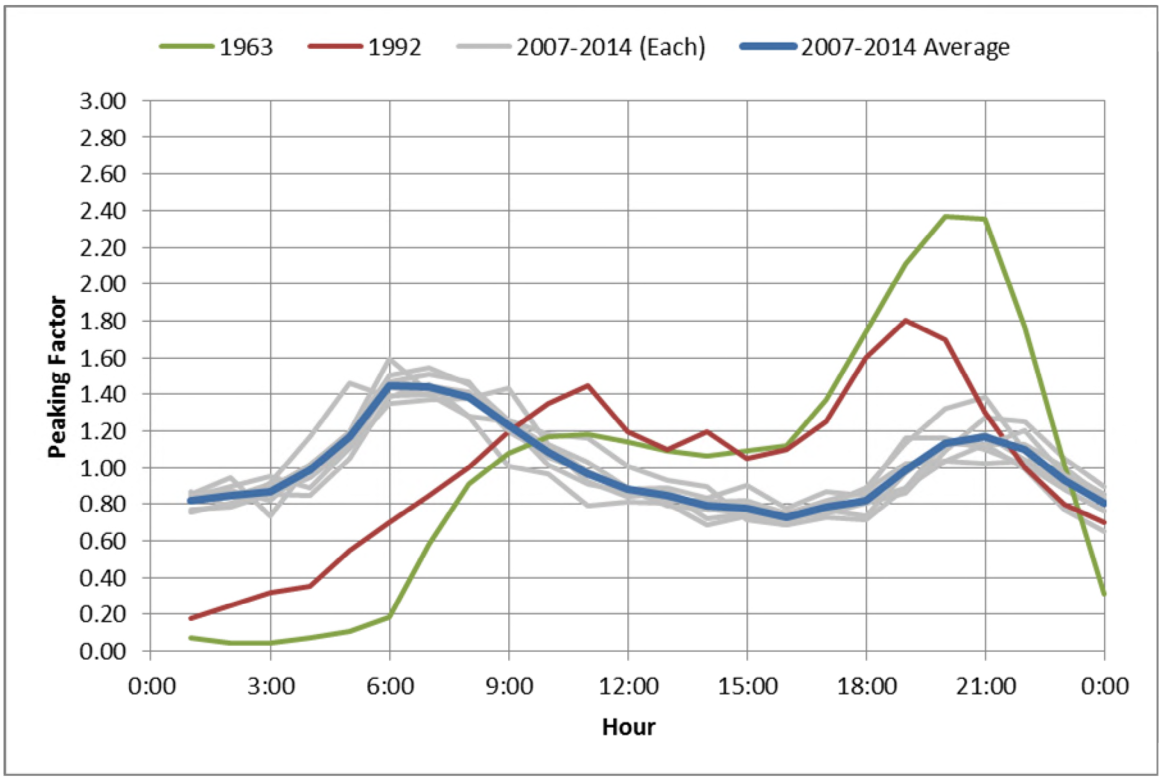
Figure 2 – Actual System-Wide Maximum Day Demands and EQ Storage



The system was operated on the maximum day such that 0.54 MG (1.8% of MDD) of stored water was added during the 24-hour period. This accounts for the majority of the difference between actual and ideal EQ storage. Actual volume used would have been approximately 7.8% if the net storage in the system was unchanged.

The analysis for 2014 maximum demand day above was repeated for each year 2007-2014. Figure 3 shows observed water system demand on the maximum day for each year from 2007 through 2014 (grey shaded lines), and the average during this period (thick blue line). This includes the hourly volume metered through water supply inlets, plus the change in reservoir volume throughout the system for each hour (excluding NH320, NH380, NH470, NH580 and RH545, which are served by CCUD and Kirkland). Observed patterns from 1963[1] and 1992[2] are also added to provide historical context, and to contrast the significant changes in demand patterns.

Figure 3 – Historical Maximum Day Diurnal Patterns



The ideal equalizing storage (calculated based on system demands) and actual equalizing storage used by operations staff for each year from 2007-2014 is shown in Table 1. The ideal required equalizing volume did not exceed 10% of MDD during any observed year, and both the average ideal and average actual equalizing volume used was less than 8% of MDD.

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

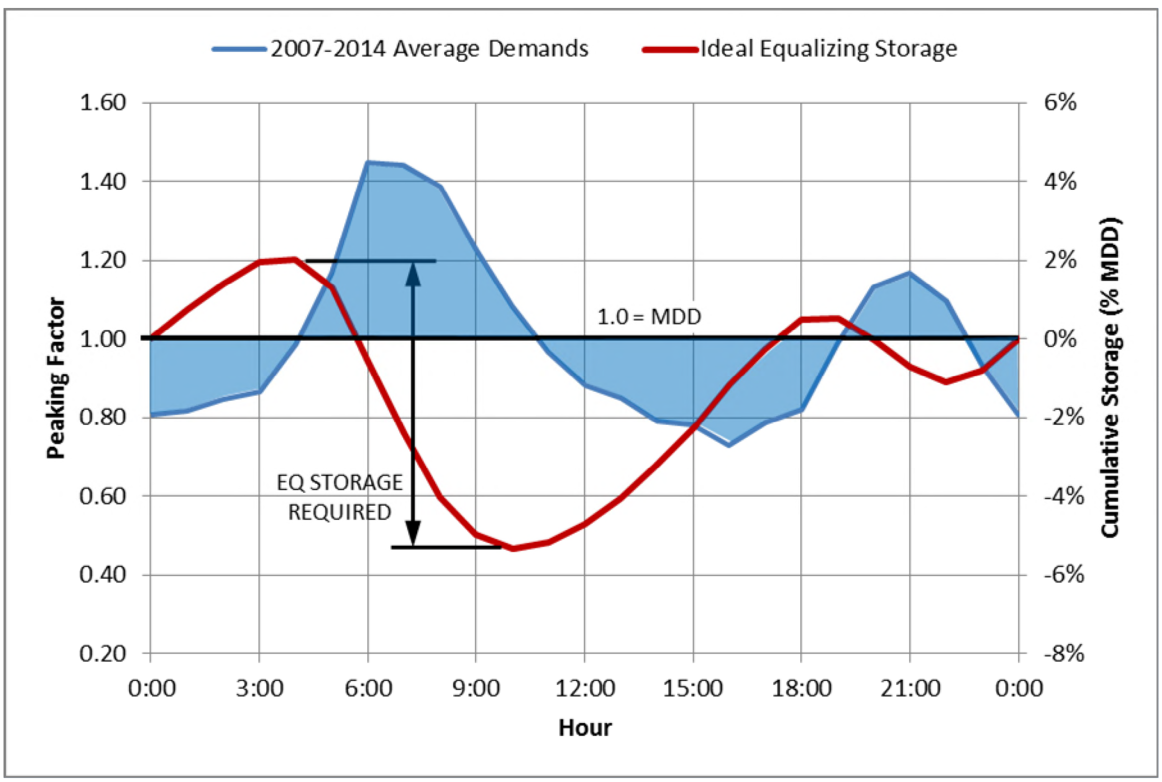
[2] Water Comprehensive Plan. City of Bellevue, 1992.

Table 1 – Ideal System-Wide Equalizing Storage Required, % of MDD

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

Figure 4 shows the 2007-2014 average MDD diurnal pattern and resulting cumulative equalizing storage requirement. Ideal EQ storage required is the negative cumulative sum of the shaded area between the demand curve and MDD, as described above.

Figure 4 – Typical 2007-2014 System-Wide MDD Diurnal Pattern and EQ Storage



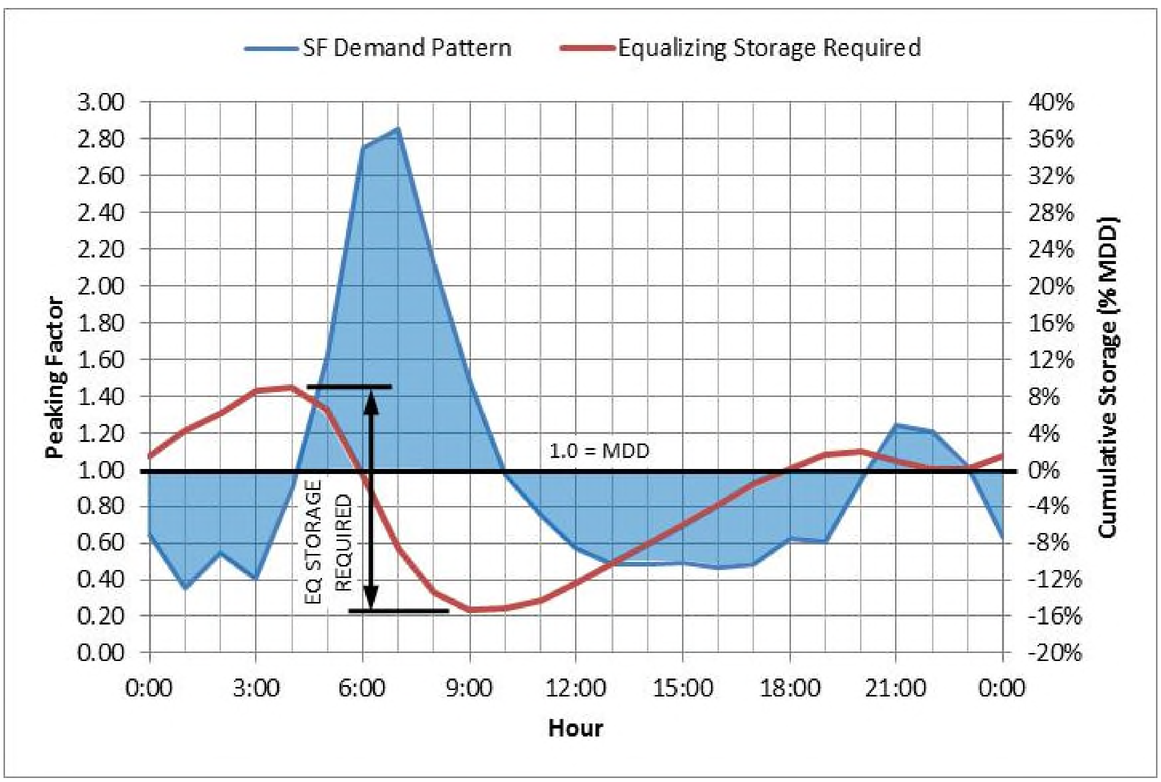
Based on the 2007-2014 maximum demand day telemetry, and neglecting special localized EQ storage needs (discussed below), typically less than 8% of MDD is required system-wide as EQ storage, and generally not more than 10% of MDD in a high year. In large areas representative of the overall customer base, it is recommended that 10% of MDD be provided for EQ storage.

2014 Estimated Single-Family Equalizing Storage

System-wide telemetry does not account for localized demand peaks, which may require substantially more equalizing storage in some areas. To account for localized differences in predominately single-family residential areas, diurnal demands and required EQ storage specific to single-family housing[3] was analyzed.

Figure 5 shows the reservoir volume fluctuation predicted in a 100% single-family residential area, resulting in 24.4% of MDD equalizing volume. It is recommended that 25% of MDD be provided as equalizing storage in primarily single-family areas.

Figure 5 – Estimated Single-Family Equalizing Storage Required



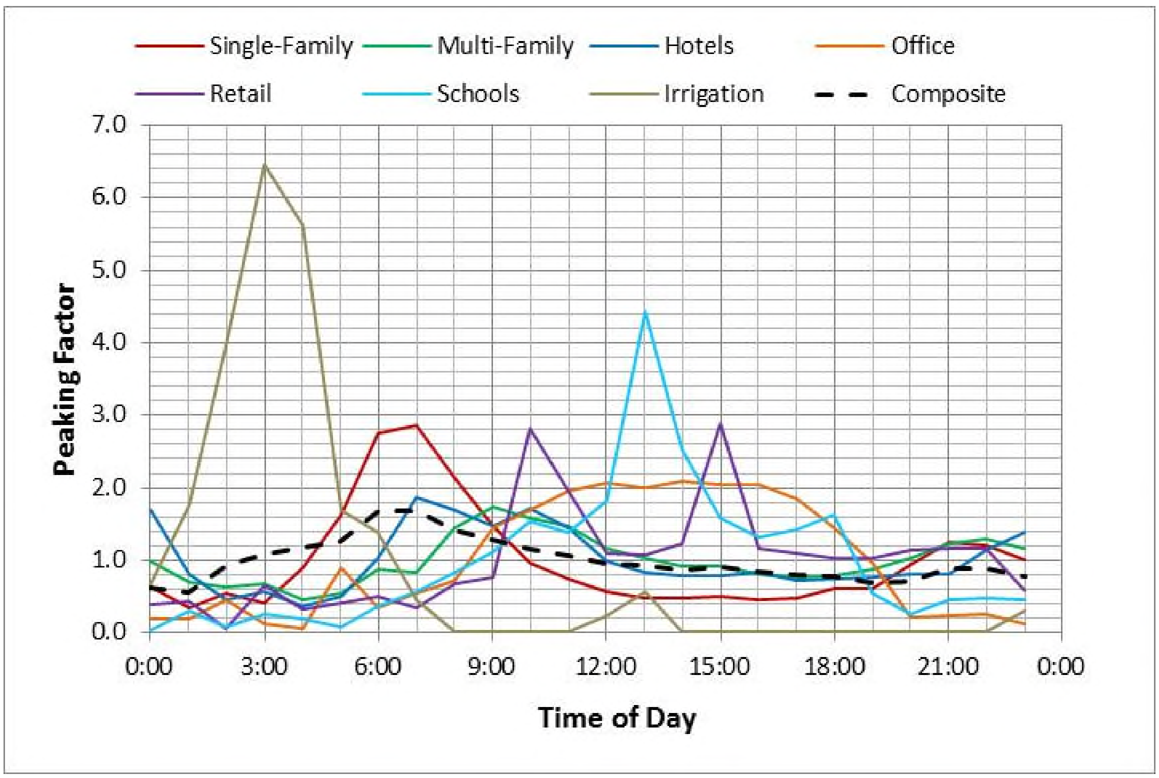
[3] City of Bellevue 2014 Summer Diurnal Demands Study

2014 Predicted Equalizing Volume

A rough, "predicted" system-wide composite diurnal curve was developed, using data from the 2014 Summer Diurnal Demands Study and the volume-weighted average of the customers represented. The "predicted" curve was compared with the ideal and actual storage curves shown above, to verify the general applicability of the limited set of customer-specific diurnal data.

Hourly diurnal demand information was collected for a limited sample set of customers for July 16, 2014 is shown in Figure 6. This was the 2014 maximum demand day.

Figure 6 – Observed Maximum Demand Day Diurnal Patterns



Bellevue's water customer base is shown in Figure 7, as a percent of total annual billed consumption in the water service area. This data does not include wheeled water.

Figure 7 – Proportion of Retail Demand, Annual Average

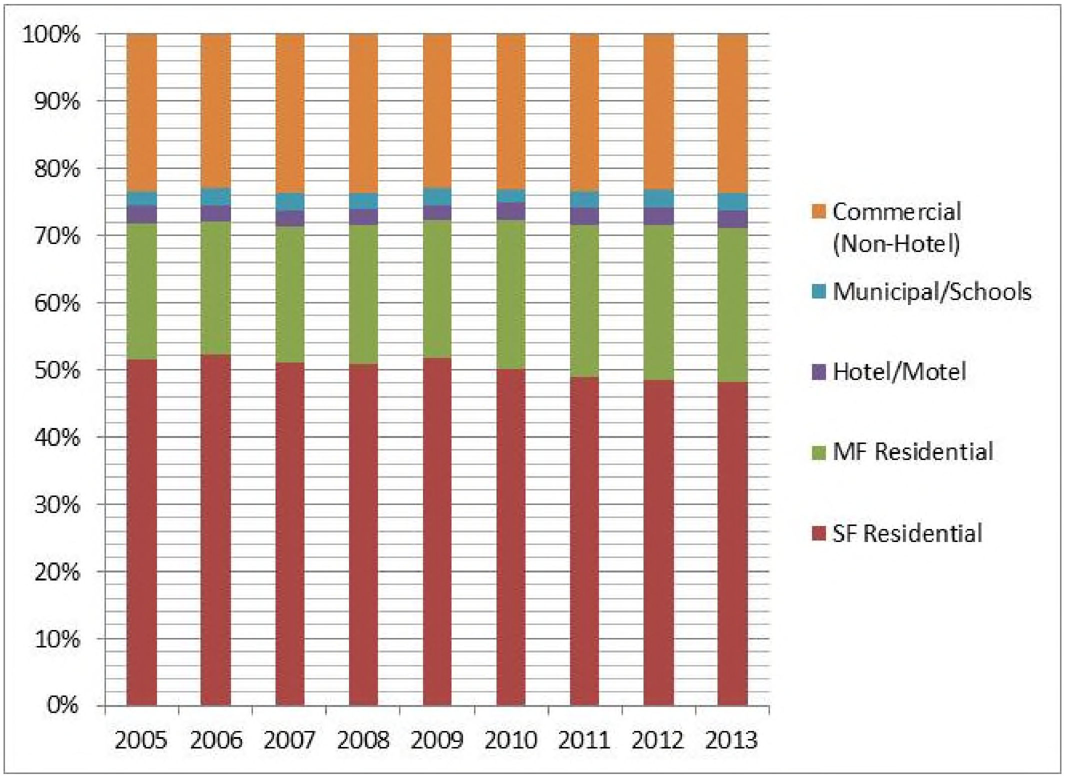


Figure 8 shows the predicted, actual, and ideal reservoir volume fluctuations on the maximum demand day (July 16, 2014), as a cumulative % of total (24-hour) maximum day demand (MDD).

Figure 8 – System-Wide Reservoir Volume Fluctuation, 2014 Maximum Day

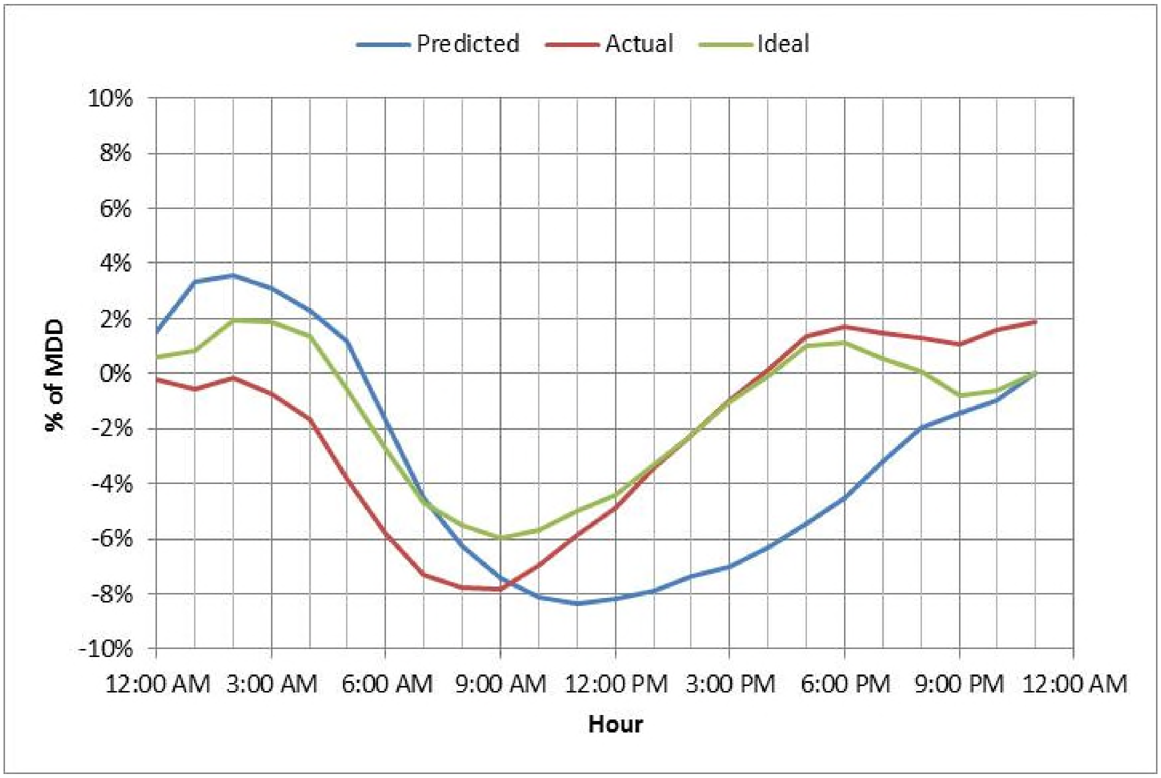


Table 2 summarizes the EQ storage requirement resulting from the curves shown in Figure 8.

Table 2 – System-Wide Equalizing Storage Used, % of MDD

	Peak Storage	Minimum Storage	EQ Volume
Predicted	+3.6%	-8.4%	11.9%
Actual	+1.9%	-7.8%	9.7%
Ideal	+1.9%	-6.0%	7.9%

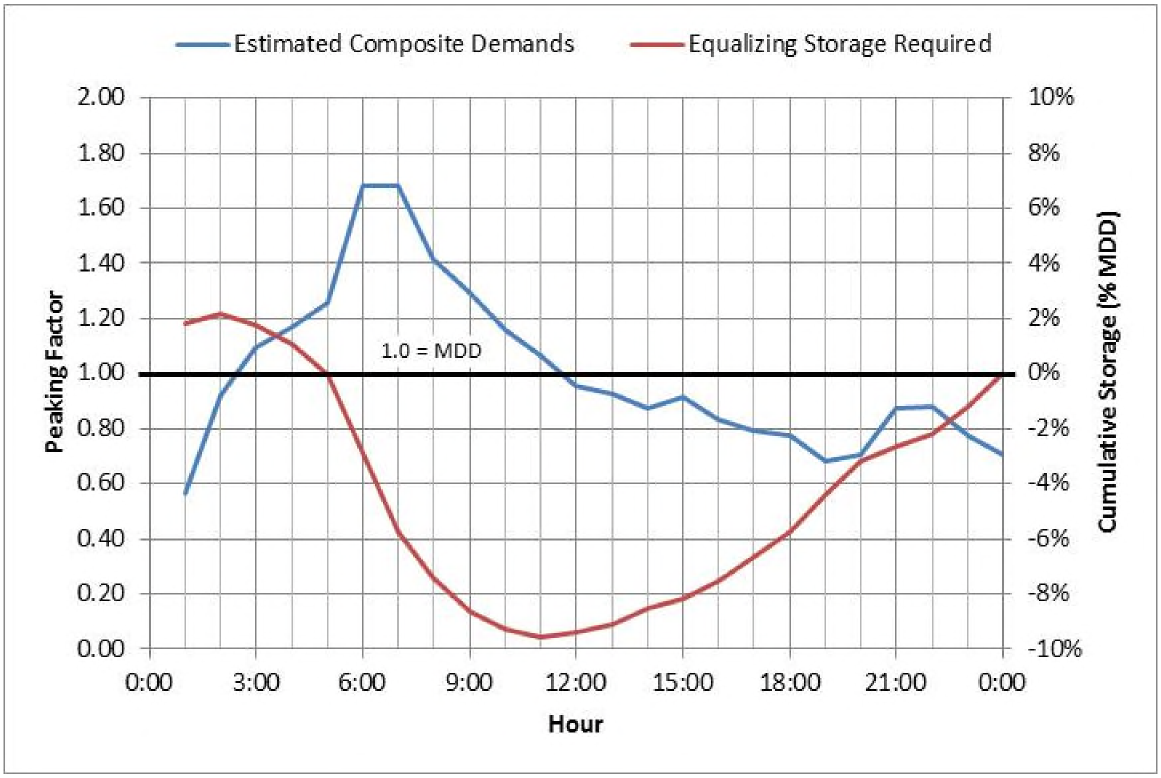
Predicted volume is higher than actual and ideal volume, possibly due to the numerous assumptions required to estimate the volume-weight (% of system demands) to apply to each customer class, as discussed below. However, a fair correlation can still be seen.

To develop the predicted equalizing storage, an estimated system-wide composite diurnal demand curve was developed. Diurnal curves for individual customer classes shown in Figure 6 were combined into a composite curve using volume-weighted demands from Figure 7, adjusted for the following factors:

- Figure 7 shows a general trend toward increased multi-family (MF) housing and reduced single-family (SF) housing, as a % of total water demands. The most recent data (2013) was used due to the clear trend, rather than the average.
- Demands were scaled to convert the annual customer class-size averages (Figure 7) into an estimated summer average, based on relative comparison of summer data with annual billing records and winter data from the same locations (SF x 2, MF x 1, Hotels x 2, Office x 1.5, Retail x 1, Schools x 0.2, Irrigation x 3.2).
- Demands were scaled to account for the maximum day occurring on a weekday, versus “average” day (SF x 1, MF x 1, Hotels x 0.8, Office x 1.4, Retail x 1.1, Schools x 1.2, Irrigation x 1).
- Roughly 10% of water served by Bellevue is wheeled to adjacent utilities, and not reflected in Figure 7. Of this, approximately 90% is provided to Redmond in the Overlake area, which includes the Microsoft campus and other Overlake offices, in addition to some SF neighborhoods. It is assumed that wheeled water is 50% office, 20% SF, 20% MF, 2% hotels, 1.8% retail and 6.2% irrigation.
- Irrigation demands represent 6.2% of 2013 water demands. These were subtracted from the customer classes as appropriate based on data in the billing system (0.5% SF, 1.2% MF, 4.5% Commercial).
- Commercial water demands were assumed to be 70% office and 30% retail by volume, based on estimated 70/30 ratio of building floor area in the City of Bellevue, as reported by Bellevue’s Planning & Community Development Department. This assumes water usage is roughly proportional to floor area.
- Estimated demands from pressure zones primarily fed by CCUD and Kirkland (NH320, NH380, NH470, NH580, RH545) were removed to allow for an apples-to-apples comparison with the supply inlet and reservoir volumes.
- Non-revenue demands were estimated at 5.8% of total system demand, consistent with 2013 estimates. It was assumed that non-revenue demands are constant (PF = 1.0). All other demands were scaled by 0.942.

Figure 9 shows the resulting estimated system-wide composite demand curve

Figure 9 – Estimated System-Wide Demands and Predicted EQ Storage



Appendix M

EOA-WOA Transmission Evaluation

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RH2 ENGINEERING, INC.
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WASHINGTON LOCATIONS

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22722 29th Drive SE, Suite 210
Bothell, WA 98021

BELLINGHAM

EAST WENATCHEE

ISSAQUAH

RICHLAND

TACOMA

OREGON LOCATIONS

NORTHERN OREGON MAIN OFFICE
6500 SW Macadam Avenue, Suite 125
Portland, OR 97239

SOUTHERN OREGON
Central Point

COASTAL OREGON
North Bend

September 27, 2013

Mr. Doug Lane, P.E.
Utilities Department/Engineering Division
City of Bellevue
450 110th Avenue NE
PO Box 90012
Bellevue, WA 98009-9012

Sent via: *Email and US Mail*

Subject: EOA-WOA Transmission Main Evaluation

Dear Mr. Lane:

This letter summarizes the results of RH2 Engineering, Inc.'s, (RH2) preliminary analyses performed to evaluate alternatives for transmission main improvements to convey water from the City of Bellevue's (City) East Operating Area (EOA) to the West Operating Area (WOA) during concurrent water supply disruption and fire flow emergency conditions. These analyses were performed using existing computer models of the City's water system. This letter report summarizes the results of the preliminary analyses and the operational conditions used in the hydraulic models.

BACKGROUND

The City's *2006 Water Comprehensive Plan* (WCP) forecasted a future storage deficiency in the City's WOA and a future storage surplus in the EOA. Subsequently, rezoning of the Bel-Red Road corridor has accelerated the timeframe and increased the projected storage deficit in the WOA. Construction of an additional 3.5 million gallons (MG) of storage in the WOA is currently being considered to resolve this storage deficiency for the medium term (until roughly 2030). As a short-term alternative to constructing new storage in the WOA, the WCP suggests that a transmission main could be constructed to convey supply from the City's East Operating Area (EOA) to the WOA in the event of a water supply emergency. The City contracted with RH2 to perform preliminary analyses to identify opportunities for transferring stored water from the EOA to the WOA and compare the relative costs of doing so to the previously identified costs of constructing additional storage in the WOA.

The City's water utility Capital Improvement Program currently includes capital improvement plan (CIP) #W-104, which will construct a new WOA inlet and transmission main; possibly in either Bel-Red Road or SE 8th Street, within the current 7-year CIP window. Although the additional transmission capacity that will be contributed by CIP #W-104 is considered in the transmission main analyses presented herein, the cost of CIP #W-104 was not included in the cost estimates for the transmission main alternatives. The City's recent conversion of the Lake Hills 520 Zone to a 530 Zone was also considered in the transmission main analyses.

Four initial alternative transmission main alignments were identified by the City for this evaluation. Two of the alternatives were based on the recommended locations suggested in the WCP, while the other two were based on the potential alignments for CIP #W-104. A fifth alternative was also identified by RH2. The analyses performed to evaluate these five alternatives are described herein.

HYDRAULIC ANALYSES DESCRIPTION

Fire flow analyses were performed to determine the water system improvements necessary to adequately convey supply from the EOA to the WOA for a 5,500 gallons per minute (gpm) fire flow event while limiting the maximum velocity to 10 feet per second (ft/s) in the proposed EOA-WOA transmission main. Velocities in distribution mains were not derated to 10 ft/s in all locations as this would require substantial additional improvements to resolve localized areas of high velocity, which is assumed would not be economically justified given the extremely critical conditions that were modeled. The model scenario assumed a water supply emergency when all SPU/Cascade inlets are offline so that standby/emergency storage is needed. For this reason, the City's standard policy of a system-wide 10 ft/s velocity constraint was only applied to transmission mains but was not applied to distribution mains. The fire flow analyses were based on providing a minimum residual pressure of 20 pounds per square inch (psi) throughout the system under maximum day demands per DOH criteria.

Separate hydraulic models were analyzed for the WOA and EOA. To perform analyses in the WOA, the hydraulic model of the WOA from the City's 2010 System-Wide Fire Flow Analyses project was used. Fire flow analyses were performed at representative nodes throughout the Bellevue 400 Zone to evaluate various EOA-WOA transmission main alignments and to identify additional water system improvements that may be necessary to convey supply from the Lake Hills 530 Zone in the EOA to the Bellevue 400 Zone in the WOA. The analyses assumed only one fire flow demand within the system was occurring at a time.

Analyses were also performed in the EOA model to confirm that the minimum required residual pressure of 20 psi during a fire event can be maintained throughout the EOA while also providing 5,500 gpm of supply to the WOA. To perform these analyses, the preliminary calibrated hydraulic model of the EOA from the City's 2013 520 Zone Conversion project was used. Fire flow demand was input to the model at the location of the EOA-WOA transmission main connection to the Lake Hills 530 Zone. The analyses assumed only one fire flow demand within the system was occurring at a time. Analyses were performed to evaluate the various EOA-WOA transmission main alignments and to identify additional water system improvements that may be necessary to convey supply from the EOA to the WOA while maintaining a minimum residual pressure of 20 psi in the Lake Hills 530 Zone. The operational conditions used in the WOA and EOA models are shown in the tables attached.

HYDRAULIC ANALYSES RESULTS

The existing water system has limited capacity to transfer water from the EOA to the WOA through a series of pressure reducing valves (PRV). The results of system analyses for existing representative locations are shown in **Tables 1** and **2** and indicate that the existing system can maintain a minimum residual pressure of 20 psi while providing at least 5,500 gpm to all locations in the table except at node 813. Although the existing system is currently capable of meeting the planning-level fire flow rate, the WOA reservoirs will not have sufficient volume in the future to sustain this flow rate for the required duration. If a new reservoir is not constructed at this time, the required volume could instead be transferred from the EOA reservoirs through a transmission main to meet the future storage needs of the WOA. Analyses were performed to identify alternative improvements for transferring the necessary storage volume from the EOA to the WOA while maintaining a minimum residual pressure of 20 psi and limiting the transmission main responsible for conveying the supply to 10 ft/s or less.

Table 1
WOA Model Available Fire Flow with Inlets Offline

Node	Location	West Operating Area Available Fire Flow (gpm)					
		Existing	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
813	10401 NE 32nd Place	3,738	3,738	3,923	3,782	3,856	3,921
1257	12241 Main Street	6,963	6,963	8,794	8,066	10,000	8,052
1414	2700 Northup Way	5,669	5,671	6,055	5,797	6,107	6,051
J-9	1252 112th Ave NE	8,529	8,529	10,000	9,800	10,000	9,710
J-5	Overlake Medical Center	7,579	7,655	9,588	8,922	10,000	8,820
J-6	1831 130th Ave NE	8,944	8,894	10,000	10,000	10,000	10,000
J-7	JC Penny	8,046	8,047	9,373	8,804	10,000	9,021
J-8	1835 Bellevue Way NE	10,000	10,000	10,000	10,000	10,000	10,000
J-10	1500 124th Ave NE	8,328	8,329	10,000	10,000	10,000	10,000

Note: Fire flow storage capacity limits the actual available fire flow in some high risk areas to 5,500 gpm. To attain the required protection in these areas, property owners may be required to install onsite fire protection improvements.

Table 2
EOA Model Minimum Residual Pressure

Node	Location	Existing Static Pressure (psi)	East Operating Area Residual Pressure with 5,500 gpm Supply to West Operating Area (psi)				
			Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
J-22036	NE 40th Inlet	85	66	81	74	84	81
J-18735	140th Ave NE & 26th St	127	119	123	120	126	97
J-2589	Bel-Red Rd and 148th Ave	94	82	89	61	93	91
J-6760	SE 8th St and 140th Ave NE	85	84	82	84	53	66
J-42771	148th Ave NE and NE 34th St	57	45	53	45	57	54
J-34481	2041 148th Ave NE	91	79	86	63	90	88
J-27054	16201 NE 19th St	29	21	24	21	28	27
J-24286	1811 156th Ave NE	49	40	43	41	48	46
J-21203	15600 NE 8th St	52	50	46	48	52	51
J-20484	141 156th Ave SE	84	83	79	82	80	81
J-17744	15 140th Ave NE	65	65	65	65	65	58
J-1392	SE 28th Inlet	27	27	25	26	25	24
J-344	4160 150th Ave SE	21	21	20	21	21	20

Initial analyses were performed to evaluate the existing transmission capacity with adjustments to the settings of existing PRVs. If the PRV settings were modified and the velocity in the transmission mains were derated to 10 ft/s, the analyses indicate that the existing system only has the capacity to convey approximately 3,750 gpm from the EOA to the WOA, which is inadequate to meet the 5,500 gpm supply requirement that is needed if a new WOA storage facility is not constructed at this time. Without the velocity requirement applied to transmission mains, some older AC water main would experience velocities in excess of 17 ft/s in order to provide the necessary supply amount of 5,500 gpm at a residual pressure of 20 psi in the system. This was not considered a viable alternative because it violates the City's standards for velocity for transmission mains.

Additional hydraulic analyses were performed to identify viable alternatives that are capable of maintaining the velocity standard of 10 ft/s in the transmission mains while conveying 5,500 gpm from the EOA reservoirs to the WOA. The five alternatives identified included various combinations of PRV, booster pump station, and transmission main improvements. The following sections describe each of the viable transmission main alternatives that were identified. The improvements for the five alternatives are shown schematically in the attached **Figure 1** and the results of the hydraulic analyses are shown in **Tables 1** and **2.**

Alternative A

The initial improvements for Alternative A included installation of a new 16-inch water main in NE 40th Street between the existing transmission main in 148th Avenue NE and 132nd Avenue NE. This potential alignment was identified in the City's 2006 WCP and would require that water be transferred through a new booster pump station (BPS) from the Lake Hills 530 Zone near 148th Avenue NE to the Pikes Peak 670 Zone at 132nd Avenue NE. Alternatively, the existing NE 40th BPS may be evaluated to determine the ability to upgrade the station to also supply the Pikes Peak 670 Zone. The water main improvements in addition to those identified in the 2006 WCP are necessary to extend the proposed transmission main from 132nd Avenue NE to existing transmission main in the PP670 Zone. The existing water main in the PP670 Zone at 132nd Avenue NE is undersized to transfer the necessary supply from the EOA to the WOA.

Supply from the PP670 Zone would need to be transferred back down through the Pikes Peak 550 Zone to the Bellevue 400 Zone through a series of new pressure reducing valve (PRV) stations. These and other system improvements to meet the velocity and pressure requirements of the system during a fire event in the WOA were identified and included in the hydraulic model. These improvements are as follows.

- 10,700 feet of 16-inch water main:
  - NE 40th Street from 148th Avenue NE to 132nd Avenue NE.
  - 134th Avenue NE from NE 40th Street to NE 36th Street.
  - NE 36th Street from 134th Avenue NE to 130th Avenue NE.
  - 130th Avenue NE from NE 36th Street to NE 39th Street.
  - NE 39th Street from 130th Avenue NE to 124th Avenue NE.
- New LH530/PP670 BPS near NE 40th Inlet or upgrade to the existing NE 40th BPS (5,500 gpm capacity).
- PP670/PP550 PRV station at 124th Avenue NE and NE 39th Street.
- PP550/BV400 PRV station at 124th Avenue NE and NE 24th Street with 16-inch water main connection from the Pikes Peak 550 Zone to the Bellevue 400 Zone.

The results of the hydraulic analyses with the Alternative A improvements, shown in **Tables 1** and **2** for representative nodes in the system, indicate that the EOA can supply 5,500 gpm to the WOA through the proposed transmission main while maintaining a minimum residual pressure of 20 psi. With the exception of node 813, the available fire flow at all nodes in the WOA that were evaluated exceed 5,500 gpm. Improvements to increase the available fire flow at node 813 require the replacement of local distribution main that was not evaluated as part of this effort.

Alternative B

The initial improvements for Alternative B included installation of a new 16-inch water main in NE 8th Street from 132nd Avenue NE to 151st Avenue NE. This potential alignment was identified in the City's 2006 WCP to transfer supply from the NE 8th Inlet to the WOA. To meet the velocity and pressure requirements of the system during a fire event in the WOA, additional improvements were identified and included in the hydraulic models. The additional water main improvements are necessary to extend the proposed transmission main across the KC300 Zone to the easterly terminus of the 12-inch BV400 Zone transmission main at 128th Avenue NE. The Alternative B improvements are as follows.

- 7,800 feet of 16-inch water main in NE 8th Street from 128th Avenue NE to 151st Avenue NE.
- LH530/KC450 PRV station near the NE 8th Inlet.
- KC450/BV400 PRV station at NE 8th Street and 140th Avenue NE.

The results of the hydraulic analyses with the Alternative B improvements, shown in **Table 1**, indicate that the EOA can supply 5,500 gpm to the WOA through the proposed transmission main while maintaining a minimum residual pressure of 20 psi. Similar to Alternative A, with the exception of node 813, the available fire flow at all nodes in the WOA that were evaluated exceed 5,500 gpm.

Alternative C

The initial improvements for Alternative C included installation of a new 16-inch water main in Bel-Red Road from the existing 16-inch transmission main at the Bel-Red Inlet near 132nd Avenue NE to the westerly extent of the LH520 Zone in the EOA at 148th Avenue NE. A portion of this potential alignment, from 132nd Avenue NE to 140th Avenue NE, may be constructed as part of the City's CIP #W-104 if the new Seattle supply inlet is installed near the existing NE 8th Inlet. Therefore, the potential cost of CIP#W-104 was subtracted from the capital cost estimate for Alternative C, since those funds are allocated to serve another purpose. To meet the velocity and pressure requirements of the system during a fire event in the WOA, additional improvements were identified and included in the hydraulic models for this alternative. The Alternative C improvements are as follows.

- 10,100 feet of 16-inch water main:
  - Bel-Red Road from the Bel-Red Inlet at 132nd Avenue NE to 148th Avenue NE.
  - 148th Avenue NE from Bel-Red Road to NE 20th Street.
  - 156th Avenue NE from NE 8th Street to NE 20th Street.
- LH530/BV400 PRV station at Bel-Red Road and 148th Avenue NE.

The results of the hydraulic analyses with the Alternative C improvements, shown in **Table 1**, indicate that the EOA can supply 5,500 gpm to the WOA through the proposed transmission main while maintaining a minimum residual pressure of 20 psi. Similar to the other Alternatives, with the exception of node 813, the available fire flow at all nodes in the WOA that were evaluated exceed 5,500 gpm.

Alternative D

The initial improvements for Alternative D included installation of a new 16-inch water main in SE 8th Street and the Lake Hills Connector from the 12-inch BV400 Zone transmission main on the east side of Interstate 405 to 140th Avenue NE. This potential alignment may be constructed as part of the City's CIP project number #W-104 if the new Seattle supply inlet is installed at SE 8th Street and Interstate 405. The potential cost of CIP#W-104 was therefore subtracted from the capital cost estimate for Alternative D, since those funds are allocated to serve another purpose.

To meet the velocity and pressure requirements of the system during a fire event in the WOA, additional improvements were identified and included in the hydraulic models for this alternative. The additional water main improvements are necessary to extend the proposed transmission main from NE 140th Avenue to the 16-inch transmission main in 148th Avenue NE and to resolve low pressures that would result from drawing supply from the southern portion of the EOA. The Alternative C improvements are as follows.

- 19,500 feet of 16-inch water main:
  - SE 8th Street and the Lake Hills Connector from the east side of Interstate 405 to 148th Avenue NE.
  - 148th Avenue SE from the SE 28th Inlet to SE Eastgate Drive.
  - SE Eastgate Drive from 148th Avenue SE to 146th Avenue SE.
  - 146th Avenue SE from SE Eastgate Drive to SE 42nd Place.
  - SE 42nd Place from 146th Avenue SE to 145th Avenue SE.
  - 145th Avenue SE from SE 42nd Place to the Parksite Reservoir.
- LH530/BV400 PRV station in SE 8th Street west of 140th Avenue SE.

The results of the hydraulic analyses with the Alternative D improvements, shown in **Table 1**, indicate that the EOA can supply 5,500 gpm to the WOA through the proposed transmission main while maintaining a minimum residual pressure of 20 psi. Similar to the other Alternatives, with the exception of node 813, the available fire flow at all nodes in the WOA that were evaluated exceed 5,500 gpm.

Alternative E

Alternative E is based on transferring water from the EOA to the WOA at two locations. This provides redundancy in supply to the WOA in the event of a failure of one of the transmission mains and better disbursement of the supply throughout the Bellevue 400 Zone. Under this alternative, water would be transferred from the EOA to the WOA through the existing LH530/BV400 PRV station in 140th Avenue NE and NE 26th Street and from the existing KC450/BV400 PRV station in SE 1st Street east of 136th Avenue NE. The existing KC450/BV400 PRV station is supplied by three PRV stations that transfer water from the Lake Hills 530 Zone to the Kelsey Creek 450 Zone. To meet the velocity and pressure requirements of the system during a fire event in the WOA, water main improvements were also identified and included in the hydraulic models for this alternative. The water main improvements in NE 8th Street are necessary to extend the transmission capacity from the KC450/BV400 PRV station across the KC300 Zone to the easterly terminus of the 12-inch BV400 Zone transmission main at 128th Avenue NE. The Alternative E improvements are as follows.

- 2,600 feet of 16-inch water main in 140th Avenue NE from NE 40th Street to NE 36th Place.
- 1,600 feet of 12-inch water main:
  - NE 8th Street from 128th Avenue NE to 136th Avenue NE.
  - SE 7th Street from 141st Place SE to 140th Avenue SE.

- Upgrades to the following PRV stations to confirm reliability during an emergency event.
  - LH530/BV400 PRV station in 140th Avenue NE and NE 26th Street.
  - KC450/BV400 PRV station in SE 1st Street east of 136th Avenue NE.

The results of the hydraulic analyses with the Alternative E improvements, shown in **Table 1**, indicate that the EOA can supply 5,500 gpm to the WOA through the proposed transmission mains while maintaining a minimum residual pressure of 20 psi. Similar to all the other Alternatives, with the exception of node 813, the available fire flow at all nodes in the WOA that were evaluated exceed 5,500 gpm.

The benefits of implementing one of the transmission main alternatives are limited to the WOA. Due to the differential in hydraulic gradients between the operating areas, the transmission main will only be capable of supplying the WOA from the EOA and not vice versa. The PRVs supplying the BV400 Zone from the transmission mains should be equipped with pressure sustaining features or other improvements should be installed in the system to prevent excessive flows being conveyed to the WOA from drawing the EOA below the City's level of service standards.

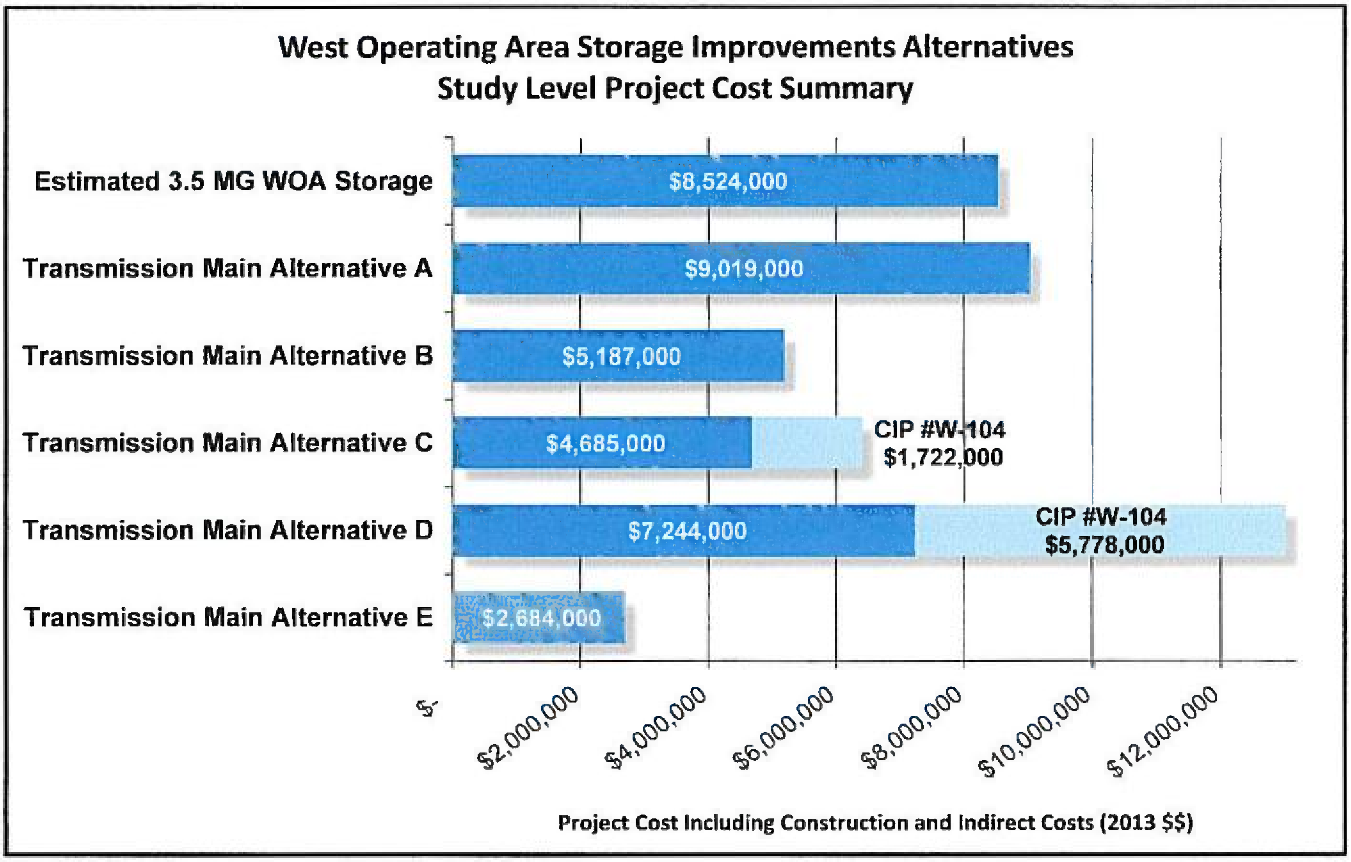
IMPACT OF 560 ZONE CONVERSION

The City is currently evaluating the viability of converting a portion of the Lake Hills 520 Zone in the EOA to a 560 Zone to increase pressures in the Crossroads area of the system. Some of the improvements identified for this transmission main analysis are included in alternative improvements that were identified to complete the 560 Zone conversion. Cost reduction for both projects may be realized depending on the alternatives selected. Implementation of the 560 Zone conversion will not otherwise impact the improvements identified for the EOA-WOA transmission main alternatives.

COMPARATIVE COST ANALYSIS

Preliminary study-level cost estimates were developed to determine each alternative's relative cost for comparison with the estimated cost for constructing an additional 3.5 MG of storage in the WOA. The cost estimates were prepared to determine the relative order of magnitude of the costs for each alternative and have not been adjusted for factors such as location, roadway restoration requirements, etc. The costs for Alternatives C and D do not include the portion of the transmission main that is included as part of the City's CIP #W-104, as this project is necessary to meet other water system needs. A summary of the alternative costs are shown in **Figure 2** and an itemized list of the improvements and estimated costs are included in the attached tables. The cost shown in the figure for the additional WOA storage is the average of the three lowest cost alternatives from RH2's 2010 *West Operating Area Capacity Improvement Study*, inflated to 2013 dollars.

Figure 2
Study-level EOA-WOA Transmission Main Costs



As shown in **Figure 2**, the study-level cost estimate for implementation of transmission main Alternative E is the lowest cost alternative.

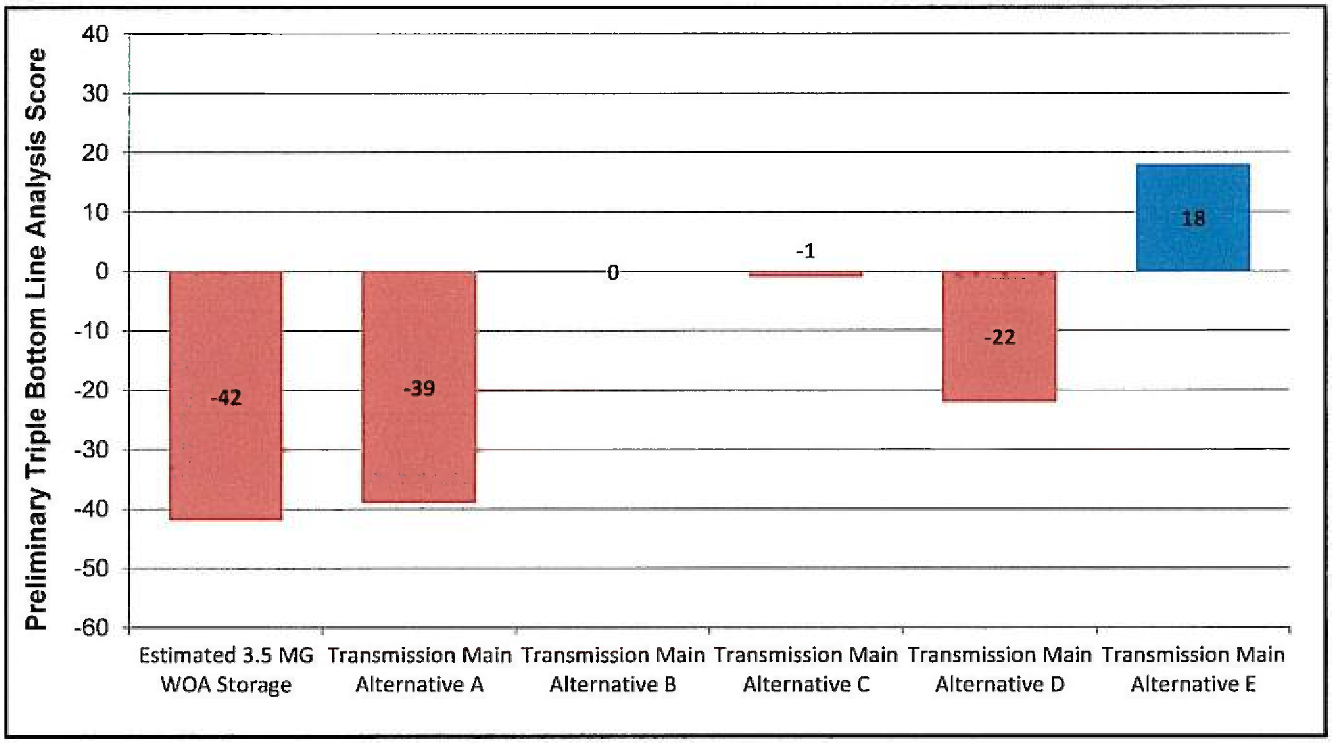
PRELIMINARY TRIPLE BOTTOM LINE ANALYSIS

In addition to the capital costs, other ecological and social impacts should be considered when evaluating the viability of constructing transmission main to transfer water from the EOA to the WOA in lieu of constructing a new reservoir in the WOA. The triple bottom line analysis should reflect the impacts to traffic and residents as well as environmental factors that may be encountered during construction, normal operation or failure of the components in the alternatives analysis. It should also consider the timing of each alternative project with regards to future operations and maintenance needs and the remaining life expectancy of the existing water system facilities.

A preliminary triple bottom line analysis is attached and a summary of the City's scoring of the items is shown in **Figure 3**. The analysis evaluated the various impacts and benefits of a new WOA reservoir and an EOA-WOA transmission main based on the five alignment alternatives described in this letter report. Each item that was considered in the analysis was given a weighting factor between 1 and 5 that indicates the relative importance of the element. A weight factor of 5 indicates items that are considered the most important in the analysis. The relative economic, social and environmental impacts were scored either a -2, -

1, 0, 1 or 2 for each item that it was applicable. A score of 2 in the table indicates that the item has a significant economic, social or environmental advantage over the other alternatives. A score of -2 indicates that the item has a significant economic, social or environmental disadvantage over the other alternatives. The economic score reflects the relative financial cost of the item being considered. The social score reflects the relative impact on people and the community. The environmental score reflects the relative impact to the environment and the City's goals for sustainability. A cursory environmental review, which considered sensitive areas currently mapped by King County, was performed for the purposes of this analysis. Further environmental investigation and analysis is recommended if the City elects to consider these alternatives further.

Figure 3
Preliminary Triple Bottom Line Analysis Summary



The preliminary triple bottom line analysis indicates that Transmission Main Alternative E is the most favorable alternative when considering the economic, social and environmental impacts of the alternatives. The remaining transmission main alternatives and the estimated 3.5 MG WOA Storage alternative scored significantly lower than Transmission Main Alternative E. If the City elects to evaluate any of the transmission main alternatives further in a subsequent phase, the triple bottom line analysis could be further refined. Some items, however, require policy decisions to be formed by the City before they can be quantified in the triple bottom line analysis. Further refinement of the analysis should be performed once these decisions are made.

CONCLUSION AND NEXT STEPS

The analyses described in this letter report indicate that construction of an EOA-WOA transmission main and associated improvements is likely less costly than constructing additional storage in the WOA. However, other factors should be considered to determine the most appropriate improvements for resolving the projected future storage deficiency in the WOA. Since the transmission main analyses described herein were performed for the purposes of determining the general order of magnitude costs for an EOA-WOA transmission main, the analyses should be further refined if the City elects to pursue this further. Prior to continuing with additional analyses, it is recommended that the distribution of demands in the models be confirmed, as well as the reservoir level setpoints, PRV settings, and other facility operational conditions. Additionally, the City updated its database of node elevations in 2012 and these elevations should be imported into the WOA model. Following these model updates, the alternative analyses may be evaluated to further optimize the identified improvements. The cost estimates may also be refined to identify more accurate construction costs for the specific projects and the triple bottom line analysis elements may be further defined.

If you have any questions regarding the analyses, please call Michele Campbell at (425) 951-5394 or Tony Pardi at (425) 951-5312. Thank you for the opportunity to assist with this project.

Sincerely,

RH2 ENGINEERING, INC.

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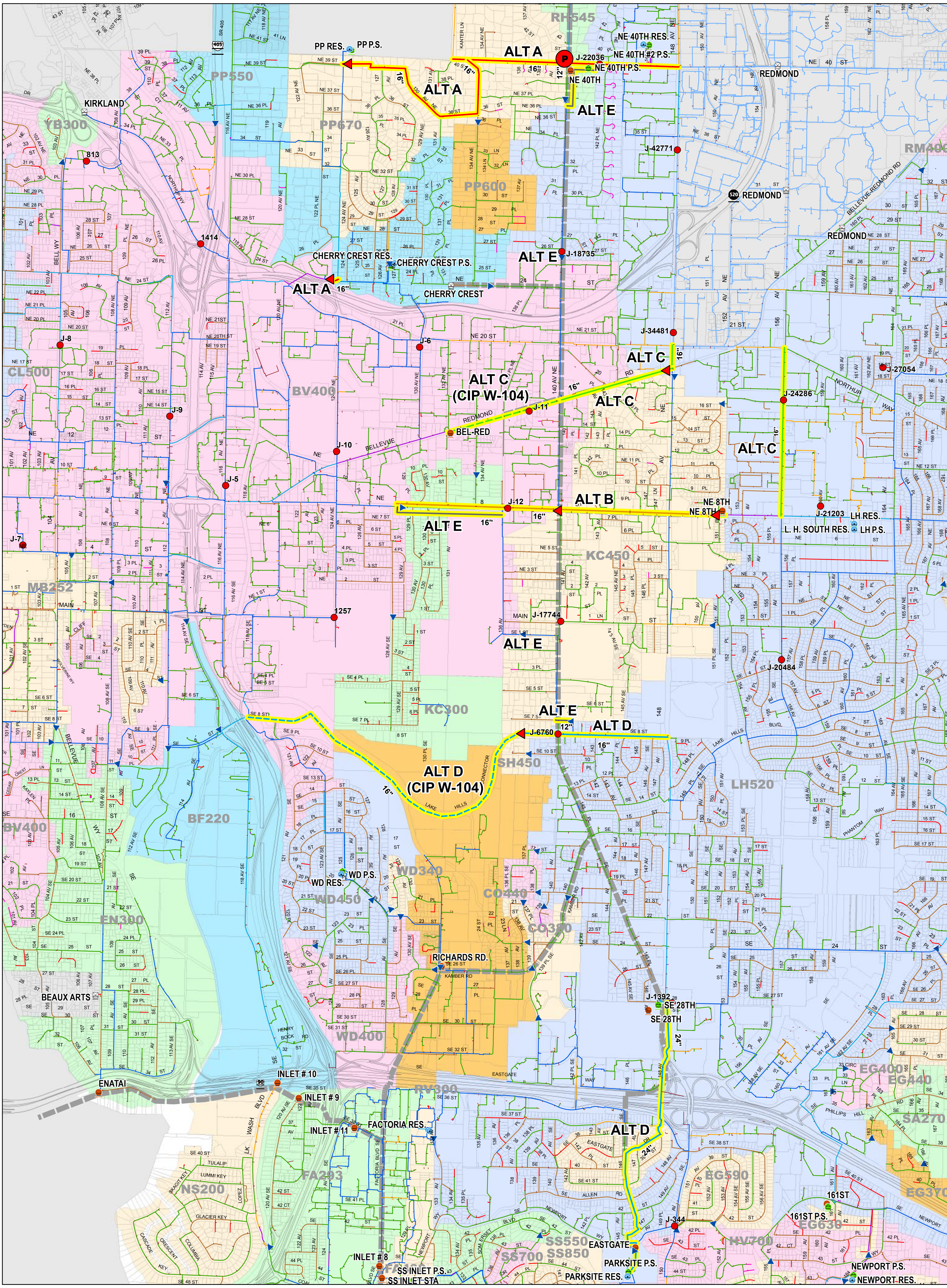
Attachments: Figure 1: Transmission Main Alternative Improvements
Hydraulic Model Operational Conditions
Preliminary Study-level Cost Estimate
Preliminary Triple Bottom Line Analysis



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NORTH

RH2

0 375 750 1,125 1,500 Feet
0 0.075 0.15 0.3 Miles

Plot Date: 6/12/2013

Legend

- PRV
- Reservoir
- Seattle Meter
- Pump Station
- Intertie
- Seattle Supply Line

Diameter

- < 4"
- 4"
- 6"
- 8"
- 10"
- 12"
- 14" & 16"
- > 16"

Figure 1
Transmission Main Alternative Improvements

City of Bellevue
EOA-WOA Transmission Main Evaluation

Map Location

This map is a graphic representation derived from the City of Bellevue Geographic Information System. It was designed and intended for City of Bellevue staff use only; it is not guaranteed to survey accuracy. This map is based on the best information available on the date shown on this map.

Any reproduction or sale of this map, or portions thereof, is prohibited without express written authorization by the City of Bellevue.

City of Bellevue
EOA-WOA Transmission Main Evaluation
Hydraulic Analyses Operational Conditions
West Operating Area

Demand

Total Demand (gpm)	18,013

Tanks

Label	Zone	Initial Elevation (ft)
30111	400 Bellevue	379
99999	400 Bellevue	392.00
30051	400 Bellevue	370.60
30011	550 Pikes Peak	542
30071	335 Clyde Hill	323
30061	335 Clyde Hill	323
30041	500 Clyde Hill	447.40
30101	252 Meydenbauer	245

Reservoirs

Label	Zone	Hydraulic Grade (ft)
450_400_PRV43	520 Lake Hills	430.6
17001	Seattle	Offline
20023	Seattle	Offline
20051	Seattle	Offline
20073	Seattle	Offline
30021	Seattle	Offline
BEL_RED_INLET_20033	Seattle	Offline
CV_RV300_1	400 Woodridge	Offline
CV_RV300_2	400 Woodridge	Offline
LH520	520 Lake Hills	Offline
NS200	220 Bellefield	Offline

Pumps

Label	Status	Zone
10031	Off	670 Pikes Peak
10091	Off	450 Woodridge
10032	Off	670 Pikes Peak
10012	On	670 Pikes Peak
10033	Off	670 Pikes Peak
10021	On	550 Pikes Peak
10011	On	670 Pikes Peak
10051	On	500 Clyde Hill
10052	On	500 Clyde Hill
10092	On	450 Woodridge
10053	On	500 Clyde Hill

PRVs

Label	Elevation (ft)	Hydraulic Grade Setting (Initial) (ft)	Pressure Setting (Initial) (psi)	Status (Initial)	Zone
1	311	335	10	Active	335 Clyde Hill
3	90	265	76	Active	300 Entai
4	73	241	73	Active	252 Meydenbauer
5	58	0	80	Active	252 Meydenbauer
7	40	0	73	Active	220 Bellefield

City of Bellevue
EOA-WOA Transmission Main Evaluation
Hydraulic Analyses Operational Conditions
West Operating Area

PRVs

Label	Elevation (ft)	Hydraulic Grade Setting (Initial) (ft)	Pressure Setting (Initial) (psi)	Status (Initial)	Zone
8	294	428	58	Active	450 Woodridge
9	196	369	75	Active	400 Woodridge
11	84	384	130	Active	400 Woodridge
12	255	368	49	Active	400 Woodridge
13	165	292	55	Active	300 Kelsey Creek
14	114	0	75	Active	300 Kelsey Creek
17	394	661	116	Closed	670 Pikes Peak
22	169	319	65	Active	335 Clyde Hill
23	112	303	83	Active	335 Clyde Hill
24	167	243	33	Active	230 Medina
25	102	252	65	Active	252 Meydenbauer
26	61	241	78	Active	252 Meydenbauer
28	154	0	0	Active	400 Bellevue
34	34	207	75	Active	220 Bellefield
35	327	465	60	Active	450 Woodridge
43	225	375	65	Active	400 Bellevue
47	218	379	70	Closed	400 Bellevue
49	306	373	29	Active	400 Bellevue
52	433	587	67	Active	600 Pikes Peak
85	28	208	78	Active	220 Bellefield
90	130	208	34	Active	220 Bellefield
116	260	378	51	Active	400 Bellevue
127	394	0	68	Active	550 Pikes Peak
131	53	247	84	Active	250 Hunts Point
132	64	0	77	Active	250 Hunts Point
133	157	247	39	Active	252 Meydenbauer
134	115	293	77	Active	300 Entai
135	122	0	53	Active	252 Meydenbauer
136	236	252	7	Active	252 Meydenbauer
156	146	0	59	Active	300 Kelsey Creek
177	100	199	43	Active	220 Yarrow Bay
178	124	198	32	Active	220 Yarrow Bay
20021	364	391	12	Active	400 Bellevue
20031	166	0	103	Active	400 Bellevue
20061	384	0	5	Inactive	400 Bellevue
99999	326	0	30	Closed	400 Bellevue
Dummy_252	236	252	7	Active	252 Meydenbauer
PRV20071	26	0	118	Active	300 Entai

FCVs

Label	Elevation (ft)	Flow Setting (Initial) (gpm)	Status (Initial)	Zone
20041	332.00	400.00	Closed	400 Bellevue
20051	80.00	2,200.00	Closed	Seattle
20071	26.00	1,500.00	Closed	300 Entai
BEL_RED_INLET	166.00	7,300.00	Closed	400 Bellevue
Cherry_Crest_Inlet	364.00	7,300.00	Closed	Seattle
Cherry_Crest_Reservoir_Supply	364.00	3,500.00	Inactive	Seattle

City of Bellevue
EOA-WOA Transmission Main Evaluation
Hydraulic Analyses Operational Conditions
West Operating Area

PBVs

Label	Elevation (ft)	Hydraulic Grade Setting (Initial) (ft)	Pressure Setting (Initial) (psi)	Status (Initial)	Zone
Dummy_valve	384	0	90	Inactive	Seattle
93	249	0	50	Inactive	400 Bellevue
985a	185	0	10	Inactive	400 Bellevue
1a	311	0	5	Inactive	400 Bellevue
11803b	326	0	35	Inactive	400 Bellevue

City of Bellevue
EOA-WOA Transmission Main Evaluation
Hydraulic Analyses Operational Conditions
East Operating Area

Demand

Total Demand (gpm)	12,432

Tanks

Label	Zone	Initial Elevation (ft)
Lake_Hills_N_30081	520 Lake Hills	516
Lake_Hills_S_30091	520 Lake Hills	508
NE40th_30021	NE 40th Res	392.5
Newport_30121	520 Lake Hills	509
Parksite_30131	520 Lake Hills	502.9
Sammamish_30191	270 Sammamish	243.5

Reservoirs

Label	Zone	Hydraulic Grade (ft)
161st_Inlet	Cascade	Offline
CESSL_to_RV300_Inlet_20051	CESSL	Offline
Eastgate_Inlet_20082	TESSL	Offline
Kirkland_Meter_200	545 Rose Hill	Offline
NE8th_Inlet_20041	TESSL	Offline
NE40th_Inlet_20014	TESSL	Offline
TESSL_Pump_LH520_20061	TESSL	Offline

Pumps

Label	Status	Zone
10021	Off	520 Lake Hills
10022	On	520 Lake Hills
10023	Off	520 Lake Hills
10061	Off	520 Lake Hills
10062	Off	520 Lake Hills
10071	On	520 Lake Hills
10072	Off	520 Lake Hills
10101	Off	TESSL

PRVs

Label	Elevation (ft)	Hydraulic Grade Setting (Initial) (ft)	Pressure Setting (Initial) (psi)	Status (Initial)	Zone
10	234.56	352.16	51	Active	330 Redmond
14	305.45	418.44	49	Active	400 Redmond
15	160.32	333.26	75	Active	330 Redmond
16	218.31	331.3	49	Active	330 Redmond
17	215.3	332.9	51	Active	330 Redmond
19	320.2	470.08	65	Active	400 Redmond
20	327.78	477.66	65	Active	400 Redmond
22	334.3	433.45	43	Active	400 Redmond
23	228.35	336.73	47	Active	330 Redmond
34	320.43	417.28	42	Active	400 Redmond
37	237	0	59	Active	380 College Hill
38	284	422.35	60	Active	380 College Hill
39	280	418.35	60	Active	440 College Hill

City of Bellevue
EOA-WOA Transmission Main Evaluation
Hydraulic Analyses Operational Conditions
East Operating Area

Label	Elevation (ft)	Hydraulic Grade Setting (Initial) (ft)	Pressure Setting (Initial) (psi)	Status (Initial)	Zone
40	154	262.38	47	Active	300 Richards Valley
42	291	429.35	60	Active	450 Kelsey Creek
44	290	430.66	61	Active	450 Kelsey Creek
50	296	498.92	88	Active	520 Lake Hills
58	159	285.82	55	Active	300 Eastgate
59	298	413.29	50	Active	440 Eastgate
60	284	410.82	55	Active	440 Eastgate
61	86	247.41	70	Active	270 Sammamish
65	208	254.12	20	Active	270 Sammamish
66	270	406.05	59	Active	440 Eastgate
67	308	365.65	25	Active	380 Lake Hills
68	112	245.74	58	Active	270 Sammamish
69	308	365.65	25	Active	380 Lake Hills
70	271	411.66	61	Active	435 Lake Hills
71	194	0	26	Active	270 Sammamish
72	144	254.68	48	Active	270 Sammamish
73	288	380.23	40	Active	400 Redmond
80	310	422.99	49	Active	435 Lake Hills
81	288	424.05	59	Active	435 Lake Hills
82	286	382.85	42	Active	435 Lake Hills
86	78	290.14	92	Active	300 Richards Valley
93	284	433.88	65	Active	450 Kelsey Creek
94	334	442.38	47	Active	450 Kelsey Creek
95	303	399.85	42	Active	400 Eastgate
98	286	373.62	38	Active	380 College Hill
101	305	392.62	38	Active	400 Eastgate
114	181	254.79	32	Active	270 Sammamish
130	210	373.72	71	Active	370 Eastgate
136	316	431.29	50	Active	440 College Hill
137	351	489.35	60	Active	520 Lake Hills
139	200	0	38	Active	330 Redmond
140	197	296.15	43	Active	330 Redmond
141	277	371.54	41	Active	400 Redmond
154	230	366.05	59	Active	380 College Hill
158	159	285.82	55	Active	300 Richards Valley
20011a	315	519.76	88.8	Active	TESSL
20012	315	0	88.8	Active	520 Lake Hills

FCVs

Label	Elevation (ft)	Flow Setting (Initial) (gpm)	Status (Initial)
FCV-3	416.04	2,000.00	Closed
FCV-4	406.46	2,000.00	Closed
FCV-5	427.54	2,500.00	Closed
FCV-6	395.96	2,000.00	Active
FCV-7	391.55	2,300.00	Inactive
FCV-NE 8th Inlet	319.19	3,500.00	Closed

City of Bellevue
EOA-WOA Transmission Main Evaluation
Preliminary Study Level Cost Estimate

Description	Base Unit Price*	Construction + Indirect Unit Price
24" Water Main (per LF)	$390	$726
16" Water Main (per LF)	$330	$615
12" Water Main (per LF)	$290	$540
PRV Station (each)	$105,000	$195,572

* Assumes grind and overlay of streets.

Alternative A					
Item	**Description**	**Units**	**Quantity**	**Unit Price**	**Total Price**
	Construction Costs (2013 $$)				
1	16-inch Water Main in NE 40th St and PP670 Zone	LF	10,700	$ 330	$ 3,531,000
2	LH520/PP670 BPS: 5,500 gpm	LS	1	$ 1,100,000	$ 1,100,000
3	PP670/PP550 PRV	EA	1	$ 105,000	$ 105,000
4	PP550/BV400 PRV	EA	1	$ 105,000	$ 105,000
	Construction Cost Subtotal				**$ 4,841,000**
	Washington State Sales Tax (9.5 percent)				$ 460,000
	Construction Cost Contingency (20 percent)				**$ 1,061,000**
	Construction Cost Total				**$ 6,362,000**
	Indirect Costs (2013 $$)				
	Indirect Costs (35 percent of construction costs and includes construction survey, predesign engineering, design engineering, construction engineering and administration, permitting and inspections)				$ 2,227,000
	Indirect Cost Total				**$ 2,227,000**
	Project Cost Subtotal				$ 8,589,000
	Project Contingency (5 percent)				$ 430,000
	Project Cost Including Construction and Indirect Costs				***$ 9,019,000***

Alternative B					
Item	**Description**	**Units**	**Quantity**	**Unit Price**	**Total Price**
	Construction Costs (2013 $$)				
1	16-inch Water Main in NE 8th St	LF	7,800	$ 330	$ 2,574,000
2	LH520/KC450 PRV	EA	1	$ 105,000	$ 105,000
3	KC450/BV400 PRV	EA	1	$ 105,000	$ 105,000
	Construction Cost Subtotal				**$ 2,784,000**
	Washington State Sales Tax (9.5 percent)				$ 265,000
	Construction Cost Contingency (20 percent)				**$ 610,000**
	Construction Cost Total				**$ 3,659,000**
	Indirect Costs (2013 $$)				
	Indirect Costs (35 percent of construction costs and includes construction survey, predesign engineering, design engineering, construction engineering and administration, permitting and inspections)				$ 1,281,000
	Indirect Cost Total				**$ 1,281,000**
	Project Cost Subtotal				$ 4,940,000
	Project Contingency (5 percent)				$ 247,000
	Project Cost Including Construction and Indirect Costs				***$ 5,187,000***

City of Bellevue

EOA-WOA Transmission Main Evaluation

Preliminary Study Level Cost Estimate

Item	Description	Units	Quantity	Unit Price	Total Price
	Alternative C				
	Construction Costs (2013 $$)				
1	16-inch Water Main in Bel-Red Rd from Bel-Red Inlet to TESSL*	LF	2,800	$ -	$ -
2	16-inch Water Main in Bel-Red Rd from TESSL to LH520 Zone	LF	2,800	$ 330	$ 924,000
3	16-inch Water Main in 148th Ave NE and 156th Ave NE	LF	4,500	$ 330	$ 1,485,000
4	LH520/BV400 PRV	EA	1	$ 105,000	$ 105,000
	Construction Cost Subtotal				**$ 2,514,000**
	Washington State Sales Tax (9.5 percent)				$ 239,000
	Construction Cost Contingency (20 percent)				**$ 551,000**
	Construction Cost Total				**$ 3,304,000**
	Indirect Costs (2013 $$)				
	Indirect Costs (35 percent of construction costs and includes construction survey, predesign engineering, design engineering, construction engineering and administration, permitting and inspections)				$ 1,157,000
	Indirect Cost Total				**$ 1,157,000**
	Project Cost Subtotal				$ 4,461,000
	Project Contingency (5 percent)				$ 224,000
	Project Cost Including Construction and Indirect Costs				***$ 4,685,000***

* Cost allocated in CIP #W-104

Item	Description	Units	Quantity	Unit Price	Total Price
	Alternative D				
	Construction Costs (2013 $$)				
1	16-inch Water Main in SE 8th and Lake Hills Conn to TESSL*	LF	9,400	$ -	$ -
2	16-inch Water Main in Lake Hills Conn from TESSL to LH520	LF	2,600	$ 330	$ 858,000
3	24-inch Water Main in LH520 Zone: Parksite to SE 28th Inlet	LF	7,500	$ 390	$ 2,925,000
4	LH520/BV400 PRV	EA	1	$ 105,000	$ 105,000
	Construction Cost Subtotal				**$ 3,888,000**
	Washington State Sales Tax (9.5 percent)				$ 370,000
	Construction Cost Contingency (20 percent)				**$ 852,000**
	Construction Cost Total				**$ 5,110,000**
	Indirect Costs (2013 $$)				
	Indirect Costs (35 percent of construction costs and includes construction survey, predesign engineering, design engineering, construction engineering and administration, permitting and inspections)				$ 1,789,000
	Indirect Cost Total				**$ 1,789,000**
	Project Cost Subtotal				$ 6,899,000
	Project Contingency (5 percent)				$ 345,000
	Project Cost Including Construction and Indirect Costs				***$ 7,244,000***

* Cost allocated in CIP #W-104

City of Bellevue

EOA-WOA Transmission Main Evaluation

Preliminary Study Level Cost Estimate

Alternative E					
Item	**Description**	**Units**	**Quantity**	**Unit Price**	**Total Price**
	Construction Costs (2013 $$)				
1	16-inch Water Main in NE 8th St	LF	2,600	$ 330	$ 858,000
2	12-inch Water Main in SE 7th St	LF	400	$ 290	$ 116,000
3	12-inch Water Main in 140th Ave NE	LF	1,200	$ 330	$ 396,000
4	Upgrade Existing PRV Stations	EA	2	$ 35,000	$ 70,000
	Construction Cost Subtotal				**$ 1,440,000**
	Washington State Sales Tax (9.5 percent)				$ 137,000
	Construction Cost Contingency (20 percent)				**$ 316,000**
	Construction Cost Total				**$ 1,893,000**
	Indirect Costs (2013 $$)				
	Indirect Costs (35 percent of construction costs and includes construction survey, predesign engineering, design engineering, construction engineering and administration, permitting and inspections)				$ 663,000
	Indirect Cost Total				**$ 663,000**
	Project Cost Subtotal				$ 2,556,000
	Project Contingency (5 percent)				$ 128,000
	Project Cost Including Construction and Indirect Costs				***$ 2,684,000***

City of Bellevue
EOA-WOA Transmission Main Evaluation
Preliminary Triple Bottom Line Analysis
Prepared by City of Bellevue

Category	Item	Description	Weight Factor	3.5 MG WOA Storage		Transmission Main Alternative A		Transmission Main Alternative B		Transmission Main Alternative C		Transmission Main Alternative D		Transmission Main Alternative E	
Economic	**Initial Capital Cost**	**Initial Capital Cost**	4	$8,524,000	-2	$9,019,000	-2	$5,187,000	-1	$4,685,000	-1	$7,244,000	-2	$2,693,000	2
Economic	**Energy Consumption After Construction**	**Long-term electricity bill**	1	It is assumed that that the proposed reservoir will be designed with an overflow elevation of 400 feet and only minimal power will be needed at the facility for lighting, SCADA, etc.	0	Increases due to need to pump water to the PP670 to be ultimately conveyed to BV400 Zone.	-1	Proposed facilities will not require power.	2	Proposed facilities will not require power.	2	Proposed facilities will not require power.	2	Proposed facilities will not require power.	2
Economic	**Long Term O&M Needs**	**Effort required to maintain infrastructure**	3	A new storage facility will require daily monitoring and frequent maintenance.	-1	A new BPS will require daily monitoring and frequent maintenance. New PRVs and transmission main will require occasional maintenance.	-2	New PRVs and transmission main will require occasional maintenance.	0	New PRVs and transmission main will require occasional maintenance.	0	New PRVs and transmission main will require occasional maintenance.	0	New transmission main will require occasional maintenance.	1
Economic	**Potential Renewal and Replacement Savings**	**Added value for R&R program**	2	It is assumed that the selected site will provide the opportunity for the City to oversize the reservoir in order to replace an existing aging facility. Cost savings may be realized for the future renewal and replacement of the existing aging facility by coordinating these projects.	2	The oldest known section of water main along the proposed alignment was installed in 1966 and is likely nearing the end of its life expectancy. Portions of the existing alignment are constructed of AC. Cost savings may be realized for the future renewal and replacement of the existing water main by coordinating these projects.	1	The oldest known section of water main along the proposed alignment was installed in 1965 and is likely nearing the end of its life expectancy. Cost savings may be realized for the future renewal and replacement of the existing water main by coordinating these projects.	1	The oldest known section of water main along the proposed alignment was installed in 1961 and is likely nearing the end of its life expectancy. Portions of the existing alignment are constructed of AC. Cost savings may be realized for the future renewal and replacement of the existing water main by coordinating these projects.	1	The oldest known section of water main along the proposed alignment was installed in 1970 and is likely nearing the end of its life expectancy. Portions of the existing alignment are constructed of AC. Cost savings may be realized for the future renewal and replacement of the existing water main by coordinating these projects.	1	The oldest known section of water main along the proposed alignment was installed in 1957 and is likely nearing the end of its life expectancy. Cost savings may be realized for the future renewal and replacement of the existing water main by coordinating these projects.	1
Economic	**Impact on Creation of 560 Zone**	**Any effects related to increasing Lake Hills pressure**	3	No impact on creation of 560 Zone anticipated.	0	No impact on creation of 560 Zone anticipated.	0	No impact on creation of 560 Zone anticipated.	0	Several of the 560 Zone alternatives include a portion of this alignment. Cost savings may be realized with coordination of these projects.	1	No impact on creation of 560 Zone anticipated.	0	No impact on creation of 560 Zone anticipated.	0
Economic	**Traffic Impacts During Construction**	**Opportunity cost of traffic delays**	2	Depending on site, traffic impacts during construction will be minimal compared to transmission main alternatives, which will be installed within existing right of ways.	-1	Traffic in residential areas will be impacted during the construction of the transmission main and other alternative improvements.	-1	Traffic within a main arterial and business district will be impacted during the construction of the transmission main and other alternative improvements.	-2	Traffic within a main arterial and business district will be impacted during the construction of the transmission main and other alternative improvements.	-2	Traffic within a main arterial will be impacted during the construction of the transmission main and other alternative improvements.	-2	Traffic within a short section of a main arterial and business district will be impacted during the construction of the transmission main and other alternative improvements.	-2
Economic	**System Water Quality**	**Effects on DBP, chlorine residual and taste & odor; O&M effort required to maintain WQ.**	2	Water turnover rates will decrease, however it will depend heavily on the selected site.	-2	No change. Transmission main will only operate during emergency conditions and will not impact the normal turnover in existing reservoirs.	1	No change. Transmission main will only operate during emergency conditions and will not impact the normal turnover in existing reservoirs.	1	No change. Transmission main will only operate during emergency conditions and will not impact the normal turnover in existing reservoirs.	1	No change. Transmission main will only operate during emergency conditions and will not impact the normal turnover in existing reservoirs.	1	No change. Transmission main will only operate during emergency conditions and will not impact the normal turnover in existing reservoirs.	1

City of Bellevue
EOA-WOA Transmission Main Evaluation
Preliminary Triple Bottom Line Analysis
Prepared by City of Bellevue

Category	Item	Description	Weight Factor	3.5 MG WOA Storage		Transmission Main Alternative A		Transmission Main Alternative B		Transmission Main Alternative C		Transmission Main Alternative D		Transmission Main Alternative E	
Economic	**Construction and Permitting Schedule**	**Storage is made available to WOA before deadline (no lapse in minimum compliance)**	4	Depending on selected site, state parks or other agencies may require coordination.	-2	The transmission main and BPS are located in residential areas that may not require as much time to mitigate utility, ROW and traffic impacts during design and construction. Minor coordination with SPU for TESSL crossing will be necessary.	-1	It is assumed that this corridor is congested with utilities and that significant traffic impact mitigation may extend design and construction schedule. Minor coordination with SPU for TESSL crossing will be necessary.	1	It is assumed that this corridor is congested with utilities and that significant traffic impact mitigation may extend design and construction schedule. Minor coordination with SPU for TESSL crossing will be necessary.	1	It is assumed that this corridor is congested with utilities and that significant traffic impact mitigation may extend design and construction schedule. Coordination with WSDOT and minor coordination with SPU for TESSL crossing will be necessary.	-1	Although it is assumed that this corridor is congested with utilities and that traffic impact mitigation will be necessary, this alignment is significantly shorter than other alternatives. Minor coordination with SPU for TESSL crossing will be necessary.	1
Economic	**System Transmission Redundancy**	**Flexibility in Ability to Move Storage/Supply**	2	Does not provide additional flexibility in the way storage and supply can be conveyed from one operating area to another.	0	Provides redundancy in supply to the WOA and flexibility in the means available to move storage and supply from the EOA to the WOA.	2	Provides redundancy in supply to the WOA and flexibility in the means available to move storage and supply from the EOA to the WOA.	2	Provides redundancy in supply to the WOA and flexibility in the means available to move storage and supply from the EOA to the WOA.	2	Provides redundancy in supply to the WOA and flexibility in the means available to move storage and supply from the EOA to the WOA.	2	Provides redundancy in supply to the WOA and flexibility in the means available to move storage and supply from the EOA to the WOA.	2
Economic	**Environmental Impacts***	**Environmental Impacts**	2	It is assumed that the selected site will have minimal environmental impact.	-1	Portions of the proposed alignment cross a creek in a Chinook distribution area or are located in an erosion hazard area and would require mitigation.	-1	The proposed alignment crosses a creek in a Chinook distribution area and 100 year floodplain and would require mitigation.	-1	Portions of the proposed alignment cross a creek in a Chinook distribution area and 100 year floodplain or are located in an erosion hazard area and would require mitigation.	-1	Portions of the proposed alignment cross a creek in a Chinook distribution area and 100 year floodplain or are located in an erosion hazard area and would require mitigation.	-1	The proposed alignment crosses a creek in a Chinook distribution area and 100 year floodplain and would require mitigation.	-1
Social	**Available Fire Flow - WOA**	**Life safety and insurance rate ramifications**	4	Increases in WOA.	0	Increases in WOA.	0	Increases in WOA.	0	Increases in WOA.	0	Increases in WOA.	0	Increases in WOA.	0
Social	**Available Fire Flow - EOA**	**Life safety and insurance rate ramifications**	4	No impact in EOA.	0	No impact in EOA.	0	No impact in EOA.	0	No impact in EOA.	0	No impact in EOA.	0	No impact in EOA.	0
Social	**Impact to Neighboring Utilities**	**Effect on O&M and supply redundancy of Redmond, CCUD, Kirkland, SPU, Issaquah, etc.**	1	An increased level of redundancy would be available to Bellevue and utilities with interties to Bellevue's WOA .	1	The NE 40th Reservoir is shared with Redmond. The surplus of storage in the EOA and the level of redundancy currently being provided would be reduced, though not below minimum standards.	-1	The NE 40th Reservoir is shared with Redmond. The surplus of storage in the EOA and the level of redundancy currently being provided would be reduced, though not below minimum standards.	-1	The NE 40th Reservoir is shared with Redmond. The surplus of storage in the EOA and the level of redundancy currently being provided would be reduced, though not below minimum standards.	-1	The NE 40th Reservoir is shared with Redmond. The surplus of storage in the EOA and the level of redundancy currently being provided would be reduced, though not below minimum standards.	-1	The NE 40th Reservoir is shared with Redmond. The surplus of storage in the EOA and the level of redundancy currently being provided would be reduced, though not below minimum standards.	-1
Social	**Long Term Neighborhood Impacts**	**Fosters liveable neighborhood**	4	Site access for O&M and other vehicles. Occasional noise for O&M tasks. Access to PRV station may be within or adjacent to ROW and may require temporary interruptions for occasional access to vault for O&M activities.	-2	BPS site access for O&M and other vehicles. City's policy is to minimize noise from normal operation of pumps and EG. Occasional noise at BPS for O&M tasks. Access to PRV station may be within or adjacent to ROW and may require temporary interruptions for occasional access to vault for O&M activities.	-1	Access to PRV station may be within or adjacent to ROW and may require temporary interruptions for occasional access to vault for O&M activities.	0	Access to PRV station may be within or adjacent to ROW and may require temporary interruptions for occasional access to vault for O&M activities.	0	Access to PRV station may be within or adjacent to ROW and may require temporary interruptions for occasional access to vault for O&M activities.	0	Access to PRV station may be within or adjacent to ROW and may require temporary interruptions for occasional access to vault for O&M activities.	0

City of Bellevue
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Preliminary Triple Bottom Line Analysis
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Category	Item	Description	Weight Factor	3.5 MG WOA Storage		Transmission Main Alternative A		Transmission Main Alternative B		Transmission Main Alternative C		Transmission Main Alternative D		Transmission Main Alternative E	
Social	**Reliability (gravity vs. pumped storage)**	**Manages risk of failure when needed most**	4	It is assumed that the proposed reservoir will be designed with an overflow elevation of at least 400 feet and would provide gravity storage to the system, which is more reliable than pumped storage.	1	Additional risk is assumed with emergency storage needing to be pumped and supplied from facilities that carry a potential for failure of the mechanical equipment.	-1	This transmission main alternative relies on gravity storage from the EOA, which is more reliable than pumped storage.	1	This transmission main alternative relies on gravity storage from the EOA, which is more reliable than pumped storage.	1	This transmission main alternative relies on gravity storage from the EOA, which is more reliable than pumped storage.	1	This transmission main alternative relies on gravity storage from the EOA, which is more reliable than pumped storage.	1
Social	**Traffic Impacts During Construction**	**Opportunity cost of traffic delays**	2	Traffic impacts during construction will vary depending on the final site selected.	-1	Traffic in residential areas will be impacted during the construction of the transmission main and other alternative improvements.	-1	Traffic within a main arterial and business district will be impacted during the construction of the transmission main and other alternative improvements.	-2	Traffic within a main arterial and business district will be impacted during the construction of the transmission main and other alternative improvements.	-2	Traffic within a main arterial will be impacted during the construction of the transmission main and other alternative improvements.	-2	Traffic within a short section of a main arterial and business district will be impacted during the construction of the transmission main and other alternative improvements.	-2
Social	**Construction and Permitting Schedule**	**Storage is made available to WOA before deadline (no lapse in minimum compliance)**	3	Depending on selected site, state parks or other agencies may require coordination.	-2	The transmission main and BPS are located in residential areas that may not require as much time to mitigate utility, ROW and traffic impacts during design and construction. Minor coordination with SPU for TESSL crossing will be necessary.	-1	It is assumed that this corridor is congested with utilities and that significant traffic impact mitigation may extend design and construction schedule. Minor coordination with SPU for TESSL crossing will be necessary.	1	It is assumed that this corridor is congested with utilities and that significant traffic impact mitigation may extend design and construction schedule. Minor coordination with SPU for TESSL crossing will be necessary.	1	It is assumed that this corridor is congested with utilities and that significant traffic impact mitigation may extend design and construction schedule. Coordination with WSDOT and minor coordination with SPU for TESSL crossing will be necessary.	-1	Although it is assumed that this corridor is congested with utilities and that traffic impact mitigation will be necessary, this alignment is significantly shorter than other alternatives. Minor coordination with SPU for TESSL crossing will be necessary.	1
Social	**System Water Quality**	**Effects on DBP, chlorine residual and taste & odor; O&M effort required to maintain WQ.**	4	Water turnover rates will decrease, however it will depend heavily on the selected site.	-2	No change. Transmission main will only operate during emergency conditions and will not impact the normal turnover in existing reservoirs.	0	No change. Transmission main will only operate during emergency conditions and will not impact the normal turnover in existing reservoirs.	0	No change. Transmission main will only operate during emergency conditions and will not impact the normal turnover in existing reservoirs.	0	No change. Transmission main will only operate during emergency conditions and will not impact the normal turnover in existing reservoirs.	0	No change. Transmission main will only operate during emergency conditions and will not impact the normal turnover in existing reservoirs.	0
Social	**Short Term Neighborhood Impacts**	**Localized quality of life during construction**	2	Construction activities will create noise, dust, vibration, odor and access interruptions within the vicinity of selected site.	-2	Construction activities will create noise, dust, vibration, odor and access interruptions within residential areas along alignment.	-1	Alignment is in major arterial. Construction activities will create noise, dust, vibration, odor and access interruptions within commercial areas along alignment.	-1	Alignment is in major arterial. Construction activities will create noise, dust, vibration, odor and access interruptions within commercial areas along alignment.	-1	Alignment is in major arterial. Construction activities will create noise, dust, vibration, odor and access interruptions within residential areas along alignment.	-1	Alignment is in major arterial. Construction activities will create noise, dust, vibration, odor and access interruptions within residential and commercial areas along alignment.	-1
Social	**System Storage Redundancy**	**Total Storage Available; Flexibility to take tanks in/out of service**	5	Increases redundancy in the amount of total storage storage available to the system.	2	Does not increase total storage available to the system.	0	Does not increase total storage available to the system.	0	Does not increase total storage available to the system.	0	Does not increase total storage available to the system.	0	Does not increase total storage available to the system.	0
Social	**System Transmission Redundancy**	**Flexibility in Ability to Move Storage/Supply**	4	Does not provide additional flexibility in the way storage and supply can be conveyed from one operating area to another.	0	Provides redundancy in supply to the WOA and flexibility in the means available to move storage and supply from the EOA to the WOA.	1	Provides redundancy in supply to the WOA and flexibility in the means available to move storage and supply from the EOA to the WOA.	1	Provides redundancy in supply to the WOA and flexibility in the means available to move storage and supply from the EOA to the WOA.	1	Provides redundancy in supply to the WOA and flexibility in the means available to move storage and supply from the EOA to the WOA.	1	Provides redundancy in supply to the WOA and flexibility in the means available to move storage and supply from the EOA to the WOA.	1

City of Bellevue
EOA-WOA Transmission Main Evaluation
Preliminary Triple Bottom Line Analysis
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Category	Item	Description	Weight Factor	3.5 MG WOA Storage		Transmission Main Alternative A		Transmission Main Alternative B		Transmission Main Alternative C		Transmission Main Alternative D		Transmission Main Alternative E	
Social	Environmental Impacts*	Environmental Impacts	3	Environmental impacts are relative to the site selected which has not been done. For that reason, an average weight and rating has been assigned with the understanding that should the final ranking be close and this be in the top two, refinement would be necessary.	-1	Portions of the proposed alignment cross a creek in a Chinook distribution area or are located in an erosion hazard area and would require mitigation.	-1	The proposed alignment crosses a creek in a Chinook distribution area and 100 year floodplain and would require mitigation.	-2	Portions of the proposed alignment cross a creek in a Chinook distribution area and 100 year floodplain or are located in an erosion hazard area and would require mitigation.	-2	Portions of the proposed alignment cross a creek in a Chinook distribution area and 100 year floodplain or are located in an erosion hazard area and would require mitigation.	-2	The proposed alignment crosses a creek in a Chinook distribution area and 100 year floodplain and would require mitigation.	-1
Environmental	Environmental Impacts*	Environmental Impacts	4	Environmental impacts are relative to the site selected which has not been done. For that reason, an average weight and rating has been assigned with the understanding that should the final ranking be close and this be in the top two, refinement would be necessary.	-1	Portions of the proposed alignment cross a creek in a Chinook distribution area or are located in an erosion hazard area and would require mitigation.	-2	The proposed alignment crosses a creek in a Chinook distribution area and 100 year floodplain and would require mitigation.	-1	Portions of the proposed alignment cross a creek in a Chinook distribution area and 100 year floodplain or are located in an erosion hazard area and would require mitigation.	-2	Portions of the proposed alignment cross a creek in a Chinook distribution area and 100 year floodplain or are located in an erosion hazard area and would require mitigation.	-2	The proposed alignment crosses a creek in a Chinook distribution area and 100 year floodplain and would require mitigation.	-1
Environmental	Energy Consumption After Construction	Long-term electricity bill	1	It is assumed that that the proposed reservoir will be designed with an overflow elevation of 400 feet and only minimal power will be needed at the facility for lighting, SCADA, etc.	1	Increases due to need to pump water to the PP670 to be ultimately conveyed to BV400 Zone.	-1	Proposed facilities will not require power.	2	Proposed facilities will not require power.	2	Proposed facilities will not require power.	2	Proposed facilities will not require power.	2
					-42		-39		0		-1		-22		18

* A cursory review of environmental impacts was performed based on sensitive areas currently mapped by King County. Further investigation and analysis is recommended if the City elects to consider these alternatives further.

Appendix N

Emergency Well Evaluation

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ROBINSON
NOBLE

January 15, 2015

Mr. Doug Lane, PE
City of Bellevue
P.O. Box 90012
Bellevue, WA 98009-9012

Subject: Emergency Well Evaluation technical memorandums

Dear Doug,

Robinson Noble is pleased to present the attached Technical Memorandums 3 and 4, our primary deliverables under the City's Water System Plan Update contract with Carollo Engineering. Our task as Carollo's subconsultant was to provide an Emergency Well Evaluation which consists of an Emergency Water Source Evaluation (Technical Memorandum 3) and a Groundwater Resource Development Analysis (Technical Memorandum 4). Our findings are summarized below.

Initial Review and Planning

At the outset of the project, the consultant team met with City staff to collect data, review the City's goals, and define the criteria for our evaluation. Those meetings generated a preliminary summary of the wells (attached). Additional information and discussions are captured in the City's minutes from the May 16 meeting. From our initial analysis and these data, we developed the form and goals for the two technical memoranda.

Technical Memorandum 3

The emergency water source evaluation summarizes the setting, site conditions and wells at two of the City's well locations: Samena and Crossroads. Five wells inherited from the old King County Water District 97 system are divided between these two sites: Wells 1 and 3 at Samena and Wells 5, 6, and 7 at Crossroads. Of these, Wells 3 and 7 are equipped with pumps and control systems to allow for emergency-only water production from the site. The Washington State Department of Health (DOH) has approved four of the five wells for this use (Well 1 is unserviceable and will need to be replaced). The City has additional historic well sites but they were not included in this project.

We summarized the hydrogeological setting and physical details of the wells. Regional information implies that groundwater resources of the Bellevue upland north of I-90 and between Lake Washington and Lake Sammamish could be used to provide the City with additional emergency-only sources or possibly new production wells that could be used as back-up or full-time water supplies.

The City's water rights related to these wells were also reviewed. The rights are considered valid and protected by the City's status as a municipal water supplier. However, in their current configuration the existing wells cannot fully exercise the rights. Further, residual on-site contamination at the Crossroads site (along with current usage of the property by the City Parks Department) presents logistical and regulatory challenges to producing water from this site (beyond that of Well 7 as equipped). Therefore, new well locations and wells will be needed if the City wishes to pursue full use of its groundwater rights.

Technical Memorandum 4

In discussing the findings of Technical Memorandum 3, the City identified that its long-term goal is to put its groundwater rights to full use. The City recognizes that this goal might require significant planning, time and costs, depending on the method(s) chosen to develop and exercise the water rights.

Technical Memorandum 4 attempts to assess the options the City could pursue to establish full use of its water rights. This effort identified the general steps needed to develop new water sources in three categories (emergency-only, back-up supply, and full-time use) at both existing and at new sites.

We evaluated each of the existing wells at the two sites and provided list of alternatives for full development of that particular well. The consultant team also defined expected costs for each site's development options. These costs are planning-level estimates without specific schedules, so some variability is expected depending on when the work takes place. Lastly, we identified additional considerations the City may wish to plan for, such as water rights processing, wellhead and regional water resource protection planning, and water quality monitoring.

Simply due to the logistical and regulatory challenges of developing the City's groundwater rights, it is probable that the work will need to be accomplished in phases. The time schedules for site development could be years or decades. A well site could even be planned to include more than one of the three identified uses, as the site is developed in stages of increasing complexity. In the end, the key component to creating successful source locations will be identifying suitable property. This may include expanding the existing well sites, acquiring new property, or by re-purposing existing City-owned sites.

Summary

Together, the technical memorandums are intended to provide the City with a sufficient evaluation of existing resources and a range of future development options such that short- and long-term planning can begin. These memorandums should provide context for both strategic-level decisions, such as whether to divide the work into phases and when to execute each, as well as capital-improvement and budgetary planning for each project identified.

For example, it appears likely that logistical and environmental constraints (on-site contamination from the former UST) at the Crossroads property will prevent the use of Wells 5, 6, and 7 for anything beyond their currently approved emergency-use status. Both memorandums attempted to give full consideration of the options for these wells, but as a practical matter, the constraints are probably large enough to warrant leaving them in their current capacity and planning on acquiring a future site to develop new production sources that could exercise the City's water rights assigned to the three wells.

The consultant team of Carollo Engineers and Robinson Noble welcome any questions concerning the memorandums, should they arise. Please contact us if you need anything further. Thank you for the opportunity to be of service.

Respectfully submitted,
Robinson Noble, Inc.

Burt G. Clothier, LHG, RG, CWRE
Principal Hydrogeologist

cc: Lara Kammereck, PE, Carollo Engineers

City of Bellevue

Emergency Supply Well Project

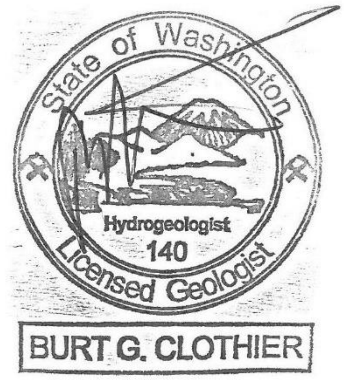
Well Summary

May 16, 2014

		Samena		Crossroads			
	Well	**1**	**3**	**5**	**6**	**7**	***Notes***
	Source approval	n/a	yes	yes	yes	yes	*(DOH 2010)*
	Source number	S05 (inactive)	S04	S06	S07	S08	
Water quality	Inorganic sample year	n/a	2011	2011	2011	2008	*(nitrates & Bac-T thru 2014)*
	VOC sample year	n/a	2011	2011	2011	2008	
	Toluene (2008)		0.69		0.8	0.73	*Reported by City as sample*
	Styrene (2008)				8.53		*errors; non-detect in 2011*
Well test	Test discharge (gpm)	900	420	480	450	590	
	Year of test	at const.	at const.	2013	2013	at const.	
	Drawdown (feet)	93	38	18.8	38	15.5	*New tests on Wells 5 & 6 only.*
	Specific capacity (gpm/ft)	9.7	11.1	25.5	11.8	38.1	*Wells 3 and 7 still to be done.*
Water rights	Certificate	C-3252-A	C-2539-A	C-4454-A	C-4453-A	C-4391-A	*Maximum total Qa of all rights*
	Priority date	1/17/1956	7/11/1955	9/13/1962	9/13/1962	6/20/1962	*combined is 4,480 af/y. All*
	Qi (gpm)	850	450	500	600	700	*rights are available to move or*
	Qa (acre-feet/year)	1360	400	800	960	1120	*reorganize within normal*
	Combined operational totals	3,100 gpm Qi (4.4 MGD max) and 4,480 Qa (4.0 MGD max)					*limits.*
Physical details	Well log?	yes	yes	no	no	yes	
	Casing (inches)	12	12	8	16	12	*Well 1 capped and partially*
	Depth (feet)	220*	160	293	302	300	*filled such that the well is*
	Screen (feet)	15	30	30	10	24	*currently unusable.*
Expandable to non-emergency use?		no	yes	yes	yes	yes	*Connecting to system would*
	Issues to be resolved?	n/a	well test	needs pump	needs pump	well test	*need new source approvals,*
	Could connect to system?	n/a	yes	yes	yes	yes	*water quality, and updated*
	Replace w/ new well?	yes	use as-is	yes	yes	use as-is	*CWSP & WHPP*
Susceptibility	Completed sanitary survey?	n/a	yes	yes	yes	yes	
	Risk from on-site contamination?	n/a	None	Low	Low	Low	*Until NFA received on clean-up, risk level still 'Low' on paper*

ROBINSON
NOBLE

Technical Memorandum 3
City of Bellevue
Emergency Water Sources Evaluation



Date: January 6, 2015

To: Doug Lane, P.E., City of Bellevue

cc: Lara Kammereck, Carollo Engineers

From: Burt G. Clothier, LHG

The City of Bellevue (City) maintains five water wells in the Lake Hills region located at two sites, Samena and Crossroads. Four of the five wells are classified for emergency use only and the fifth is unserviceable. Wells 1 and 3 are at the Samena site at 1028 151st Avenue SE and Wells 5, 6, and 7 are at the Crossroads Reservoir site at 16049 NE 8th Street (Figure 1). These wells were constructed and used by King County Water District 97 before that entity was absorbed by the City of Bellevue. The City has additional surface and groundwater rights, but the scope of this study is for the currently usable wells only. Additional rights exist for three Water District 68 wells along Bellevue Way, as well as an abandoned surface water treatment plant on Lake Washington.

Well 1 has been partially filled and is considered unusable in its current form. Wells 5 and 6 are capped and secure, but do not have pumping equipment installed. Wells 3 and 7 have been equipped with pumps, utility and emergency power connections, and secure wellheads that will allow for immediate use during an emergency. Both pumps are operated on an intermittent basis to collect water quality samples and to exercise the pump equipment as part of basic maintenance.

The following evaluation describes the well details, setting, water rights situation, and susceptibility issues. The City conducted a site visit for the project team on April 5, 2014. The project team visually inspected each of the two well sites and the five wells and discussed their history with City staff. The City also provided extensive background information on the wells and the well sites, describing the physical condition of the wells, their history, water rights, and testing information (both physical and water quality), where available.

Hydrogeologic Setting

Few regional-level hydrogeologic studies of the area are available. It appears that the primary hydrogeologic reference remains Liesch and others (1963). While the terminology used and absolute age of geologic units has been revised by more recent work, the fundamental hydrostratigraphy (water-bearing versus non-water-bearing sediments) is largely unchanged. Woodward and others (1995) presents a regional correlation of units for the Puget Sound area but this discussion will use the recent nomenclature resulting from the detailed mapping and geochemical investigations of Troost and others (2005).

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The City of Bellevue is located between Lake Washington and Lake Sammamish on the southern edge of a deep basin of unconsolidated sediments of glacial and non-glacial origin (the Interlake Drift Plain; Liesch and others, 1963). To the south of Interstate 90 lie the Newcastle-Grand Ridge Hills, which are primarily composed of Tertiary-age sedimentary bedrock (Liesch and others, 1963). The deep sediments to the north and bedrock at surface to the south are a result of movement on the Seattle Fault. The Seattle Fault zone, tracing the area where the fault is expected to exist, runs roughly east-west from Issaquah to Bainbridge Island.

In our opinion, the unconsolidated sediments north of I-90 present the most likely opportunity for developing new source wells of appreciable production capacity. The upper portion of these sediments—the shallower, Vashon-age recessional outwash (Qvr) and glacial till (Qvt) units—often support low-yield wells adequate for single-domestic and small-system use. Municipal and commercial wells typically target deeper, regional aquifer systems typically found at elevations near or below sea level. The uppermost regional aquifer system consists of Vashon advance outwash (Qva). Beneath the Qva aquifer is the thick, low-permeability Lawton Clay (Qvlc) that acts as a regional confining unit for deeper aquifers. Below the Lawton Clay, a series of older glacial and non-glacial sediments are present with coarse-grained sediments (Qpoc/Qpogc/Qponc) hosting aquifers between lower-permeability, fine-grained units (Qpof/Qpogf/Qponf) forming confining layers. Some of these coarse-grained units are recognized to be capable of "yielding large quantities of water to wells" (Liesch and others, 1963).

A cursory search of water well logs from the Ecology water well report database yielded seven logs (including one for Well 7) for wells larger than 12-inch diameter where test pumping was recorded. The average production rate was 586 gpm with a range of 300 to 900 gpm. Depths were variable with one well exceeding 1,000 feet. Aquifer descriptions were broadly similar for the systems of interest here.

Well Summary

Samena Wells 1 and 3 and Crossroads Wells 5, 6, and 7 are all completed in the Vashon advance outwash deposits. The aquifer at both sites is overlain by a confining layer of Vashon till. Table 1, below, summarizes the physical details of each of the wells.

Table 1: City of Bellevue emergency wells at Crossroads and Samena Well sites

Well	1	3	5	6	7
Well log available	yes	yes	No	no	yes
Casing diameter (inches)	12	12	8	16	12
Final depth (feet)	220*	160	293	302	300
Screen length (feet)	15	30	30	10	24
Projected production (gpm)**	--	400	500	600	700

* Well 1 capped and partially filled such that the well is currently unusable.

** Apparent capability of the well under full use and assuming each well is pumped individually; cannot exceed the well's water right allocation.

Inorganic water quality sampling in 2011 for Well 3 shows manganese slightly over the MCL at 0.053 mg/L. For Well 5, iron is over the MCL at 0.58 mg/L.

A well-testing program was initiated by the City in 2013 beginning with test pumping of Wells 5 and 6 conducted by GeoEngineers. Well 5 was pumped at 480 gallons per minute (gpm) and Well 6 at 450 gpm. Dividing the production (in gpm) by the final drawdown (in feet) provides a diagnostic measurement called specific capacity (Q/s). Well 5 exhibited a Q/s of 25.5 gpm/ft;

Well 6 showed a Q/s of 11.8 gpm/ft. Original tests recorded on well logs for Wells 1 and 3 at Samena showed testing at 420 and 900 gpm, respectively, and resulted in Q/s values of 11 gpm/ft and 9.7 gpm/ft.

The GeoEngineers report (2014a) included various calculations to estimate aquifer transmissivity (T)[1] values at Wells 5 and 6 of 55,500 gallons per day per foot (gpd/ft) and 49,100 gpd/ft, respectively. A general rule-of-thumb for estimating T from a well test in a confined aquifer, assuming a perfectly efficient[2] well, is to multiply the specific capacity times 2,000. Using the Q/s values above, this implies transmissivity values of 51,000 and 24,000 gpd/ft, respectively, for Wells 5 and 6. Consequently, Well 5 is apparently efficient while Well 6 is likely to have a greatly reduced efficiency resulting in a lower Q/s value[3].

As a separate check, we assessed the GeoEngineers semi-log plots for the Wells 5 and 6 test data shown on their Figures 12 and 15. Our analysis identified a higher T value of 105,000 gpd/ft for Well 5 and a slightly higher value of 59,000 gpd/ft for Well 6. Though larger, these T values are in rough agreement with those obtained by GeoEngineers with the variations most likely resulting from differing interpretations of the data. However, if the values we calculated are correct, the wells are even less efficient. Regardless, we concur with GeoEngineer's findings that the wells should be capable of producing their respective water right allocations of 500 and 600 gpm. Further, the aquifer at this location appears capable of supporting high volume production, although new or additional wells might be needed.

Wells 3 and 7 were scheduled for testing in the summer of 2014. The testing was again conducted by GeoEngineers (2014b). Well 7 was pumped at rates of 568, 624, and 710 gpm and is shown graphically on GeoEngineers Figures 3 and 5 with a typical drawdown and recovery pattern for a confined aquifer well. It has a specific capacity of 35 gpm/ft after pumping 710 gpm for four hours and even though drawdown did not stabilize within that time, the drawdown slope shown on Figure 5 suggests that it might approach stabilization with extended pumping. The well appears capable of pumping its water right amount of 700 gpm when pumping alone. If the City determines that all three wells at the Crossroads wellfield should be developed for use, we recommend that a controlled test for up to 72 hours be conducted using all three wells. GeoEngineers (2014b) makes a similar recommendation. Such a test should focus on the interference drawdown each well has on the others and establish a long-term baseline record of aquifer performance under large-volume production. Ideally, the results from such testing would include recommendations on maximizing use of the current wells or on the placement of new wells to minimize interference, if Wells 5 and 6 were to be replaced. Specific details of the proposed testing, if desired, would need to be defined based on site constraints and expected or desired production levels.

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[1] Transmissivity is a measure of how much water will move through an aquifer formation. In this case, it is measured as gallons per day across a one-foot width of the aquifer (gpd/ft). Note that the GeoEngineer's reports use different units for transmissivity values, reporting their measurements as ft^2/day, which is equivalent to gpd/ft divided by 7.481.

[2] Efficiency is a measure of how easily water enters a well. Well screens (and other well completion methods) cause resistance (friction) to water entering a well; the lower the resistance, the higher the efficiency. In a perfectly efficient well, water enters the well without any resistance.

[3] The Well 6 testing revealed a T value of 49,100 gpd/ft, whereas the rule-of-thumb calculation using the observed Well 6 Q/s gives a T that is approximately half that value. Since the rule-of-thumb assumes a 100% efficient well, the difference in Q/s values implies inefficiency in the well.

The testing conducted at Samena Well 3 showed a drawdown pattern of an obviously inefficient well, (GeoEngineers 2014b; Figures 3 and 7). The report states that the screen may be plugged with debris and that the aquifer water had to move through this restriction during the test. The test was conducted in six steps between 100 and 312 gpm with an almost constant specific capacity of 8.4 gpm/ft. The reported transmissivity was higher than reported for Crossroads Well 7 suggesting that the aquifer can support greater withdrawals but that this well is very inefficient in producing water. Well 3 should be cleaned out, redeveloped, and retested. Once done, the well is expected to be capable of producing up to its water right allocation of 400 gpm. Additional testing up to 850 gpm would be needed if this well is to be used to exercise the Well 1 water right. It is unlikely that the well could exercise both the Well 1 and Well 3 water rights (1,250 gpm) but the additional testing should be able to determine if the aquifer could support a replacement for Well 1 allowing production from two wells together.

The aquifer system supporting the Crossroads and Samena sites is generally at or above sea level and the elevations of Lake Washington and Lake Sammamish. They may be limited by their size and the amount of recharge they receive each year. GeoEngineers (2014b) recommends a hydrogeologic study to fully characterize the upland. Such an investigation would be useful for determining alternate well locations, but is probably not necessary if the City's groundwater use is confined to the Crossroads and Samena sites. Instead, Wells 3 and 7 could be placed into regular production use and monitored for a couple of years. The monitoring record can provide guidance for decisions at each site. If aquifer water levels appear stable and able to provide more volume than produced by Well 7 alone, then it might make sense to start using Wells 5 and 6. If the Well 3 aquifer appears capable of more production, then constructing a new well into that aquifer may be appropriate. These concepts will be described in Technical Memorandum 4.

The Department of Health (DOH) has issued source approval for each of the two well sites to provide emergency-only water supplies. This use is governed by DOH policies (publication 331-317) and WAC 246-290 (DOH, 2010). Wells 3, 5, 6, and 7 are covered by the approval.

Water Rights

The City has multiple groundwater rights inherited from the old King County Water District 97 system. Five are related to the five wells at the Crossroads and Samena sites. Table 2, below, shows the water right number, date of issuance (priority date), instantaneous withdrawal rate (Qi), and annual withdrawal volume (Qa) for each well.

Table 2: City of Bellevue water rights at Crossroads and Samena Well sites

Well	1	3	5	6	7
Certificate	C-3252-A	C-2539-A	C-4454-A	C-4453-A	C-4391-A
Priority date	1/17/1956	7/11/1955	9/13/1962	9/13/1962	6/20/1962
Qi (gpm)	850	400	500	600	700
Qa (acre-feet/year)*	1,360	450	800	960	1,120

* Limitations included in the final certificates limit the combined maximum total Qa of all rights to 4,480 acre-feet per year (afy) instead of the sum of the rights (4,640 afy).

All of these rights remain active as municipal water supply rights. Ecology's current policies and rules grant protection from relinquishment of these rights based on the City's status as a municipal supplier, recognizing the need of a supplier to identify and protect future sources of supply to meet expected, long-term growth within their systems. We expect that the status as municipal supply sources will remain in place for the foreseeable future; however, it is always possible the law could be altered by legislative action or a new court case.[4]

Each right can be exercised by the current on-site well (or wells) the right is related to, or by a new well if that well is constructed within the same location as originally advertised in the corresponding water right application (RCW 90.44.100(3)). For example, a water rights application typically records a withdrawal location as a township, range, quarter-quarter section location (roughly 40 acres); so as long as the new well is within the same quarter-quarter section, the new or additional well is permissible by the same water right. Currently, we don't have documentation on the advertised areas. Some additional sleuthing in Ecology's records or other historical sources will be needed to resolve this.

If additional flexibility is needed, the City could apply for a water rights change to allow use of one or more rights at a new location, or to amend each of the rights so that any one of them could be used by any of the wells (such as the right to exercise Well 1 and Well 3 withdrawals at the Well 7 site or vice versa). There are multiple paths such water rights changes could take, and these should be investigated on a case-by-case basis depending on the specific needs the City identifies for future water use. We recommend engaging a water rights attorney (if the City doesn't have one on staff already) for any water rights application process.

Bellevue Parks Contamination Impacts on Wellhead Protection

The Crossroads site is shared by Bellevue Parks Maintenance. A former underground storage tank (UST) on the property was found to be leaking gasoline in 1989. The City provided historic records of the delineation of the contamination and subsequent tank removal, cleanup, and monitoring activities. Reports completed by GeoEngineers from 1989, 2013 and 2014 were reviewed to gain an understanding of the site and its current conditions. We also reviewed Ecology's Site Hazard Assessment letters of 2013 and 2014. The City also provided copies of the DOH susceptibility survey that identifies areas of concern around each well (as a radius from the well representing the distance a contaminant might move in ½, 1, 5 or 10 years). These surveys provide preliminary guidance regarding wellhead protection risks to a source.

The DOH wellhead protection guidelines attempt to consider all aspects of potential contamination for a water source. Both surface and subsurface contamination pathways are intended to be investigated, but when describing the relative risk a contaminant might pose to a source, the wellhead protection procedures require the presumption that contaminants have already made it to the source aquifer. This has the effect of defining a shorter distance of travel for each time period (radius) than would be expected in the real world. So, for the Crossroads site, the radii by the susceptibility surveys do not take into account the presence of the overlying glacial till material. However, so long as water use at the site is confined to the emergency use currently defined for Well 7, additional wellhead protection delineation does not seem warranted. Developing new or different water uses at the site may trigger DOH requirements to create a formal wellhead protection plan.

[4] For example, the current law protecting municipal rights from relinquishment was recently changed. Washington's Municipal Water Law was passed in 2003. Several challenges to the law were filed leading to a Supreme Court ruling in 2010. The current policies, including the protection against relinquishment, are the result of the original law and the interpretation of the 2010 court ruling.

The former UST site remains contaminated, and although contaminant concentrations have decreased over time, there appears to be significant residual concentrations in the shallow subsurface. However, during this same period, the City has not detected contamination in the underlying aquifer, suggesting that the glacial till deposits at the Crossroads site retard the vertical flow of both water and contaminants.

The 2008 sample data from production Wells 6 and 7 showed low-level detections of toluene. This is one of the constituents present in the contamination plume. However, the City has identified that these sample results suffered from errors in collection procedures and are considered invalid. Sampling in subsequent years has resulted in non-detect values for petroleum byproducts in all cases for these two wells; strengthening the conclusion that the 2008 data are not representative of water quality in the aquifer.

Groundwater depths in monitoring wells vary greatly ranging from 6.98 to greater than 40 feet in depth, based on 2012-2014 data. This suggests a series or permeable zones within the till. While the annual monitoring reports discuss these permeable zones, little to no detail on the vertical interconnection of these zones appears to have been generated.

The 2012-2014 sample data reported by GeoEngineers (2013 and 2014c) show that detectable concentrations of gasoline, benzene, and ethyl benzene are present at depth. This data also shows that the highest concentrations were found in monitoring well MW-14, which appears to have historically deeper water levels (to greater than 40 feet below land surface) than other monitoring points. The most recent data from August 2014 show both significant vapor concentrations along with substantially elevated benzene, ethylbenzene, toluene, xylene and gasoline-range petroleum hydrocarbons. While some attenuation has occurred, the slope of the attenuation in this well is shallower and seems to have plateaued since 2012.

To provide clarity regarding the relative risk level the contamination site poses to the source aquifer for the production wells, we recommend preparation of a hydrogeologic cross-section of the Crossroads site, including the monitoring wells and the production wells. It should include an emphasis on delineating the maximum depth of contaminants in relation to the production wells, their screen intervals, and surface seal depths. Based on this effort, it may be prudent to consider placing monitoring wells that are completed within the production aquifer so that representative samples suitable for investigative analysis can be collected.

Both the cross section and the additional monitoring well in the aquifer may be needed if the City intends to pursue expansion of Wells 5, 6, or 7 at this location. The DOH source approval process would require demonstration that the contamination has been remediated or that sufficient vertical protection exists and a monitoring plan is in place to identify contamination risks before they impact the aquifer. The additional effort would likely also be needed if the City determined that sample results indicated contaminant levels were below clean-up requirements and wished to request a no-further-action determination from the Ecology.

Conclusions

Wells 3, 5, 6, and 7 represent viable groundwater sources capable of various uses from emergency, stand-alone supply up to regular-use, production wells. The possible uses for each well will be discussed in Technical Memorandum 4. Based on available data, the aquifer at the Crossroads and Samena locations is capable of supporting large-volume withdrawals.

The wells in question are all screened and could be used in their current form for emergency use or regular use (provided source approval is granted by DOH). As noted by GeoEngineers, Well 3 at Samena should be cleaned and re-developed to remove debris and improve pumping efficiency. Cleaning and screen rehabilitation of the remaining wells should be considered if they will be used beyond an emergency-use-only function. If larger production is desired, additional wells could be drilled to augment or replace the existing wells as needed (again, requiring DOH approvals) but new well locations may be needed in some cases (see Technical Memorandum 4).

In relation to the larger, regional context of future water resource decisions, it is our opinion that the Vashon advance outwash aquifer has acceptable water quality and quantity available for use by the City as a source of potable water for everyday or emergency use.

If the City intends to use the Crossroads location for groundwater production beyond its current emergency-only configuration, we recommend that the City actively pursue securing a no-further-action designation from Ecology. To do this, additional sampling, analysis and monitoring may be needed, possibly including the construction of a dedicated, deep sampling well that taps the top of the groundwater aquifer. The exact tasks required would need to be defined after meeting with Ecology's Toxics Cleanup Program.

Based on the information above and the additional work to be completed under the project, we will assess the benefits and limitations of potential uses and provide the City with recommendations for each well. This will include planning-level project descriptions and cost estimates for any future work identified. These findings will be summarized in Technical Memorandum 4.

Selected References

GeoEngineers, 1989, Report of geotechnical services subsurface contamination assessment underground fuel storage tank leak at the City of Bellevue Parks Maintenance facility, prepared for the City of Bellevue, 9.p, appendices

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GeoEngineers, 2013, Progress report 15, Ground water and vapor monitoring and sampling, gasoline UST release at the City of Bellevue Parks Maintenance facility, prepared for the City of Bellevue, 5.p, appendices

GeoEngineers, 2014a, Emergency groundwater supply well testing, Crossroads Wells 5 and 6, prepared for the City of Bellevue, 18p, 22 figures, 3 appendices

GeoEngineers, 2014b, Emergency groundwater supply well testing, Crossroads Well 7 and Samena Well 3, prepared for the City of Bellevue, 18p, 13 figures, 2 appendices

GeoEngineers, 2014c, Progress report 16, Ground water and vapor monitoring and sampling, gasoline UST release at the City of Bellevue Parks Maintenance facility, prepared for the City of Bellevue, 5.p, appendices

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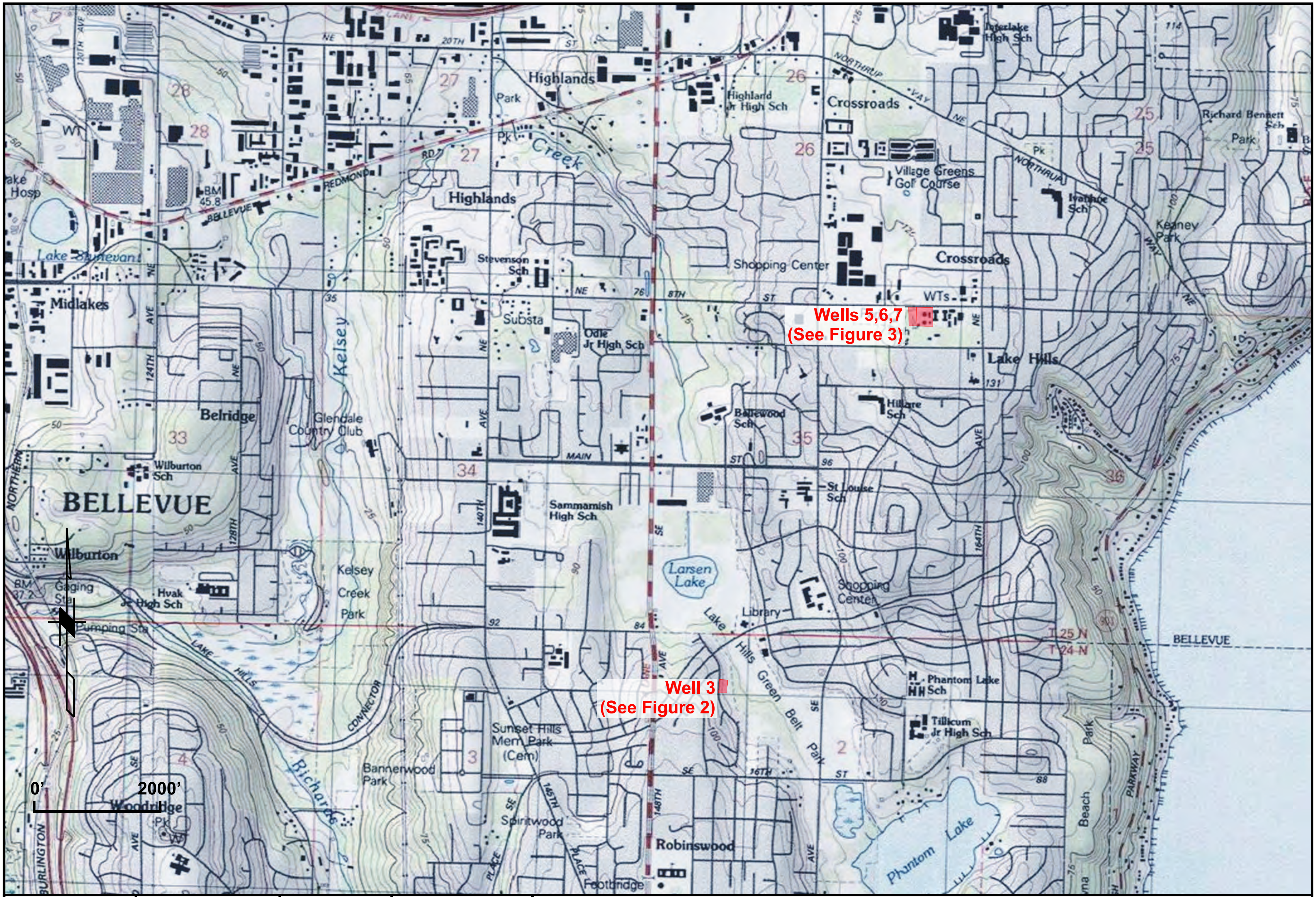
The statements, conclusions, and recommendations provided in this report are to be exclusively used within the context of this document. They are based upon generally accepted environmental and hydrogeologic practices and are the result of analysis by Robinson Noble, Inc. staff. This report, and any attachments to it, is for the exclusive use of the City of Bellevue and Carollo Engineers. Unless specifically stated in the document, no warranty, expressed or implied, is made.



ROBINSON NOBLE	Note: Basemap taken from USGS Tacoma South Quadrangle	PM: BGC January 2015 2710-003A	King County T 25 N/R 05 E - 35 Scale 1" = 2000'	Figure 1 Vicinity Map City of Bellevue/Carollo: Emergency Well Evaluation

ROBINSON NOBLE

Note: Image from ESRI ArcGIS

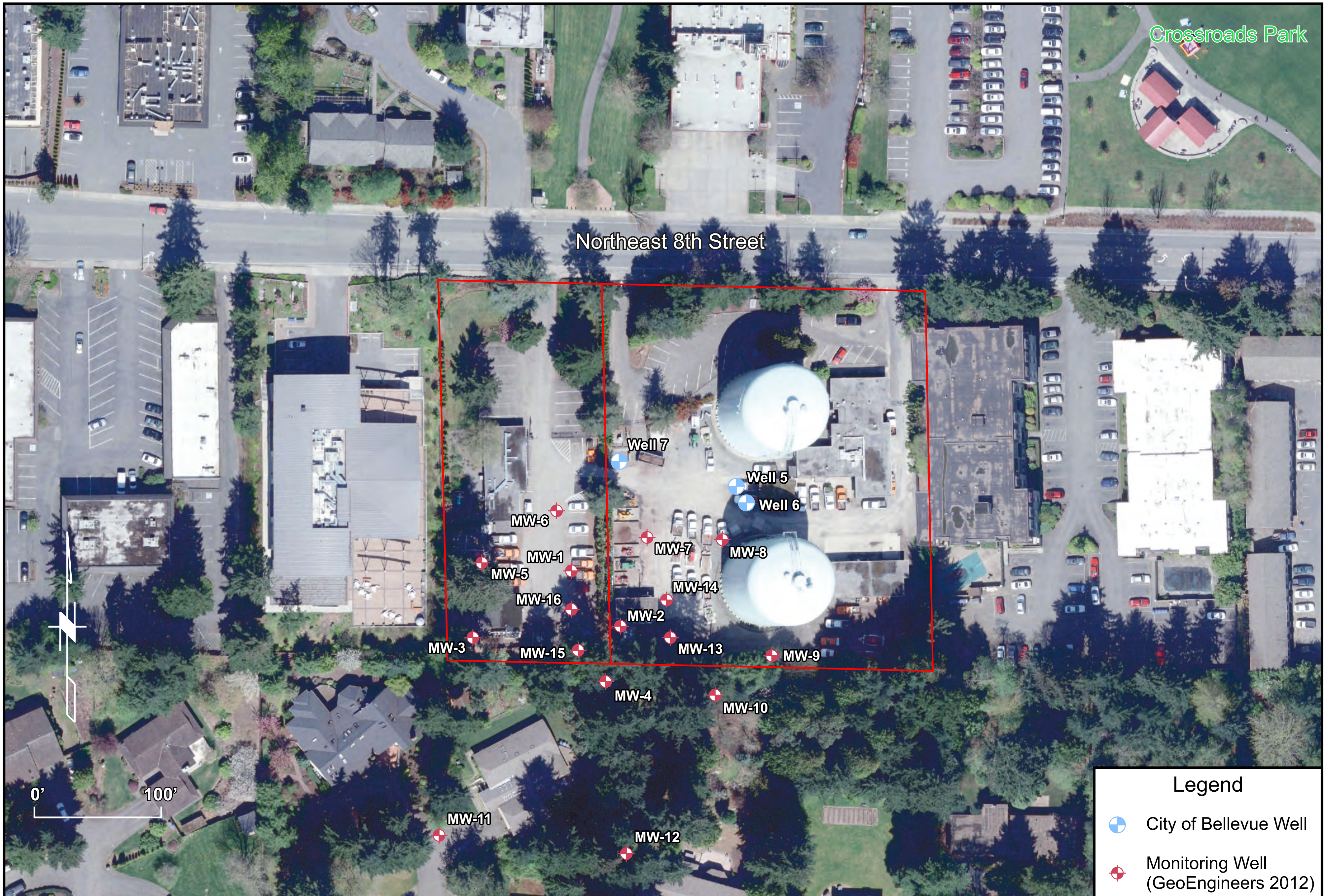
PM: BGC
January 2015
2710-003A

King County
T 25 N/R 05 E - 35
Scale 1" = 100'

Figure 2

Aerial Map of Well 3 Site

City of Bellevue/Carollo: Emergency Well Evaluation



ROBINSON NOBLE

Note: Image from USGS EarthExplorer
Date: March 2012

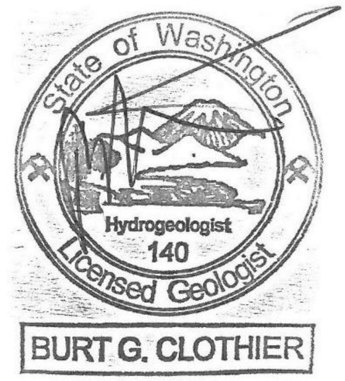
PM: BGC
January 2015
2710-003A

King County
T 25 N/R 05 E - 35
Scale 1" = 100'

Figure 3
Aerial Map of Well 5,6,7 Site
City of Bellevue/Carollo: Emergency Well Evaluation

ROBINSON NOBLE

Technical Memorandum 4
City of Bellevue
Groundwater Resource Development Analysis



Date: January 6, 2015

To: Doug Lane, P.E., City of Bellevue

cc: Lara Kammereck, P.E., Carollo Engineers

From: Burt G. Clothier, LHG

The City of Bellevue (City) has established two independent emergency supply potable groundwater sources and is interested in possibly expanding those sources to augment standby reservoir storage in case of a water supply emergency. These sources are based on groundwater rights originally established by King County Water District 97 in the Lake Hills area which were later absorbed by the City. Our prior report, Technical Memorandum 3, more fully describes the existing wells and their water rights. Ultimately, the City's desire is to fully exercise these groundwater rights but it recognizes that the particular pathway required to complete this goal will be based on a long-term implementation and funding strategy. The City has additional groundwater rights associated with other legacy water districts, but these are not part of this effort.

The Carollo consultant team developed this technical memorandum to summarize the implementation strategy and options for the City to fully exercise its groundwater rights. This strategy includes a range of possibilities for known and future well sites to facilitate the City's ability to chart short- and long-term courses for groundwater-supply development.

In order for the City to fully exercise the Lake Hills water rights, additional wells will be required. There are three basic possibilities for establishing new wells under the City's water rights (see Figure 1 below):

- A stand-alone well. This will typically be a well with relatively low production rates (roughly equivalent to Wells 3 and 7 as they are now). Stand-alone wells must remain physically unconnected to the City's distribution system.
- An emergency back-up well that is connected to the system. This well can produce water directly to the City system but is classified by the Washington State Department of DOH (DOH) for use only in an emergency situation. The well and its production rate could be small or large, depending on the needs of the location in the system.
- A full-use production well providing regular production. This is an approved groundwater source well available for production as needed. The well will be sized to maximize production from a given site and source aquifer.

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The complexity of these options generally increases from the stand-alone source to the emergency back-up connection to the full-use connection, although the differences between the last two are largely due to regulatory issues, not a matter of infrastructure changes.

Water quality sampling of the existing sites shows slightly elevated levels of iron in Well 7 and manganese in Well 3, which are secondary drinking water parameters. The City will need to establish an acceptable level of water quality that may vary based on the delivery method (i.e. stand-alone, emergency back-up, or full-use source options). Treatment, such as Greensand Filtration or biological methods, may be required to remove these elevated level iron, manganese, or other currently unidentified parameters on a new site. Ground water quality varies by well and site; therefore, the City may be able to reduce treatment costs through blending multiple wells to achieve a better average water quality. Operational strategies, such as flushing, may also be able to cost-effectively mitigate water quality issues, especially for the emergency back-up source option.

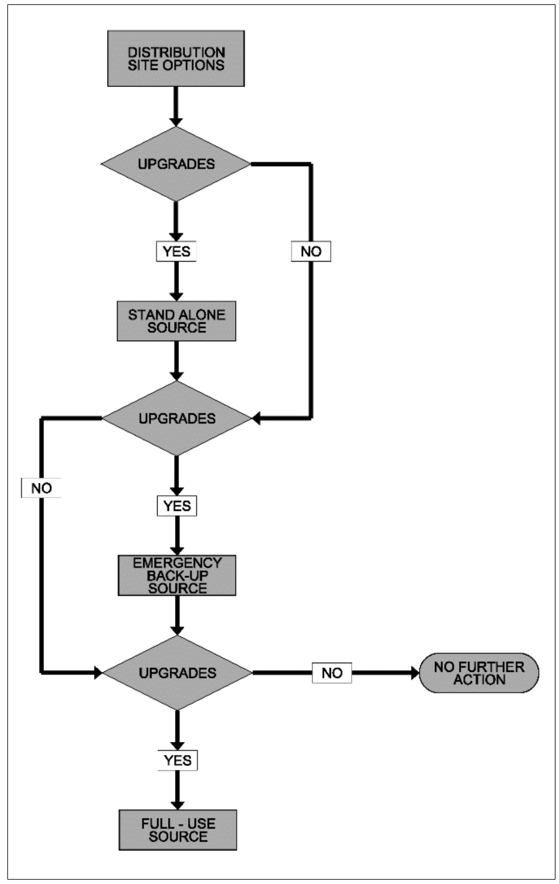

Figure 1. Generalized new well development options

In addition, the emergency back-up source and full-use source options will result in a blending of dissimilar waters (groundwater and surface water) that may result in negative impacts to water quality in the distribution system. DOH requires that a blending study to identify if negative water quality effects will occur with the addition of the new supply (WAC 246-209-110(4)(d)). An important aspect of the study is to determine the impact of the new source on compliance with the Lead and Copper Rule, as well as corrosion in general. Blended water may also result in taste and odor issues, as well as changes in the aesthetics of the water; though these may be difficult to predict from a numerical desktop study. Removal of adhered material and biofilms prior to blending, through unidirectional flushing or other techniques, may reduce the potential of creating taste and odor issues. Treatment, such as pH adjustment, may be required to reduce negative impacts to the system. However, it should be noted that many utilities in the Seattle-Tacoma metropolitan area have successfully blended surface water and groundwater supplies.

From a construction standpoint, each well site could be developed directly with one of the above options, or a phased approach could be used to combine options. A single-option choice would construct and equip a well sized to the specific purpose of the well (stand-alone, back up, or full use). Alternatively, a phased approach would drill a well large enough to be capable of full production when eventually desired, but it would be equipped with different levels of pumps and ancillary infrastructure depending on the development phase, increasing in size and complexity as the site progresses from stand-alone to back up to full use.

The City has established stand-alone supplies at both the Samena site (Well 3) and Crossroads site (Well 7). These are expected to be retained as-is (or under certain circumstances expanded), but the City's remaining water rights can be used to support new well sites. Development of new sources of supply at locations away from the Crossroads or Samena sites will require adequately-sized properties and the successful processing of one or more water rights change applications. To meet the full use of the City's groundwater rights, it is likely that several wells will be needed beyond Wells 3 and 7 (presuming they remain in service in some capacity), as discussed further below.

Conceptual project costs to undertake well projects were developed to aid in the City's decision making. The estimated costs should be revisited once the City's policies have been established and more is known about each individual site. The conceptual costs were developed at a planning level of detail and include: well drilling, well infrastructure changes, water rights processing, engineering, permitting, and administrative activities. Well infrastructure includes well pumps and housing; civil and electrical engineering; instrumentation; backup generator; and chlorination equipment. Distribution infrastructure costs may vary substantially by site; therefore an allowance was provided, rather than a set cost. Distribution infrastructure may include a transmission pipeline, stand-alone distribution facility, tanker-fill site (more likely at Crossroads than Samena), transportation improvements, additional yard piping, site improvements to enhance pedestrian access, etc. Construction costs also include a 30% construction contingency. Design, permitting, and legal costs include water rights and engineering, permitting, and administrative activities. A 30% planning contingency was also included to account for unforeseen changes in project scope.

The City is considering using the wells as metered fill sites for water-tanker trucks. Tankers are commonly used for dust suppression at construction sites, in landscaping, pest control, and other activities. The City currently allows filling at several hydrants in the City on an honor-based system, which is believed to contribute to water loss due to inaccurate reporting. The benefits and costs of the metered tanker-fill sites at the wells should be careful considered. Transportation improvements to the site and nearby roads may be required to facilitate the safe and efficient use of the facility (signage, turn lane, traffic light, etc.). Additional drainage infrastructure and large paved surfaces may also be required to protect the well from contamination (oil and grease, chemicals, herbicides, etc.). Security concerns may also necessitate additional infrastructure (fencing, lighting, intrusion sensors, etc). The water infrastructure needed to fill tanker trucks may include yard piping, a metal frame to facilitate use of a hose/dispenser, and metering equipment. Specific distribution infrastructure costs could not be estimated; however, a $100,000 allowance was provided for planning purposes. Specific costs should be developed once additional site information is available.

Samena Site Options

At the Samena Site, only Well 3 is likely to retain some functional capacity; Well 1 has been partially backfilled and will be decommissioned.

Well 1

The well casing is partially blocked and repair or rehabilitation is not considered viable. The well can be replaced on the Samena site without requiring a water rights change application, and the site currently appears sufficiently large to accommodate another well. If a new well at this site is not desired, a new location and a water rights change may be required to fully exercise the right (Figure 2).

Decommissioning of the well should be a straightforward process, but the work will require a licensed well driller. The well drilling contractor may elect to video inspect the well prior to beginning work in order to inform their final choice of decommissioning method. Washington State's rules on decommissioning (WAC 173-160-381) require either removal of the existing casing and sealing of the borehole or, if that is not possible, perforation of the casing(s) such that injected sealants reach outside the casing. Sealant materials are typically bentonite, cement, or a grout mixture of both. Currently, it is anticipated that the Well 1 casing cannot be removed and that the second method will be used. However, the drilling contractor may be able to cut the casing off above the blockage and then use the first method after cementing in the casing remnant that will be left behind. Coordination with the contractor will be needed to finalize the approach. Hydrogeologic or engineering oversight of the fieldwork is probably not needed, although a Licensed Hydrogeologist can assist with the project coordination and planning if desired.

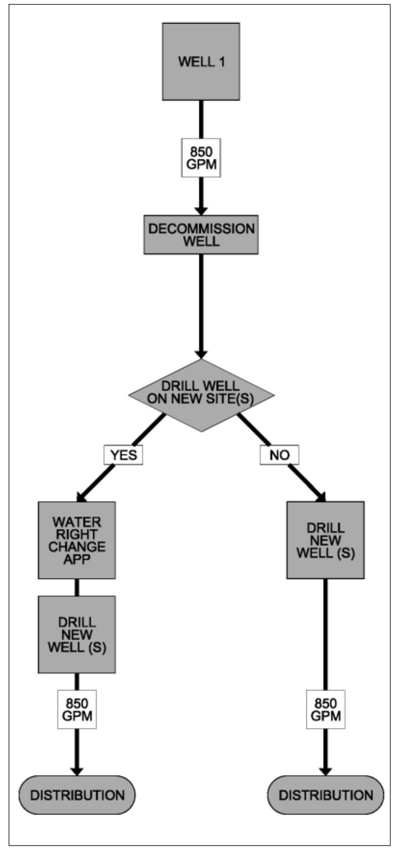

Figure 2. Well 1 options

Conceptual project costs for the Well 1 decommissioning project have been developed. The conceptual costs were developed at a planning level of detail and may vary based on the chosen method of decommissioning. Construction costs also include a 30% construction contingency. Hydrogeologic and engineering services have been included, but may not be required. A 30% planning contingency is also added to the total projected costs. Anticipated itemized costs for the Well 1 decommissioning project are shown in Table 1.

Table 1. Well 1 Decommissioning Project Itemized Costs

Task Service Provider	Cost (thousands)	Elements
Construction		
Well Drilling Contractor	$20	Decommission well
Sales tax (9.5%)	$2	
Construction Subtotal	$22	
Construction Contingency (30%)	$7	
Total Construction	$29	
Design, Permitting, and Legal		
Hydrogeologic and Engineering Services (35%)	$10	Hydrogeologic and engineering services, as required
Total Project Costs	$39	
Planning contingency (30%)	$12	
Total Project Costs	$51	
Rounded Total Project Costs	$51	

Conceptual project costs to replace Well 1 on the Samena site were developed to aid in the City's decision making. Costs should be revisited once the City's source and distribution strategy for the Samena site has been established. The costs assume new well pumps and housing, site civil engineering, electrical, instrumentation, backup generator, and chlorination. Distribution infrastructure costs may vary substantially depending on distribution method and location; therefore, a $100,000 distribution allowance was provided. For example, a simple walk-up distribution facility co-located with the Well 1 would use only a portion of the allowance. However, a walk-up distribution facility located directly off Lakeland Hills Boulevard would require additional transmission piping and may use the entire allowance. A tanker-fill site is not expected to be possible on the Samena site due to impacts on the neighborhood. Acquisition of new land is not included in the estimates. A 30% construction contingency was included due to the conceptual nature of the cost estimate. Legal costs were also not included as no changes to water rights are anticipated, but a 30% planning contingency was added to the final total to account for unforeseen additional tasks. Estimated costs for a replacement for Well 1 on the Samena site are presented in Table 2.

Table 2. Samena Site Replacement Well Estimated Costs

Task Service Provider	Cost (thousands)	Elements
Construction		
Well Drilling Contractor	$80	Drill replacement well; install permanent pumps
Well Infrastructure	$400	Pump and housing, site civil, electrical, instrumentation, backup generator, chlorination, etc.
Distribution Allowance	$100	Distribution facility and minor site piping. Transmission and distribution costs may exceed the allowance for some sites.
Sales tax (9.5%)	$55	
Construction Subtotal	$635	
Construction Contingency (30%)	$191	
Total Construction	$826	
Design, Permitting, and Legal		
Engineering, Permitting, and Administrative (35%)	$289	Hydrogeologic services, engineering, permitting, and administration of project.
Total Project Costs	$1,115	
Planning contingency (30%)	$334	
Total Project Costs	$1,449	
Rounded Total Project Costs	$1,500	

Well 3

Well 3 is currently permitted for use as a stand-alone supply and has an existing capacity of 150 gpm. The initial decision for this site is whether to maintain that option, to expand production from the well, or to add a new well to the site that maximizes production under the existing water right (Figure 3). Thus far, no regulatory obstacles have been identified that would limit the full use of the water right from the site. Well 3 appears to be structurally sound and capable of higher production rates than the current pump allows. A larger pump could be installed to bring production rates up to the water right quantity of 450 gpm, though the distribution infrastructure may require upgrades to accommodate the higher production rate. Well 3 could also be considered, now or in the future, for an emergency or permanent connection to the system.

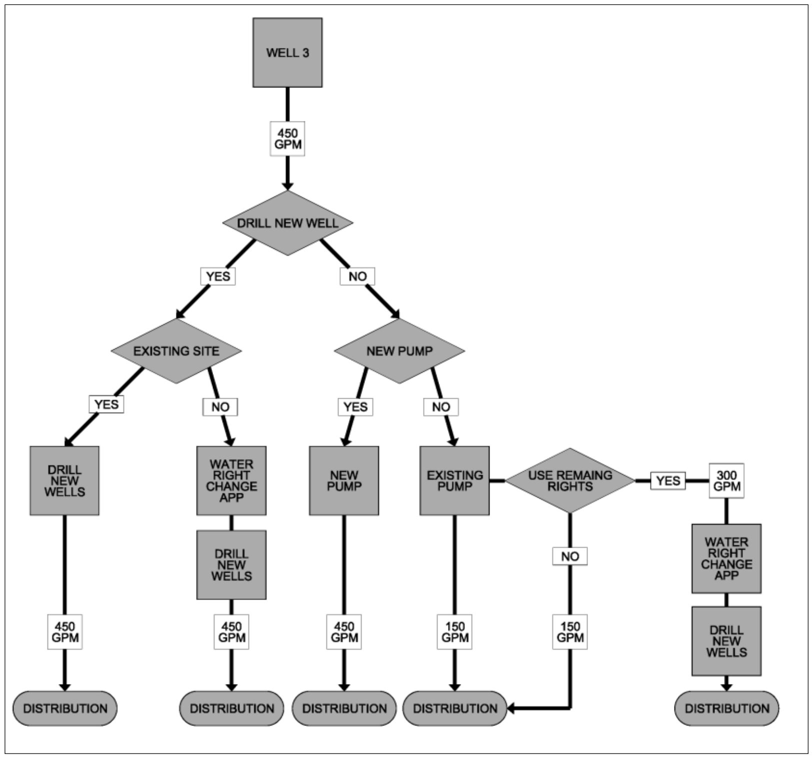

Figure 3. Well 3 options

Testing of the well was completed this summer to provide further details on the capabilities of the well and the source aquifer. From the information provided by the GeoEngineers report, testing suggests that the aquifer is capable of supporting production up to 300 gpm, possibly higher. However, according to GeoEngineers, the well screen may be plugged such that water entry to the well is inefficient. The well should be cleaned, rehabilitated, and re-tested. This effort will help to improve pumping efficiency and to preserve the long-term health of the well. A long-term (24 hour) test of the well after the rehabilitation is also recommended to more fully gage aquifer capabilities and thus better judge whether site expansion would be warranted.

Up-sizing the pump in the well should be uncomplicated, but distribution of the increased flow will require a change to the wellhead configuration and/or distribution pipelines to deliver water into the City's system. If the City wishes to expand production at the site, the City will need to install a new pump house for telemetry, back-up power, water-quality treatment, or other considerations. Currently, it appears that there is sufficient space on the parcel to accommodate these infrastructure changes, but doing so may impact use of the site as a park. Regulatory approval will be needed for any configuration that connects the well directly to the system.

Expansion of Well 3 would have identical conceptual project costs to drilling a new Well 1, except no drilling is required. Well 1 and Well 3 would likely be able to share infrastructure if both were developed on the Samena site, which would substantially reducing the project costs. For instance, simply replacing the pump may be as little as 10% of the presented conceptual costs. Anticipated costs for the Well 3 project shown on Table 3.

Table 3. Well 3 Project Anticipated Costs

Task Service Provider	Cost (thousands)	Elements
Construction		
Well Infrastructure	$400	Pump and housing, site civil, electrical, instrumentation, backup generator, chlorination, etc.
Distribution Allowance	$100	Distribution facility and minor site piping. Transmission and distribution costs may exceed the allowance for some sites.
Sales tax (9.5%)	$48	
Construction Subtotal	$548	
Construction Contingency (30%)	$164	
Total Construction	$712	
Design, Permitting, and Legal		
Engineering, Permitting, and Administrative (35%)	$249	Hydrogeologic services, engineering, permitting, and administration of project.
Total Project Costs	$961	
Planning contingency (30%)	$288	
Total Project Costs	$1,249	
Rounded Total Project Costs	$1,300	

Additional Well

Expansion of the Samena site would be accomplished by installing a new well. A new well on the site is expected to be roughly similar in construction to Well 3. It is assumed to be a 12-inch-diameter casing (minimum) placed to an estimated maximum depth of 200 feet. Additional information provided by the Well 3 testing will help determine whether the aquifer can sustain both Well 3 at an expanded production rate and a new well.

If the new well is intended for production as a stand-alone source, then equipment similar to Well 3 can be installed. For a back-up or full-use well, distribution lines and related infrastructure, water quality treatment systems (if needed), monitoring and telemetry equipment, and facility buildings will all be needed.

If Well 3 (expanded or as-is) plus a new well can fully exercise the Well 1 and Well 3 combined water rights (1,300 gpm), then no additional work would be needed. If some portion of the combined water rights that cannot be produced here, then a new well site will be needed (see the new well development section below).

Crossroads Site Options

Well 7 is the only Crossroads site well likely to retain some functional capacity. Decommissioning of Wells 5 and 6 is assumed due to site restrictions that include the current use by City Parks and remnant, on-site contamination issues (Figure 4).

Wells 5 and 6

Given the location of Wells 5 and 6 in the center of the current parking lot area between the water tanks, establishing wellheads for these two wells would present, at the minimum, a logistical challenge to the current use of the property by Bellevue Parks. Getting source approval from the DOH department for the two wells also represents a potential hurdle due to the on-site contamination of surface soils by the former UST spill (discussed in Technical Memorandum 3). While converting the wells to temporary or full-time use is not technically difficult as far as the infrastructure needed, source approval would at least require establishing that each well has a viable surface seal outside the well casing and to a minimum of 18 feet below ground and resurfacing the surrounding parking areas to be an impermeable cover with controlled stormwater flow away from the wellheads. This all presumes that the needed changes could be made while retaining use of the site for Bellevue Parks.

Based on the current feedback from the City, it is unlikely that changes to the site would be made to allow physical use of Wells 5 and 6. If this is the case and the City intends to drill new wells to exercise the Well 5 and Well 6 water rights, then the existing wells should be formally decommissioned. The process and expected costs will be similar in nature to that discussed above for Well 1 (excepting the blockage issue).

The combined 1,100 gpm allocated under the Well 5 and 6 water rights will need to be assigned to one or more new sites (see the new well development section below).

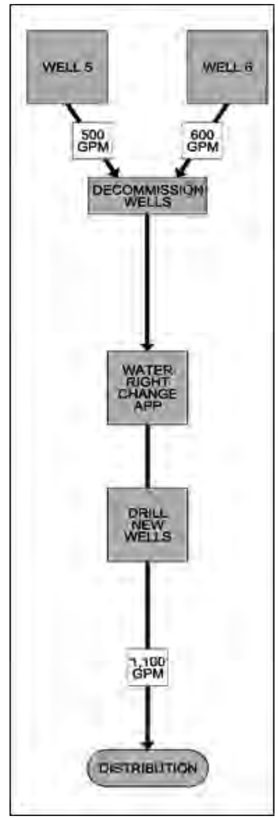

Figure 4. Well 5 & 6 options

Well 7

Like Well 3 at the Samena site, Well 7 is currently permitted for use as a stand-alone supply with a pump capacity of 150 gpm, so the initial decision is whether to maintain that option (Figure 5). Site distribution infrastructure aside, efforts to expand on-site production to utilize some or all of the 700 gpm water right is likely to face source-approval difficulties. Even if some additional portion of the Well 7 right can be exercised at the Crossroads site, there may still be residual allocation that would need to be moved to a new well site (see below).

It may be possible to expand the production from the well so long as it remains unconnected from the City system, but as a practical matter, this

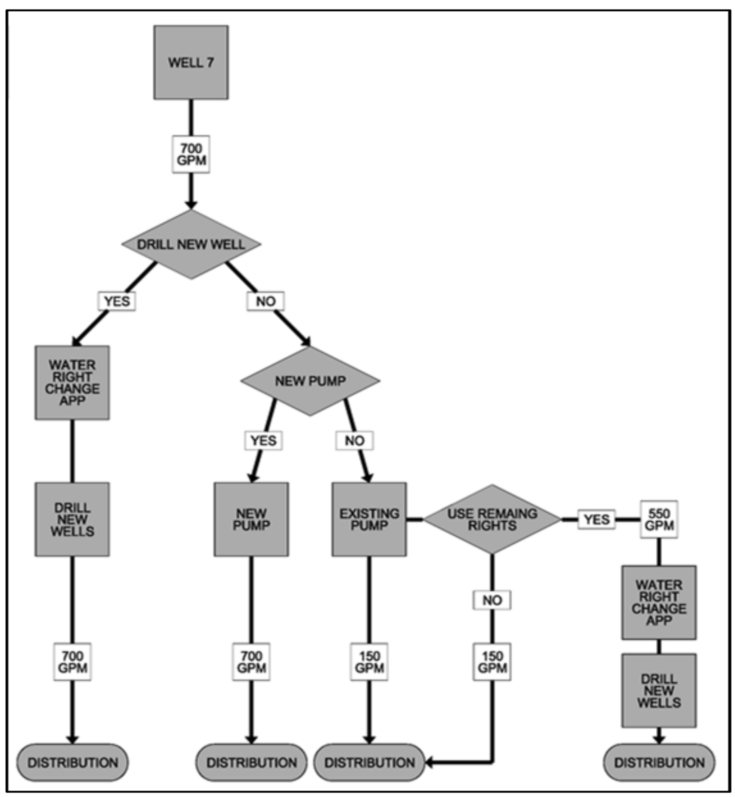

Figure 5. Well 7 options

may not be needed since few, if any, emergency needs would require production greater than the current level. That said, it may also be possible that DOH would approve expansion to install a tight-line connection to fill one or both of the storage tanks on an emergency basis. We recommend discussing this scenario directly with the regional engineer at DOH. Various possibilities for the well are shown on the flow diagram.

Expansion of Well 7 would be similar to Well 3. However, due to the constrained well site, the distribution allowance was reduced to $50,000. The site is well located to be a tanker-fill site; however, transportation requirements, security concerns, and impacts to Bellevue Parks need to be addressed. Anticipated costs for the Well 7 project shown on Table 4.

Table 4. Well 7 Project Anticipated Costs

Task Service Provider	Cost (thousands)	Elements
Construction		
Well Infrastructure	$400	Pump and housing, site civil, electrical, instrumentation, backup generator, chlorination, etc.
Distribution Allowance	$50	Distribution facility and minor site piping. Transmission and distribution costs may exceed the allowance for some sites.
Sales tax (9.5%)	$43	
Construction Subtotal	$493	
Construction Contingency (30%)	$148	
Total Construction	$641	
Design, Permitting, and Legal		
Engineering, Permitting, and Administrative (35%)	$224	Hydrogeologic services, engineering, permitting, and administration of project (if needed)
Total Project Costs	$865	
Planning contingency (30%)	$259	
Total Project Costs	$1,124	
Rounded Total Project Costs	$1,200	

New Well Development

From the practical standpoint of expanding the City's overall groundwater use up to its maximum water right allocation, new sites will be needed since the current sites cannot produce sufficient water even if new wells were installed at both sites. Multiple new well sites may be needed and each will ultimately need the full array of improvements (distribution lines and related infrastructure, water-quality treatment systems, monitoring and telemetry equipment, and facility buildings).

For each new site selected, the City could pursue wells for stand-alone, emergency back-up, or for full-use production. As noted above, the production scenario for each site could be made by selecting one of the three options and tailoring a project to achieve that goal or by following a phased approach where the site is incrementally upgraded from one option to the next over time.

The City's water rights can support a total instantaneous production of 3,050 gpm. Assuming that the City retains Wells 3 and 7 in their current form and Wells 1, 5 and 6 are properly decommissioned, the remaining water rights (2,750 gpm) would support:

- Three to five new sites with a total of five new production wells (producing about 500 to 600 gpm each)[1], or
- Up to 18 locations where stand-alone emergency wells could be installed (producing an average of 150 gpm), or
- Some combination of the above.

Each proposed production well location will need a minimum set-back of 100 feet or more from property boundaries to provide for regulatory requirements under DOH's source approval rules. Within this distance, development or land-use activities will be proscribed in order to protect the well from surface and subsurface contamination. Properties selected should be sized accordingly. DOH should be consulted ahead of time for any sites where concerns are identified.[2]

The cost to install a 150-gpm stand-alone well is too high to make 18 individual emergency wells cost effective. Instead, a more reasonable scenario is a small number of emergency source wells along with a set of major production wells. So, operating on the assumption that the larger production quantities will remain the primary focus of a well construction program, the following will be needed for each new well site:

1. A city-owned or purchased property with minimum 100-foot setback distance from the property line for the proposed production well location,
2. A water rights change application submitted to the Washington State Department of Ecology (Ecology) describing the intended well location, depth, and quantities of production[3],
3. Depending on information available, site constraints, and the desired production for the site, a non-production test well might be recommended prior to completing a production well,
4. Construction and testing of the new well,
5. Completion of the water rights change process,
6. Source approval by DOH[4],
7. Construction of facilities building, if needed,
8. Installation of pump and telemetry equipment, and
9. Construction of distribution system connection, if needed.

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[1] The 500 to 600 gpm production value is an estimate based on current knowledge of the regional aquifer system. This range may be an underestimation as higher rates occur in similar settings throughout the Puget lowland. An average, upper-end range of production would be 1,000 to 1,200 gpm. In the instance where higher rates are achieved, the City may realize savings by needing a smaller number of wells.

[2] In some cases, DOH will give a variance to the 100-foot setback rule. These are given on a case-by-case basis and often require a supporting investigation by a licensed hydrogeologist.

[3] It may be possible to combine two or more sites under a single water right application depending on location and hydrogeologic setting. Consultation with a water rights attorney prior to filing an application is recommended.

[4] The DOH source approval process can usually begin after construction and testing of the well but is typically not fully complete until the facility is finalized.

A new well at a new location will be tailored to expected geologic conditions at that location, but deeper drilling should be anticipated unless a nearby well log provides greater certainty about the aquifer depth. Deeper drilling will be needed to fully explore the aquifer system(s) and ensure that the well fully penetrates the target aquifer (if present). For planning purposes, the City should anticipate drilling depths of 300 to 400 feet, depending on site elevation. Since the horizontal and vertical variability of the aquifers of the upland area are not defined in any great detail, each new well will likely face this same additional drilling effort.

In some cases, this uncertainty may lead to a test well being drilled to determine if a viable aquifer system is available at the site (item 3 above) prior to drilling of a production well. The choice of whether a test well is warranted will be on a case-by-case basis determined by of the level of risk the City is comfortable with in expending money on drilling in an area with poorly understood hydrogeology. The main considerations in this decision are:

- A production well is more expensive than a test well because it uses larger diameter casings and may need more than one casing string (a smaller one nested inside a larger one) to reach its target depth. Using larger casings requires a larger drill rig and, depending on the drilling method, may result in fewer contractors being able to bid. Drilling and well construction are also slower than for a small-diameter well, which also increases cost.
- A test well can rely on a smaller diameter casing and may only need one string to reach the needed depth. But if successful, a test well may not be able to produce as much water as a full production well and so a production well might still be needed.

Drilling a test and production well combination is always more expensive than either one alone. However, if the cost of the test well is markedly smaller than the production well, expending that effort on a location where an aquifer might not be present is more acceptable in the case of a failure even if a success means that the production well would be necessary to follow. Additionally, while more expensive, having two wells at a site can provide management and operation advantages.

Estimated costs for a test well, assuming a smaller diameter casing not capable of use as a full production well and a final drilling depth of 400 feet, are shown on Table 5.

Table 5. Test Well Estimated Costs

Task Service Provider	Cost (thousands)	Elements
Construction		
Well Drilling Contractor	$140	Well drilling and testing.
Sales tax (9.5%)	$14	
Construction Subtotal	$154	
Construction Contingency (30%)	$46	
Total Construction	$200	
Design, Permitting, and Legal		
Engineering, Permitting, and Administrative (35%)	$70	Hydrogeologic services, engineering, permitting, and administration of project (if needed)
Total Project Costs	$270	

Task Service Provider	Cost (thousands)	Elements
Planning contingency (30%)	$81	
Total Project Costs	$351	
Rounded Total Project Costs	$360	

Conceptual project costs to construct a new well were developed to aid in the City's decision-making. The presented costs are generic, and should be revisited when a specific site or sites are known. The conceptual costs include well drilling, well infrastructure, water rights, engineering, permitting, and administrative, as described previously. Distribution infrastructure costs may include transmission pipelines, walk-up distribution facilities, tanker-fill site(s), transportation improvements, additional yard piping, site improvements to enhance pedestrian access, etc. Costs do not include the acquisition of new land or improvements to the existing distribution system. Water rights processing costs may be reduced by processing water right changes together, rather than by individual well. Estimated costs for a production well with a final drilling depth of 400 feet are shown on Table 6.

Table 6. Production Well Estimated Costs

Task Service Provider	Cost (thousands)	Elements
Construction		
Well Drilling Contractor	$200	Drill production well; install permanent pump
Well Infrastructure	$400	Pump and housing, site civil, electrical, instrumentation, backup generator, chlorination, etc.
Distribution Allowance	$100	Distribution facility and minor site piping. Transmission and distribution costs may exceed the allowance for some sites.
Sales tax (9.5%)	$70	
Construction Subtotal	$770	
Construction Contingency (30%)	$231	
Total Construction	$1,001	
Design, Permitting, and Legal		
Water Rights Attorney	$20	Water rights change application
Ecology Water Right Processing	$25	Water rights application processing costs
Engineering, Permitting, and Administrative (35%)	$351	Hydrogeologic services, engineering, permitting, and administration of project.
Total Project Costs	$1,397	
Planning contingency (30%)	$419	
Total Project Costs	$1,816	
Rounded Total Project Costs	$1,900	

Future Considerations

The well construction program will, by its nature, be a long-term commitment and may be dependent upon outside factors such as contractual relationships between the City and current water provider, Cascade Water Alliance (Cascade). It seems likely that funding, regulatory challenges, and shifting priorities over that period will mean that progress may be made in a sporadic manner. This can be best managed by establishing a number of phases or individual well projects that can be accomplished either in a set order or independently.

An initial consideration will be to define the implications that the City's regional-supply contract(s) may have on the pursuit of new, independent groundwater sources for use as back-up or regular potable supply. Negotiations with or approval by Cascade may be needed before the project could proceed beyond the establishment of emergency, stand-alone sources.

Water rights considerations may be one of the largest variables in the City's water resource development plan to fully utilize the water rights assigned to the Lake Hills wells. Once the City has established a phased program or list of well projects to complete, conferring with a water rights attorney is recommended to determine how best to approach the necessary water rights change applications and to confirm that the City's comprehensive water system plan reflects the City's long-term plans for the water rights. It may be possible that this could be accomplished as a single, all-inclusive application, assigning individual sites to each water right or establishing that each right may be used collectively at a set of new well sites. If this approach is viable, it should represent a savings of effort and time over making a separate change application for each well site. However, the process will result in a set of new water right permits with established locations and development time schedules. This could be more proscriptive than the City may wish because if the approved locations need to be changed later, it would require yet another water rights change effort. A water rights attorney will be able to help determine the pros and cons of each approach.

If production wells are established and approved for use, the City will be required to establish a wellhead protection plan (WHPP) as described by WAC 246-290. This WHPP is typically appended to a comprehensive water system plan. The WHPP would identify wellhead protection areas for each well or wellfield, identify known or potential hazards within those areas as listed by government databases and field efforts, prioritize those hazards, and conduct a public outreach to educate business and the public about groundwater protection. Implementation strategies and tasks are also developed to help the City manage the plan over time. Finally, a spill response plan is created to help guide responders in the case of hazardous material spills within the protection areas. A full WHPP is estimated to cost $22,000 to $38,000. Final costs are dependent on the number of separate sites to be included and the overall area of investigation for the hazard inventory; the larger both of these are, the more costly the plan can become.

Regional aquifer protection is a regulatory effort undertaken to identify to City and County land-use authorities areas with dedicated groundwater use and to modify land-use codes accordingly. For example, some jurisdictions enact prohibitions against the drilling of private wells in order to limit groundwater use within such areas. The City may wish to consider whether such an ordinance would be needed. More information about overall groundwater use (location, purpose, and quantities of use) on the upland surrounding the City's likely well properties may also be needed to determine whether the presence of other groundwater users is (or might become) problematic to the City in some way.

The emergency back-up source and full-use source options will result in the City being directly regulated under national primary and secondary drinking water regulations and the Groundwater Rule. The City will need to conduct regular monitoring to ensure the groundwater supplies meet criteria for inorganic, physical, nitrate and nitrite, volatile organic chemicals (VOC), synthetic organic chemicals (SOC), and radionuclide parameters. The groundwater rule will require the City to conduct compliance monitoring and sanitary surveys of the well facilities. If positive samples for E. Coli are found during the monitoring, then the City will be required to complete corrective actions. Additionally, the City may be required to conduct additional monitoring for programs, such as the Disinfection Byproduct Rule, that currently have reduced monitoring requirements based on participation in the Regional Monitoring program. DOH and Seattle Public Utilities should be consulted once specific details are available to determine the extent of monitoring required, which may differ between emergency back-up and the full-use source options. These additional ongoing monitoring activities will result in additional costs to the City.

In addition to monitoring, the City will need to provide regular costs for operating and maintenance the wells and their facilities. The cost of well operations and maintenance will vary depending on number of well sites and the required infrastructure. While operating, it is recommended that the well facilities be inspected at least daily by staff and any discovered issues promptly addressed. Tanker fill sites may require more frequent inspection due to heavy use. During non-operating periods, it is recommended that the facilities be inspected on a weekly basis. Well pumps, treatment systems, emergency generators, and other related infrastructure should be tested and maintained according to manufacture recommendations. Operation and Maintenance activities may be partially automated to reduce ongoing staff time, such as using automatic run starts on emergency generators or security cameras on well sites. The expected staff equivalents would vary depending on the final number of well sites and proposed function.

Summary

The City's existing stand-alone emergency sources at Wells 3 and 7 are a good starting point for the development of its groundwater resources. Five water right certificates are available for use in the Lake Hills area, currently divided between the Crossroads and Samena well sites. Expansion of these sites may be possible, but new well locations are also expected to be necessary to reach full development of the five water rights.

A phased approach to implementing the wells was recommended: stand-alone emergency use, emergency-backup, and potentially full-use. The City will next need to assess what level of additional effort (if any) to expend at each of the two current locations, identify a selection of new well sites, determine a timeframe (short, 10 to 20 years; or long, 20 to 50 years) for the overall project, and settle any contractual issues with its regional suppliers. Once ready to move forward, the City will need to decide how to approach the expected water rights changes (either individually or as a group) and undertake appropriate capital improvements planning to describe the whole process.

The statements, conclusions, and recommendations provided in this report are to be exclusively used within the context of this document. They are based upon generally accepted environmental and hydrogeologic practices and are the result of analysis by Robinson Noble, Inc. staff. This report, and any attachments to it, is for the exclusive use of the City of Bellevue and Carollo Engineers. Unless specifically stated in the document, no warranty, expressed or implied, is made.

Appendix O

Water Balance Tables

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Appendix O

Water Balance Tables

Table O-1: 2014 Water Balance (Million Gallons)

<table>
<tr><td rowspan="11">System Input Volume 5,975</td><td rowspan="6">Water Exported 522</td><td rowspan="5">Authorized Consumption 5,612</td><td rowspan="3">Billed Authorized Consumption 5,591</td><td>Billed Water Exported 522</td><td rowspan="3">Revenue Water 5,591</td></tr>
<tr><td>Billed Metered Consumption 5,069</td></tr>
<tr><td>Billed Unmetered Consumption 0</td></tr>
<tr><td rowspan="2">Unbilled Authorized Consumption 21</td><td>Unbilled Metered Consumption 11</td><td rowspan="8">Non-Revenue Water 384</td></tr>
<tr><td>Unbilled Unmetered Consumption 10</td></tr>
<tr><td rowspan="6">Water Losses 363</td><td rowspan="3">Apparent Losses</td><td>Unauthorized Consumption</td></tr>
<tr><td rowspan="5">Water Supplied 5,453</td><td>Customer Metering Inaccuracies</td></tr>
<tr><td>Systematic Data Handling Errors</td></tr>
<tr><td rowspan="3">Real Losses</td><td>Leakage on Transportation and Distribution Mains</td></tr>
<tr><td>Leakage and Overflows at Utility's Storage Tanks</td></tr>
<tr><td>Leakage on Service Connections Up to Point of Customer Metering (individual leakage components not quantified)</td></tr>
</table>

Table O-2: 2013 Water Balance (Million Gallons)

<table>
<tr><td rowspan="11">System Input Volume
5,884</td><td rowspan="6">Water Exported
586</td><td rowspan="5">Authorized Consumption
5,557</td><td rowspan="3">Billed Authorized Consumption
5,541</td><td>Billed Water Exported **587**</td><td rowspan="3">Revenue Water
5,541</td></tr>
<tr><td>Billed Metered Consumption **4,954**</td></tr>
<tr><td>Billed Unmetered Consumption **0**</td></tr>
<tr><td rowspan="2">Unbilled Authorized Consumption
16</td><td>Unbilled Metered Consumption **7**</td><td rowspan="8">Non-Revenue Water
343</td></tr>
<tr><td>Unbilled Unmetered Consumption **9**</td></tr>
<tr><td rowspan="6">Water Losses
327</td><td rowspan="3">Apparent Losses</td><td>Unauthorized Consumption</td></tr>
<tr><td rowspan="5">Water Supplied
5,298</td><td>Customer Metering Inaccuracies</td></tr>
<tr><td>Systematic Data Handling Errors</td></tr>
<tr><td rowspan="3">Real Losses</td><td>Leakage on Transportation and Distribution Mains</td></tr>
<tr><td>Leakage and Overflows at Utility's Storage Tanks</td></tr>
<tr><td>Leakage on Service Connections Up to Point of Customer Metering (individual leakage components not quantified)</td></tr>
</table>

Table O-3: 2012 Water Balance (Million Gallons)

<table>
<tr><td rowspan="11">System Input Volume
5,713</td><td rowspan="6">Water Exported
553</td><td rowspan="5">Authorized Consumption
5,554</td><td rowspan="3">Billed Authorized Consumption
5,529</td><td>Billed Water Exported **553**</td><td rowspan="3">Revenue Water
5,529</td></tr>
<tr><td>Billed Metered Consumption **4,976**</td></tr>
<tr><td>Billed Unmetered Consumption **0**</td></tr>
<tr><td rowspan="2">Unbilled Authorized Consumption
25</td><td>Unbilled Metered Consumption **17**</td><td rowspan="8">Non-Revenue Water
184</td></tr>
<tr><td>Unbilled Unmetered Consumption **8**</td></tr>
<tr><td rowspan="6">Water Losses
159</td><td rowspan="3">Apparent Losses</td><td>Unauthorized Consumption</td></tr>
<tr><td rowspan="5">Water Supplied
5,160</td><td>Customer Metering Inaccuracies</td></tr>
<tr><td>Systematic Data Handling Errors</td></tr>
<tr><td rowspan="3">Real Losses</td><td>Leakage on Transportation and Distribution Mains</td></tr>
<tr><td>Leakage and Overflows at Utility's Storage Tanks</td></tr>
<tr><td>Leakage on Service Connections Up to Point of Customer Metering (individual leakage components not quantified)</td></tr>
</table>

Table O-4: 2011 Water Balance (Million Gallons)

<table>
<tr><td rowspan="11">System Input Volume
5,736</td><td rowspan="6">Water Exported
472</td><td rowspan="5">Authorized Consumption
5,239</td><td rowspan="3">Billed Authorized Consumption
5,221</td><td>Billed Water Exported **472**</td><td rowspan="3">Revenue Water
5,221</td></tr>
<tr><td>Billed Metered Consumption **4,749**</td></tr>
<tr><td>Billed Unmetered Consumption **0**</td></tr>
<tr><td rowspan="2">Unbilled Authorized Consumption
18</td><td>Unbilled Metered Consumption **11**</td><td rowspan="8">Non-Revenue Water
515</td></tr>
<tr><td>Unbilled Unmetered Consumption **7**</td></tr>
<tr><td rowspan="6">Water Losses
497</td><td rowspan="3">Apparent Losses</td><td>Unauthorized Consumption</td></tr>
<tr><td rowspan="5">Water Supplied
5,264</td><td>Customer Metering Inaccuracies</td></tr>
<tr><td>Systematic Data Handling Errors</td></tr>
<tr><td rowspan="3">Real Losses</td><td>Leakage on Transportation and Distribution Mains</td></tr>
<tr><td>Leakage and Overflows at Utility's Storage Tanks</td></tr>
<tr><td>Leakage on Service Connections Up to Point of Customer Metering (individual leakage components not quantified)</td></tr>
</table>

Table O-5: 2010 Water Balance (Million Gallons)

<table>
<tr><td rowspan="11">System Input Volume
5,493</td><td rowspan="6">Water Exported
471</td><td rowspan="5">Authorized Consumption
5,197</td><td rowspan="3">Billed Authorized Consumption
5,166</td><td>Billed Water Exported **471**</td><td rowspan="3">Revenue Water
5,166</td></tr>
<tr><td>Billed Metered Consumption **4,695**</td></tr>
<tr><td>Billed Unmetered Consumption **0**</td></tr>
<tr><td rowspan="2">Unbilled Authorized Consumption
31</td><td>Unbilled Metered Consumption **21**</td><td rowspan="8">Non-Revenue Water
327</td></tr>
<tr><td>Unbilled Unmetered Consumption **10**</td></tr>
<tr><td rowspan="6">Water Losses
296</td><td rowspan="3">Apparent Losses</td><td>Unauthorized Consumption</td></tr>
<tr><td rowspan="5">Water Supplied
5,022</td><td>Customer Metering Inaccuracies</td></tr>
<tr><td>Systematic Data Handling Errors</td></tr>
<tr><td rowspan="3">Real Losses</td><td>Leakage on Transportation and Distribution Mains</td></tr>
<tr><td>Leakage and Overflows at Utility's Storage Tanks</td></tr>
<tr><td>Leakage on Service Connections Up to Point of Customer Metering (individual leakage components not quantified)</td></tr>
</table>

Table O-6: 2009 Water Balance (Million Gallons)

<table>
<tr><td rowspan="11">System Input Volume 6,120</td><td rowspan="6">Water Exported 585</td><td rowspan="5">Authorized Consumption 5,773</td><td rowspan="3">Billed Authorized Consumption 5,753</td><td>Billed Water Exported 585</td><td rowspan="3">Revenue Water 5,753</td></tr>
<tr><td>Billed Metered Consumption 5,168</td></tr>
<tr><td>Billed Unmetered Consumption 0</td></tr>
<tr><td rowspan="2">Unbilled Authorized Consumption 21</td><td>Unbilled Metered Consumption 14</td><td rowspan="8">Non-Revenue Water 367</td></tr>
<tr><td>Unbilled Unmetered Consumption 7</td></tr>
<tr><td rowspan="6">Water Losses 346</td><td rowspan="3">Apparent Losses</td><td>Unauthorized Consumption</td></tr>
<tr><td rowspan="5">Water Supplied 5,535</td><td>Customer Metering Inaccuracies</td></tr>
<tr><td>Systematic Data Handling Errors</td></tr>
<tr><td rowspan="3">Real Losses</td><td>Leakage on Transportation and Distribution Mains</td></tr>
<tr><td>Leakage and Overflows at Utility's Storage Tanks</td></tr>
<tr><td>Leakage on Service Connections Up to Point of Customer Metering (individual leakage components not quantified)</td></tr>
</table>

Appendix P

Annual Water Use Efficiency Reporting

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CASCADE WATER ALLIANCE
2015 Annual Member Survey

FORM 1
2014 WATER SUPPLY & DEMAND

Please complete lines 1 through 7 in the table below for 2014. Note that line 7 should match Total Retail Billed Consumption (cell B25) and line 6 should match Wholesale Billed Consumption (cell P25) in **FORM 2**. Lines 9 and 10 will calculate your non-revenue water automatically. Lines 11, 12 and 13 have been added at the bottom to calculate "Distribution System Leakage" (DSL) as defined in the Washington State Department of Health Water Use Efficiency Guidebook. This is for your convenience and is optional. If you have it, you may enter your estimate of unmetered but authorized water consumption (such as main flushing, tank cleaning, fire fighting, etc.) in Line 11. DSL and % DSL are then calculated in lines 12 and 13.

If you purchased water from someone other than Cascade or sold water wholesale in 2014, please provide the requested details in the second table, below.

Member Name: City of Bellevue

WATER SUPPLY AND DEMAND FOR 2014

1	Water Purchased from Cascade	7,970,637
2	Water Purchased form Other Cascade Members*	17,723
3	Water Purchased from Other Utilities Outside of Cascade*	0
4	Water Obtained from Own Source	0
5	Total Supply	7,988,360
6	Water Sold Wholesale to Other Utilities**	698,572
7	Water Sold to Retail Customers	6,776,081
8	Total Water Sales	7,474,653
9	Non-Revenue Water	513,707
10	% Non-Revenue Water	6.4%
11	Other Authorized Consumption***	28,533
12	Distribution System Leakage (DSL)****	485,174
13	% DSL	6.1%

* Please list the individual utilities from whom you purchased water and the amount purchased in columns 1 & 3, below.
** Please list the individual utilities to whom you sold water and the amount sold in columns 1 & 2, below.
*** Other authorized uses of water not billed to customers. These are usually unmetered and must be estimated. They can include main flushing, sewer flushing, reservoir and tank cleaning, fire fighting and training, temporary contruction, etc.
**** "Distribution System Leakage" as defined in the Washington State Department of Health Water Use Efficiency Guidebook.

2014 SALES TO AND PURCHASES FROM OTHER CITIES OR DISTRICTS IN CCF

	(1) Intertie with:	(2) Water Sold in ccf	(3) Water Purchased in ccf
1	Kirkland		17,723
2	Redmond	645,025	
3	Issaquah	53,547	
4			
5			
6			
7			
8			
9			
10			
	TOTAL	**698,572**	**17,723**

CASCADE WATER ALLIANCE

2014 Annual Member Survey

FORM 1

2013 WATER SUPPLY & DEMAND

Please complete lines 1 through 7 in the table below for 2013. Note that line 7 should match Total Retail Billed Consumption (cell B25) and line 6 should match Wholesale Billed Consumption (cell P25) in **FORM 2**. Lines 9 and 10 will calculate your non-revenue water automatically. Lines 11, 12 and 13 have been added at the bottom to calculate "Distribution System Leakage" (DSL) as defined in the Washington State Department of Health Water Use Efficiency Guidebook. This is for your convenience and is optional. If you have it, you may enter your estimate of unmetered but authorized water consumption (such as main flushing, tank cleaning, fire fighting, etc.) in Line 11. DSL and % DSL are then calculated in lines 12 and 13.

If you purchased water from someone other than Cascade or sold water wholesale in 2013, please provide the requested details in the second table, below.

Member Name: City of Bellevue

WATER SUPPLY AND DEMAND FOR 2013

1	Water Purchased from Cascade	7,847,662
2	Water Purchased form Other Cascade Members*	19,095
3	Water Purchased from Other Utilities Outside of Cascade*	0
4	Water Obtained from Own Source	0
5	Total Supply	7,866,757
6	Water Sold Wholesale to Other Utilities**	783,901
7	Water Sold to Retail Customers	6,622,564
8	Total Water Sales	7,406,465
9	Non-Revenue Water	460,292
10	% Non-Revenue Water	5.9%
11	Other Authorized Consumption***	23,146
12	Distribution System Leakage (DSL)****	437,146
13	% DSL	5.6%

* Please list the individual utilities from whom you purchased water and the amount purchased in columns 1 & 3, below.
** Please list the individual utilities to whom you sold water and the amount sold in columns 1 & 2, below.
*** Other authorized uses of water not billed to customers. These are usually unmetered and must be estimated. They can include main flushing, sewer flushing, reservoir and tank cleaning, fire fighting and training, temporary contruction, etc.
**** "Distribution System Leakage" as defined in the Washington State Department of Health Water Use Efficiency Guidebook.

2013 SALES TO AND PURCHASES FROM OTHER CITIES OR DISTRICTS IN CCF

	(1) Intertie with:	(2) Water Sold in ccf	(3) Water Purchased in ccf
1	Kirkland		19,095
2	Redmond	731,758	
3	Issaquah	52,143	
4			
5			
6			
7			
8			
9			
10			
	TOTAL	**783,901**	**19,095**

If you have any questions in completing this form, please contact **Mike Brent** at **(425) 453-1810.**

Prepared by: Phone:

Please save and email this completed form to mbrent@cascadewater.org

CASCADE WATER ALLIANCE

2013 Annual Member Survey

FORM 1

2012 WATER SUPPLY & DEMAND

Please complete lines 1 through 7 in the table below for 2012. Note that line 7 should match Total Retail Billed Consumption (cell B25) and line 6 should match Wholesale Billed Consumption (cell P25) in **FORM 2**. Lines 9 and 10 will calculate your non-revenue water automatically. Lines 11, 12 and 13 have been added at the bottom to calculate "Distribution System Leakage" (DSL) as defined in the Washington State Department of Health Water Use Efficiency Guidebook. This is for your convenience and is optional. If you have it, you may enter your estimate of unmetered but authorized water consumption (such as main flushing, tank cleaning, fire fighting, etc.) in Line 11. DSL and % DSL are then calculated in lines 12 and 13.

If you purchased water from someone other than Cascade or sold water wholesale in 2012, please provide the requested details in the second table, below.

Member Name: City of Bellevue

WATER SUPPLY AND DEMAND FOR 2012

1	Water Purchased from Cascade	7,621,273
2	Water Purchased form Other Cascade Members*	17,142
3	Water Purchased from Other Utilities Outside of Cascade*	0
4	Water Obtained from Own Source	0
5	Total Supply	7,638,415
6	Water Sold Wholesale to Other Utilities**	739,567
7	Water Sold to Retail Customers	6,652,102
8	Total Water Sales	7,391,669
9	Non-Revenue Water	246,746
10	% Non-Revenue Water	3.2%
11	Other Authorized Consumption***	33,568
12	Distribution System Leakage (DSL)****	213,178
13	% DSL	2.8%

* Please list the individual utilities from whom you purchased water and the amount purchased in columns 1 & 3, below.
** Please list the individual utilities to whom you sold water and the amount sold in columns 1 & 2, below.
*** Other authorized uses of water not billed to customers. These are usually unmetered and must be estimated. They can include main flushing, sewer flushing, reservoir and tank cleaning, fire fighting and training, temporary contruction, etc.
**** "Distribution System Leakage" as defined in the Washington State Department of Health Water Use Efficiency Guidebook.

2012 SALES TO AND PURCHASES FROM OTHER CITIES OR DISTRICTS IN CCF

	(1) Intertie with:	(2) Water Sold in ccf	(3) Water Purchased in ccf
1	Kirkland		17,142
2	Redmond	687,745	
3	Issaquah	51,822	
4			
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10			
	TOTAL	**739,567**	**17,142**

If you have any questions in completing this form, please contact **Mike Brent** at **(425) 453-1810.**

Prepared by: Phone:

Please save and email this completed form to mbrent@cascadewater.org

CASCADE WATER ALLIANCE
2012 Annual Member Survey

FORM 1
2011 WATER SUPPLY & DEMAND

Please complete lines 1 through 7 in the table below for 2011. Note that line 7 should match Total Retail Billed Consumption (cell B25) and line 6 should match Wholesale Billed Consumption (cell P25) in **FORM 2**. Lines 9 and 10 will calculate your non-revenue water automatically. Lines 11, 12 and 13 have been added at the bottom to calculate "Distribution System Leakage" (DSL) as defined in the Washington State Department of Health Water Use Efficiency Guidebook. This is for your convenience and is optional. If you have it, you may enter your estimate of unmetered but authorized water consumption (such as main flushing, tank cleaning, fire fighting, etc.) in Line 11. DSL and % DSL are then calculated in lines 12 and 13.

If you purchased water from someone other than Cascade or sold water wholesale in 2011, please provide the requested details in the second table, below.

Member Name: City of Bellevue

WATER SUPPLY AND DEMAND FOR 2011

1	Water Purchased from Cascade	7,650,956
2	Water Purchased form Other Cascade Members*	17,476
3	Water Purchased from Other Utilities Outside of Cascade*	0
4	Water Obtained from Own Source	0
5	Total Supply	7,668,432
6	Water Sold Wholesale to Other Utilities**	630,700
7	Water Sold to Retail Customers	6,349,457
8	Total Water Sales	6,980,157
9	Non-Revenue Water	688,275
10	% Non-Revenue Water	9.0%
11	Other Authorized Consumption***	24,239
12	Distribution System Leakage (DSL)****	664,036
13	% DSL	8.7%

* Please list the individual utilities from whom you purchased water and the amount purchased in columns 1 & 3, below.
** Please list the individual utilities to whom you sold water and the amount sold in columns 1 & 2, below.
*** Other authorized uses of water not billed to customers. These are usually unmetered and must be estimated. They can include main flushing, sewer flushing, reservoir and tank cleaning, fire fighting and training, temporary contruction, etc.
**** "Distribution System Leakage" as defined in the Washington State Department of Health Water Use Efficiency Guidebook.

2011 SALES TO AND PURCHASES FROM OTHER CITIES OR DISTRICTS IN CCF

	(1) Intertie with:	(2) Water Sold in ccf	(3) Water Purchased in ccf
1	Kirkland		17,476
2	Redmond	583,223	
3	Issaquah	47,477	
4			
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10			
	TOTAL	**630,700**	**17,476**

If you have any questions in completing this form, please contact **Mike Brent** at **(425) 453-1810.**

Prepared by: Phone:

Please save and email this completed form to mbrent@cascadewater.org

CASCADE WATER ALLIANCE

2011 Annual Member Survey

FORM 1

2010 WATER SUPPLY & DEMAND

Please complete lines 1 through 7 in the table below for 2010. Note that line 7 should match Total Retail Billed Consumption (cell B25) and line 6 should match Wholesale Billed Consumption (cell P25) in **FORM 2**. Lines 9 and 10 will calculate your non-revenue water automatically. Lines 11, 12 and 13 have been added at the bottom to calculate "Distribution System Leakage" (DSL) as defined in the Washington State Department of Health Water Use Efficiency Guidebook. This is for your convenience and is optional. If you have it, you may enter your estimate of unmetered but authorized water consumption (such as main flushing, tank cleaning, fire fighting, etc.) in Line 11. DSL and % DSL are then calculated in lines 12 and 13.

If you purchased water from someone other than Cascade or sold water wholesale in 2010, please provide the requested details in the second table, below.

Member Name: City of Bellevue

WATER SUPPLY AND DEMAND FOR 2010

1	Water Purchased from Cascade	7,321,646
2	Water Purchased form Other Cascade Members*	22,076
3	Water Purchased from Other Utilities Outside of Cascade*	0
4	Water Obtained from Own Source	0
5	Total Supply	7,343,722
6	Water Sold Wholesale to Other Utilities**	629,568
7	Water Sold to Retail Customers	6,276,954
8	Total Water Sales	6,906,522
9	Non-Revenue Water	437,200
10	% Non-Revenue Water	6.0%
11	Other Authorized Consumption***	41,395
12	Distribution System Leakage (DSL)****	395,805
13	% DSL	5.4%

* Please list the individual utilities from whom you purchased water and the amount purchased in columns 1 & 3, below.
** Please list the individual utilities to whom you sold water and the amount sold in columns 1 & 2, below.
*** Other authorized uses of water not billed to customers. These are usually unmetered and must be estimated. They can include main flushing, sewer flushing, reservoir and tank cleaning, fire fighting and training, temporary contruction, etc.
**** "Distribution System Leakage" as defined in the Washington State Department of Health Water Use Efficiency Guidebook.

2010 SALES TO AND PURCHASES FROM OTHER CITIES OR DISTRICTS IN CCF

	(1) Intertie with:	(2) Water Sold in ccf	(3) Water Purchased in ccf
1	Kirkland		22,076
2	Redmond	575,473	
3	Issaquah	54,095	
4			
5			
6			
7			
8			
9			
10			
	TOTAL	**629,568**	**22,076**

If you have any questions in completing this form, please contact **Mike Brent** at **(425) 453-1810.**

Prepared by: Phone:

Please save and email this completed form to mbrent@cascadewater.org

CASCADE WATER ALLIANCE

2010 Annual Member Survey

FORM 1

2009 WATER SUPPLY & DEMAND

Please complete lines 1 through 7 in the table below for 2009. Note that line 7 should match Total Retail Billed Consumption (cell B25) and line 6 should match Wholesale Billed Consumption (cell P25) in **FORM 2**. Lines 9 and 10 will calculate your non-revenue water automatically. Lines 11, 12 and 13 have been added at the bottom to calculate "Distribution System Leakage" (DSL) as defined in the Washington State Department of Health Water Use Efficiency Guidebook. This is for your convenience and is optional. If you have it, you may enter your estimate of unmetered but authorized water consumption (such as main flushing, tank cleaning, fire fighting, etc.) in Line 11. DSL and % DSL are then calculated in lines 12 and 13.

If you purchased water from someone other than Cascade or sold water wholesale in 2009, please provide the requested details in the second table, below.

Member Name: City of Bellevue

WATER SUPPLY AND DEMAND FOR 2009

1	Water Purchased from Cascade	8,139,840
2	Water Purchased form Other Cascade Members*	41,722
3	Water Purchased from Other Utilities Outside of Cascade*	0
4	Water Obtained from Own Source	0
5	Total Supply	8,181,562
6	Water Sold Wholesale to Other Utilities**	782,485
7	Water Sold to Retail Customers	6,908,439
8	Total Water Sales	7,690,924
9	Non-Revenue Water	490,638
10	% Non-Revenue Water	6.0%
11	Other Authorized Consumption***	27,430
12	Distribution System Leakage (DSL)****	463,208
13	% DSL	5.7%

* Please list the individual utilities from whom you purchased water and the amount purchased in columns 1 & 3, below.
** Please list the individual utilities to whom you sold water and the amount sold in columns 1 & 2, below.
*** Other authorized uses of water not billed to customers. These are usually unmetered and must be estimated. They can include main flushing, sewer flushing, reservoir and tank cleaning, fire fighting and training, temporary contruction, etc.
**** "Distribution System Leakage" as defined in the Washington State Department of Health Water Use Efficiency Guidebook.

2009 SALES TO AND PURCHASES FROM OTHER CITIES OR DISTRICTS IN CCF

	(1) Intertie with:	(2) Water Sold in ccf	(3) Water Purchased in ccf
1	Kirkland		41,722
2	Redmond	725,934	
3	Issaquah	56,551	
4			
5			
6			
7			
8			
9			
10			
	TOTAL	**782,485**	**41,722**

If you have any questions in completing this form, please contact **Mike Brent** at **(425) 453-1810.**

Prepared by: ________ Phone: ________

Please save and email this completed form to mbrent@cascadewater.org

CURRENT & FORECAST WATER SUPPLY & DEMAND

Please complete columns 1 through 5 in the table below for 2009 as well as your forecasts of these amounts for the year 2010-2025. Column 6 will calculate your non-revenue water automatically. If you purchased water from someone other than SPU or sold water wholesale in 2009, please provide the requested details in the second table**.**

Name of Wholesale Customer : City of Bellevue

Double click on this table to enter amounts. Non-revenue water will be calculated automatically.

When finished, click once in the first box in the next table down.

WATER AMOUNT IN HUNDREDS OF CUBIC FEET (CCF)						
	Purchased from CWA (1)	Wheeled from other CWA members (2)*	Obtained from Own Source (3)**	Wheeled to other CWA members (4)***	Sold Direct Service (5)	Non-Revenue Water (6) 1-5=6
2009 WATER SUPPLY & DEMAND						
2009 Annual	7,399,077	41,722		782,485	6,908,439	490,638
FORECAST OF WATER SUPPLY & DEMAND						
2010 Annual	8,635,615			878,464	7,959,092	676,523
2015 Annual	8,896,156			945,665	8,199,222	696,934
2020 Annual	9,156,697			1,012,867	8,439,352	717,345
2025 Annual	9,445,690			1,080,068	8,705,705	739,985

* Please list the individual utilities from whom you purchased water and the amount purchased in columns 1 & 3, below.

** Please fill out Form 5 with additional information on groundwater or surface water sources, if you utilize your own.

*** Please list the individual utilities to whom you sold water and the amount sold in columns 1 & 2, below.

2009 METERED TO AND FROM OTHER CITIES OR DISTRICTS		
Intertie with:	**Water Wheeled "through" Bellevue(4)**	**Water Wheeled "to" Bellevue (2)**
1. Kirkland (purchased directly from CWA)		**41,722**
2. Redmond (purchased directly from CWA)	**725,934**	
3. Issaquah (purchased directly from CWA)	**56,551**	
4.		
5.		

Prepared by: David Perry Phone: 425-452-4351

If you have any questions in completing this form, please contact **Bruce Flory** at **(206) 684-5859.**

CASCADE WATER ALLIANCE

2009 Annual Member Survey

FORM 1

2008 WATER SUPPLY & DEMAND

Please complete lines 1 through 7 in the table below for 2008. Note that line 7 should match Total Retail Billed Consumption (cell B25) and line 6 should match Wholesale Billed Consumption (cell P25) in **FORM 2**. Lines 9 and 10 will calculate your non-revenue water automatically. Lines 11, 12 and 13 have been added at the bottom to calculate “Distribution System Leakage” (DSL) as defined in the Washington State Department of Health Water Use Efficiency Guidebook. This is for your convenience and is optional. If you have it, you may enter your estimate of unmetered but authorized water consumption (such as main flushing, tank cleaning, fire fighting, etc.) in Line 11. DSL and % DSL are then calculated in lines 12 and 13.

If you purchased water from someone other than Cascade or sold water wholesale in 2008, please provide the requested details in the second table, below.

Member Name: City of Bellevue

WATER SUPPLY AND DEMAND FOR 2008

1	Water Purchased from Cascade	7,883,441
2	Water Purchased form Other Cascade Members*	17,214
3	Water Purchased from Other Utilities Outside of Cascade*	0
4	Water Obtained from Own Source	0
5	Total Supply	7,900,655
6	Water Sold Wholesale to Other Utilities**	674,124
7	Water Sold to Retail Customers	6,612,399
8	Total Water Sales	7,286,523
9	Non-Revenue Water	614,132
10	% Non-Revenue Water	7.8%
11	Other Authorized Consumption***	0
12	Distribution System Leakage (DSL)****	614,132
13	% DSL	7.8%

* Please list the individual utilities from whom you purchased water and the amount purchased in columns 1 & 3, below.
** Please list the individual utilities to whom you sold water and the amount sold in columns 1 & 2, below.
*** Other authorized uses of water not billed to customers. These are usually unmetered and must be estimated. They can include main flushing, sewer flushing, reservoir and tank cleaning, fire fighting and training, temporary contruction, etc.
**** “Distribution System Leakage” as defined in the Washington State Department of Health Water Use Efficiency Guidebook.

2008 SALES TO AND PURCHASES FROM OTHER CITIES OR DISTRICTS IN CCF

	(1) Intertie with:	(2) Water Sold in ccf	(3) Water Purchased in ccf
1	Kirkland		17,214
2	Redmond	620,620	
3	Issaquah	53,504	
4			
5			
6			
7			
8			
9			
10			
	TOTAL	**674,124**	**17,214**

If you have any questions in completing this form, please contact **Mike Brent** at **(425) 453-1810.**

Prepared by: Phone:

Please save and email this completed form to mbrent@cascadewater.org

CURRENT & FORECAST WATER SUPPLY & DEMAND

Please complete columns 1 through 5 in the table below for 2008 as well as your forecasts of these amounts for the year 2010-2025. Column 6 will calculate your non-revenue water automatically. If you purchased water from someone other than SPU or sold water wholesale in 2008, please provide the requested details in the second table**.**

Name of Wholesale Customer : City of Bellevue

Double click on this table to enter amounts. Non-revenue water will be calculated automatically.

When finished, click once in the first box in the next table down.

WATER AMOUNT IN HUNDREDS OF CUBIC FEET (CCF)						
	Purchased from CWA (1)	Wheeled from other CWA members (2)*	Obtained from Own Source (3)**	Wheeled to other CWA members (4)***	Sold Direct Service (5)	Non-Revenue Water (6) 1-5=6
2008 WATER SUPPLY & DEMAND						
2008 Annual	7,226,531	17,214		674,124	6,612,399	614,132
FORECAST OF WATER SUPPLY & DEMAND						
2010 Annual	8,635,615			878,464	7,959,092	676,523
2015 Annual	8,896,156			945,665	8,199,222	696,934
2020 Annual	9,156,697			1,012,867	8,439,352	717,345
2025 Annual	9,445,690			1,080,068	8,705,705	739,985

* Please list the individual utilities from whom you purchased water and the amount purchased in columns 1 & 3, below.

** Please fill out Form 5 with additional information on groundwater or surface water sources, if you utilize your own.

*** Please list the individual utilities to whom you sold water and the amount sold in columns 1 & 2, below.

2008 METERED TO AND FROM OTHER CITIES OR DISTRICTS		
Intertie with:	**Water Wheeled "through" Bellevue(4)**	**Water Wheeled "to" Bellevue (2)**
1. Kirkland (purchased directly from CWA)		**17,214**
2. Redmond (purchased directly from CWA)	**620,620**	
3. Issaquah (purchased directly from CWA)	**53,504**	
4.		
5.		

Prepared by: David Perry Phone: 425-452-4351

CURRENT & FORECAST WATER SUPPLY & DEMAND

Please complete columns 1 through 5 in the table below for 2007 as well as your forecasts of these amounts for the year 2010-2025. Column 6 will calculate your non-revenue water automatically. If you purchased water from someone other than SPU or sold water wholesale in 2007, please provide the requested details in the second table.

Name of Wholesale Customer : City of Bellevue

Double click on this table to enter amounts. Non-revenue water will be calculated automatically.

When finished, click once in the first box in the next table down.

WATER AMOUNT IN HUNDREDS OF CUBIC FEET (CCF)						
	Purchased from CWA (1)	Wheeled from other CWA members (2)*	Obtained from Own Source (3)**	Wheeled to other CWA members (4)***	Sold Direct Service (5)	Non-Revenue Water (6) 1-5=6
2006 WATER SUPPLY & DEMAND						
2007 Annual	7,232,029	19,105		731,462	6,851,810	380,219
FORECAST OF WATER SUPPLY & DEMAND						
2010 Annual	8,635,615			878,464	7,959,092	676,523
2015 Annual	8,896,156			945,665	8,199,222	696,934
2020 Annual	9,156,697			1,012,867	8,439,352	717,345
2025 Annual	9,445,690			1,080,068	8,705,705	739,985

* Please list the individual utilities from whom you purchased water and the amount purchased in columns 1 & 3, below.
** Please fill out Form 5 with additional information on groundwater or surface water sources, if you utilize your own.
*** Please list the individual utilities to whom you sold water and the amount sold in columns 1 & 2, below.

2007 METERED TO AND FROM OTHER CITIES OR DISTRICTS		
Intertie with:	**Water Wheeled "through" Bellevue(4)**	**Water Wheeled "to" Bellevue (2)**
1. Kirkland (purchased directly from CWA)		**19,105**
2. Redmond (purchased directly from CWA)	**677,360**	
3. Issaquah (purchased directly from CWA)	**54,102**	
4.		
5.		

Prepared by: David Perry Phone: 425-452-4351

CURRENT & FORECAST WATER SUPPLY & DEMAND

Please complete columns 1 through 5 in the table below for 2006 as well as your forecasts of these amounts for the year 2010-2025. Column 6 will calculate your non-revenue water automatically. If you purchased water from someone other than SPU or sold water wholesale in 2005, please provide the requested details in the second table**.**

Name of Wholesale Customer : City of Bellevue

Double click on this table to enter amounts. Non-revenue water will be calculated automatically.

When finished, click once in the first box in the next table down.

WATER AMOUNT IN HUNDREDS OF CUBIC FEET (CCF)						
	Purchased from CWA (1)	Wheeled from other CWA members (2)*	Obtained from Own Source (3)**	Wheeled to other CWA members (4)***	Sold Direct Service (5)	Non-Revenue Water (6) 1-5=6
2006 WATER SUPPLY & DEMAND						
2006 Annual	7,479,985	19,976		814,225	7,293,247	186,738
FORECAST OF WATER SUPPLY & DEMAND						
2010 Annual	8,635,615			878,464	7,959,092	676,523
2015 Annual	8,896,156			945,665	8,199,222	696,934
2020 Annual	9,156,697			1,012,867	8,439,352	717,345
2025 Annual	9,445,690			1,080,068	8,705,705	739,985

* Please list the individual utilities from whom you purchased water and the amount purchased in columns 1 & 3, below.

** Please fill out Form 5 with additional information on groundwater or surface water sources, if you utilize your own.

*** Please list the individual utilities to whom you sold water and the amount sold in columns 1 & 2, below.

2006 METERED TO AND FROM OTHER CITIES OR DISTRICTS		
Intertie with:	**Water Wheeled "through" Bellevue(2)**	**Water Wheeled "to" Bellevue (3)**
1. Kirkland (purchased directly from CWA)		**19,976**
2. Redmond (purchased directly from CWA)	**753,650**	
3. Issaquah (purchased directly from CWA)	**60,575**	
4.		
5.		

Prepared by: David Perry Phone: 425-452-4351

If you have any questions in completing this form, please contact **Bruce Flory** at **(206) 684-5859.**

CURRENT & FORECAST WATER SUPPLY & DEMAND

Please complete columns 1 through 5 in the table below for 2005 as well as your forecasts of these amounts for the year 2010-2025. Column 6 will calculate your non-revenue water automatically. If you purchased water from someone other than SPU or sold water wholesale in 2005, please provide the requested details in the second table.

Name of Wholesale Customer : City of Bellevue

Double click on this table to enter amounts. Non-revenue water will be calculated automatically.

When finished, click once in the first box in the next table down.

WATER AMOUNT IN HUNDREDS OF CUBIC FEET (CCF)						
	Purchased from CWA (1)	Wheeled from other CWA members (2)*	Obtained from Own Source (3)**	Wheeled to other CWA members (4)***	Sold Direct Service (5)	Non-Revenue Water (6) 1-5=6
2005 WATER SUPPLY & DEMAND						
2005 Annual	7,125,574	16,648		756,051	6,813,952	311,622
FORECAST OF WATER SUPPLY & DEMAND						
2010 Annual	8,635,615			878,464	7,959,092	676,523
2015 Annual	8,896,156			945,665	8,199,222	696,934
2020 Annual	9,156,697			1,012,867	8,439,352	717,345
2025 Annual	9,445,690			1,080,068	8,705,705	739,985

* Please list the individual utilities from whom you purchased water and the amount purchased in columns 1 & 3, below.

** Please fill out Form 5 with additional information on groundwater or surface water sources, if you utilize your own.

*** Please list the individual utilities to whom you sold water and the amount sold in columns 1 & 2, below.

2005 METERED TO AND FROM OTHER CITIES OR DISTRICTS		
Intertie with:	**Water Wheeled "through" Bellevue(2)**	**Water Wheeled "to" Bellevue (3)**
1. Kirkland (purchased directly from CWA)		**16,648**
2. Redmond (purchased directly from CWA)	**705,537**	
3. Issaquah (purchased directly from CWA)	**50,514**	
4.		
5.		

Prepared by: David Perry Phone: 425-452-4351

Appendix Q

Reclaimed Water Checklist

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For questions, call Kristina Westbrook,
King County Reclaimed Water Program Manager at (206) 296-5279
www.kingcounty.gov/reclaimedwater

King County

Water Reclamation Evaluation Checklist
For Systems with 1,000 or more Connections

Please use this checklist, including the inventory template, to ensure that your water system plan includes sufficient information about opportunities for reclaimed water and your system's efforts to develop those opportunities. If a question is not applicable or the information is unavailable, then answer, "unknown" or "n/a." King County will consider the checklist completed if each answer is filled in with the best available information, even if the utility states that it is not aware of any reclaimed water opportunities within its service area.

The County and State recognize that changing conditions could initiate a need to respond in new ways to future water quality standards, wastewater discharge requirements, take advantage of advances in treatment technologies and/or allow our region to be positioned to respond to changes associated with climate change and population growth.

In 2003, Chapter 90.46 of the Revised Code of Washington (RCW) was amended to require public water systems serving 1,000 or more connections to evaluate opportunities for reclaimed water when completing their water system plans. Please use this checklist to meet King County consistency requirements in responding to this legislation.

Water System Name: BELLEVUE, CITY OF
Date: October 8, 2015 (DRAFT)
PWS ID# 05575
Contact: D. LANE (425) 452-6865

1. **Identifying Potential Future Demand for Reclaimed Water:** King County maintains a database and map of potential reclaimed water users for evaluating future projects. Please use the template below, or similar table, to provide information to assist King County in further researching these potential uses.
   - **Large Utility Water Users** (choose one):
     - ☐ Attached is an inventory of twenty large (above 20,000 gallons/month on average), non single-family residential, water users served by our utility that have a potential for reclaimed water use, or
     - ☑ Attached is an inventory of our utility's top twenty water users, or
     - ☐ The information requested is unknown or not available.
       Additional Comments: ______
   - **Large Self Suppliers** (choose one):
     - ☑ Attached is an inventory of large, self-supplied water users within our water utility's service boundaries - especially those near wastewater treatment plants, mainlines, outfalls, and pump stations or similar reclaimed water facilities), or 1. Bellevue Municipal Golf Course 2. Glendale Country Club
     - ☐ The information requested is unknown or not available.
       Additional Comments: Two are known: Bellevue Municipal Golf Course; Glendale Country Club
   - **Other** (choose one):
     - ☐ Attached is an inventory of other water users (such as those that are clustered near one another and could be served by a single system) that may be likely candidates for reclaimed water use, or
     - ☑ The information requested is unknown or not available.
       Additional Comments: Potential reclaimed water users are few and are identified on Page 3.

2. **Environmental Commitment**: Are you a city/town, or providing water service to a city/town, that has made commitments within resource management plans, salmon recovery plans, or other environmental initiatives for which there is a potential opportunity for using reclaimed water to assist in meeting commitments? (choose one)

☑ Yes, here are plans that have potential for reclaimed water use in our service area to meet the above commitments:
The City of Bellevue Comprehensive Plan has generalized language that promotes and encourages green infrastructure and resource conservation where appropriate.

☐ The information requested is unknown, not available.
Additional Comments: ______________________________

3. **Identifying Areas of Potential Use of Reclaimed Water for Environmental Benefit:**
Below are ***examples*** of uses of reclaimed water ***that comply with State, Federal and other reclaimed water environmental, health and safety standards***. All of these uses are currently in effect somewhere in Washington State. To the best of your knowledge, are any of these potential uses for reclaimed water applicable to your area?

River Augmentation (choose one):

☐ Yes, our water rights are limited by instream flows. For more information, King County may contact:
____
____

☑ The information requested is unknown, or not available.
Additional Comments: Bellevue purchases regional water supplied by the Cedar and Tolt riversheds.

Groundwater Recharge (choose one):

☐ Yes, we withdraw water from an aquifer that is in a groundwater management area, or from a declining aquifer, where water levels may need to be replenished or to maintain aquifer storage. For more information, King County may contact:
____

☑ The information requested is unknown, or not available.
Additional Comments: Bellevue Utilities Dept currently maintains wells only for emergency water supply.

Water Rights Mitigation (choose one):

☐ Yes, our area is pursuing, or planning to pursue, new or additional water rights, and there may be an opportunity to use reclaimed water for mitigation of those new water rights. For more information, King County may contact:
____

☑ The information requested is unknown, or not available.
Additional Comments: ______________________________

Potential Areas of Environmental Need (choose one):

☐ Yes, parts of our service area include potential environmental enhancement locations, such as wetlands enhancement, aquifer recharge, stream flow augmentation, that might be candidates for reclaimed water use. For more information, King County may contact:
____

☑ The information requested is unknown, or not available.
Additional Comments: ______________________________

4. **Local Reclaimed Water Legislation**: If water reclamation is mandated for this water system through local government agreement, contract, local regulations, ordinances, or other mechanisms, please provide a copy of the governing mechanism (choose one).

☐ Yes, local legislation exists in our area in support of reclaimed water use. The following relevant legislation is attached (please list titles of documents):
____
____

☑ No water reclamation legislation exists, or is known to exist, at a local level in our service area.

5. **Coordination with Local Wastewater Utility:** Include a brief description of your interactions with any wastewater or reclaimed water utility (King County or other) adjacent to your service area to evaluate any potential opportunities to develop reclaimed water (choose one).

☑ Describe if applicable:
The City participates in the regional Metropolitan Water Pollution Abatement Advisory Committee (MWPAAC) and has advised on King County's Reclaimed Water Comprehensive Plan.

☐ None. Additional Comments: ____

Template for
Inventory of Water Users and Identification of Potential Reclaimed Water Users

Site Owner or Site Name	Site Address (for general mapping purposes)	Estimated Annual Water Use	Water uses not requiring potable water[1]	Is this a Potential Reclaimed Water Customer?
FOOD & BEVERAGE PRODUCTION	BEL-RED NEIGHBORHOOD	122298 (CCF)	Toilets	No
FOOD & BEVERAGE PRODUCTION	BEL-RED NEIGHBORHOOD	105914 (CCF)	Toilets	No
FOOD & BEVERAGE PRODUCTION	BEL-RED NEIGHBORHOOD	45771 (CCF)	Toilets	No
RETAIL	DOWNTOWN	42506 (CCF)	Toilets, Decorative Fountains	No
HEALTH & FITNESS CLUB	BRIDLE TRAILS NEIGHBORHOOD	37643 (CCF)	Toilets, Irrigation	Yes
OFFICES	EASTGATE NEIGHBORHOOD	35035 (CCF)	Toilets, Irrigation	Yes
HOSPITAL FACILITIES	BEL-RED NEIGHBORHOOD	31716 (CCF)	Toilets, Irrigation	Yes
APARTMENTS	CROSSROADS NEIGHBORHOOD	30637 (CCF)	Toilets	No
APARTMENTS	CROSSROADS NEIGHBORHOOD	27811 (CCF)	Toilets	No
HOTEL	WEST BELLEVUE NEIGHBORHOOD	25057 (CCF)	Toilets	No
APARTMENTS	CROSSROADS NEIGHBORHOOD	24805 (CCF)	Toilets	No
APARTMENTS	COUGAR MTN / LAKEMONT NEIGHBORHOOD	23713 (CCF)	Toilets, Irrigation	Yes
HOTEL	DOWNTOWN	21909 (CCF)	Toilets	No
HEALTH & FITNESS CLUB	WEST BELLEVUE NEIGHBORHOOD	21740 (CCF)	Toilets, Irrigation	Yes
HOTEL	DOWNTOWN	21399 (CCF)	Toilets	No
APARTMENTS	BRIDLE TRAILS NEIGHBORHOOD	17594 (CCF)	Toilets, Irrigation	Yes
CONDOMINIUMS	DOWNTOWN	17496 (CCF)	Toilets, Irrigation	Yes
CONDOMINIUMS	DOWNTOWN	17125 (CCF)	Toilets, Irrigation	Yes
RETAIL	DOWNTOWN	16265 (CCF)	Toilets	No
APARTMENTS	CROSSROADS NEIGHBORHOOD	16181 (CCF)	Toilets, Irrigation	Yes

[1] See Washington State Reclamation and Reuse Standards, September 1997, Section 1, Articles 1-5 for allowable uses of reclaimed water. http://www.ecy.wa.gov/PROGRAMS/WQ/reclaim/standards.html

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Appendix R

Shortage Management Plan

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City of Bellevue

Water Shortage Management Plan

DRAFT - April 2015

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1.0 Introduction and Purpose

Municipal water suppliers must be prepared for water shortages in order to minimize effects on the communities they serve. This Shortage Management Plan (SMP) outlines how the City of Bellevue (Bellevue) will respond to a water supply shortage affecting its regional water supply.

Bellevue purchases its water from Cascade Water Alliance (Cascade). At the present time, all of the water Cascade provides to Bellevue is supplied from Seattle Public Utilities (SPU). Various events could cause a shortage in the SPU water supply system. These include reduced snowpack in the Cascade Range due to a dry winter or early spring melt; an earthquake or other event that damages reservoirs, treatment facilities or transmission lines; water quality problems; or intentional destructive acts. These different kinds of events may cause shortages with different characteristics in terms of advance warning, severity and duration. The SMP offers flexibility for a range of appropriate responses.

As required by Chapter 246-290-100 Washington Administrative Code, the Washington State Department of Health (DOH) requires SPU, Cascade, and each Member of Cascade (including Bellevue) to have its own shortage management plan to guide water system operations and interaction with end-use customers in each community during a water shortage. Bellevue's SMP complements the SPU Water Shortage Contingency Plan (WSCP) and Cascade's Shortage Management Plan (CSMP).

2.0 Related Agreements

2.1 Cascade Interlocal Contract

Cascade's 2012 *Joint Municipal Utility Services Agreement* provides the basis for Cascade's operations. Section 7.3 of the Interlocal Contract addresses water shortages and emergencies. The agreement says Cascade Members "must respond to water shortages in a collective, shared fashion under a Cascade shortage management plan adopted by the Board." The agreement allows Cascade to impose penalty charges or to impose a disproportionate reduction in supply on any Cascade Member (including Bellevue) who does not comply with Cascade's shortage management plan during a shortage.

A copy of Section 7.3 of the 2012 *Joint Municipal Utility Services Agreement* is included in Appendix A of this SMP.

2.2 Seattle Block Contract

In 2004 Cascade and SPU entered into a *50-Year Declining Block Water Supply Agreement between the City of Seattle and the Cascade Water Alliance* (Block Contract; amended in 2008 and 2013). Article VII of the Block Contract provides for shortage management. Section 7.2 says that Cascade and SPU "shall coordinate the development, adoption and implementation" of shortage management plans and "shall communicate with each other concerning current and projected water supply conditions" prior to invoking shortage management plans.

Section 12.1 of the Block Contract recognizes that unilateral actions by Seattle may be needed at times due to unforeseen and unavoidable events, including water shortages. It indicates that any curtailment of supply by Seattle shall be imposed proportionately among its wholesale and retail customers.

As a separate matter, Section 7.3 of the Block Contract provides that if water use restrictions are imposed on SPU by the terms of its agreements with Federal and State agencies and Tribes, such restrictions will be borne proportionally by SPU and its wholesale customers, including Cascade. In this event, Cascade and its Members will need to review the restrictions and determine appropriate short-term or long-term actions.

3.0 Plan Activation and Applicability to Cascade Members

3.1 Activation of SMP

It is anticipated that the initial need for shortage management will be identified through a communication from SPU and Cascade indicating that a supply shortage may occur or is in progress. If this is the case, SPU will activate its own WSCP, and Cascade will activate its own CSMP. While SPU is required to deliver to Cascade amounts up to the limits of their Block Contract with Cascade, Section 12.1 (Emergency Events) permits SPU to curtail supply to Cascade (on a proportional basis with its retail and other wholesale customers) in the event of an “unforeseen and unavoidable” event, including water shortages resulting from drought circumstances. SPU may declare an Emergency Event at any stage under its WSCP.

Action by the Bellevue Utilities Director (the Director) will be required in order to activate Bellevue’s shortage management actions under this SMP. Although this action would be anticipated in response to action by Cascade, alternatively the Director also has the authority to activate the Bellevue SMP without activation of Cascade’s CSMP.

In the event of an emergency that requires immediate action to prevent risks to public health and safety, the Director may activate the SMP on a temporary basis. In this event the Utilities Leadership Team.

Once the SMP has been activated, it may be necessary to move from one level of shortage management to another. This will likely be in response to a change in the stage of curtailment by Cascade, but could also be done as an independent action by Bellevue if conditions warrant. The Director shall have the authority to either elevate or diminish the level of curtailment from one level to another.

3.2 Water Shortage Management Committee

Cascade’s CSMP calls for the establishment of a Water Shortage Management Committee, consisting of select Cascade staff and Cascade Member staff (including Bellevue) to advise Cascade on implementation of the CSMP once it has been activated and for the duration of the water shortage.

3.3 Coordination with Cascade

The Director or designee will communicate closely with Cascade regarding activation of the SMP and a change in the level of shortage designated. Bellevue will take the following actions in the event Cascade activates its plan:

- If Cascade initiates any stage of its CSMP, Bellevue will respond in a collective, shared fashion and implement Bellevue's SMP.
- If Cascade activates its Emergency Curtailment stage, Cascade anticipates that Section 12.1 (Emergency Events) of their Block Contract with SPU would also be triggered (if it had not already been triggered at a previous stage). In the event of significant curtailment, Cascade and Bellevue would need to activate their CSMP and SMP in order to manage the situation effectively.
- Cascade and Bellevue have a key role in the communications strategy during a regional water shortage. It is anticipated that SPU will communicate with its own retail customers, regional stakeholders, state/federal resource agencies, and regional media. Bellevue should communicate with Bellevue's retail customers, local stakeholders, and local media. Cascade will help to coordinate and facilitate communications between the regional level and the local level.

Bellevue will maintain a current copy of SPU's WSCP and Cascade's CSMP on file.

4.0 Stages of Water Use Curtailment

Bellevue's SMP has the same four stages of curtailment as SPU's WSCP and Cascade's CSMP. These are designed for progressive implementation during a drought or other long-range disruption of water supply. However if a shortage occurs due to a sudden, unexpected event, any of the four stages can be activated from the outset of the event.

Table 1 summarizes actions to be taken in the four stages of curtailment. Additional detail is provided in the subsections following Table 1.

4.2 Advisory Stage

This stage is advisory only, and does not require curtailment actions by water users. The public is informed as early as meaningful data are available that a water shortage may occur.

Objectives

- Prepare Bellevue and its customers for a potential water shortage, thereby allowing for adequate planning and coordination.
- Implement distribution system management actions that may help to forestall or minimize the need for more stringent demand or supply management actions.

Triggers

- Notice from Cascade that they have activated the Advisory Stage of their SMP and that Bellevue is requested to do the same; and
- An action of the the Director authorizing activation of Bellevue's advisory stage.

Theme of Public Messages

- Cascade's public messaging will be consistent with SPU's messaging during the shortage event. The SPU's WSCP provides the following description for this stage: "Potential exists for lower than normal supply; conditions may return to normal, or later on we may need to reduce consumption. Continue to use water wisely to help ensure sufficient supply for people and fish. We'll keep you informed."

Table 1: Four Stages of Curtailment

	Advisory	Voluntary	Mandatory	Emergency
Theme of Public Messages from SPU	A shortage may occur soon; get ready.	A shortage has occurred. We are requesting voluntary curtailment to reduce demand by x percent.	A severe shortage has occurred. Mandatory curtailment is necessary and specific uses of water are restricted.	An emergency shortage has occurred. Mandatory curtailment is necessary and public health and safety uses are the priority.
Cascade Communication Actions	• Inform Members they are required to activate their Advisory Stage (see exemptions). • Establish a regular communication mechanism with Members. • Request Cascade Members carry out supply-side management actions. • Participate on SPU's Water Shortage Advisory Group. • Assist Members to acquire and distribute public information materials.	• Inform Members they are required to activate their Voluntary Stage. • Request Cascade Members report to Cascade regarding supply-side management actions. For Members that have independent supply, this may include relying more heavily on these supplies. • Request Cascade Members communicate with their largest customers. • Communicate regularly with Cascade Members. • Communicate with the Washington State Department of Health. • Participate on SPU's Water Shortage Advisory Group. • Assist Cascade Members to acquire and distribute public information materials.	• Inform Cascade Members that they are required to activate their Mandatory Stage, including enforcement as appropriate. • Gather information from SPU on water quality or pressure problems, and communicate these to Members. • Continue communication actions from the Voluntary Stage, with modifications as appropriate for the Mandatory Stage.	• Inform Cascade Members that they are required to activate their Emergency Stage, including enforcement as appropriate. • Continue and intensify communication actions from the Mandatory Stage. • For Members that have independent supply, request they rely as much as possible on these supplies. • Alert Members of particular operational problems that may occur with system-wide reduced water consumption. • Assist Cascade Members to define and communicate exemptions for public health and safety.
Cascade Operating Actions	• Initiate preparation for Voluntary Stage.	• Assess revenue implications and remedies. • Initiate preparation for Mandatory Stage.	• Continue operating actions from the Voluntary Stage • Initiate preparation for Emergency Stage. • If necessary consider enforcement actions against any non-complying Member.	• Continue operating actions from Mandatory Stage. • Make staff resources available to Cascade Members. • Coordinate volunteers on behalf of Members.
Bellevue Communication Actions	• Create Water Shortage Team (WST) & meet • Coordinate w/Cascade on supply conditions; stages of curtailment; actions taken by SPU, Cascade & others; etc • Brief City Leadership Team, PIO, ESC and elected officials • Brief City Employees, EOC if appropriate • Provide Advisory Stage info to admin staff, Utility Billing account representatives, and Service First. • If requested, participate on SPU's Water Shortage Advisory Group. • Coordinate w/Cascade and distribute public information as needed	• Establish systematic communications w/Mayor, Council, City Leadership Team, EOC, City PIO. ESC, City employees • Concurrent with SPU actions, prepare emergency declaration for CMO and public notice materials for appropriate local media. • Prepare mandatory restrictions and/or surcharges for the Director's consideration and approval. • Request City Departments conserve more than the minimum voluntary actions. • Establish systematic communication to update Utilities and Service First staff on goals, conditions, and actions. • Consult w/local customer groups to target info and obtain feedback • Report to Cascade regarding supply-side management actions that Bellevue will take during the Voluntary Stage. • Establish routine timing and regular format for press releases • Publish regional consumption graph w/goal vs. consumption. • Promote conservation goals for typical households, and % reduction goal for commercial customers. • Support regional and local communications plans promoting voluntary curtailment • Include water quality information in public information so that if flushing is necessary, the public understands that it is essential for water quality maintenance. • Publicize the water supply conditions through appropriate media (with regular	• Continue or commence actions listed for Advisory Stage and Mandatory Stage • Brief Mayor, Council; City Leadership Team, others as needed. • Inform public about nature and scope of the mandatory restrictions and enforcement • Modify the hotline to receive reports of violations • Urge customers with private wells to install signs indicating well water. • Prohibit use of ornamental fountains • Prohibit car washing except at commercial car wash facilities that recycle water. • Rescind all Hydrant Use Permits. • Prohibit sidewalk, streets, deck & driveway cleaning • Limit or prohibit pressure-washing of buildings • Prohibit water waste	• Continue all previous, applicable actions. • Brief Mayor, Council; City Leadership Team, others as needed. • If not done previously, and, if applicable, prepare emergency declaration • Prepare emergency curtailment Water Use restrictions, prohibitions, and surcharge legislation for Council consideration and approval. • Inform customers of the rate surcharge and how it will affect them. • Coordinate with EOC, Police, Fire, and other City departments for assistance in enforcing prohibition of water waste and other response activities as determined. • Inform customers of potential taste and odor problems. • Inform customers about possible pressure reductionsl. • Define and communicate exemptions for medical facilities and other public health situations.

		updates). Ensure information provided covers the needs of all key stakeholders: the public, news media, and purveyors. • Identify and promote reduced evapotranspiration (ET) rate for large irrigators. • Prepare list of and promote commercial car wash facilities that recycle water. • Request that non-recirculating fountains be turned off. • Request that Fire Department limit training exercises that use water. • Request that the City, Bellevue School District, and other large fleet agencies eliminate washing fleet vehicles unless recycling car washes are used. • Request curtailment of sidewalk, driveway, parking lot cleaning. • Communicate regularly with Cascade • Communicate with large customers to request percentage reductions.	• Prohibit all irrigation during the warmest hours. • Limit irrigation to a specific number of days per week	• Prohibit all irrigation • If feasible make reclaimed water available to tanker trucks for street cleaning, construction projects, landscape irrigation, dust control, etc. • Prohibit the use of water in fire training exercises • Require Parks Dept to close outdoor pools. • Continue and intensify communication actions from the Mandatory Stage, with modifications as appropriate for the Emergency Stage (as determined in consultation with SPU and Cascade).
Bellevue Operating Actions	• Carry out and document supply-side Advisory Stage management actions as requested by Cascade, • Intensify supply & demand data collection and monitoring • Establish a "hotline" • Assess flushing and reservoir cleaning activities, and modify to be consistent with regional decision. • Assess areas with potential for severe water quality degradation due to reduced consumption. • Initiate planning and preparation for Voluntary Stage • Communicate with large customers to request percentage reductions.	• Continue actions listed in the Advisory Stage. • Eliminate O&M consumption not essential to maintain water quality • Increase WQ monitoring • Implement staff reassignments as needed. • Initiate planning and preparation for Mandatory Stage actions,	• Continue operating actions from the Voluntary Stage • Initiate planning for Emergency Stage. • If appropriate implement procedures for exemptions from restrictions and/or emergency surcharges. • Implement Enforcement Procedures for Mandatory Water Use Restrictions, • Establish "Water Watcher" patrols.	• Continue and/or enhance all appropriate actions listed in prior stages. • Curtail fire line testing • Continue to monitor staffing impacts, training needs and communications strategies and make adjustments where feasible to enhance effectiveness of the regional water shortage response. • If volunteer services are available and deemed valuable to the water shortage response, and if desired by the City, Cascade will coordinate volunteers on behalf of its the City. • If necessary the Director will consider enforcement actions against any customers who do not comply with Emergency Stage actions, as appropriate per applicable City Codes and policies.

Bellevue Advisory Stage Communication Actions

- Establish and convene a Bellevue Water Shortage Team (WST).
- Coordinate with Cascade to stay informed regarding stages of curtailment; water supply conditions; actions taken by SPU, Cascade and others in the region; and information that should be communicated to the public, local parks departments, large customers, landscape industry professionals and others.
- Brief City Leadership Team and Public Information Officer
- Brief elected officials
- Brief Environmental Services Commission
- Brief City Employees
- Provide Advisory Stage information to all BU administrative staff, Utility Billing account representatives, and Service First.
- If requested by Cascade and SPU, participate on SPU's Water Shortage Advisory Group to help develop public information messages and materials and to provide input on Bellevue's actions.
- Coordinate with Cascade and distribute public information materials as needed. This may include materials from SPU or other sources, as appropriate. Post information on Bellevue's web site and social media forums regarding the Advisory Stage.

Bellevue Advisory Stage Operating Actions

- Carry out supply-side Advisory Stage management actions as requested by Cascade, to reduce use of water for local water distribution system operations, and compile information on the actions taken.
- Intensify data collection actions (local water consumption, regional supply status) and monitoring weather and SPU supply forecasts.
- Establish a "hotline" with frequently updated recording providing latest information, conservation tips, and supply and demand data.
- Assess scheduled water main flushing and reservoir cleaning activities. Be consistent with regional decision to either accelerate so they are completed prior to the peak season or to reduce activities to conserve supply.
- Assess water quality in reservoirs and distribution system to target for correction areas predicted to experience severe degradation due to reduced consumption.
- Initiate planning and preparation for Voluntary Stage actions, including an assessment of potential staffing impacts, training needs, communications strategies and voluntary water use curtailment actions to suggest to retail customers if the Voluntary Stage is activated.

4.3 Voluntary Stage

If supply conditions worsen, the plan moves to the Voluntary Stage which relies on voluntary cooperation and support of customers to meet target consumption goals. During this stage, specific voluntary actions are suggested for residential and commercial customers.

Objectives

- Implement distribution system management actions to further stretch available supply, if feasible.
- Encourage customer voluntary actions to maintain or reduce demand to meet target consumption levels.
- Forestall or minimize need for later more stringent demand or supply management actions.
- Maintain drinking water quality at acceptable levels throughout the shortage.

Triggers

- Notice from Cascade that they have activated the Voluntary Stage of their SMP and that Bellevue is requested to do the same; and
- The Director can authorize a change in curtailment level to the Voluntary Stage. (Alternatively the Director may authorize the Voluntary Stage as Bellevue's initial response to a shortage).

Theme of Public Messages

- Bellevue's public messaging will be consistent with Cascade's and SPU's messaging during the shortage event. The SPU's WSCP provides the following description for this stage: "Regional water demands need to be reduced by *x* percent [the level will be determined in consultation with Cascade and SPU]. Customers are responsible for determining how they will meet that goal. We are relying on support and cooperation of all water users to stretch the available water supply. If everyone cooperates we may avoid imposing more stringent restrictions. In addition to meeting essential water needs of customers, meeting the needs of fish habitat and other environmental concerns is a priority."

Bellevue Voluntary Stage Communication Actions

- Establish systematic communications with Mayor and City Council, Leadership Team, Emergency Operations Center (if appropriate), Public Information Officer, Environmental Services Commission, and City employees (Appendix B).
- Concurrent with SPU actions, prepare Declaration of Shortage Water Emergency for the City Manager to sign and public notice materials for appropriate local media.
- Prepare Mandatory Water Use Restrictions and/or Surcharges for the Director's consideration and approval.

- Request that highly visible City Departments (e.g. Utilities, Transportation, and Parks) set a public example by doing more than the minimum voluntary actions. Request curtailment plan from Parks.
- Establish systematic communication to keep Utilities staff (especially phone coverage staff), Utility Billing representatives, O&M staff, and Service First up to date on goals, conditions, and actions.
- Consult with local customer groups to target public information messages and materials, and to obtain feedback on utility actions.
- Report to Cascade regarding supply-side management actions that Bellevue will take during the Voluntary Stage.
- Establish routine timing for press releases that provide current status and outlook; present information in standardized format that becomes familiar to local media and public.
- Publish and promote Bellevue consumption graph that displays the goal and previous 24 hour consumption. Approximate the total by adding 3% to the SPU/Cascade inlet supply telemetry volumes, to account for supply from CCUD and Kirkland (which require manual meter reading).
- Promote consumption goals for typical households, and a percentage reduction goal for commercial customers.
- Support development and implementation of regional and local communications and marketing plans promoting voluntary curtailment, including paid advertising to inform customers about supply and demand conditions; recommended customer actions to reduce demand sufficiently (see appendixes). Depending on conditions, remind customers that if goals are not achieved, restrictions may be necessary.
- Include water quality information in public information so that if flushing is necessary, the public understands that it is essential for water quality maintenance.
- Identify and promote reduced evapotranspiration (ET) rate for large irrigators.
- Contact largest customers to request percentage reduction.
- Prepare list of and promote commercial car wash facilities that recycle water.
- Request that non-recirculating fountains be turned off (Appendix C).
- Request that Fire Department limit training exercises that use water.
- Request that the City, Bellevue School District, and other large fleet agencies eliminate washing fleet vehicles unless recycling car washes are used.
- Request that water washing of City sidewalks, driveways, parking lots, etc. be limited to situations that require it for public health and safety.
- Communicate regularly with Cascade regarding information that should be communicated to the public, local parks departments, large customers, landscape industry professionals and others. At the voluntary stage, this will include specific

recommendations on how customers can reduce water consumption, including links to the savingwater.org website or equivalent information resources.

- If requested by Cascade and SPU, participate on SPU's Water Shortage Advisory Group to help develop public information messages and materials and to provide input on Cascade Member actions.

Bellevue Voluntary Stage Operating Actions

- Continue actions listed in the Advisory Stage.
- Eliminate system operation water uses determined not to be essential to maintain water quality such as pipeline flushing; complete cleaning of any in-town reservoirs known to be vulnerable to warm weather taste and odor concerns.
- Increase water quality monitoring actions.
- Implement staff reassignments as needed.
- Identify the potential "next steps needed to reduce demand" including timing, what type of restrictions, and/or surcharges to be imposed.
- Initiate planning and preparation for Mandatory Stage actions, including an assessment of potential staffing impacts, training needs and communications strategies.

4.4 Mandatory Stage

If the voluntary stage does not result in the demand reduction needed, or supply conditions worsen, the Mandatory Stage would be implemented. This stage prohibits or limits certain water actions. Cascade will rely on its Members to enforce mandatory actions, using techniques as appropriate to each service area or jurisdiction.

Objectives

- Achieve targeted goals for reducing consumption, by restricting certain water uses. Goals will be determined in consultation with SPU, based on the characteristics and severity of the water shortage.
- Ensure that adequate water supply will be available for the duration of the supply shortage.
- Minimize the disruption to customers' lives and businesses while meeting target consumption goals.
- Maintain drinking water quality at acceptable levels throughout the shortage.
- Promote equity among customers in responding to the supply shortage.

Triggers

- Notice from Cascade that they have activated the Mandatory Stage of their SMP and that Bellevue is requested to do the same; and

- The Director can authorize a change in curtailment level to the Mandatory Stage. (Alternatively the Director may authorize the Mandatory Stage as Bellevue's initial response to a shortage).

Theme of Public Messages

- Bellevue's public messaging will be consistent with SPU's and Cascade's messaging during the shortage event. The 2006 SPU WSCP provides the following description for this stage: "It is necessary to impose mandatory restrictions to reduce demand because the voluntary approach has not resulted in the necessary savings [*or* conditions have continued to get worse and even more savings are needed]. We are continuing to rely on the support and cooperation of the public to comply with these restrictions, but need the certainty and predictability of restricting certain water uses in order to ensure that throughout the duration of this shortage an adequate supply of water is maintained for public health and safety."

Bellevue Mandatory Stage Communication Actions

- Continue or commence actions listed for Advisory Stage and Mandatory Stage
- Brief Mayor and City Council; Leadership Team, City Emergency Preparedness Manager, and City Public Information Officer; Environmental Services Commission; and City employees regarding water shortage status, the move into the Mandatory Stage, and water restrictions, and/or surcharges if implemented.
- Inform public about the nature and scope of the mandatory restrictions through a press conference, paid advertising and other means, including direct mail. Information will address enforcement mechanisms, rate surcharges, target consumption goals, projected duration of restrictions, and reasons for imposing restrictions, the possible consequences if targeted demand reduction goals are not met. Exemptions from restrictions, if any, will be clearly identified.
- In communicating mandatory restrictions to the public, a clear distinction will be made between lawn/turf watering and watering gardens and ornamental plantings. The type and amount of watering allowed will be clearly defined.
- Modify the "Water Shortage Hotline" as necessary to receive reports of violations of restrictions.
- Urge customers who irrigate with private wells to install signs to let the public know that private well water is being used.
- Once the Mandatory Stage has been activated by the Director, inform relevant City staff. Enforcement actions may be needed in the Mandatory Stage. Cascade expects each Member to enforce restrictions in a manner suitable to the local service area or to work with other local governments having enforcement powers to do so.
- Gather information from SPU and Cascade regarding any water quality or water pressure problems, if any, that are identified or that may possibly occur at the mandatory stage.

- Prohibit use of any ornamental fountain using drinking water for operation or make-up.
- Prohibit car washing except at commercial car wash facilities that recycle water.
- Rescind all Hydrant Use Permits.
- Prohibit washing of sidewalks, streets, decks or driveways except as necessary for public health and safety.
- Limit pressure-washing of buildings to situations that require it as part of scheduled building rehabilitation project (e.g., painting), or prohibit entirely if necessary.
- Prohibit water waste including untended hoses without shut-off nozzles, obvious leaks, and water running to waste such as gutter flooding and sprinklers or irrigation systems whose spray pattern unnecessarily and significantly hits paved areas.
- Prohibit all landscape and garden watering during the warmest hours of the day. For example: No Watering Between 10:00 a.m. and 7:00 p.m.
- Limit all landscape and garden watering to a specific number of days per week or per month. This option will depend on target consumption goals, the time of year, the extent to which watering is occurring, and how much demands have already decreased. For example, if demand has already been reduced by 15% through other measures, during July and August limiting turf watering to two days a week on a region-wide basis would further reduce average daily demand by approximately 15 million gallons. Limiting lawn or turf watering to one day a week will yield an additional average daily reduction of 15 to 20 million gallons. (These figures are based on experience during 1992.)
- Prohibit/ban lawn watering with other watering restricted. For example, no landscape or garden watering between 10:00 a.m. and 7:00 p.m. Newly installed lawns may be exempted from this ban if the procedures listed below are followed. If exemptions are granted, it is with the understanding that if supply conditions deteriorate, before moving to the Emergency Curtailment Stage, lawn watering will be banned and exemptions will be rescinded.

Bellevue Mandatory Stage Operating Actions

- Continue operating actions from the Voluntary Stage, and:
- Initiate planning and preparation for Emergency Stage actions, including an assessment of potential staffing impacts, training needs, and communications strategies.
- If appropriate implement procedures for exemptions from restrictions and/or emergency surcharges.
- Implement Enforcement Procedures for Mandatory Water Use Restrictions, including highly visible "Water Watchers".

- If necessary the Director will consider enforcement actions against any customers who do not comply with Mandatory Stage actions, as appropriate per applicable City Codes and policies.

4.5 Emergency Stage

At this stage Cascade and its Members recognize that a critical water situation exists and that, without additional significant curtailment actions a shortage of water for public health and safety is imminent. This would be used as the last stage of a progressive drought or similar situation, or to address an immediate crisis such as a disruption to water sources, treatment or transmission facilities. This type of situation has never occurred in regional history, but could occur during a very severe drought or under emergency conditions such as a major earthquake that ruptures transmission pipelines.

Objectives

- Strive to meet the water use goals established for this stage, recognizing that customers' lives and businesses may be significantly impacted in order to achieve necessary water savings. Goals will be determined in consultation with Cascade, based on the characteristics and severity of the water shortage.
- Promote equity among customers in responding to the supply shortage.

Triggers

- Notice from Cascade that they have activated the Emergency Stage of their SMP and that Bellevue is requested to do the same; and
- If Cascade's SMP has already been activated, action by the Director can authorize a change in curtailment level to the Emergency Stage. (Alternatively the Director may authorize the Emergency Stage as Bellevue's initial response to a shortage; or may authorize the Emergency Stage if there is an emergency that requires immediate action to prevent risks to public health and safety. See Section 3.1.).

Theme of Public Messages

- Bellevue's public messaging will be consistent with SPU's and Cascade's messaging during the shortage event. The 2006 SPU WSCP provides the following description for this stage: "We are in an emergency water supply situation and need the immediate assistance of the public to achieve necessary water savings. We are imposing additional water restrictions to achieve the savings because the mandatory approach has not resulted in sufficient savings [*or* conditions have continued to get worse], and we need to ensure water will be available for public health and safety throughout this shortage."

Bellevue Emergency Stage Communication Actions

- Continue all previous, applicable actions.
- Brief Mayor and City Council; Leadership Team, Emergency Operations Center, Public Information Officers, Environmental Services Commission; and, City

employees regarding water shortage status, the move into the Emergency Curtailment Stage, and water restrictions, prohibitions, and surcharges.

- If not done previously, and, if applicable, concurrent with SPU actions, prepare Declaration of Water Shortage Emergency for the City Manager to sign and public notice materials for appropriate local media.
- Prepare Emergency Curtailment Water Use Restrictions, Prohibitions, and Surcharge legislation for Council consideration and approval.
- Inform customers of the rate surcharge and how it will affect them. Provide information on an appeal process.
- Coordinate with Emergency Operations Center for appropriate implementation of the EOC and City Emergency Response Plan.
- Through EOC, coordinate with Police, Fire, and other City departments for assistance in enforcing prohibition of water waste and other response activities as determined.
- Inform customers that taste and odor water quality problems may occur with system-wide reduced water consumption.
- Inform customers about possible pressure reductions and problems this may entail.
- Define and communicate exemptions for medical facilities and other public health situations.
- Prohibit all lawn and turf irrigation. Lawn Watering and Irrigation System Exemptions previously issued are repealed.
- If feasible make reclaimed water available to tanker trucks for street cleaning, construction projects, landscape irrigation, dust control, etc.
- Require that all fire fighting agencies discontinue the use of water in training exercises until emergency is over.
- Require local parks departments to close down any outdoor pools.
- Once the Emergency Stage has been activated by the Director, inform relevant City staff. Enforcement actions may be needed in the Emergency Stage. Cascade anticipates each Member will enforce restrictions in a manner suitable to the local service area or will work with other local governments having enforcement powers to do so.
- Continue and intensify communication actions from the Mandatory Stage, with modifications as appropriate for the Emergency Stage (as determined in consultation with SPU and Cascade).

Bellevue Emergency Stage Operating Actions

- Continue and/or enhance all appropriate actions listed in prior stages.
- Continue and enhance "Water Watcher" patrols.

- Curtail fire line testing unless it can be shown to be essential to protect the immediate public health and safety.
- Coordinate with SPU to further enhance water quality monitoring actions.
- Continue to monitor staffing impacts, training needs and communications strategies and make adjustments where feasible to enhance effectiveness of the regional water shortage response.
- If volunteer services are available and deemed valuable to the water shortage response, and if desired by the City, Cascade will coordinate volunteers on behalf of its the City.
- If necessary the Director will consider enforcement actions against any customers who do not comply with Emergency Stage actions, as appropriate per applicable City Codes and policies.

5.0 Communications During Water Shortages

In the event of a water shortage that requires this SMP to be activated, Bellevue will coordinate closely with Cascade and SPU regarding public communications. It is anticipated that SPU will take the lead on communications involving regional media such as major radio, television and newspaper outlets. Bellevue will have the primary responsibility for communicating directly with their own customers and local communities. Cascade will coordinate communications among Bellevue and SPU and will help Bellevue to issue consistent and effective communications.

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Appendix A

Cascade Interlocal Contract Section 7.3
(Shortages and Emergencies)

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Section 7.3 Shortages and Emergency.

Section 7.3.1 Shortages. Members must respond to water shortages in a collective, shared fashion under a Cascade shortage management plan adopted by the Board. Resources must be shared in a manner that reduces the risk of severe shortages to each Member. Cascade's shortage management plan may include without limitation, a definition and classification of shortages, a shortage contingency plan including mandatory programmatic actions among all Members in the event of shortages, allocation of authority for determining and responding to shortages, and a communications and outreach program for the public. Members shall not be required to implement Cascade's shortage management plan in areas not served by the Supply System.

In the event of shortages, Cascade shall reduce or halt Interruptible Supply before invoking the Shortage Management Plan with respect to all Members with a Full Supply Commitment. However, the Board may, by 65% Dual Majority Vote, continue service in the amounts it deems appropriate to one or more Members receiving Interruptible Supply.

The Board may require that Members failing to comply with mandatory shortage management programs implemented under Cascade's shortage management plan assume a disproportionate reduction in supply or pay penalty charges, or both.

In the event of a Cascade-wide water shortage, members with Independent Supply may, without penalty decline to participate in the shortage management program for that shortage by foregoing all supply from Cascade for the duration of the emergency or shortage.

To avoid shortages resulting from emergencies or the inability to develop sufficient supplies, the Board may, by 65% Dual Majority Vote, establish moratoria on connections or additional commitments for future water services by the Members. A moratorium may be discontinued by a Dual Majority Vote of the Board.

Section 7.3.2 Emergency. The Board shall include in Cascade's shortage management plan policies and procedures for addressing short-term disruptions of water supply, transmission or water quality, and it may delegate to the General Manager authority to address such disruptions according to such policies and procedures.

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Appendix B

Actions that Can Reduce Water Usage by Distribution Systems and Customers

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POSSIBLE ADVISORY STAGE WATER CONSERVATION TIPS FOR CUSTOMERS (Adapted from SPU 2006 WSCP)

Conserve Inside

For most households, the vast majority of water is used indoors. Taking conservation actions and installing efficient fixtures help reduce your water use year-round. There are also ways to conserve water in outdoor uses and at work. Below are suggested actions:

- Fix leaking faucets and toilets.
- Wash only full loads in the dishwasher and clothes washer.
- Minimize faucet use when brushing your teeth, shaving and washing dishes.
- Don't pre-rinse dishes unless you need to. Most new dishwashers don't require pre-rinsing.
- Save lukewarm water for watering plants, etc. while you wait for hot water in kitchens and showers.
- If you are buying a new toilet, look for a WaterSense model.
- If you are buying a new washing machine, purchase a high-efficiency model. WashWise rebates may be available for qualified machines.

Conserve Outside

Make the most of the water you will use in the spring and summer:

- Aerate lawns in the spring to better absorb water.
- Mulch planting beds to decrease evaporation.
- Select the right plants for the right place – contact SPU or see our website for information.
- Tune-up and improve your irrigation system – rebates may be available.
- Wash your cars at locations that recycle their water.

Note: For more information on home water conservation tips for inside and out, visit www.savingwater.org or call 684-7283 (684-SAVE)

Conserve at Work

Businesses and institutions can reduce water use and lower utility costs by adopting conservation practices and replacing inefficient equipment or operations.

- Check for leaks.
- Use a broom, instead of a hose, to routinely clean driveways and sidewalks
- Turn off water-using equipment when not in use, including dishwashers, garbage disposals, and food troughs.
- Upgrade equipment efficiency – rebates may be available.
- Increase employee awareness of water conservation.

POSSIBLE VOLUNTARY STAGE CUSTOMER WATER SAVING ACTIONS (Adapted from SPU 2006 WSCP)

The following voluntary actions are being requested of all customers:

SET A GOAL: Such as use 10% less water
Most customers can easily save 10% by choosing several items from the menu of water saving actions below. If you routinely do outdoor watering, select those actions first. Set a goal to reduce your water use by 10% from the amount you used during the same billing period last year. Most utility bills contain your water consumption for each billing period. Much of the 10% can probably be achieved through conservation actions that are wise to do all the time. If that is not sufficient, then the special curtailment actions listed here can be implemented during the duration of the supply problem.

REDUCE OUTDOOR WATER USE

<u>Conservation Actions:</u>
- Avoid **watering** between 10 AM and 7 PM to reduce evaporation.
- **Stop obvious water waste** such as gutter flooding, sidewalk and street watering, and fix leaks.
- **Never leave a hose running,** always use a shut-off nozzle.
- **Use a broom** rather than a hose or pressure washer to clean sidewalks and driveways.

<u>Curtailment Actions:</u>
- **Reduce lawn watering** (twice a week or less if possible).
- **Water lawns and gardens only early in the morning** or late in the evening to reduce evaporation.
- **When it rains,** do not water lawns.
- **Let your lawn go dormant**. Customers who choose to not water their lawns should water deeply once each rainless month to keep grass roots alive. To avoid runoff when you water, if the water puddles, cycle your sprinkler on and off until water is absorbed.
- **If you have an automatic irrigation system have it audited** to ensure that it is using water efficiently. Learn how to change the program that controls the system in order to cut back on irrigation time. Equip it with a rain sensor that will override the system during rainfall.
- **Refrain from filling** empty pools and hot tubs.
- **Eliminate outdoor water play,** i.e. running through the sprinkler, plastic water slides, wading/swimming pools
- **Eliminate all cleaning and hosing** of sidewalks, driveways, decks.
- **Water established plants only when necessary:** Probe into the soil to see if the root zone is dry. Mulch--from two to four inches--in planting beds will help retain moisture.
- **Turn off water features** and fountains.
- **Wash vehicles less often, and only at car washes that recycle their water.**

REDUCE INDOOR WATER USE

<u>Conservation Actions:</u>
- **Install a water efficient WaterSense toilet.** These toilets have proven to perform well and give long-term water savings. Replacing a frequently used old toilet with a new efficient toilet can save most households in utility bills. Check www.savingwater.org for WaterSense toilet models.

- **Install a high-efficiency clothes washer**. New washers are typically one-third more water efficient than old washers.
- **Wash only full loads in the clothes washer and dishwasher,** or choose an appropriate load-size setting for the number of items in the washer.
- **Turn off the tap** while brushing your teeth, hand-washing dishes or shaving. when washing vegetables, use a pan or bowl of water instead of letting water run.
- **Keep drinking water cold in the refrigerator** rather than running the faucet until the water's cold.
- Catch water while waiting for hot water for use on plants.
- **Fix leaky faucets and toilets**. Put several drops of food coloring in your toilet tank. After 20 minutes, if you have color in the bowl, you have a slow leak that over time can amount to a lot of water.
- **Install an efficient showerhead.** New showerheads work well and use much less water than old high-flow models.
- **Install an efficient faucet aerator.** Replace your older bathroom faucet nozzle (aerator) with one that uses one gallon per minute or less.

Curtailment Actions:

- **Spend one minute less in the shower.** Try to limit showers to five minutes or less.
- **Flush your toilet less often.** Toilet flushing is the largest water use inside the home. As the saying goes, "If it's yellow, let it mellow."

REDUCE WATER USE AT WORK

There are a wide variety of opportunities for businesses and agencies to reduce their water use and operating expenses.

Conservation Actions:

- **Check cooling towers.** Cooling towers - and the ways that they regulate water use – represent real opportunities for improving water efficiency.
- **Check for and fix leaks.** Faucet, toilet and urinal leaks are very common. Investigate obvious or suspected leaks.
- **Use a broom,** instead of a hose or pressure washer, to routinely clean driveways and sidewalks.
- **Turn off water-using equipment** when not in use, including open hoses, dishwashers, garbage disposals, and food troughs.
- **Check air conditioners, refrigerators, and ice machines.** If your company's air conditioners or refrigerators use water-cooled condensers, investigate air-cooled equipment for possible efficiencies. Rebates are available. Visit **www.savingwater.org.**
- **Ensure that all hoses are fitted with shut-off nozzles**.
- **Eliminate hosing of used ice** as a means to dispose of it.
- **Eliminate hosing of walkways, parking lots, loading docks**. Pressure washers use less water.
- **Postpone building washing or cleaning** until after shortage
- **Install water-efficient toilets, urinals and faucets** in public and employee restrooms. Replacing old toilets, urinals, and faucet aerators with efficient ones can produce substantial savings. Rebates are available. Visit **www.savingwater.org.**
- **Reuse process water.** Water used in industrial and manufacturing processes should be reused as often as possible. Rebates are available. Visit **www.savingwater.org.**
- Hospitality businesses can offer guests the **option to decline clean linens each day**.
- Restaurants can **provide water only on request**.
- **Increase employee awareness of water conservation** through management memos or newsletter messages. Install signs that encourage water conservation in restrooms or work areas where water

is used, and encourage employees to report leaks. For additional work-related conservation tips, call (206) 343-8505**.**

- **Post signs informing customers** of the nature of the water shortage and ask for cooperation in reducing water use.

<u>Curtailment Actions:</u>

- **Reduce outdoor watering** (twice a week or less if possible). Rebates are available for smart irrigation technologies. Visit **www.savingwater.org.**
- **Reduce or eliminate vehicle washing**, Use only a commercial car wash facility that recycles water.
- **Turn off** decorative water fountains.
- **Serve water only on request** at restaurants. Avoid thawing with running water.

For home water conservation tips, visit www.savingwater.org
or call (206) 684-7283 (684-SAVE)

Appendix C

Mandatory Stage Enforcement Procedures

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Mandatory Stage Enforcement Procedures

_____Determine number of warnings before fines applied;

_____Self-duplicating "Notice of Violation" forms printed; one copy to leave at property, one to record violation with BUD.

_____Staff with customer service and communication experience assigned to "Water Watch"

_____Establish procedure for "Water Watchers" to record warnings and penalties on customer accounts

_____Establish "hotline" for customers to complain about violations; to help avoid frivolous complaints, recorded message should note that only complaints with name and address recorded can be responded to

____ Vehicles for "Water Watch" made available; vehicles that are signed as "Water Watchers" will increase visibility and effectiveness of enforcement

_____High priority routes established, e.g., areas with large lawns

_____All field and customer service staff provided "fact sheets", Question and Answer sheets; briefed on restrictions, enforcement procedures; field staff trained on tagging obvious violations

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Appendix D

Curtailment Measures Potential Demand Reductions

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Curtailment Measures Potential Demand Reductions

Major Uses	Total Use MGD May 15-Sep 15	Curtailment Savings MGD Low	Curtailment Savings MGD High	Share of Curtailment Savings Percent Share Residential	Share of Curtailment Savings Percent Share Commercial	Measures
Toilet	31	1.9	3.9	65%	35%	1 Less flush (25-50% compliance
Irrigation	27	18.9	24.3	84%	16%	Irrigation ban (75-95% compliance, new landscapes exempt)
Other House Hold Use	22	1.1	2.2	84%	16%	Use less, don't let it run (25-50% compliance)
Shower	18	1.8	3.6	100%	0%	5 minute max (25-50% compliance)
Water System Use	18	1.8	3.6	0%	100%	Only crucial health and safety needs (100% compliance)
Clothes Washing	16	0.8	1.6	100%	0%	Eliminate partial loads (25-50% compliance)
Cooling	11	0.6	1.1	0%	100%	Raise the thermostat (25-50% compliance)
Process	10	0.5	1	0%	100%	Cut non-essential use (25-50% compliance)
Other	6	0.3	0.6	0%	100%	Cut non-essential use (25-50% compliance)
Leaks	6	0.3	0.6	91%	9%	Fix the leaks (5-10% compliance)
Dishwashing	5	0.3	0.5	100%	0%	Eliminate partial loads (25-50% compliance)
Recreation	5	0.6	1.3	78%	22%	Don't let it run (25-50% compliance)
Food Service	5	0.3	0.5	0%	100%	Cut non-essential use (25-50% compliance)
TOTAL	**180**	**29.2**	**44.8**	**68%**	**32%**	

Outside Water Use Breakdown (Included in categories above)

Home Car Washing	1	0.2	0.4	100%	0%	Go to recycled car washes (25-50% compliance)
Hydrant Permits	1	0.4	0.8	0%	100%	Only crucial health and safety needs
Lawn Watering	20	14	18	86%	14%	Lawn watering ban
Lawn Watering-Time Limited Restriction	20	7	12	86%	14%	Water no more than 1 hour/week (50-90% compliance)
All Watering	27	18.9	24.3	84%	16%	All watering ban
All Watering-Time Limit Restriction	27	9.5	16.2	84%	16%	Water no more than 1 hour/week (50-90% compliance)
All Outdoor Use	31	21.7	27.9	89%	11%	All outdoor use ban (Health and safety exemempt)
Nonresidential Irrigation	4	0.5	1	0%	100%	Water to 50% of ET" (25-50% compliance)

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Appendix E

Exemptions from Water Use Restrictions

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Exemptions from Water Use Restrictions

- **Lawn watering exemption -** Newly installed lawns ***may*** be exempted from restrictions if the procedures listed below are followed. Customers wishing to use this exemption need to contact BU as directed in advance of the exemption being granted, and provide their name, address, phone number, size of lawn and type of watering system. This information will be used to quantify the amount of water allowed under this exemption and to spot check for compliance. The procedures and requirements to obtain a New Lawn Watering Exemption (subject to change) are:
- Upon request, applicant will be provided a packet that includes the New Lawn Watering Exemption requirements and the required application and certification forms for the exemption.
- New lawn owner must apply to BU for a New Lawn Watering Restriction Exemption. The Exemption Application Form shall be provided by BU, and the applicant shall include the following information in making application for the exemption:
  - Property owner's name, address, and phone number.
  - Name, address, and phone number of local contact if different than property owner.
  - Address of property the exemption is being requested for.
  - Drawing of the turf area the exemption is being requested for that shows the turf shape, and that provides the *actual square footage* and *approximate dimensions* of the turf area.
  - Form Certification signed by the property owner certifying that: a) the exemption is being requested for a new lawn as defined below; and b) required signage provided by BU will be prominently displayed at all times; and c) that the soil was properly prepared as described below; and d) that watering guidelines provided by BU will be followed; and e) that the City and BU will be held harmless in the event the exemption is rescinded as discussed below.
- After BU verifies that applicant meets requirements, an authorization packet will be mailed to the customer, including a sign to be visibly posted indicating that BU Exemption Requirements are being complied with.
- New lawns must be properly installed, meaning that at a minimum two inches of organic soil amendment, such as composted yard waste, is cultivated into the top six inches of existing soil.
- New lawns must be watered according to guidelines provided by BU in the packet mentioned above.
- For purposes of this exemption, ***"new lawn"*** shall be defined as seeded or sod lawns installed according to the requirements outlined in the Water Shortage Contingency Plan after October 1st of the previous calendar year. Overseeding an existing established lawn does not qualify as a new lawn.

- In the event that supply conditions deteriorate, before moving to the Emergency Curtailment Stage, lawn watering will be banned and exemptions will be rescinded. It will also be revoked on a case by case basis if the exemption requirements are violated by the customer granted the exemption or in the case of a water system emergency. Monitoring and enforcement are at the discretion of BU.

If exemptions are granted, it is with the understanding that if

- Customer will agree to hold BU harmless for any and all loss resulting from rescinding of the Restriction Exemption for any reason.
- The existence of an exemption to a lawn watering ban would be announced as early in the water shortage response process as practical.

Automatic irrigation system exemption - Users of automatic irrigation systems ***may*** be exempt from certain mandatory watering restrictions if specific requirements are met and followed – but not from a total watering ban. This exemption allows an alternate path to achieving equivalent water use reductions due to the precision that automatic irrigation systems can achieve. This exemption shall not be used as a loophole to avoid water use curtailment. ***Example:*** If only 30 minutes of lawn watering is allowed per week, automatic irrigation systems that meet specified criteria would be allowed to water based on a determined percentage of evapotranspiration (ET), such as 50%, instead of the time-limit based restriction. [Note: ET is a factor calculated according to climatic data, which is commonly used for lawn watering in commercial applications. ET data would be made available on the SPU web page and/or from BU and in alternate formats.] In the event of a total watering ban, these users would also be prohibited from watering (unless safety-base exemption is met)

The procedures and requirements to obtain an Automatic Irrigation System Exemption (subject to change) are:

- Upon request, applicant will be mailed a packet that includes the exemption requirements and the required application and certification forms for the Automatic Irrigation System exemption. Required information includes:
  - Irrigation system owner must apply to BU for Automatic Irrigation System Exemption. The Exemption Application Form shall be provided by BU, and the applicant shall include the following in making application for the exemption:
  - Name, address, and phone number of the property owner.
  - Address of property exemption is being requested for, and the name, address, and phone number of local contact responsible for operation of the irrigation system the exemption is being requested for.

- ➢ Certification that irrigation system has been audited, and is:

  (a) Hydro-zoned (separate zones for turf and planter areas).

  (b) At least 62.5% efficient as defined by the Irrigation Association, including both system distribution uniformity and management practices.

  (c) System efficiency rating must result from an actual audit of the system performed and certified by an Irrigation Association Certified Irrigation System Auditor. The Auditor’s name, address, and phone number must also be provided.

  (d) Equipped with a functioning rain shut-off device.

  (e) Audit was conducted within 12 months prior to the request for the exemption.

A list of Irrigation Association certified Irrigation System Auditors will be maintained and available from BU and/or SPU. Certification form to be used shall be provided by BU.

- ➢ A ***Baseline Irrigation Schedule*** for the landscape based upon historical ET and hydrozones water needs must be provided to BU and the local system operator. This schedule will be used to monitor conformance with Exemption Requirements. Schedule form to be used shall be provided by BU.
- ➢ Irrigation system owner and operator must agree to adjust ***Baseline Irrigation Schedule*** for the system on a weekly basis according to current ET data. Watering limitations stipulated by BU would need to be followed. The limitations would be stated as a percent of ET. For example, users who meet the above requirements would be able to water based on 50% of ET (specific percent amount decided at the time the restriction is announced depending on the supply outlook). The SPU website (www.ci.seattle.wa.us/util/rescons/conserve.htm) and the City of Bellevue’s government television station (BTV Channel 55) would be regularly updated to provide the information needed for those watering according to this exemption. The information would be available through other means as well.

- Time of day restrictions, such as watering between 10:00 a.m. and 7:00 p.m. must be followed.
- In the event that supply conditions deteriorate, before moving to the Emergency Curtailment Stage, lawn watering will be banned and exemptions will be rescinded. It would also be revoked on a case by case basis if the rules stated above are violated by the customer granted the exemption, or in the case of a water system emergency. Monitoring and enforcement are at the discretion of BU. Customer will agree to hold

BU harmless for any and all loss resulting from rescinding of the Restriction Exemption for any reason.

Other exemptions - For purposes of dust control, water may be applied to construction areas or other areas needing to comply with air quality requirements. If available and feasible, reclaimed water will be promoted or required for dust control in-lieu of the public water supply.

Ballfields and playfields may be watered at the minimum rate necessary for dust control and safety purposes.

BU will exempt customers with special medical needs, such as home dialysis, from any emergency surcharge, provided individual customers notify the utility of such a need.

Appendix S

Standard Operating Procedures

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Appendix S
Standard Operating Procedures

The City of Bellevue Utilities Department maintains over 240 Standard Operating Procedures (SOPs). This appendix includes only the following that are reference in the Water System Plan:

- Drinking Water Quality Complaints and Informational Calls
- Emergency Water Supply System (Blivet) Operations, Set-up Maintenance and Training
- Fire Hydrant Survey
- Flushing (Zone)
- Flushing Potable Water Dechlorination
- Meter Reading
- Pump and Reservoir Run
- Valve Survey
- Water Main Break Response
- Water Meter Installations

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Utilities Department Standard Operating Procedure

City of Bellevue, WA

Title:

Drinking Water Quality Complaints and Informational Calls

Responsible Division:
O&M

Point of Contact:
Water Quality Supervisor

Category:
Operations

Frequency:
As Needed

Applicable Accreditation Chapter:

Approved Date:

Last Review:
5/1/2006

Next Review:
7/15/2014

Applicable Divisions (Click all that apply):

☐ Entire Department ☐ Director's Office ☐ Engineering ☐ O&M ☐ RMCS

Applicable Sections (Skip this section if SOP is applicable to entire department):

O&M Sections (Click all that apply):

☐ Administration
☐ Streets
☐ Telemetry
☐ Water
☐ Water Quality
☐ Emergency Operations
☐ Surface Water
☐ Projects and Programs
☐ Wastewater

Purpose:

This SOP establishes proper procedures for responding to drinking water quality complaints originating within Bellevue Utilities direct water service area.

Procedures:

Drinking water quality complaints are taken directly by the Senior Engineering Technician (SET) in Water Quality.

They are forwarded to the SET by administrative staff. All calls are to be reported to the WQ SET for documentation.

Examples of the types of drinking water quality complaints and their possible causes are included in the resources section at the end of this document.

When a drinking water quality complaint/informational call is received, attempt to get the nature of the call, the name, telephone number and address of the caller. If need be, take a message from the caller for the SET to get back to them. <u>The goal is to resolve all drinking water quality complaint/informational calls by the close of business on the day the call was received.</u>

Try to identify the nature of the complaint/informational call by allowing the caller to describe the situation or issue. The SET will attempt to resolve the call immediately if the information available to them. If need be, tell the customer they will get back with them.

Check the map grids for the possibility of a dead end watermain and the location of the caller.

If it's a complaint that may be related to O&M (ex: discolored water), call radio dispatch or the O&M Crewleaders to see if BUD has any work in the area. Also, the daily route sheets are a good source of information.

<u>If the customer is describing a potential cross connection/backflow incident, page the SET for a field response immediately.</u>

Once the complaint/informational call is resolved, enter the data into the "Customer Comment" MSAccess database to allow for tracking of drinking water quality complaint/informational call's received.

<u>Resources and Possible Causes:</u>

Yellow, Orange or Reddish Brown Water

This problem is sometimes seen in both the hot and cold water taps first thing in the morning or after being gone most of the day. It is also seen at seldom-used faucets. The water should clear after flushing the faucet for a moment or two. The cause is probably galvanized iron plumbing in the home or business. It does not indicate that the plumbing is about to fail or that it needs to be replaced, unless there is also a significant reduction in water pressure.

If this is only occurring in the hot water, flushing the hot water tank may help by clearing out the sediment in the bottom of the tank. Hot water increases the rate of corrosion in plumbing. You may want to consult a plumber for safety precautions.

If the discoloration is sudden, not fitting the above categories, there may be some activity that has disturbed the direction or rate of flow in the water main, such as use of a fire hydrant or a main shutdown. This should clear on its own. You can try running the water for a few minutes to see if it is clearing or still discolored. If the water does not clear, let the water sit for an hour and then run the water for a few minutes and flush the toilet a couple of times.

Brown or Black Muddy Water
If this happens suddenly it is usually due to some activity involving a fire hydrant or the main itself. The Fire Department might be checking the fire hydrant or someone may be filling a tanker truck or clearing out the storm drains. These will usually clear up without further action when the water settles in the main, unless the home is located on a dead-end line where the sediment may collect. If it doesn't clear after a few minutes of flushing (flush cold water taps only), shut off the faucet and wait an hour before flushing the faucets and the toilets again.
It is not recommended to run the hot water if the cold water is still discolored. This will minimize filling the hot water tank with turbid water. If the customer is washing clothes at the time, it is better to stop the cycle while it is full and wait until clean water is available to finish. If you allow the water to empty from the washing machine and go into the spin cycle it is more likely to cause permanent staining to clothing or linens.

Uncolored Cloudy
Cloudy water is usually caused by tiny air bubbles in the water similar to gas bubbles in beer and pop. This cloudiness occurs more often in the winter when the drinking water is cold. Cloudiness can also be the result of fine silt that is stirred up from operations of hydrants or flow reversals.

If you notice cloudy water, fill a clean, clear glass with water from the cold tap and let it sit on the counter. If the water starts to clear from the bottom of the glass first, it is caused by air in the lines. This is probably due to air bubbles either from dissolved oxygen being released or trapped air in the plumbing. It is common since our water comes from the mountains supersaturated with oxygen. If you are also noticing spitting from the faucet and have had recent plumbing work, it is probably the air trapped when the water refilled the empty plumbing. This should clear as the water is used. If others in the neighborhood have a similar problem, especially where BUD has been working on the main, the problem may be the result of air trapped in a main or fine silt stirred up.

Foaming/Cloudy Water

Foaming water, especially from kitchen sinks, can be caused by dish detergent being splashed on the faucet. If your water is foaming, shake up a glass of water to form a layer of bubbles. Does the layer last when you stop shaking? Does it smell like soap? Is this coming from more than one tap? If only one tap is affected (usually the kitchen faucet with an aerator), dish washing detergent may have been splashed onto the faucet. This can be rinsed off and the problem should clear up. If it is from all the faucets, it's possible a cross connection exists. Ask the customer to save some of the water to show to the inspector, and refrain from drinking or cooking with the water until it is checked out.

Pink, Pinkish-Orange or Black Rings
These may form around sink fixtures, drains, dog bowls and other standing containers of water and at the waterline of toilets. They are usually easily removed with cleaning and consist of a mixed culture of yeast, mold and bacteria that grows well in moist conditions with few nutrients other than dust that falls out of the air, saliva from animals, or soap or toothpaste residue. You may just need to clean more often, especially in the summer when humidity and warmer temperatures increase microbial growth rates.

Orange Staining
Orange stains on fixtures that are harder to remove are usually due to galvanized plumbing. Fixing the leaking faucet or more frequent cleaning should help the problem. Worn surfaces on old tubs and sinks require a lot of elbow grease to clean. There are rust remover compounds on the market, but care is needed to prevent damage to the finish of porcelain fixtures.

Gray Sediment
Gray sediment, especially from the hot water tap, may be coming from the hot water tank which can be overheating. You may want to call a plumber if it continues. If the sediment consists of visible particles from the cold water tap and you have recently installed or replaced an in-line water filter, the material may be charcoal from the filter.

White chalky chunks
This is indicative of the dip tube in a hot water tank going bad. It needs to be replaced or serviced

Hot Water from Cold Water Faucet
This is a serious concern. If your water stays hot after flushing the cold tap a few minutes, turn off source of power to the hot water heater and call a service repair representative for your brand of hot water tank. If you don’t have a properly installed pressure relief valve, the pressure can build in the tank and launch it like a rocket. It is a potential threat to life and property and shouldn’t be ignored. Most recent hot water tank installations and replacements have included the provision of relief valves.

Earthy or Musty Taste and/or Odor
Algae blooms in our storage reservoirs can be a source of earthy tastes in the water. Flushing the tap may reduce the problem, but may not clear it completely.

The best way to reduce the earthy or stale taste and odor is to flush the faucet for several minutes or until color and turbidity disappears. Then collect this freshened water into a clean container suitable for beverages, cap it, and store it in the refrigerator for future drinking and cooking purposes. A few drops of lemon juice or a slice of lemon can also help improve the taste. If the taste and odor is still present, you may want to consider a home filter.

Filter-Clogging
Filter clogging is more common in the spring and fall. Diatoms are the most prevalent form of algae in our water system and can very quickly clog filters during an algae bloom. You may notice that you have to change the filters more often and that they appear to be covered with clay or plaster. There is currently no known health risk due to the algae.

To alleviate the filter-clogging problem, an inexpensive prefilter can be installed. The prefilter could then be removed, cleaned with a brush or just replaced with a new one. This technique will protect the more expensive cartridge filters and prolong their life.

Lead
Seattle and Bellevue's drinking water sources do not contain lead. **Lead, however, can be leached into water by home plumbing systems** built with lead-based solder, brass fixtures, or some types of zinc coatings used on galvanized pipes and fittings.

Is your home high risk? The City of Seattle banned the use of lead solder in 1980, and King County banned it in 1985. Residential homes built or replumbed with copper pipe and tin-lead solder just prior to the 1980 or 1985 bans (depending on where you live) have been classified as "High Risk" by the EPA for elevated lead levels. Homes plumbed with copper after these bans should have been plumbed with tin-antimony (instead of tin-lead) solder. Many of the homes in King County built prior to about 1948 have galvanized plumbing. Between 1948 and 1955 both galvanized iron and copper piping were frequently used. After 1955, and prior to the 1980/1985 bans, copper piping was most commonly used. The majority of homes, however, have some risk of lead contamination in water that sits in pipes for longer than 2 hours.

During 1992 and 1997, regional lead and copper monitoring was conducted by Seattle Public Utilities and wholesale water systems which purchase their water from Seattle. Between us, we located almost 400 volunteer residences that met the EPA "high risk" criteria, and asked these customers to sample their tap water at worst case conditions (after their water had stood in their plumbing for at least six hours). About 14% of the residences tested had lead levels which exceeded the EPA lead action level of 15 parts per billion (ppb) in the first liter of water that had been standing in the pipes. An additional sample was taken after the faucet was run for 3 minutes. In 95% of these flushed water samples, the lead level was less than 2 parts per billion, the detection limit.

What is Seattle Public Utilities doing to lower your exposure to lead? To reduce the corrosiveness of the water to home plumbing materials, SPU adds minerals (lime and soda ash) to the water. We expect the new Tolt Treatment Facility to reduce the corrosiveness of the water further by removing organics and increasing the pH and alkalinity. We expect to meet the lead action level in the future once these improvements are in place.

What can you do to reduce your exposure to lead? There are also a few simple steps you can take in the home to reduce the risk of lead in your drinking water:

If water has been standing in pipes for over 2 hours, flush out the pipes by running the tap until you feel a temperature change before using for drinking or cooking (remember to conserve -- collect the water and use it for other purposes like watering plants or doing dishes);

Always draw drinking and cooking water from COLD water tap; lead dissolves more quickly in hot water;

Never make baby formula or other drinks or food for children with HOT water tap. Start with water taken from the cold water faucet (after flushing) and warm it if necessary;

If you are making plumbing changes, select low-lead or no-lead fixtures.

Where can you have your home drinking water tested? AmTest Labs in Redmond is the nearest state certified lab for lead testing. You can also call (206) 684-7801 for a recorded list.

Definitions:

- **ammonia** A chemical that can be used with chlorine to disinfect water. Not currently used by SPU.
- **aquifer** An underground geologic formation capable of storing water. SPU uses an aquifer know as Highline wellfield to supplement summer demands when necessary.
- **bacteria** Single-celled microorganisms that have the potential to cause disease in humans.
- **chloramination** Treating drinking water by applying chlorine before or after applying ammonia. Not currently used by SPU.
- **chlorine** A chemical which destroys small organisms in water. Currently

SPU's primary disinfectant.

- **chloroform** A volatile organic compound. One of the four compounds constituting trihalomethanes. See disinfection by products.
- **coliform** A group of bacteria commonly found in the environment. They are an indicator of potential contamination of water. Adequate and appropriate disinfection effectively destroys coliform bacteria.
- **contaminant** Any natural or man-made physical, chemical, biological, or radiological substance or matter in water, which is at a level that may have an adverse effect on public health, and which is known or anticipated to occur in public water systems.
- ***Cryptosporidium*** A disease-causing parasite, resistant to chlorine disinfection.
- **disinfection by products (DBPs)** A group of chemicals that can form in drinking water when chlorine or other disinfectant reacts with the naturally occurring organic matter. Examples of DBPs are Haloacetic Acids and Trihalomethanes.
- **distribution System** The network of pipes, pumps, and storage facilities used to deliver drinking water the residential and business customers.
- **E. coli** *Escherichia coli* is a bacterium commonly found in the human intestine. For water quality analyses purposes, it is considered an indicator organism. These are considered evidence of water contamination. Indicator organisms may be accompanied by pathogens, but do not necessarily cause disease themselves.
- **enterovirus** A virus whose presence may indicate contaminated water; a virus which may infect the gastrointestinal tract of humans.
- **fecal coliform** A group of bacteria that may indicate the presence of human or animal fecal matter in water.
- **filtration** A series of processes that physically removes particles from water. SPU is constructed a [filtration and ozonation facility on our Tolt River supply] , which came on-line in December 2000.
- **finished water** Treated drinking water that meets state and federal drinking water regulations.
- ***Giardia lamblia*** A microscopic protozoan which, when ingested, can cause giardiasis.
- **giardiasis** A gastro-intestinal disease manifested by diarrhea, fatigue, and cramps.
- **headworks** The facility at the "head" of the water source where water is first treated and routed into the distribution system.
- **Haloacetic Acids (HAAs)** A group of disinfection by products. The major haloacetic acids are: mono-, di-, and trihaloacetic acids, and mono- and dibromoacetic acids.
- **hardness** The sum of polyvalent cations present in water, expressed as an equivalent quantity of calcium carbonate (CaCO3). The most common such cations are calcium and magnesium.
- **heterotrophic plate count bacteria** A broad group of bacteria

including nonpathogens, pathogens, and opportunistic pathogens; they may be an indicator of poor general biological quality of drinking water.

- **maximum contaminant level (MCL)** The highest level of a contaminant that is allowed in drinking water by federal or state regulations. If the MCL is exceeded, the water system must treat the water so that it meets the MCL.
- **maximum contaminant level goal (MCLG)** The level of a contaminant in drinking water below which there is no know or expected risk to human health.
- **microbe, microbial** Any minute, simple, single-celled form of life, especially one that causes disease.
- **mg/L, milligrams per liter**. 1 mg/L is equal to 1000 micrograms per liter (*u*g/L). For aqueous (water) samples 1 mg/L is equal to 1 part per million (ppm).
- **mL** Milliliter, equal to one thousandth of a liter.
- **nitrates** A dissolved form of nitrogen found in fertilizers and sewage by-products which may leach into groundwater and other water sources. Nitrates may also occur naturally in some waters. Over time, nitrates can accumulate in aquifers and contaminate groundwater.
- **NTU (nephelometric turbidity unit)** A measure of the clarity of water.
- **Ozone** A very powerful oxidant which destroys small organisms in water, including *cryptosporidium*. SPU constructed a filtration and ozonation facility on our Tolt River supply (on-line in December 2000), and an ozonation facility on our Cedar River supply (expected to be on-line in 2004).
- **pathogens; disease-causing pathogens; waterborne pathogens** A pathogen is a bacterium, virus or parasite that causes or is capable of causing disease. Pathogens may contaminate water and cause waterborne disease.
- **ppm, part per million**. One ppm is equal to 1000 ppb.
- **pCi/L, picocuries per liter** A curie is the amount of radiation released by a set amount of a certain compound. A picocurie is one quadrillionth of a curie.
- **pH** A measure of the acidity or alkalinity of water.
- **potable water** Water that is safe to drink.
- **primacy agency** The agency authorized by law to enforce drinking water regulations. In Washington, the U.S. Environmental Protection Agency has delegated enforcement authority to the Washington State Department of Health, Division of Drinking Water.
- **raw water** Water that has not been treated in any way; it is generally considered to be unsafe to drink.
- **reservoir** An impoundment used to store water. SPU's water system has 12 distribution reservoirs, three of these are currently covered. Refer to this link for information on SPU's 9 open reservoirs.
- **standpipe** A water tank that is taller than it is wide.

- **surface water** Water which is open to the atmosphere and subject to surface runoff; generally, lakes, streams, rivers. SPU's surface water supplies are the Tolt and Cedar Rivers.
- **treated water** Disinfected and/or filtered water served to water system customers. It must meet or surpass all drinking water standards to be considered safe to drink.
- **Trihalomethanes (THMs)** A group of disinfection-by-products consisting of four separate compounds: chloroform, dichlorobromomethane, dibromochloromethane, and bromoform. The MCL for trihalomethanes is based on a continuous averaging of four quarters of sampling.
- **turbidity** A measure of the cloudiness of water caused by suspended particles. Measured in Nephelometric Turbidity Units (NTU).
- **μg/L** Micrograms per liter. For aqueous (water) samples 1 μg/L is equal to one part per billion (ppb).
- **valve** A device that opens and closes to regulate the flow of liquids. Faucets include valves.
- **watershed** An area which drains all of its water to a particular water course or body of water. Refer to this link for information on SPU's watersheds.
- **water works** All of the pipes, pumps, reservoirs, dams and buildings that make up a water system.

References:

Annual Water Quality Report for Bellevue Utilities
Annual Analysis of Cedar and Tolt Water Supplies
BUD Water webpage:
http://www.ci.bellevue.wa.us/Utilities/water/default.htm
SPU Drinking Water webpage:
http://www.ci.seattle.wa.us/util/services/WaterQuality/default.htm
Monitored but not detected 2000.doc

Revision History:

Revision Date	Revision By	Reason for Revision

Utilities Department Standard Operating Procedure

City of Bellevue, WA

Title:

Emergency Water Supply System (Blivet) Operations, Set-up Maintenance and Training

Responsible Division:

O&M

Point of Contact:

Projects and Programs Supervisor

Category:

Emergency Response

Frequency:

Biennially

Applicable Accreditation Chapter:

8.5, 8.7, 8.16

Approved Date:

5/13/2009

Last Review:

5/13/2009

Next Review:

5/13/2011

Applicable Divisions (Click all that apply):

☐ Entire Department ☐ Director's Office ☐ Engineering ☐ O&M ☐ RMCS

Applicable Sections (Skip this section if SOP is applicable to entire department):

O&M Sections (Click all that apply):

☐ Administration
☐ Streets
☐ Telemetry
☐ Water
☐ Water Quality
☐ Emergency Operations
☐ Surface Water
☐ Projects and Programs
☐ Wastewater

Purpose:

Define Operations, Set-up, Maintenance, Safeguarding and Training for the Regional Emergency Water Supply System (Blivet).

Procedures:

Background:

The City of Bellevue, Utilities Department has acquired an Emergency Drinking Water Supply System (Blivet) through a Federal U.S. Department of Homeland Security, 2006 Urban Area Security Initiative (UASI), grant as a sub-recipient of Pierce County Department of Emergency Management (PCDEM). The total value of this equipment, at the time of purchase, $43,411.20.

The EWSS (Blivet) consists of two 3500 gallon bladders, a pump and generator, water bag filling table, 25,000 individual water distribution bags, assorted filling hoses and disinfection equipment.

The Blivet is intended to be used as a regional emergency water supply with situations that disrupt potable water service due to a terrorist incident involving weapons of mass destruction, or in connection with other Federally sponsored events, e.g., an earthquake event where the Federal Government has declared the region a disaster area.

Deployment and Operations:

The Blivet is designed to be set-up at a fixed site, such as a City reservoir or hydrant, where potable water is available, allowing the public to come and collect individual water distribution bags filled with drinking water . The Blivet can also be set-up where potable water is not available by delivering potable drinking water to a remote location using the Blivet's bladder.

To operate the Blivet and distribute drinking water you'll need to consider your distribution station location and public demand for drinking water to determine the number of people the station will take to operate. See Attachment, *Blivet Powerpoint Pres*.

Currently, it is not practical to move a bladder filled with water with any City owned vehicle because of its size and weight (each bladder's dimension is 39 X 8 X 1.5 feet and weighs 30K pounds filled). Consideration to decrease the size of the bladder is being made to make it easier to haul when the bladder is necessary to deliver drinking water. Changes or additions will be made to this SOP reflecting changes to the equipment.

See Attachment, *Blivet Technical Manual.pdf*, for set-up instructions.

Certification:

A minimum of once every two years a physical inspection and inventory must be performed to assess and document the EWSS's existence, condition and the location where it's stored. See Attachment, *Distribution Agreement, Attachment A and B*. This biennial inventory also safeguards the EWSS from damage and theft. Attachment B, Certification Letter, inventories the pieces of equipment associated with the EWSS and verifies each piece of equipment's description, model/part/serial numbers and condition assessment. *This certification letter is due to Pierce County, Department of Emergency Management every 24 months starting from the day the City received the EWSS,* ***July 12, 2007***.

Maintenance and Safeguarding:

Maintenance must be performed to the bladder every time it's filled with water to ensure the bladder sanitized, dry and ready of it's next use before it's put back in storage (procedure still needs to be developed).

The Blivet is currently stored at a Parks Department Facility in the Crossroads

Area. See Attachment, *BlivetLocation*. Jim Cruse is the contact person to open the storage area. Jim Cruse phone number is 425 452 6217.

All Maintenance and Safeguarding shall be in accordance with the Distribution Agreement.

Roles and Responsibilities:

Parks Department: It is the intent of the Citywide EOP to have the Parks Department in the primary roll of emergency drinking water distribution. Parks will ultimately be responsible for storing, operations, certification, deployment and maintenance/safeguard of the Blivet.

Utilities: Utilities Department's primary role for an emergency which results in widespread water outages, will be to restore water service. However, Utilities will need to work with Parks Department to identify potable water sources and assist with technical support in deployment of the Blivet.

Training:

Initial training will be provided by the vendor and train key Water Operations, P&P and Parks Department Staff. Additional training will be provide to Parks Department staff on the EWSS's deployment and set-up. Parks Department will eventually and ultimately be responsible for this SOP in accordance with the City-wide Emergency Operations Plan.

Definitions:

EWSS: Emergency Water Supply System
Blivet: All components of the Emergency Water Supply System

Associated SOPs:

Attachments:

Blivit Technical Manual.pdf Adobe Acrobat Document 4.54 MB	Blivit Acquisition Memo.doc Microsoft Word 97 - 2003 Document 26.5 KB	Distribution Agreement.pdf Adobe Acrobat Document 318 KB
Site Visit for Equipment Distribution Program.txt Text Document 1.63 KB	Pierce Co Insp Followup.pdf Adobe Acrobat Document 63.6 KB	Blivet Location.pdf Adobe Acrobat Document 4.96 MB

Blivit Powerpoint Pres.pdf Adobe Acrobat Document 5.30 MB	File Attachment	File Attachment
File Attachment	File Attachment	File Attachment

Revision History:

Revision Date	Revision By	Reason for Revision
5/13/2009	Chris Hagen	Creation of SOP

Utilities Department Standard Operating Procedure

City of Bellevue, WA

Title:

Fire Hydrant Survey

Responsible Division:
O&M

Point of Contact:
Water Superintendent

Category:
Operations

Frequency:
Biennially

Applicable Accreditation Chapter:
28.8

Approved Date:
11/17/1997

Last Review:
6/20/2014

Next Review:
12/31/2018

Applicable Divisions (Click all that apply):

☐ Entire Department ☐ Director's Office ☐ Engineering ☐ O&M ☐ RMCS

Applicable Sections (Skip this section if SOP is applicable to entire department):

O&M Sections (Click all that apply):

- ☐ Administration
- ☐ Streets
- ☐ Telemetry
- ☐ Water
- ☐ Water Quality
- ☐ Emergency Operations
- ☐ Surface Water
- ☐ Projects and Programs
- ☐ Wastewater

Purpose:

An biennial program maintaining fire hydrant accessibility and operational reliability through inventory, exercise, repair, and necessary replacement.

Procedures:

- A rotating survey schedule is established by the crew leader and monitored by updating both a working map, and a physical features inventory.
- Hydrants are field checked using facility identification records on assigned survey sheets and grid maps.
- Locate the foot valve and completely close the valve (while counting the turns on the foot valve).
    - Notes:
        - Unless in traffic or other area that could compromise safety, the valve wrench should be left on the valve during the complete operation for emergency shut off.
        - **Do not stand in front of port caps while the fire hydrant is under pressure**. When using the hydrant wrench, make sure wrench is securely attached to the port caps and operating nut.
- Making sure the hydrant is off, remove the port caps, check the gasket and check for standing water (Indicates a faulty drain).
- Lube the port threads with food grade grease or graphite spray (making sure to only spray the outside threads) before reinstalling port caps.
- Install a Female National Standard Thread (FNST) x male adaptor on a port outlet.
- Install a 3/4" "T" on the adaptor with valve and pressure gauge on one side of the "T" and a valve and flushing hose on the other.
- Open the valve to the flush hose one to two turns to purge air out of the hydrant.
- Make sure valve to the pressure gauge is off until water from the hose has cleaned up then open valve to test pressure.
- Check to see if water meter(s) are next to hydrant. If yes, and within 15 feet, make customer contact and isolate meter(s) before operating the hydrant. Take into account long side services (meters across the street from the fire hydrant that could be tapped off the water main within the 15 feet of the hydrant.)
- Completely open the hydrant operating nut verifying if the foot valve has shut down fully. Once verified, open the foot valve back up slowly until the fire hydrant run pressurizes, then open foot valve to full open. Run water long enough to clear debris, then turn operating nut clockwise to shut hydrant off. Verify if drain valve closed and opened properly.
- Remove the valve wrench and paint the valve cover white.

    - The following maintenance tasks shall be performed providing the work does not exceed 15 minutes:
        - Replace missing or damaged valve covers and/or port caps
        - Paint valve cover white.
        - Install valve stem extensions and/or valve box risers as necessary.
        - Clean out the valve box.
        - If the area around the FH (3' radius) needs to be trimmed, give the customer a trim tag and allow them a minimum of 10 business days to complete. Turn in the carbon copy to the Crew Leader. The Crew Leader will assign follow-up after 10 business days when time permits.
        - Note foot valve location on hydrant bonnet (example 5' East).

- Update missing or incorrect information on survey sheets and return competed sheets to the crew leader.

- Check the as-built for missing or incorrect information and note changes accordingly.
- Note specific problems on the maintenance sheet and submit to the crew leader at the end of the shift.
    - Examples:
        - Damaged operating nuts
        - Faulty drain valves
        - Grade problems effecting either the valve or the hydrant
        - Leaks
        - If the foot valve does not shut down completely.
        - Foot valve leaks from packing.

Turn in <u>completed</u> survey sheet(s) daily.

Attachments:

Hydrant Survey.doc Microsoft Word 97 - 2003 Document 134 KB	File Attachment	File Attachment
File Attachment	File Attachment	File Attachment
File Attachment	File Attachment	File Attachment
File Attachment	File Attachment	File Attachment

Revision History:

Revision Date	Revision By	Reason for Revision
5/15/2009	D. Eich	Updated language
3/23/2010	G Knight	Updated language (under Purpose, changed to annually).
8/30/2010	K Fockler	Updated language (under Purpose, changed to "biennial program") Also changed review date to reflect what gets approved in Budget Proposals.
9/27/2013	K Fockler	Review and edits made to SOP.

6/20/2014	G. Fletcher	Title change and updated language.

Utilities Department Standard Operating Procedure

City of Bellevue, WA

Title:

Flushing - Zone

Responsible Division:
O&M

Point of Contact:
Water Superintendent

Category:
Operations

Frequency:
As Needed

Applicable Accreditation Chapter:
28.6, 6.7

Approved Date:
10/23/2008

Last Review:
11/15/2013

Next Review:
10/18/2015

Applicable Divisions (Click all that apply):
☐ Entire Department ☐ Director's Office ☐ Engineering ☐ O&M ☐ RMCS

Applicable Sections (Skip this section if SOP is applicable to entire department):

O&M Sections (Click all that apply):
- ☐ Administration
- ☐ Streets
- ☐ Telemetry
- ☐ Water
- ☐ Water Quality
- ☐ Emergency Operations
- ☐ Surface Water
- ☐ Projects and Programs
- ☐ Wastewater

Purpose:

This SOP establishes procedures for the cleaning of water mains using high velocity, unidirectional flushing to remove sediment and bio-film and to maintain good water quality throughout the distribution system.

Procedures:

1. Equipment: Each vehicle will be equipped with the equipment and material listed below.

- Flushing Equipment
    - 2 ½" fire hoses and adapters
    - Pressure gauges with hosebib and hydrant adapters
    - 2-2 ½" diffuser pipe nozzle with pitot gauge openings or 2 LPD-250 diffusers
    - 2-pitot gauges
    - Several sand bags
    - Accurate and updated maps of the area to be flushed
    - Blank record keeping forms
    - Chlorine and pH test kits
    - Customer notification signboard.
    - Informational leaflets.
    - Dechlorination equipment (see Dechlorination S.O.P.'s)
    - Food grade sodium ascorbate and/or Vita-D-Chlor ascorbic acid tablets.

- Safety Equipment
    - Eye protective goggles
    - Traffic control devices
    - Personal Protective Equipment (PPE)
    - Material Safety Data Sheets (MSDS)

2. Procedure for Zone Flushing Water Mains:

- Public Notification
    - Two weeks before flushing, notification letters giving the time and dates for the area to be flushed will be sent out to all affected customers.
    - Sensitive areas (i.e. hospitals, dental clinics, industry, etc.), will be notified not only by mail but also by phone.
- Interdepartmental Notification
    - Before flushing an area, the following agencies, when appropriate, will be notified prior to and during the flush.
    - Water Quality Section
    - Water Maintenance and Operations
    - Storm Drainage Section
    - Waste Water Maintenance and Operations
    - Fire Department
    - King County's Surface Water Drainage Department
    - Cities of Seattle, Redmond, Issaquah, Kirkland, and Coal Creek Water District
    - Administrative Section
    - Any other agencies which maybe affected by water main flushing activities.
- Planning Procedure
    - Compile all water, sewer, storm drainage, and stream sensitive area maps for the zone to be flushed.
    - Compare flushing points of the zone with both sewer and surface water systems for the disposal of the water.
    - Check previous flushing records for problem areas or overflows.

- If the disposal of water is into the storm drainage system, any free chlorine shall be neutralized (See S.O.P.'s on Dechlorination) and will comply with Water Quality Guidelines for Fire Flow Testing.
- Meet with the representatives from the sewer and storm drainage divisions and go over the zone to be flushed.
- Continue to notify the interdepartmental agencies by E-mail while the zone flushing proceeds.

- Flushing Procedure Guidelines
  - All unidirectional flushing will be from a source supply of a zone to the other extent using clean water.
  - Whenever possible, the reservoir that serves that zone will be taken down for cleaning before flushing, ensuring that clean water is used for the flush. The reservoir can also aid in the flushing of the larger mains that feed them.
  - All unidirectional flushing will occur between the months of September through June, weather permitting.
  - All sensitive customer areas, (i.e. hospitals, schools, dental clinics, etc.) will be flushed at night, or at times specified by the operations supervisor.
  - All other areas will be flushed during normal working hours.
- Flushing Procedure
  - Set up traffic control and notification signboard in the area.
  - Disposal of flushed water should always be to a pre-approved sewer, whenever possible. All flow rates over 200g.p.m. must be pre-approved by the Waste Water Section – sewer mains may only be appropriate when flushing smaller pipe diameters.
  - If disposal of flushed water is to a storm drain check that enough Vita-D-Chlor tablets are on hand, or pre mix several buckets of dechlor. solution, so that more may be added as needed. (see S.O.P.'s on Dechlorination)
  - Isolate the section of water main to be flushed, not to exceed 1,000 feet.
  - Place a pressure gauge on a nearby house and record the starting static pressure for the zone.
  - If flushing to a storm drainage system use LPD-250 diffuser, or start pre mixed sodium ascorbate solution by turning on ball valve at bucket and follow S.O.P.'s on Dechlorination.
  - Open the flushing hydrant about 200-300 g.p.m., and after the hydrant run is cleaned up record the pH and FREE CL2 readings at "y" strainer port on the injector, or at the port on the LPD-250.
  - Slowly open the flushing points to the desired rate of flow.
  - Use pitot gauges to measure the flow, while monitoring the pressure to maintain at least 20 p.s.i. in the system.
  - Whenever possible, try to obtain a minimum scouring velocity of 4 feet per second.
  - Check and monitor downstream flows into the sanitary sewers and storm drainage systems for possible blockages, surcharges, ponding or flooding. Downstream, check and record TOTAL CL2 and pH of dechlorinated water.
  - Once two pipe volumes of water have been flushed, and the water is no longer cloudy, slowly lower the flow rate to about 300g.p.m.and continue flushing until the water is clear.
  - Once the water is cleared up record the pH and FREE CL2 at the flush point on the strainer, or at the port on the LPD-250 – pH will usually go down, CL2 will usually go up (though not always).
  - Slowly shut down all flushing points.
  - Check the ending static pressure to make sure it's the same pressure before the flush.
  - It is important to operate flush points slowly, with particular care to be taken when PRVs are involved, to allow for valve reaction times to increases and decreases in demand.
  - Pick up equipment.

- Record all data on the record keeping forms and transfer to flushing database and spreadsheets at frequent intervals - preferably daily – to prevent data loss.
- Daily linear feet should be recorded as quantity on time cards.

Attachments:

Water Quality Guidelines for Fire Flow Testing.doc Microsoft Word 97 - 2003 Document 25.5 KB	File Attachment	File Attachment
File Attachment	File Attachment	File Attachment
File Attachment	File Attachment	File Attachment
File Attachment	File Attachment	File Attachment

Revision History:

Revision Date	Revision By	Reason for Revision
3/4/2005	Robert Humphries	Revised field practices and new equipment
10/23/2008	Robert Humphries	Revised field practices and procedures
10/18/2010	K Fockler	Reviewed SOP

Utilities Department Standard Operating Procedure

City of Bellevue, WA

Title:

Flushing: Potable Water De-chlorination

Responsible Division:
O&M

Point of Contact:
Water Superintendent

Category:
Operations

Frequency:
As Needed

Applicable Accreditation Chapter:
26.4, 26.5, 28.17

Approved Date:
3/3/2005

Last Review:
5/30/2014

Next Review:
5/1/2017

Applicable Divisions (Click all that apply):

☐ Entire Department ☐ Director's Office ☐ Engineering ☐ O&M ☐ RMCS

Applicable Sections (Skip this section if SOP is applicable to entire department):

O&M Sections (Click all that apply):

☐ Administration
☐ Streets
☐ Telemetry
☐ Water
☐ Water Quality
☐ Emergency Operations
☐ Surface Water
☐ Projects and Programs
☐ Wastewater

Purpose:

This SOP establishes proper procedure for neutralizing chlorine in potable water during flushing operations using LPD 250 Dechlorinating diffusers.

Procedures:

Equipment Needed:

- Dechlorination equipment.
  i. Currently the Pollard LPD 250 or 250A diffuser is used. The type of diffuser used can change as technology progresses.
  ii. Food grade sodium ascorbate in 4 oz. tablets. The exact type of dechlorination chemical can change based on technology or possible NPDES restrictions.
  iii. 2 ½ inch 2-½ inch fire hose in various lengths.
  iv. Pitot Gauges.
  v. Hach Cl2 tester and total Cl2 test pillows.
  vi. BMPs to protect downstream catch basins and open ditches from erosion or excessive introduction of sediments and debris.

- Safety Equipment
  i. Rubber gloves (Sodium ascorbate absorbs through your skin).
  ii. Goggles and other P.P.E.
  iii. M.S.D.S. sheet (The Global Harmonized System is in the process of being implemented. When the new sheets are made available this item will be updated.)

- Procedure for dechlorination
  i. Follow M.S.D.S. sheet for use of P.P.E.
  ii. Check static pressure.
  iii. Set up flushing and dechlorination equipment.
  iv. Routinely sample down stream Cl2 to insure there is no total chlorine residual. If total chlorine is detected, check to see if the dechlorination chemical is consumed. Add more dechlorination chemical as needed. Retest and repeat as needed.
  v. Increase flow to desired rate (4 feet per second), while maintaining 30-psi residual pressure, and never less than 20 psi.
  vi. Continue to flush strainer during operation.
  vii. Check downstream of discharge for proper drainage and surface water quality issues. If issues found, report them to appropriate staff immediately. Flushing in this area may only be restarted upon approval from the responsible Section.
  viii. After water is clean, reduce flow and wait for 1-2 minutes allowing water pressure to return to normal pressure, then shut off flush point.
  ix. Check static pressure after all water is shut off.
  x. Pick up equipment.
  xi. (NOTE) Left over sodium ascorbate can be saved for use within 24 hrs or dumped into sewer.

Definitions:

- **Pitot gauge:** A gauge that is used in the center of the flow to measure pressure. The pressure is converted to flow from use of a chart
- **P.P.E.:** Personal protection equipment.

- **M.S.D.S. :** Material safety data sheet.
- **P.P.M. :** Parts per million.
- **G.P.M. :** Gallons per minute

References:

Zone Flushing SOP.

LPD 250 Dechlorinating Diffusers and Vita-D-Chlor Ascorbic Acid tablets may be obtained at pollardwater.com

Revision History:

Revision Date	Revision By	Reason for Revision
3/3/2005	Joe Harbour	New SOP covering new equipment
2/3/2009	Kipp Fockler	Updated information
5/19/2011	Tyler Himmelman	Review for accreditation
5/30/2014	Andy Tuchscherer	Review and some updated information.

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Utilities Department Standard Operating Procedure

City of Bellevue, WA

Title:

Meter Reading

Responsible Division:
O&M

Point of Contact:
Admin & Support Manager

Category:
Operations

Frequency:
As Needed

Applicable Accreditation Chapter:
28.15

Approved Date:
10/15/1997

Last Review:
12/29/2014

Next Review:
12/29/2015

Applicable Divisions (Click all that apply):

☐ Entire Department ☐ Director's Office ☐ Engineering ☐ O&M ☐ RMCS

Applicable Sections (Skip this section if SOP is applicable to entire department):

O&M Sections (Click all that apply):

☐ Administration
☐ Streets
☐ Telemetry
☐ Water
☐ Water Quality
☐ Emergency Operations
☐ Surface Water
☐ Projects and Programs
☐ Wastewater

Purpose:

To provide the Customer Service (Billing) staff with the necessary data to accurately bill customers bi-monthly based on volume, and to notify both customers and/or internal staff of maintenance related problems.

Procedures:

Meter Reading
Meters are read daily using handheld data storage units for collection. These units are connected to a net-linked PC for both data retrieval and transfer to a DCI file for billing use. Using a pre-established schedule, data (meter routes) are read daily and the handheld storage units are both loaded and unloaded daily.

All utility owned meters are read every two months then repeated enabling bi-monthly billing. The meters are divided into eight weeks (cycles) and separated into specific routes assigned to each reader. The meters are read using the sequential order. Completed cycles are uploaded into the DCI file weekly and new cycles are downloaded continuing the process.

By assigning each reader specific routes, maximum efficiency is achieved by minimizing time spent searching for meters in an unfamiliar area. This has allowed for other maintenance related activities such as meter box maintenance or meter change-outs.

It is also the responsibility of each reader to maintain their assigned routes by marking and trimming as necessary. Customers must be notified in advance anytime trimming will adversely affect the appearance or damage trees or shrubbery.

As issues are encountered, customer contact is made either verbally or by leaving a door tag. Examples of these include: high-consumption, leaks, and trim tags. Refer to the Problem Code List attached.

Work that requires more time than immediately available or assistance from maintenance crews (depending on urgency) is coded in the handheld for retrieval at a later date or a Maximo work order is created. In more urgent situations a crew leader is contacted by radio or telephone.

Deduct Meters
Deduct meters are owned and maintained by customers, registering water that does not enter the sewer system, and read for the purpose of reducing wastewater billing. Types include irrigation, inclusion into product, and evaporation.

Customer Requirements:

- The customer must contact the Utility and agree to an initial inspection as required by approval.
- The customer is responsible for both installation and continued maintenance or replacement of the meter.
- Upon request the customer will supply a copy of the meter manufacturers 'Certification of Accuracy' as needed.
- Based on the location of the meter, the Utility will determine if the meter is read by the reader or if a call-in procedure is required.

Call in Read Requirements:

- The customer must supply the Utility read(s) as requested bi-monthly.
- The meter must be made accessible for periodic inspections.
- The customer agrees to have the meter tested for accuracy at their expense if required by the Utility
- All related plumbing must comply with current backflow/ cross-connection requirements.
- Credit will not be issued if compliance is not met.

Deduct Meter Types:

- Irrigation - limited to existing systems or in specific situations where the location prohibits the installation of a service connection.

- Inclusion into Product - beverage companies, bakeries, etc.
- Evaporation - re-circulating cooling systems with contained storage, ponds, pools, and boilers.

Meters that are located outside and accessible to readers are read every two months by the readers. It is required that customers operating meters which are located inside buildings or non-accessible areas, call in the reads bi-monthly. Utility Billing calls and requests these reads as necessary.

As a source of audit (Best Management Practice), reads for the top five volume users are read by the readers every two months. The other meters are checked every one to two years.

References:

CIS (Customer Information System)

Associated SOPs:

Marking and Trimming

Attachments:

Meter Reading.doc Microsoft Word 97 - 2003 Document 234 KB	Revised 2001 Problem Code list.doc Microsoft Word 97 - 2003 Document 22.0 KB	2013 Miss Reads.xlsx Microsoft Excel Worksheet 11.9 KB
MeterReadingMatrix.doc Microsoft Word 97 - 2003 Document 72.0 KB	File Attachment	File Attachment
File Attachment	File Attachment	File Attachment
File Attachment	File Attachment	File Attachment

Revision History:

Revision Date	Revision By	Reason for Revision
3/7/2006	Greg Knight	Updated route assignments & language changes

6/11/2009	J Harrison	update review date
4/13/2011	G Knight	Update/review/combined with Meter Deduct Req's, added Attachments
12/29/2014	G Knight	Updated Attachments

Utilities Department Standard Operating Procedure

City of Bellevue, WA

Title:

Pump and Reservoir Run

Responsible Division:
O&M

Point of Contact:
Water Superintendent

Category:
Operations

Frequency:
Weekly

Applicable Accreditation Chapter:
28.16

Approved Date:
1/1/2001

Last Review:
9/27/2013

Next Review:
9/27/2017

Applicable Divisions (Click all that apply):

☐ Entire Department ☐ Director's Office ☐ Engineering ☐ O&M ☐ RMCS

Applicable Sections (Skip this section if SOP is applicable to entire department):

O&M Sections (Click all that apply):

☐ Administration
☐ Streets
☐ Telemetry
☐ Water
☐ Water Quality
☐ Emergency Operations
☐ Surface Water
☐ Projects and Programs
☐ Wastewater

Purpose:

This SOP establishes procedures for the routine site visits to all water pump stations, reservoirs, inlet stations, and generators.

Procedures:

- Assemble needed equipment prior to leaving BSC:
  a. General Equipment
     i. 0 – 200 p.s.i. Pressure Gauge
     ii. Temperature Probe
     iii. Hach Chlorine Tester
     iv. Portable pH tester
     v. Small Tools
     vi. Volt/Ohm Meter
     vii. Ventilation Blower
  b. Safety Equipment
     i. Applicable PPE including hearing protection (See applicable SOP)
     ii. Multi Gas Detector
     iii. Safety Climb Harness
     iv. Fall Protection Tripod Assembly (See applicable SOP)
     v. Confined Space Entry Sheet (See applicable SOP)
- Upon arrival at the site, perform the following checks and record findings on the Routine Water Facility Check form - Attachment A. (If the site is a confined space, follow the procedures outlined in the SOP on Confined Spaces entry; if the site visit requires climbing over 10 feet high, follow procedures set forth in the SOP on Fall Prevention.)
  a. Pumps and Motors:
     i. Check pump and motor operation for noise and vibration.
     ii. Check V.F.D.s operation.
     iii. Observe pump control valve operation.
     iv. Check motor to pump couplers.
     v. Check level and lubrication schedule.
     vi. Check pump and motor bearings for temperature.
     vii. Check for amps and voltage across all three legs.
  b. Pump Station Components:
     i. Sump pumps.
     ii. Walkways and grating.
     iii. Ensure that all lights are working.
     iv. Ventilation equipment.
     v. Communication and PLC equipment operation.
     vi. Compressors and vacuum pumps.
     vii. Chlorine and pH monitoring equipment.

viii. Intrusion, Operator in Trouble, and other alarms.

ix. Pressure tanks

c. Check for leaks:

i. Pipe joints and connections.

ii. Sump pump fittings.

iii. Hose bib, R.P. devices, hose and fittings.

iv. Check all underground vaults for proper drainage.

v. Diesel tanks.

d. Station Cleanliness:

i. Painted surfaces.

ii. Stairway debris.

iii. Hatch cover gutters.

iv. Clean off roof and gutters.

v. Remove garbage.

vi. Other.

e. Reservoir and Fenced Area:

i. Check appearance, paint, etc.

ii. Check for signs of vandalism.

iii. Inspect safety climb rails and cables. (Two person Pump and Reservoir Run).

iv. Inspect all padlocks on vaults and structures.

v. Reservoir ventilation, overflow, and drain lines. (Two person Pump and Reservoir Run).

f. Pump and Generator operation:

i. See the Routine Pump and Generator Operation list of Pump Stations for additional details on checking pumps and generators (attachment B).

- Bring any discrepancies to the attention of the Water Operations crew leader in a timely fashion.
- Upon return to the BSC, submit the completed Routine Water Facility Check form to the Water Operations crew leader.

Definitions:

SOP = Standard Operating Procedure

References:

SOP – Fall Protection
SOP – Confined Space Entry
SOP – PPE (Personal Protective Equipment)

Attachments:

Pump Run Attachment.doc Microsoft Word 97 - 2003 Document 114 KB	File Attachment	File Attachment
File Attachment	File Attachment	File Attachment
File Attachment	File Attachment	File Attachment
File Attachment	File Attachment	File Attachment

Revision History:

Revision Date	Revision By	Reason for Revision
4/29/2011	A. Tuchscherer	Updated attachment, corrected spelling errors.
9/27/2013	K Fockler	General review/date of next review set

Attachment A

Routine Water Facility Check Form		Pump 1	Pump 2	Pump 3	Pump 4
	Pumps and Motors:				
	• Check pump and motor operation for noise and vibration.				
	• Check V.F.D.s operation.				
	• Observe pump control valve operation.				
	• Check motor to pump couplers.				
	• Check level and lubrication schedule.				
	• Check pump and motor bearings for temperature.				
	• Check for amps and voltage across all three legs.				
	Pump Station Components: • Sump pumps. • Walkways and grating. • Ensure that all lights are working. • Ventilation equipment. • Communication and PLC equipment operation. • Compressors and vacuum pumps. • Chlorine and pH monitoring equipment. • Intrusion, Operator in Trouble, and other alarms. • Pressure tanks.				
	Check for leaks:				
	• Pipe joints and connections.				
	• Sump pump fittings.				
	• Hose bib, R.P. devices, hose and fittings.				
	• Check all underground vaults for proper drainage.				
	• Diesel tanks.				
	Station Cleanliness:				
	• Painted surfaces.				
	• Stairway debris.				
	• Hatch cover gutters.				
	• Clean off roof and gutters.				
	• Remove garbage.				
	• Other.				
	Reservoir and Fenced Area:				
	• Check appearance, paint, etc.				
	• Check for signs of vandalism.				
	• Inspect safety climb rails and cables.				
	• Inspect all padlocks on vaults and structures.				
	• Reservoir ventilation, overflow, and drain lines.				

Attachment B

Routine Pump and Generator Operation

Pump Station	Comments	Generator Fire Pumps
Pikes Peak	Bump pumps separately	N/A
N.E. 40th Inlet	Bump pumps separately	Yes / Runs once a week on an automatic timer
N.E. 40th 670	Can operate all pumps separately – Need to watch pressure	Yes / Runs once a week on an automatic timer
Cherry crest	Can operate all pumps separately	N/A
Clyde Hill	Can operate all pumps separately – Need to watch pressure	Yes / Runs once a week on an automatic timer
N.E. 8th Inlet	Can run pumps separately. Need to use the inlet valve to control the pressure to the zone	N/A
Lake Hills	Can operate all pumps separately	N/A
Meydenbauer	Runs automatically once a week for 1 hour	N/A
Wood ridge	Bump pumps separately	N/A
S.E. 28th Inlet	Can run pumps separately. Need to use the inlet valve to control the pressure to the zone	N/A
Newport	Can operate all pumps separately	N/A
Parksite	Can operate all pumps separately	N/A
Somerset Inlet	Operate 1&4 Bump 2&3	N/A
Somerset 2	Bump pumps separately	N/A
Horizon 1	Can operate all pumps separately	N/A
Horizon 2	Can operate all pumps separately//Make sure Forest Hills Pumps are off before operating	N/A
Horizon 3	Can operate all electrical pumps separately	Fire pump on weekly timer
Forest Hills	Can operate all / Make sure H.V.#2 pumps are off before operating	N/A
Cougar Mt. 1	Can operate all pumps separately	N/A
Cougar Mt. 2	Can operate all pumps separately	N/A
Cougar Mt. 3	Can operate all pumps separately	Fire pump on weekly timer

**** Make sure Pumps are off***

Attachment C

WATER FACILITY LOCATION LIST

Water Facility Name	Maximo Legacy ID RES = Reservoir IS = Inlet Station PSW = Pump Station Water	Address /Location
PIKES PEAK	RES03001 PSW01001	3900 124TH AVE NE
NE 40^{TH}	RES03002 PSW01002 IS02001	4075 148TH AVE NE
NE 40TH 670 ZONE	PSW01003	14051 NE 40TH ST
CHERRY CREST	RES03003 PSW01004 IS02002	2532 127TH AVE NE
CLYDE HILL 465	RES03004	9600 NE 22ND ST
CLYDE HILL 390	RES03005 PSW01005	2200 96TH AV NE
CLYDE HILL 335	RES03006	9700 NE 16TH ST
CLYDE HILL 335 A	RES03007	9700 NE 16TH ST
BEL-RED INLET	IS02003	13200 BEL RED RD
NE 8TH INLET	IS02004 PSW01006	15190 NE 8TH ST
LAKE HILLS N	RES03008 PSW01007	16049 NE 8TH ST
LAKE HILLS S	RES03009	16049 NE 8TH St
MEYDENBAUER	RES03010 PSW01008	9500 SE 7TH ST
WOODRIDGE	RES03011 PSW01009	1843 125TH AVE SE
RICHARDS ROAD	IS02005	2600 132ND AVE SE
ENATAI INLET	IS02007	3400 108TH AVE SE
SE 28TH INLET	IS02006 PSW01010	2649 145TH PL SE
EASTGATE INLET	IS02008	14502 NEWPORT WY
NEWPORT	RES03012 PSW01011	4330 164TH AVE SE
PARKSITE	RES03013 PSW01012	14501 NEWPORT WY

Water Facility Name	**Maximo Legacy ID** **RES = Reservoir** **IS = Inlet Station** **PSW = Pump Station Water**	**Address /Location**
SOMERSET INLET	IS02009 PSW01013	4400 130th AVE SE
SOMERSET 1	RES03014	4454 SOMERSET BLVD SE
SOMERSET 2	RES03015 PSW01015	13717 SOMERSET BD SE
HORIZON 1	RES03016 PSW01016	4810 HIGHLAND DR SE
HORIZON 2	RES03018 PSW01018	4801 150TH AVE SE
SAMMAMISH	RES03019	19221 NEWPORT WY
HORIZON 3	RES03020 PSW01019	5304 153RD AVE SE
HORIZON 3-A	RES03021	5304 153RD.AVE.S.E
FOREST HILLS	RES03022 PSW01020	5601 142ND AVE SE
COUGAR MT.1	RES03023 PSW01021	16431 SE 57TH PL
COUGAR MT.2	RES03024 PSW01022	16859 SE 59TH ST
COUGAR MT. 3	RES03025 PSW01023	17617 SE COUGAR MT DR
COUGAR MT. 3 A	RES03026	17617 SE COUGAR MT DR
FACTORIA RES.	RES03028	3763 132ND AVE SE
INLET 6	IS02015	5419 128TH AVE SE
INLET 8	IS02014	4315 128TH AVE SE
INLET 11	IS02011	3826 124TH AVE SE

Utilities Department Standard Operating Procedure

City of Bellevue, WA

Title:

Valve Survey

Responsible Division: O&M

Point of Contact: Water Superintendent

Category: Operations

Frequency: Biennially

Applicable Accreditation Chapter:

Approved Date: 5/15/2009

Last Review: 9/27/2013

Next Review: 10/1/2017

Applicable Divisions (Click all that apply):

☐ Entire Department ☐ Director's Office ☐ Engineering ☐ O&M ☐ RMCS

Applicable Sections (Skip this section if SOP is applicable to entire department):

O&M Sections (Click all that apply):

☐ Administration
☐ Streets
☐ Telemetry
☐ Water
☐ Water Quality
☐ Emergency Operations
☐ Surface Water
☐ Projects and Programs
☐ Wastewater

Purpose:

A two year rotating program for maintaining water valve accessibility and operational reliability through inventory, exercise, repair and replacement as necessary.

Procedures:

- A rotating survey schedule is established by the crew leader and monitored by updating both a working map, and a physical features inventory.
- Valves are field checked using facility identification records on assigned survey sheets and grid maps. They are then operated as follows:
  - Rotate the valve clockwise (close) to avoid any system damage by opening a closed valve.
  - Count turns to the closed position then back to the open position to verify the complete exercise of the valve.
  - Following completion of the valve "exercise", close valve 1/2 turn from the open position.

- The following routine maintenance shall be performed providing the work does not exceed 15 minutes:
    - Replace missing or damaged valve covers.
    - Paint valve cover blue
    - Install valve stem extensions and / or valve box risers
    - Clean out valve box and trim surrounding area

- Exceptions or special circumstances are as follows:
  - Single-Supply zone valves, (identified by plastic in the valve box) should be operated only ½ way to the closed position and back to the full open position.
  - All closed valves will have plastic in the box and are not to be opened. Examples include zone valves and isolation valves for capped off mainlines.
  - Check the as-built for any missing or incorrect information and route to the crew leader at the end of the shift.
- Update missing or incorrect information on the survey sheet. All completed sheets are returned to the crew leader.
- Note specific valve problems on the maintenance sheet and submit to the crew leader at the end of each shift.

Attachments:

Valve Survey.doc Microsoft Word 97 - 2003 Document 129 KB	File Attachment	File Attachment
File Attachment	File Attachment	File Attachment
File Attachment	File Attachment	File Attachment
File Attachment	File Attachment	File Attachment

Revision History:

Revision Date	Revision By	Reason for Revision
5/15/2009	D Eich	Minor grammatical corrections
5/4/2011	A. Tuchscherer	Reviewed
9/27/2013	K Fockler	Review and set next review date

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Utilities Department Standard Operating Procedure

City of Bellevue, WA

Title:

Water Main Break Response

Responsible Division:
O&M

Point of Contact:
Water Quality Supervisor

Category:
Operations

Frequency:
As Needed

Applicable Accreditation Chapter:

Approved Date:
12/31/2014

Last Review:
11/5/2014

Next Review:
1/1/2018

Applicable Divisions (Click all that apply):
☐ Entire Department ☐ Director's Office ☐ Engineering ☐ O&M ☐ RMCS

Applicable Sections (Skip this section if SOP is applicable to entire department):

O&M Sections (Click all that apply):
- ☐ Administration
- ☐ Streets
- ☐ Telemetry
- ☐ Water
- ☐ Water Quality
- ☐ Emergency Operations
- ☐ Surface Water
- ☐ Projects and Programs
- ☐ Wastewater

Purpose:

To establish main break response and the repair procedures to ensure the protection of Bellevue's drinking water quality and public health during a main break.

Categorizing Main Break Responses:

Main Break Response Categories

Type I Response	**Type II Response**	**Type III Response**	**Type IV Response**
Positive pressure maintained during break	Positive pressure maintained during break	Loss of pressure at break site or limited water system depressurization elsewhere	Loss of pressure at break site and depressurization elsewhere in the system
Positive pressure maintained in pipe during repair	Positive pressure maintained at break site until pipe exposed & trench dewatered. Shutdown limited to immediate valved off area, no loss of pressure elsewhere in system	Loss of pressure at the break site while the pipe is still buried or submerged / or no pressure loss at break site, but pressure loss elsewhere in the system	Loss of pressure at the break site while the pipe is still buried or submerged and / or widespread depressurization
Water contamination unlikely	Limited possibility of water contamination	Possible contamination intrusion	Possible/ actual contamination intrusion

GOAL

Maintain positive pressure at the break location until the pipe is exposed and the trench water is controlled at a level below the break

Procedures:

General Procedures

- **If the break is not doing immediate damage shut off services in affected area before shutting main down**

- Carefully throttle the main valves to maintain positive pressure at the break location. Some flow should be maintained at the break site until the trench can be excavated below the pipe and the trench water is controlled.
    - Small amounts of water flowing up from the break itself and/or from a fire hydrant port off the same main can be used as a visual indicator that positive pressure is being maintained in the pipe

- Once the main has been throttled, install appropriate BMPs to protect property and surface water quality from the remaining water flow
    - Vactor(s), sand bags, catch basin inserts, etc.
    - If needed, contact WQ or Storm for assistance with BMPs

- For all breaks with television media attention the WQ supervisor will send information to DOH regional engineer and their supervisor. Information includes: Location, type, next steps, etc. Alt. Contacts - O&M Manager and Assistant Director

- Contact Water Quality When positive pressure is not able to be maintained until excavation below the pipe and trench water is controlled, to help determine the required sanitization procedures and sample requirements.

- If the main break caused significant impacts on nearby surface waters, contact Water Quality once the site is controlled

- During regular work hours Water Maintenance staff shall send out a "Big Rock" report summarizing impacts to water quality (flow, duration, customers impacted, media presence, etc.) to the section SET and Superintendent. For afterhours repair send information to the Superintendent, O&M Water Quality staff, the Operations Manager and the Assistant Director when possible.

If there is evidence of water backflow (Ex. meters are found spinning backwards or hot, colored, sheen covered and/or foamy water is found in the main) or customers not in the immediate area of the break reporting no water, the response category is elevated to a Type IV response and Water Quality Supervisor must be notified

Main Break Response procedures – By Type:

Type I and Type II - (Positive pressure controlled –Contamination Unlikely)

- Maintained trench water levels below pipe at all times
- Complete repairs under pressure (Type I) or maintain trench levels below pipe while customer services and main are isolated (controlled depressurization – Type II)
- Once a Type II repair is completed, perform a low velocity flush to reestablish representative chlorine residual levels
- For Type II repairs, once representative residuals are achieved, allow chlorine a minimum of 30 minutes contact time before putting the water main and services back online
- Instruct affected customers to flush premise plumbing upon return to service in person or

with “Customer Flushing Instructions” door hanger

Type III and Type IV - (Uncontrolled Pressure Loss - Actual or Potential Contamination)

Type III = Localized pressure is lost while the pipe is still buried
Type IV = Widespread depressurization or evidence of water backflow is observed. Both responses require additional disinfection, sanitization, and flushing efforts and trigger water quality samples be collected

- After the main break is controlled, identify all possible sources of water contamination (Ex. broken sewer pipe, connection type(s) where meters were found spinning backwards, etc.)
- Contact Water Quality Supervisor who will:
  - Collect the possible sources of contamination information
  - Determine customer notification, health advisory, and post-repair sampling requirements
  - Contact Department of Health regional engineer as above
  - Send Water Quality Alert Level to appropriate staff per response plan
    - The decision to develop a Boil Water *Advisory* for the affected area will include coordination through the chain of command and the PIO
- Repair main taking steps to remove any/all debris from inside the pipe and to prevent other potential contamination
  - *Refer to SOP - Disinfection of Water Mains and Appurtenances*
- Sanitize the main by refilling it slowly and in a way to ensure that the added chlorine can both mix and distribute throughout the affected area(s)
- Conduct scour flushing in area of break (3ft/sec) to remove any sediment from pipe bottom.
- Slow flows and conduct low velocity flushing at main break location.
  - Low velocity flushing may also be required in areas that experienced low pressure or a loss of pressure due to the break.
  - *Refer to SOP - Flushing: Potable Water Dechlorination*
- Flushing should be performed until representative chlorine residuals are established
- Allow chlorine a minimum of 30 minutes of contact time.
- If sampling is required, Water Quality or other trained staff designated by WQ Supervisor will collect purity samples prior to the main being placed back into service:
  - Sampling will be used to verify the effectiveness of the response in protection of water quality and public health or to provide the basis for lifting any public health advisories
  - “Unsatisfactory” sample results will trigger repeat sampling as determined by WQ Supervisor
- Put water main and services back online
- Instruct customers to flush premise plumbing upon return to service

- WQ will lift any public health advisories when monitoring results from two separate sample sets collected in a 24 hour period are reported as being "satisfactory".

References:

- Water Main Break Response Protocols - For Chlorinated Systems
- DOH Pub. #331-338 - Responding to Pressure Loss Events
- Water Research Foundation Report - Effective Microbial Control Strategies for Main Breaks and Depressurization

Associated SOPs:

- Disinfection of Water Mains and Appurtenances; and Flushing: Potable Water Dechlorination

Attachments:

Post Main Break Response Sampling - 06 17 14.docx Microsoft Word Document 26.3 KB	331-338_Pressure Loss.pdf Adobe Acrobat Document 214 KB	loss of pressure boil water advisory notice.doc Microsoft Word 97 - 2003 Document 38.5 KB
File Attachment	File Attachment	File Attachment
File Attachment	File Attachment	File Attachment
File Attachment	File Attachment	File Attachment

Revision History:

Revision Date	Revision By	Reason for Revision
11/5/2014	Bob Hubbert	Document creation

Utilities Department Standard Operating Procedure

City of Bellevue, WA

Title:

Water Meter Installations

Responsible Division:
O&M

Point of Contact:
Admin Supervisor

Category:
Operations

Frequency:
As Needed

Applicable Accreditation Chapter:
28.15

Approved Date:
4/25/2011

Last Review:
4/25/2011

Next Review:
4/25/2012

Applicable Divisions (Click all that apply):

☐ Entire Department ☐ Director's Office ☐ Engineering ☐ O&M ☐ RMCS

Applicable Sections (Skip this section if SOP is applicable to entire department):

O&M Sections (Click all that apply):

- ☐ Administration
- ☐ Streets
- ☐ Telemetry
- ☐ Water
- ☐ Water Quality
- ☐ Emergency Operations
- ☐ Surface Water
- ☐ Projects and Programs
- ☐ Wastewater

Purpose:

Working procedures for the installation or replacement of water meters.

Procedures:

New Installations

Service work requests for new water meter installations are initiated by the Development Review Section of Utilities in the Permit Center. The appropriate information is entered in the Amanda tracking system which downloads and generates a Maximo work order for retrieval by maintenance staff.

Procedures:

1. A hard copy of the work order is printed for field use by the employees assigned to the task.

2. The employee provides inventory personnel with the appropriate work order number for tracking purposes and checks out the correct meter by size and any additional parts required for installation.

3. The employee installs the meter and performs any other approved work by identifying the correct meter box using the following:
   A. As-built to identify correct lot.

   B. Addresses and/or permits posted on lot or structure.

   C. Contact personnel on site or as listed on the work order for verification.

4. The employee checks for damage, appropriate parts were installed, and the meter box is set at the proper grade. Minor adjustments are corrected by the employee if the work can be completed within 15 minutes. (A Olympic foundry SM30 meter box is required in all areas subject to traffic and in sidewalks).

5. Using a flush tube, the employee will flush the water from the angle stop on the setter to check for adequate flow, volume, and water quality.

6. The open meter setter connections are disinfected (see Disinfection of Water Mains & Appurtenances SOP).

7. Using the correct size gaskets, the meter is installed and the setter is left shut off unless otherwise requested (both irrigation and fire/domestic combination meters will be locked off pending back flow tests as noted on the work order).

8. The meter number, read, location code, and any other pertinent information should be noted prior to leaving the site and a location mark should be painted on the street or curb (Marking and Trimming SOP).

9. The assigned employee is responsible for noting work performance and other related commentary in the work order "Log", and returning the hard copy to the Crew Leader upon completion.

10. The appropriate Crew Leader will review job performance, labor, parts, costs, create specific meter equipment IDs, close the work order, and route information as necessary.

11. The employee is responsible for recording appropriate work order numbers, quantity, and labor hours on daily time sheets for proper documentation.

Rejects

If any of the problems listed below occur, the employee should attempt to advise the customer of the problem on site. When on site contact is not possible, the problem should be noted on the hard copy and returned to the Crew Leader at the end of the working day or as soon as possible thereafter.

A. The meter box cannot be located or correctly identified,

B. There is damage to the meter box, cover, or setter,

C. Parts are missing such as the meter cover or box,

D. Water flow or volume is not adequate from the setter,

E. Water quality is not acceptable (water remained turbid after flushing the setter),

F. Due to a grade problem, the service needs to be extended or a re-setter needs to be installed,

G. The meter box used is wrong for the application (traffic area), and

H. There is more than 15 minutes required to make any minor adjustments.

Meter Change-Outs

Water meters are targeted for replacement due to either damage or age.

Procedure:

A. Meters and related plumbing components necessary to perform the task are checked out from Stores.

B. Organizing is done geographically by address with use of location codes, special instructions, and the meter numbers for proper verification. The employee identifies needed work such as the installation of a re-setter or meter box and readies parts accordingly.

C. Every attempt is made to contact the customer at the door to advise of water service interruption, the nature of work involved, and the approximate completion time.

D. Water is shut off, the defective meter is removed, and the exposed interior piping is disinfected (See Disinfection of Water Mains & Appurtenances SOP) before the new meter is installed.

E. Following installation, water service is restored by partially opening the shut off valve and allowing the service line to fill slowly. Once the meter dial indicates flow has stopped, the shut off valve can be opened fully. If a customer is not at home and flow continues as indicated by the meter dial (approx. 1 or more CF), water needs to be shut off and the appropriate tag left at the door advising the customer of the situation.

F. The customer should be advised to flush one or more faucets to eliminate air and/or the employee should attempt to open an outside faucet.

G. After completing any necessary restoration the employee fills out the required data on a change-out sheet.

H. Completed meter change-out sheets are turned in to the Crew Leader for review and processing in the Maximo Equipment field.

I. The employee is responsible for tracking quantities on their time sheets for correct labor reporting.

Associated SOPs:

Marking & Trimming SOP

Disinfection of Water Mains and Appurtenances SOP

Attachments:

Eng Detail.pdf Adobe Acrobat Document 85.9 KB	File Attachment	File Attachment
File Attachment	File Attachment	File Attachment
File Attachment	File Attachment	File Attachment
File Attachment	File Attachment	File Attachment

Revision History:

Revision Date	Revision By	Reason for Revision
4/25/2011	Greg Knight	Combined Meter Change-Outs & Meter Installation Drop-In SOP's

Appendix T

DOH Sanitary Survey

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Appendix X
DOH Sanitary Survey

The Washington State Department of Health (DOH) most recently conducted a sanitary survey of the City's water system in October 2015. DOH comments and responses by the City for the 2015 Sanitary Survey are not yet available.

The previous Sanitary Survey was conducted in 2010. Survey comments for the 2010 Sanitary Survey were addressed as follows:

1. "Please verify and add or change any permanent and emergency supply interties on your Water Facilities Inventory… Update your WFI to include the accurate number of interties with Cascade/SPU, Kirkland, and Redmond."
   - WFI has since been updated.
2. "Recommend staff routinely inspect each opening to the reservoir to ensure each seal or screen is intact."
   - Water Quality initiated annual inspection of all tanks in 2010, prior to the sanitary survey. Several tanks are also inspected each year while offline for routine cleanings
   - Required upgrades and repairs are being tracked by Water Quality, and are either completed immediately or are placed on a list for future CIPs
3. Horizon View #1 Reservoir – "Raise the air gap so that it is above ground and install adequate screening."
   - Horizon View #1 Reservoir will be replaced in 2015-2016. Design is underway.
   - As in interim measure, the City fabricated and installed a pressure activated release plug in the existing reservoir overflow pipe outlet located in the control manhole, approximately 15 feet east of the reservoir.
4. "Please consider inspection of all reservoir overflow lines and if the existing configuration appears to be vulnerable to contamination, consider scheduling appropriate modifications to keep the reservoir safe from contamination."

- O&M Staff checked all reservoir overflow pipe outlets in 2011. They either repaired existing screens or installed new screens, where appropriate. In some circumstances, such as at Horizon View 1, they fabricated and installed pressure activated release plugs in the reservoir overflow piping.

- The City inspects all reservoir overflow lines annually.

5. "Please schedule a pre-plan meeting late in 2013 or early 2014 as you begin to compile your next plan." Also states, "The City's Water System Plan Update is due January 2015. Please schedule a pre-planning meeting to discuss the appropriate level of planning required for the update with Department staff with the adequate lead time to meet this submittal deadline."

   - The last Water System Plan was submitted in 2006 and was approved in January 2009

   - A Pre-Plan meeting between the City and DOH was conducted on March 5, 2014.

6. "Please continue to update routine and repeat sample locations as needed (due to growth, change in flow patterns, etc.)."

   - Bellevue's last Coliform Monitoring Plan (CMP) update was in March 2007.

   - The CMP is currently being upgraded. A draft is anticipated to be ready in early 2016.

7. Wellhead Protection Program – "Recommend develop a source contaminant inventory and notification program for these wells."

   - A wellhead protection program is not yet required because the wells are not being used for public water supply. Wellhead protection will be considered as part of the City's proposed well analysis (recommended well locations and alternatives are not yet identified). If required, a wellhead protection plan will be developed at that time.

8. "… please verify that all seals and screens on all storage tank roof vents, access hatches, overflows, and access point where level gauge wire enters each tank are in excellent condition. Please note the attached photos showing openings that need to be addressed. Next time you visit each reservoir for routine inspection, please take a photo of the seals and screens in place and send them to the Department. Recommend you add the routine inspection of seals and screens to your standard checklist for reservoir inspection,"

   - Water Quality inspects all reservoir seals and screens annually. As requested, photos are collected and included in a summary report sent to the Department.

   - New hatches at Somerset 2 ('08), Sammamish ('10), Clyde Hill 335 ('10), Clyde Hill 390 ('10)

9. Factoria Reservoir – "Confirm overflow line daylights here and that screen is intact… Confirm that drain line is adequately screened."

- The Factoria Reservoir drains and overflow pipes are connected. The overflow pipe outlet is located in a control manhole 20 feet north of the pump station building. O&M staff installed screening on the overflow pipe outlet

10. Somerset #2 Reservoir – “Confirm adequate screening is intact.”

    - The Somerset 2 reservoir drains and overflow pipes are connected. The overflow pipe outlet is located in a control manhole approximately 150 feet northwest of the pump station on the north side of Somerset Blvd SE. O&M staff installed a pressure activated release plug in the reservoir overflow pipe

11. Forest Hills Reservoir Overflow and Drain Swale – “Confirm pipe daylights here and that screen is intact.”

    - The Forest Hills Reservoir drain and overflow pipes are connected and the overflow pipe outlet daylights in the reservoir swale/pond. O&M staff installed screening on the overflow pipe outlet.

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STATE OF WASHINGTON

DEPARTMENT OF HEALTH

NORTHWEST DRINKING WATER REGIONAL OPERATIONS

20435 72nd Avenue South, Suite 200, Kent, Washington 98032-2358

June 2, 2011

WES JORGENSON, ASSISTANT DIRECTOR
CITY OF BELLEVUE
PO BOX 90012
BELLEVUE, WA 98009-9012

Subject: City of Bellevue Water System (ID#05575)
King County
Water System Sanitary Survey

Dear Mr. Jorgenson:

This letter is in follow up to the Department's inspection of the City of Bellevue water system on October 21, 2010. I apologize for the delay in sending this report to you. Thank you to your staff for meeting and spending time with me and Bob James during our site visit. The purpose of the routine survey was to assess the overall operation, maintenance and management of the water system towards ensuring the distribution of safe and reliable drinking water. The survey is an important opportunity for DOH staff and water system personnel to develop relationships and to discuss any issues we might have. We had a very dynamic discussion regarding planning, operations, conservation, emergency preparedness and water quality during the morning session and a short but informative field visit in the afternoon.

The City of Bellevue's drinking water system appears to be in good condition; a result of competent staff and comprehensive operations and maintenance program. Congratulations to your staff for their hard work and continued commitment towards protecting public health by providing safe and reliable water to your customers.

Enclosed is a copy of my survey notes and photographs. Please check for accuracy and consider any issues in **BOLD** text and listed under the Recommendations section. I observed no major deficiencies that would pose an immediate health risk.

The Drinking Water Regulations require that all Group A public water systems have a sanitary survey at least once every 5 years (WAC 246-290-416). In order to receive credit for the survey, a sanitary survey fee must be paid. Enclosed is an invoice for $2,040 (20 hrs x $102/hr). Please remit your complete payment in the form of a check or money order within thirty days of the date of this letter to: **DOH, Revenue Section, P.O. Box 1099, Olympia, WA 98507-1099.**

If you have any questions or concerns, please call me at (253) 395-6764.

Sincerely,

Paige S. Igoe, PE
Northwest Regional Office
Office of Drinking Water

Enclosures

cc: Public Health – Seattle & King County
Joe Harbour, City of Bellevue
Bob James - DOH

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
NORTHWEST DRINKING WATER REGIONAL OPERATIONS
20435 72nd Avenue South, Suite 200, Kent, Washington 98032-2358

SYSTEM INSPECTION / MEETING SUMMARY
Date: October 21, 2010

CITY OF BELLEVUE WATER SYSTEM - King County (ID#05575)

Persons Attending:
City of Bellevue: Mike Jackman, Joe Harbour, Mike Graves, Randy Thompson, Andy Tuchscherer, Bob Hubbert, Kipp Fockler, Patricia Burgess
DOH: Bob James, Paige Igoe PI

Purpose: Routine Sanitary Survey

WATER FACILITIES INVENTORY:
Group A Community System

Existing Connects	=	35,237 residential
Population	=	135,100 full time residential
Engineering Capacity	=	Determined by Bellevue according to approved Water System Plan

LAST SANITARY SURVEY:
The last sanitary survey was conducted on November 1, 2 and 17, 2005. The management and operation of the system was found to be in good condition with no major deficiencies. However, the City was reminded of their obligation to consistently submit monthly monitoring reports which record disinfection system residuals, submit their water system plan and consider booster chlorination for areas of the system that have consistently low chlorine residuals. The City submitted all monthly reporting forms and submitted their water system plan in January 2007. Operations staff continually monitors the system for areas of low chlorine residual and crews address issues as they arise with flushing and/or operational changes.

GENERAL OVERVIEW:
The City of Bellevue's water service area shares borders with the Cities of Kirkland, Redmond, Issaquah, and Newcastle, and both Lake Washington and Lake Sammamish shorelines. In 2004, Bellevue assumed the portion of Coal Creek Utility District's service area and facilities located with the City's corporate limits. In 2005, Bellevue acquired Water District 1 facilities and customers.

The water system is managed by the City's Utilities Department, which consist of four main departments: Intergovernmental/Policy; Resource Management and Customer Service; Operations and Maintenance; and Engineering. Bellevue operates a large integrated system which includes 13 supply interties, 26 storage reservoirs (1 is currently out of service), and 22 booster pump stations within three major operating areas. The facilities and pressure zones that comprise the east, west and south operating areas are shown in the table included at the end of this report. The water system has 64 pressure zones in total.

Bellevue is a member of the Cascade Water Alliance (Cascade), and receives 100 percent of its supply from Cascade which has a supply contract with Seattle Public Utilities (SPU). The sources are the Cedar River (feeds service area from the south) and the South Fork Tolt River (feeds service area from the north). A main supply transmission pipeline runs north south with multiple interties to Bellevue's distribution system. Bellevue provides no additional treatment within the distribution system.

The City recently developed emergency source of supply in the form of Samena Well 3 and Crossroads Wells 5, 6 and 7, approved by the Department on May 13, 2010. Bellevue also maintains three permanent interties with the City of Redmond and one permanent intertie with the City of Kirkland.

City staff provided a list of changes that have occurred in the system between 2005 and 2010. A summary of projects (organized by project type) is provided below.

Inlet projects:

- Upgrade to Bel-Red Inlet to provide a maximum flow of 9,500 gpm
- Inlet 10 abandoned. Two lines were connected eliminated need for this inlet.
- Inlet 9 abandoned. Sufficient system redundancy eliminated need for this inlet.

Water quality projects include:

- Forest Hills Reservoir – sample lines were installed to take water quality samples at 5-foot and 15-foot depths. Recirculation lines were also added. Project completed in 2008.
- Clyde Hill 465 Tank – sample lines were installed to take water quality samples at 5-foot, 32 foot – 8 inches and 48 foot – 8 inches depths. Replaced existing 2-inch fill valve to with larger 4-inch valve. Emergency water supply connection plumbed in as part of this project. Completed in 2008.

Reservoir and Pump Station Projects:

- The Clyde Hill 465 Reservoir was painted in 2010.
- Membrane sprayed on roofs of Cougar Mountain 1 and 2 in 2007.
- Membrane replacement for the following reservoirs: Newport Reservoir (2006), Forest Hills Reservoir (2010), Horizon 3A Reservoir (2010).
- The Somerset 3 Reservoir and Pump Station were abandoned in 2010. Sufficient system redundancy eliminated the need for this station.
- At the Somerset 2 Reservoir, the tar coating was removed from the interior of the tank in 2008.
- Access hatches were replaced at the following reservoirs: Somerset 2 Reservoir (2008), Sammamish Reservoir (2010), Clyde Hill 335 Reservoir (2010) and Clyde Hill 390 Reservoir (2010).
- The altitude valve was replaced at the Clyde Hill 335 Reservoir in 2010.

<u>SITE VISIT:</u>
Thank you to Mike Jackman and Joe Harbour for working with their staff to get prepared for our site visit. We talked to the following people:

- Conservation program activities with Patricia Burgess
- Water system planning with Randy Thompson, Engineering
- Operations – Joe Harbour, Andy Tuchsherer
- Field Crew and Maintenance Activities – Kipp Fockler
- Water Quality – Mike Graves
- Cross-Connection Program – Bob Hubbert

City staff prepared a binder of system information which included the following:

- Facility information for pump stations, reservoirs, inlet stations, generators, fire pumps, control valves and pressure reducing valve stations
- List and figure showing system pressure zones
- Description of drinking water quality group responsibilities, activities, performance measures
- Pictures of a typical City of Bellevue flushing station, the new Samena Well 3 facility and the Blivet water station and associated equipment
- IDSE and Standard Monitoring Reports and approval letters from EPA
- Example of Water Quality 'Live Check' Spreadsheet
- Cross Connection Program Summary
- Total Coliform Monitoring Plan – Updated in March 2007
- Organizational Charts for Bellevue Utilities
- System Demand and Production information (2006 through 2010)
- List of Maintenance Activities with planned and actual time spent
- 2009 Utilities Business Profile from City of Bellevue Utilities Department
- CD with City of Bellevue Conservation Program information

During the survey, we visited the following facilities:

- Samena Well 3
- Factoria Reservoir
- Somerset No. 2 Reservoir
- Forest Hills Reservoir and Pump Station
- Horizon No. 1 Reservoir

<u>SOURCES, INTERTIES AND TREATMENT:</u>
The City receives its drinking water supply from Seattle Public Utilities (SPU) through 13 inlet source stations according to terms of a wholesale supply contract with Cascade Water Alliance. *Inlet 10 was abandoned in 2008 and Inlet 9 was abandoned in 2010.* Supply inlets are metered and typically located in below grade vaults. In general, SPU's treated Tolt River supply (from the Tolt Eastside Supply Line) feeds the north service area, and treated Cedar River supply (from the Cedar River Eastside Supply Line) feeds the south service area. In addition, the south operating area has inlets providing supply through the Mercer Island Pipeline. Operation can be complicated due to the variation of water pressure along SPU's transmission mains. All water treatment is provided by the City of Seattle; Bellevue does not provide any additional booster chlorination or other treatment.

Active Supply Inlets:

- Enatai Inlet
- NE 40th Inlet
- Cherry Crest Inlet
- Bel-Red Inlet
- NE 8th Inlet
- Richards Rd Inlet
- SE 28th Inlet
- 161st Inlet
- Inlet #11
- Inlet #8
- Somerset Inlet
- Eastgate Inlet
- Inlet #6

The City also has the following interties:

- Kirkland – four interties: two permanent supply Bellevue, two emergency (one supplies Bellevue)
- Redmond – six interties: five permanent (one supplies Bellevue), one emergency
- Issaquah – two interties: permanent
- Coal Creek Utility District – one intertie: permanent supply to Bellevue
- Water District 1 – one intertie; permanent
- Water District 117 – one intertie: emergency
- Beaux Arts Water – one intertie: emergency

In addition, the Department approved use of emergency wells in the Crossroads area of Bellevue on May 13, 2010. The wells were originally drilled to serve King County District Water District #97 customers (which is now served directly by Bellevue) and are not connected to the City's distribution system. The City developed a standard operating procedure to operate the wells using an NSF certified bladder tank distribution unit consistent with DOH Publication #331-317 (*Requirements for Using Emergency Sources Safely*). Portable generators are used to power the wells and City staff exercises the wells regularly. Sample taps have been installed and staff samples for coliform and nitrate on a quarterly basis and IOCs and VOCs on an annual basis.

Please verify and add or change any permanent and emergency supply interties on your Water Facilities Inventory and send to the Department.

STORAGE:

The City owns and operates 27 facilities with over 40 million gallons of storage capacity. The 2005 sanitary survey report noted that all storage facilities have been evaluated for and, if applicable, retrofitted to handle seismic events; and all reservoir vents have been replaced with tamper proof, freeze proof units.

Security is in place at all facilities and typically consists of fencing with locked gates, locked buildings, locked hatches, access limited and locked ladders, intrusion alarms, lights and cameras with recording capability.

The reservoirs visited during this site visit appeared well maintained. City staff visit each facility weekly and do an overall inspection looking for leaks, security breaches, equipment failure, etc. **Recommend that staff routinely inspect each 'opening' to the reservoir to ensure each seal or screen is intact.** Add this inspection to the facility checklist and conduct on a monthly or quarterly schedule. Prioritize repairs as necessary.

The overflow and drain lines at the Horizon No. 1 Reservoir had an airgap located in a manhole which could be subject to flooding. **Raise the air gap so that it is above ground and install adequate screening.** City staff said this reservoir is subject for replacement and would incorporate an appropriate drain/overflow configuration in the new facility design.

DISTRIBUTION:

The City operates and maintains miles of distribution (majority) and transmission (limited) piping, over 180 pressure reducing valves and 23 booster pump stations within 64 major pressure zones. Distribution piping is mainly asbestos cement or ductile iron. The system is separated into three major zones: west, east, and south, plus the Coal Creek area is interconnected with the south zone. There is the ability to move limited flow between zones through pressure reducing valves. Capacity is available to provide greater than 1,000 gpm available fireflow for more than 97% of the system.

Pump stations include redundant domestic and fire pumps for reliability. Many stations are equipped with generators. The pump stations visited were clean. Pumps, piping and associated appurtenances appeared adequately maintained.

WATER SYSTEM PLAN:

The last City of Bellevue Water System Plan (WSP) was submitted in 2006 and approved by the Department on January 7, 2009. It took 18 months to get the WSP approved by King County. Next plan is due by January 10, 2015.

Two primary projects identified in 2006 WSP Plan include need for additional storage in West Operating Area and need to upgrade inlet capacity from Seattle/Cascade. A project was completed to upgrade the capacity of the Bel-Red Inlet. With this additional capacity, adequate capacity is available to serve customers for an additional five years. New capacity will need to be in place in 2021 instead of 2017.

The Bel-Red commercial area was rezoned in 2009 to high-density development. The City is currently planning for two light rail stations and additional medical/commercial applications for this area. This rezone will require additional storage in West Operating Area. The 2006 WSP called for 3MG; the City determined the storage requirement to now be 6 MG. City staff exploring options including siting a new reservoir and/or moving excess storage from east to west operating area.

EMERGENCY RESPONSE PROGRAM:

City staff is continually improving a very dynamic and comprehensive emergency response program. The following bullets capture recent highlights of the City's program.

- City updated program in January 2010. Prepared for the following types of emergencies: wind/rain events, water shortage, snow/ice, flooding, water quality emergencies, volcano eruptions, earthquakes and West Nile virus events. Program incorporates NIMS format; includes incident command concept.
- Participate in Washington Water/Wastewater Agency Response Network (WARN) that allows them to receive rapid mutual aid and assistance from other systems in an emergency.
- Developed a way to triage critical portions of the system; split city into 5 districts based on routes and/or criticality of sites. Used this system during the Nisqually earthquake.
- City Hall has city-wide emergency operations center (EOC). Bellevue has a representative that goes to King County EOC.
- Communication system in place is robust; have a command center with dispatch capabilities; have old radios if normal communications are down. GIS information can be used to develop mailing lists for messages or mailings. The City is evaluating use of a reverse 911 service to get messages out to customers.
- City staff developed a separate Emergency Response Plan for water quality events:
  - Prepared for contamination events, response to positive coliform/E.coli events, and response to backflow events.
  - For emergency preparedness, the City purchased and developed an operational strategy for using a Blivet system (drinking water bladder), which fits on a water truck and is comprised of a water table with taps that people can fill containers with potable water. The City deployed the Blivet system recently in the Puget SoundShake events.
  - The City also developed a program to directly connect the Blivet system to reservoirs in the event of an emergency. The system can be set up at two existing reservoirs, one located at the South Bellevue Community Center and another located at the North Bellevue Senior Center.
  - If a water quality event occurs, the City will start EOC, and get directors on board. Have City PIO and Utilities PIO together and developing appropriate messaging for media. Call appropriate agencies and/or stakeholders (including DOH, SPU, Seattle-King County Public Health)

SECURITY PROGRAM:

A Vulnerability Assessment was completed by City staff and submitted to EPA in 2002. Most facilities are fenced and/or have locked entry, except the Meydenbauer and Cherry Crest facilities. Many facilities have cameras that can be viewed through telemetry or DVRs which record activities on site. In last 10 years, City spent nearly $750,000 on security upgrades (mostly in house labor).

City staff developed a security related field manual for the field crews; recently updated in 2010. The manual explains the process for those who reach a site first in the event of a security breach. The manual details who is appropriate to contact under different scenarios and includes maps to show how to isolate portions of system in case a reservoir is contaminated (for example).

If an alarm sounds after hours, the on-call person would respond. First, staff would look at SCADA to see what facility has been intruded upon. The on-call person would go to site, police would be called. If the event is real, the police will enter the site first and take control. Operations staff can get on site once police have cleared their entry.

MANAGEMENT & OPERATIONS:
Highly competent staff manage and operate the City's distribution system. The City shared the following list of successes achieved by staff in the last five years.

- Flushing Program - goal is to conduct flushing of complete system once every 6 years
- Emergency response plan – staff developed action plans to swiftly isolate and repair main breaks in critical areas of the system
- Operator Training – all field staff maintain WDS certification
- Meter Maintenance Program – goal is to replace every service within the system once every 20 years (approx. 2,000 per year)
- PRV Maintenance – with 64 pressure zones, the system relies on more than 300 PRVs; high priority, staff can do maintenance/repair/replacement in house
- Complaints – O&M staff investigate all complaints received

Item	Status
Water System Plan	2006 Plan was approved by Department on January 7, 2009. Next update is due by 1/10/2015. **Please schedule a pre-plan meeting in late 2013 or early 2014 as you begin to compile your next Plan.**
Water Rights	The Department of Ecology (DOE) has jurisdiction with respect to the water rights associated with your water system.
WFI Update	The WFI is sent out annually for you to review, update and send back to DOH so Sentry can be updated. **Please update the information regarding interties for your system and send to the Department.**
Water Quality Monitoring Report	Not applicable. Sent to utility with source(s) at the beginning of each year.
Coliform Monitoring Plan	• Included in SPU Regional Coliform Monitoring Plan. SPU required to take 84 weekly samples (typically take 85 samples). Bellevue takes any required follow-up samples. No non-acute or acute MCL violations in last 5 years. • City sent updated CMP to Department in 2007 which included new sample sites for Coal Creek Utility District and Water District 1 areas. **Please continue to update routine and repeat sample locations as needed (due to growth, change in flow pattern, etc.).**
Chlorine Residuals	Have 23 sampling stands that provide online water quality monitoring; take temperature, pH and chlorine residual. Not want to be lower than 0.2 mg/L. Operators look at trends on SCADA and do flushing and/or operational changes if problems are observed. HPCs collected with SPU monitoring; Bellevue staff monitors these.

Lead and Copper	Included in SPU Regional Monitoring Plan. On current schedule, City collects 50 samples per year, once every 3 years. All recent samples are under action levels. Do bill insert with required language for customers.
D/DBPs	• Sampling will be required under EPA Stage 2 DBP Rule. The City must submit a Stage 2 DBPR monitoring plan prior to sampling which begins in the second quarter of 2012. For questions regarding Stage 2 D-DBPs, please contact Jolyn Leslie at (253) 395-6762. • Historically, City has some water quality concerns in the South Cove neighborhood (including high DBPs). Made operational changes in system to improve water quality for this area.
Asbestos	Required every 9 years if more than 10% of distribution is asbestos cement. The City is required to submit a sample by the end of 2011.
Monthly Monitoring Reports	Systems that purchase treated surface water you are required to measure and maintain a detectable chlorine residual in your distribution system according to WAC 246 290 694(8) and 694(6)(b). You are required to submit a report to the Department on a monthly basis.
Treatment	Bellevue receives chlorinated and fluoridated water from Seattle Public Utilities. No additional treatment is provided within the City's system.
Consumer Confidence Report	Annual. In compliance.
Operating Permit	Green at time of inspection.
Overall Design Approval	Yes, unspecified.
Certified Operator	In compliance.
Preventative Maintenance	Active program in place and updated on a regular basis; details below.
Pipes	Asset management program in place to determine which pipes get priority for replacement. Developing funding mechanism to pay for replacement costs.
Flushing Program	• Goal of flushing entire system once every six years. • Staff have tools in place to monitor chlorine residuals and track complaints; if problems arise, crews flush system appropriately.
Valves and Hydrants	• Visit PRV stations once a year to inspect. Do complete overhaul at for all PRVs, control valves, altitude control valves stations once every 5 years. Major maintenance activities are tracked through Maintenance Management System (MMS). • Historically, staff conducted maintenance on hydrants once per year; currently maintenance occurs on a less frequent basis.

Pumps	Pump stations visited once a week; complete inspection checklist. Repairs and replacements prioritized and scheduled. Operated via telemetry system.
Reservoirs	• Visit each reservoir once a week; complete inspection checklist. Strive to clean and inspect each reservoir on a 4 year basis; currently able to do this on a 6 year cycle. Paint as necessary. Operated via telemetry system. • Would like to put monitoring equipment in all reservoirs to monitor chlorine residual – include in CIP. Change configuration to promote improved water quality (inlet/outlet), install recirculation equipment, etc.
Telemetry	Telemetry (operations and alarms) and data management systems in place.
Water Use Efficiency/Conservation	• Program included in 2006 Comprehensive Plan is considered a transition plan. • Goal set in November 2007 – save 355,000 gal/day by end of 6 year program (2008 through 2013). • Program is regional and local in nature and targets all customer areas. • Rely on Cascade to do large hardware programs. • At local level, focus on outdoor use, irrigation, education and commercial users.
Production Data	• Each of the inlets are metered. SCADA provides historical production data. Numbers from SPU are compared with City data. • Staff provided excel summary for each inlet for 2006 through 2010.
Consumption Data	• Peak day for system historically was in 1987 (36.82 mgd). Reached new peak day demand of 39 mgd during hot spell at end of July 2009. • The City is fully metered and meters are read every two months. • Replace residential meters every 20 years; prioritize highest commercial users and look at recalibrating those meters every three years with a limited number completed each year.
Distribution System Leakage	In 2009, leakage reported as 5.7% (3 year average).
Cross Connection Control Program	• Have an active, combined program. All backflow prevention devices (BFP) – commercial and residential irrigation - are required to have annual test. Staff sends reminder letters for device testing. • Prefer point of use devices for maximum protection. • Growth rate slowed from 12% is 10% per year; still difficult to maintain compliance with growth rate. • Medical reporting requirements present a challenge to staff. • Achieved 93% compliance on BAT testing in 2009.

Cross Connection Control Program (Cont.)	• Have approx. 400 Table 9 high hazard devices in City; try to visit 30 or so per year. • Do inspections when tenants do improvements or buildings change hands. • Staff concerned about contamination potential from approx. 400 wells that customers have on water front properties in the City limits. • Recent code changes provide stronger enforcement if found to be out of compliance.
Wellhead Protection Program	• Did not discuss in detail. Developed elements for recently approved emergency wells (Samena and Crossroads wells). • **Recommend develop a source contaminant inventory and notification program for these wells.**
Reliability	• Onsite generators not standard – approximately eight permanent generators. Have two portable generators; would like to see more onsite power generation to improve reliability. • Pump stations have built in redundancy.
Financial Viability Program	Did not discuss in depth. It was mentioned that Bellevue does not carry any debt. Philosophy is to plan and fund replacement program (R&R Fund).
Complaints	• Handled internally by City Utility Water Quality staff. • DOH received no complaints since the last survey.
Asset Management	City hired a person to develop and implement on an asset management program that will focus on rehabilitation and replacement. Most of system installed in the 1960s. Council supports concept and approved funding for a pipeline replacement program of 5 miles/year for next 10 years. Program looks at failure probability. Large portion of system comprised of AC pipe which can fail in a catastrophic manner.

RECOMMENDATIONS/REQUIREMENTS:

1. During the survey, the overflow and drain pipe for the Horizon No. 1 Reservoir was inspected and determined to be subject to flooding and potential contamination. We discussed modifications that could be made to the existing overflow and drain piping. If the reservoir is not scheduled to be replaced in the immediate future, please implement the modifications discussed. Please consider inspection of all reservoir overflow lines and if the existing configuration appears to be vulnerable to contamination, consider scheduling appropriate modifications to keep the reservoir safe from contamination.

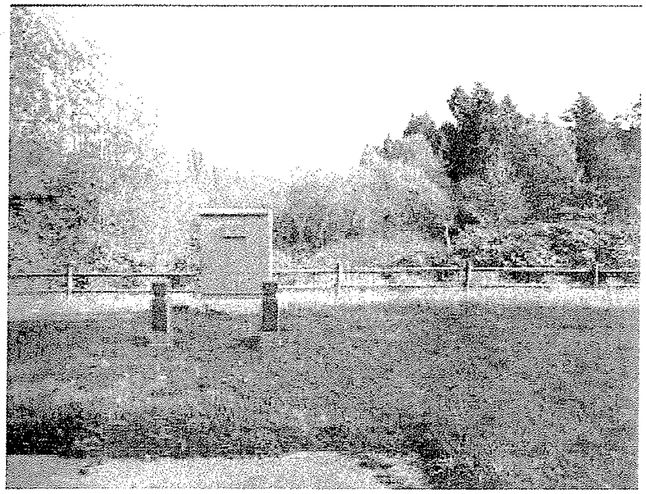
2. Update your WFI to include the accurate number of interties with Cascade/SPU, Kirkland, and Redmond. Please submit your revisions to the Department within 30 days.

3. Biological contamination can enter a water system via insects, birds, bats, and unsealed openings vulnerable to rainwater runoff. Since we were unable to climb each reservoir or verify the location of each drain and overflow pipe, please verify that all seals and screens on all storage tank roof vents, access hatches, overflows, and access point where level gauge wire enters each tank are in excellent condition. Please note the attached photos showing openings that need to be addressed. Next time you visit each reservoir for routine inspection, please take a photo of the seals and screens in place and send them to the Department. Recommend you add the routine inspection of seals and screens to your standard checklist for reservoir inspection.

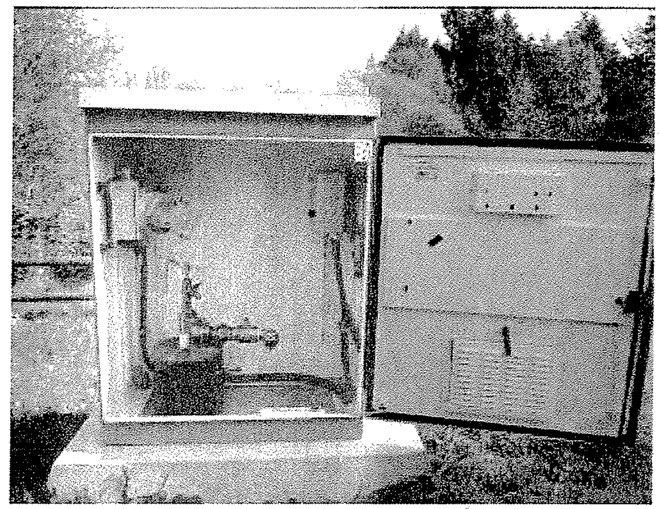
4. The City's Water System Plan Update is due in January 2015. Please schedule a pre-planning meeting to discuss the appropriate level of planning required for the update with Department staff with the adequate lead time to meet this submittal deadline.

EXISTING OPERTING AREA INFORMATION

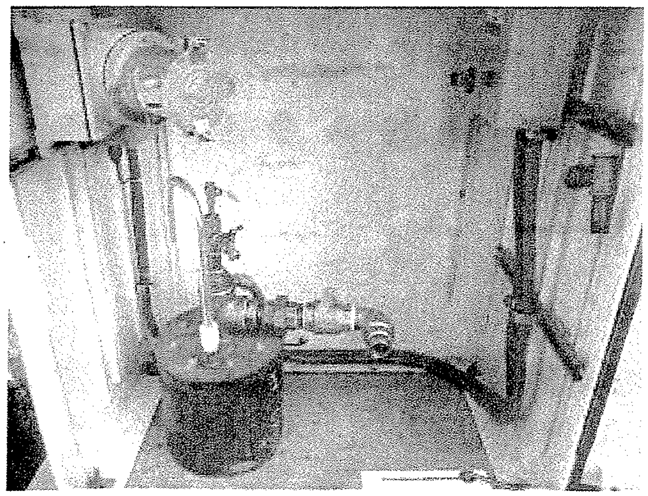
OPERATING AREA	PRESSURE ZONES	PRIMARY SUPPLY	STORAGE
WEST	Bellevue (BV) 400	Cherry Crest	Pikes Peak
	Pikes Peak (PP) 550, 600, 670	NE 40th	Cherry Crest
	Bellefield (BF) 220	Bel-Red	Clyde Hill 335 (2), 390, 465
	Kelsey Creek (KC) 300	Enatai	Woodridge
	Clyde Hill (CL) 335, 500	Richards Road	Meydenbauer
	Yarrow Bay (YB) 300		
	Medina (MD) 230		
	Enatai (EN) 300		
	Woodbridge (WD) 340, 400, 450		
	Meydenbauer (MB) 252		
	Richards Valley (RV) 200		
	Hunts Point (HP) 250		
EAST	Lake Hills (LH) 520	NE 8th	NE 40th
	Rose Hill (RH) 545	SE 28th	Lake Hills 520 (N & S)
	Redmond (RM) 330, 400	Eastgate	Newport
	College Hill (CO) 380, 440	NE 40th	Parksite
	Kelsey Creek (KC) 450		Sammamish
	Lake Hills (LH) 380, 435		City of Kirkland's 545 Reservoir
	Sammamish (SA) 270		
	Eastgate (EG) 300, 370, 400, 440		
	Sunset Hills (SH) 450		
SOUTH	Newport Shores (NS) 200	Somerset Inlet	Somerset 2
	Factoria (FA) 293, 440, 470	Eastgate	Forest Hills
	Newport Hills (NH) 380, 470, 580	SE 28th	Horizon View 1, 2, 3, 3a
	Forest Hills (FH) 465, 1100	Inlet 7	Cougar Mountain 1, 2, 3,3a
	Somerset (SS) 550, 700, 850, 940, 1000	Inlet 11	Factoria
	Eastgate (EG) 590, 630		CCUD's 440, 580 (E&W)
	Horizon View (HV) 700, 940, 1080, 1115, 1175		
	Summit (SU) 1060, 1100, 1350		
	Cougar Moutain (CM) 1000, 1150, 1300, 1465, 1550		



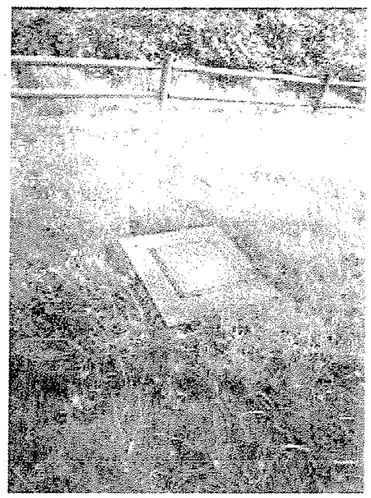
Samena Emergency Well 3– Site Overview



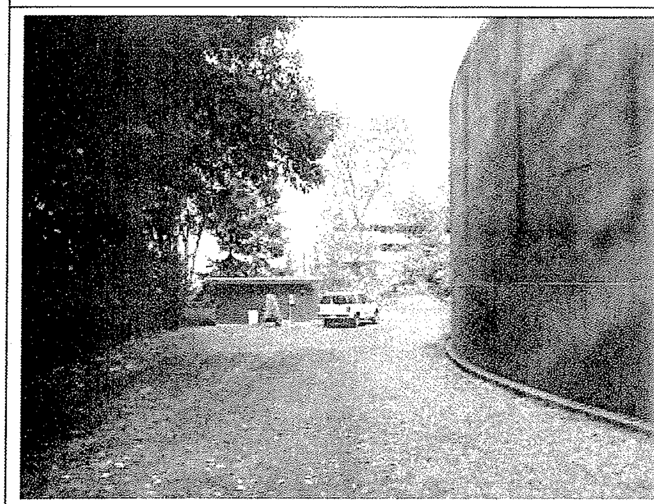
Samena Emergency Well 3 Equipment



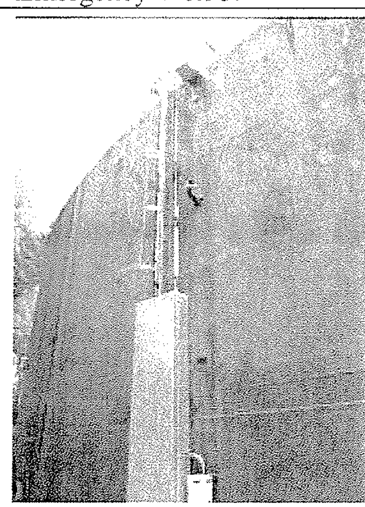
Samena Emergency Well 3 Closeup 1



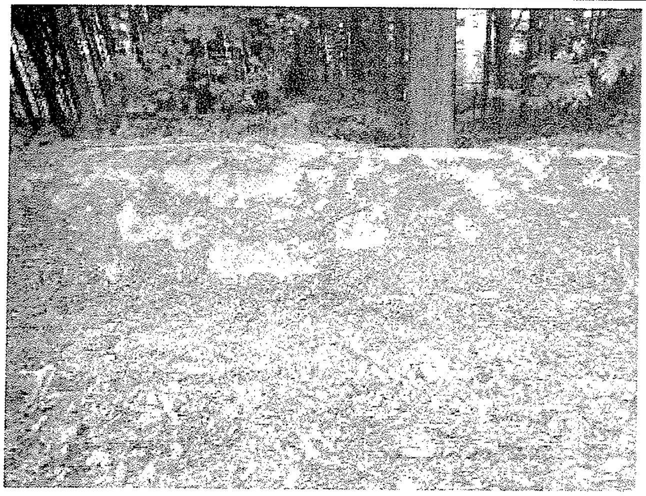
Partially decommissioned well adjacent to Samena Emergency Well 3.



Factoria Reservoir Site Overview

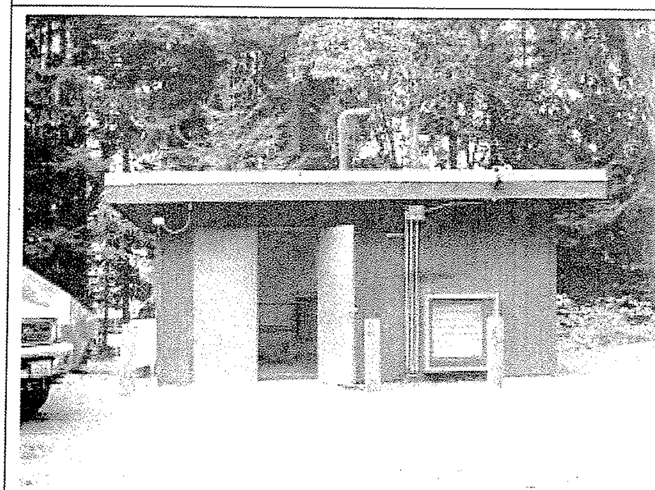


Factoria Reservoir Ladder

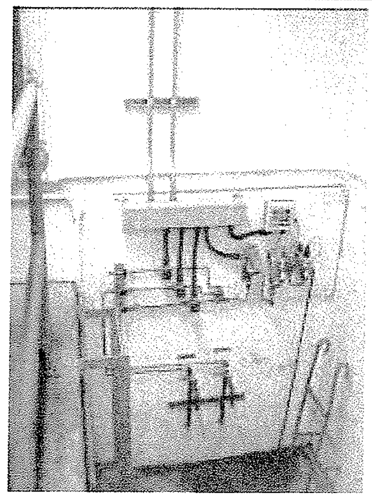


Factoria Reservoir Overflow Basin – **confirm overflow line daylights here and that screen is intact.**

Factoria Reservoir drain line spills water into this catch basin which is connected to the storm sewer system – did not open hatch. **Confirm that drainline is adequately screened.**

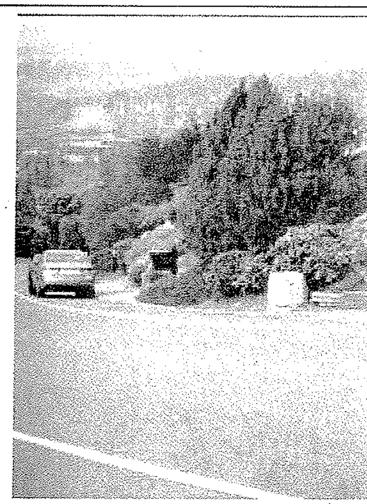


Building on Factoria Reservoir site – abandoned pump station (all pump equipment has been removed); houses water quality equipment and DVR/camera only.



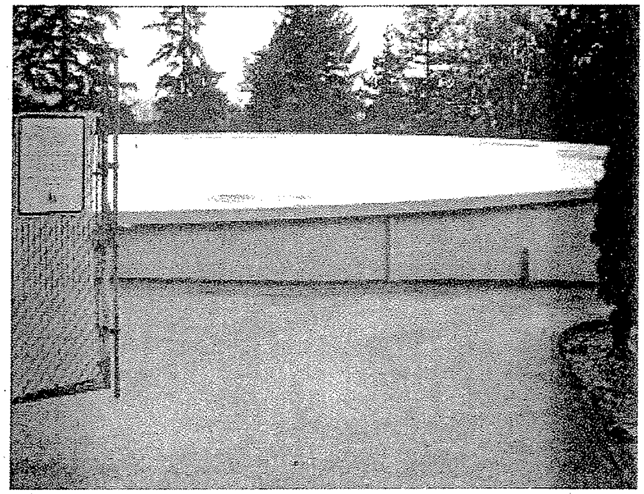
Water quality monitoring equipment for Factoria Reservoir – measures pH, temperature, chlorine residual different water level in reservoir.

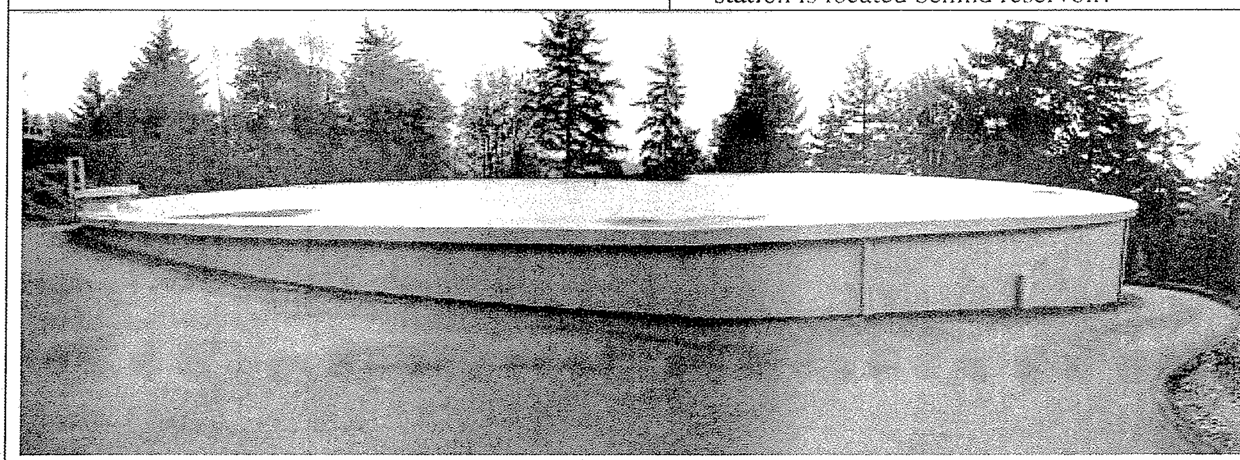
Somerset #2 Reservoir and Pump station (all underground); structural work being conducted at site (reservoir empty).

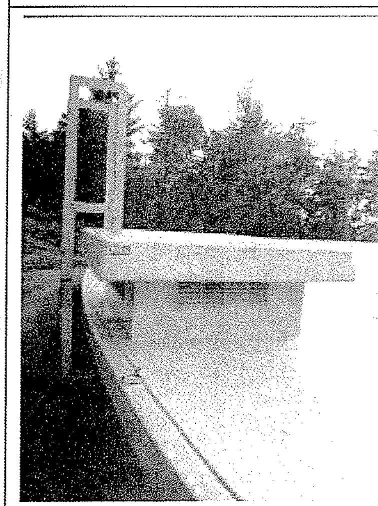


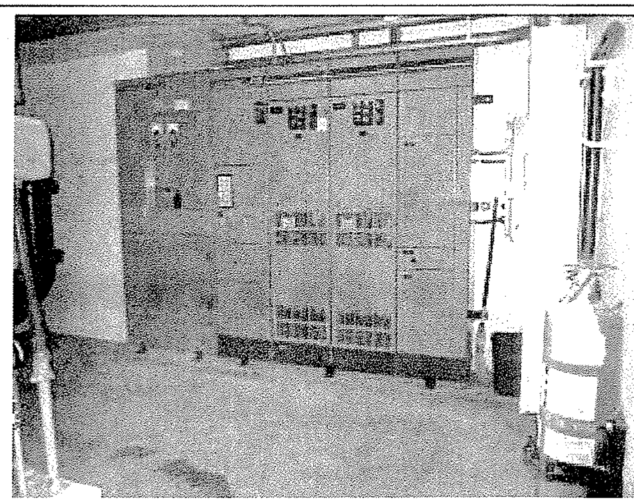
Drain and overflow lines from Somerset #2 Reservoir flow into catch basin located in road behind car (did not open during survey). **Confirm adequate screening is intact.**

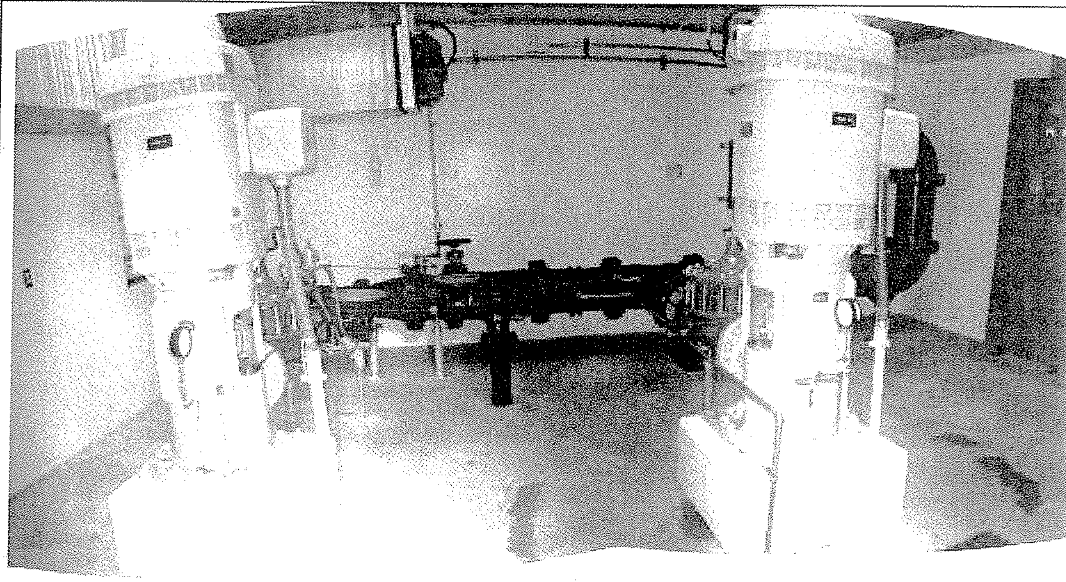
Sign located at entrance to Forest Hills Reservoir.


Overview of Forest Hills site from entrance; pump station is located behind reservoir.

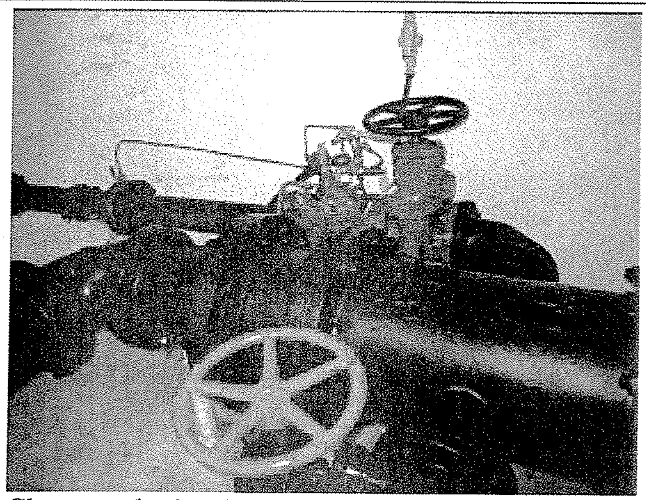

Forest Hills Reservoir Site Overview


Close up of Forest Hills Reservoir vent and access hatch (did not open during site visit).

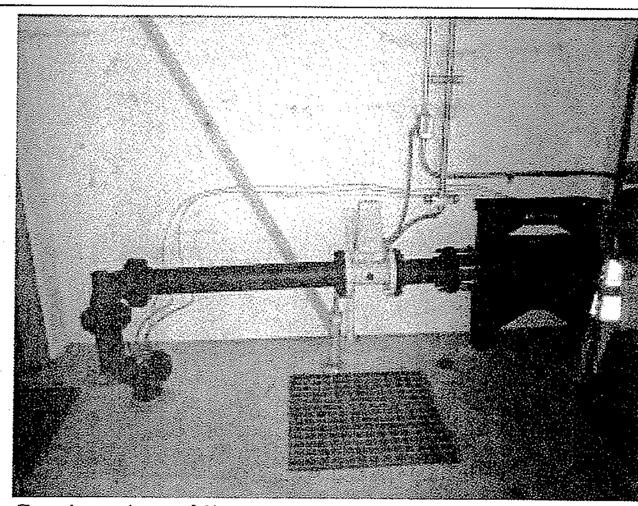

Control Panel at Forest Hills Pump Station



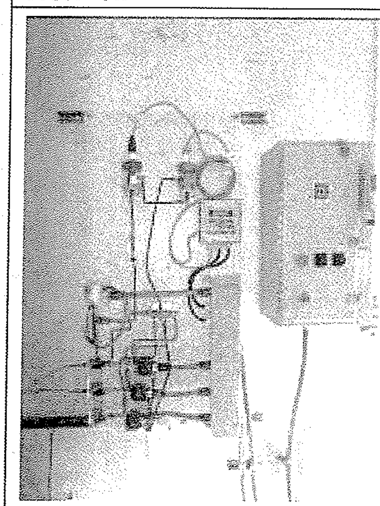
Forest Hills Pump Station Overview



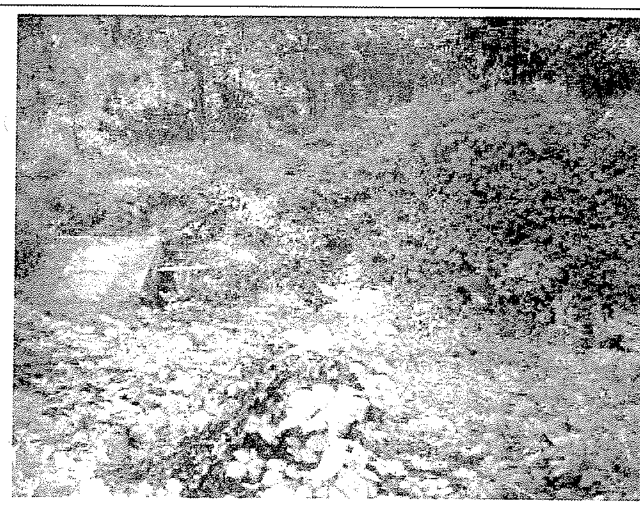
Close up of valve that can push 500 gpm of water into tank through pipe with 90 degree raised entrance – part of water quality improvements project for this reservoir



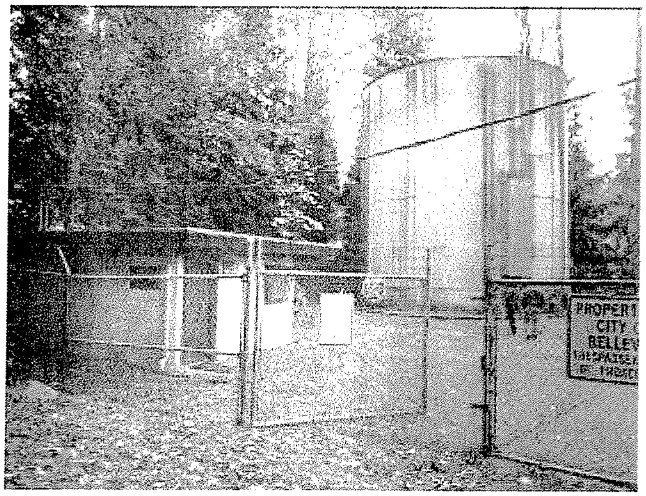
Continuation of line that can change how tank is fed to improve mixing/water quality in tank; includes meter and sample lines for continuous monitoring equipment



Monitoring equipment for Forest Hills Reservoir; measures pH, temperature and chlorine residual at two levels within reservoir and pump suction pipeline

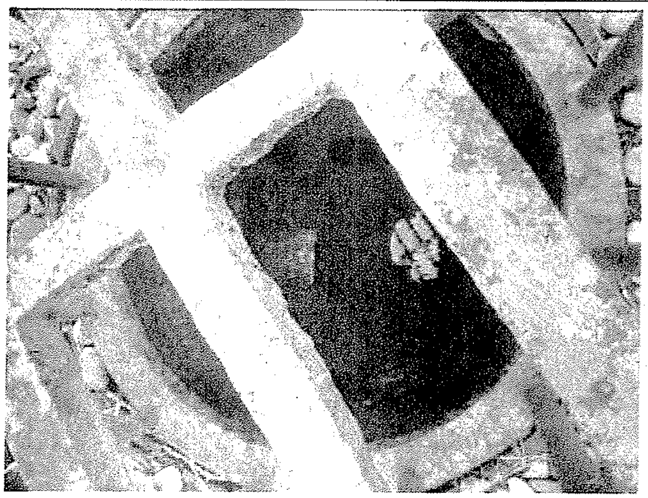


Swale where overflow and drain line empties from Forest Hills Reservoirs – **confirm pipe daylights here and that screen is intact.**

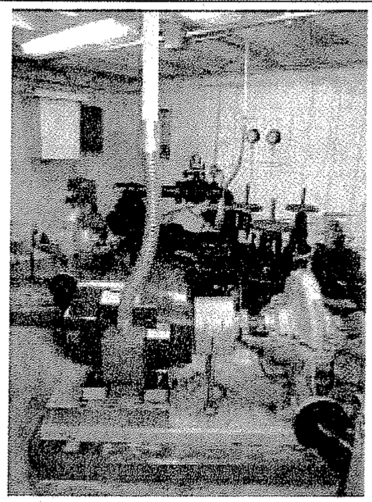


Horizon #1 Reservoir and Pump Station site overview

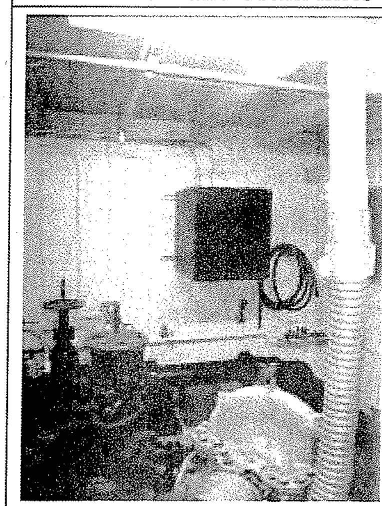
Catch Basin for reservoir drain/overflow line



Close up of catch basin; drain and overflow lines not screened. **Recommend provide air gap and screen for overflow and drain lines when tank is rebuilt.**



Horizon View #1 Pump Station



Horizon View #1 Pump Station – close up of box that holds DVR/camera for site

Appendix U

Coliform Monitoring Plan

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WATER QUALITY REGULATORY COMPLIANCE HANDBOOK

SECTION 2.1

TOTAL COLIFORM RULE

CITY OF BELLEVUE - COLIFORM MONITORING PLAN

Prepared and Administered by:	Michael L. Jackman Drinking Water Quality Manager Environment Division, Bellevue Utilities Department Phone #425-452-6012

Effective Date:	April 30, 1997
Updated:	March, 2007

REGULATORY REFERENCES:
WDOH WAC 246-290 (Effective July 1994)
Part 4 - Water Quality

CITY OF BELLEVUE - COLIFORM MONITORING PLAN

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Section 2.1a - Background on the Rule

In June 1989, the United States Environmental Protection Agency (EPA) promulgated a revised regulation for total coliform. Where the previous regulation was based on the density of coliform given volume of water, the revised rule is based on the presence/absence of coliform. Under the TCR, (Total Coliform Rule) utilities must develop a monitoring plan to collect representative samples of water throughout the distribution system. Monitoring frequency is based on the population served. For a Type A water system, compliance is based on no more than 5% of the samples collected in a calendar month testing positive. Additionally, coliform positive samples must be analyzed for fecal coliform and/or E. Coli. *Repeat Samples* collected in response to a *Routine Sample* that tested positive for coliform, must also be analyzed for fecal coliform and/or E. Coli. The TCR was effective December 31, 1990. The TCR was implemented and enforced in Washington State under the Federal Rule on September 1, 1991. The TCR was adopted and effective in the Washington Drinking Water Regulations in February, 1992.

The Maximum Contaminant Level (MCL) for total coliform is as follows:

1. For a system collecting more than 40 samples per month, a non-acute TCR-MCL violation occurs when more than 5% of the samples collected during the month are coliform-positive.

2. For systems collecting less than 40 samples per month, a non-acute TCR-MCL violation occurs when there is more than one positive coliform sample in a given month.

3. An acute TCR-MCL violation for coliform bacteria occurs when there is:

   (a) Fecal coliform presence in a repeat sample;
   (b) E. Coli presence in a repeat sample; or
   (c) Coliform presence in a set of repeat samples collected as a follow-up to a sample with fecal coliform or E. Coli presence.

Concerns were raised about the TCR because no variances or exemptions were allowed. The concern was that biofilm in the distribution system may lead to violations of the TCR even though there would not be a demonstrable risk to public health. In August, 1989, the American Water Works Association (AWWA) filed a legal petition to review the rule in the U.S. Court of Appeals. As a result of those activities, EPA agreed to allow variances to systems not at risk for fecal or pathogenic contamination. EPA developed interim criteria as guidance to states seeking to identify systems that could operate under a variance without posing an unreasonable risk to health. In the future, EPA will establish variance criteria. Public notification is required for a Type A system operating under a variance.

The state can invalidate a positive coliform sample under three conditions:

1. The laboratory determines that improper sample analysis caused the total coliform positive result,

2. The state determines that the positive total coliform sample resulted from a domestic or other non-distribution system plumbing problem (the state cannot invalidate a sample on the basis of repeat sample results unless all repeat samples collected at the same tap as the original total coliform positive sample are also coliform positive, and all repeat samples collected within five service connections of the original tap are total coliform negative), or

3. The state has substantial ground to believe that a total coliform positive result is due to a circumstance or condition which does not reflect water quality in the distribution system. A laboratory must invalidate a total coliform sample (unless total coliform are detected) if the sample produces a turbid culture in the absence of gas production, using an analytical method where gas formation is examined.

Section 2.1b - City of Bellevue Water System Overview

General Information

The City of Bellevue (System I.D. #05575B) buys its water from the Cascade Water Alliance . Seattle Public Utilities I.D # 77050Y provides drinking water to approximately 1.3 million people in the Puget Sound area on a wholesale and retail (direct service) basis. In 1975, EPA agreed to the implementation of a regional coliform monitoring plan for the total Seattle served system on the basis that the direct service and wholesale areas share the same sources, primary treatment plants, and transmission grid.

The sources of supply for the region are the Cedar River (S-01) and the South Fork Tolt River (S-02), The South Fork Tolt supply treatment process includes filtration, ozonation,disinfection by free chlorine, pH and alkalinity adjustment with lime and soda ash, and the addition of fluoride for dental benefits. The Cedar supply treatment process includes ozonation, ultraviolet light disinfection , screening , fluoridation, corrosion control and chlorination. The City of Bellevue receives approximately 80% of its water from the South Fork Tolt River supply and 20% from the Cedar River supply.

Twenty three sample stands currently are used to overcome the problems of gaining daily access to public and private premises for water quality sampling. These stands are located to represent different population concentrations, sources of supply (inlets), pressure zones and storage facilities so that representative water samples can be collected.

The City of Bellevue water service area covers approximately 37.8 square miles and includes a residential population of 131,800. The service area is located in King County. Surrounding purveyors include the Cities of Kirkland and Redmond to the north and northeast, the City of Renton and Coal Creek Utility District to the south and the City of Issaquah to the east. The City has interties with surrounding Kirkland, Issaquah, Redmond, Coal Creek Utility District and emergency interties with Beaux Arts Water District No. 22 , and the Hilltop Community Water District No. 117.

The City of Bellevue has 27 reservoirs with a total volume of 40.3 MG in the direct service area to provide equalizing storage and fire flows. The City currently has no form of gaseous or hypo chlorination to boost disinfectant residuals in the system.

The City's distribution system is comprised of over 616 miles of water supply and distribution mains, 39,778 water services, nearly 5,000 hydrants and 8,200 gate valves. The system is divided into 3 major operating areas and 62 pressure zones discussed below. The City currently has 23 sample stands that Seattle Public Utilities uses for routine coliform compliance monitoring. These 23 sample stand locations represent the hydrologic and geographic layout of the City's water system. The number and location of the sample stands was reviewed and approved by DOH in April, 2004.

Approximate Service Connections by Operating Areas:

Operating Area	Pressure Zones	UB Abbreviation	Service Connections
West Bellevue			
	Bellevue 400	BV400	4082
	Pikes Peak 550	PP550	631
	Pikes Peak 600	PP600	92
	Pikes Peak 670	PP670	571
	Bellefield 220	BF220	93
	Kelsey Creek 300	KC300	438
	Clyde Hill 335	CL335	1473
	Clyde Hill 500	CL500	950
	Yarrow Bay 300	YB300	32
	Medina 230	MD230	20
	Enatai 300	EN300	1095
	Woodridge 340	WD340	49
	Woodridge 400	WD400	352
	Woodridge 450	WD450	536
	Meydenbauer 252	MB252	1021
	Richards Valley 300	RV300	398
	Hunts Point 250	HP250	168
	Yarrow Bay 220	YB220	150
East Bellevue			
	Lake Hills 520	LH520	9064
	Rose Hill 545	RH545	69
	Redmond 330	RM330	98
	Redmond 400	RM400	223
	College Hill 380	CO380	100
	College Hill 440	CO440	81
	Kelsey Creek 450	KC450	1188
	Lake Hills 380	LH380	178
	Lake Hills 435	LH435	725
	Sammamish 270	SA270	1753
	Eastgate 300	EG300	89
	Eastgate 370	EG370	134
	Eastgate 400	EG400	38
	Eastgate 440	EG440	204
	Sunset Hills 450	SH450	11
South Bellevue			
	Forest Hills 465	FH465	106
	Somerset 550	SS550	487
	Somerset 700	SS700	641
	Somerset 850	SS850	2460

Somerset 940	SS940	57
Somerset 1000	SS1000	901
Eastgate 590	EG590	500
Eastgate 630	EG630	44
Horizon View 700	HV700	467
Horizon View 940	HV940	74
Newport Hills 580	NH580	440
Factoria 440	FA440	110
Newport Hill 320	NH320	170
Newport Hills 380	NH380	1500
Factoria 293	FA293	520
Newport Shores 200	NS200	440
Horizon View 1080	HV1080	103
Horizon View 1115	HV1115	70
Horizon View 1175	HV1175	139
Summit 1060	SU1060	68
Summit 1100	SU1100	84
Summit 1350	SU1350	131
Cougar Mountain 1000	CM1000	326
Cougar Mountain 1150	CM1150	310
Cougar Mountain 1300	CM1300	123
Cougar Mountain 1465	CM1425	30
Cougar Mountain 1575	CM1550	34
Unclassified		6636
Total		**39778**

Source: Utility Billing; Ernie Henry, Feb/2007

HYDRAULIC OPERATIONS

The following sections describe the hydraulic operation of the Bellevue system. The Bellevue system has been divided into three major operating areas: East Bellevue operating area, West Bellevue operating area, and South Bellevue operating area. Figure 6-1 identified the areas served by each operating area. The text discussion is arranged by major operating area. An operating area consists of those pressure zones that use common reservoirs for equalizing and emergency storage. The individual pressure zones associated with each of these major areas will be discussed separately. The discussion will include the operation of the SPU supply connections, PRVs, pump stations, and reservoirs.

Table 6-1 Existing Operating Areas

Operating Area	Pressure Zones	Primary Supply	Storage
West Bellevue	Bellevue 400 Pikes Peak 550, 600, 670 Bellefield 220 Kelsey Creek 300 Clyde Hill 335, 500 Yarrow Bay 300 Medina 230 Enatai 300 Woodridge 340, 400, 450 Meydenbauer 252 Richards Valley 300 Hunts Point 250 Yarrow Bay 220	Cherry Crest NE 40th Bel-Red Enatai Richards Road	Pikes Peak Cherry Crest Clyde Hill 335, 390, 465 Woodridge Meydenbauer
East Bellevue	Lake Hills 520 Rose Hill 545 Redmond 330, 400 College Hill 380, 440 Kelsey Creek 450 Lake Hills 380, 435 Sammamish 270 Eastgate 300, 370, 400, 440 Sunset Hills 450	NE 8th SE 28th Eastgate NE 40th	NE 40th Lake Hills 520 Newport Parksite Sammamish City of Kirkland's 545 Reservoir
South Bellevue	Forest Hills 465, 1100 Somerset 550, 700, 850, 940, 1000 Eastgate 590, 630 Horizon View 700, 940, 1080, 1115, 1175 Summit 1060, 1100, 1350 Cougar Mountain 1000, 1150, 1300, 1465, 1550 Factoria 440, 293 Newport Hills 580, 380,320 Newport Shores 200	Somerset Inlet Eastgate SE 28th Inlets 6, 8, 9, 11	Somerset 1, 2, 3 Forest Hills Horizon View 1, 2, 3, 3a Cougar Mountain 1, 2, 3, 3a Factoria

East Bellevue Operating Area

The following zones within the Bellevue water system are associated with the East Bellevue operating area:

- Lake Hills 520 zone (including the Redmond 520 zone)
- Redmond 400 and 330 zones
- Kelsey Creek 450 zone
- Lake Hills 435 and 380 zones
- Sammamish 270 zone
- Eastgate 440, 400, 370 and 300 zones
- Sunset Hills 450
- College Hill 440, and 380 zones

Lake Hills 520 Zone

The primary supplies to the 520 zone are the NE 40th, NE 8th, SE 28th, and Eastgate supply connections from Seattle. The Lake Hills 520 zone serves as the primary supply zone for the East Bellevue operating area.

The 520 zone can be served on an emergency basis by PRV's 050, and 137 which provide access to water from the City of Kirkland's 545 reservoir via Bellevue's Rose Hill 545 zone.

The Lake Hills booster pump station, located near 160th Avenue NE and NE 8th Street, is typically used to exercise either the north or south Lake Hills tanks periodically by closing the altitude valve and pumping directly into the zone. Normally this is done twice a week by alternating tanks and pumping them down approximately 20 feet for water quality purposes. This procedure is followed from September through May.

During flow control periods, the Lake Hills booster pump station is used to supplement 520 zone demand during the day by isolating one of the two tanks and pumping from it into the zone, drawing the isolated tank down to between 25 and 35 feet. Storage is replenished during off-peak hours.

There is a total of 15 million gallons of storage in the Lake Hills 520 zone. The five reservoirs that contain this storage volume are:

- NE 40th reservoir (6 MG, allocation: Bellevue 3.4 MG, Redmond 2.6 MG)
- Lake Hills reservoirs (two at 2 MG each)
- Newport reservoir (3 MG)
- Parksite reservoir (2 MG)

The full condition for the Newport reservoir is 20 feet of water. During the summer this tank is operated between 16 feet and 10 feet for equalizing storage. The top 4 feet are reserved as an operational storage buffer.

The summertime full condition for the Parksite reservoir is 36 feet, 4 feet below overflow, with the top 4 feet reserved as an operational storage buffer. Typically, this tank floats with the Newport reservoir and at times it falls to 20 to 22 feet.

The NE 40th reservoir was completed in 1991 to strengthen the north 520 pressure zone. This reservoir is jointly shared with the City of Redmond. Bellevue is allotted 3.4 MG of the total volume. The addition of this reservoir increases the City's ability to respond to a major fire or other emergency conditions in the north 520 zone, while still maintaining service in the remainder of the zone.

There is also 1.5 MG of emergency storage available to the 520 zone from the 11.2 MG 545 reservoir jointly owned with the City of Kirkland.

Redmond 400 and 330 Zones

The Redmond 400 and 330 zones are served exclusively from the 520 zone. The 400 zone is served through PRV's 073, 082, and 041 from the 520 zone. The 400 zone drops to the 300 via two PRV's, 139 and 140. These zones are small and have no storage.

Kelsey Creek 450 Zone

This zone is fed by four PRV's (No. 042, 093, 044, and 094). All of these PRV's operate continuously. This zone relies on the 520 zone for storage.

Lake Hills 435 and 380 Zone

The Lake Hills 435 and 380 zones are served exclusively by PRV's from the 520 zone. The north 435 zone is served by PRV's 081, 070, and 080. The south 385 zone is served by PRV's 067 and 069. Both zones rely on the 520 zone for storage.

Sammamish 270 Zone

The Sammamish 270 zone is served by two PRV's from the 520 zone, two PRV's from the Lake Hills 435 zone, one PRV from the Lake Hills 380 zone, and two PRV's from the Eastgate 370 zone. The main supply to the zone is from the 520 via the Eastgate 370 zone through PRV 065.

Some of the PRV's that feed this zone are set to open successively at lower pressures. They include PRVs 065 and 061 from the 520 zone; PRV 072 from the 435 zone; PRV 071 from the 435 zone; PRV 068 from the 380 zone; and PRV 114 from the Eastgate 370 zone.

Storage is provided in this zone by the 1 MG Sammamish 260 reservoir. The summertime full level in this reservoir is elevation 257 to 258, 2 to 3 feet below overflow. A typical daily fluctuation of 4 feet (elevation 256) provides approximately 0.12 MG of equalizing storage. PRV 065 is the primary feed to this zone. The 8-inch valve is equipped with a motorized control, which can be manipulated from the Bellevue Service Center. This allows the operator to draw down the Sammamish Reservoir to prevent water quality problems.

Eastgate 440, 400, 370 and 300 Zones

The 440, 400, and 370 zones are supplied by PRV's directly from the 520 zone. The primary supply to the 440 zone is through PRV's 059, 060, and 066. The 400 zone is fed by PRV's 095 and 101, and the Eastgate 370 zone by PRV 130. All of these PRV's operate continuously.

The Eastgate 300 zone is a small zone served by a single PRV 058, from the Eastgate 440 zone.

There is no storage in the Eastgate zones; they rely on the 520 zone for equalizing and emergency storage.

Sunset Hills 450 and College Hill 440, 380 Zones

The Sunset Hills 450 zone is a very small zone fed by a single PRV (No. 041).

The 440 zone is served by PRV's 039 and 136 from the 520 zone. The 380 zone is served from the 520 zone through PRV's 038 and 098. The 380 zone is also served from the 440 zone through PRV 037.

All of the zones are served exclusively by PRV's and rely on the 520 zone for equalizing and emergency storage.

West Bellevue Operating Area

The zones listed below are associated with the West Bellevue operating area:

- Bellevue 400 zone
- Yarrow Bay 300 and 220 zones
- Clyde Hill 500/465 zone
- Kelsey Creek 300 zone
- Clyde Hill 335 zone
- Medina 230, Hunts Point 250 and Meydenbauer 252 zones
- Bellefield 220 zone
- Woodridge 450, 400, and 340 zones
- Enatai 300 zone
- Pikes Peak 670, 600, and 550 zones

Bellevue 400 Zone

The Bellevue 400 zone is the primary supply zone for the West Bellevue operating area. The 400 zone is served primarily by the SPU supply connections Cherry Crest, Bel-Red, Enatai, NE 40th and Richards Road. During high demand or emergencies, there are several other PRV's that can supply water to the 400 zone. The 400 zone is served on a standby basis from the Lake Hills 520 zone through PRV 047, from the 520 zone via the Kelsey Creek 450 zone through PRV 043, and from the Woodridge 450 zone through PRV 128.

Storage in the 400 zone is provided by the newly constructed 3 MG Cherry Crest reservoir, which floats on the 400 gradient, and the 4 MG Clyde Hill 390 reservoir, which operates on two altitude valves. The overflow condition for the Cherry Crest reservoir is 25 feet of water. The reservoir operates between 17.5 and 22.5 feet in the summer with the 5-foot fluctuation, providing approximately 0.42 million gallons of equalizing storage. During the winter, the reservoir fills to elevation 388 and fluctuates 2 or 3 feet through the day. The 1.5-MG Clyde Hill 335 reservoirs can also provide storage for the 400 zone. The 335 reservoir is filled from the 400 zone through an altitude valve, and if the 400 zone gradient falls below 335, water will flow to the 400 zone through a check valve. Additional storage can be provided from the Woodridge 397 reservoir, which is discussed later.

The only pump supply to the 400 zone is from the 1-MG Meydenbauer 252 reservoir. The pump can serve only a limited area of the Bellevue 400 zone in the vicinity of Enatai because of a check valve. This pump is operated only during emergencies.

Yarrow Bay 300/220 Zone

The Yarrow Bay 300 and 220 zones are small zones supplied by one PRV from the 400 zone to YB 300, and in kind the YB 220 zone is fed through two PRV's in the YB300 zone.

Clyde Hill 500/465 Zone

The Clyde Hill pump station is the primary supply for the Clyde Hill 500 zone. This station operates from 5:30 a.m. through midnight. During these hours, the hydraulic gradient in the zone is 500 feet. When the pump is not operating, midnight to 5:30 a.m, demands are met by the Clyde Hill 465 reservoir. During pumping hours, if the gradient falls below 465, the Clyde Hill 465 reservoir then can also provide water to the zone. The pump station is supplied by the 400 zone, with equalizing storage provided by the 400 zone reservoirs.

Kelsey Creek 300 Zone

This zone is supplied on a continuous basis by PRVs 013 and 014. The zone has no storage and relies on the 400 zone for equalizing and emergency storage needs.

Clyde Hill 335 Zone

This zone is supplied water from the 400 zone by two PRV's, 022 and 023, and an altitude valve, PRV 3006-01. Storage is provided in this zone by the 1.0-MG and 0.5-MG Clyde Hill 335 reservoirs. These reservoirs are filled by an altitude valve from the 400 zone and are typically kept full and used for emergency storage. A check valve has been installed so that, in the event of a fire at Bellevue Square, the 335 reservoir can supply water to the 400 zone.

Medina 230 Zone

This zone has a single supply from the Clyde Hill 335 zone through PRV 024. This zone is quite small and has no storage. The Clyde Hill 335 reservoirs provide equalizing and emergency storage for the zone.

Meydenbauer 252 Zone

The primary supply to this zone is from the Enatai 300 zone through PRV 004 and from the Bellevue 400 zone through PRV 005. PRV 004 is set up as the refill valve for the Meydenbauer reservoir and acts like an altitude valve with a pressure sustaining feature on the 300 zone side of the valve. During peak demands or hot summer days this feature enables Bellevue to equalize the flow from the Enatai supply connection. This zone has 1-MG of storage in the Meydenbauer 252 reservoir. The reservoir storage is from elevation 236 to 252 overflow. During the summer, a daily fluctuation of 10 feet is typical. This reservoir is filled primarily by PRV 004. In case of emergency or heavy demand, water can be dropped from the Bellevue 400 zone into the reservoir through a float valve PRV 030, which also can be controlled from the Bellevue Service Center.

The Meydenbauer 252 zone is also supplied from the Bellevue 400 zone by two PRV's, 133 and 135. As mentioned previously, the Meydenbauer 252 pump station can serve as an emergency supply for a portion of the 400 zone, allowing the Meydenbauer 252 storage to be used in emergencies.

The western most portion of the Meydenbauer 252 zone is supplied continuously from the Clyde Hill 335 zone by two PRV's, 026 and 025. This portion of the 252 zone relies on the Clyde Hill 335 zone for storage because of its remoteness from the Meydenbauer reservoir.

Hunts Point 250 Zone

The Hunts Point 250 zone is supplied by two PRV's 131 and 132; which receive their supply from the Clyde Hill 335 zone. This zone must rely on the Clyde Hill 335 zone for storage because the zone has no internal storage.

Bellefield 220 Zone

The north portion of the Bellefield 220 zone is residential and is supplied by PRV 034; the south portion of this zone is commercial, and three PRV's serve this area, PRVS 085, 007, and 090.

Woodridge 450, 400, and 340 Zones

All three Woodridge zones are served from the CESSL. The 450, 400, and 340 zones are served off a 12-inch high-pressure main, which is connected to the CESSL at the Richards Road Seattle inlet connection.

The 450 zone is served by two PRV's 035, and 008, along with the Woodridge pump station. The primary feed to the 450 zone is PRV 035, which is located in the Woodridge pump station. The Woodridge pump station will supply water to the 450 zone when the pressure for the zone falls below 430 feet, with its supply of water coming from the Woodridge reservoir. The pump station operates automatically, based on 450 zone pressure.

No storage is provided in the 450 zone; however, water stored in the Woodridge 397 reservoir is available via the Woodridge pump station.

The Woodridge 400 zone is served by three PRV's on a continuous basis: PRV's 011, 009 are associated with the Richards Road supply connection, and PRV 012 from the Woodridge 450 zone.

There is no direct storage for the Woodridge 400 zone. The Woodridge 397 reservoir provides storage for the Bellevue 400 zone and the Woodridge 450 zone via the Woodridge pump station. The reservoir is filled from the Richards Road supply through an altitude valve PRV 3011-01. The overflow condition for Woodridge reservoir is 71 feet of water. Typically, the reservoir is operated at full condition between 55 and 65 feet and can fluctuate up to 30 feet daily in the summer.

The 340 zone, a single feed zone, is served exclusively by PRV 092, which is connected to the Richards Road supply pipeline.

Richards Valley 300 Zone

The Richards Valley 300 zone is supplied primarily from PRV 086, this PRV is connected directly to the Richards Road Seattle inlet from the CESSL. The 300 zone is also served by two PRV's from the College Hill 380 zone, PRV's 040 and 158.

Enatai 300 Zone

The main source of supply for the Enatai 300 zone is from the Enatai supply connection to the CESSL and its associated PRV 2007-01. PRV 134 is the secondary feed to this zone, and under extreme demand conditions such as fire fighting, PRV 003 will also feed this zone.

Pikes Peak 670, 600, and 550 Zones

There are three zones in the Pikes Peak area: the 670 zone, 600 zone, and the 550 zone. The 670 zone is served primarily from PRV 1003-02 located in the NE 40th 670 zone pump station, when Seattle's TESSL pressure is above 680 feet. If Seattle's pressure falls below 680 feet or usage in the zone increases, the NE 40th inlet and Pikes Peak 670 zone pump stations take over. The source of supply for the Pikes Peak 670 pump station is the Pikes Peak 550 zone. PRV 017 can serve the 670 zone when Seattle's pressure is above 680. The 600 zone is served exclusively from the 670 zone by PRV 052. The 550 zone is fed from three places: The Pikes Peak 550 reservoir which is fed from PRV 016 when Seattle's pressure is above 570 feet, the Cherry Crest pump station (at the Cherry Crest 400 zone reservoir) when the Seattle pressure is below 570 feet or in periods of heavy demands, and in emergency situations, a backfeed valve PRV 1001-01 will allow the 670 zone to supply the 550 zone.

The only storage in the Pikes Peak zones is the 1-MG Pikes Peak 550 reservoir. This reservoir provides equalizing, fire, and emergency storage for the 550, 600, and 670 zones (via the Pikes Peak pump station). In emergency situations this reservoir can be supplied by the 670 zone through PRV 1001-01 located adjacent to the 550 reservoir. Flow through the PRV can be controlled from the operation center. The overflow condition for this reservoir is 24 feet (elevation 550); however, the reservoir is operated between 15 feet (elevation 541) and 22.5 feet (elevation 548.5) in the summer and between elevation 548 and 543 in the winter. An 8-foot fluctuation is typical during the summer months.

South Bellevue Operating Area

The South Bellevue operating area includes the zones shown below. The primary supply zones for this operating area are those containing most of the area's storage: The Somerset 850, Horizon View 1175, Cougar Mountain 1150 and 1465 zones, and Factoria 440 zone.

- Somerset 550, 700, 850, 940 and 1000 zones
- Eastgate 590, and 630 zones
- Horizon View 700, 940, 1080, 1115, and 1175 zones
- Forest Hills 465, and 1100 zones
- Summit 1060, 1100, and 1350 zones
- Cougar Mountain 1000, 1150, 1300,1465, 1550 zones
- Factoria 440, 293
- Newport Hills 580, 380,320
- Newport Shores 200

Generally, supply to each zone of the South Bellevue operating area is via a booster pump stations and adjacent reservoirs acting as a supply sump for the booster pumps and discharge storage for the lower zone pump station. The reservoir maintains the hydraulic gradient for each zone. PRVs are also used as a supply source to zones that are not directly pumped, as well, as inlets 6-11 and several metered interties with neighboring Coal Creek Utility District.

The major storage to this area is provided by: the Forest Hills (2-MG) and Cougar Mountain-1 (0.5-MG) reservoirs in the 850 zone, the Horizon View-3 (2-MG) reservoir in the 1175 zone, the Cougar Mountain-2 (1-MG) reservoir in the 1150 zone, the Cougar Mountain-3 (2-MG) reservoir in the 1465 zone, and the Factoria (3-MG) in the 440 zone. In addition to these five reservoirs, there are seven smaller reservoirs, ranging in size from 0.1-MG to 0.3-MG, located within this operating area.

Single-Source Zones

There are twelve zones in the South Bellevue operating area that are fed by only one PRV or pump station. Most of these zones are provided with standby and emergency storage by reservoirs located in the adjacent zones which provide their supply. The PRV or pump station provides access to the required storage. Two single source zones, the Cougar Mountain 1150 and 1465 zones, each contain a major storage facility. The single-source pressure zones are:

- Eastgate 630
- Horizon View 940 and 1115
- Summit 1060, 1100, and 1350
- Cougar Mountain 1150, 1300, 1465, and 1550
- Somerset 450, and 940

The Eastgate 630 zone is fed from the Horizon View 700 zone through PRV 057. The Horizon View 940 zone is fed from the 1000 zone through PRV 119 and the 1115 zone is fed from the 1175 zone through PRV 054. The Summit 1060 zone is fed from the 1175 zone through PRV 124, the 1100 zone is also fed from the 1175 zone through PRV 143, and the Summit 1350 zone is supplied from the 1175 zone by the Horizon View 3 pump station. The Cougar Mountain 1150 zone and reservoirs are supplied from the 850 zone by the Cougar Mountain 1 pump station, the Cougar Mountain 1465 zone and reservoirs are supplied from the 1150 zone by the Cougar Mountain 2 pump station, and the Cougar Mountain 1550 zone is a pumped single-source zone that is supplied from the 1465 zone by the Cougar Mountain 3 pump station. The Cougar Mountain 1300 zone is fed from the Cougar Mountain 1465 zone through PRV 153. The Somerset 450 zone is fed from the 700 zone by PRV 108, and the 940 zone is fed from the 1000 zone through PRV 091. All of the PRV's listed above supply water as determined by the zone demand. The rest of the South Bellevue operating area consists of zones with multiple feeds. Each of these is discussed below.

Somerset 465 Zone

The Somerset 465 zone is fed from the Somerset 550 zone through the PRV's, 104 and 031. Standby and equalizing storage is provided in this zone from the 550 zone by the 0.1-MG Somerset 1 reservoir.

Somerset 550 Zone

The Somerset 550 zone is fed by the Somerset 1 altitude valve PRV 3014-01 and three PRV's (No. 109, 107, and 106). The PRV's are secondary supplies to the Somerset 550 zone and are set slightly lower than the normal operating range of the Somerset 1 altitude valve. The Somerset 550 zone also provides an emergency intertie for fire protection to the Coal Creek Utility District through PRV 121, which is owned and maintained by the Coal Creek Utility District.

Standby and equalizing storage is provided to this zone by the 0.1-MG Somerset 1 reservoir located in the 550 zone.

Eastgate 590 Zone

The Eastgate 590 zone is fed from the Horizon View 700 zone through PRV's 055 and 120. Storage is provided in this zone from the 700 zone by the 0.2-MG Horizon View 1 reservoir.

Somerset 700 Zone

The Somerset Inlet Supply pump station is the primary supply for the Somerset 700 zone, and its operation is controlled based upon the Somerset 2 reservoir level.

The Somerset 700 zone has five PRV's that serve as a secondary supply. All five PRV's supply water from the Somerset/Horizon View 850 zone, and they are PRV's 105, 103, 099, 100, and 122. Storage is provided in this zone by the 0.1-MG Somerset 2 700 reservoir, the 0.1-MG Somerset 3 850 reservoir, and the 2-MG 850 Forest Hills Reservoir.

Horizon View 700 Zone

The Parksite pump station is the primary supply source for the Horizon View 700 zone. The pump station is operated from the operations center based upon the level of the Horizon View 1 reservoir.

The Horizon View 700 zone also has three PRV's (No. 118, 096, and 148) that serve as secondary supplies. Each delivers water from the Somerset 850 zone. Two PRV's are located near the Newport reservoir. Storage is provided in this zone by the 0.2-MG Horizon View 1 reservoir, which floats on the 700 gradient, and the 2-MG Forest Hills Reservoir in the 850 zone. The Horizon View 1 reservoir also provides storage for the Eastgate 590 and 630 zones. An emergency supply PRV (No. 1016-01) is located in the Horizon View 1 pump station which will allow water supply from the 850 zone when the Parksite pump station is out of service.

Somerset 850 Zone

The Somerset 850 zone serves a large area that includes portions of Forest Hills, Somerset, Horizon View, and Cougar Mountain. The 850 zone is supplied by six sources, including three pump stations and three PRV's. One source of supply to the 850 zone is the Newport pump station. The station is used daily to supply water to the 850 zone from the Lake Hills south zone, based on the Horizon View 2 (850 zone) reservoir level, with the pump operation controlled from the Bellevue Service Center. This station is also equipped with an emergency diesel operated fire pump for usage during power outages. The Somerset 2 pump station delivers water from the Somerset 700 zone to the 850 zone. The operation of this station is also controlled from the Bellevue Service Center. Over the last few years, during the summer demand metering period, as much water as possible is pumped during off-peak hours, and a minimal amount is pumped during peak hours. This procedure helps keep the flow from the supply connection constant. The Somerset 2 reservoir operates as a supply for the pump station. The Horizon View 1 pump station supplies water from the Horizon View 700 zone to the 850 zone. This station is the primary supply for the 850 zone and is also operated from the Bellevue Service Center.

The Somerset 850 zone has six secondary PRV supplies. PRV's, 097, 149 and 113 supply water to the zone from the Somerset 1000 zone. PRV No. 123 supplies water to the zone from the Summit 1060 zone. PRV's 147 and 151 supply water from the Cougar Mountain 1000 zone.

This zone has a total of 2.75 MG of storage in four reservoirs. The main reservoir is the 2-MG Forest Hills reservoir. Localized equalizing and standby storage is provided by the 0.15-MG Horizon View 2 reservoir, 0.5-MG Cougar Mountain 1 reservoir, and the 0.1-MG Somerset 3 reservoir. All four reservoirs float on the 850 gradient.

Somerset and Cougar Mountain 1000 Zones

There are seven PRV's that supply water to the Somerset 1000 zone, all of which operate continuously. Storage for the Somerset 1000 zone is provided by the 2.1 MG Horizon View 1175 reservoirs.

The Somerset 1000 zone is supplied from the Horizon View 1175 zone through PRV's 125, 112, 115, and 087, the Horizon View 1080 through PRV's 111, 088, and 102. These PRV's have pressure-sustaining features which maintain a minimum pressure in the 1080 zone during periods of heavy demand. PRV 157 feeds the Somerset 1000 zone from the single fed 1100 zone. The last Somerset 1000 zone feed is the Somerset 3 pump station which is a secondary supply, pumping from the 850 zone. This station operates with local control based on 1000 zone pressure and is used to maintain pressure in the west end of the zone.

The Cougar Mountain 1000 zone is supplied from the Cougar Mountain 1150 zone through PRV's 145, 146, 150, and 152. Storage for the Cougar Mountain 1000 zone is provided primarily by the 1-MG Cougar Mt. 1 (1150 zone) reservoir. Additional storage is available from the 2.3-MG Cougar Mt.3 (1465 zone) reservoirs.

Horizon View 1080 Zone

The Horizon View 1080 zone is supplied from the 1175 zone by PRV's 117 and 089, both of which operate continuously. Storage for this zone is provided by the 2.1-MG Horizon View 3 (1175 zone) reservoirs.

Horizon View 1175 Zone

The Horizon View 2 and the Forest Hills pump stations supply water to the 1175 zone from the 850 zone. The operation of these stations is controlled from the Bellevue Service Center. The Horizon View 2 and Forest Hills reservoirs operate as supply sources for these pump stations.

The 2-MG Horizon View 3 reservoir floats on the 1175 gradient. This reservoir also provides storage for the Horizon View 1115 and 1080 zones, the Summit 1060 zone, the Somerset/Horizon View 1000 zone, the Somerset 940 zone, the Horizon View 940 zone, and the Somerset/Horizon View 850 zone.

Newport Shores 200 Zone

The Newport Shores 200 zone is supplied water from the Newport Hills 320 and the Factoria 293 zones, from PRV's 173, 171, and 164, respectively. It was was also formerly served by inlet 10, which is out of service, as the neighboring Bellefield 220 zone is going to be interconnected with Newport Shores 200, creating a larger single zone with multiple additional feeds from the Bellevue 400 zone, the primary supply zone for the west operating area. This work is being done as part of the 2004 assumption of the Coal Creek Utility District to create a more consistant, and continuous water service area. Storage provided for this area is by way of the Factoria 3-MG reservoir through the Factoria 440 and 293 zones. This zone is also supported by CCUD meter site 1.

Newport Hills 320 Zone

There are two PRV's, (175 and 172) that feed this small zone along I-405 from the Factoria 440 zone. Independently, these PRV's feed separate sections of the zone, north and south, that are not interconnected at this time. Each respective PRV is currently the single feed for their portions of the zone. Storage provided for this area is by way of the Factoria 3-MG reservoir through the Factoria 440 zone

Newport Hills 380 Zone

The Newport Hills 380 zone is supplied from Factoria 440 zone via PRV's number 167, 168, 170, and 189. Another very small residential pressure zone with storage provided by the Factoria 3-MG reservoir by way of the Factoria 440 zone.

Factoria 440 Zone

The Factoria 440 zone is supplied by Inlet 8, from the Somerset 550 zone through PRV 121 and from the Lake Hills 520 zone through PRV 176. As well, it is supported by CCUD meters at Site 2 (4 inch) ,3 (6 inch)and 5 (6 inch). The major storage for this zone is the Parksite reservoir through the 520 zone.

Factoria 293 Zone

This zone, the major commercial zone of the Factoria area, is fed through Inlets 8, 9, and 11, which feed the 3MG Factoria Reservoir, the primary storage for this area, and provide support for the zone. PRV's 165, 166, and 380 also support this zone in event of high fire flow needs

Newport Hills 580 Zone

The Newport Hill 580 zone is supplied water by Inlet 6 and several metered connections from CCUD, which includes sites 6, 7, 9, and 10 (6, 6, 4, and 1 inch, respectively). Major fire flow storage for this zone is supported by CCUD 580 zone reservoirs and the ability to pump from the CCUD 460 zone storage reservoirs.

Supply Inlet Meters

Name	Location	Date of first use approx	Seattle Line Feeding	Seattle Demand Metering	Bellevue Recording	Bellevue Control	Meter Size (in)	Capacity (gal/min)
NE 40th	NE 40th and 140th	1965	Tolt Supply Line	Yes	Yes	Yes	18	10,000
Cherry Crest	NE 24th and 132nd	1965	Tolt Supply Line	Yes	Yes	Yes	12	7,000
Bel-Red	Bel-Red Road and 132nd	1965	Tolt Supply Line	Yes	Yes	Yes	12	7,500
NE 8th	NE 8th and 152nd	1965	Tolt Supply Line	Yes	Yes	Yes	16	7,500
SE 28th	SE 28th and 145th	1965	Tolt Supply Line	Yes	Yes	Yes	16	7,500
Eastgate	14501 Newport Way	1991	Tolt Supply Line	Yes	Yes	Yes	16	7,000
Richards Road	SE 26th and 132nd	1967	Cedar Supply Line	Yes	Yes	Yes	8	3,000
Enatai	I-90 and 108th SE	1967	Mercer Island Pipe	Yes	Yes	Yes	8	2,000
Somerset	Newport Way and 128th	1967	Cedar Supply Line	Yes	Yes	Yes	12	3,000
161st Ave SE	Newport Way 161st Ave SE	2003	Cascade Water Alliance	Yes	Yes	Yes	12	1800
Inlet 6	SE 56th and 128th	2004	Cedar Supply Line	Yes	Yes	Yes	6	Emergency only
Inlet 7		2004	Cedar Supply Line	Yes	Yes	Yes		Out of service
Inlet 8	Factoria Blvd Newport Way	2004	Cedar Supply Line	Yes	Yes	Yes	6	1500
Inlet 9	SE 36th and 128th	2004	Cedar Supply Line	Yes	Yes	Yes	6	to be eliminated
Inlet 10	I-90 and Lake Wa Blvd	2004	Cedar Supply Line	Yes	Yes	Yes	6	to be eliminated
Inlet 11	SE 38th and Factoria Blvd		Cedar Supply Line	Yes	Yes	Yes	8	2000
Site 1	Hazelwood Lane	2004	CCUD Cedar Supply	No	No	No	4	1000
Site 2	112th & SE 64th	2004	CCUD Cedar Supply	No	No	No	4	1000
Site 3	114th & SE 68th	2004	CCUD Cedar Supply	No	No	No	6	1500
Site 5	119th & SE 68th	2004	CCUD Cedar Supply	No	No	No	6	1500
Site 6	123rd & SE 69th	2004	CCUD Cedar Supply	No	No	No	6	1500
Site 7	125th & SE 69th	2004	CCUD Cedar Supply	No	No	No	6	1500
Site 9	Delmar Woods	2004	CCUD Cedar Supply	No	No	No	4	1000
Site 10	SE 66th & Coal Creek Pkwy	2004	CCUD Cedar Supply	No	No	No	1	

Pump Stations

Name	Location	Map Location Code	Zones		Pump No.	Head (ft)		Flow Operating (gpm)	Local Elevation (ft)	Local Automatic Control	Telemetry	
			Supply	Service		Operating	Shut Off				Control	Status Report
Pikes Peak	3900 - 124th Ave NE	H-2	550 550 550	670 670 670	4 5 6	100 100 100	130 130 130	1000 1250 1250	521.3 521.3 521.3	Yes	Yes	Yes
Clyde Hill	2200 - 96th Ave NE	D-5	400 400 400 400	500 500 500 500	1 2 3 4	135 138 138 138	170 172 172 172	200 600 600 600	355.6 355.6 355.6 355.6	Yes	Yes	Yes
Meydenbauer	9500 SE 7th St	D-8	252	400	1	135	240	1000	245.8	No	Yes	Yes
Woodridge	1843 - 125th Ave SE	H-10	400 400 400	450 450 450	1 2 3	104 102 102	166 166 166	800 3000 3000	327 327 327	Yes	Yes	Yes
670 Pump Station at NE 40th St (BPS)	14051 NE 40th St	J-3	TESSL TESSL TESSL TESSL	670 670 670 520	*1 *2 *3 4	110 110 110 40	125 142 175 60	200± 300± 1800 2500	305 305 305 305	Yes	Yes	Yes
Somerset Inlet	4335 - 130th PL SE	H-14	CESSL CESSL CESSL CESSL	700 700 700 700	1 2 3 4	392 392 392 392	468 501 500 459	400 1200 1200 800	370 370 370 370	No	Yes	Yes
Somerset-2	13713 Somerset Blvd SE	J-14	700 700 700	850 850 850	1 2 3	216 220 216	280 280 270	1100 1100 650	688 688 688	No	Yes	Yes
Somerset-3	13909 SE 47th St	J-14	850 850 850	1000 1000 1000		189 180 180	190 210 210	50 240 240	834.5 834.5 834.5	Yes	No	No
Parksite	14501 Newport Way	J-13	520 520	700 700	1 2	220 220	300 300	1980 1980	480.4 480.4	No	Yes	Yes
Horizon View-1	4610 Highland Dr SE	J-14	700 700	850 850	1 2	200 200	272 272	1300 1275	667 667	No	Yes	Yes
Horizon View-2	4801 - 150th Ave SE	K-15	850 850	1175 1175	1 2	370 370	480 479	1100 1100	821 821	No	Yes	Yes
Horizon View-3	15419 SE 53rd PL	K-15	1175	1350	1	184	220	220	1153.5	Yes	No	Yes

Pump Stations

Name	Location	Map Location Code	Zones		Pump No.	Head (ft)		Flow Operating (gpm)	Local Elevation (ft)	Local Automatic Control	Telemetry	
			Supply	Service		Operating	Shut Off				Control	Status Report
			1175 1175	1350 1350	2 3	184 188	220 220	220 1500	1153.5 1153.5	Yes Yes	No Yes	Yes Yes
Newport	4330 - 164th Ave SE	L-13	520 520 520 520	850 850 850 850	1 2 3 4	380 388 380 380	450 450 400 400	1000 1250 375 375	505 505 505 505	No	Yes	Yes
NE 40th (Reservoir Pump Station)	4075 - 148th Ave NE	J-2	TESSL TESSL TESSL	520 520 520	1 2 3	140 144 145	233 260 258	2000 4000 4000	390 390 390	Yes	Yes	Yes
Lake Hills (Booster Station)	16049 NE 8th St	L-7	520 520	520 520	1 2	50 50	75 75	1500 1500	440.0 440.0	No	Yes	Yes
Cherry Crest	2532 - 127th Ave NE	H-4	400 400	550 550	1 2	150 150	190 190	650 650	391 391	No	Yes	Yes
NE 8th (BPS)	15190 NE 8th St	K-6	TESSL TESSL	520 520	1 2	165 165	205 205	4000 4000	310 310	No No	Yes Yes	Yes Yes
SE 28th (BPS)	2649 - 145th PL SE	J-11	TESSL TESSL	520 520	1 2	260 245	320 330	5000 4000	420 420	No No	Yes Yes	Yes Yes
Cougar Mountain-1	16431 SE 57th PL	M-16	850 850 850	1150 1150 1150	1 2 3	321 321 310	410 410 406	590 590 1000	831 831 831	No	Yes	Yes
Cougar Mountain-2	16859 SE 59th St	M-16	1150 1150	1465 1465	1 2	350 350	435 437	1000 1000	1116.4 1116.4	No	Yes	Yes
Cougar Mountain-3	17617 SE Cougar Mt Dr	N-17	1465 1465 1465 1465 1465	1550 1550 1550 1550 1550	1 2 3 4 5	115 115 115 115 162	162 162 162 162 200	200 200 50 100 1500	1445 1445 1445 1445 1445	Yes	Yes	Yes
Forest Hills	5601 - 142nd Ave SE	J-16	850 850	1175 1175	1 2	155 155	170 210	70 140	821 821	No	Yes	Yes

*Operating parameters vary with Seattle suction head.

SYSTEM CONTROL VALVES

PRV No.	Grid Loc.	Address Location	Zones Supply	Zones Served	Valve Type	Elevation (ft)	Setting psi Inlet	Setting psi Outlet	Size	Date Installed	Remarks
PRESSURE REDUCING VALVE STATIONS											
003	E-9	10400 SE 10TH	BV400	EN300	PRV	76.5	130	92	8	1955	Back up feed to the Enatai 300 Zone set 12psi lower than the zone
004	E-9	800 104TH AVE SE	EN200	ME252	PRV	66.1	101	84	6	1986	Out of Service as of 10/1/2004. To be abandoned by summer of 2005.
006	F-8	11116 SE 4TH ST	BV400	ME252	PRV		148	86	3	1993	Primary east end 252 zone feed. PRV upgraded in 1996. Epoxy Coated.
006					PRV		148	81	6	1993	
006					Relief		148	91	2	1993	
007	F-8	11400 MAIN ST	BV400	BP220	PRV	40	150	78	2	1990	Station relocated 9/1/88, all valves have SS trim.
007					PRV		150	73	6	1990	Primary 220 feed.
007					Relief		150	90	1.5	1990	
008	H-10	12700 SE 28TH PL	CESSL	WD450	PRV	293.6	CESSL	58	6	1971	Secondary 450 feed (Woodridge), both valves have reverse
008					PRV		CESSL	70	2	1971	flow checks
009	H-10	2300 129TH AVE SE	CESSL	WD400	PRV	166.7	CESSL	80	2	1971	Secondary feed to Woodridge 400 Zone
009					PRV		CESSL	75	6	1971	
011	H-11	13100 SE 28th St	CESSL	WD400	1	84	CESSL	135	3	1997	Primary Woodridge 400 Zone feed. This station was relocated
011					2		CESSL	130	8	1997	150' west of the intersection and a relief was added. Epoxy Coated.
011					Relief		CESSL	146	3	1997	
012	G-11	12225 SE 25TH ST	WD450	WD400	PRV	255	90	54	2	1985	Back up Woodridge 400 Zone feed.
012					PRV		90	49	6	1985	
012					Relief		90	68	1.5	1985	
013	H-8	12800 MAIN ST	BV400	KC300	PRV	165	97	55	6	1970	Back up feed for the Kelsey Creek 300 Zone. Installed a 2"
013					Relief		97	70	2	1994	pressure relief in 1994. Possible CIP candidate.
014	H-7	800 129TH AVE NE	BV400	KC300	PRV	116	125	80	2	1974	Primary feed for the Kelsey Creek 300 Zone.
014					PRV		125	75	6	1974	
016	H-5	12700 NE 24TH ST	TESSL	PP550	PRV	360.5	TESSL	80		N/S	As part of the new Cherry Crest inlet station, this PRV station was eliminated. The vault was left intact, the 10" valve was removed and both ends of the pipe were flanged.
017	H-4	12700 NE 25TH ST	TESSL	PP570	PRV	394	TESSL	121	3	1998	Both valves have reverse flow checks, station is only
017					PRV		TESSL	116	8	1998	operational when Seattle's pressure is above 670'. Epoxy Coated.
017					Relief		TESSL	139	3	1998	
021	E-4	9106 103rd Ave SE	BV400	YB300	PRV	155	103	56	2	2001	Upgraded in 2001. Epoxy Coated.
021					PRV		103	51	6	2001	
021					Relief		103	71	1.5	2001	
022	D-4	2600 92ND AVE NE	BV400	CL335	PRV	169	98	70		1984	Secondary North 335 zone feed.
022					PRV		98	65	8	1984	
022					Relief	PRV	98	82	1.5	1984	
023	C-4	9720 NE 24TH ST	BV400	CL335	PRV	203	115	88	3	1994	This PRV was installed as part of CIP program upgrade 10/1/94. Epoxy Coated.
023					PRV		115	83	8	1994	This is the primary north end 335 zone feed.
023					Relief		115	90	2	1994	
024	A-5	1800 74TH AVE NE	CL335	ME252	PRV	167	73	39	3	1997	Single feed zone [252]. This station was relocated and upgraded
024					PRV		73	33	8	1997	6/1/97. Epoxy Coated.
024					Relief		73	50	3	1997	
025	B-6	1012 76TH AVE NE	CL335	ME252	PRV	102	98	65	6	1964	Back up 252 feed.
026	B-6	1200 84TH AVE NE	CL335	ME252	PRV	56.7	115	73	2	2003	Upgraded 6/2003. Epoxy Coated.
026					PRV		115	68	6	2003	
026					Relief		115	85	2	2003	
027	C-6	1400 90TH AVE NE			PRV				1.5	N/S	Out of service 1/1/69
027					PRV				4		
031	I-15	12305 SE 55TH PL	SS550	FH465	PRV	321	96	60	2	1983	
031					PRV		96	55	6	1983	
031					Relief		95	72	1.5	1983	
034	F-9	11200 SE 8TH ST	BV400	BP220	PRV	30.9	156	80	2		Replaced all 2" piping (galv.) with brass, due to corrosion (1992).
034					PRV		156	75	6		
035	H-10	1843 125th Ave SE	CESSL	WD450	PRV	332	CESSL	60	8	1993	Primary feed to the Woodridge 450 zone, when Seattle's pressure (CESSL) is up. Located in the Woodridge pump station the 2" relief
035					Relief		CESSL	68	3	1993	is for both the 8" and the pumps. It discharges to the Woodridge Res. Epoxy Coated.
036	I-10	13904 SE 23RD ST	CO440	CO380	PRV		80	60	1.25	N/S	Taken out of service 2/26/85
036					PRV		80		6		
037	I-10	2100 137TH PL SE	CO440	CO380	PRV	236.6	86	64	2	1992	Upgraded 10/23/92 as part of CIP rehab. program. Secondary 380
037					PRV		86	50	6	1992	feed. Epoxy.
037					Relief		86	75	2	1992	
038	I-10	2038 139TH PL SE	LH520	CO440	PRV	283.9	103	55	1.25		Single feed zone.
038					PRV		103	60	6		
038					Relief		103	77	1.5		
039	I-10	13504 SE 20TH ST	LH520	CO440	PRV	280	104	45	2	1992	Primary 440 zone feed. The PRV station was upgraded 10/92. Epoxy Coated.
039					PRV		104	60	6	1992	
039					Relief		104	78	2	1992	
040	I-11	2260 135TH AVE SE	CO380	RV300	PRV	177	87	52	2	1992	Back up 300 zone feed to Richards Rd. This station was upgraded
040					PRV		87	47	6	1992	in 10/92. Epoxy Coated.
040					Relief		87	62	2	1992	
041	I-9	1000 137TH AVE SE	LH520	SH450	PRV	300.6	85	55	1.25		This station is a single feed zone and requires shut down of 15 homes
041					PRV		85	50	6		and 2 hydrants. Possible CIP candidate.
042	J-8	14000 SE 7TH ST	LH520	KC450	PRV	268	97	56	4	1975	This PRV station is located in an old well pump station. Primary
042					PRV		97	60	8		central 450 zone feed. Relief was taken out of service in 1994.
042	J-8				Relief		97	80	3		
043	I-8	13630 SE 1ST ST	KC450	BV400	PRV	224.6	93	65	2	1968	Secondary feed to the 400 zone.

043					PRV		93	55	10	1968	
044	K-5	14800 BEL RED RD	LH520	KC450	PRV	287.2	105	66	3	1995	Primary north 450 zone feed.
044					PRV		105	61	6	1995	
044					Relief		105	78	3	1995	
046	J-6	14605 NE 13TH PL								N/S	Not in Service
047	I-4	2440 140TH AVE NE	LH520	BV400	PRV	210	130	80	3	1994	Back up 400 zone feed. Station rehab 3/94. Epoxy Coated.
047					PRV		130	70	6	1994	
047					Relief		130	82	3	1994	
048	I-4	2400 134TH AVE NE	TESSL	LH520	PRV	335.1	TESSL	65	2	1963	Station out of service 9/16/86. Rezoned area to 550 zone //
048					PRV		TESSL	60	6	1963	Emergency back up.
049	I-5	2400 135TH AVE NE	LH520	BV400	PRV	300	112	29	6	1972	1.25" Taken out of service 3/31/75. Back up 400 zone feed.
050	I-3	3700 140TH AVE NE	RH545	LH520	PRV	290	110	36	2	1994	Kirkland feed// Set up for secondary supply to 520 zone. Epoxy Coated.
050					PRV		110	68	6	1994	
050					Relief		110	105	2	1994	
051	I-3	4000 140TH AVE NE	TESSL	PP670	PRV	314	TESSL	155	1.25	N/S	Taken out of service 11/1/90. Both valves were vented and the
051					PRV		TESSL		6		by-pass valve was opened.
052	I-3	3540 134TH AVE NE	PP670	PP500	PRV	433	104	72	3	1997	Single feed zone, station was rehab. on 6/1/97. Epoxy Coated.
052					PRV		104	57	6	1997	
052					Relief		104	82	2	1997	
053	J-3	14057 NE 40TH ST	TESSL	PP670	PRV		TESSL		4	1993	This valve is the primary feed to the 670 zone, when Seattle's pressure is above 685. It also acts as the primary relief for the 670 zone pump station at NE 40th when Seattle's pressure is low and the pumps are on. Epoxy Coated.
054	K-15	5105 150TH PL SE	HV1175	HV1115	PRV	982	83	58	2	1978	Single feed zone.
054					PRV		83	53	6		
054					Relief		83	67	1.5		
055	K-13	15000 SE NEW PORTW	HV700	EG590	PRV	416	118	75	2	1970	Secondary 590 zone feed. Possible CIP candidate.
055					PRV		118	70	6	1970	
057	L-13	4266 163RD AVE SE	HV700	EG630	PRV	483	100	70	2	2000	Single feed zone. Upgraded in 2000. Epoxy Coated.
057					PRV		100	65	6	2000	
057					Relief		100	84	2	2000	
058	M-11	17000 SE 26TH ST	EG440	EG200	PRV	159.4	120	60	3	1970	Single feed zone
058					PRV		120	55	6	1970	
058					Relief		120	73	1.5	1970	
059	M-11	2843 165TH AVE SE	LH520	EG440	PRV	302	90	55	3	1970	
059					PRV		90	50	6	1970	
059					Relief		90	67	1.5	1970	
060	M-10	16800 SE 24TH ST	LH520	EG440	PRV	283	100	50	2	1970	
060					PRV		100	55	6	1970	
061	M-11	2501 W LK SAM BD SE	LH520	SA270	PRV	85.5	190	75	3	1994	This is the primary north 270 zone feed. This station was rebuilt
061					PRV		190	70	8	1994	in 1994 as part of a CIP project. Epoxy Coated.
061					Relief		190	80	3	1994	
063	L-13	SOMERSET ENTRANCE	SS550	LH520						N/S	Station no longer in service 1979.
064	K-14	15000 SE 47TH ST	HV1175	935	PRV		180	76		N/S	Taken out of service 1983
065	N-13	4099 173RD PL SE	LH520	SA270	PRV	194	138	20	3	2005	Upgraded 2005. Solenoid and hydraulically controlled valve that can be
065					PRV		138	27	8	2005	adjusted remotely . Epoxy Coated.
065					Relief		138	42	3	2005	
066	M-11	16400 SE 31ST ST	LH520	EG440	PRV	256	110	75	3	1972	Single feed zone.
066					PRV		110	70	6	1972	
066					Relief		110	85	1.5	1972	
067	M-7	200 167TH PL NE	LH520	LH380	PRV	306	90	30	3	1974	Primary 380 zone feed
067					PRV		90	25	6	1974	
067					Relief		90	40	1.5	1974	
068	M-7	17400 NE 2ND PL	EG400	SA270	PRV	137	120	63	2	2001	Upgraded 07/2001. Epoxy Coated.
068					PRV		120	58	6	2001	
068					Relief		120	76	2	2001	
069	M-7	412 172nd Pl NE	LH520	LH380	PRV	306	90	30	2	2001	Upgraded 07/2001. Epoxy Coated.
069					PRV		90	25	6	2001	
069					Relief		90	42	2	2001	
070	N-6	1013 NORTHUP WY NE	LH520	LH435	PRV		103	66	3	1974	
070					PRV		103	61	6	1974	
071	O-6	16510 NE 15TH PL	LH435	SA270	PRV		103	31	2	1974	Located 240 feet east of 165th Ave NE. Stacked Assembly
071					PRV		103	26	6	1974	
071					Relief		103	43	1.5	1974	
072	P-5	1818 W LK SAMM SD N	LH435	SA270	PRV	139.36	125	54	3	1974	
072					PRV		125	48	6	1974	
072					Relief		125	70	2	1974	
073	M-3	16920 NE 32ND ST	LH520	RM400	PRV		100	45	3	1974	
073					PRV		100	40	6	1974	
073					Relief		100	55	1.5	1974	
080	N-6	1200 173RD AVE NE	LH520	LH435	PRV	306	90	49	3	1975	Stacked Assembly
080					PRV		90	54	6	1975	
080					Relief		90	70	1.5	1975	
081	N-6	1520 175TH PL NE	LH520	LH435	PRV	288.2	98	64	3	1975	
081					PRV		98	59	6	1975	
081					Relief		98	75	1.25	1975	
082	M-4	17020 NE 28TH PL	LH520	RM400	PRV	284	100	47	3	1974	
082					PRV		100	42	6	1974	
082					Relief		100	56	1.25	1974	
085	G-9	11800 118TH AVE SE	BV400	BF220	PRV	42	150	83	3	2002	Upgraded 11/2002. Epoxy Coated.
086					PRV		150	78	8	2002	
086					Relief		150	98	2	2002	
086	F-11	2601 RICHARDS RD	CEESL	RV300	PRV	76	190	30	3	1975	Primary R.R. 300 zone feed. We installed the Richards Road inlet
086					PRV		190	82	9	1976	meter in this vault 6/1/97.

087	K-15	4800 150TH AVE SE	HV1175	SS1000	PRV	934.3	151	76	2	1976	Station is located just outside Horizon View 2 Pump Station.
087					PRV		151	71	6	1976	
087					Relief		151	86	1.25	1976	
088	K-15	15306 SE 49TH ST	HV1080	SS1000	PRV	914	76	41	2	1976	The 6" valve has a pressure sustainer installed in 1988 set for
088					PRV		76	37	6	1976	20psi.
088					Relief		76	55	1.25	1976	Relief was Shut off 11/76, removed 02/00.
089	L-15	5002 156TH AVE SE	HV1175	HV1080	PRV	983	86	55	2	1976	2" CLA-VAL and relief not in service due to broken downstream 2" gate
089					PRV		86	50	6	1976	valve. 2/21/81
089					Relief		86	67	1.5	1976	
090	R-9	1037 102th Ave SE	BV400	BF220	PRV	134	115	39	2	1977	Primary 220 zone (north) feed
090					PRV		115	34	6	1977	
090					Relief		115	50	1.5	1977	
091	J-14	14300 SOMERSET BD S	SS1000	SE940	PRV	762	93	55	2	1998	Upgraded in 1998. Epoxy Coated.
091					PRV		93	50	6	1998	
091					Relief		93	67	2	1998	
092	H-10	12806 SE 22ND PL	CESSL	WD340	PRV	223	118	50	2	1977	Single feed CESSL/340 zone served from Woodridge feeder.
092					PRV		118	45	6	1977	
092					Relief		118	62	1.5	1977	
093	K-7	15100 MAIN ST	LH520	KC450	PRV	280.8	103	70	2	1978	Primary south 450 zone feed
093					PRV		103	65	6	1978	
093					Relief		103	82	1.5	1978	
094	K-5	1701 151ST AVE NE	LH520	KC450	PRV	324.15	82	52	2	1978	Primary north 450 zone feed, valves are stacked
094					PRV		82	47	6	1978	
094					Relief		82	64	2	1978	
095	L-12	16181 SE 31ST ST	LH520	EG400	PRV	303	92	47	2	1978	Relief removed 11/1986.
095					PRV		92	42	6	1978	
096	K-13	4300 SE 156TH PL	SS850	HV700	PRV	589	116	53	2	1979	
096					PRV		116	48	6	1979	
096					Relief		116	70	2	1979	
097	L-14	16119 SE 46TH WAY	SS1000	SS850	PRV	750	112	45	2	1980	Pressure sustainer installed at 980 on the 6" valve.
097					PRV		112	40	6	1980	2" out of service. Downstream valve broken. 1/2000
097					Relief		112	58	2	1980	
098	J-10	2000 SE NAMBER RD	LH520	CC380	PRV	284	100	44	2	1980	
098					PRV		100	38	6	1980	
098					Relief		100	56	2	1980	
099	J-15	14304 SE 61ST ST	SS850	SS700	PRV	601	110	47	2	N/S	Out of Service. 2" and 6" prvs taken out and blind flanges were placed on both sides of both pipes.
099					PRV		110	42	6		
099					Relief		110	60	2		
100	J-16	14710 SE 63RD ST	SS850	SS700	PRV	557	116	52	2	1980	
100					PRV		116	47	6	1980	
100					Relief		116	65	2	1980	
101	L-12	16200 SE 34TH CT	LH520	EG400	PRV	298	96	43	2	1979	
101					PRV		96	38	6	1979	
101					Relief		96	70	2	1979	Relief set high for 400 zone.
102	L-15	15812 SE 50TH ST	HV1080	SS1000	PRV	882	95	50	2	1979	
102					PRV		95	45	6	1979	
103	I-15	12908 SE 52ND PL	SS850	SS700	PRV	547	131	65	2	1979	
103					PRV		131	60	6	1979	
103					Relief		131	77	2	1979	
104	I-16	13408 SE 57TH ST	SS550	FH465	PRV	360	90	48	2	1979	
104					PRV		90	43	6	1979	
104					Relief		90	60	2	1979	
105	I-15	13600 SE 51ST PL	SS850	SS700	PRV	597	109	40	3	1980	
105					PRV		109	35	8	1980	
105					Relief		109	62	2	1980	Relief set high for the 700 zone.
106	I-15	13500 SE 52ND ST	SS700	SS550	PRV	443	115	50	2	1980	2" out of service. Upstream valve broken. 3/1996.
106					PRV		115	45	6	1980	
106					Relief		115	70	2	1980	
107	I-15	5500 134TH AVE SE	SS700	SS550	PRV	429	118	48	2	1982	
107					PRV		118	43	6	1982	
107					Relief		118	60	2	1982	
108	I-16	13708 SE 59TH ST	SS700	SS550	PRV	440	110	48	2	1982	Single feed 550 zone.
108					PRV		110	43	6	1982	
108					Relief		110	65	2	1982	
109	I-13	12900 SE 42ND PL	SS700	SS550	PRV	452	108	45	2	1982	
109					PRV		108	40	6	1982	
109					Relief		108	60	1.25	1982	
111	K-14	4724 155TH PL SE	HV1080	SS1000	PRV	893	82	47	2	1982	Pressure sustainer installed in 1987 on the 1080 zone set at
111					PRV		82	42	6	1982	about 65psi.
112	K-16	14900 SE 58TH PL	HV1175	SS1000	PRV	906	116	41	2	1982	
112					PRV		116	36	6	1982	
112					Relief		116	53	2	1982	
113	K-16	14901 SE 60TH ST	SS1000	SS850	PRV	741	111	44	2	1983	
113					PRV		111	39	6	1983	
113					Relief		111	61	2	1983	
114	M-12	3844 166TH AVE SE	EG370	SA270	PRV	178	82	37	2	1982	Secondary 270 zone feed
114					PRV		82	32	6	1982	
115	J-16	5601 145TH AVE SE	HV1175	SS1000	PRV	898	124	49	2	1983	
115					PRV		124	44	6	1983	
115					Relief		124	61	1.5	1983	
116	R-3	3400 115TH AVE NE	PP550	BV400	PRV	260	120	56	2	1984	
116					PRV		120	51	6	1984	

116					Relief		120	60	2	1984	
117	L-15	5027 157TH AVE SE	HV1175	HV1080	PRV	980	65	46	2	1983	
117					PRV		65	41	6	1983	
118	L-14	4330 154TH AVE SE	SS850	HV700	PRV	519	144	84	2	1984	Located at Newport Pump Station.
118					PRV		144	79	6	1984	
118					Relief		144	96	2	1984	
119	K-15	4730 151ST AVE SE	SS1000	HV940	PRV	834	74	58	2	1983	Single feed zone. Epoxy Coated.
119					PRV		74	53	6	1983	
119					Relief		74	70	2	1983	
120	K-13	15300 NEWPORT WY	HV730	EG590	PRV	455	100	64	2	1985	Primary 590 feed
120					PRV		100	60	6	1985	
120					Relief		100	75	1.25	1985	
121	L-15	13200 SE 40TH ST	SS850	FA460	PRV		100	63	6	2004	Back up feed to the new FA460 zone. Upgraded in 2004, Epoxy Coated.
121					Relief		100	88	1.5	2004	
122	K-16	6591 152nd Ave SE	SS850	SS700	PRV		120	54	2	1988	Bailey valves. Epoxy Coated.
122					PRV		120	49	6	1988	
122					Relief		120	70	1.5	1988	
123	K-16	15400 SE 63RD ST	SU1060	SS850	PRV	755	139	48	2	1987	Lower Summit 850 feed
123					PRV		139	38	6	1987	
123					Relief		139	80	2	1987	
124	K-16	6200 155TH AVE SE	HV1175	SU1060	PRV		95	47	2	1987	Single Feed Zone.
124					PRV		95	42	8	1987	
124					Relief		95	60	2	1987	
125	L-16	16039 SE 63RD ST	HV1175	CM1000	PRV	886	126	54	2	1993	6" valve was changed to a Watts in 2003, we changed out the 2" to a CLA-VAL in
125					PRV		126	49	6	2003	1993
125					Relief		126	66	2	1993	
127	H-4	12700 NE 25TH ST	TESSL	PP550	PRV	394	150	68	3	1998	Primary 550 zone feed when Seattle's press. is up the 6" valve is
127					PRV		150	75	6	1998	solenoid activated based upon Pikes Peak reservoir level.
127					Relief		150	87	3	1998	Station upgraded in 1998.
128	H-10	12500 SE 20TH ST	WD450	WD400	PRV	322	60	37	8	1991	450/400 Downtown feed 400 zone. Used in summer time. Remotely controlled, pressure reducing, pressure sustaining, and pressure override. Located in the Woodridge pump station.
130	N-13	4099 173RD PL SE	LH520	EG370	PRV	190	140	76	3	2005	Upgraded 2005. Single feed zone.
130					PRV		140	71	8	2005	
130					Relief		140	88	3	2005	
131	B-4	3001 FAIRWEATHER PL	CL335	MB252	PRV	53	121	87	2	1990	Secondary 252 feed to Fairweather Basin/ Hunts Pt. area
131					PRV		121	82	6	1990	Bailey valves
131					Relief		121	90	2	1990	
132	C-4	3002 94TH AVE NE	CL335	HP250	PRV	64	116	82	2	1989	Primary 252 feed to Fairweather basin and Hunts Pt.
132					PRV		116	77	6	1989	
132					Relief		116	94	2	1989	
133	E-7	10800 NE 2ND ST	BV400	MB252	PRV	157	104	44	2	1986	Back up 252 feed
133					PRV		104	39	6	1986	
133					Relief		104	56	2	1986	
134	D-10	1600 100TH AVE SE	BV400	EN300	PRV	115	122	82	2	1986	Secondary 300 zone feed. Vault also contains a 300-400
134					PRV		122	77	6	1986	zone check valve, see PRV 905. Stacked.
134					Relief		122	94	2	1986	
135	E-7	350 105TH AVE NE	BV400	MB252	PRV	122.4	119	58	2	1988	Bailey valves
135					PRV		119	53	6	1988	
135					Relief		119	70	2	1988	
136	I-10	12709 SE 17TH ST	LH520	CO440	PRV		88	50	4	1988	Back up feed to the 440 zone
136					Relief		88	62	2	1988	
137	J-2	4715 148TH AVE NE	RH545	LH520	PRV	358.2	85	70	2	1986	Back up, 520 zone feed, reverse flow valves installed
137					PRV		85	60	6	1986	
137					Relief		85	82	2	1986	
139	M-3	3717 169TH AVE NE	RM400	RM330	PRV	207.9	82	43	2	1986	Pressure lowered in 2001.
139					PRV		82	38	6	1986	
139					Relief		82	55	1.5	1986	
140	M-3	17200 SE 32ND AVE NE	RM400	RM330	PRV	217.1	78	48	2	1986	Secondary 330 Zone feed
140					PRV		78	43	6	1986	
140					Relief		78	60	1.5	1986	
141	M-3	3200 NE 165TH PL	LH520	RM400	PRV	280.9	102	46	2	1989	Secondary feed to 400 zone
141					PRV		102	41	6	1989	
141					Relief		102	56	1.5	1989	
142	K-15	5418 151ST AVE SE	HV1175	FH1100	PRV		80	53	2	1992	Secondary feed to the 1100 zone
142					PRV		80	48	6	1992	
142					Relief		80	63	2	1992	
143	L-16	6201 LAKEMONT BD SE	HV1175	SU1100	PRV		166	132	3	1991	Single Feed Zone.
143					PRV		166	127	8	1991	
143					Relief		166	144	2	1991	
144	J-16	14545 SE 56TH ST	HV1175	FH1100	PRV		100	75	4	1990	Primary feed to the 1100 zone
144					PRV		100	70	8	1990	
144					Relief		100	88	3	1990	
145	M-16	5500 166TH AVE SE	CM1150	CM1000	PRV	768	95	35	2	1992	Secondary feed to 1000 zone. Epoxy Coated.
145					PRV		95	30	6	1992	
145					Relief		95	51	2	1992	
146	M-16	16900 SE 55TH ST	CM1150	CM1000	PRV		115	55	4	1992	Primary 1000 zone feed for Cougar Mt. area. Epoxy Coated.
146					PRV		115	50	8	1992	
146					Relief		115	67	2	1992	
147	M-15	5500 VILLAGE PK DR S	CM1000	SS850	PRV	768	102	35	2	1992	Set below normal 850 zone by about 5 psi. Epoxy Coated.
147					PRV		102	30	6	1992	
147					Relief		102	51	2	1992	
148	M-15	17524 SE 45TH ST	SS850	HV700	PRV		90	34	2	1992	Secondary 700 zone feed. Epoxy Coated.

148					PRV		90	29	6	1992	
148					Relief		90	44	2	1992	
149	L-17	5622 156THAVE SE	CM1000	S3850	PRV		120	50	2	1992	Secondary 850 zone feed. Replaced 6" Baileywith a Watts valve 03/2003 .
149					PRV		120	45	6	2003	The other 2 valves are Baileys. Epoxy Coated.
149					Relief		120	65	1.5	1992	
150	L-17	16100 SE 65TH ST	CM1150	CM1000	PRV		115	53	2	2004	Primary south Lakemont 1000 zone feed. Upgraded in 2004. Epoxy Coated.
150					PRV		115	48	6	2004	
150					Relief		115	66	2	2004	
151	N-16	5626 179THAVE SE	CM1000	S3850	PRV		97	42	2	1995	Secondary feed to the 850 zone. Epoxy Coated.
151					PRV		97	37	6	1995	
151					Relief		97	52	1.5	1995	
152	N-16	17801 SE 58TH PL	CM1150	CM1000	PRV		112	50	2	1996	This is a secondary feed to the 1000 zone. Epoxy Coated.
152					PRV		112	45	6	1996	
152					Relief		112	62	2	1996	
153	M-16	17110 SE Cougar Mt. Dr	CM1465	CM1300	PRV		105	26	2	1998	Single feed zone. Epoxy Coated.
153					PRV		105	21	6	1999	
153					Relief		105	39	2	1999	
154	I-11	2900 139th Ave SE	LH520	CO390	PRV		123	64	2	1996	This is the primary feed to the College Hills 390 zone. Epoxy Coated.
154					PRV		123	59	6	1996	
154					Relief		123	76	2	1996	
156	I-6	1022 124THAVE NE	BV400	KC300	PRV		108	64	2	1997	Primary north 300 zone feed. Epoxy Coated.
156					PRV		108	59	6	1997	
156					Relief		108	75	2	1997	
157	L-15	5209 164th Ave SE	SU1100	CM1000	PRV		112	76	2	1997	Epoxy Coated.
157					PRV		112	70	6	1997	
157					Relief		112	88	2	1997	
158	I-11	13900 KAMBER RD	CO390	RV300	PRV		91	60	2	1998	This PRV station replaces PRV 094. Epoxy Coated.
158					PRV		91	55	6	1998	
158					Relief		91	72	2	1998	
159	N-15	17301 Lakemont Blvd SE	850	500	PRV	825	140	39	6	1999	6" prv for fire hydrant on Lakemont Blvd. 1 Relief for the 850 zone, 1 for the 500 zone.
159					PRV		140	45	3	1999	Epoxy Coated.
159					Relief		140	155	3	1999	
160	M-17	6737 169th Pl SE	CM1465	1300	PRV		123	58	2	1999	Single feed zone. Epoxy Coated.
160					PRV		123	53	6	1999	
160					Relief		123	73	2	1999	
161	M-17	16700 Cougar Mt. Way	CM1300	CM1150	PRV		106	47	2	2001	Epoxy Coated.
161					PRV		106	42	6	2001	
161					Relief		106	60	2	2001	
162	N-16	17406 SE 60th St	CM1300	CM1150	PRV		102	43	2	1999	Epoxy Coated.
162					PRV		102	38	6	1999	
162					Relief		102	58	2	1999	
163	M-17	6810 166th Way SE	1300	CM1150	PRV	1050	109	38	2	2002	Epoxy Coated.
163					PRV		109	33	6	2002	
163					Relief		109	50	2	2002	
164	G-13	12000 Coal Creek Pkwy	FA293	NS200	PRV	56.8	102	62	2		Main Feeder to the North 200 zone. Newport Shores Community.
164					PRV		102	57	8		Inherited the prvs from Coal Creek Water District in 2003.
165	G-14	4546 119th Ave SE	NH350	FA293	PRV	181.7	86	43	2		Back up feed to the Factoria 293 zone. Relief is shut off
165					PRV		86	38	6		because the vent pipe terminates underground.
165					Relief		86		2		Prvs are plumbed with sustainers. Inherited the prvs from CCUD in 2003.
166	G-14	4508 116th Ave SE	NH350	FA293	PRV		84	42	6		Back up Feed to the Factoria 293 zone. Inherited the prvs from CCUD in 2003.
166					Relief		84	57	2		Epoxy Coated. Prvs are plumbed to sustain the 350 zone.
167	G-14	4657 123rd Ave SE	NH470	NH380	PRV	243.7	105	50	2		Inherited the prvs from Coal Creek Water District in 2003. Epoxy Coated.
167					PRV		105	46	6		
167					Relief		105	65	2		
168	G-14	12104 SE 47th St	NH470	NH380	PRV	243.7	105	50	2		Inherited the prvs from Coal Creek Water District in 2003. Epoxy Coated
168					PRV		105	45	6		
168					Relief		105	65	2		
169	G-15	4840 119th Ave SE	NH470	NH380	PRV	245	97	51	1.5		Inherited the prvs from CCUD in 2003.
169					PRV		97	46	4		
170	G-14	4818 116th Ave SE	NH470	NH380	PRV		86	40	2		Inherited the prvs from CCUD in 2003.
170					PRV		86	35	6		
170					Relief		86	55	2		
171	F-15	5115 113th Pl SE	NH320	NS200	PRV	121.8	95	39	2		Inherited the prvs from CCUD in 2003. The 6" valve is epoxy coated.
171					PRV		95	34	6		
171					Relief		95	54	2		
172	F-16	5801 Lk Wash Blvd SE	NH470	NH320	PRV	242.5	111	49	2		Inherited the prvs from CCUD in 2003. Epoxy coated. Single Feed Zone.
172					PRV		111	44	6		
172					Relief		111	62	2		
173	F-16	6216 108th Ave SE	NH320	NS200	PRV	94.6	106	46	2		Inherited the prvs from CCUD in 2003.
173					PRV		106	41	6		
173					Relief		106	61	2		
174	G-16	12300 SE 60th St	NH580	NH470	PRV	346	101	60	2		Inherited the prvs from CCUD in 2003. Valves were plumbed in sideways.
174					PRV		101	56	6		
174					Relief		101	75	2		
175	F-16	6215 112th Ave SE	NH470	NH320	PRV	229.4	112	48	2		Inherited the prvs from CCUD in 2003. Single Feed Zone.
175					PRV		112	43	6		
175					Relief		112	63	2		
176	H-12	3650 132nd Ave SE	520	480	PRV		82	74	3	2005	Installed 01/2005 to feed the Factoria 480 zone. Epoxy Coated.
176					PRV		82	70	8	2006	
176					Relief		82	90	3	2005	

Inlet Station Valves

041					PRV		88	50	8		and 2 hydrants. Possible CIP candidates.
042	J-6	14000 SE 7TH ST	LH520	KC450	PRV	203	37	65	4	1975	This PRV station is located in an old well pump station. Primary
042					PRV		37	60	8		central 450 zone feed. Relief was taken out of service in 1994.
042	J-6				Relief		37	50	3		
043	I-6	13830 SE 1ST ST	KC450	BV400	PRV	234.8	93	65	2	1983	Secondary feed to the 400 zone.

PRV	Grid	Address	Zones		Valve	Elevation	Setting		Size	Date Installed	Remarks
No.	Loc.	Location	Supply	Served	No.	(ft)	(psi) Inlet	Outlet			
2001-01	J-02	N.E. 40th Inlet 4076 148th Ave NE	TESSL	LH520	PRV	370	TESSL		20	1991	20" valve is a flow control valve with solenoids. Flow is set remotely. 18" valve is a regular prv
			TESSL		PRV	370	TESSL	60	18	1991	
2002-01	H-4	Cherry Crest Inlet 2600 127TH AVE NE	TESSL	BV400	PRV		TESSL	12	12	1997	Cherry Crest Res. this valve is a combination electronic interface control valve w/ surge override and pressure sensitive closing plus a solenoid selected pressure reducing feature. Epoxy Coated
2003-01	I-6	Bel-Red Inlet 13200 BEL RED RD	TESSL	BV400	PRV	157	TESSL	103	12	1983	Bel Red Inlet Station, Solenoid operated set up on 12" valve, pressure override feature, and reverse flow check. 6" bypass has a rate of flow [orifice plate] control plus an override and reverse control.
2003-01			TESSL		PRV	157	TESSL	98	6	1983	
2004-01	K-6	8th Inlet 15200 NE 8TH N.E.	TESSL	LH520	PRV	314	TESSL	90	12	1991	NE 8th Inlet Station, Modified station installed an 8" pressure relief to operate when the booster pumps are running set at 750ft. The 12" valve is solenoid operated either pressure/rate of flow.
2004-01			TESSL		Relief	314	TESSL	180	8	1991	
		Richards Road Inlet 2600 132nd. Ave S.E.	CESSL	BV400	PRV	323	CESSL	30	12	1991	Richards Roads Inlet supplies several zones off the transmission line. the 300,340,400 and 450 zone are all supplied by this 12" line. These zones along with the Woodridge altitude valve regulates the inlet flow.
2006-01	J-11	S.E. 28th Inlet 2649 145TH PL SE	TESSL	LH520	PRV	403	TESSL	50	12	1991	SE 28TH Res. This 12" valve is solenoid controlled (remotely from the BSC) rate of flow with a pressure override and a reverse flow check feature. In case of communication loss there is a remote pressure control.
2006-01			TESSL		Relief	403	TESSL	150	8	1991	
2007-01	F-12	Enatai Inlet 3400 108TH AVE SE	CESSL	EN300	PRV	25.5	CESSL	110	3	1964	Enatai Inlet. The 8" valve is remotely controlled solenoid for pressure and flow. With an override feature and a reverse flow check. The 3" valve is a standard PRV with ACRD control, pressure override, and a reverse flow feature.
2007-01			CESSL		PRV		CESSL	118	8	1964	
2008-01	P-15	Eastgate Inlet 14502 NEWPORT WY	TESSL	LH520	PRV	398	TESSL	48	12	2004	Upgraded in 2004. Eastgate Inlet, this 12" motorized (Rotork) butterfly valve is controlledremotely from the BSC. The 6" valve is a rate of flow controlled valve (locally) and is used in the winter time for lower flows. Epoxy Coated.
2008-01			TESSL		PRV		TESSL	48	6	2004	
2009-01	H-14	Somerset Inlet 4350 130TH PL SE	CESSL	SS700	PRV	261	CESSL	190	12	1994	Somerset Inlet. this valve is located in the Somerset Inlet pump station it controls the pumped discharge flow and is usually set to between 800 - 1000gpm.
2009-01			CESSL		Relief	261	CESSL	300	3	1994	
2010-01	L-13	161st. Street Inlet 4112 161st Ave SE	TESSL	LH520	PRV	400	TESSL	50	12	2002	Motorized Butterfly used as a flow control valve.
2011-01	H-12	Inlet # 11 12501 SE 38th St	MISL	FA293	PRV	93.6	MISL		8	2005	Station upgraded in 2005. Main feed to the Factoria Reservoir. Epoxy Coated valves except for the 6" relief.
2011-01			MISL		PRV	93.6	MISL		4	2005	
2011-01			MISL		PRV	93.6	MISL		6	2005	
2012-01	G-12	Inlet # 9 3516 120th Ave SE	MISL	FA293	PRV	137.5	MISL		6		Station set to feed only in case of emergency.
2013-01	G-12	Inlet # 10 3600 Lk Wash Blvd SE	MISL	NS200	PRV	27.4	MISL		6		Station set to feed only in case of emergency. Epoxy Coated
2013-01			MISL		PRV	27.4	MISL		4		
2013-01			MISL		Relief	27.4	MISL		2		
2014-01	H-12	Inlet # 8 4400 128th Ave SE	CESSL	FA293	PRV	203	CESSL	44	2	2005	Secondary feed into the 293 Zone. Upgraded in 2005. Epoxy Coated
2014-01			CESSL		PRV	203	CESSL	38	6	2005	
2014-01			CESSL		Relief	203	CESSL	55	2	2005	
2014-02	H-12	Inlet # 8 4400 128th Ave SE	CESSL	FA460	PRV	203	CESSL	115	2	2005	Secondary feed to the 460 Zone. Installed in 2005. Epoxy Coated.
2014-02			CESSL		PRV	203	CESSL	110	6	2005	
2014-02			CESSL		Relief	203	CESSL	130	2	2005	
2015-01	H-15	Inlet # 6 5419 128th Ave SE	CESSL	NH470	PRV		CESSL		6	2004	Designed to feed only in case of an emergency

Table 6-6
Storage Facilities

Operating Area/Name	Map Location Code	Volume (MG)	Water Level (el. in ft)		Zone Served	Construction Material	Volume Per Foot (gal)
			Maximum	Minimum			
West Bellevue							
Pikes Peak 550	H-2	1	550	526	670/600	Steel	42,450
Meydenbauer 252	D-8	1.2	251	246	252	Concrete	57,142
Woodridge 397 Standpipe	H-10	2	397	326	400/450	Steel	28,200
Clyde Hill 465 Standpipe	D-5	0.75	465	365	465/500	Steel	7,500
Clyde Hill 390	D-5	4	389.6	358.6	500/400	Prestressed concrete	132,000
Clyde Hill 335 Round	D-6	1	335	311	335	Steel	41,450
Clyde Hill 335 Square	D-6	0.5	335	319	335	Reinforced concrete	31,600
Cherry Crest 401	H-4	3	404	384	400	Concrete	150,390
Subtotal		13.45					
East Bellevue							
Lake Hills (N)	L-7	2	520	445	520	Steel	28,650
Lake Hills (S)	L-7	2	520	445	520	Steel	28,650
Parksite	J-13	2	520	480.4	520	Steel	50,490
Newport	L-13	3	519.42	499.42	520	Prestressed Concrete	169,000
Sammamish	R-15	1	259.5	224.5	270	Prestressed Concrete	29,000
Kirkland's 545 Reservoir	N/A	1.5*	545		520N	Steel	
NE 40th Reservoir	J-2	3.4*	412.5	376.5	520N	Prestressed Concrete	160,750
Subtotal		14.9					

Table 6-6
Storage Facilities

Operating Area/Name	Map Location Code	Volume (MG)	Water Level (eL in ft)		Zone Served	Construction Material	Volume Per Foot (gal)
			Maximum	Minimum			
South Bellevue							
Factoria	H-12	2.6	290	278	293	Steel	100,000
CCUD's 440 Reservoir	N/A	1.65[a]	434	428	470	Steel	250,000
CCUD's 580 West Reservoir	N/A	1[a]	567	548	580	Steel	62,500
CCUD's 580 East Reservoir	N/A	0.4[a]	567	548	580	Steel	25,000
Somerset-1	I-14	0.1	550.5	540.5	550	Concrete	9,500
Somerset-2	I-14	0.1	700	690	700	Concrete	9,500
Somerset-3	I-14	0.1	844.5	834.5	850	Concrete	9,700
Horizon View-1	J-14	0.2	700	666.3	700	Steel	5,900
Horizon View-2	K-15	0.15	850	821	850	Steel	5,100
Horizon View-3	K-15	2	1175	1155	1175/1350	Prestressed Concrete	99,300
Horizon View-3A	K-15	0.1	1175	1159.5	1175/1350	Reinforced Concrete	6,700
Forest Hills	J-16	2	845.5	822	850	Prestressed Concrete	84,600
Cougar Mountain-1	M-16	0.5	846	822	850	Prestressed Concrete	21,875
Cougar Mountain-2	M-16	1.0	1150.0	1118.0	1150	Prestressed Concrete	31,250
Cougar Mountain-3	N-17	2.0	1465.6	1445.25	1465/1550	Steel	100,000
Cougar Mountain-3A	N-17	0.3	1465.6	1445.25	1465/1550	Steel	15,000
Subtotal		14.2					
						Total Storage	42.55 MG

[a]Capacity available to Bellevue's water system. These joint use facilities are operated and maintained by the City of Kirkland or the Coal Creek Utility District (CCUD).
[b]Capacity available to Bellevue's water system. This is a 6.0 MG joint use facility with the City of Redmond. It is operated and maintained by Bellevue

System Maintenance

Water quality is maintained by a system maintenance program that consists of five primary components: system flushing, reservoir cleaning and inspections, pressure reducing valve maintenance, sample stand maintenance, and system water quality monitoring.

All watermains are flushed using the unidirectional method. The unidirectional flushing program was implemented in 1995. While dead ends are flushed as part of the unidirectional flushing program, they may also be flushed if water quality concerns or water quality complaints develop. With unidirectional flushing, pressure zones are flushed with fresh water from their supplies out to the end of the zones. Valves are closed to target the flows and create velocities of 7.5 feet per second for scouring. Bellevue Utilities is participating with the American Water Works Research Foundation (AWWARF) Project #2606 Establishing Contaminant Specific Flushing Velocities to determine the range of velocities and associated boundary shears required to dislodge and remove various accumulated materials from the water distribution system. The results of AWWARF Project #2606 will aid in determining what velocities are required to remove accumulated materials from the water distribution system. Bellevue Utilities is currently projecting the entire system will be flushed on a 4-5 year basis.

All reservoirs are cleaned and inspected for possible sources of contamination on a three year rotating basis. An inspection form has been adopted for use when reservoirs are place out of service and drained for cleaning. The inspection form was created as part of the AWWARF Project: *Maintaining Water Quality in Finished Water Storage Facilities.* Pressure Reducing Valves (PRV's) which control inlets, reservoirs and zones are also cleaned and maintained on a regular rotating basis. PRV's to single feed and high use zones are inspected and cleaned every year. All inlet and reservoir PRV's are cleaned and inspected every one to two tears. All other pressure zone PRV's are cleaned and inspected every two to four years depending on the number of PRV's feeding the pressure zone.

Water system sample stands are cleaned, disinfected and inspected every six months. Sample stands may be disinfected prior to taking a *repeat sample* to ensure that the source of the positive *routine sample* is not the sample stand. Sample stands are disinfected with a hypochlorite solution for twenty minutes.

Water quality is monitored on a routine basis, in compliance with all state and federal requirements. Additionally, Bellevue Utilities monitors disinfected residuals, pH, disinfection byproducts (DBP's) customer complaints and other parameters on a regular basis from throughout the water system. This is done to analyze, identify and correct any changes in water quality which may adversely effect the quality of customer's water, or cause a violation of a drinking water standard, prior to its occurring, and to ensure that high water quality is maintained.

Section 2.1c - Total Coliform Rule Compliance Requirements

Routine Sampling requirements

The City of Bellevue is one of approximately 27 separate water systems that purchase their water from SPU. SPU and its wholesale customers have been participating in a regional, DOH approved, coliform monitoring program since 1972. As part of the regional program, wholesale customers are responsible for installing and maintaining designated coliform monitoring sample stands, while SPU collects the routine monthly samples. Bellevue is responsible for collecting any repeat samples. Under this agreement, SPU and its purveyors sample at a rate of at least 0.6 samples per 1000 customers per month. Bellevue currently supplies water to a population of 131,800 therefore, the minimum number of routine samples collected within Bellevue's distribution system is 84 per month. Prior to 1997, SPU collected monthly samples from 12 sample stands within Bellevue's distribution system. As of January, 1997, Bellevue added four sample stands and re-located five sample stands. The changes were made to:

- Prepare Bellevue for continued compliance with State and Federal monitoring requirements;
- Better monitor the water quality throughout the distribution system from a local standpoint;
- Respond to the recommendations in the 1992 Water Comprehensive Plan to add sample stands; and
- Prepare for and conduct extensive system monitoring as part of a Water Quality Assessment study currently underway.

Two meetings were held at the City of Bellevue to develop a plan for installing new sample stands, and for maintaining/abandoning existing stands. Bellevue personnel representing water quality, operations, design, maintenance, and planning attended the meetings. A representative from SPU was also present. The sample stand locations were selected based on:

- Geographic spread,
- Representation of 4 operating areas,
- Tolt (80%) and Cedar (20%) source water,
- Piping size and material
- Hydraulic residence time,
- Known water quality concerns,
- 1992 Comprehensive Plan recommendations,
- Adequate drainage/stormwater sewer access, and
- Ease of collecting upstream and downstream samples in the event of a coliform-positive result.

Sample Stands

New #	Location	Area	Source	Zone	Main
Be-N-1	116th Ave. & NE 36th St.	NB	Tolt	PP 550	8" AC
Be-N-2	124th Ave. & NE 32nd St.	NB	Tolt	PP 670	6" AC
Be-W-3	102nd Ave. & NE 33rd St.	WB	Tolt	BV 400	6" AC
Be-W-4	97th Ave. & NE 1st St.	WB	Tolt	MB 252	12" AC
Be-W-5	78th Ave. & NE 22nd St.	WB	Tolt	CH 335	6" AC
Be-W-6	126th Ave. & NE 6th St	WB	Tolt	BV 400	6" AC
Be-W-7	104th Ave. & SE 20th St.	WB	Cedar	EN 300	4" AC
Be-E-8	164th Ave. & SE 12th St.	LH	Tolt	LH 520	6" AC
Be-E-9	169th Ave. & NE 31st St.	LH	Tolt	LH 520	6" AC
Be-E-10	145th Pl. & NE 1st Pl.	LH	Tolt	KC 450	6" AC
Be-E-11	193rd Ave. & SE 47th St.	LH	Tolt	SA 270	8" DI
Be-S-12	156th Pl. & SE 44th Pl.	SB	Tolt	SS 850	8" CI
Be-S-13	169th Ave. & SE 58th St.	SB	Tolt	CM 1150	12" DI
Be-S-14	149th Ave. & SE 60th St.	SB	Tolt	SS 1000	8" DI
Be-S-15	137th Ave. & SE 42nd St.	SB	Cedar	SS 550	8" AC
Be-S-16	Forest Drive & SE 55th Pl.	SB	Cedar	SS 700	8" AC
Be-W-17	4305 Hunts Point Rd	WB	Tolt	HP 250	8" DI
Be-S-18	13234 SE 51st Pl.	SB	Cedar	SS 550	8" AC
Be-S19	45th Pl & 121st Ave SE	SB	Cedar	FA 293	8"CI
Be-S20	SE 62nd & Lk. Wash Blvd	SB	Cedar	NH 320	8"DI
Be-S21	SE 60th & 116th Ave SE*	SB	Cedar	FA440	8"CI
Be-S22	3818 Lk Wash Blvd SE	SB	Cedar	NS 200	10"CI
Be-S23	125th Ave SE & SE 53rd St.	SB	Cedar	NH 580	6"AC

~~*Be-S-21 to be eliminated in 2007/2008. A replacement sample stand will be added in~~ the Yarrow Point area (YB220) per tentative approval from DOH January 2007. See below.

New Stand #	Location	Area	Source	Zone	Main
Be-W-24	4656 95th Ave NE Yarrow Point, WA	NB	Tolt	YB220	8inch DI

upstream resample 4650 95th Ave NE
downstream resample 4660 95th Ave NE

Likely sample schedule, Thursdays or Fridays, 1-2 samples per month. To be coordinated with SPU.

Sample Station Code	Sample Station Location	Total Samples Per Month	Samples per month on day of week						
			Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	CITY OF BELLEVUE								
BE-N1	3625 - 116TH AVENUE NE	4			4				
BE-N2	3046 - 124TH AVENUE NE	4		1				3	
BE-W3	3323 - 102ND AVENUE NE	4						4	
BE-W4	9705 - NE 1ST STREET	4			4				
BE-W5	2240 - 78TH AVENUE NE	4					4		
BE-W6	12655 - NE 6TH STREET	4						4	
BE-W7	10430 - SE 20TH STREET	4			4				
BE-E8	1218 - 164TH AVENUE SE	4		4					
BE-E9	3020 - 169TH AVENUE NE	4		4					
BE-E10	110 - 145TH PLACE NE	4		4					
BE-E11	19213 - SE 46TH PLACE	4					4		
BE-S12	15604 - SE 44th PLACE	4			4				
BE-S13	16870 - SE 58TH STREET	4					4		
BE-S14	14938 - SE 60TH STREET	4					4		
BE-S15	13718 - SE 42ND STREET	4			4				
BE-S16	5800 - FORESTDRIVE SE	7			3		4		
BE-W17	4305 HUNTS POINT DR	4					1	3	
BE-S18	13234 SE 51ST PLACE	4			3		1		
BE-S19	SE 45TH PL & 121ST AV SE (107-1)	5			4		1		
BE-S20	SE 62ND ST & LAKE WASHINGTON BLVD (107-2)	5			4		1		
BE-S21	SE 60TH ST & 116TH AV SE (107-3)	1			1				
BE-S22	3818 LAKE WASHINGTON BLVD (107-4)	1					1		
BE-S23	125TH AV SE & SE 53RD ST (107-8)	1			1				
	BELLEVUE TOTAL	**88**	**0**	**13**	**36**	**0**	**25**	**14**	**0**

Response to Unsatisfactory Samples

When unsatisfactory samples have been confirmed the area around or pressure zone where the *routine sample* was obtained from shall be thoroughly flushed, and the sample stand disinfected. A chlorine residual shall be taken before and immediately after flushing. If a low chlorine residual (below .30 ppm) is found, additional flushing and other appropriate measures to boost the chlorine levels in the system shall be undertaken. Recent activities within the area of the bad sample shall be researched to determine if a cross-connection or other source caused the positive sample. Do not assume source water is contaminated until all other possibilities have been eliminated.

Repeat samples must be collected within 24 hours of being informed by the laboratory that a *routine sample* tested positive for coliform. *Repeat samples* include three samples as follows:

- One sample must be collected from the sample stand that the original coliform positive result came from;
- One sample must be taken within 5 service connections upstream of the original, positive coliform *routine sample*
- One sample must be taken within 5 service connections downstream of the original, positive coliform *routine sample*

Repeat Sample Locations

SS#	ADDRESS	GRID	SOURCE	ZONE	MAIN
Be-N-1	3625 116th Av. NE	G-3	Tolt	PP 550	8" AC
	Upstream sample location:		3906 116th Av. NE (meter setter)		
	Downstream sample location:		3630 116th Av. NE (meter setter)		
BE-N-2	3046 124th Av. NE	H-4	Tolt	PP 670	6" AC
	Upstream sample location:		3070 124th Av. NE (meter setter)		
	Downstream sample location:		3024 124th Av. NE (meter setter)		
Be-W-3	3323 102nd Av. NE	E-3	Tolt	BV 400	6" AC
	Upstream sample location:		3335 102nd Av. NE (meter setter)		
	Downstream sample location:		10054 NE 33rd St (meter setter)		
Be-W-4	9705 NE 1st St	D-7	Tolt	MB 252	12" AC
	Upstream sample location:		9708 NE 1st St (meter setter)		
	Downstream sample location:		9605 NE 1st St (meter setter)		
Be-W-5	2240 78th Av. NE	B-5	Tolt	CL 335	6" AC
	Upstream sample location:		2254 78th Av. NE (meter setter)		
	Downstream sample location:		2220 78th Av. NE (meter setter)		
Be-W-6	12655 NE 6th St	H-7	Tolt	BV 400	6" AC
	Upstream sample location:		12654 NE 6th St (meter setter)		
	Downstream sample location:		12657 NE 5th St (meter setter)		

Be-W-7	10430 SE 20^{th} St	E-10	Cedar	EN 300	4" AC
	Upstream sample location:		1946 104^{th} Av. SE (meter setter)		
	Downstream sample location:		10444 SE 20^{th} St (meter setter)		
Be-E-8	1218 164^{th} Av. SE	M-9	Tolt	LH 520	6" AC
	Upstream sample location:		1236 164^{th} Av. SE (meter setter)		
	Downstream sample location:		1204 164^{th} Av. SE (meter setter)		
Be-E-9	3020 169^{th} Av. NE	M-4	Tolt	LH 520	6" AC
	Upstream sample location:		3004 169^{th} Av. NE (meter setter)		
	Downstream sample location:		3028 169^{th} Av. NE (meter setter)		
Be-E-10	110 145^{th} PL NE	J-7	Tolt	KC 450	6" AC
	Upstream sample location:		20 145^{th} PL NE (meter setter)		
	Downstream sample location:		132 145^{th} PL NE (meter setter)		
Be-E-11	19213 SE 46^{th} PL	P-14	Tolt	SA 270	8" DI
	Upstream sample location:		19204 SE 47^{th} St (meter setter)		
	Downstream sample location:		4610 192^{nd} Av. SE (meter setter)		
Be-S-12	15604 SE 44^{th} PL	L-14	Tolt	SS 850	8" CI
	Upstream sample location:		15530 SE 44^{th} PL (meter setter)		
	Downstream sample location:		15615 SE 44^{th} PL (meter setter)		
Be-S-13	16870 SE 58^{th} St	M-16	Tolt	CM 1150	12" DI
	Upstream sample location:		16906 SE 58^{th} St (meter setter)		
	Downstream sample location:		16870 SE 58^{th} St (meter setter)		
Be-S-14	14938 SE 60^{th} St	K-16	Tolt	SS 1000	8" DI
	Upstream sample location:		14948 SE 60^{th} St (meter setter)		
	Downstream sample location:		14920 SE 60^{th} St (meter setter)		
Be-S-15	13718 SE 42^{nd} St	I-13	Cedar	SS 550	8" AC
	Upstream sample location:		13808 SE 42^{nd} St (meter setter)		
	Downstream sample location:		13605 SE 42^{nd} St (meter setter)		
Be-S-16	5800 Forest Dr SE	I-16	Cedar	SS 700	8" AC
	Upstream sample location:		5775 Highland Dr SE (meter setter)		
	Downstream sample location:		13819 SE 60^{th} St (meter setter)		
Be-W-17	4305 Hunts Pt Rd	B-2	Tolt	HP 250	8" DI
	Upstream sample location:		4315 Hunts Pt Rd (meter setter)		
	Downstream sample location:		4245 Hunts Pt Rd (meter setter)		
BE-S-18	13234 SE 51^{st} Pl.	I-15	Cedar	SS550	8" AC
	Upstream sample location:		13233 SE 51^{st} Pl. (meter setter)		
	Downstream sample location:		13232 SE 51^{st} Pl. (meter setter)		
BE-S-19	SE 45^{th} Pl & 121^{st} Ave SE.	G-13	Cedar	FA293	8" CI
	Upstream sample location:		12120 SE 45^{th} Pl. (meter setter)		
	Downstream sample location:		12104 SE 45^{th} Pl. (meter setter)		
BE-S-20	SE 62nd St. & Lake Wa Blvd.	F-16	Cedar	NH320	8" DI
	Upstream sample location:		6205 112^{th} Ave SE. (meter setter)		
	Downstream sample location:		6123 SE 62^{nd} St.. (meter setter)		
BE-S-21*	SE 60^{th} St. & 116^{th} Ave SE.	F-16	Cedar	FA440	8" CI
	Upstream sample location:		SE60th and 116thave SE. (Hyd)		

	Downstream sample location:		6004 116th Ave SE.. (meter setter)		
BE-S-22	3818 Lake Wa. Blvd. SE.	G-12	Cedar	FA220	10" CI
	Upstream sample location:		3828 Lake Wa Blvd. (Hyd)		
	Downstream sample location:		3848 Lake Wa Blvd. (Hyd)		
BE-S-23	125th Ave SE & SE 53rd St.	H-15	Cedar	NH580	6" AC
	Upstream sample location:		5309 125th Ave SE (Meter setter)		
	Downstream sample location:		5212 125th Ave SE (Meter setter)		

*see notes under sample stand listings

Reporting to the State

The City shall notify the State Department of Health as follows, in the following situations:

- Within 10 days of notification by the Seattle Public Utilities laboratory of a positive *Routine Coliform Sample* (this does not constitute a violation unless *Repeat Samples* confirm the violation). DOH has approved SPU's electronic data reporting system for routine coliform sampling as adequate notice for a routine coliform positive sample.
- By the end of the business day in which the City is notified by the Seattle Public Utilities laboratory of a positive *Routine fecal or E-Coli sample* (this does not constitute a violation unless *Repeat Samples* confirm the violation).
- Within 24 hours of confirming an *Acute Coliform MCL violation.*
- Before the end of the next business day after confirming a *Non-Acute Coliform MCL violation.*
- Within 10 days of a monitoring violation, including or expired CSE's.

Section 2.1d - Public Notification:

Notification to the public shall only be made after confirmation of an MCL violation with the Seattle Public Utilities Water Quality Laboratory and the Washington State Department of Health, and after notice of the violation has been provided to the City of Bellevue Utilities Director, City Manager, and Mayor and City Council or their designees.

The following information shall be included in public notifications for both Acute and Non-Acute Coliform MCL violations:

A. DOH Mandatory Language

B. A clear concise and simple explanation of the violation

C. Discussion of potential adverse health effects and any segment of the population that can be at a higher risk

D. A list of steps the City has taken or is planning to take to remedy the situation

E. A list of steps the consumer should take, including advice on seeking an alternative water supply if necessary

F. The City's name, phone number and a contact

G. When appropriate, notices shall be multi-lingual

H. The purveyor may provide additional information to further the situation

NOTE: A copy of the public notice must be sent to DOH immediately:

Department of Health NW Regional Office
Attn: Sheri Miller PE
20435 72nd Ave S, Suite 200, K17-12
Kent, WA 98032-2358

Department of Health NW Regional Office
Attn: Carol Stuckey
20435 72nd Ave S, Suite 200, K17-12
Kent, WA 98032-2358

FAX (253) 395-6760

Non-Acute MCL Violations

The City shall notify water system users when the system has a Non-Acute Coliform MCL violation as follows:

- Notification to water system users must occur but within 30 days after you learn of the violation
- Notification shall be made by newspaper, mail, and/or hand delivery to all customers of the system.
- Notification to newspapers means publication in the following daily newspapers which serve the Bellevue area: The Seattle Times, The Seattle Post-Intelligencer and the Eastside Journal.

DOH Mandatory Language for Non-Acute Coliform MCL Violations

"The United States Environmental Protection Agency (EPA) sets drinking water standards and has determined that the presence of total coliform is a possible health concern. Total coliform are common in the environment and are generally not harmful themselves. The presence of these bacteria in drinking water, however, generally is the result of a problem with water treatment or the pipes which distribute the water, and indicates that the water may be contaminated with organisms that can cause disease. Disease symptoms may include diarrhea, cramps, nausea, and possibly jaundice, and any associated headaches and fatigue. These symptoms, however, are not just associated with disease-causing organisms in drinking water, but also may be caused by a number of factors other than your drinking water. EPA has set an enforceable drinking water standard for total coliform to reduce the risk of these adverse health effects. Under this standard, no more than 5.0 percent of the samples collected during a month can contain these bacteria, except that systems collecting fewer than 40 samples/month that have one total coliform-positive sample per month are not violating the standard. Drinking water which meets this standard is usually not associated with a health risk from disease-causing bacteria and should be considered safe".

Acute Violation:

The City shall notify all water system users of a confirmed Acute Coliform MCL violation as follows:

- Notification shall be made within 24 hours of confirmation of an Acute Coliform MCL violation.
- Notification shall be made by:
  1) Notification to radio and television stations serving the area.
  2) Notification to newspapers serving the Bellevue area.
  3) Direct mail notification to all water customers.

DOH Mandatory Language for Acute Coliform MCL Violations

"The United States Environmental Protection Agency (EPA) sets drinking water standards and has determined that the presence of fecal coliform or E. Coli is a serious health concern. Fecal coliform and E. Coli are generally not harmful themselves, but their presence in drinking water is serious because they usually are associated with sewage of animal wastes. The presence of these bacteria in drinking water is generally the result of a problem with water treatment or the pipes which distribute the water and indicates that the water may be contaminated with organisms that can cause disease. Disease symptoms may include diarrhea, cramps, nausea, and possibly jaundice, and any associated headaches and fatigue. These symptoms, however, are not just associated with disease-causing organisms in drinking water, but also may be caused by a number of factors other than your drinking water. EPA has set an enforceable drinking water standard for fecal coliform and E. Coli to reduce the risk of these adverse health effects. Under this standard , all drinking water samples must be free of these bacteria. Drinking water which meets this standard is associated with little or none of this risk and should be considered safe. State and local health authorities recommend that consumers take the following precautions: (to be inserted by the public water system, according to instructions from State or local authorities)".

The City of Bellevue recommends that customers boil their water or seek an alternative water supply (bottled water) during this incident. Customers undergoing chemotherapy or customers with compromised immune systems should refrain from drinking the water until it is deemed safe. The City of Bellevue is working with State and local authorities to take every possible step to remedy the situation. Steps include flushing, chlorinating, and sampling the whole distribution system. The City of Bellevue is also investigating why this happened, and what the City can do to prevent it from happening in the future. The City of Bellevue apologizes for the inconvenience that this unfortunate situation this has caused. Please contact the office at 425-452-6012 if you have any questions regarding this matter.

2.1e **Media Contacts for Public Notification**

Newspaper Contacts	Phone Number
The Seattle Times-Eastside Bureau 10777 Main St, Suite 100 Bellevue, WA 98004 newstips@seattletimes.com	425-453-2130
Seattle Post-Intelligencer 101 Elliot Avenue West Seattle, WA 98119 newstips@seattlepi.com	206-448-8303
King County Journal 1705 132nd Avenue NE Bellevue, WA 98005	425-453-4622
Bellevue Reporter 11400 SE Eighth St., Suite 450 Bellevue, WA 98004 Carrie.wood@reporternewspaper.com	425-453-4290

Television Contacts	Phone Number
KING (Channel 5) 333 Dexter Avenue North Seattle, WA 98109 newstips@king5.com	1-800-456-3975
KIRO (Channel 7) 2807 3rd Avenue Seattle, WA 98121 newstips@kirotv.com	206-728-7777
KOMO (Channel 4) 100 4th Avenue North Seattle, WA 98109 tips@komo4news.com	1-888-477-5666
KCPQ (Channel 13) 1813 Westlake Avenue North Seattle, WA 98109 tips@q13.com	206-674-1313

Radio Contacts	Phone Number
KING FM (FM98.1) 333 Dexter Avenue North Seattle, WA 98109	206-448-3981
KIRO (AM710) 1820 Eastlake Avenue East Seattle, WA 98102 editor@entercom.com	206-726-6397
KOMO (AM 1000) 1809 7th Avenue, Suite 200 Seattle, WA 98101 newstips@komo1000news.com	206-223-5700
KMPS (FM 94.1) 1000 Dexter Avenue North Seattle, WA 98	206-421-5677
KLSY (FM 92.5, AM 1540) 3650 131st Avenue SE, Suite 550 Bellevue, WA 98005	425-653-9462

Section 2.1g - System Maps

- Distribution Grid and Major Facilities (attached)
- Hydraulic Profile (attached)

(Insert maps and profile)

Section 2.1i - Glossary of Terms

ACUTE - posing an immediate risk to human health

AWWA - American Water Works Association

BIOFILM - biological regrowth of bacterial or organic nature that can use up chlorine residual

COLIFORM - are on of the group of microbiological contaminants regulated as part of the Safe Drinking Water Act (SDWA) written by the U.S. Environmental Protection Agency (EPA). The many types of coliform, including fecal coliform, are usually not disease causing (pathogenic). However, their presence in drinking water indicates the potential presence of pathogens associated with waterborne disease outbreaks. In particular, the presence of fecal coliform in drinking water indicates that an urgent public health problem may exist.

COLIFORM SAMPLE - a sample of water collected from the distribution system at or after the first service and analyzed for coliform presence.

CONTAMINANT - a substance present in drinking water which may adversely affect the health of the consumer or the aesthetic qualities of the water.

DISTRIBUTION SYSTEM - that portion of a public water system which conveys water from the source and/or treatment facilities to consumers.

DOH - Washington State Department of Health

E/COLI - Fecal coliform bacteria

EPA - United States Environmental Protection Agency

MCL - Maximum Contaminant Level

NON-ACUTE - posing a possible or less than immediate risk to human health

NTNC - non-transient non-community

POTABLE - water suitable for drinking by the public

PRV - pressure reducing valve

PURVEYOR - agency, subdivision of the state, municipal corporation, firm, company, mutual or cooperative association, institution, partnership, or person or other entity owning or operating a public water system. Purveyor also means authorized agents of such agencies.

REPEAT SAMPLE - a sample collected to confirm the results of a previous analysis

ROUTINE SAMPLE - a sample collected on a monthly or regular basis, as part of the monitoring plan.

SAMPLE SITE - a designated site to collect samples for analysis

SERVICE CONNECTION - a connection to the public water system designed to provide potable water to a single-family residence, or other residential or non-residential population.

SOURCE - the origin of the water that the purveyor is receiving.

TURBID - measurable indication of water clarity. High levels can indicate water quality problems.

TYPE "A" WATER SYSTEM - a public water system with fifteen or more service connections, regardless of the number of people; or serving an average of twenty-five or more people per day for sixty or more days within a calendar year, regardless of the number of service connections.

Appendix V

Cross-Connection Control Plan

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TABLE OF CONTENTS

WAC 246-290-490 10 Elements of a Cross Connection Control Program

CITY OF BELLEVUE
CROSS-CONNECTION CONTROL PROGRAM
INTRODUCTION

Congress passed the “Safe Drinking Water Act” with the intent of protecting the public health and welfare of all public water supply users in the United States. The Environmental Protection Agency (EPA) interpreted this mandate to mean that certain contaminants should not be found in water “delivered to the free flowing outlet of the ultimate user.” Thus, these contaminants became the responsibility of the water purveyor (City of Bellevue). The EPA specifically exempted contaminants added to the water under controlled circumstances by the user (except for plumbing corrosion by-products). This was not, however, intended to absolve the purveyor of the responsibility to conduct a cross connection control program.

In cross connection control, the City of Bellevue’s responsibility is to protect the water distribution system from contamination. The greatest public health risk lies in the introduction of a contaminant into the public water supply system because the water distribution system can provide the conduit for the spread of the contaminant to a large population. Cross connections within the customer’s plumbing system and within the purveyor’s distribution system pose a potential source for the contamination of the public water supply.

Once water leaves the control of the water purveyor (i.e., leaves the distribution system), the water purveyor must consider the possibility that the water could become contaminated. Accordingly, the water purveyor must consider the plumbing systems of all customers to be a potential health hazard. The hazard, and the health risk, may vary from minor to severe. The purveyor’s cross connection control program should be based on the supposition that all customers should be isolated at the property line (meter) with an approved air gap, unless the purveyor is satisfied with the level of protection provided by the customer. Notwithstanding this basic supposition, the water purveyor should recognize the practical needs of the customer, and the responsibility of other regulatory agencies to protect the customer’s plumbing system from becoming contaminated.

The water purveyor’s satisfaction in the customer’s reduction of their possible cross connection risk is a factor in determining the purveyor’s requirement for premises isolation. Premise isolation may be reduced from an approved air gap, to a reduced pressure backflow assembly, double check valve assembly, or no premises isolation at all.

To protect occupants of the customer's premises, it is necessary to isolate areas of the premises and/or each outlet, fixture or use rather than to install backflow protection at the meter. Generally, the prevention of contamination of the water distribution system or potable water system in a building is of concern to the following:

The water purveyor (City of Bellevue Utilities)
The plumbing inspector (City of Bellevue Planning & Community Development)
The local health inspector (Seattle & King County Public Health)
Worker safety regulations (Washington State Department of Labor & Industries)
The agency with oversight of water systems (Washington State Department of Health)

A Cross connection program may be administered by any or all of the above. To avoid confusion, it is desirable for the water purveyor to have a joint or cooperative program with the other agencies having jurisdiction. Unfortunately, although each has the same overall goal of preventing contamination, each has a different enforcement criteria, authority and responsibility that may prevent a subordination of its authority to another agency.

The need to eliminate cross connections as a source of potential contamination has been long recognized in plumbing design and plumbing code enforcement. However, plumbing codes address cross connections only in very general terms. Few details are provided to specify methods of identifying and preventing cross connections. This is because it is impractical to cover in a plumbing code all of the information needed to control cross connections.

The plumbing code addresses the plumbing design and installation in new buildings. Generally, once a building occupancy permit is given, plumbing code jurisdiction effectively ceases until a permit is requested to modify the plumbing system. Changes to a plumbing system are often made without a permit. New equipment may be added; piping, fixtures and appliances may wear out, malfunction, or be relocated. New cross connections may then be created. Backflow prevention assemblies and devices installed under the plumbing code to protect the public could be removed, bypassed or fail to operate due to the lack of maintenance. For these reasons, it is recommended that a water purveyor not place full reliance on the enforcement of the plumbing code to protect the public water supply from contamination through cross connections – particularly on an ongoing basis.

The history of cross connection control has provided regulatory authorities with sufficient information to establish a list of those premises where high health hazard cross connections exist, or where the potential hazard is so great that these premises must be isolated from the water purveyor's system. Some states and provinces have established mandatory protection for these premises. However, it is important that each premise be surveyed individually to assess the degree of hazard and the corresponding backflow prevention assembly requirements. Never assume that all premises of the same kind will require the same type of backflow protection. Experience has shown that the water purveyor is in a unique position to implement and administer a cross connection control program. The water purveyor has authority to supply water to a customer and to establish standards and remedies for a breach of those standards. The City of Bellevue cross connection control program is needed to effectively deal with all aspects of the public health posed by cross connections.

CITY OF BELLEVUE UTILITIES

Element 1: *Adoption of a written legal instrument authorizing the establishment and implementation of a CCC program.*

1.1 Cross Connection Control Program

PURPOSE: The purpose of the City of Bellevue (the City) cross-connection control program (CCP) is to protect the public water system from contamination via cross-connection. City of Bellevue Code 24.02.190 gives authority to operate the CCP, which meets the State of Washington regulation WAC 246-290-490.

1.1.1 Policy

The City will ensure that cross-connections between the distribution system and a customer's premises are eliminated or controlled by the installation of a State of Washington approved backflow preventer that is equal to the degree of hazard. The City will operate a combination program whereby premises isolation requires backflow protection with an Air Gap (AG) or a Reduced Pressure Backflow Assembly (RPBA). In-premises isolation backflow protection protecting the Public Water System (within the customer's property lines) will be permitted if there is no high health hazard and the CCS coordinates with the Authority Having Jurisdiction (AHJ).

The final building construction approval and occupancy shall not be granted by the Authority Having Jurisdiction until final cross-connection compliance by a State Certified Cross-Connection Control Specialist, under guidance of the City's Cross Connection Control Program Manager

The customer is responsible for the expense to protect the public water system from backflow contamination by installing, maintaining and testing backflow assemblies in accordance with the City Cross-Connection Program. Failure of the customer to cooperate in the installation, maintenance, repair, inspection or testing of backflow prevention assemblies required by the City may be grounds for termination of water service to the premise, or, escalating enforcement civil violations code 1.18

In the event the water purveyor must initiate action to enforce compliance with the Ordinance on this program, all costs incurred enforcing the action shall be borne by the properties responsible party.

The City will refer to the Pacific Northwest Section AWWA Cross-Connection Control Manual Accepted Procedure and Practice (most current edition) and the current Manual of Cross-Connection Control (USC Manual) on issues concerning cross-connection control.

A. Responsibilities

The City will not be responsible for any loss or damage caused by any negligence or wrongful act of a customer or his authorized representative in installing, maintaining, operating or using any and/or all appliances, facilities, or equipment for which water service is supplied. In addition, they City will not be responsible for adverse consequence to the consumer's water system through the requirement of backflow protection. The customer will be held responsible for health and safety impacts on the water system as well as damage to the City facilities and other property resulting from the use and operation of appliances and facilities on the customer's premises, including damage caused by steam, hot water, chemical, etc.

Element 2: *Development and implementation of procedures and schedules for evaluating new and existing service connections to assess the degree of hazard.*

1.1.2 Service Connections

Water service connections to the City public water system must meet the state of Washington Cross-connection Control requirements outlined in WAC-246-290-490. The City shall ensure that the customer installs a State of Washington approved backflow preventer that is commensurate with the degree of hazard on all identified cross connections. All high hazard service connections to the City public water system are required to have premises isolation backflow protection that shall be a CCS approved air gap (AG) or a State of Washington approved RPBA directly behind the City water meter or an alternate location approved by the CCS installed by the customer at the customer's expense. The RPBA shall be installed to the City specifications and the customer is responsible to have the RPBA tested in accordance with the City cross-connection control test schedule annually or as required by City and State regulations. In-premises isolation will be permitted if the criteria for premises isolation is met and the CCS and AHJ agree that the level of backflow protection is commensurate to the degree of hazard.

There is no grandfathering that can exempt an existing cross-connection violation from meeting current cross-connection requirements of the adopted codes. Where public health protection for the public water system is required, no facility shall be exempt from compliance with current standards.

A plumbing permit is required for the installation or alteration of a backflow prevention assembly. Plumbing permits may be acquired at the City Development Services located at 450 110th Ave NE Bellevue WA 98009.

The City shall ensure that the customer installs approved backflow preventers that equal the degree of hazard in accordance with the following time frame:

- For a cross-connection that poses an **immediate** or **direct** high hazard, the City will terminate water service immediately and will not restore service until the cross-connection is protected to the CCS's satisfaction.

- High health cross-connection hazards within 30 days of the City notifying the customer of the high health cross-connection hazard, or to the CCS's discretion.

- Low health cross-connection hazards within 90 days of the City notifying the customer of the cross-connection hazard or to the CCS's discretion.

1.1.3 Schedule for Evaluation and Continued Reevaluation

a. Facilities that pose an immediate high health hazard cross-connection have priority.
b. When there is a backflow incident.
c. Facilities with severe or high health hazard cross-connections.
d. Facilities with high hazard equipment will be evaluated before facilities with no high hazard equipment.
e. Annually when backflow assembly testing is due.
f. When there is a history of backflow incidents.
g. When there is a history of failed backflow test reports.
h. When there is a change in the use of the premises.
i. When a plumbing permit is issued.
j. Known sites with high or severe hazards will have a routine re-evaluation every 5 years, or as time and resources allow.

1.1.4 New Connections

The City's designated CCS will review all pre-application documents, new construction plans submitted to the City, all water service applications and any other documents which may indicate that a requirement for cross-connection control exists. Where possible and appropriate, consultations prior to service installation will be conducted to assist the customer in meeting State Regulations and the City Cross-Connection Control Ordinance to minimize retrofits and revisions.

For new connections made on or after the effective date of these regulations, the following conditions shall be met before water service is provided;

1. They shall be controlled by eliminating the cross-connection or by installation of approved backflow preventers equal with the degree of hazard.

2. A satisfactory completion of a test by a backflow assembly tester (BAT) must be submitted to the City in accordance with the description of backflow preventer inspection and testing prior to plumbing final.

1.1.5 Existing Connections

The City CCS will survey the premises to determine whether the requirement for cross-connection control exists.

For existing connections where the City identifies a high health cross-connection hazard, the hazard(s) shall be eliminated or controlled by installation of approved backflow preventers equal with the degree of hazard. Photos or drawings indicating the installation point will be provided by the CCS. Alternate locations for installations may be satisfactory if approved by the CCS.

Backflow Preventers shall be installed within thirty days of the City notifying the consumer of the high health cross-connection hazard; or in accordance with an alternate schedule acceptable to the City.

For existing connections where the City identifies a low health cross-connection hazard, the low hazard shall be controlled by installation of approved backflow preventers equal with the degree of hazard with a schedule acceptable to the City.

1.1.6 Existing Commercial Connections

Existing commercial connections that do not meet the criteria for a backflow assembly and any cross-connection hazard do not need to have a backflow assembly installed. This will be determined by a field evaluation and requires continued reevaluations. At the time of remodel, reconstruction, ownership change etc., the connection may be required to have or convert to premises isolation backflow protection with an AG, RPBA, or RPDA. If the existing commercial connection is found to have a high health hazard cross-connection an AG, RPBA, or RPDA shall be required.

The City may allow a State of Washington approved DCVA or DCDA for premises isolation, if the DCVA is **already** installed correctly and there are **no** potential high health hazard cross-connections at the facility (determined by a field evaluation and requires continued reevaluations).

The primary enforcement action will be to work with the CCS or AHJ to get the customer to comply. The secondary action shall be to invoke Bellevue City Code 24.02.280 Code Violations, Enforcement, and Penalties as amended. The third action shall start the process of discontinuing water service. Restricted access would require an Air Gap or RPBA (to be determined by the CCS) behind the City water meter. **No facility is exempt from complying with the most current standards**. The customer is responsible to have the assembly tested annually in accordance with the City cross-connection program.

1.1.7 All Service Connections

Facilities not found on the list below will be evaluated for appropriate premises or in-premises protection based upon potential or actual cross-connection(s) found. The City CCS will coordinate with the Authority Having Jurisdiction (AHJ) regarding in-premises protection.

A. Premises Isolation

The minimum criteria required for backflow prevention stated below shall be used during the above mentioned evaluations.

The City will ensure a CCS assesses the degree of hazard posed by the customer's water system. The CCS will determine the appropriate
method of backflow protection by the following table.

Appropriate Methods of
Backflow Protection for Premises Isolation

Degree of Hazard	Application Conditions	Appropriate Approved Backflow Preventer
High health cross-connection hazard	Back siphonage or back pressure backflow	AG, RPBA, or RPDA
Low health cross-connection hazard	Back siphonage or back pressure backflow	AG, RPBA, RPDA, DCVA, DCDA

The following facilities shall have an Air Gap (AG) or an RPBA unless there is no immediate potential for a cross-connection. In that case, a DOH Exemption form must be filled out and document why that facility does not need backflow prevention. Such a facility will be kept on record, reevaluated as defined by the exception and reported to DOH.

High health hazard cross-connections requiring premises isolation by AG or RPBA, including but not limited to the following (meets or exceeds the minimum requirements of WAC 246-290-490(4)(b)(iii)(Table 9):

- Agricultural (farms and dairies)
- Beverage bottling plants
- Car washes
- Chemical plants

- Commercial laundries and dry cleaners
- Premises where both reclaimed water and potable water are provided.
- Film process facilities
- Food processing plants
- Hospitals, medical centers, nursing homes, veterinary, medical and dental clinics, and blood plasma centers.
- Premises with separate irrigation systems using the City water supply and with chemical addition such as parks, playgrounds, golf courses, cemeteries, estates, Etc.
- Laboratories
- Metal plating industries
- Mortuaries
- Petroleum processing or storage plants
- Piers and docks
- Survey access denied or restricted
- Wastewater lift stations and pumping stations.
- Wastewater treatment plants, radioactive material processing plants or nuclear reactors. May use RPBA's only when used in combination with an in-plant approved air gap, otherwise an air gap behind the meter shall be used.
- Premises with an unapproved auxiliary water supply whether or not interconnected with the potable water supply.

The City may require backflow preventers commensurate with the degree of hazard determined by the City's CCS to be installed for premises isolation for connections serving premises that have characteristics such as, but not limited to, the following:

- Complex plumbing arrangements or plumbing potentially subject to frequent changes that make it impracticable to assess whether cross-connection hazards exist;

- A repeated history of cross-connections being established or reestablished; or

- Cross-connection hazards that are unavoidable or not correctable, such as, but not limited to tall buildings.

- Multi-Tenant Non-Residential mixed use water services.

- Facilities not found on the above list and above special cases will be evaluated for appropriate premises or in-premises protection based upon potential or actual cross-connection(s) found. The CCS will coordinate with the AHJ personnel regarding in-premises protection.

B. In-Premises Isolation

The City's CCS determines the level of protection equal with the degree of hazard for all potential cross connections within the consumers plumbing system

If the facility does not need premises isolation as described above and in WAC 246-290-490 then backflow protection provided at the point of hazard in accordance with WAC 51-46-0603 of the UPC for hazards may be used.

For example, the City may accept an approved AVB on a residential irrigation system, if the AVB is properly installed in accordance with the UPC.

1.1.8 Fire Connections

A. Backflow Protection for Fire Systems

The City shall ensure that backflow protection consistent with WAC 51-46-0603 of the UPC is installed. The UPC requires minimum protection as follows: A RPBA or RPDA shall be used for fire protection systems with chemical addition or using unapproved auxiliary water supply. A DCVA or DCDA shall be used for all other fire protection systems except flow through fire protection systems constructed of potable water pipe.

B. New Fire Connections

For new connections made on or after the effective date of these regulations, the City shall ensure that required backflow protection is installed before water service is provided.

C. Existing Fire Connections

With chemical addition or using unapproved auxiliary supplies, the City shall ensure that backflow protection is installed within thirty days of the City notifying the customer of the high health cross-connection hazard or in accordance with an alternate schedule acceptable to the City.

Without chemical addition, without on-site storage, and using only the City water (i.e., no unapproved auxiliary supplies on or available to the premises), the City shall ensure that backflow protection is installed within 90 days of the City notifying the customer of the cross-connection hazard or in accordance with a schedule acceptable to the CCS or at an earlier date if required by the AHJ

1.1.9 Procedures for Field Inspection (Water Use Survey)

The customer's water system shall be open for inspection to the City within normal business hours or as otherwise arranged to determine whether cross-connections or other structural or sanitary hazard including violations of the regulations exist.

The initial inspection shall proceed according to the following steps:

1. Contact each customer explaining the need for a water system inspection, and requesting a convenient date and time for the inspection. Request that someone familiar with the plumbing system be on hand to answer questions, if possible.

2. On the appointed date, the CCS will meet with the customer/owner (and/or individual from the facility that is knowledgeable with the plumbing system). The CCS will discuss any questions or other problems that may arise, and conduct the inspection. The CCS will make a complete physical survey of all exposed piping; the underground system is to be checked as accurately as possible. Each line shall be followed to its end and a survey made to determine whether there are any actual or potential cross-connections or conditions that have the potential to pollute or contaminate the potable water system.

3. Upon completion of the survey, the inspector will orally brief the customer/owner (or representative) of the findings, if desired.

4. The Cross-Connection Specialist will prepare a written report that will include, but is not limited to, the following:

   a. A list of all cross-connections found in their location, and any optional methods of control.
   b. Any applicable drawings, sketches, blueprints, photographs etc.
   c. A summary of the findings, and the recommendations or requirements for Corrective actions, and a time (normally 30 days) in which the corrective action Must be completed.
   d. Immediate or **direct** Cross Connections will be isolated immediately at the source or by any other means of isolation and will not be returned to service until backflow prevention has been installed, inspected and tested determined by the CCS.

5. The Cross Connection specialist shall mail one copy of the completed report and a copy of the City installation specification requirements to the customer, Water Quality Supervisor and the AHJ (if applicable). The completed report shall include the recommendations and requirements for corrective actions and a corrective action completion date. One copy of the completed report shall reside in the CCS's permanent cross-connection file for the facility.

6. On the corrective action completion date, the CCS shall contact the customer and ask if the corrective actions have been completed. If the corrective actions have been completed, the CCS shall make a re-inspection of the facility. If the corrective actions have not been completed, a new completion date will be set, or enforcement action begun, depending on the degree of hazard and other mitigating circumstances.

7. When all required actions have been completed, the file copy of the completed actions shall be placed in the cross-connection control file for the facility, together with any completed backflow assembly test report forms.

8. Re-inspection of each premise found to be subject to this procedure shall be accomplished annually or more often if the degree of hazard so indicates as time and resources allow.

9. If entry is refused the AHJ shall secure entry and premise isolation shall be required (see Appendix F Enforcement Action).

10. If a cross-connection is a high hazard then the plumbing causing the cross-connection must be disconnected immediately. If the disconnection is disregarded water may be shut off and locked out until the cross-connection is disconnected.

11. If corrections have not been made by the completion date, the CCS will review the status with the Water Quality Supervisor before beginning escalated enforcement as outlined in Bellevue City Code (BBC) *1.18 Civil Violations*

12. If corrections have not been made by the completion date, and the Water Quality Supervisor and Operations & Maintenance Assistant Director give permission, the CCS shall begin procedures for enforcement outlined in *BBC 1.18.075 (E) (1) or section (E) (2)* depending on mitigating circumstances.

13. Upon re-inspection, if the violation has been corrected, the CCS shall update the notice and a copy sent to the owner and/or occupant, AHJ, Water Quality Supervisor and into the cross-connection control file.

14. The City purveyor reserves the right to suspend water service at any time during the enforcement case if it is determined that the public water system is in danger of contamination.

15. If water is turned off due to non-compliance, and the violation **is corrected**, the customer shall do the following to have water service restored:

    A. Call the CCS for a violation correction re-inspection.
    B. Upon re-inspection if the violation has been corrected, the notice shall be updated by the CCS and a copy given to the customer, AHJ, Water Quality Supervisor and into the cross-connection control file.

C. Water service may be restored by the City.

16. If water is turned off, the BAT must make arrangements with the CCS to restore water for testing purposes only.

If water is turned off due to non-compliance, and the violation **<u>is not corrected</u>**, the CCS shall update the notice, give a copy to the customer, AHJ, the cross-connection control file and leave the water turned off and locked out.

Element 3: *Development and implementation of procedures and schedules for elimination and/or control of cross-connections.*

1.1.10 Backflow Preventers

The City will eliminate cross-connections whenever possible. When cross-connections cannot be eliminated, they will be controlled by installation of approved backflow preventers equal with the degree of hazard.

Approved backflow preventers will be selected and installed in accordance with the following requirements:

WAC 246-290-490, the most current edition of the Accepted Procedure and Practice in Cross-Connection Control (prepared by the Cross-Connection Control Committee of the Pacific Northwest Section American Water Works Association) which shall be used as a guideline, as well as the University of Southern California manual, and the Uniform Plumbing Code.

The City will monitor all backflow assemblies. These assemblies are required to have a backflow assembly test performed at least annually and the City CCS may require backflow assembly testing more frequently in cases such as:

a. Failed backflow assembly tests.
b. Backflow contamination incident.
c. High hazards.
d. Required by CCS

A. Approval of Backflow Preventers

The City requires backflow preventers protecting the public water systems to be on the current State of Washington approved list unless the next paragraph applies.

The City may rely on testable backflow prevention assemblies that are not currently approved by the State of Washington, if the assemblies:

a. Were included on the department and/or University of Southern California Foundation for Cross Connection Control and Hydraulic Research (USC) list of approved backflow prevention assemblies at the time of installation.
b. Have been properly maintained.
c. Are equal with the City assessed degree of hazard.
d. Have been inspected and tested at least annually and have successfully passed the annual tests.

The City shall ensure that an unlisted backflow assembly is replaced by an approved assembly equal with the degree of hazard, when the unlisted assembly:

a. Does not meet the conditions of (a) through (d) above of this section.
b. Is moved.
c. Cannot be repaired using spare parts from the original manufacturer.

B. Installation of Backflow Preventers

The City shall ensure that approved backflow preventers are installed in a manner that:

Facilitates their proper operation, maintenance, inspection, and in-line testing (as applicable) using standard installation procedures acceptable to the department such as those in the USC Manual, PNWS-AWWA Manual or Uniform Plumbing Code; ensures that the assembly will not become submerged due to weather-related conditions such as flooding; and ensures compliance with all applicable safety regulations.

The City shall ensure that approved backflow assemblies for premises isolation are installed at a location adjacent to the meter or property line or an alternate location acceptable to the City.

When premises isolation assemblies are installed at an alternate location acceptable to the City, the City shall ensure that there are no connections between the point of delivery from the public water system and the approved backflow assembly, unless the installation of such a connection meets the City cross-connection control requirements and is specifically approved by the City.

The City shall ensure that by-pass piping installed around any approved backflow preventer is equipped with an approved backflow preventer that affords at least the same level of protection as the approved backflow preventer that is being bypassed and complies with all applicable requirements of this section.

Backflow preventers shall be installed to the City specifications and in compliance with the AHJ. The City requires that when a backflow assembly that protects the public water system is improperly installed, defective, an unapproved assembly, or does not equal the degree of hazard; it shall be properly reinstalled, repaired, overhauled, or replaced.

The City requires a Cross-Connection Specialist (CCS) to inspect new installations of Reduced Pressure Backflow Assemblies (RPBA's), Reduced Pressure Detector Assemblies (RPDA's), Double Check Valve Assemblies (DCVA's), Double Check Detector Assemblies (DCDA's), Pressure Vacuum Breaker Assemblies (PVBA's), and Spill Resistant Vacuum Breaker Assemblies (SVBA's) that protect the public water system to ensure that protection is equal with the degree of hazard and that installation is in accordance with standards. These assemblies are required to be tested:

a. At the time of installation.
b. Annually after installation, or more frequently, if required by the City for facilities that pose a high health cross-connection hazard or for assemblies that repeatedly fail.
c. After a backflow incident.
d. After an assembly is repaired, reinstalled, or relocated.

Element 4: *Provision of qualified personnel, including at least one person certified as a CCS, to develop and implement the CCC program.*

Oversight and management of the City's Cross Connection Control Program will be performed by the Utilities Cross Connection Control Specialist (CCS). Responsibilities include:

1. Administer the Cross-Connection Control Program (CCP).
2. Evaluate service connections for backflow hazards.
3. Assess customer's premises for cross connections and potential for cross connections and determine action to be taken.
4. Reporting on the annual progress of the CCP.
5. Public Education.
6. Investigate water quality concerns where backflow is suspected.
7. Keep current records of all backflow preventer testing, air gaps installed in-lieu of approved backflow preventers, test kit calibration, and tester certification.
8. Responsible to eliminate or control cross-connections between the distribution system and the customer's premises.
9. Ensure quality control for backflow testing.
10. Complete Backflow Incident Response Forms and inform DOH, and the AHJ of incidents involving contamination to the public water system.
11. Training and continued education

Element 5: *Development and implementation of procedures to ensure that approved backflow preventers are inspected and/or tested (as applicable).*

C. Inspection and/or Testing of Backflow Preventers

A CCS inspects backflow preventer installations to ensure that protection is provided equal with the assessed degree of hazard.

A BAT tests approved backflow prevention assemblies for proper operation.

The Backflow Assembly Tester (BAT) or a Cross-Connection Specialist (CCS) inspects:

a. Air gaps installed in-lieu of approved backflow prevention assemblies for compliance with the approved air gap definition.

b. Backflow prevention assemblies for correct installation and approval status.

1. The City shall ensure that inspections and/or tests of approved air gaps and approved backflow assemblies are conducted:

   a. At the time of installation.

   b. Annually after installation, or more frequently if required by the City for facilities that pose a high health cross-connection hazard, or for assemblies that repeatedly fail;

   c. After a backflow incident, and after an assembly is repaired, reinstalled, relocated or an air gap is replumbed. The City will notify customers annually before their due date informing them that their backflow preventer is due to be tested, However, this reminder process does not relieve the owner of the responsibility for testing their device(s) annually and providing the test reports to the City.

2. The City shall ensure that inspections of Atmospheric Vacuum Breakers (AVB's) that protect the public water system installed on irrigation systems are conducted:

   a. At the time of installation;
   b. After a backflow incident; and
   c. After repair, reinstallation, or relocation

The City shall ensure that approved backflow prevention assemblies are tested using procedures acceptable to the department, such as those specified in the most recently published edition of the USC Manual. When circumstances, such as, but not limited to, configuration or location of the assembly, preclude the use of USC test procedures, the City may allow, on a case-by case basis, the use of alternate (non-USC) test procedures acceptable to the department. These procedures must be approved by the City prior to proceeding with any testing.

The City shall ensure that results of backflow prevention assembly inspections and tests are documented and reported on a form and in a manner acceptable to the City.

The City shall ensure that an approved backflow prevention assembly or AVB, whenever found to be improperly installed, defective, not equal with the degree of hazard, or failing a test (if applicable) is properly reinstalled, repaired, overhauled, or replaced.

The City shall ensure that an approved air gap, whenever found to be altered or improperly installed, is properly replumbed or, if equal with the degree of hazard, is replaced by an approved RPBA.

Element 6: *Development and implementation of a backflow prevention assembly testing quality assurance/quality control program.*

1.1.11 Backflow Assembly Testing and Quality Control

To meet the WAC regulation the City requires the following:

1. All backflow assemblies require a backflow assembly test annually by a State of Washington certified tester in accordance with the City Cross-Connection Program.

2. The City will only accept backflow assembly test reports from current State of Washington certified Backflow Assembly Tester's (BAT's).

3. Each tester is required to have current BAT certification and current test kit calibration on file with the City.

4. It is the customer's responsibility to ensure that the backflow test reports are submitted to the City in a timely manner.

5. All test report forms (Appendix H) must be filled out with the contents required in *WAC 246-292-036 Backflow preventer inspection and field test report content* (Appendix D) as amended

6. The City will only accept tests that have been performed using the most recent State approved (USC) test procedures. When circumstances preclude the use of State approved test procedures, the City may allow on case by case basis, the use of alternate test procedures acceptable to the City.

Element 7: *Development and implementation of procedures for responding to backflow incidents.*

1.1.12 Backflow Incident Response Procedures

In the **City of Bellevue's** Water Quality Emergency response plan, the incident response plan will include, but is not limited to:

• Notification of affected users (employees, occupants, etc.);

• Notification and cooperation with other agencies, such as DOH, the Local Administrative Authority, and the local health jurisdiction;

• Identification of the source of contamination;

• Isolation of the source of contamination and the affected area(s);

• Provision of alternate supplies of drinking water;

• Cleaning, flushing and other mitigation measures; and

• Corrective action to prevent future occurrences.

The City of Bellevue has developed a Backflow Incident Response Plan and it is included in *the Drinking Water Quality Emergency Response Plan* **APPENDIX G**

Technical Resources - The City of Bellevue will use the manual, *Backflow Incident Investigation Procedures*, First Edition, 1996, published by the PNWS-AWWA as a technical resource and/or supplement to the Backflow Incident Response Plan as amended.

Element 8: *Development and implementation of a cross-connection control public education program.*

1.1.13 Cross-Connection Public Education Program

The City shall implement an education program for the City’s customer. The education program will consist of but not limited to:

1. Sharing knowledge with inspectors, engineers, architects, plumbing contractors, suppliers and, irrigation contractors and suppliers, fire protection contractors, wastewater personnel and the customer.

2. Educating the staff of the City. Utilize locators, meter readers, maintenance workers, Building Official, Inspectors and Engineering staff to assist in identifying cross-connections.

3. Public education using billing inserts newspapers, newsletters, brochures, annual water quality report and The City Website.

4. Have education information available for community events.

Element 9: *Development and maintenance of cross-connection control records.*

1.1.14 Cross-Connection Control Record Keeping

The CCS shall develop and maintain cross-connection control records that include:

A. Service Connection Master List

A master list of service connections where the City relies upon approved backflow preventers to protect the public water system from contamination by premises isolation and/or in-premises protection and the assessed hazard level of each, as well as an inventory of all water system service connections and summary of the history of inspections at each location. The required backflow preventer(s) records shall be kept as long as the premises pose a cross-connection hazard to the City distribution system.

1. The Cross Connection Program Manager in Utilities shall establish an electronic file, for each individual customer that requires the installation of a backflow prevention assembly. Electronic files shall be filed by grid in numerical order. The following information shall be maintained in each electronic file folder:

    a. Copies of all correspondence with customer relative to cross-connection control.
    b. Copies of inspection reports complete with field drawings.
    c. Copy of application and completed installation order.
    d. Copies of test reports on all assemblies.

2. All backflow assembly test report forms shall be entered into a computer database that tracks backflow testing and dates of tests.

B. Inventory Information

Records regarding inventory information shall be kept for five years or the life of the approved backflow preventer whichever is longer in the City's respective database. Inventory information will be kept on:

1. Approved air gaps installed in-lieu of approved assemblies:

    a. Exact air gap location, design and dimensions with photos
    b. Assessed degree of hazard.
    c. Installation date.
    d. History of inspections.
    e. Inspection results.

f. Person conducting inspection.
g. What the assembly protects against

2. Approved backflow assemblies including:

   a. Exact assembly location, design and dimensions with photos
   b. Type of assembly.
   c. Manufacturer.
   d. Model.
   e. Size.
   f. Serial number.
   g. Assessed degree of hazard.
   h. Installation date.
   i. History of inspections, tests, and repairs.
   j. Test results.
   k. Person performing test.
   l. What the assembly protects against

3. Approved AVB's used for irrigation systems including:

   a. Location, design and dimensions with photos
   b. Manufacturer.
   c. Model.
   d. Size.
   e. Installation date.
   f. History of inspections(s).
   g. Person performing inspection.
   h. What the assembly protects against

C. Annual Summary Report

The CCS will complete and submit to the Department of Health an annual summary report. All records will be kept on file for at least ten years. Records will include:

1. Types of connections:

   a. Residential.
   b. Commercial.

2. High health hazard facilities that the water system serves:

a. Number of facilities served.
b. The number currently protected by an AG or RPBA installed for premise isolation.
c. The number exempted from premise isolation. The City shall document reasons for not applying premises isolation for facilities that are considered high hazard facilities.

3. AG and AVB's used for irrigation systems that are:

    a. Installed in the system (total).
    b. New installations for reporting year.
    c. Inspected.
    d. Failing initial inspection, including incorrect installations.
    e. Re-plumbed or reinstalled correctly.
    f. Replaced by assembly.
    g. Replaced by new AVB.
    h. Re-inspected.

4. All assemblies (RPBA, RPDA, DCVA, DCDA, PVBA, SVBA):

    a. Installed in system by type and total.
    b. New installations during year by type and total.
    c. Inspected and tested.
    d. Installed incorrectly.
    e. Failing initial test.
    f. Repaired.
    g. Replaced.
    h. Replaced with different assembly type.
    i. Re-tested.

5. The CCS will record test report information that includes:

    a. Customer's name.
    b. Address.
    c. Location of the assembly.
    d. Phone number.
    e. Assembly manufacturer.
    f. Model.
    g. Size.
    h. Serial number.
    i. Test kit calibration date.
    j. BAT certification number and signature.
    k. Date of test.
    l. Line pressure

m. Pressure that the check valve held at.
n. RPBA's opening relief valve pressure and measurement of the *minimum air gap
o. Results of the test, did the assembly pass or fail.

Twice the diameter of the supply piping measured vertically from the

Element 10: *Additional cross-connection control requirements for reclaimed water.*

1.1.15 Reclaimed Water Additional Requirements

The City does not connect, distribute and/or have facilities that receive reclaimed water within their water service area. If in the future this does occur the City will meet any additional cross-connection control requirements imposed by the department under a permit issued in accordance with chapter 90.46 RCW.

Any facility that uses reclaimed water and which is also supplied by the City water supply shall have an A/G or RPBA protecting the City water distribution from that premises.

1.1.16 <u>Notification Procedures for Backflow Assembly Testing</u>

1. Customers with backflow assemblies will be required to have these assemblies tested in accordance with the City Cross-Connection Program (section 1.1.10) at the owner's expense.

2. A first letter will be sent to the customer annually (usually giving 30 days compliance).

3. If there is no response from the first letter, a second letter will be sent notifying the customer that the City may shut their water off.

4. If there is no response to the second letter, a third letter, (usually giving 7 days compliance) will be sent notifying the customer that enforcement actions according to City of Bellevue Code 1.18 may be accessed.

5. If there is no response from the third letter, a door hanger will be hung at the property (and the property owner will be notified if rental property) notifying them that the water shall be shut off.

6. The City may elect to use other methods of enforcement, such as requiring "premises isolation" at the customer's water meter and/or escalating enforcement outlined in Bellevue City Code 1.18.075 as amended

1.1.17 Tanker Truck & Trailer Requirements

1. Tanker trucks and trailers require a cross-connection inspection in accordance with the City Cross-Connection Program (Section 1.1.10).

2. Tanker trucks and trailers will be assessed the same risk as an unapproved auxiliary supply, a high health hazard.

3. An Air Gap or Reduced Pressure Backflow Assembly is the required protection for all tanker trucks and trailers (unless otherwise approved by the City in writing by the Water Quality Supervisor).

4. Only designated hydrants will be used for filling tanker trucks.

5. All tanker trucks shall be inspected for an approved air gap between the fill piping and the receiving vessel located. Inspections will be performed by appointment only at 2901 115th Avenue NE from 7:00am to 3:00pm Monday through Friday.

6. Standard Operation Procedures for Tank Lot Truck Filling and hydrant operation shall be provided (SEE APPENDIX L)

1.1.18 Hydrant Use Requirements

Authorization must be obtained to use a City hydrant. Permits can be obtained at the Bellevue Service Center office located at 2901 115TH Ave NE Bellevue WA 98004.

1. Any portable pressure spray or cleaning unit that is connected to a hydrant shall be fitted with a double check valve assembly if it does not contain an approved air gap. If chemicals are used, a RPBA must be used in place of the DCVA. Testing of all assemblies must be in accordance with the City Cross-Connection Program (Section 1.1.10)

2. Flushing storm drains and sanitary sewers from a hydrant is prohibited, unless approved by the CCS. In all cases an air gap must separate the potable water piping from the storm or sewer system, as above. The configuration must be approved by the CCS.

3. Filling tanker trucks and trailers from a hydrant is assessed the same risk as an unapproved auxiliary supply; a high health hazard.

4. When using a hydrant to flush newly constructed water mains prior to acceptance by the City and purity sample results, a double check valve assembly is required to separate the potable water system from the new water main.

5. See APPENDIX L FOR FIRE HYDRANT OPERATION

APPENDIX

A. DEFINITIONS, ABBREVIATIONS AND ACRONYMS

B. SECTION 24.02.190 BELLEVUE CITY CODE

C. CROSS-CONNECTION MEMORANDUM OF UNDERSTANDING WITH AHJ

D. WAC 246-290-490, 033, 034, & 036

E. WAC 51-46-0603 CHAPTER 6 OF THE UPC

F. ENFORCEMENT ACTION AND BUSINESS PROCESS

G. DRINKING WATER QUALITY EMERGENCY RESPONSE PLAN

H. BACKFLOW PREVENTION TEST REPORT

I. WASHINGTON STATE APPROVED ASSEMBLIES

J. AWWA RECOMMENDED PROTECTION AT FIXTURES AND EQUIPMENT

K. CITY OF BELLEVUE SPECIFICATIONS

L. TANK LOT & FIRE HYDRANT OPERATION

M. REFERENCE GUIDE

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DEFINITIONS, ABBREVIATIONS AND ACRONYMS

"Approved air gap" means a physical separation between the free-flowing end of a potable water supply pipeline and the overflow rim of an open or non-pressurized receiving vessel. To be an air gap approved by the department, the separation must be at least:

- Twice the diameter of the supply piping measured vertically from the overflow rim of the receiving vessel, and in no case be less than one-inch, when unaffected by vertical surfaces (sidewalls); and:

- Three times the diameter of the supply piping, if the horizontal distance between the supply pipe and a vertical surface (sidewall) is less than or equal to three times the diameter of the supply pipe, or if the horizontal distance between the supply pipe and intersecting vertical surfaces (sidewalls) is less than or equal to four times the diameter of the supply pipe and in no case less than on and one-half inches.

"Approved atmospheric vacuum breaker" means an AVB of make, model, and size that is approved by the department. AVB's that appear on the current approved backflow prevention assemblies list developed by the University of Southern California foundation for Cross-Connection Control and Hydraulic Research or that are listed or approved by other nationally recognized testing agencies (such as IAPMO, ANSI, or UL) acceptable to the Authority Having Jurisdiction are considered approved by the department.

"Approved backflow preventer" means an approved air gap, an approved backflow prevention assembly, or an approved AVB. The terms ''approved backflow prevention" "approved air gap," or "approved backflow prevention assembly" refer only to those approved backflow preventers relied upon by the purveyor for the protection of the public water system. The requirements of WAC 246-290-490 do not apply to backflow preventers installed for other purposes.

"Approved backflow prevention assembly" means an RPBA, RPDA, DCVA, DCDA, PVBA, or SVBA of make, model, and size that is approved by the department. Assemblies that appear on the current approved backflow prevention assemblies list developed by the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research or other entity acceptable to the department are considered approved by the department.

"Authority Having Jurisdiction" means the local official, board, department, or agency authorized to administer and enforce the provisions of the Uniform Plumbing Code as adopted under chapter 19.27 RCW.

"Backflow" means the undesirable reversal of flow of water or other substances through a cross-connection into the public water system or consumer's potable water system.

"Backflow assembly tester" means a person holding a valid BAT certificate issued in accordance with chapter 246-292 WAC.

"Backpressure" means a pressure (caused by a pump, elevated tank or piping, boiler, or other means) on the consumer's side of the service connection that is greater than the pressure provided by the public water system and which may cause backflow.

"**Backsiphonage"** means backflow due to a reduction in system pressure in the purveyor's distribution system and/or consumer's water system.

"Combination fire protection system" means a fire sprinkler system that:

- Is supplied only by the purveyor's water;
- Does not have a fire department pumper connection; and
- Is constructed of approved potable water piping and materials that serve both the fire sprinkler system and the consumer's potable water system.

"Consumer" means any person receiving water room a public water system from either the meter, or the point where the service line connects with the distribution system if no meter is present. For purposes of cross-connection control, "consumer" means the owner or operator of a water system connected to a public water system through a service connection.

"Consumer's water system" as used in WAC 246-290-490, means any potable and/or industrial water system that begins at the point of delivery from the public water system and is located on the consumer's premises. The consumer's water system includes all auxiliary sources of supply, storage, treatment, and distribution facilities, piping, plumbing, and fixtures under the control of the consumer.

"Cross-connection" means any actual or potential physical connection between a public water system or the consumer's water system and any source of
non-potable liquid, solid, or gas that could contaminate the potable water supply by backflow.

"Cross connection control program" means the administrative and technical procedures the purveyor implements to protect the public water system from contamination via cross-connections as required in WAC 246-290-490.

"Cross-connection control specialist" means a person holding a valid CCS certificate issued in accordance with chapter 246-292 WAC.

“Cross-connection control summary report” means the annual report that describes the status of the purveyor’s cross-connection control program.

“Customer” means any person receiving water from a public water system from either the meter, or the point where the service line connects with the distribution system if no meter is present. For purposes of cross-connection control, “customer” means the owner or operator of a water system connected to a public water system through a service connection.

“Department” refers to the Washington State Department of Health (DOH).

“Flow-through fire protection system” means a fire sprinkler system that:

- Is supplied only by the purveyor’s water;
- Does not have a fire department pumper connection;
- Is constructed of approved potable water piping and materials to which sprinkler heads are attached; and
- Terminates at a connection to a toilet or other plumbing fixture to prevent the water from becoming stagnant.

“High health cross-connection hazard” means a cross-connection which could impair the quality of potable water and create an actual public health hazard through poisoning or spread of disease by sewage, industrial liquids or waste.

“In-premises protection” means a method of protecting the health of consumers served by the consumer’s potable water system, located within the property lines of the consumer’s premises by the installation of an approved air gap or backflow prevention assembly at the point of hazard, which is generally a plumbing fixture.

“Low health cross-connection hazard” means cross-connection that could cause an impairment of the quality of potable water to a degree that does not create a hazard to the public health, but does adversely and unreasonably affect the aesthetic qualities of such potable waters for domestic use.

“Premises Isolation” means a method of protecting a public water system by installation of approved air gaps or approved backflow prevention assemblies at or near the service connection or alternative location acceptable to the purveyor to isolate the consumer’s water system from the purveyor’s distribution system.

“Reclaimed water” means effluent derived in any part from sewage from a wastewater treatment system that has been adequately and reliably treated, so that as a result of that treatment, it is suitable for beneficial use or a controlled use that would not otherwise occur, and it is no longer considered wastewater.

“Unapproved auxiliary water supply” means a water supply (other than the purveyor’s water supply) on or available to the consumer’s premises that is either not approved for human consumption by the health agency having jurisdiction or is not otherwise acceptable to the purveyor.

“Uniform Plumbing Code” means the code adopted under RCW 19.27.031 (4) and amended under chapter 51-46 WAC. This code establishes statewide minimum plumbing standards applicable within the property lines of the consumer’s premises.
“Used water” means water which has left the control of the purveyor.

Abbreviations and Acronyms

AG	Air Gap
AHJ	Authority Having Jurisdiction
AVB	Atmospheric Vacuum Breaker
AWWA	American Water Works Association
BAT	Backflow Assembly Tester (for WAC 246-290-490)
DOH	State of Washington Department of Health
CCP	Cross-Connection Control Program
CCS	Cross-Connection Control Specialist
CITY	Refers to the City of Bellevue
COB	City of Bellevue
DCDA	Double Check Detector Assembly
DCVA	Double Check Valve Assembly
IAPMO	International Association of Plumbing and Mechanical Officials
PVBA	Pressure Vacuum Breaker Assembly
RPBA	Reduced Pressure Backflow Assembly
RPDA	Reduced Pressure Detector Assembly
SVBA	Spill Resistant Vacuum Breaker Assembly
Table 9	Refers to WAC 246-290-490(4)(iii)(Table 9)
UBC	Uniform Building Code
UL	Underwriters Laboratories Inc.
UPC	Uniform Plumbing Code

A. Construction/Installation Inspection.

1. All projects permitted or approved by the utility under a utility developer extension agreement or other permit are subject to utility inspection to ensure compliance with the code and permit/approval conditions. As a condition of permit issuance or execution of a utility developer extension agreement, the property owner shall consent to inspection and testing.

2. Newly installed water facilities shall be inspected, tested, and documentation completed according to the permit requirements or developer extension agreement conditions, the engineering standards, and procedures.

3. Newly installed or relocated backflow prevention assemblies shall be inspected, tested, and certified pursuant to the requirements of BCC 24.02.190(D).

4. The quality, taste and odor of water drawn from new water mains shall be the same as the quality, taste and odor of water in the existing facility classed as acceptable for use by the utility. Should the water not be acceptable in quality, taste or odor, required steps as approved by the utility shall be taken to attain acceptable water quality standards.

B. Warranty Inspections and Tests. Facilities and equipment accepted by the utility under specific warranties may be reinspected at the utility's discretion and, if necessary, retested prior to the expiration of the warranty period. (Ord. 5963 § 1, 2010.)

24.02.180 Water quality programs.

A. General Requirements. The utility shall initiate and carry out any water quality testing, monitoring, maintenance, corrective activities or other activities necessary to ensure that the city's public drinking water meets or exceeds drinking water standards and other requirements of Chapter 246-290 WAC, the Washington State Health Department's rules that govern Group A public water systems, the federal Safe Drinking Water Act and any other applicable federal, state or local requirement for public drinking water, as now or hereafter amended.

B. Implementation of Water Quality Programs. To maintain water quality in the most effective and efficient manner, the utility may initiate, implement and carry out any required or necessary water quality testing, monitoring, maintenance, or corrective activities or programs locally, jointly with other local or regional water purveyors; or jointly with other federal, state or local agencies having jurisdiction within the city's water service area. (Ord. 5963 § 1, 2010.)

24.02.190 Cross-connection abatement and control.

A. General.

1. The utility shall initiate and carry out a cross-connection abatement and control program in conformance with state law by establishing and maintaining minimum requirements for the installation, inspection, testing, certification and maintenance of backflow prevention assemblies. The program shall meet the minimum requirements of WAC 246-290-490 and the latest edition of the Uniform Plumbing Code adopted by the city.

2. The utility hereby adopts by reference the standards and requirements of WAC 246-290-490, as now or hereafter amended.

B. Approved Backflow Prevention Assemblies. Only those backflow prevention assemblies and controls identified in the most recent current edition of Approved Cross Connection Control Assemblies, published by the Washington State Department of Health, shall be approved for installation.

C. New or Upgraded Cross-Connection Control Requirements.

1. In situations where there is an existing water service or use and the water supply is protected from cross-connection by a nonconforming backflow prevention assembly (i.e., an assembly that does not meet the current standards and requirements of WAC 246-290-490 or this code), the existing nonconforming backflow prevention assembly shall, at the property owner's risk, be allowed to remain in service only if:

a. At the time the backflow prevention assembly was installed, the assembly was a state-approved backflow prevention assembly;

b. At the time the backflow prevention assembly was installed, its installation was approved by the city as appropriate for the degree of hazard; and

c. The backflow prevention assembly does not meet the criteria for upgrading as required in subsection (C)(2) of this section.

2. All existing nonconforming backflow prevention assemblies shall be replaced and upgraded to current standards at such time as any of the following conditions exist:

a. The assembly fails to operate properly;

b. The assembly fails required annual testing and certification;

c. The assembly requires continual and excessive repair or maintenance;

d. The degree of hazard at the premises increases from that which existed at the time the assembly was installed; or

e. The water service, fire protection system, landscape irrigation system or plumbing is, or has been, modified.

3. When the utility discovers previously unknown and/or unprotected cross-connections, the utility shall notify the property owner of the cross-connection, the degree of hazard, and the cross-connection abatement and control measures required. The property owner shall make provision to implement all required abatement and control measures within the time frame specified by the utility subject to the enforcement provisions of BCC 24.02.250 or state law.

D. Inspection, Testing and Certification Requirements.

1. Inspection of all newly installed or relocated backflow prevention assemblies shall be completed by the city. Testing and certification shall be done by a private backflow prevention assembly tester certified by the Washington State Department of Health.

2. All backflow prevention assemblies shall be tested and certified annually by a private backflow prevention assembly tester certified by the Washington State Department of Health.

E. Costs and Fees. The property owner or developer shall be responsible for paying all utility costs and fees associated with the installation, inspection, testing, certification, repair, replacement or upgrade of backflow prevention assemblies. See BCC 24.02.250 regarding fees. (Ord. 5963 § 1, 2010.)

24.02.200 Water conservation – Waste of water.

The waste of water supplied by the utility is prohibited at all times. Waste of water includes, but is not limited to, continuous application of water to lawns or landscaping that results in excessive puddling or runoff of water, failure to repair leaking water service lines and irrigation systems, application of water to impervious surfaces other than for cleaning purposes, and all other applications of domestic water that do not result in a beneficial use of the city's public water supply. (Ord. 5963 § 1, 2010.)

24.02.205 Landscape and irrigation water budgeting requirements.

A. Applicability. The water budgeting requirements of this section shall apply to new or modified landscaping whenever new or modified landscaping is required by the Land Use Code or proposed by the property owner except that the following shall be exempt from such requirements:

1. Single-family residential lots; provided, that community area landscaping installed by the developer is not exempt.

2. Any project with a total landscape area of less than 500 square feet. If a project is constructed in phases, the total landscape area shall include the total area of all phases.

3. Those portions of a site irrigated with water that is not supplied by the utility.

4. Turf portions of public athletic facilities where turf provides a playing surface and turf portions of public access land used for purposes of public recreation and activities, such as but not limited to outdoor assemblies, picnicking, unstructured sports fields and sunbathing. However, this exemption applies only if the applicant submits a statement designating such turf areas and specifying additional water needs above the irrigation water budget. The additional irrigation water needs shall be based upon the evapotranspiration information for the turf-grass species or species mix designated for the turf area.

5. Those portions of privately owned properties where athletic and recreation facilities, as identified by subsection (A)(4) of this section, are installed for use by the general public. However, this exemption applies only if the applicant submits a statement designating such area (s) as open to the public.

B. Water Budget Requirements. For each proposed landscape design not exempted by subsection A of this section, a state-registered landscape architect, Washington-certified nurseryman (WCN) or

City of Bellevue

Post Office Box 90012 Bellevue, Washington 98009-9012

Cross-Connection Memorandum of Understanding
Bellevue Utilities and Bellevue Planning and Community Development

1. **Purpose**

   1.1. To establish the procedures for implementing the cross-connection control program between City of Bellevue Utilities Department (hereafter Utilities) and the Bellevue Planning and Community Development Department (hereafter PCD) within Utilities direct service area inside the city limits of Bellevue.

   1.2. This Memorandum of Understanding establishes the mutually agreed to roles and responsibilities of Utilities and PCD to implement a cross connection control program per Department of Health requirements but is not a legally enforceable agreement. This agreement supersedes all previous cross-connection memorandum's of understanding.

2. **Organizations Affected**

   2.1. Bellevue Utilities Department (Utilities)
   2.2. Planning and Community Development (PCD)
   2.3. All permanent or temporary (e.g. hydrant users) direct service water customers within the City of Bellevue on whose premise or property a potential or existing cross connection exists.
   2.4. Washington State Department of Health (DOH)

3. **References**

   3.1. WAC 246-290-490, Washington State Department of Health Drinking Water regulations relating to Cross-Connection
   3.2. Latest edition of the Uniform Plumbing Code as adopted under RCW 19.27.031(4) and WAC 51-46 as amended.
   3.3. Latest edition of the PNWS/AWWA Accepted Procedure and Practice in Cross-Connection Control Manual
   3.4. Latest edition of the USC Manual on Cross-Connection

4. Policy

4.1. It is the policy of Utilities and PCD to implement a cooperative program of cross-connection control where the potential for backflow presents a health hazard to the customers served by Bellevue Utilities and/or the occupants of the customer's premises.

5. Definitions

5.1. Approved backflow assembly - An assembly that has been approved by the DOH for use in Washington State. Approval of backflow assemblies by DOH shall be on the basis of a favorable laboratory and field evaluation report by an approved testing laboratory.

5.2. Auxiliary Water Supply:-Any water supply on, or available to, a premise in addition to the purveyor's (Utilities) approved public potable water supply.

5.3. Backflow - The undesirable reversal of flow of water or other substances through a cross-connection into the public water system or any consumer's potable water system.

5.4. Backflow Assembly Tester - A person who is certified through DOH to test approved backflow assemblies.

5.5. Customer's potable water system - Any potable and/or industrial water system (beyond the water meter) that begins at the point of delivery to the building from the public water system and is located on the customer's premises. The customer's water system includes all auxiliary sources of supply, storage, treatment, and distribution facilities, piping, plumbing, and fixtures under the control of the consumer.

5.6. Cross-connection - Any actual or potential physical connection between a public water system or the customer's water system and any source of nonpotable liquid, solid, or gas that could contaminate the customer or public potable water supply by backflow.

5.7. Cross-connection control specialist - A person holding a valid and current Washington State cross-connection control specialist certificate issued in accordance with WAC chapter 246-292-001.

5.8. High health hazard - A substance that could pose an immediate health concern because of the risk of death, spread of disease or illness, or injury to the consumer if it were introduced into the potable water supply.

5.9. In-premise protection - A method of protecting the health of consumers served by customer's potable water systems by the installation of an approved air gap or backflow prevention assembly at the point of cross connection, instead of or in addition to premise isolation, which is generally a plumbing fixture.

5.10. Low health hazard - A substance that would not impose an immediate health concern, but could result in the water in the purveyor's system failing to meet minimum drinking water standards or that could interfere with the monitoring of water quality or cause aesthetic problems.

5.11. Mixed Use Building:-Any combination of residential and retail/office housed within one structure where there exists the potential for a high health hazard cross connection premises.

5.12. <u>Premise isolation</u> - The practice of protecting the potable water supply by installing backflow prevention assemblies at or near the end of the public water system (e.g. at the meter).

5.13. <u>Public Water System</u>: - by definition includes collection, storage, treatment and distribution facilities *under the purveyor's control.* The water meter is generally used as the end of the public water system for domestic services.

6. Responsibilities

6.1. PCD, as the local Administrative Authority, has responsibility for the inspection of cross-connection control assemblies within the customer's water system. (within the building and property).

6.2. Utilities responsibility for cross-connection control includes the water meter and the building supply piping up to the main water shutoff in the building (i.e. all premise isolation assemblies).

6.3. Utilities and PCD Plumbing Inspection both have the responsibility of collaborating to reach mutually agreeable decisions on the fixtures and piping arrangements that require in-premise backflow protection and the proper assemblies for the assessed degree of hazard.

6.4. Utilities and PCD Plumbing Inspection have joint responsibility for implementing a continuing program of cross-connection control within the consumer's water system (within the building).

7. Procedure

7.1. Utilities and PCD shall mutually agree upon assessed degrees of hazard, associated with specific in-premise plumbing fixtures and water using equipment or arrangements. When agreement cannot be reached, the final determination for the level of backflow protection will be made by a certified cross connection control specialist from Utilities.

7.2. Tank truck inspections - Utilities shall conduct all inspections of tank trucks and issue all tank truck air gap/backflow assembly approvals.

7.3.New Construction and tenant improvements

7.3.1. For new construction and tenant improvements within the building, PCD performs the plan review. PCD and BUD jointly come to agreement during plan review on the fixtures and piping arrangements that require in-premise backflow protection and the proper assemblies for the assessed degree of hazard. PCD communicates the requirements to the applicant and is responsible for inspection of the installation within the consumer's building and property (with the exception of exterior vaults).

7.3.2. For new construction and tenant improvements Utilities determines whether or what type of backflow assemblies are needed for irrigation systems and buildings over 3 stories in height and those on the DOH mandatory premise isolation list in WAC 246-290-490.

7.3.3 Utilities tests only premise isolation backflow preventers upon installation for high hazard premises, as well as, premise isolation backflow preventers installed on mixed-use buildings and properties with auxiliary water supply.

7.3.4 PCD ensures that all other backflow assemblies are tested and test reports are provided to Utilities. PCD may give temporary occupancy prior to receipt of test reports, but will not final permits until receipt of said test reports. Utilities will work with PCD to actively pursue receipt of test reports.

7.4. Existing sites and periodic reevaluations - Utilities shall conduct periodic reevaluations in accordance with a schedule acceptable to the DOH and whenever there is a change in use of the premises.

7.5. Database management and record keeping

7.5.1. Utilities is responsible for maintaining a master list of service connections and/or consumer's premises where the purveyor relies upon approved backflow assemblies used for both premise and in-premise isolation to protect the public water system from contamination, the assessed hazard level of each, and the required backflow assemblies.

7.5.2. Utilities is responsible for monitoring the approved backflow assemblies including exact assembly location, assembly description (type, manufacturer, model, size, and serial number), assessed degree of hazard, installation date, history of inspections, tests and repairs, test results, and the person performing tests.

7.5.3. Utilities is responsible for issuing renewal notices for testing of backflow assemblies, entering the results of annual testing and all enforcement related to the testing of new and existing backflow assemblies.

8. Appendix

8.1. Bellevue Utilities map of direct water service area

8.2. Mandatory premises isolation list in WAC 246-290-490

Dated this 27 day of March, 2007	Dated this 26 day of March, 2007
Bellevue Utilities Department	Planning and Community Development
By:	By
Mike Jackman, Water Quality Manager	Gregg Schrader, Building Official

HIGH HEALTH CROSS-CONNECTION HAZARD PREMISES REQUIRING PREMISES ISOLATION BY AG OR RPBA

Agricultural (farms and dairies)

Beverage bottling plants

Car washes

Chemical plants

Commercial laundries and dry cleaners

Premises where both reclaimed water and potable water are provided

Film processing facilities

Food processing plants

Hospitals, medical centers, nursing homes, veterinary, medical and dental clinics, and blood plasma centers

Premises with separate irrigation systems using the purveyor's water supply and with chemical addition[+]

Laboratories

Metal plating industries

Mixed use buildings

Mortuaries

Petroleum processing or storage plants

Piers and docks

Radioactive material processing plants or nuclear reactors[*]

Survey access denied or restricted

Wastewater lift stations and pumping stations

Wastewater treatment plants[*]

Premises with unapproved auxiliary water supply

\+ For example, parks, playgrounds, golf courses, cemeteries, estates, etc.

* RPBAs for connections serving these premises are acceptable only when used in combination with an in-plant approved air gap; otherwise, the purveyor shall require an approved air gap at the service connection.

WAC 246-290-490

Cross-connection control.

(1) Applicability, purpose, and responsibility.

(a) All community water systems shall comply with the cross-connection control requirements specified in this section.

(b) All noncommunity water systems shall apply the principles and provisions of this section, including subsection (4)(b) of this section, as applicable to protect the public water system from contamination via cross-connections. Noncommunity systems that comply with subsection (4)(b) of this section and the provisions of WAC **51-56-0600** of the UPC (which addresses the installation of backflow preventers at points of water use within the potable water system) shall be considered in compliance with the requirements of this section.

(c) The purpose of the purveyor's cross-connection control program shall be to protect the public water system, as defined in WAC **246-290-010**, from contamination via cross-connections.

(d) The purveyor's responsibility for cross-connection control shall begin at the water supply source, include all the public water treatment, storage, and distribution facilities, and end at the point of delivery to the consumer's water system, which begins at the downstream end of the service connection or water meter located on the public right of way or utility-held easement.

(e) Under this section, purveyors are not responsible for eliminating or controlling cross-connections within the consumer's water system. Under chapter **19.27** RCW, the responsibility for cross-connection control within the consumer's water system, i.e., within the property lines of the consumer's premises, lies with the authority having jurisdiction.

(2) General program requirements.

(a) The purveyor shall develop and implement a cross-connection control program that meets the requirements of this section, but may establish a more stringent program through local ordinances, resolutions, codes, bylaws, or operating rules.

(b) Purveyors shall ensure that good engineering and public health protection practices are used in the development and implementation of cross-connection control programs. Department publications and the most recently published editions of references, such as, but not limited to, those listed below, may be used as guidance for cross-connection program development and implementation:

(i) *Manual of Cross-Connection Control* published by the Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California (USC Manual);

(ii) *Cross-Connection Control Manual, Accepted Procedure and Practice* published by the Pacific Northwest Section of the American Water Works Association (PNWS-AWWA Manual); or

(iii) Guidance document: *Cross-Connection Control for Small Water Systems* published by the department.

(c) The purveyor may implement the cross-connection control program, or any portion thereof, directly or by means of a contract with another agency or party acceptable to the department.

(d) The purveyor shall coordinate with the authority having jurisdiction in all matters concerning cross-connection control. The purveyor shall document and describe the coordination, including delineation of responsibilities, in the written cross-connection control program required in (e) of this subsection.

(e) The purveyor shall include a written description of the cross-connection control program in the water system plan required under WAC **246-290-100** or the small water system management program required under WAC **246-290-105**. The cross-connection control program shall include the minimum program elements described in subsection (3) of this section.

(f) The purveyor shall ensure that cross-connections between the distribution system and a consumer's water system are eliminated or controlled by the installation of an approved backflow preventer commensurate with the degree of hazard. This can be accomplished by implementation of a cross-connection program that relies on:

(i) Premises isolation as defined in WAC **246-290-010**; or

(ii) Premises isolation and in-premises protection as defined in WAC **246-290-010**.

(g) Purveyors with cross-connection control programs that rely both on premises isolation and in-premises protection:

(i) Shall comply with the premises isolation requirements specified in subsection (4)(b) of this section; and

(ii) May reduce premises isolation requirements and rely on in-premises protection for premises other than the type addressed in subsection (4)(b) of this section, only if the following conditions are met:

(A) The in-premises backflow preventers provide a level of protection commensurate with the purveyor's assessed degree of hazard;

(B) Backflow preventers which provide the in-premises backflow protection meet the definition of approved backflow preventers as described in WAC **246-290-010**;

(C) The approved backflow preventers are installed, inspected, tested (if applicable), maintained, and repaired in accordance with subsections (6) and (7) of this section;

(D) Records of the backflow preventers are maintained in accordance with subsections (3)(j) and (8) of this section; and

(E) The purveyor has reasonable access to the consumer's premises to conduct an initial hazard evaluation and periodic reevaluations to determine whether the in-premises protection is adequate to protect the purveyor's distribution system.

(h) The purveyor shall take appropriate corrective action as authorized by the legal instrument required by subsection (3)(b) of this section, when:

(i) A cross-connection exists that is not controlled commensurate to the degree of hazard assessed by the purveyor; or

(ii) A consumer fails to comply with the purveyor's requirements regarding the installation, inspection, testing, maintenance or repair of approved backflow preventers required by this chapter.

(i) The purveyor's corrective action may include, but is not limited to:

(i) Denying or discontinuing water service to a consumer's premises until the cross-connection hazard is eliminated or controlled to the satisfaction of the purveyor;

(ii) Requiring the consumer to install an approved backflow preventer for premises isolation commensurate with the degree of hazard; or

(iii) The purveyor installing an approved backflow preventer for premises isolation commensurate with the degree of hazard.

(j) Except in the event of an emergency, purveyors shall notify the authority having jurisdiction prior to denying or discontinuing water service to a consumer's premises for one or more of the reasons listed in (h) of this subsection.

(k) The purveyor shall prohibit the intentional return of used water to the purveyor's distribution system. Used water includes, but is not limited to, water used for heating, cooling, or other purposes within the consumer's water system.

(3) Minimum elements of a cross-connection control program.

(a) To be acceptable to the department, the purveyor's cross-connection control program shall include the minimum elements identified in this subsection.

(b) Element 1: The purveyor shall adopt a local ordinance, resolution, code, bylaw, or other written legal instrument that:

(i) Establishes the purveyor's legal authority to implement a cross-connection control program;

(ii) Describes the operating policies and technical provisions of the purveyor's cross-connection control program; and

(iii) Describes the corrective actions used to ensure that consumers comply with the purveyor's cross-connection control requirements.

(c) Element 2: The purveyor shall develop and implement procedures and schedules for evaluating new and existing service connections to assess the degree of hazard posed by the consumer's premises to the purveyor's distribution system and notifying the consumer within a reasonable time frame of the hazard evaluation results. At a minimum, the program shall meet the following:

(i) For connections made on or after April 9, 1999, procedures shall ensure that an initial evaluation is conducted before water service is provided;

(ii) For all other connections, procedures shall ensure that an initial evaluation is conducted in accordance with a schedule acceptable to the department; and

(iii) For all service connections, once an initial evaluation has been conducted, procedures shall ensure that periodic reevaluations are conducted in accordance with a schedule acceptable to the department and whenever there is a change in the use of the premises.

(d) Element 3: The purveyor shall develop and implement procedures and schedules for ensuring that:

(i) Cross-connections are eliminated whenever possible;

(ii) When cross-connections cannot be eliminated, they are controlled by installation of approved backflow preventers commensurate with the degree of hazard; and

(iii) Approved backflow preventers are installed in accordance with the requirements of subsection (6) of this section.

(e) Element 4: The purveyor shall ensure that personnel, including at least one person certified as a CCS, are provided to develop and implement the cross-connection control program.

(f) Element 5: The purveyor shall develop and implement procedures to ensure that approved backflow preventers relied upon to protect the public water system are inspected and/or tested (as applicable) under subsection (7) of this section.

(g) Element 6: The purveyor shall develop and implement a backflow prevention assembly testing quality control assurance program, including, but not limited to, documentation of BAT certification and test kit calibration, test report contents, and time frames for submitting completed test reports.

(h) Element 7: The purveyor shall develop and implement (when appropriate) procedures for responding to backflow incidents.

(i) Element 8: The purveyor shall include information on cross-connection control in the purveyor's existing program for educating consumers about water system operation. The public education program may include periodic bill inserts, public service announcements, pamphlet distribution, notification of new consumers and consumer confidence reports.

(j) Element 9: The purveyor shall develop and maintain cross-connection control records including, but not limited to, the following:

(i) A master list of service connections and/or consumer's premises where the purveyor relies upon approved backflow preventers to protect the public water system from contamination, the assessed hazard level of each, and the required backflow preventer(s);

(ii) Inventory information on backflow preventers that protect the public water system including:

(A) Approved air gaps installed in lieu of approved assemblies including exact air gap location, assessed degree of hazard, installation date, history of inspections, inspection results, and person conducting inspections;

(B) Approved backflow assemblies including exact assembly location, assembly description (type, manufacturer, model, size, and serial number), assessed degree of hazard, installation date, history of inspections, tests and repairs, test results, and person performing tests; and

(C) Approved AVBs used for irrigation system applications including location, description (manufacturer, model, and size), installation date, history of inspection(s), and person performing inspection(s).

(iii) Cross-connection program summary reports and backflow incident reports required under subsection (8) of this section.

(k) Element 10: Purveyors who distribute and/or have facilities that receive reclaimed water within their water service area shall meet any additional cross-connection control requirements imposed by the department in a permit issued under chapter **90.46** RCW.

(4) Approved backflow preventer selection.

(a) The purveyor shall ensure that a CCS:

(i) Assesses the degree of hazard posed by the consumer's water system upon the purveyor's distribution system; and

(ii) Determines the appropriate method of backflow protection for premises isolation as described in Table 8.

TABLE 8
APPROPRIATE METHODS OF BACKFLOW PROTECTION FOR PREMISES ISOLATION

Degree of Hazard	Application Condition	Appropriate Approved Backflow Preventer
High health cross-connection hazard	Backsiphonage or backpressure backflow	AG, RPBA, or RPDA
	Backsiphonage or	AG, RPBA, RPDA,

Degree of Hazard	Application Condition	Appropriate Approved Backflow Preventer
Low cross-connection hazard	backpressure backflow	DCVA, or DCDA

(b) Premises isolation requirements.

(i) The purveyor shall ensure that an approved air gap, RPBA, or RPDA is installed for premises isolation for service connections to premises posing a high health cross-connection hazard including, but not limited to, those premises listed in Table 9, except those premises identified as severe in (b)(ii) of this subsection.

(ii) For service connections to premises posing a severe health cross-connection hazard including wastewater treatment plants, radioactive material processing plants, and nuclear reactors, the purveyor shall ensure that either an:

(A) Approved air gap is installed for premises isolation; or

(B) Approved RPBA or RPDA is installed for premises isolation in combination with an in-plant approved air gap.

(iii) If the purveyor's CCS determines that no hazard exists for a connection serving premises of the type listed in Table 9, the purveyor may grant an exception to the premises isolation requirements of (b)(i) of this subsection.

(iv) The purveyor shall document, on a case-by-case basis, the reasons for granting an exception under (b)(i) of this subsection and include the documentation in the cross-connection control program annual summary report required in subsection (8) of this section.

TABLE 9
SEVERE* AND HIGH HEALTH CROSS-CONNECTION HAZARD PREMISES REQUIRING PREMISES ISOLATION BY AG OR RPBA

Agricultural (farms and dairies)

Beverage bottling plants

Car washes

Chemical plants

Commercial laundries and dry cleaners

Premises where both reclaimed water and potable water are provided

Film processing facilities

Food processing plants

Hospitals, medical centers, nursing homes, veterinary, medical and dental clinics, and blood plasma centers

Premises with separate irrigation systems using the purveyor's water supply and with chemical addition+

Laboratories

Metal plating industries

Mortuaries

Petroleum processing or storage plants

Piers and docks

Radioactive material processing plants or nuclear reactors*

Survey access denied or restricted

Wastewater lift stations and pumping stations

Wastewater treatment plants*

Premises with an unapproved auxiliary water supply interconnected with the potable water supply

+ For example, parks, playgrounds, golf courses, cemeteries, estates, etc.

* RPBAs for connections serving these premises are acceptable only when used in combination with an in-plant approved air gap; otherwise, the purveyor shall require an approved air gap at the service connection.

(c) Backflow protection for single-family residences.

(i) For single-family residential service connections, the purveyor shall comply with the premises isolation requirements of (b) of this subsection when applicable.

(ii) If the requirements of (b) of this subsection do not apply and the requirements specified in subsection (2)(g)(ii) of this section are met, the purveyor may rely on backflow protection provided at the point of hazard in accordance with WAC **51-56-0600** of the UPC for hazards such as, but not limited to:

(A) Irrigation systems;

(B) Swimming pools or spas;

(C) Ponds; and

(D) Boilers.

For example, the purveyor may accept an approved AVB on a residential irrigation system, if the AVB is properly installed under the UPC.

(d) Backflow protection for fire protection systems.

(i) Backflow protection is not required for residential flow-through or combination fire protection systems constructed of potable water piping and materials.

(ii) For service connections with fire protection systems other than flow-through or combination systems, the purveyor shall ensure that backflow protection consistent with WAC **51-56-0600** of the UPC is installed. The UPC requires minimum protection as follows:

(A) An RPBA or RPDA for fire protection systems with chemical addition or using unapproved auxiliary water supply; and

(B) A DCVA or DCDA for all other fire protection systems.

(iii) For connections made on or after April 9, 1999, the purveyor shall ensure that backflow protection is installed before water service is provided.

(iv) For existing fire protection systems:

(A) With chemical addition or using unapproved auxiliary supplies, the purveyor shall ensure that backflow protection is installed within ninety days of the purveyor notifying the consumer of the high health cross-connection hazard or in accordance with an alternate schedule acceptable to the purveyor.

(B) Without chemical addition, without on-site storage, and using only the purveyor's water (i.e., no unapproved auxiliary supplies on or available to the premises), the purveyor shall ensure that backflow protection is installed in accordance with a schedule acceptable to the purveyor or at an earlier date if required by the code official administering the State Building Code as defined in chapter **51-04** WAC.

(C) When establishing backflow protection retrofitting schedules for fire protection systems that have the characteristics listed in (d)(iv)(B) of this subsection, the purveyor may consider factors such as, but not limited to, impacts of assembly installation on sprinkler performance, costs of retrofitting, and difficulty of assembly installation.

(e) Purveyors may require approved backflow preventers commensurate with the degree of hazard as determined by the purveyor to be installed for premises isolation for connections serving premises that have characteristics such as, but not limited to, the following:

(i) Complex plumbing arrangements or plumbing potentially subject to frequent changes that make it impracticable to assess whether cross-connection hazards exist;

(ii) A repeated history of cross-connections being established or reestablished; or

(iii) Cross-connection hazards are unavoidable or not correctable, such as, but not limited to, tall buildings.

(5) Approved backflow preventers.

(a) The purveyor shall ensure that all backflow prevention assemblies relied upon by the purveyor are models included on the current list of backflow prevention assemblies approved for use in Washington state. The current approved assemblies list is available from the department upon request.

(b) The purveyor may rely on testable backflow prevention assemblies that are not currently approved by the department, if the assemblies:

(i) Were included on the department and/or USC list of approved backflow prevention assemblies at the time of installation;

(ii) Have been properly maintained;

(iii) Are commensurate with the purveyor's assessed degree of hazard; and

(iv) Have been inspected and tested at least annually and have successfully passed the annual tests.

(c) The purveyor shall ensure that an unlisted backflow prevention assembly is replaced by an approved assembly commensurate with the degree of hazard, when the unlisted assembly:

(i) Does not meet the conditions specified in (b)(i) through (iv) of this subsection;

(ii) Is moved; or

(iii) Cannot be repaired using spare parts from the original manufacturer.

(d) The purveyor shall ensure that AVBs meet the definition of approved atmospheric vacuum breakers as described in WAC **246-290-010**.

(6) Approved backflow preventer installation.

(a) The purveyor shall ensure that approved backflow preventers are installed in the orientation for which they are approved (if applicable).

(b) The purveyor shall ensure that approved backflow preventers are installed in a manner that:

(i) Facilitates their proper operation, maintenance, inspection, in-line testing (as applicable), and repair using standard installation procedures acceptable to the department such as those in the USC Manual or PNWS-AWWA Manual;

(ii) Ensures that the assembly will not become submerged due to weather-related conditions such as flooding; and

(iii) Ensures compliance with all applicable safety regulations.

(c) The purveyor shall ensure that approved backflow assemblies for premises isolation are installed at a location adjacent to the meter or property line or an alternate location acceptable to the purveyor.

(d) When premises isolation assemblies are installed at an alternate location acceptable to the purveyor, the purveyor shall ensure that there are no connections between the point of delivery from the public water system and the approved backflow assembly, unless the installation of the connection meets the purveyor's cross-connection control requirements and is specifically approved by the purveyor.

(e) The purveyor shall ensure that approved backflow preventers are installed in accordance with the following time frames:

(i) For connections made on or after April 9, 1999, the following conditions shall be met before service is provided:

(A) The provisions of subsection (3)(d)(ii) of this section; and

(B) Satisfactory completion of the requirements of subsection (7) of this section.

(ii) For existing connections where the purveyor identifies a high health cross-connection hazard, the provisions of (3)(d)(ii) of this section shall be met:

(A) Within ninety days of the purveyor notifying the consumer of the high health cross-connection hazard; or

(B) In accordance with an alternate schedule acceptable to the purveyor.

(iii) For existing connections where the purveyor identifies a low cross-connection hazard, the provisions of subsection (3)(d)(ii) of this section shall be met in accordance with a schedule acceptable to the purveyor.

(f) The purveyor shall ensure that bypass piping installed around any approved backflow preventer is equipped with an approved backflow preventer that:

(i) Affords at least the same level of protection as the approved backflow preventer that is being bypassed; and

(ii) Complies with all applicable requirements of this section.

(7) Approved backflow preventer inspection and testing.

(a) For backflow preventers that protect the public water system, the purveyor shall ensure that:

(i) A CCS inspects backflow preventer installations to ensure that protection is provided commensurate with the assessed degree of hazard;

(ii) Either a BAT or CCS inspects:

(A) Air gaps installed in lieu of approved backflow prevention assemblies for compliance with the approved air gap definition; and

(B) Backflow prevention assemblies for correct installation and approval status.

(iii) A BAT tests approved backflow prevention assemblies for proper operation.

(b) The purveyor shall ensure that inspections and/or tests of approved air gaps and approved backflow assemblies that protect the public water system are conducted:

(i) When any of the following occur:

(A) Upon installation, repair, reinstallation, or relocation of an assembly;

(B) Upon installation or replumbing of an air gap;

(C) After a backflow incident involving the assembly or air gap; and

(ii) Annually thereafter, unless the purveyor requires more frequent testing for high hazard premises or for assemblies that repeatedly fail.

(c) The purveyor shall ensure that inspections of AVBs installed on irrigation systems are conducted:

(i) At the time of installation;

(ii) After a backflow incident; and

(iii) After repair, reinstallation, or relocation.

(d) The purveyor shall ensure that approved backflow prevention assemblies are tested using procedures acceptable to the department, such as those specified in the most recently published edition of the USC Manual. When circumstances, such as, but not limited to, configuration or location of the assembly, preclude the use of USC test procedures, the purveyor may allow, on a case-by-case basis, the use of alternate (non-USC) test procedures acceptable to the department.

(e) The purveyor shall ensure that results of backflow prevention assembly inspections and tests are documented and reported in a manner acceptable to the purveyor.

(f) The purveyor shall ensure that an approved backflow prevention assembly or AVB, whenever found to be improperly installed, defective, not commensurate with the degree of hazard, or failing a test (if applicable) is properly reinstalled, repaired, overhauled, or replaced.

(g) The purveyor shall ensure that an approved air gap, whenever found to be altered or improperly installed, is properly replumbed or, if commensurate with the degree of hazard, is replaced by an approved RPBA.

(8) Recordkeeping and reporting.

(a) Purveyors shall keep cross-connection control records for the following time frames:

(i) Records pertaining to the master list of service connections and/or consumer's premises required in subsection (3)(j)(i) of this section shall be kept as long as the premises pose a cross-connection hazard to the purveyor's distribution system;

(ii) Records regarding inventory information required in subsection (3)(j)(ii) of this section shall be kept for five years or for the life of the approved backflow preventer whichever is shorter; and

(iii) Records regarding backflow incidents and annual summary reports required in subsection (3)(j)(iii) of this section shall be kept for five years.

(b) Purveyors may maintain cross-connection control records in original form or transfer data to tabular summaries.

(c) Purveyors may maintain records or data in any media, such as paper, film, or electronic format.

(d) The purveyor shall complete the cross-connection control program summary report annually. Report forms and guidance on completing the report are available from the department.

(e) The purveyor shall make all records and reports required in subsection (3)(j) of this section available to the department or its representative upon request.

(f) The purveyor shall notify the department, authority having jurisdiction, and local health jurisdiction as soon as possible, but no later than the end of the next business day, when a backflow incident is known by the purveyor to have:

(i) Contaminated the public water system; or

(ii) Occurred within the premises of a consumer served by the purveyor.

(g) The purveyor shall:

(i) Document details of backflow incidents contaminating the public water system on a backflow incident report form available from the department; and

(ii) Include all backflow incident report(s) in the annual cross-connection program summary report referenced in (d) of this subsection, unless otherwise requested by the department.

[Statutory Authority: RCW **70.119A.180** and **43.20.050**. WSR 08-03-061, § 246-290-490, filed 1/14/08, effective 2/14/08. Statutory Authority: RCW **43.20.050** (2) and (3) and **70.119A.080**. WSR 03-08-037, § 246-290-490, filed 3/27/03, effective 4/27/03. Statutory Authority: RCW **43.02.050** [43.20.050]. WSR 99-07-021, § 246-290-490, filed 3/9/99, effective 4/9/99. Statutory Authority: RCW **43.20.050**. WSR 91-02-051 (Order 124B), recodified as § 246-290-490, filed 12/27/90, effective 1/31/91. Statutory Authority: P.L. 99-339. WSR 89-21-020 (Order 336), § 248-54-285, filed 10/10/89, effective 11/10/89. Statutory Authority: RCW **34.04.045**. WSR 88-05-057 (Order 307), § 248-54-285, filed 2/17/88. Statutory Authority: RCW **43.20.050**. WSR 83-19-002 (Order 266), § 248-54-285, filed 9/8/83.]

WAC 51-56-0600

Chapter 6— Water supply and distribution.

603.1 General. Cross-connection control shall be provided in accordance with the provisions of this chapter. Devices or assemblies for protection of the public water system must be models approved by the department of health under WAC **246-290-490**. The authority having jurisdiction shall coordinate with the local water purveyor where applicable in all matters concerning cross-connection control within the property lines of the premises.

No person shall install any water operated equipment or mechanism, or use any water treating chemical or substance, if it is found that such equipment, mechanism, chemical or substance may cause pollution or contamination of the domestic water supply. Such equipment or mechanism may be permitted only when equipped with an approved backflow prevention device or assembly.

603.2 Approval of Devices or Assemblies. Before any device or assembly is installed for the prevention of backflow, it shall have first been approved by the authority having jurisdiction. Devices or assemblies shall be tested for conformity with recognized standards or other standards acceptable to the authority having jurisdiction. Backflow prevention devices and assemblies shall comply with Table 603.2, except for specific applications and provisions as stated in Section 603.5.1 through 603.5.21.

All devices or assemblies installed in a potable water supply system for protection against backflow shall be maintained in good working condition by the person or persons having control of such devices or assemblies. Such devices or assemblies shall be tested in accordance with Section 603.4.2 and WAC **246-290-490**. If found to be defective or inoperative, the device or assembly shall be replaced or repaired. No device or assembly shall be removed from use or relocated or other device or assembly substituted, without the approval of the authority having jurisdiction.

Testing shall be performed by a Washington state department of health certified backflow assembly tester.

TABLE 603.2
Backflow Prevention Devices, Assemblies and Methods
The following line is deleted from the table:

Device, Assembly or Method	Applicable Standards	Pollution (Low Hazard)		Contamination (High Hazard)		Installation
		Back Siphonage	Back Pressure	Back Siphonage	Back Pressure	
Backflow preventer for carbonated beverage dispensers (two independent check valves with a vent to	ASSE 1022	X				Installation includes carbonated beverage machines or dispensers. These devices operate under

Device, Assembly or Method	Applicable Standards	Pollution (Low Hazard)		Contamination (High Hazard)		Installation
		Back Siphonage	Back Pressure	Back Siphonage	Back Pressure	
the atmosphere.)						intermittent or continuous pressure conditions.

603.4.2 Testing. For devices and assemblies other than those regulated by the Washington department of health in conjunction with the local water purveyor for the protection of public water systems, the authority having jurisdiction shall ensure that the premise owner or responsible person shall have the backflow prevention assembly tested by a Washington state department of health certified backflow assembly tester:

(1) At the time of installation, repair or relocation; and

(2) At least on an annual schedule thereafter, unless more frequent testing is required by the authority having jurisdiction.

603.5.6 Protection from Lawn Sprinklers and Irrigation Systems. Potable water supplies to systems having no pumps or connections for pumping equipment, and no chemical injection or provisions for chemical injection, shall be protected from backflow by one of the following:

(1) Atmospheric vacuum breaker (AVB).

(2) Pressure vacuum breaker backflow prevention assembly (PVB).

(3) Spill-resistant pressure vacuum breaker (SVB).

(4) Reduced pressure principle backflow prevention assembly (RP).

(5) A double check valve backflow prevention assembly (DC) may be allowed when approved by the water purveyor and the authority having jurisdiction.

603.5.10 Steam or Hot Water Boilers. Potable water connections to steam or hot water boilers shall be protected by an air gap or a reduced pressure principle backflow preventer.

603.5.12 Beverage Dispensers. Potable water supply to carbonators shall be protected by a listed reduced pressure principle backflow preventer as approved by the authority having jurisdiction for the specific use. The backflow preventer shall be located in accordance with Section 603.4.3. The piping downstream of the backflow preventer shall not be of copper, copper alloy, or other material that is affected by carbon dioxide.

603.5.13 Prohibited Location. Backflow preventers shall not be located in any area containing fumes or aerosols that are toxic, poisonous, infectious, or corrosive.

603.5.15 Protection from Fire Systems. Except as provided under Sections 603.5.15.1 and 603.5.15.2, potable water supplies to fire protection systems that are normally under pressure, including but not limited to standpipes and automatic sprinkler systems, except in one or two family or townhouse residential flow-through or combination sprinkler systems piped in materials approved for potable water distribution systems, shall be protected from back-pressure and back-siphonage by one of the following testable assemblies:

1. Double check valve backflow prevention assembly (DC).
2. Double check detector fire protection backflow prevention assembly.

3. Reduced pressure principle backflow prevention assembly (RP).
4. Reduced pressure detector fire protection backflow prevention assembly.

Potable water supplies to fire protection systems that are not normally under pressure shall be protected from backflow and shall meet the requirements of the appropriate standard(s) referenced in Table 1401.1.

604.11 Lead Content. The maximum allowable lead content in pipes, pipe fittings, plumbing fittings and fixtures intended to convey or dispense water for human consumption shall be not more than a weighted average of 0.25 percent with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings and fixtures. For solder and flux, the lead content shall be not more than 0.2 percent where used in piping systems that convey or dispense water for human consumption.

EXCEPTIONS: 1. Pipes, pipe fittings, plumbing fittings, fixtures or backflow preventers used for nonpotable services such as manufacturing, industrial processing, irrigation, outdoor watering, or any other uses where the water is not used for human consumption.

2. Water closets, bidets, urinals, fill valves, flushometer valves, tub fillers, shower valves, service saddles, or water distribution main gate valves that are two inches (50 mm) in diameter or larger.

604.14 Plastic water service piping may terminate within a building, provided the connection to the potable water distribution system shall be made as near as is practical to the point of entry and shall be accessible. Barbed insert fittings with hose clamps are prohibited as a transition fitting within the building.

608.5 Drains. Relief valves located inside a building shall be provided with a drain, not smaller than the relief valve outlet, of galvanized steel, hard drawn copper piping and fittings, CPVC, PP, or listed relief valve drain tube with fittings which will not reduce the internal bore of the pipe or tubing (straight lengths as opposed to coils) and shall extend from the valve to the outside of the building, with the end of the pipe not more than two (2) feet (610 mm) nor less than six (6) inches (152 mm) above the ground or the flood level of the area receiving the discharge and pointing downward. Such drains may terminate at other approved locations. No part of such drain pipe shall be trapped or subject to freezing. The terminal end of the drain pipe shall not be threaded.

EXCEPTION: Where no drainage was provided, replacement water heating equipment shall only be required to provide a drain pointing downward from the relief valve to extend between two feet (610 mm) and six inches (152 mm) from the floor. No additional floor drain need be provided.

610.4 Systems within the range of Table 610.4 may be sized from that table or by the method set forth in Section 610.5.

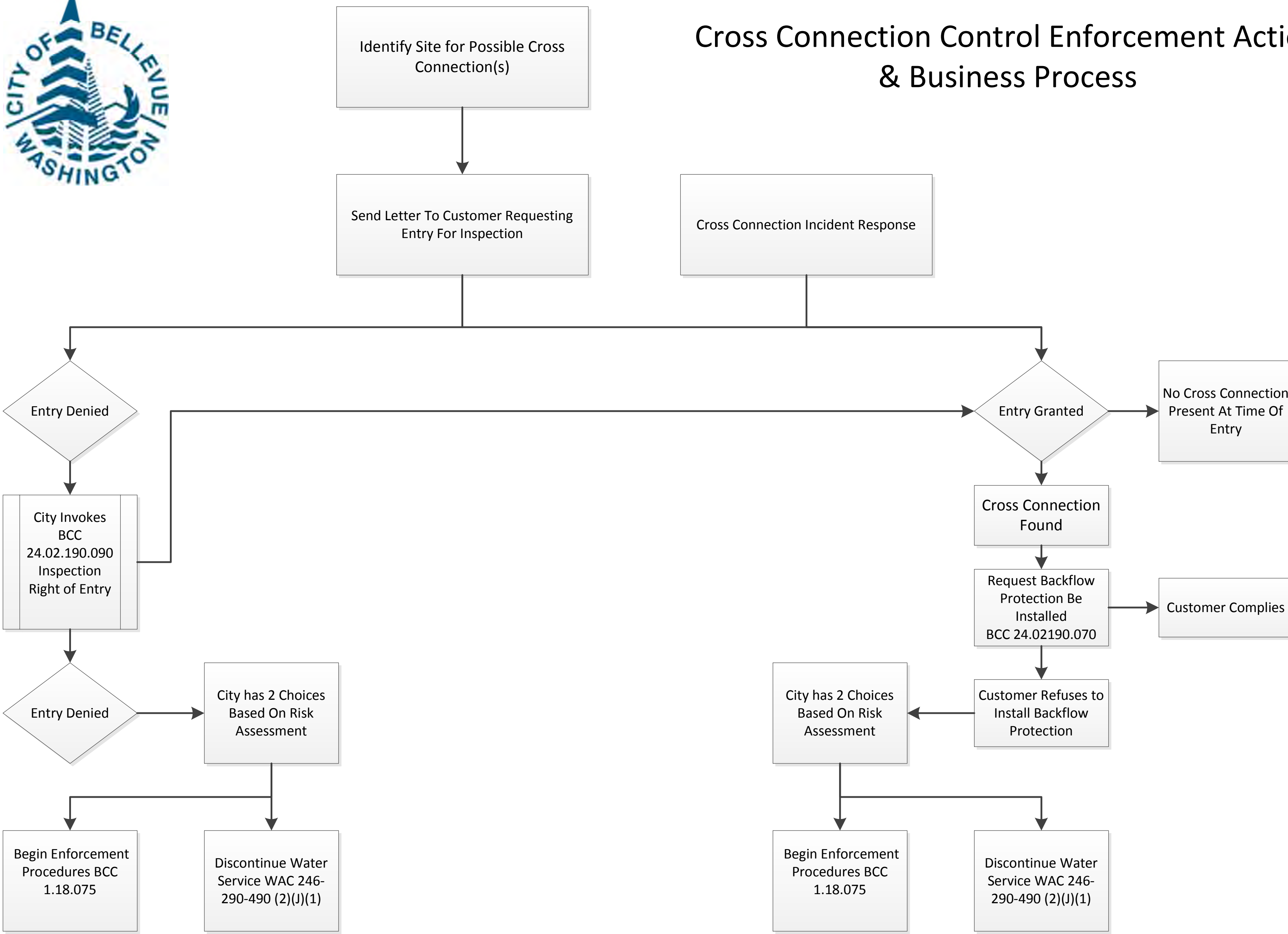
Listed parallel water distribution systems shall be installed in accordance with their listing.

612.1 General. Where residential fire sprinkler systems are installed, they shall be installed in accordance with the International Building Code or International Residential Code.

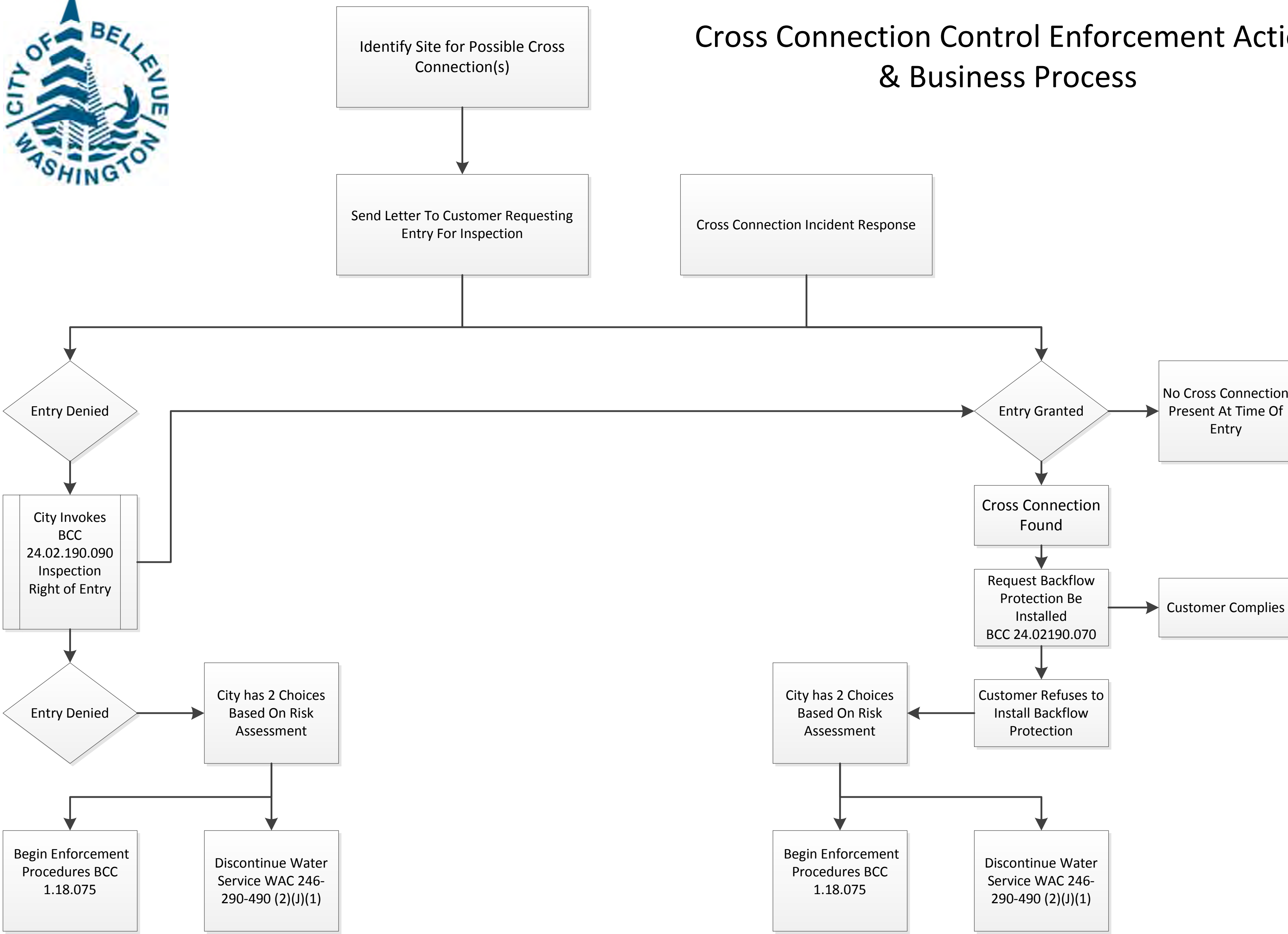
613.0 Insulation of Potable Water Piping. Domestic water piping within commercial buildings shall be insulated in accordance with Section C403.2.8 and Table C403.2.8 or Section C404.6 of the Washington State Energy Code, as applicable.

[Statutory Authority: RCW **19.27A.025**, **19.27A.045**, and **19.27.074**. WSR 13-23-094, § 51-56-0600, filed 11/20/13, effective 4/1/14. Statutory Authority: RCW **19.27.074**, **19.27.031** and chapters **19.27** and **34.05** RCW. WSR 13-04-054, § 51-56-0600, filed 2/1/13, effective 7/1/13. Statutory Authority: RCW **19.27.031**, **19.27.035**, **19.27.074**, and chapters **19.27** and **34.05** RCW. WSR 12-07-018, § 51-56-0600, filed 3/12/12, effective 4/12/12. Statutory Authority: RCW **19.27.074**, **19.27.031** and chapters **19.27** and **34.05** RCW. WSR 10-03-101, § 51-56-0600, filed 1/20/10, effective 7/1/10. Statutory Authority: RCW **19.27.190**, **19.27.020** and chapters **19.27** and **34.05** RCW. WSR 07-01-094, § 51-56-0600, filed 12/19/06, effective 7/1/07. Statutory Authority: RCW **19.27.031** and **19.27.074**. WSR 04-01-110, § 51-56-0600, filed 12/17/03, effective 7/1/04; WSR 02-01-114, § 51-56-0600, filed 12/18/01, effective 7/1/02.]

Cross Connection Control Enforcement Action & Business Process



Cross Connection Control Enforcement Action & Business Process



BACKFLOW PREVENTION ASSEMBLY TEST REPORT

CITY OF BELLEVUE
Water Quality
Box 90012 Bellevue, WA 98009
(425) 452-7840

EMAILTO: **Backflow@Bellevuewa.gov**
FAX (425) 452-7116

NOTE: *all new backflow assemblies installed must be tested prior to plumbing final, test reports must be made available to the plumbing inspector at final.*

ACCOUNT #______________

NAME OF PREMISE ______________________________ **Commercial** ☐ **Residential** ☐

SERVICE ADDRESS ______________________ **CITY** ________________ **ZIP** _____

CONTACT PERSON ____________________ **PHONE** ( ) ______________ **FAX** ( ) ______________

LOCATION OF ASSEMBLY ______________________________

DOWNSTREAM PROCESS ____________________ **DCVA** ☐ **RPBA** ☐ **PVBA** ☐ **OTHER** __________

NEW INSTALL ☐ **EXISTING** ☐ **REPLACEMENT** ☐ **OLD SER. #** ____________ **PROPER INSTALLATION? YES** ☐ **NO** ☐

MAKE OF ASSEMBLY_______________**MODEL** ________________**SERIAL NO**. ____________________**SIZE** ___________

	DCVA / RPBA CHECK VALVE NO.1	**DCVA / RPBA CHECK VALVE NO.2**	**RPBA**	**PVBA/SVBA** AIR INLET
INITIAL TEST **PASSED** ☐ **FAILED** ☐	LEAKED ☐ _______________ PSID	LEAKED ☐ _______________ PSID	OPENED AT _____ PSID #1 CHECK _______PSID AIR GAP OK? ________	OPENED AT_______PSID DID NOT OPEN ☐ CONTINUED TO FULLY OPEN? Y N
NEW PARTS AND REPAIRS	CLEAN REPLACE PART ☐ ☐ ______ ☐ ☐ ______ ☐ ☐ ______ ☐ ☐ ______	CLEAN REPLACE PART ☐ ☐ ______ ☐ ☐ ______ ☐ ☐ ______ ☐ ☐ ______	CLEAN REPLACE PART ☐ ☐ ______ ☐ ☐ ______ ☐ ☐ ______ ☐ ☐ ______	CHECK VALVE HELD AT _________PSID LEAKED ☐ _________________ CLEANED ☐ REPAIRED ☐
TEST AFTER REPAIRS **PASSED** ☐ **FAILED** ☐	LEAKED ☐ _______________PSID	LEAKED ☐ _______________PSID	OPENED AT _____PSID #1 CHECK_______PSID	AIR INLET _______ PSID CHK VALVE ______PSID

Air Gap Inspection: Supply Pipe Diameter: ___________" Separation: ______________" PASS ☐ FAIL ☐

REMARKS: ______________________________ **LINE PRESSURE** ______**PSI**

COMPANY NAME:______________________________**WSDOH APPROVED ASSEMBLY? YES** ☐ **NO** ☐

TESTERS SIGNATURE: ______________________ **CERT. NO.** ____________**DATE** __________________

TESTERS NAME PRINTED: ______________________ **TESTERS PHONE # (** **)** ____________________

REPAIRED BY: ______________________________**DATE** _________________

FINAL TEST BY:______________________ **CERT. NO.** _______________**DATE** _________________

CALIBRATION DATE __ /__ /__ GAUGE # _________ **MODEL**_________ **SERVICE RESTORED? YES** ☐ **NO** ☐

I certify that this report is accurate, and I have used WAC 246-290-490 approved test methods and test equipment.

Table 4 - 4 (Continued)

Description of fixture, equipment or use of water	Assessed Health Hazard	Minimum Protection at Fixture	Additional Premise or Internal Isolation*
• Chemical feeder for commercial cleaners	high	AG/RPBA	
• Chemical feeder for commercial cleaners	high	AVB/PVBA	RPBA/DCVA
• Chlorinators	high	RPBA	
• Commercial coffee urns	low	AG/AVB	
• Computer cooling lines	high	RPBA	
• Condensate tanks	high	RPBA	
• Commercial cooking kettles	low	AG/AVB	
• Cooling towers	high	AG/RPBA	
• Decorative ponds	high	AG/RPBA	
• Degreasing equipment	high	RPBA	
• Dental equipment/cuspidors	high	RPBA	RPBA
• Dialysis equipment	high	RPBA	
• Dishwashers	low	AVB	
• Drinking fountains	low	AG	
• Dye vats and tanks	high	AG/RPBA	
• Etching tanks	high	AG/RPBA	RPBA
• Fermenting tanks	high	AG/RPBA	RPBA
• Fertilizer injection	high	RPBA	
• Film processors	high	RPBA	
• Fire dept. connection	low	DCVA	
• Fire sprinkler system w/o chemical addition	low	DCVA/DCDA	
• Fire sprinkler system with chemical addition	high	RPBA/RPDA	
• Floor drains	high	AG	
• Flushing floor drains	high	AVB	DCVA
• Fume hoods (lab)	high	AVB	RPBA
• Garbage can washers	high	RPBA	

Table 4 - 4 (Continued)

Description of fixture, equipment or use of water	Assessed Health Hazard	Minimum Protection at Fixture	Additional Premise or Internal Isolation*
• Heat exchangers other than double wall with leak path	high	RPBA	
• Heat pumps	high	RPBA	
• High pressure washers w/o chemical injection	low	DCVA	
• Hose bibbs (residential)	low	AVB/HBVB	
• Hose bibbs (industrial)	varies	AVB/HBVB	RPBA/DCVA
• Hoses, kitchen rinse	low	AVB	
• Hot tubs	high	AG/RPBA	
• Commercial hot water heating boilers	high	RPBA	
• Hydrotherapy baths	high	RPBA	
• Ice makers	high	AG/RPBA	
• Industrial fluid systems	high	RPBA	
• Intertied (looped) services	low	DCVA	
• Irrigation system (lawn) with chemical addition	high	RPBA	
• Irrigation system (lawn) w/o chemical addition	low	PVBA/DCVA	
• Janitor sinks	low	AVB/HBVB	
• Kitchen equipment	low	AVB	
• Laboratory equipment	high	AVB/LFVB	RPBA
• Laundry machines, commercial	high	RPBA	
• Livestock drinking tanks	high	AG/AVB	DCVA
• Make-up tanks	high	AG/RPBA	
• Mobile carpet cleaners	high	RPBA	
• Pesticide applicator trucks	high	AG/RPBA	
• Photo developing sinks/tanks	high	RPBA	
• Private fire hydrants	low	DCVA	
• Pump prime lines	high	RPBA	

Table 4 - 4 (Continued)

Description of fixture, equipment or use of water	Assessed Health Hazard	Minimum Protection at Fixture	Additional Premise or Internal Isolation*
• Radiator flushing equipment	high	RPBA	
• Recreational vehicle dump station	severe	AG	RPBA
• Sewer connected equipment	severe	AG	
• Sewer flushing	severe	AG	
• Spas	high	AG/RPBA	
• Steam generating equipment	high	RPBA	
• Sterilizers	high	RPBA	
• Stills	high	RPBA	
• Sumps	high	AG	
• Swimming pools	high	AG/RPBA	
• Trap primers	high	AG	
• Used or gray water systems	high	RPBA	
• X-ray equipment	high	RPBA	

The information in Table 4-4 may differ from the backflow prevention requirements for individual plumbing fixtures found in plumbing codes. For public health protection within a customer's premise, the plumbing code having jurisdiction governs (see Chapter 9). Table 4-4 is provided to illustrate only some of the health hazards found in plumbing systems. This table should be used by water purveyors in assessing the degree of hazard a customer's plumbing system places upon the purveyor's water distribution system. Deficiencies in backflow prevention within the customer's premise, should be compensated for through the selection of an appropriate assembly for premise isolation.

Table 4 - 4 (Continued)

Description of fixture, equipment or use of water	Assessed Health Hazard	Minimum Protection at Fixture	Additional Premise or Internal Isolation*
• Chemical feeder for commercial cleaners	high	AG/RPBA	
• Chemical feeder for commercial cleaners	high	AVB/PVBA	RPBA/DCVA
• Chlorinators	high	RPBA	
• Commercial coffee urns	low	AG/AVB	
• Computer cooling lines	high	RPBA	
• Condensate tanks	high	RPBA	
• Commercial cooking kettles	low	AG/AVB	
• Cooling towers	high	AG/RPBA	
• Decorative ponds	high	AG/RPBA	
• Degreasing equipment	high	RPBA	
• Dental equipment/cuspidors	high	RPBA	RPBA
• Dialysis equipment	high	RPBA	
• Dishwashers	low	AVB	
• Drinking fountains	low	AG	
• Dye vats and tanks	high	AG/RPBA	
• Etching tanks	high	AG/RPBA	RPBA
• Fermenting tanks	high	AG/RPBA	RPBA
• Fertilizer injection	high	RPBA	
• Film processors	high	RPBA	
• Fire dept. connection	low	DCVA	
• Fire sprinkler system w/o chemical addition	low	DCVA/DCDA	
• Fire sprinkler system with chemical addition	high	RPBA/RPDA	
• Floor drains	high	AG	
• Flushing floor drains	high	AVB	DCVA
• Fume hoods (lab)	high	AVB	RPBA
• Garbage can washers	high	RPBA	

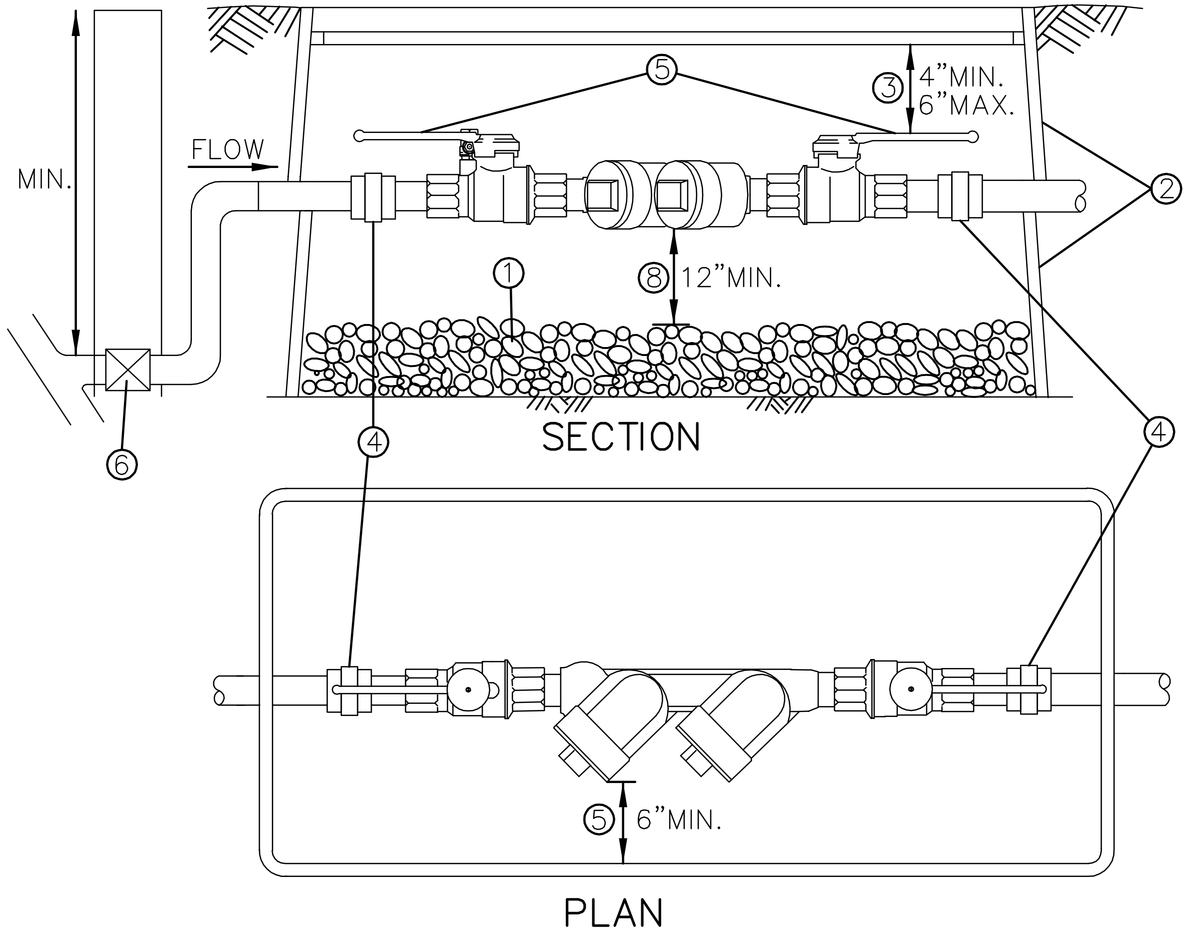
Table 4 - 4 (Continued)

Description of fixture, equipment or use of water	Assessed Health Hazard	Minimum Protection at Fixture	Additional Premise or Internal Isolation*
• Heat exchangers other than double wall with leak path	high	RPBA	
• Heat pumps	high	RPBA	
• High pressure washers w/o chemical injection	low	DCVA	
• Hose bibbs (residential)	low	AVB/HBVB	
• Hose bibbs (industrial)	varies	AVB/HBVB	RPBA/DCVA
• Hoses, kitchen rinse	low	AVB	
• Hot tubs	high	AG/RPBA	
• Commercial hot water heating boilers	high	RPBA	
• Hydrotherapy baths	high	RPBA	
• Ice makers	high	AG/RPBA	
• Industrial fluid systems	high	RPBA	
• Intertied (looped) services	low	DCVA	
• Irrigation system (lawn) with chemical addition	high	RPBA	
• Irrigation system (lawn) w/o chemical addition	low	PVBA/DCVA	
• Janitor sinks	low	AVB/HBVB	
• Kitchen equipment	low	AVB	
• Laboratory equipment	high	AVB/LFVB	RPBA
• Laundry machines, commercial	high	RPBA	
• Livestock drinking tanks	high	AG/AVB	DCVA
• Make-up tanks	high	AG/RPBA	
• Mobile carpet cleaners	high	RPBA	
• Pesticide applicator trucks	high	AG/RPBA	
• Photo developing sinks/tanks	high	RPBA	
• Private fire hydrants	low	DCVA	
• Pump prime lines	high	RPBA	

Table 4 - 4 (Continued)

Description of fixture, equipment or use of water	Assessed Health Hazard	Minimum Protection at Fixture	Additional Premise or Internal Isolation*
• Radiator flushing equipment	high	RPBA	
• Recreational vehicle dump station	severe	AG	RPBA
• Sewer connected equipment	severe	AG	
• Sewer flushing	severe	AG	
• Spas	high	AG/RPBA	
• Steam generating equipment	high	RPBA	
• Sterilizers	high	RPBA	
• Stills	high	RPBA	
• Sumps	high	AG	
• Swimming pools	high	AG/RPBA	
• Trap primers	high	AG	
• Used or gray water systems	high	RPBA	
• X-ray equipment	high	RPBA	

The information in Table 4-4 may differ from the backflow prevention requirements for individual plumbing fixtures found in plumbing codes. For public health protection within a customer's premise, the plumbing code having jurisdiction governs (see Chapter 9). Table 4-4 is provided to illustrate only some of the health hazards found in plumbing systems. This table should be used by water purveyors in assessing the degree of hazard a customer's plumbing system places upon the purveyor's water distribution system. Deficiencies in backflow prevention within the customer's premise, should be compensated for through the selection of an appropriate assembly for premise isolation.



1. 1" ROUND WASHED GRAVEL BY 6" DEEP ON BOTTOM OF BOX
2. ENCLOSE 2" & SMALLER D.C.V.A. IN TWO METER BOXES STACKED ON TOP OF EACH OTHER OR, OVERSIZED BOX. MUST HAVE REMOVABLE COVER. BOXES TO BE LOCATED IN SIDEWALK AND AREAS WITH VEHICULAR TRAFFIC SHALL BE METAL, EQUAL TO OLYMPIC FOUNDRY SM30. BOXES IN OTHER NON-TRAFFIC AREAS TO BE CARSON INDUSTRIES 1730-18 BCFXL METER BOX WITH 1730 COVER.
3. MAXIMUM OF 6" DISTANCE BETWEEN UNDERSIDE OF LID AND HIGHEST POINT OF DEVICE.
4. (2) UNIONS.
5. WHEN TEST-COCKS ARE FACING SIDEWAYS THERE MUST BE A 6" MIN. CLEARANCE BETWEEN THEM AND SIDE OF BOX.
6. PER PLUMBING CODE REQUIREMENT, IRRIGATION SYSTEMS MUST HAVE SHUT OFF INSTALLED AS SHOWN. FEMALE FITTINGS ARE PROHIBITED IN CONJUNCTION WITH METALLIC MALE FITTINGS.

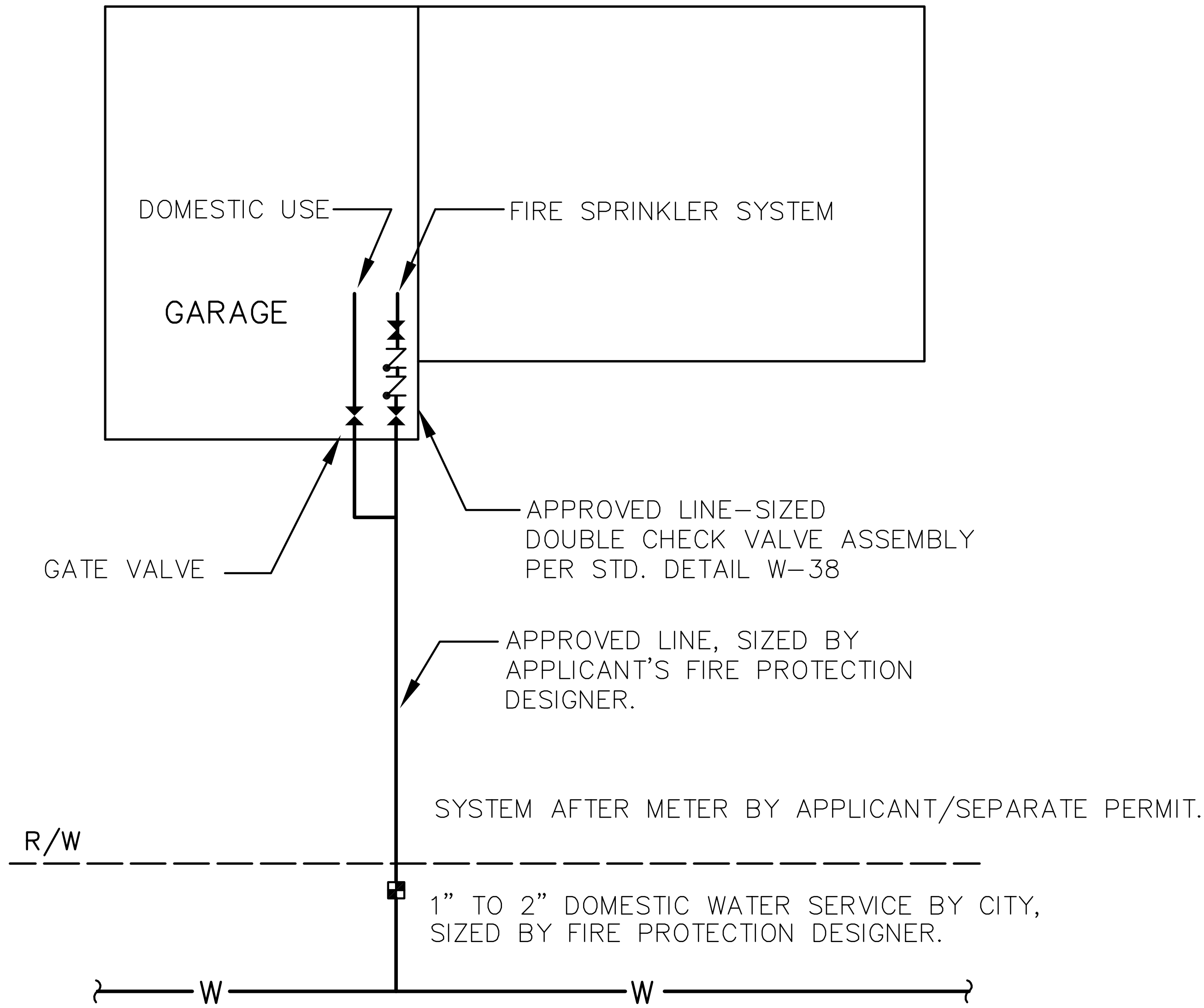
NOTES:

1. ALL INSTALLATIONS MUST MEET MINIMUM STANDARDS OF THE UNIFORM PLUMBING CODE AND WSDOH APPROVED INSTALLATIONS LIST.
2. TESTING IS REQUIRED BY A WASHINGTON STATE DEPARTMENT OF HEALTH CERITFIED BACKFLOW ASSEMBLY TESTER UPON INSTALLATION AND ANNUALLY THEREAFTER. ASSEMBLY TO BE MAINTAINED BY OWNER.

City of Bellevue — WATER UTILITY

TITLE
1" TO 2" DOUBLE CHECK VALVE ASSEMBLY FOR IRRIGATION SYSTEMS (OUTSIDE INSTALLATION)

JANUARY 2013 | NO SCALE | NO. W-36



NOTE:

1. TESTING IS REQUIRED BY A WASHINGTON STATE DEPARTMENT OF HEALTH CERTIFIED BACKFLOW ASSEMBLY TESTER UPON INSTALLATION AND ANNUALLY THEREAFTER. ASSEMBLY TO BE MAINTAINED BY OWNER.

City of Bellevue

WATER UTILITY

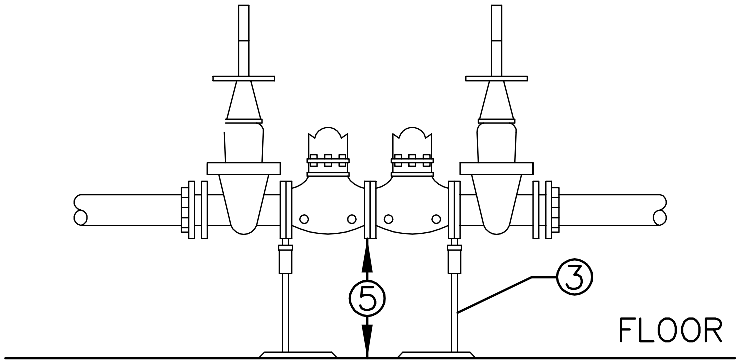
TITLE

INSIDE DCVA INSTALLATION FOR RESIDENTIAL FIRE SPRINKLER SYSTEMS

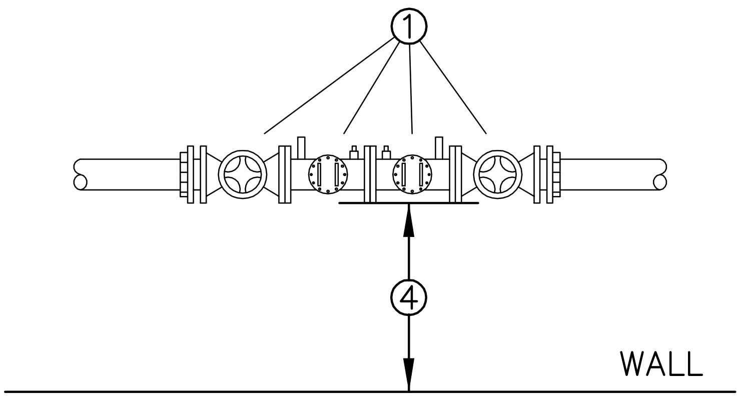
JANUARY 2013

NO SCALE

NO. W–37



SECTION



PLAN

NOTES:

1. LINE–SIZED WA STATE APPROVED DOUBLE CHECK VALVE ASSEMBLY. THE D.C.V.A. INCLUDES (2) RESILIENT–SEATED SHUT–OFF VALVES AND (4) RESILIENT–SEATED TEST–COCKS.
2. THE D.C.V.A. MUST BE INSTALLED PER WSDOH APPROVED INSTALLATIONS LIST.
3. (2) SUPPORTS (EITHER WALL OR FLOOR) ONE ON EACH SIDE OF ASSEMBLY, MUST FIRMLY ANCHOR DEVICE. REQUIRED FOR 2 1/2" AND LARGER LINE SIZE.
4. MUST PROVIDE A MINIMUM OF 6" SIDE CLEARANCE BETWEEN D.C.V.A. AND WALL OR OBSTRUCTION.
5. CLEARANCE BETWEEN FLOOR AND ASSEMBLY MUST BE A MINIMUM OF 12" AND A MAXIMUM OF 5'.
6. TESTING IS REQUIRED BY A WASHINGTON STATE DEPARTMENT OF HEALTH CERTIFIED BACKFLOW ASSEMBLY TESTER UPON INSTALLATION AND ANNUALLY THEREAFTER. ASSEMBLY TO BE MAINTAINED BY OWNER.
7. PROTECT AGAINST FREEZING OR DAMAGE. USE HEAT–TAPE IF AREA IS SUBJECT TO FREEZING.
8. INTERIOR WATER APPURTENANCES MUST CONFORM TO UNIFORM PLUMBING CODE REQUIREMENTS.
9. FDC TO BE LOCATED DOWNSTREAM OF DCVA (COMMERCIAL ONLY).

City of Bellevue

WATER UTILITY

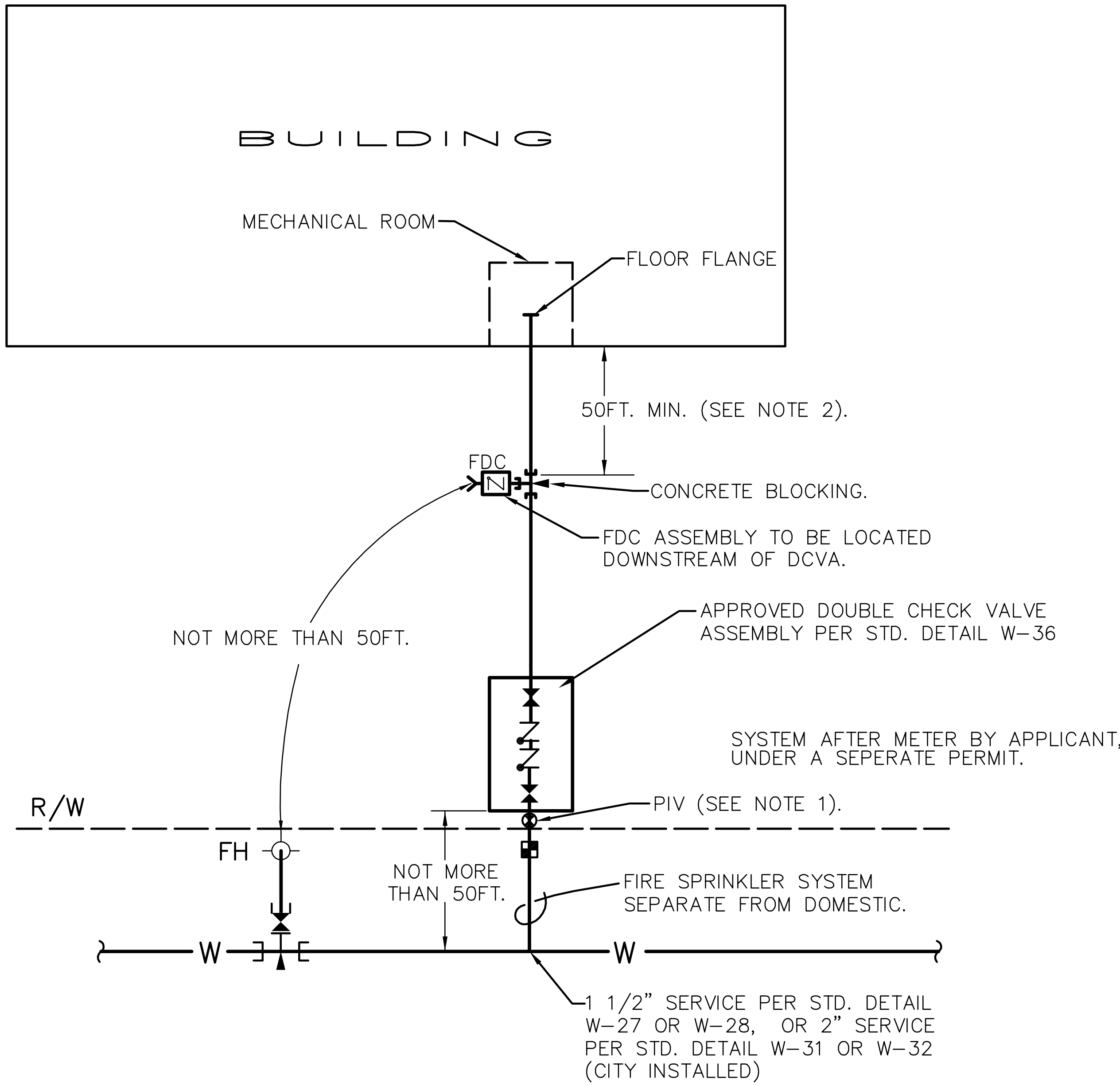
TITLE

DOUBLE CHECK
VALVE ASSEMBLY
(INSIDE INSTALLATION)

JANUARY 2013

NO SCALE

NO. W–38



NOTES:

1. PIV MUST BE LOCATED ON THE FIRELINE BETWEEN THE R/W LINE AND THE FDC.
2. FIRE MARSHALL SHALL APPROVE FDC LOCATION IF LESS THAN 50FT. FROM STRUCTURE.
3. TESTING IS REQUIRED BY A WASHINGTON STATE DEPARTMENT OF HEALTH CERTIFIED BACKFLOW ASSEMBLY TESTER UPON INSTALLATION AND ANNUALLY THEREAFTER. ASSEMBLY TO BE MAINTAINED BY OWNER.

City of Bellevue

WATER UTILITY

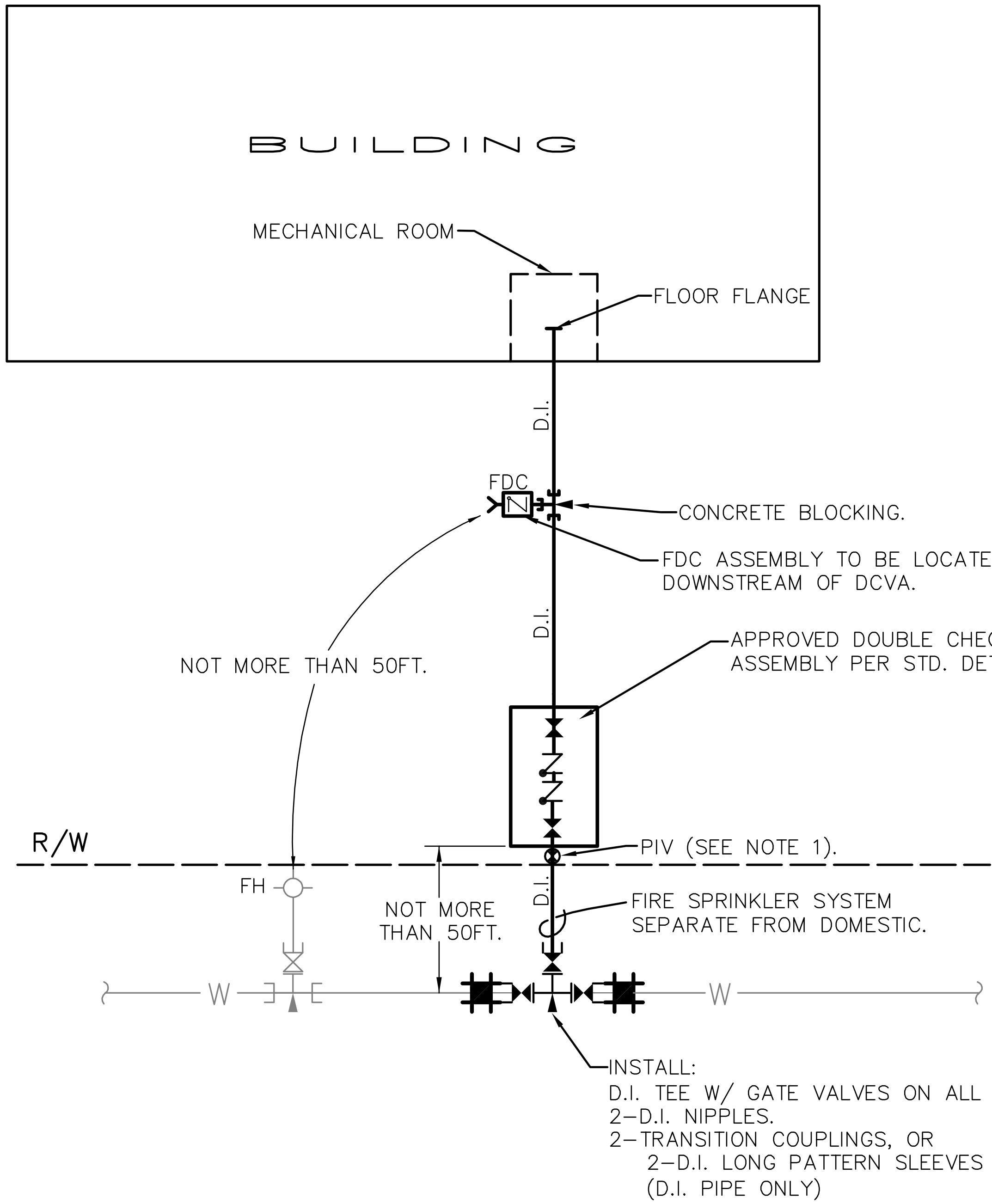
TITLE

OUTSIDE DCVA INSTALLATION FOR 1 1/2" & 2" COMMERCIAL FIRE SPRINKLER SYSTEMS

JANUARY 2013

NO SCALE

NO. W-39



NOTES:

1. WHERE POSSIBLE, PIV SHALL BE LOCATED ON THE FIRELINE BETWEEN THE R/W LINE AND THE FDC.
2. FIRE MARSHALL SHALL APPROVE FDC LOCATION.
3. TESTING IS REQUIRED BY A WASHINGTON STATE DEPARTMENT OF HEALTH CERTIFIED BACKFLOW ASSEMBLY TESTER UPON INSTALLATION AND ANNUALLY THEREAFTER. ASSEMBLY TO BE MAINTAINED BY OWNER.

City of Bellevue

WATER UTILITY

TITLE

OUTSIDE DCVA INSTALLATION FOR 3" AND LARGER COMMERCIAL FIRE SPRINKLER SYSTEMS

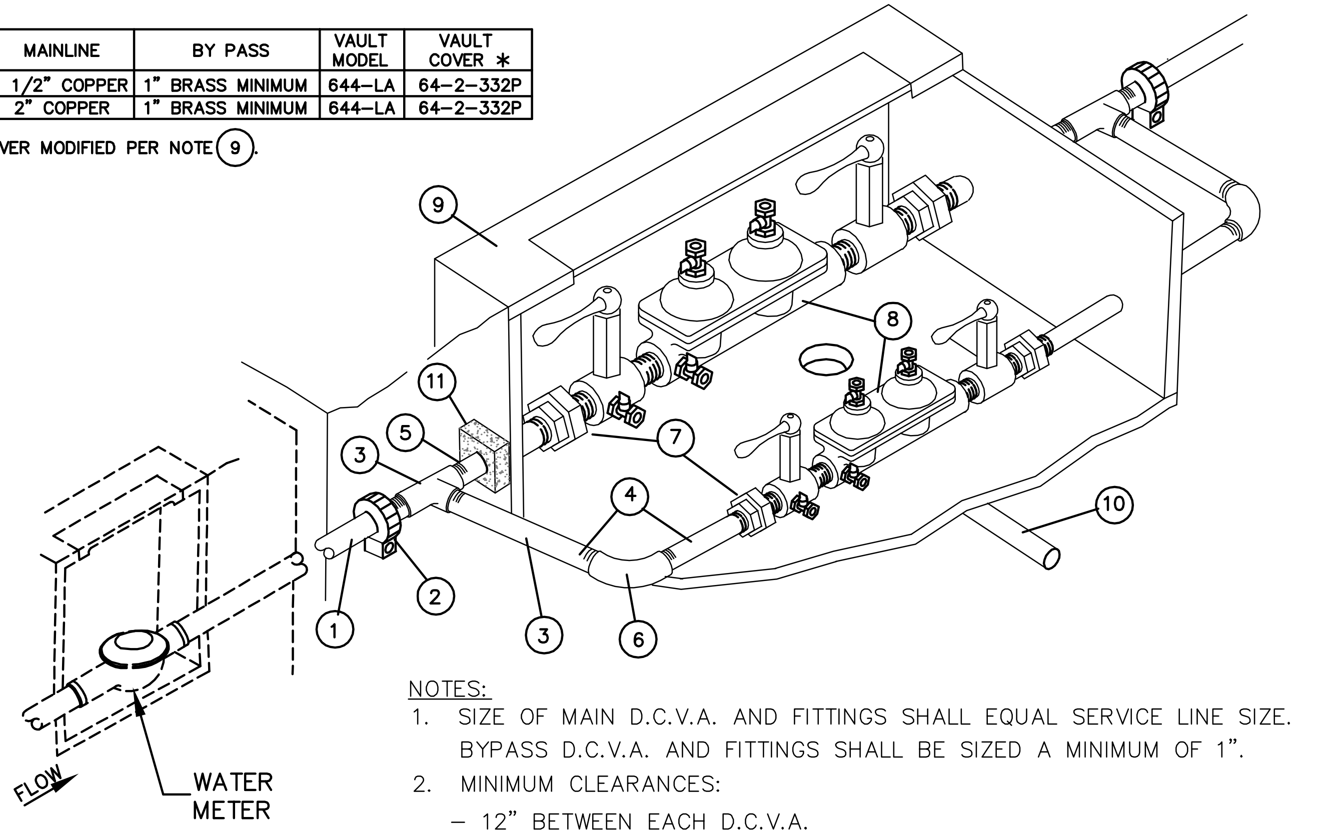
JANUARY 2013

NO SCALE

NO. W-40

METER SIZE	MAINLINE	BY PASS	VAULT MODEL	VAULT COVER ∗
1 1/2"	1 1/2" COPPER	1" BRASS MINIMUM	644–LA	64–2–332P
2"	2" COPPER	1" BRASS MINIMUM	644–LA	64–2–332P

∗ COVER MODIFIED PER NOTE (9).



NOTES:

1. SIZE OF MAIN D.C.V.A. AND FITTINGS SHALL EQUAL SERVICE LINE SIZE. BYPASS D.C.V.A. AND FITTINGS SHALL BE SIZED A MINIMUM OF 1".
2. MINIMUM CLEARANCES:
   - 12" BETWEEN EACH D.C.V.A.
   - 12" BETWEEN D.C.V.A. AND SIDE OF VAULT.
   - 12" BETWEEN D.C.V.A. AND VAULT FLOOR.
   - 24" SOIL COVER OVER SERVICE LINE.
3. INSTALL PLUGS IN ALL TEST COCKS.
4. TESTING IS REQUIRED BY A WASHINGTON STATE DEPARTMENT OF HEALTH CERTIFIED BACKFLOW ASSEMBLY TESTER UPON INSTALLATION AND ANNUALLY THEREAFTER. ASSEMBLY TO BE MAINTAINED BY OWNER.
5. BRASS FITTINGS.
6. WHERE ACCESS OPENING DOES NOT EXPOSE SHUT OFF VALVES, MIN. 18" CLEARANCE SHALL BE REQUIRED BETWEEN TOP OF VALVE AND UNDERSIDE OF VAULT COVER.

(1) COPPER TUBING, TYPE K. *

(2) COUPLING, MALE IRON PIPE THREAD BY PACK JOINT (COMPRESSION FITTING) FOR COPPER, MUELLER NO. H–15428 OR EQUAL. *

(3) BRASS TEE, MAIN LINE SIZE x 1", FEMALE IRON PIPE THREAD. *

(4) BRASS NIPPLE, LENGTH TO FIT, 1", MALE IRON PIPE THREAD. *

(5) BRASS NIPPLE, MAIN LINE SIZE, LENGTH TO FIT, MALE IRON PIPE THREAD. *

(6) BRASS ELBOW, 1", FEMALE IRON PIPE THREAD. *

(7) BRASS UNION, MALE x FEMALE IRON PIPE THREAD. *

(8) WASHINGTON STATE APPROVED DOUBLE CHECK VALVE ASSEMBLY. MUST BE INSTALLED IN APPROVED ORIENTATION.

(9) CONCRETE VAULT WITH 2 LOCKING ALUMINUM LW HATCH DOORS (PART NO. HHD–36"x72"), RATED FOR H–30 LOADING, WITH SLIP RESISTANT TREATMENT PER SECTION W4–17 OF THE ENGINEERING STANDARDS. COVER TO READ "WATER". SIZE VAULT TO PROVIDE MINIMUM CLEARANCES LISTED IN NOTE 2.

(10) DRAIN, SLOPE TO DAYLIGHT OR STORM DRAINAGE SYSTEM (DO NOT CONNECT TO SANITARY SEWER). WIRE MESH RODENT SCREEN OVER DRAIN.

(11) VAULT PENETRATION THRUST BLOCK SEE STANDARD DETAIL W–56.

* TYPICAL, EACH SIDE OF D.C.V.A.

City of Bellevue

WATER UTILITY

TITLE

1 1/2" AND 2" DOMESTIC DOUBLE CHECK VALVE ASSEMBLY FOR CONTINUOUS SUPPLY (OUTSIDE INSTALLATION)

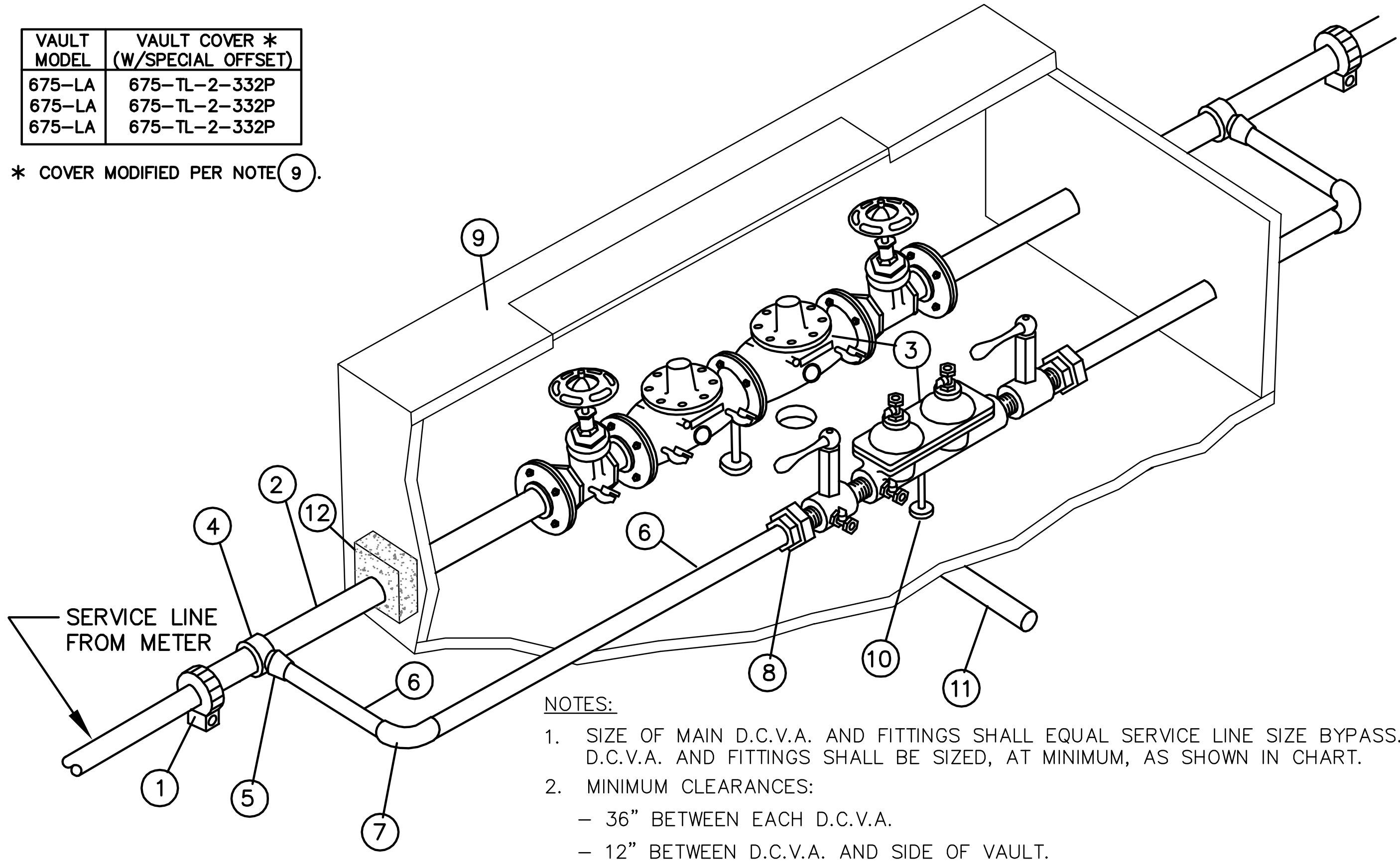
NO. W–41

JANUARY 2013

NO SCALE

VAULT MODEL	VAULT COVER * (W/SPECIAL OFFSET)
675-LA	675-TL-2-332P
675-LA	675-TL-2-332P
675-LA	675-TL-2-332P

* COVER MODIFIED PER NOTE 9.



NOTES:

1. SIZE OF MAIN D.C.V.A. AND FITTINGS SHALL EQUAL SERVICE LINE SIZE BYPASS. D.C.V.A. AND FITTINGS SHALL BE SIZED, AT MINIMUM, AS SHOWN IN CHART.
2. MINIMUM CLEARANCES:
   - 36" BETWEEN EACH D.C.V.A.
   - 12" BETWEEN D.C.V.A. AND SIDE OF VAULT.
   - 12" BETWEEN D.C.V.A. AND VAULT FLOOR.
   - 24" SOIL COVER OVER SERVICE LINE.
3. INSTALL PLUGS IN ALL TEST COCKS.
4. TESTING IS REQUIRED BY A WASHINGTON STATE DEPARTMENT OF HEALTH CERTIFIED BACKFLOW ASSEMBLY TESTER UPON INSTALLATION AND ANNUALLY THEREAFTER. ASSEMBLY TO BE MAINTAINED BY OWNER.
5. PROVIDE LADDER AND LADDER-UP PER DETAIL W-19.
6. WHERE ACCESS OPENING DOES NOT EXPOSE SHUT OFF VALVES MIN. 18" CLEARANCE SHALL BE REQUIRED BETWEEN TOP OF VALVE AND UNDERSIDE OF VAULT COVER.
7. MINIMUM 2' OF LEVEL, UNOBSTRUCTED AREA AROUND HATCHES.
8. LOCATE HATCH PER DETAIL W-17.

METER SIZE	MAIN-LINE	BY PASS
3"	3"D.I.	1 1/2" COPPER MINIMUM
4"	4"D.I.	1 1/2" COPPER MINIMUM
6"	6"D.I.	2" COPPER MINIMUM

(1) FLEX COUPLING , ROCKWELL 441 OR EQUAL. *

(2) D.I. PIPE, P.E. X FL., LENGTH TO FIT. *

(3) STATE APPROVED INTERNALLY LOADED DOUBLE CHECK VALVE ASSEMBLY, COMPLETE WITH (2) FULL FLOW BALL VALVE SHUT-OFF VALVES AND TEST COCKS. *

(4) DOUBLE STRAP SERVICE SADDLE, ROMAC 202S WITH IPS TAP, OR EQUAL. *

(5) COUPLING, OUTSIDE IRON PIPE THREAD TO COPPER COMPRESSION CONNECTION, MUELLER H-15428, OR EQUAL. *

(6) COPPER TUBING, TYPE K. *

(7) 1/4 BEND COUPLING, COPPER TO COPPER, MUELLER H-15526, OR EQUAL. *

(8) COUPLING, COPPER COMPRESSION CONNECTION BY FEMALE IRON PIPE THREAD, MUELLER H-15451, OR EQUAL. *

(9) CONCRETE VAULT WITH 2 LOCKING ALUMINUM LW HATCH DOORS (PART NO. HHD-36"x72"), RATED FOR H-30 LOADING, WITH SLIP RESISTANT TREATMENT PER SECTION W4-17 OF THE ENGINEERING STANDARDS. COVER TO READ "WATER". SIZE VAULT TO PROVIDE MINIMUM CLEARANCES LISTED IN NOTE 2.

(10) ADJUSTABLE PIPE STANCHIONS, BOLTED TO FLOOR.

(11) DRAIN, SLOPE TO DAYLIGHT OR STORM DRAINAGE SYSTEM (DO NOT CONNECT TOSANITARY SEWER). WIRE MESH RODENT SCREEN OVER DRAIN.

(12) VAULT PENETRATION THRUST BLOCK SEE STANDARD DETAIL W-56.

* TYPICAL, EACH SIDE OF D.C.V.A.

CITY OF BELLEVUE WASHINGTON

City of Bellevue

WATER UTILITY

TITLE

3" TO 6" DOMESTIC DOUBLE CHECK VALVE ASSEMBLY FOR CONTINUOUS SUPPLY (OUTSIDE INSTALLATION)

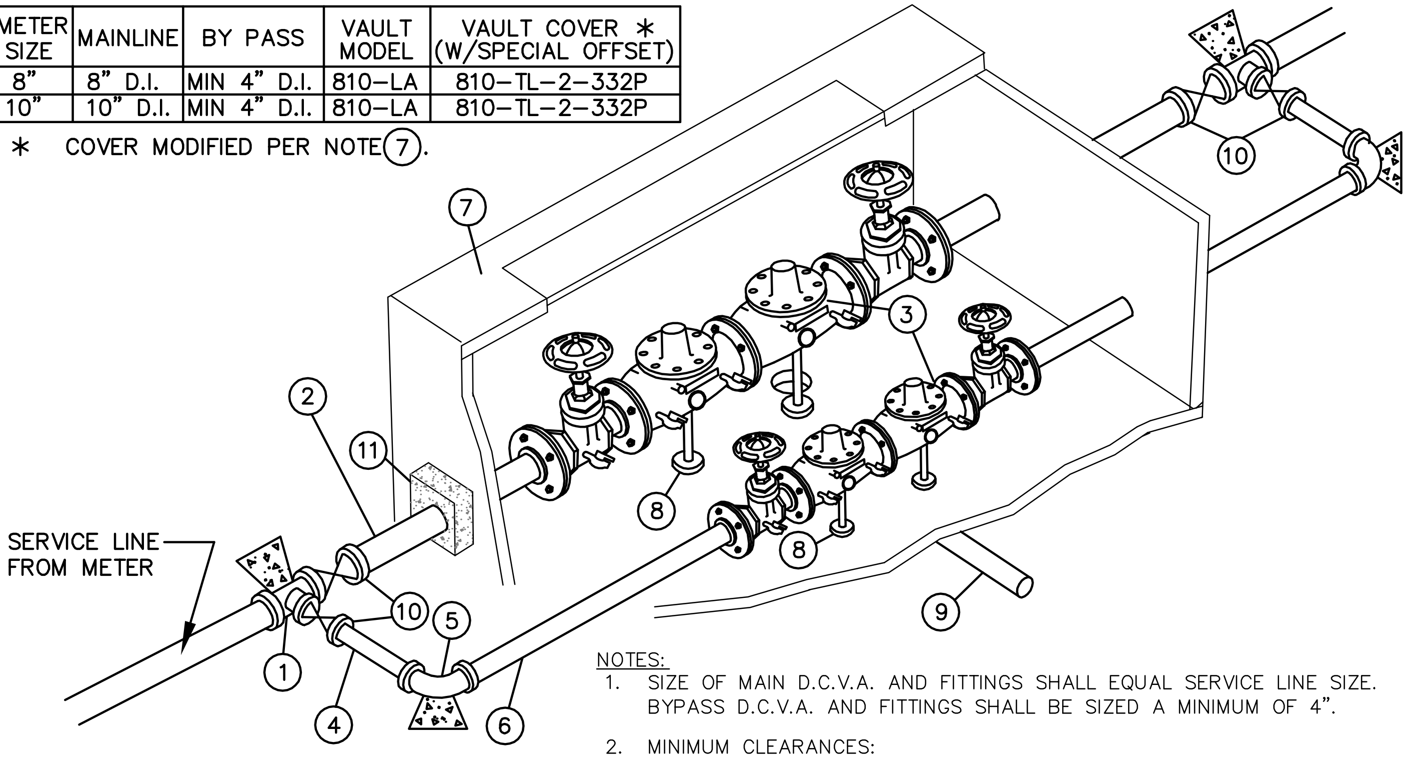
NO. W-42

JANUARY 2013

NO SCALE

METER SIZE	MAINLINE	BY PASS	VAULT MODEL	VAULT COVER * (W/SPECIAL OFFSET)
8"	8" D.I.	MIN 4" D.I.	810-LA	810-TL-2-332P
10"	10" D.I.	MIN 4" D.I.	810-LA	810-TL-2-332P

* COVER MODIFIED PER NOTE (7).



NOTES:

1. SIZE OF MAIN D.C.V.A. AND FITTINGS SHALL EQUAL SERVICE LINE SIZE. BYPASS D.C.V.A. AND FITTINGS SHALL BE SIZED A MINIMUM OF 4".
2. MINIMUM CLEARANCES:
   - 36" BETWEEN EACH D.C.V.A.
   - 12" BETWEEN D.C.V.A. AND SIDE OF VAULT.
   - 12" BETWEEN D.C.V.A. AND VAULT FLOOR.
   - 24" SOIL COVER OVER SERVICE LINE.
3. INSTALL PLUGS IN ALL TEST COCKS.
4. TESTING IS REQUIRED BY A WASHINGTON STATE DEPARTMENT OF HEALTH CERTIFIED BACKFLOW ASSEMBLY TESTER UPON INSTALLATION AND ANNUALLY THEREAFTER. ASSEMBLY TO BE MAINTAINED BY OWNER.
5. PROVIDE LADDER AND LADDER-UP PER DETAIL W-19.
6. WHERE ACCESS OPENING DOES NOT EXPOSE SHUT OFF VALVES MIN. 24" CLEARANCE SHALL BE REQUIRED BETWEEN TOP OF VALVE AND UNDERSIDE OF VAULT COVER.
7. ALL FITTINGS OUTSIDE VAULT SHALL INCLUDE THRUST BLOCKING AND JOINT RESTRAINT DEVICES.
8. MINIMUM 2' OF LEVEL, UNOBSTRUCTED AREA AROUND HATCHES.
9. LOCATE HATCH PER DETAIL W-17.

(1) TEE, MJ, MAINLINE SIZE BY 4" MINIMUM BRANCH. *

(2) D.I. PIPE, P.E. X FL., LENGTH TO FIT. *

(3) STATE APPROVED INTERNALLY LOADED DOUBLE CHECK VALVE ASSEMBLY, COMPLETE WITH (2) FULL FLOW BALL VALVE SHUT-OFF VALVES AND TEST COCKS.

(4) 4" MINIMUM DI PIPE, PE x PE, LENGTH TO FIT. *

(5) 4" MINIMUM 90° BEND, MJ. *

(6) 4" MINIMUM DI PIPE, PE x FL, LENGTH TO FIT. *

(7) CONCRETE VAULT WITH 2 LOCKING ALUMINUM LW HATCH DOORS (PART NO. HHD-36"x72"), RATED FOR H-30 LOADING, WITH SLIP RESISTANT TREATMENT PER SECTION W4-17 OF THE ENGINEERING STANDARDS. COVER TO READ "WATER". SIZE VAULT TO PROVIDE MINIMUM CLEARANCES LISTED IN NOTE 2.

(8) ADJUSTABLE PIPE STANCHIONS, BOLTED TO FLOOR.

(9) DRAIN, SLOPE TO DAYLIGHT OR STORM DRAINAGE SYSTEM (DO NOT CONNECT TO SANITARY SEWER). WIRE MESH RODENT SCREEN OVER DRAIN.

(10) GATE VALVE, F.L.xM.J. (WITH VALVE BOX AND COVER).

(11) VAULT PENETRATION THRUST BLOCK SEE STANDARD DETAIL W-56 FOR BOTH MAINLINE AND BYPASS.

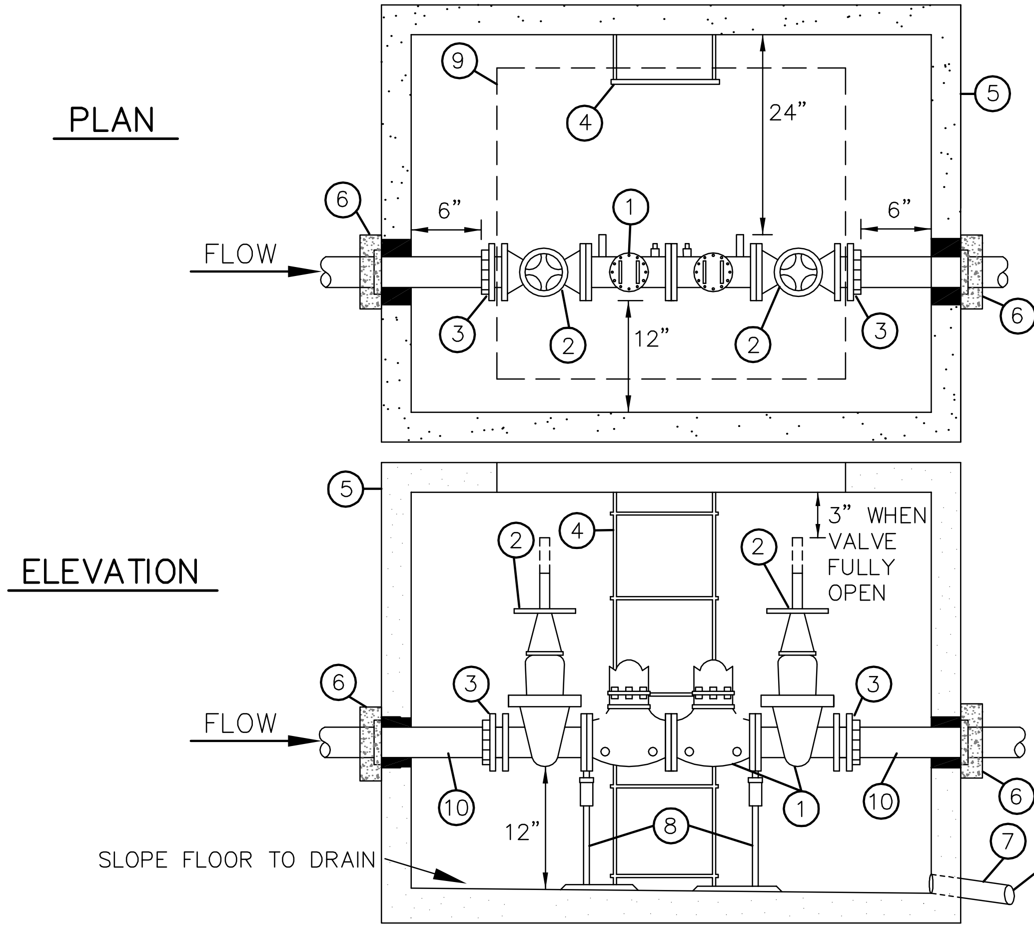
* TYPICAL, EACH SIDE OF D.C.V.A.

JANUARY 2013 NO SCALE

City of Bellevue — WATER UTILITY

TITLE 8" AND 10" DOMESTIC DOUBLE CHECK VALVE ASSEMBLY FOR CONTINUOUS SUPPLY (OUTSIDE INSTALLATION)

NO. W-43



(1) STATE APPROVED DOUBLE CHECK VALVE ASSEMBLY, COMPLETE WITH (2) RESILIENT SEATED O.S.&Y. VALVES AND (4) RESILIENT SEATED TEST COCKS.

(2) EACH VALVE SHALL BE MARKED WITH MODEL NUMBER WITH DESIGNATION OF RESILIENT SEAT: SUCH AS "RS" OR "R", WHICH MUST BE CAST, MOLDED, OR AFFIXED ONTO THE BODY OR BONNET OF THE VALVE. ALL FERROUS BODIED VALVES SHALL BE COATED WITH A MINIMUM OF 4MLS. OF EPOXY OR EQUIVALENT POLYMERIZED COATING.

(3) MEGAFLANGE

(4) ONE GALVANIZED STEEL LADDER TO BE SECURED TO VAULT WITH LADDER-UP (BILCO MODEL LU-2). LADDER TO BE ATTACHED TO VAULT PER STANDARD DETAIL W-19.

(5) CONCRETE VAULT WITH 2 LOCKING ALUMINUM LW HATCH DOORS (PART NO. HHD-36"x72"), RATED FOR H-30 LOADING WITH SLIP RESISTANT TREATMENT PER SECTION W4-17 OF THE ENGINEERING STANDARDS. COVER TO READ "WATER". VAULT SHALL BE EQUAL TO UTILITY VAULT CO. MODEL LISTED IN TABLE BELOW.

(6) WATER TIGHT GROUT. RESTRAIN INLET/OUTLET PIPE WITH MEGALUG MID-SPAN RESTRAINT AND THRUST BLOCK ADJACENT TO VAULT SEE STANDARD DETAIL W-56.

(7) DRAIN, SLOPE TO DAYLIGHT OR STORM DRAINAGE SYSTEM, MINIMUM DIAMETER 6".

(8) TWO ADJUSTABLE PIPE STANCHIONS, BOLTED TO FLOOR.

(9) ACCESS TO BE CENTERED OVER ASSEMBLY.

(10) CL. 52 D.I., PExFL WITH RETAINER GLANDS.

(11) INSTALL WIRE MESH RODENT SCREEN OVER DRAIN OUTLET.

SIZE	MIN. VAULT SIZE (INSIDE) W	L	H	UTIL. VAULT CO. MODEL	UTIL. VAULT CO. COVER *
3"	3'-8"	4'-8"	3'-3"	644-LA	64-2-332P
4"	3'-10"	5'-3"	3'-8"	575-LA	57TL-2-332P
6"	4'-0"	6'-6"	4'-5"	577-LA	57TL-20332P
8"	4'-5"	7'-8"	5'-3"	4484-LA	4484-TL2-332P
10"	4'-8"	8'-8"	6'-1"	5106-LA	5106-TL3-332

* COVER MODIFIED PER NOTE (5).

NOTES:

1. TESTING IS REQUIRED BY A WASHINGTON STATE DEPARTMENT OF HEALTH CERTIFIED BACKFLOW ASSEMBLY TESTER UPON INSTALLATION AND ANNUALLY THEREAFTER. ASSEMBLY TO BE MAINTAINED BY OWNER.
2. TEE AND GATE VALVES REQUIRED ON MAIN.
3. ALL CLEARANCES SHOWN ARE MINIMUM.
4. VAULTS SHALL NOT BE INSTALLED IN AREAS WITH VEHICULAR TRAFFIC.
5. IN CENTRAL BUSINESS DISTRICT, 3" THROUGH 6" ASSEMBLIES SHALL CONNECT TO WATER MAIN WITH 8" PIPE.
6. MINIMUM 2' OF LEVEL, UNOBSTRUCTED AREA AROUND HATCHES.

City of Bellevue

WATER UTILITY

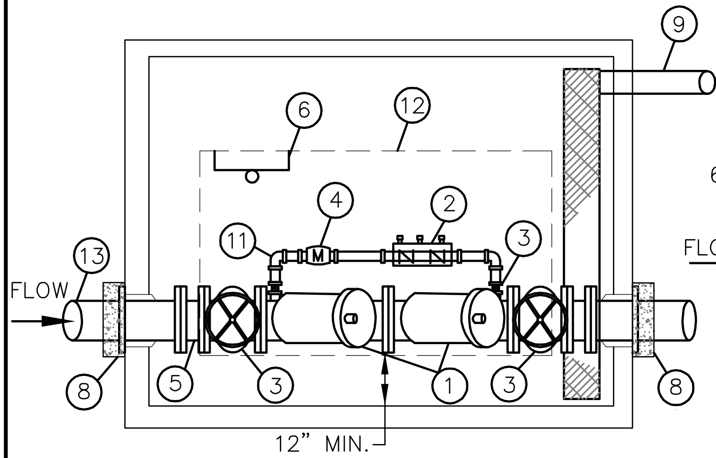
TITLE

3" TO 10" DOUBLE CHECK VALVE ASSEMBLY FOR DOMESTIC AND IRRIGATION SERVICES (OUTSIDE INSTALLATION)

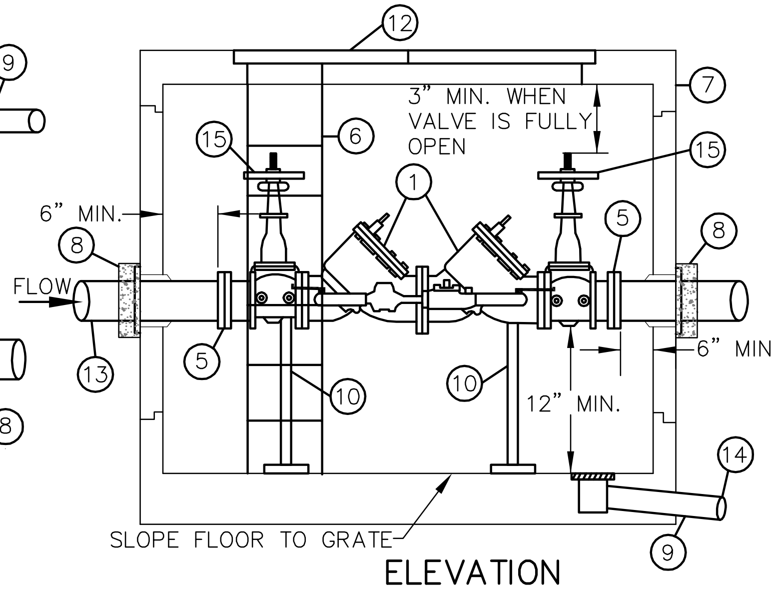
NO. W-44

JANUARY 2013

NO SCALE



PLAN



ELEVATION

1. STATE APPROVED DOUBLE CHECK VALVE ASSEMBLY, COMPLETE WITH (2) RESILIENT SEATED O.S.&Y. VALVES AND (4) RESILIENT SEATED TEST COCKS, AND BRASS OR COPPER DETECTOR BY-PASS. FACE TEST COCKS TOWARD CENTER OF VAULT AND ACCESSIBLE.
2. STATE APPROVED 3/4" DOUBLE CHECK VALVE ASSEMBLY, COMPLETE WITH (2) RESILIENT SEATED BALL VALVES AND (4) RESILIENT SEATED TEST COCKS. FACE TEST COCKS TOWARD CENTER OF VAULT.
3. EACH VALVE SHALL BE MARKED WITH MODEL NUMBER WITH DESIGNATION OF RESILIENT SEAT: SUCH AS "RS" OR "R", WHICH MUST BE CAST, MOLDED, OR AFFIXED ONTO THE BODY OR BONNET OF THE VALVE. ALL FERROUS BODIED VALVES SHALL BE COATED WITH A MINIMUM OF 4MLS. OF EPOXY OR EQUIVALENT POLYMERIZED COATING.
4. 3/4" METER (CUBIC FEET READING)
5. MEGAFLANGE
6. ONE GALVANIZED STEEL LADDER TO BE SECURED TO VAULT WITH LADDER-UP (BILCO MODEL LU-2). LADDER TO BE ATTACHED TO VAULT PER STANDARD DETAIL W-19.
7. CONCRETE VAULT WITH 2 LOCKING ALUMINUM LW HATCH DOORS (PART NO. HHD-42"x72"), RATED FOR H-30 LOADING, OFFSET WITH SLIP RESISTANT TREATMENT PER SECTION W4-17 OF THE ENGINEERING STANDARDS. COVER TO READ "WATER". VAULT SHALL BE EQUAL TO UTILITY VAULT CO. MODEL LISTED IN THE TABLE BELOW.
8. WATER TIGHT GROUT. RESTRAIN INLET/OUTLET PIPE WITH MEGALUG MID-SPAN RESTRAINT AND THRUST BLOCK ADJACENT TO VAULT SEE STANDARD DETAIL W-56.
9. DRAIN, SLOPE TO DAYLIGHT OR STORM DRAINAGE SYSTEM, MINIMUM DIAMETER 6".
10. TWO ADJUSTABLE PIPE STANCHIONS, BOLTED TO FLOOR.
11. ALL PLUMBING FOR BY-PASS TO BE COPPER AND BRASS.
12. ACCESS TO BE CENTERED OVER ASSEMBLY.
13. CL. 52 D.I., PExFL WITH RETAINER GLANDS.
14. INSTALL WIRE MESH RODENT SCREEN OVER DRAIN OUTLET.
15. 2 VALVE SUPERVISORY SWITCHES, SPDT, PER FIRE DEPARTMENT REQUIREMENTS (1 SWITCH PER VALVE).

NOTES:

1. TESTING IS REQUIRED BY A WASHINGTON STATE DEPARTMENT OF HEALTH CERTIFIED BACKFLOW ASSEMBLY TESTER UPON INSTALLATION AND ANNUALLY THEREAFTER. ASSEMBLY TO BE MAINTAINED BY OWNER.
2. TEE & GATE VALVES REQUIRED ON MAIN.
3. WHEN DOUBLE CHECK VALVE ASSEMBLY IS USED IN SAME LINE WITH DOMESTIC BUILDING METER, METERED DETECTOR BYPASS SHALL BE OMITTED.
4. ALL CLEARANCES SHOWN ARE MINIMUM.
5. VAULTS SHALL NOT BE INSTALLED IN AREAS WITH VEHICULAR TRAFFIC.
6. IN CENTRAL BUSINESS DISTRICT, 3" THROUGH 6" ASSEMBLIES SHALL CONNECT TO WATER MAIN WITH 8" PIPE.
7. FDC TO BE LOCATED DOWNSTREAM OF DCVA. FDC LINE & CHECK VALVE MAY BE ROUTED INSIDE THE DCVA VAULT PROVIDED ALL PROVISIONS IN STANDARD DETAIL W-48 ARE MET.
8. MINIMUM 2' OF LEVEL, UNOBSTRUCTED AREA AROUND HATCHES.
9. SECURE A VALVE MARKER, PER DETAIL W-55, TO EACH GATE VALVE HANDLE.
10. LONGER VALVE ASSEMBLIES MAY REQUIRE A LARGER VAULT TO MEET THE REQUIRED CLEARANCES. SUBMIT FOR APPROVAL.

SIZE	MIN. VAULT SIZE (INSIDE) W	L	H	UTIL. VAULT CO. MODEL	UTIL. VAULT CO. COVER *
3"	4'-2"	4'-8"	3'-3"	675-WA	675-2-332P
4"	4'-6"	5'-3"	3'-8"	675-WA	675-2-332P
6"	4'-8"	6'-6"	4'-5"	675-WA	675-2-332P
8"	5'-0"	7'-8"	5'-3"	687-LA	687-TL-2-332
10"	5'-2"	8'-8"	6'-1"	5106-LA	5106-TL3-332

* COVER MODIFIED PER NOTE 7.

City of Bellevue

WATER UTILITY

TITLE

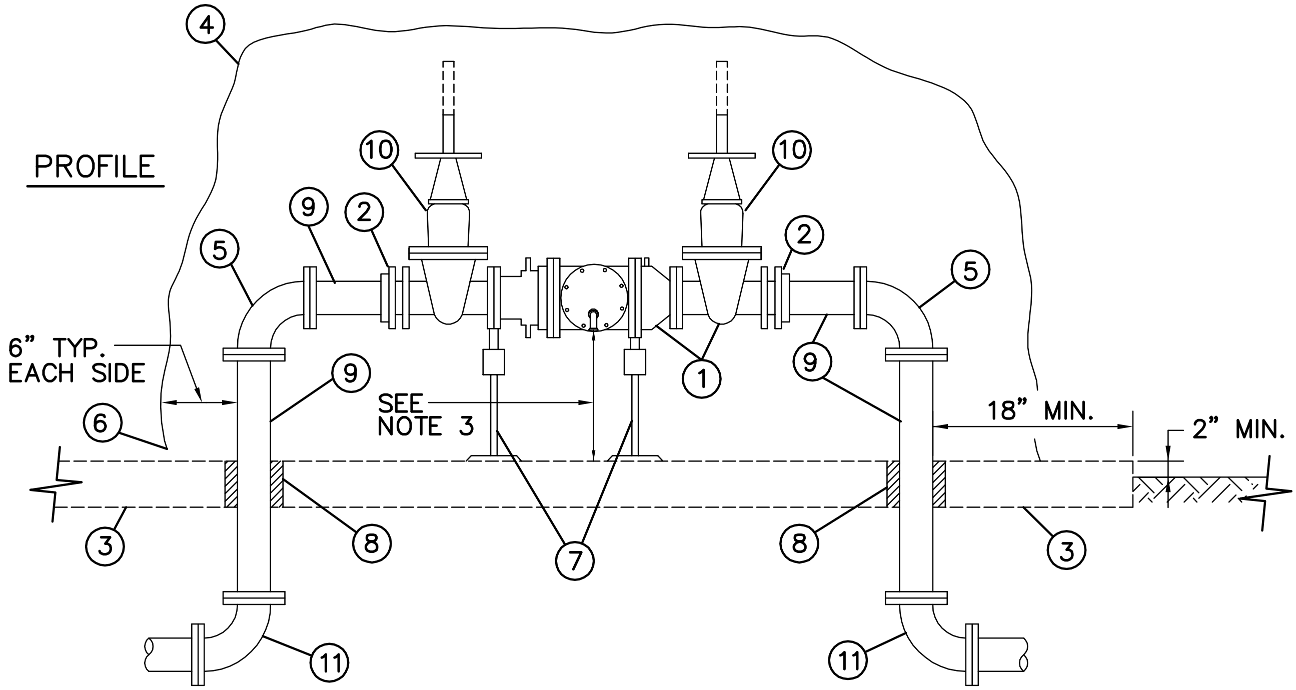
3" TO 10" DOUBLE CHECK DETECTOR ASSEMBLY FOR FIRE SPRINKLER SYSTEMS (OUTSIDE INSTALLATION)

NO. W-45

JANUARY 2013

NO SCALE

NOTICE: OUTSIDE–INSTALLED RPBA IS <u>NOT</u> ALLOWED IN BURIED VAULTS. DEVELOPER SHALL PROVIDE UTILITIES WITH A DESIGN FOR AN ABOVE–GROUND ENCLOSURE THAT DRAINS TO DAY LIGHT FOR APPROVAL. CLEARANCES SHOWN BELOW SHALL APPLY TO THE ENCLOSURE.



(1) STATE APPROVED REDUCED PRESSURE BACKFLOW ASSEMBLY, COMPLETE WITH (2) RESILIENT SEATED O.S.&Y. GATE VALVES (2" AND SMALLER: FULL FLOW RESILIENT SEATED BALL VALVES) AND (4) RESILIENT SEATED TEST COCKS.
(2) MEGAFLANGE. (2" AND SMALLER: BRASS UNION, M.I.P.T.xF.I.P.T.).
(3) 4" CONC. (2,000 PSI) SLAB EXTENDED 6" BEYOND ENCLOSURE (ALL DIRECTIONS). REINFORCED W/ 6x6 W2.9xW2.9 WWF.
(4) APPROVED ENCLOSURE. CONTRACTOR TO VERIFY REQUIRED SIZE.
(5) 90° BEND, FL (2" AND SMALLER: BRASS, F.I. P.T.).
(6) ENCLOSURE DRAIN, SIZED IN ACCORDNCE WITH PNWS–AWWA CROSS CONNECTION CONTROL MANUAL (7TH ADDITION) FIGURE 6–1.
(7) TWO ADJUSTABLE PIPE STANCHIONS, BOLTED TO SLAB.
(8) PVC SLEEVE THROUGH SLAB.
(9) CL. 52 D.I., PExFL (2" AND SMALLER: BRASS NIPLE, M.I.P.T.)
(10) EACH VALVE SHALL BE MARKED WITH MODEL NUMBER WITH DESIGNATION OF RESILIENT SEAT: SUCH AS "RS" OR "R", WHICH MUST BE CAST, MOLDED, OR AFFIXED ONTO THE BODY OR BONNET OF THE VALVE. ALL FERROUS BODIED VALVES SHALL BE COATED WITH A MINIMUM OF 4MLS. OF EPOXY OR EQUIVALENT POLYMERIZED COATING.
(11) 90° BEND, RESTRAINED JOINT (2" AND SMALLER: BRASS, COMPRESSION x F.I.P.T.).

NOTES:
1. PROVIDE ELECTRICAL HEAT TAPE FREEZE PROTECTION.
2. WHEN THE REDUCED PRESSURE ASSEMBLY IS LOCATED INSIDE A BUILDING A SIZED DRAIN LINE SHALL BE PROVIDED FOR RELIEF PORT. THERE MUST BE AN APPROVED AIR GAP BETWEEN THE RELIEF PORT AND DRAIN.
3. ALLOW 12"+ NOMINAL DIAMETER OF ASSEMBLY CLEARANCE BELOW RELIEF PORT FOR REPAIR. ALSO PROVIDE 12" MIN. AIR GAP CLEARANCE FROM TOP OF DRAIN PIPE.
4. REDUCED PRESSURE BACKFLOW ASSEMBLY WILL BE ALLOWED TO BE INSTALLED IN VAULTS ONLY IN CASES WHERE NO OTHER MEANS OF INSTALLATION IS AVAILABLE AND AS APPROVED BY A CITY OF BELLEVUE WATER QUALITY TECHNICIAN.
5. TESTING IS REQUIRED BY A WASHINGTON STATE DEPARTMENT OF HEALTH CERTIFIED BACKFLOW ASSEMBLY TESTER UPON INSTALLATION AND ANNUALLY THEREAFTER. ASSEMBLY TO BE MAINTAINED BY OWNER.
6. ALL CLEARANCES SHOWN ARE MINIMUM.
7. ENCLOSURES SHALL NOT BE INSTALLED IN AREAS WITH VEHICULAR TRAFFIC.
8. TEE AND GATE VALVES REQUIRED ON MAIN.
9. IN CENTRAL BUSINESS DISTRICT, 3" THROUGH 6" ASSEMBLIES SHALL CONNECT TO WATER MAIN WITH 8" PIPE.
10. MINIMUM 2' OF LEVEL, UNOBSTRUCTED AREA AROUND ENCLOSURES.
11. RPBA INSTALLATIONS THAT DIFFER FROM THE STANDARD DETAIL MUST BE APPROVED BY THE CROSS CONNECTION PROGRAM ADMINISTRATOR (425–452–5208) AND WILL BE REVIEWED ON A CASE–BY–CASE BASIS TO ENSURE THEY MEET CURRENT MINIMUM REQUIREMENTS FOR INSTALLATION AND FREEZE PROTECTION.

City of Bellevue — WATER UTILITY

TITLE

REDUCED PRESSURE BACKFLOW ASSEMBLY FOR DOMESTIC AND IRRIGATION SERVICE (OUTSIDE INSTALLATION)

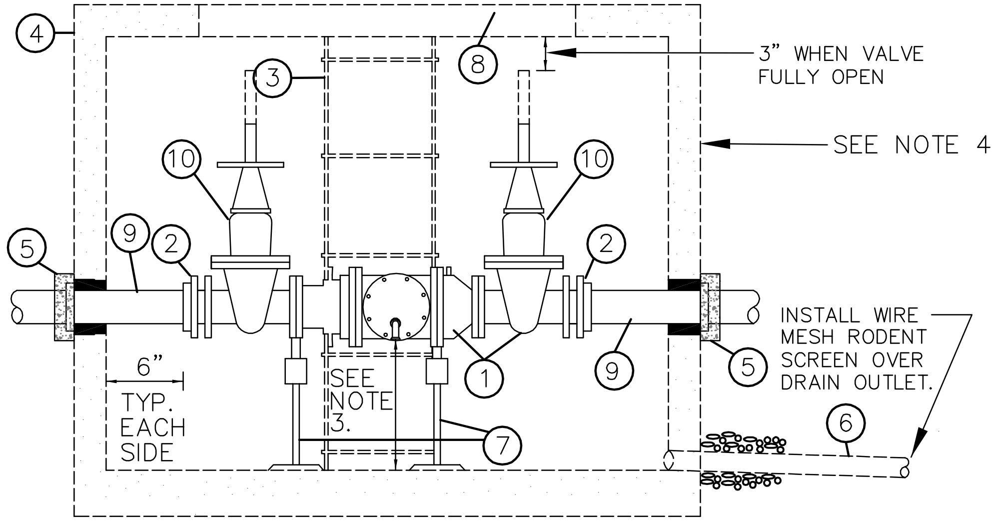
NO. W–46A

JANUARY 2013

NO SCALE

NOTICE: OUTSIDE–INSTALLED RPBA IS <u>NOT</u> ALLOWED IN BURIED VAULTS. DEVELOPER SHALL PROVIDE UTILITIES WITH A DESIGN FOR AN ABOVE–GROUND ENCLOSURE THAT DRAINS TO DAY LIGHT FOR APPROVAL. THE BURIED VAULT DETAIL SHOWN BELOW IS ONLY ALLOWED WHEN GIVEN SPECIAL APPROVAL BY THE CITY.

PROFILE



(1) STATE APPROVED REDUCED PRESSURE BACKFLOW ASSEMBLY, COMPLETE WITH (2) RESILIENT SEATED O.S.&Y. GATE VALVES AND (4) RESILIENT SEATED TEST COCKS. FACE TEST COCKS TOWARD CENTER OF VAULT AND ACCESSABLE.

(2) MEGAFLANGE

(3) ONE GALVANIZED STEEL LADDER TO BE SECURED TO VAULT WITH LADDER–UP (BILCO MODEL LU–2). LADDER TO BE ATTACHED TO VAULT PER STANDARD DETAIL W–19.

(4) CONCRETE VAULT WITH 2 LOCKING ALUMINUM LW HATCH DOORS (PART NO. HHD–36"x72") RATED FOR H–30 LOADING WITH SLIP RESISTANT TREATMENT PER SECTION W4–17 OF THE ENGINEERING STANDARDS. COVER TO READ "WATER". VAULT SHALL BE EQUAL TO UTILITY VAULT CO. MODEL LISTED IN THE TABLE BELOW.

(5) WATER TIGHT GROUT. RESTRAIN INLET/OUTLET PIPE WITH MEGALUG MID–SPAN RESTRAINT AND THRUST BLOCK ADJACENT TO VAULT SEE STANDARD DETAIL W–56.

(6) DRAIN, SLOPE TO DAYLIGHT WITH BORE SIGHTED DAYLIGHT DRAIN CLEARLY VISIBLE END TO END WITH STRAIGHT PIPE, SIZED TO MEET FLOW REQUIREMENTS OF RPBA RELIEF VENT.

(7) TWO ADJUSTABLE PIPE STANCHIONS, BOLTED TO FLOOR.

(8) ACCESS TO BE CENTERED OVER ASSEMBLY.

(9) CL. 52 D.I., PExFL WITH RETAINER GLANDS.

(10) EACH VALVE SHALL BE MARKED WITH MODEL NUMBER WITH DESIGNATION OF RESILIENT SEAT: SUCH AS "RS" OR "R", WHICH MUST BE CAST, MOLDED, OR AFFIXED ONTO THE BODY OR BONNET OF THE VALVE. ALL FERROUS BODIED VALVES SHALL BE COATED WITH A MINIMUM OF 4MLS. OF EPOXY OR EQUIVALENT POLYMERIZED COATING.

SIZE	MIN. VAULT SIZE (INSIDE) W	L	H	UTIL. VAULT CO. MODEL	UTIL. VAULT CO. COVER *
3"	4'–3"	4'–8"	3'–11"	575–LA	64–2–332P
4"	4'–3"	5'–3"	4'–7"	577–LA	57TL–2–332P
6"	4'–4"	6'–6"	5'–5"	4484–LA	4484–TL2–332P
8"	5'–2"	7'–7"	7'–1"	687–LA	687–TL–2–332
10"	5'–4"	8'–8"	8'–0"	5106–2X	5106–TL3–332

* COVER MODIFIED PER NOTE (4).

NOTES:
1. DAYLIGHT DRAIN MUST BE ABLE TO BE LINE SIGHTED, INSTALLED ABOVE MAXIMUM FLOOD LEVEL, AND BE ABLE TO HANDLE THE VOLUME OF WATER THAT CAN BE DISCHARGED FROM THE RELIEF VALVE PORT.
2. WHEN THE REDUCED PRESSURE ASSEMBLY IS LOCATED INSIDE A BUILDING A SIZED DRAIN LINE SHALL BE PROVIDED FOR RELIEF PORT. THERE MUST BE AN APPROVED AIR GAP BETWEEN THE RELIEF PORT AND DRAIN.
3. ALLOW 12"+ NOMINAL DIAMETER OF ASSEMBLY CLEARANCE BELOW RELIEF PORT FOR REPAIR. ALSO PROVIDE 12" MIN. AIR GAP CLEARANCE FROM TOP OF DRAIN PIPE.
4. REDUCED PRESSURE BACKFLOW ASSEMBLY WILL BE ALLOWED TO BE INSTALLED IN VAULTS ONLY IN CASES WHERE NO OTHER MEANS OF INSTALLATION IS AVAILABLE AND AS APPROVED BY A CITY OF BELLEVUE WATER QUALITY TECHNICIAN.
5. TESTING IS REQUIRED BY A WASHINGTON STATE DEPARTMENT OF HEALTH CERTIFIED BACKFLOW ASSEMBLY TESTER UPON INSTALLATION AND ANNUALLY THEREAFTER. ASSEMBLY TO BE MAINTAINED BY OWNER.
6. MINIMUM CLEARANCE BETWEEN ASSEMBLY AND WALL ON LADDER SIDE OF VAULT IS 24". MINIMUM CLEARANCE FROM OPPOSITE WALL IS 12". ALL CLEARANCES SHOWN ARE MINIMUM.
7. VAULTS SHALL NOT BE INSTALLED IN AREAS WITH VEHICULAR TRAFFIC.
8. TEE AND GATE VALVES REQUIRED ON MAIN.
9. IN CENTRAL BUSINESS DISTRICT, 3" THROUGH 6" ASSEMBLIES SHALL CONNECT TO WATER MAIN WITH 8" PIPE.
10. MINIMUM 2' OF LEVEL, UNOBSTRUCTED AREA AROUND HATCHES.
11. RPBA INSTALLATIONS THAT DIFFER FROM THE STANDARD DETAIL MUST BE APPROVED BY THE CROSS CONNECTION PROGRAM ADMINISTRATOR (425–452–5208) AND WILL BE REVIEWED ON A CASE–BY–CASE BASIS TO ENSURE THEY MEET CURRENT MINIMUM REQUIREMENTS FOR INSTALLATION AND FREEZE PROTECTION.

City of Bellevue

WATER UTILITY

TITLE

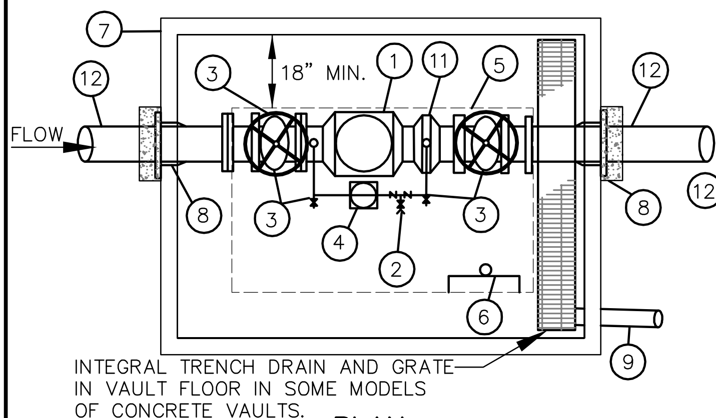
3" TO 10" REDUCED PRESSURE BACKFLOW ASSEMBLY FOR DOMESTIC AND IRRIGATION SERVICE (BURIED VAULT INSTALLATION)

NO. W–46B

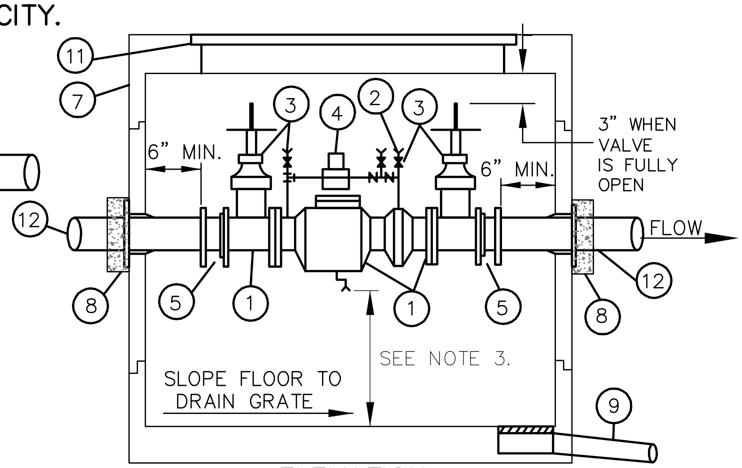
JANUARY 2013

NO SCALE

NOTICE: OUTSIDE-INSTALLED RPBA IS <u>NOT</u> ALLOWED IN BURIED VAULTS. DEVELOPER SHALL PROVIDE UTILITIES WITH A DESIGN FOR AN ABOVE-GROUND ENCLOSURE THAT DRAINS TO DAY LIGHT FOR APPROVAL. CLEARANCES SHOWN BELOW SHALL APPLY TO THE ENCLOSURE. THE BURIED VAULT DETAIL SHOWN BELOW IS ONLY ALLOWED WHEN GIVEN SPECIAL APPROVAL BY THE CITY.



PLAN



ELEVATION

1. STATE APPROVED REDUCED PRESSURE BACKFLOW ASSEMBLY, COMPLETE WITH (2) RESILIENT SEATED O.S.&Y. GATE VALVES AND (4) RESILIENT SEATED TEST COCKS, AND BRASS OR COPPER DETECTOR BY-PASS, CENTERED IN VAULT.
2. STATE APPROVED 3/4" REDUCED PRESSURE ASSEMBLY ON BY-PASS, COMPLETE WITH (2) RESILIENT SEATED BALL VALVES AND (4) RESILIENT SEATED TEST COCKS.
3. EACH VALVE SHALL BE MARKED WITH MODEL NUMBER WITH DESIGNATION OF RESILIENT SEAT: SUCH AS "RS OR "R", WHICH MUST BE CAST, MOLDED, OR AFFIXED ONTO THE BODY OR BONNET OF THE VALVE. ALL FERROUS BODIED VALVES SHALL BE COATED WITH A MIN. OF 4mils d.f.t. EPOXY OR EQUIVALENT POLYMERIZED COATING.
4. 3/4" METER (CUBIC FEET READING) AS REQUIRED.
5. MEGAFLANGE
6. ONE GALVANIZED STEEL LADDER TO BE SECURED TO VAULT WITH LADDER-UP (BILCO MODEL LU-2). LADDER TO BE ATTACHED TO VAULT PER STANDARD DETAIL W-19.
7. CONCRETE VAULT WITH 2 LOCKING ALUMINUM LW HATCH DOORS (PART NO. HHD-42"x72") RATED FOR H-30 LOADING WITH SLIP RESISTANT TREATMENT PER SECTION W4-17 OF THE ENGINEERING STANDARDS. COVER TO READ "WATER". VAULT SHALL BE EQUAL TO UTILITY VAULT CO. MODEL LISTED IN TABLE BELOW.
8. WATER TIGHT GROUT. RESTRAIN INLET/OUTLET PIPE WITH MEGALUG MID-SPAN RESTRAINT AND THRUST BLOCK ADJACENT TO VAULT SEE STANDARD DETAIL W-56.
9. DRAIN, SLOPE TO DAYLIGHT WITH BORE SIGHTED DAYLIGHT DRAIN CLEARLY VISIBLE END TO END WITH STRAIGHT PIPE, SIZED TO MEET FLOW REQUIREMENTS OF RPBA RELIEF VENT. INSTALL WIRE MESH RODENT SCREEN OVER DRAIN OUTLET.
10. TWO ADJUSTABLE PIPE STANCHIONS, BOLTED TO FLOOR.
11. ACCESS TO BE CENTERED OVER ASSEMBLY.
12. CL. 52 D.I., PExFL WITH RETAINER GLANDS.
13. VALVE SUPERVISORY SWITCH, SPDT, PER FIRE DEPARTMENT REQUIREMENTS.

SIZE	MIN. VAULT SIZE (INSIDE) W	L	H	UTIL. VAULT CO. MODEL	UTIL. VAULT CO. COVER *
3"	4'-9"	4'-8"	3'-11"	675-WA	675-2-332P
4"	5'-0"	5'-3"	4'-7"	675-WA	675-2-332P
6"	5'-1"	6'-6"	5'-5"	676-WA	676-2-332P
8"	5'-9"	7'-7"	7'-1"	687-LA	687-TL-2-332
10"	5'-10"	8'-8"	8'-0"	612-2X	612-3-332P

* COVER MODIFIED PER NOTE 7.

NOTES:

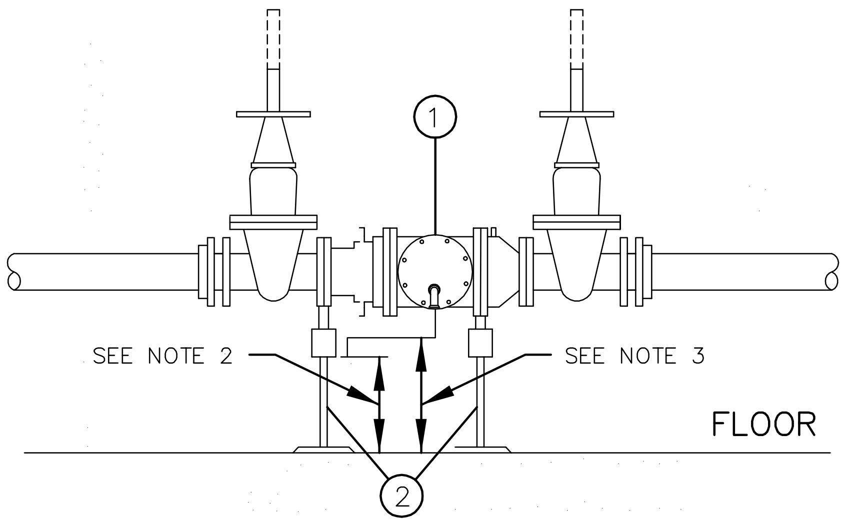
1. DAYLIGHT DRAIN MUST BE ABLE TO BE LINE SIGHTED, INSTALLED ABOVE MAXIMUM FLOOD LEVEL, AND BE ABLE TO HANDLE THE VOLUME OF WATER THAT CAN BE DISCHARGED FROM THE RELIEF VALVE PORT.
2. WHEN THE REDUCED PRESSURE ASSEMBLY IS LOCATED INSIDE A BUILDING A SIZED DRAIN LINE SHALL BE PROVIDED FOR RELIEF PORT. THERE MUST BE AN APPROVED AIR GAP BETWEEN THE RELIEF PORT AND DRAIN.
3. ALLOW 12"+ NOMINAL DIAMETER OF ASSEMBLY CLEARANCE BELOW RELIEF PORT FOR REPAIR. ALSO PROVIDE 12MIN. AIR GAP CLEARANCE FROM TOP OF DRAIN PIPE.
4. REDUCED PRESSURE BACKFLOW ASSEMBLY WILL BE ALLOWED TO BE INSTALLED IN VAULTS ONLY IN CASES WHERE NO OTHER MEANS OF INSTALLATION IS AVAILABLE AND AS APPROVED BY A CITY OF BELLEVUE WATER QUALITY TECHNICIAN.
5. TESTING IS REQUIRED BY A WASHINGTON STATE DEPARTMENT OF HEALTH CERTIFIED BACKFLOW ASSEMBLY TESTER UPON INSTALLATION AND ANNUALLY THEREAFTER. ASSEMBLY TO BE MAINTAINED BY OWNER.
6. MINIMUM CLEARANCE BETWEEN ASSEMBLY AND WALL ON LADDER SIDE OF VAULT IS 24". MINIMUM CLEARANCE FROM OPPOSITE WALL 12". ALL CLEARANCES SHOWN ARE MINIMUM.
7. VAULTS SHALL NOT BE INSTALLED IN AREAS WITH VEHICULAR TRAFFIC.
8. TEE AND GATE VALVES REQUIRED ON MAIN.
9. IN CENTRAL BUSINESS DISTRICT, 3" THROUGH 6" ASSEMBLIES SHALL CONNECT TO WATER MAIN WITH 8" PIPE.
10. FDC TO BE LOCATED DOWNSTREAM OF RPBA. FDC LINE AND CHECK VALVE MAY BE ROUTED INSIDE THE RPBA VAULT PROVIDED ALL PROVISIONS OF STANDARD DETAIL W-48 ARE MET.
11. MINIMUM 2' OF LEVEL, UNOBSTRUCTED AREA AROUND HATCHES.
12. SECURE A VALVE MARKER, PER DETAIL W-55, TO EACH GATE VALVE HANDLE.
13. LONGER VALVE ASSEMBLIES MAY REQUIRE A LARGER VAULT TO MEET THE REQUIRED CLEARANCES. SUBMIT FOR APPROVAL.
14. RPBA INSTALLATIONS THAT DIFFER FROM THE STANDARD DETAIL MUST BE APPROVED BY THE CROSS CONNECTION PROGRAM ADMINISTRATOR (425-452-5208) AND WILL BE REVIEWED ON A CASE-BY-CASE BASIS TO ENSURE THEY MEET CURRENT MINIMUM REQUIREMENTS FOR INSTALLATION AND FREEZE PROTECTION.

JANUARY 2013 NO SCALE

City of Bellevue — WATER UTILITY

TITLE 3" TO 10" REDUCED PRESSURE DETECTOR ASSEMBLY FOR FIRE SPRINKLER SYSTEMS (OUTSIDE INSTALLATION)

NO. W-47



1. LINE-SIZED WA STATE APPROVED REDUCED PRESSURE BACKFLOW ASSEMBLY, COMPLETE WITH (2) RESILIENT SEATED O.S.&Y. GATE VALVES AND (4) RESILIENT SEATED TEST COCKS.

2. TWO ADJUSTABLE PIPE STANCHIONS, BOLTED TO FLOOR. REQUIRED FOR ASSEMBLIES 2 1/2" AND LARGER.

NOTES:

1. WHEN THE REDUCED PRESSURE ASSEMBLY IS LOCATED INSIDE A BUILDING A SIZED DRAIN LINE SHALL BE PROVIDED FOR RELIEF PORT. THERE MUST BE AN APPROVED AIR GAP BETWEEN THE RELIEF PORT AND DRAIN.
2. ALLOW 12"+ NOMINAL DIAMETER OF ASSEMBLY CLEARANCE BELOW RELIEF PORT FOR REPAIR. MAXIMUM CLEARANCE OF 5'.
3. ASSEMBLY TO BE MAINTAINED BY OWNER AND ANNUAL CERTIFICATION REQUIRED.
4. SIDE CLEARANCES TO WALL;
   VALVE SIZE 2" AND LESS: 6" CLEARANCE.
   VALVE SIZE 3" AND ABOVE: 12" CLEARANCE.
5. TESTING IS REQUIRED BY A WASHINGTON STATE DEPARTMENT OF HEALTH CERTIFIED BACKFLOW ASSEMBLY TESTER UPON INSTALLATION AND ANNUALLY THEREAFTER. ASSEMBLY TO BE MAINTAINED BY OWNER.
6. PROTECT AGAINST FREEZING OR DAMAGE. USE HEAT-TAPE IF AREA IS SUBJECT TO FREEZING.
7. INTERIOR WATER APPURTENANCES MUST CONFORM TO UNIFORM PLUMBING CODE REQUIREMENTS.
8. DEVICE TO BE INSTALLED NO HIGHER THAN 5 FEET ABOVE FLOOR.
9. RPBA INSTALLATIONS THAT DIFFER FROM THE STANDARD DETAIL MUST BE APPROVED BY THE CROSS CONNECTION PROGRAM ADMINISTRATOR (425-452-5208) AND WILL BE REVIEWED ON A CASE-BY-CASE BASIS TO ENSURE THEY MEET CURRENT MINIMUM REQUIREMENTS FOR INSTALLATION AND FREEZE PROTECTION.

City of Bellevue

WATER UTILITY

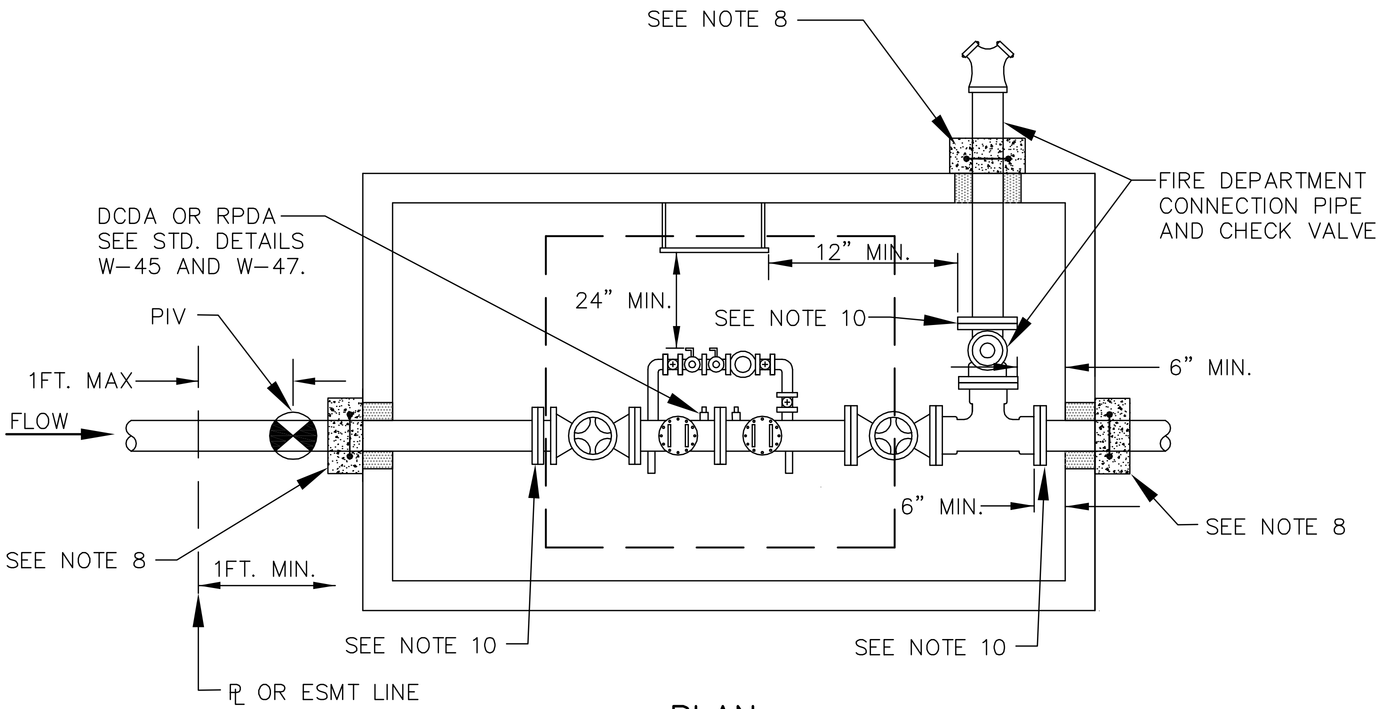
TITLE

REDUCED PRESSURE BACKFLOW ASSEMBLY (INSIDE INSTALLATION)

JANUARY 2013

NO SCALE

NO. W-48



PLAN

NOTES:

1. FDC TO BE LOCATED DOWNSTREAM OF DCDA (DOUBLE CHECK DETECTOR ASSEMBLY) OR RPDA (REDUCED PRESSURE DETECTOR ASSEMBLY).
2. PROVIDE MINIMUM OF 6" CLEARANCE BETWEEN VALVES, FITTINGS AND THE VAULT WALL.
3. ALL DIMENSIONS SHOWN ARE MINIMUM ALLOWED.
4. INSTALL FDC LINE ON SIDE OF VAULT WITH GREATEST AVAILABLE SPACE, AS SHOWN.
5. WHEN FDC LINE IS ROUTED THROUGH THE VAULT, THE VAULT SIZE SHALL BE INCREASED TO MATCH THE SIZE REQUIRED FOR THE MINIMUM CLEARANCES.
6. ALL PIPE JOINTS SHALL BE RESTRAINED. CONCRETE BLOCKING IS REQUIRED AT CHANGES IN DIRECTION.
7. CORE DRILL (O.D. +2") VAULT IF KNOCK-OUTS ARE NOT PROVIDED.
8. SEAL PIPE PENETRATIONS WITH WATER-TIGHT GROUT. RESTRAIN INLET/OUTLET PIPES WITH MEGALUG MID-SPAN RESTRAINT AND THRUST BLOCK ADJACENT TO VAULT (DETAIL W-56).
9. WHEN PIV IS LOCATED IN VAULT, THE VAULT SIZE SHALL BE INCREASED TO MATCH THE SIZE REQUIRED TO ACCOMMODATE PIV INSTALLATION WITH 6" CLEARANCES ON VAULT INTERIOR. (LID TO BE CORE DRILLED – USE LINK SEAL/GROUT TO SEAL PENETRATION).
10. MEGAFLANGE ON PE CONNECTION TO FLANGED VALVES AND TEE.
11. TESTING IS REQUIRED BY A WASHINGTON STATE DEPARTMENT OF HEALTH CERTIFIED BACKFLOW ASSEMBLY TESTER UPON INSTALLATION AND ANNUALLY THEREAFTER. ASSEMBLY TO BE MAINTAINED BY OWNER.
12. POSITION DCVA WITHIN HATCH TO ALLOW FOR VERTICAL REMOVAL.

City of Bellevue

WATER UTILITY

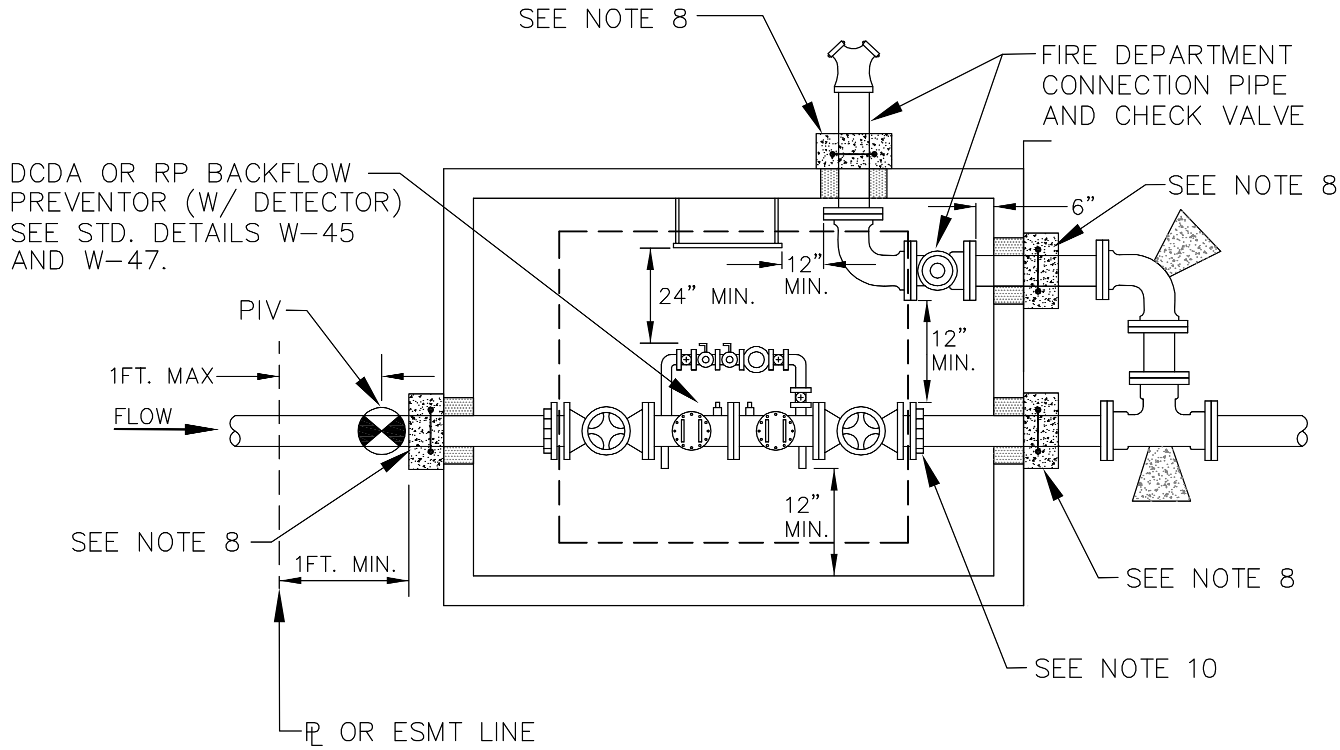
TITLE

REQUIREMENTS FOR FDC AND CHECK VALVE ROUTED THROUGH BACKFLOW ASSEMBLY VAULT-1

JANUARY 2013

NO SCALE

NO. W-49



PLAN

NOTES:

1. FDC TO BE LOCATED DOWNSTREAM OF DCDA (DOUBLE CHECK DETECTOR ASSEMBLY) OR RPDA (REDUCED PRESSURE DETECTOR ASSEMBLY).
2. PROVIDE MINIMUM OF 6" CLEARANCE BETWEEN VALVES, FITTINGS AND THE VAULT WALL.
3. ALL DIMENSIONS SHOWN ARE MINIMUM ALLOWED.
4. INSTALL FDC LINE ON SIDE OF VAULT WITH GREATEST AVAILABLE SPACE, AS SHOWN.
5. WHEN FDC LINE IS ROUTED THROUGH THE VAULT, THE VAULT SIZE SHALL BE INCREASED TO MATCH THE SIZE REQUIRED FOR THE MINIMUM CLEARANCES.
6. ALL PIPE JOINTS SHALL BE RESTRAINED. CONCRETE BLOCKING IS REQUIRED AT CHANGES IN DIRECTION.
7. CORE DRILL (O.D. +2") VAULT IF KNOCK-OUTS ARE NOT PROVIDED.
8. SEAL PIPE PENETRATIONS WITH WATER-TIGHT GROUT. RESTRAIN INLET/OUTLET PIPES WITH MEGALUG MID-SPAN RESTRAINT AND THRUST BLOCK ADJACENT TO VAULT (DETAIL W-56).
9. WHEN PIV IS LOCATED IN VAULT, THE VAULT SIZE SHALL BE INCREASED TO MATCH THE SIZE REQUIRED TO ACCOMMODATE PIV INSTALLATION WITH 6" CLEARANCES ON VAULT INTERIOR. (LID TO BE CORE DRILLED – USE LINK SEAL/GROUT TO SEAL PENETRATION).
10. MEGAFLANGE ON PE CONNECTION TO FLANGED VALVES AND TEE.
11. TESTING IS REQUIRED BY A WASHINGTON STATE DEPARTMENT OF HEALTH CERTIFIED BACKFLOW ASSEMBLY TESTER UPON INSTALLATION AND ANNUALLY THEREAFTER. ASSEMBLY TO BE MAINTAINED BY OWNER.
12. POSITION DCVA WITHIN HATCH TO ALLOW FOR VERTICAL REMOVAL.

City of Bellevue

WATER UTILITY

TITLE

REQUIREMENTS FOR FDC AND CHECK VALVE ROUTED THROUGH BACKFLOW ASSEMBLY VAULT-2

NO. W-50

JANUARY 2013

NO SCALE

City of Bellevue Utilities

Operations & Maintenance

2015
FIRE HYDRANT OPERATION

If you encounter damage to the hydrant or experience any problems please call Bellevue Utilities as soon as possible so the necessary repairs can be made, 425-452-7840 (24 hours).

1. A hydrant permit is required to utilize any fire hydrant. Operate only the hydrant you are authorized to use.
2. Verify hydrant is shut off, remove the port cap and install meter and backflow assembly.
3. For any use where the connection to the fire hydrant does not involve filling with an inspected and approved Tank Lot vehicle the minimum requirement is the installation of an approved and tested DCVA. An increased level of protection may be required if connecting to a high health hazard. Test reports are required at the time the permit is processed.
4. Open the hydrant operating nut slowly, (one revolution per second) and completely. The gate valve on the hydrant port is to be used for throttling and the operating nut must be fully open to eliminate leakage through the hydrant drain valve.
5. When completed, turn the operating nut slowly to the closed position - *Do not force*.
6. Remove equipment, check for leaks, and replace port cap. Hydrant should drain empty.
7. Report any hydrant problems or damage immediately: 425-452-7840, (24 hours)
8. Return rental equipment to Bellevue Service Center Receiving, 2901 - 115th Ave. N.E.

Failure to comply with the standard requirements can result in the immediate termination of this permit and the issuance of any applicable fines per Bellevue Civil Enforcement code chapter 1.18 and is subject to escalating enforcement including up to $500 per day per violation and up to $5,000 per day for repeat violations.

In addition to permit fees and equipment deposits, you are charged rental and water use at the following rates:

Permit Fee:	$100.00 (non-refundable)
Water Use Charge:	$7.39 per hundred cubic ft. (1 ccf = 748 gallons)
Wrench Deposit	$25.00 refundable deposit
Hydrant Meter Rental:	¾ Meter $100 Deposit / $25.00 per month
	3” Meter $850 Deposit / $50.00 per month

Permits & equipment are issued at the Bellevue Service Center - 2901 115th AVE NE, Bellevue 98004

Tank Lot Permits are not issued until the vehicle has been inspected by Bellevue Utilities. Call 425-452-7840 for scheduling inspections or questions regarding backflow assemblies.

Tank Lot Quantity Reports must be submitted by the 15th of each month. Charges will be billed at $7.39 per ccf based on the tank capacity and charged based on one fill-up per day for the number of days the permit is active (Assuming one fill up per day) if the log is not received by the 15th of the following month.

Fill logs and/or questions regarding billing should be sent to:
City of Bellevue
Utilities RMCS
Attn: Elvie Muya
P.O. Box 90012
Bellevue, WA 98009-9012
425-452-6989 (phone) 425-452-5214 (fax)

See map for hydrant locations designated for Tank Lot use.
Designated hydrants are painted blue for easy identification.

City of Bellevue Utilities

2015 Fire Hydrant Use Permit - *Tank Lot*

Permit #:_________________________ *Expires 12/31/2015*

Business Name: ___________________________________

Business Phone: ___________________________________

☐ **Annual Permit Fee** ($100.00) **(Required)**

☐ **Hydrant Wrench Deposit** ($25.00) **(Optional)**

☐ **Air Gap Inspection Done? (Required)**

Contact Name: ___________________________________ Contact Phone: ___________________________

Billing Address: _________________________________ City: ____________________ Zip:____________

Purpose of Water Usage: ____

* Use of approved fill sites (designated hydrants) is limited to the vehicle identified below *

Vehicle Make: __________ Type: ___________ License #: ___________________ Tank Capacity: _______ gal

Vehicle Backflow Inspection Date: _____/_____/_____Inspected By: ___________CCS/BAT Cert #: _________

In consideration of monthly service charge payment, this permit authorizes use on designated hydrants at designated fill site only.

Note: This permit is non-transferable and must be carried in the vehicle listed above.

Class Number __________________________ **Received By:** ____________________

- This Tank Lot Permit Requires:.
  - Use of hydrants at designated fill site **only** (see map provided). All other hydrants require a separate permit for use.
  - Backflow device inspection reports certified upon installation (at start of a new project) and annually thereafter.
  - Vehicle backflow inspection is required annually and for each vehicle. Call 425-452-5208 to schedule inspection.
  - A individual permit is required for ***each*** vehicle using designated fill sites and permit sticker must be visible on tank.

Failure to comply with the standard requirements can result in the immediate termination of this permit and the issuance of any applicable fines per Bellevue Civil Enforcement code chapter 1.18 and is subject to escalating enforcement including up to $500 per day per violation and up to $5,000 per day for repeat violations.

Tank Lot Quantity Reports must be submitted by the 15th of each month. Charges will be billed at $7.39 per ccf based on the tank capacity and charged based on one fill-up per day for the number of days the permit is active (assuming one fill up per day) if the log is not received by the 15th of the following month **even if no water is used.**

Notify Utilities immediately if you encounter any damages to a hydrant at 425-452-7840.
For billing or fill log questions contact Elvie Muya at 425-452-6989.
To schedule Tank Lot Inspection for additional vehicles, contact ***John Sizemore*** at 425-452-5208.

Do you understand and agree to adhere to the conditions listed above? **YES NO**

Print name: _____________________________Sign: ______________________ Date: ____/____/____

Hydrant Wrench Return Information (Utilities Stores Personnel)

Wrench Issue Date: ______/_______/______ Issued To (Print full name): _________________________ Issued By (Signature): ___________

Wrench Return Date: ______/_______/______ Returned By (Print full name): _______________________ Received By (Signature): __________

PO Box 90012 – Bellevue, WA 98009-9012

Bellevue Utilities
Tanker Inspection Report

Permit Number: ____________________ Issued Date: ___/___/___ ***Expires: 12/31/2015***

Business Name: ____________________________ Business Phone: _______________

Contact Name: _____________________________ Contact Phone: ________________

Address: _____________________ City: ______________ State: _____ Zip: _________

Vehicle Make: ____________________ License #: ________________ State: ________

Tank Type: ________________ Tank Capacity (gallons):________ ***Photo ? YES NO***

(To be completed by Tank Inspector Only)

Required minimum air gap provided? YES NO

Method of filling inspected and approved? YES NO

Attach copy of test report for approved backflow prevention assembly used in lieu of air gap test (if applicable)

Additional comments: ____

____

Inspected By: CCS/BAT CERTIFICATION #: _________________ DATE: ___/___/___

(print name): ________________________ (sign name): _______________________

Conditions:
This inspection and permit are only good for the truck listed on this report.
This inspection expires with permit.

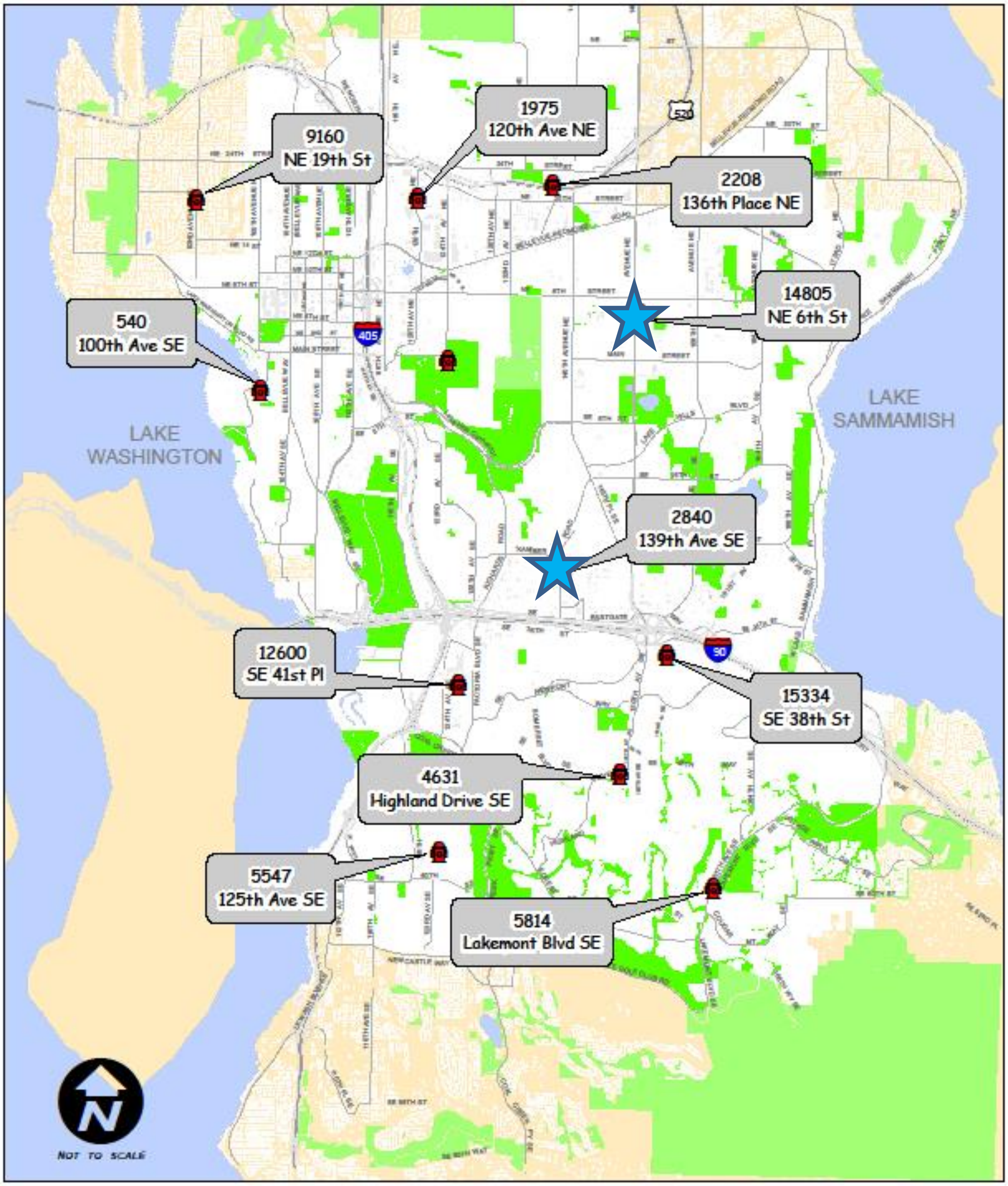
Permits & equipment are issued at the Bellevue Service Center - 2901 115th AVE NE, Bellevue 98004

Tank Lot Permits are not issued until the vehicle has been inspected by Bellevue Utilities.
Call 425-452-5208 for scheduling inspections or questions regarding backflow assemblies.

Tank Lot Quantity Reports must be submitted by the 15th of each month. Charges will be billed at $7.39 per ccf based on the tank capacity and charged based on one fill-up per day for the number of days the permit is active (assuming one fill up per day) if the log is not received by the 15th of the following month.

Designated Hydrants for Tank Lot Permits

Designated hydrants are painted Blue and have posted signs
City of Bellevue



*****Hydrants marked with a star ★ are only operational between 8am – 5pm*****

Notify Utilities immediately if there is any damage or problems with the hydrant at 425-452-7840
Tank sticker must be fixed to the rear drivers side of the tank at all times.
Keep copy of permit with the vehicle.
If you lose or damage your permit sticker, contact 425-452-7840.

Reference Guide

Ordinance 5963

Cross-Connection Program

Appendix W

Asset Management Program Review

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ONE COMPANY | *Many Solutions*℠

August 22, 2012

Mr. Wes Jorgenson, P.E.
Assistant Director, Engineering
Bellevue Utilities
450 110th Avenue NE, 5W
Bellevue, Washington 98009-9012

Subject: Cursory Review of the City of Bellevue's Water Utility Asset Management Plan Final Report

Dear Mr. Jorgenson:

The City of Bellevue (City) retained HDR Engineering, Inc. (HDR) to provide a cursory technical review of the City's water utility Asset Management Plan. This Plan consists primarily of two Microsoft Excel files and the asset rehabilitation and replacement projections that are contained within these files. Using best business practices for asset management and replacement, HDR reviewed the assumptions and results contained with these files, along with additional data HDR requested from the City. HDR was also retained to perform a cursory and independent review of the utility's Asset Management Plan projected financial needs, and whether an R&R Reserve Fund is most appropriate to meet those needs.

In providing these services, HDR has provided a limited technical review of the City's water utility Asset Management Plan, as presented in the City provided electronic files, which is essentially an asset replacement forecast. The City requested that the study be expedited, and completed within 30 business days, in order that results are available for the beginning of the City's biennial budgeting process. Therefore, the review had to be cursory in order to complete the process in the time allowed. This report documents HDR's observations of the files, assumptions and results as recommendations for consideration or actions the City can take.

HDR appreciates the opportunity to provide these technical services to the City. We look forward to future opportunities to work together again.

Sincerely yours,

HDR Engineering, Inc.

Cil Pierce

Priscilla (Cil) Pierce
Senior Project Manager

HDR Engineering, Inc.

500 108th Avenue NE
Suite 1200
Bellevue, WA 98004-5549

Phone: (425) 450-6200
Fax: (425) 453-7107
www.hdrinc.com

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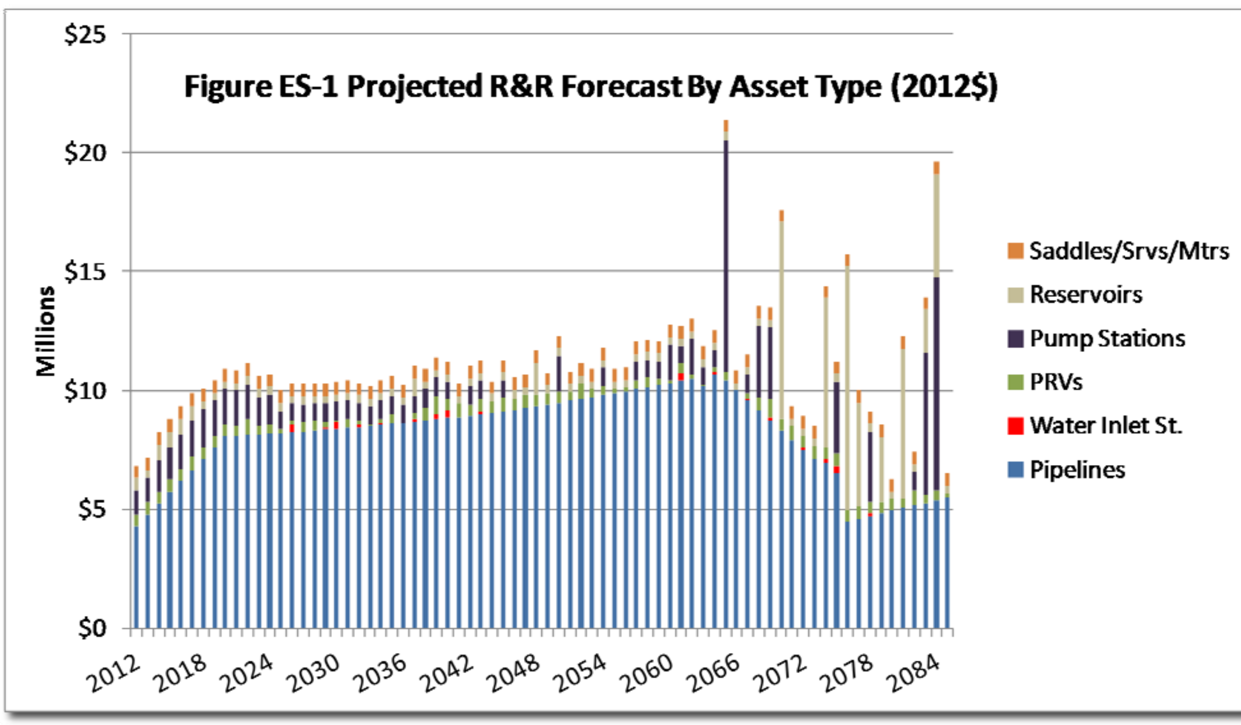
Cursory Review of the City of Bellevue Water Utility Assets Management Plan

Introduction

HDR Engineering, Inc. (HDR) was retained by the City of Bellevue (City) to conduct a review of their long-term Asset Management Plan (AM Plan) for the water utility (utility). The City also requested that this review be expedited and completed within 30 business days. Thus, it was necessary to provide a high level, cursory review of the Plan. HDR conducted the review in three separate but connected components, the pipeline assets, vertical assets (pump stations, reservoirs, etc.) and a review of the financial impacts of the Plan.

In summary, the City's AM Plan has been developed using existing data from the City's system, research into current trends in the asset management industry, and collaborative decision making by City utility staff and management. The total renewal and replacement (R&R) forecasted costs to the water utility over the 75-year period are approximately $820 million, in 2012 dollars, as represented in Figure ES-1. Over the course of the 75-year period, the average annual expenditure is $11 million.



The pipe line assets comprise 73% of the total replacement costs within the AM Plan. The City's overall water utility AM Plan assumptions for useful life of pipe and replacement costs are within ranges commonly seen in use by other utilities in the region. The City is currently focusing replacement resources and efforts on small diameter Asbestos Cement (AC) pipe replacements, due to a trend of significant failures in small diameter AC pipes. These failures are significant in the volume of water lost and damages and claims associated with them. Therefore, the City requested that HDR focus additional attention on the AC main replacements and assumptions as well. HDR has provided recommendations for modifications to some of the assumptions. However, these recommendations will not significantly change the City's forecast.

Pump stations and reservoirs (vertical assets) make up approximately 22% of the water utility AM Plan forecasted R&R costs. HDR provided recommendations for the City to consider in adjusting the useful life of the pump stations and to perform an individual assessment of each pump station. Likewise, for the reservoirs, an individual reservoir assessment will provide the most precise rehabilitation and replacement needs for the future. Useful life adjustments were also recommended. These adjustments, again, because the percentage of the overall forecast is smaller, are not anticipated to have a large impact on the existing overall forecast.

The City recognizes the importance of making a commitment to infrastructure replacement in order to maintain existing service levels. Additionally, the City chooses to strive to complete the R&R program in the least cost financing approach possible. While the City does update the AM Plan every two years for the budgeting process, HDR recommends that the City update the water AM Plan in a comprehensive and independent manner, reviewing the key assumptions, replacement costs and data at least once every five years. A routine updating process every five years will help the City keep the forecast current with industry trends and new City data.

An executive summary of the findings of this cursory review are provided below, followed by the study's letter report.

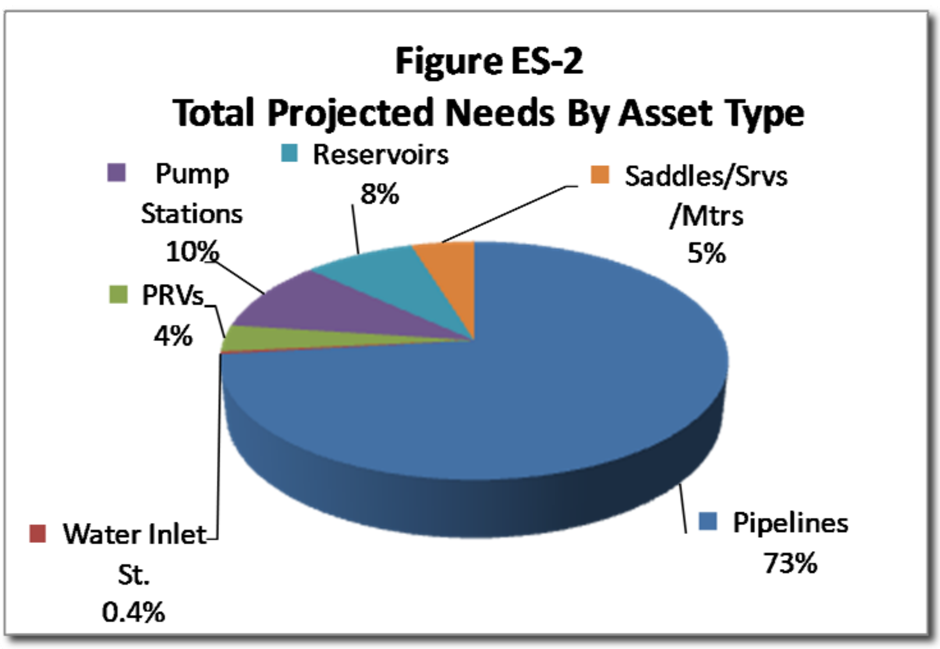
Overall View of the City's Renewal and Replacement Long Term Forecast

The water mains, or pipelines, make up the largest portion of the assets (73%) to be replaced. The vertical assets represent another 22% of the system. The overall asset management plan 75-year forecast has relatively smooth total replacement projections through 2064. Then larger projects begin to come on line for replacement of major facilities as they reach the end of their useful lives. The City has stated that it intends to smooth these larger increases that are out in the future years. While the City has determined the total asset replacement needs for the 75-year time period, their financing focus, at this time, is on the next twenty to forty year forecast.

Table ES-1 represents the overall system asset replacement costs. Figure ES-2 presents these graphically.

TABLE ES-1
SUMMARY OF THE RELATIVE PORTIONS OF THE WATER SYSTEM ASSET REPLACEMENT COSTS

Water Mains	Saddles/Services And Meters	Pump Stations	Reservoirs	PRVs	Water Inlet Stations
73.0%	4.7%	9.7%	8.4%	3.7%	0.4%



The utility projects renewal and replacement projects for all significant utility's assets over a 75-year time period. The Plan consists primarily of two Microsoft Excel files, which the City provided electronically to HDR. Upon initial review of these files, HDR requested additional information in order to make informed observations of the assumptions and results contained within the two Excel files.

Each class of assets does have the essential assumptions contained within that particular asset's tab, but definitions of asset failure, leaks and breaks, and data source for these assumptions and decisions would enhance the City's AM Plan, especially for future use and updating.

Recommendations for Consideration

The asset management plan for each major asset class should be concisely documented. This plan should include the long range R&R forecast and the data and assumptions used to generate the forecast.

Review of the Asset Management Plan for Water Mains

The utility's water mains, or pipe lines, comprise 73% of the total asset replacement cost over the next 75 years. Water main expected life is a function of several factors. Service level expectations/requirements, pipe material, soil properties, water chemistry, climate, loading and construction methods are significant factors. Depending on these (and other) factors, water mains have lasted from as short as a few decades to over 200 years.

Bellevue has been proactive in developing its asset cost projections and has begun to assemble the data necessary to account for many of these varying conditions that affect the useful life of the City's water mains. HDR has reviewed the City's assumptions and AM Plan results and has the following observations and recommendations for the AM Plan for water mains.

Key Observations of the Water Main Review

HDR reviewed the City of Bellevue's AM Plan models and assumptions and had the following observations regarding the Plan:

- Ductile iron accounts for nearly 50% of the City's water mains, followed by AC at approximately 45%. The current plan/forecast anticipates an average reduction in AC pipe of a little over 0.8% per year with a corresponding increase in ductile iron pipe.
- The total number of breaks per 100 miles of water main compared to the U.S. and European national averages is significantly below those averages.
    - Bellevue's system wide performance for all material types is 3.5 breaks per 100 miles. As the City has focused on replacing small diameter AC pipe, the number of breaks per 100 miles has also been declining.
    - The overall U.S. and European averages are approximately 25 and 80 breaks per 100 miles.
    - The overall U.S. and European averages reflect significantly older infrastructure and possibly acceptance of lower customer service levels in older U.S, and European communities. Additionally, Bellevue currently has a larger percentage of asbestos cement pipe than many water systems. It appears that asbestos cement pipe is more likely to fail catastrophically than iron pipes, where failure may consist of just a minor leak from pinhole corrosion in iron pipes. Consequently, Bellevue may have a higher percentage of *significant* failures than utilities without a high percentage of asbestos cement pipe. Bellevue's water main break rate is average when compared to other Puget Sound water systems with newer infrastructure.
- Bellevue's smaller diameter asbestos cement pipes are breaking at a higher rate than the larger diameter asbestos cement pipes. Many other utilities with asbestos cement water mains are also experiencing higher failure rates for smaller diameter asbestos cement mains. The reason larger diameter asbestos mains have lower failure rates is believed to be because larger diameter mains have thicker walls and stronger structural cross sections, and acceptance and inspection standards were typically higher during installation.
- Cast iron pipe can also often fail in brittle and consequential ways. Although there is not enough data to make a definitive conclusion, recent trends show that, break rates could be on the rise for that asset class.
- Due to the catastrophic nature of asbestos cement water main failure and the high failure rates of small diameter (4-inch and 6-inch) AC mains, the City is currently focused on replacing smaller diameter AC mains. The intent of this program is to help maintain community trust in the City's utility management, and avoid undermining the utility's credibility caused by the catastrophic type failures of the small diameter AC mains.
- Based on Bellevue's current AM Plan, over the next 75 years, the average age at the time of main replacement is planned to be 100 years. The replacement age of asbestos cement mains currently ranges from approximately 50 years to 125 years. As the asbestos cement mains are replaced, the overall average replacement age will gradually rise to 125 years to reflect the currently estimated average replacement age of non- asbestos cement mains.
- Based on currently available information, the replacement age estimates appear to be consistent with keeping the current water main break rate at its present rate.
- Overall, the life expectancies for pipe assets appear to be reasonable and within an expected range of similar utilities.

Recommendations to Consider for Water Main Assets

Based on the review conducted, HDR has developed the following recommendations for further consideration by the City for the water main assets.

- Continue to re-evaluate the long term AM Plan on a regular interval (e.g., during the biennial budget process) or if the break rates moves significantly in one direction or the other. Test validity and make any necessary adjustments to estimated water main expected life estimates and replacement forecast based on:

- Water Research Foundation asbestos cement pipe deterioration models that will likely be published in 2012
- Accruing failure rate and condition information
- Any modifications that are made to service level targets

On a formal basis, the City should conduct a comprehensive and independent review of the life expectancy assumptions and replacement costs at least once every five years. A routine updating process every five years will help the City stay current with industry trends and to maintain the most accurate forecast, to the extent possible.

- The City's unit replacement costs are based on historic replacement cost data experienced by Bellevue, as presented in Table ES-2. These unit costs are in line with industry standards for long-term water main renewal planning.

TABLE ES-2 WATER MAIN REPLACEMENT COSTS	
8-inch	$285
12-inch	$330
16-inch	$375
20-inch	$430
24-inch	$495

In a cost analysis of other King County water main replacement projects, using King County tabula data, these costs appeared slightly low for inclusion of pavement restoration. However, since the City is using City specific costs based on actual experience within the City, these costs may be more applicable to the City's contracting procedures, etc. The City's costs have accounted for the current low-bid construction cost climate.

- Refine Standard Operating Procedures and data collection procedures to capitalize on gathering enhanced observation data for condition assessment to be added to the AM Plan modeling. Bellevue should capture asset failure data for 2010 and 2011 and continue capturing this data for subsequent years,
- Work with operations and maintenance management to develop procedure for O&M crews to capture pipe failure causes and failure mode information.
- Continue to evaluate break history based on various pipe characteristics that may lead to increased risk of failure. Characteristics could include material, diameter, age, geographic location and pressure. Analysis should support programmatic condition assessment and renewal programs as well as support useful life assumptions.
- Monitor water chemistry data available from Seattle Public Utilities and use to adjust long term water main useful life projections.
- Develop more scientific methodology of estimating expected life estimates for non-asbestos cement water mains. Continue to stay abreast of current technology.

Review of the Asset Management Plan for Water Saddles, Services and Meters

The saddles, services and meters account for 5% of the system's total asset projected replacement cost. The failure consequences of these assets are usually less severe than the failure of other significant water utility assets. The total number of saddle and service failures is generally on the order of 50 per year.

Approximately 100 saddles and/or services are replaced each year as part of the CIP or by the Operations and Maintenance Division. Additional saddles and services get replaced as part of the main replacement program. Because saddles and services do not last as long as water mains, the City continues to monitor saddle and service performance to make sure the saddle and service replacement program is consistent with the City's water system customer service levels. However, the City's current mapping/data management systems make it impractical to establish saddle and service data bases.

Meter replacements are generally performed by the Operations and Maintenance Division. Larger commercial meter replacements that require more extensive work such as vault replacement are performed as part of the CIP program.

Recommendations Regarding Saddle, Service and Meter Assets

- When the utility's data mapping/management system is upgraded and saddle and service assets can more easily be exported/imported to Maximo, provide resources to establish a data base for saddles and services.
- Continue to monitor failures and adjust proactive component of replacement program accordingly.
- Determine if there are saddle and service materials, or direct tap materials and methods that can be expected to last as long as the service main.

Water Utility Vertical Assets Cursory Review

Vertical assets include pump stations, reservoirs, PRVs and other related infrastructure. These assets account for approximately 22% of total system asset replacement costs. Each vertical asset class was reviewed individually, reflecting the organization the City has used in developing the AM Plan.

Pump Stations

Bellevue currently has 22 pump stations in the system. The replacement cost of this asset class represents approximately 10% of the total system replacement cost. The life cycle replacement interval within the AM Plan is 100 years, with rehabilitation every 25 years. The interval of 100 years can be considered as a maximum potential life. Rehabilitation of motors and pumps on a planning level of 25 years appears to be reasonable, along with the planning level replacement costs for rehabilitation and replacement of $750,000 and $3,000,000 respectively. A closer and more detailed examination of each pump station's capacity, horse power, criticality to the overall system and condition assessment data would enhance the replacement projections in the future.

Reservoirs

This asset class comprises 8.4% of the asset replacement total for the water utility. There are 31 drinking water reservoirs in the water utility system with a combined capacity of 42.5 million gallons. There are three materials used for the structures of the reservoirs: steel, pre-stressed concrete, and concrete. The life cycle useful life estimates for each type of reservoir contained within the AM Plan files appear to be optimistic compared to industry recommendations and HDR experience.

TABLE ES-3
TYPE OF RESERVOIR AND USEFUL LIFE

Type of Material	City AM Plan Useful Life, years	Typical Useful Life, years
Steel Tank (Welded)[1]	125	60 – 125
Concrete	75	60
Pre-stressed Concrete	100	75 – 80

1] Maximum potential useful life ranges from 100 – 125 years.

PRVs

Bellevue's water system includes over 150 PRVs that supply water throughout Bellevue. PRVs comprise approximately 3.7% of total water system replacement costs.

The City can consider increasing the life cycle interval for replacement to reflect an service useful life closer to the manufacturer's effective life cycle intervals (60 years), or retain the existing useful life estimate (replacement every 30 years) to support a more conservative approach. The City can also consider criticality of a PRV station in assessing replacement timing. Whether a PRV is primary or secondary should be included in determining the timing of replacement. Primary stations should be prioritized over older secondary PRVs.

Recommendations Regarding Vertical Assets

Pump Stations

- For pump stations HDR recommends, given the small number of pump stations, each pump station should be evaluated individually to determine a specific replacement and rehabilitation costs for each pump station. This will allow the forecast to account for differences in capacity, type of pump station, horse power and criticality.
- Overall, the replacement cost estimates for rehabilitation and replacement are good place holders until the individual pump station assessments are completed.

Reservoirs and PRVs

- As a baseline, use the following expected service lives for the long-term R&R forecasting:
  - Welded steel tanks – 100 years
  - Reinforced concrete – 60 years
  - Pre-stressed concrete – 75 years
  - Epoxy coated PRV's – 50 years
- Evaluate and further refine reservoir rehabilitation (capital costs that occur during tank life) cost estimates.
- When possible, use asset-specific characteristics to modify standard useful life, rehabilitation interval, and rehabilitation and replacement cost estimates.
- Consider asset criticality when replacement intervals are defined.

Financial Review of Asset Management Plan Impacts

The City's financial policies have provided a basis for managing the water utility assets in a financially responsible and proactive manner.

The City has historically funded the R&R projects primarily from rates and the R&R Account (R&R reserve). When annual funding for capital improvements exceeds annual capital expenditures, funds are transferred to the R&R reserve in anticipation of future replacement expenditures.

The water utility R&R forecast initially indicated there would be a large asset replacement peak as water mains came to the end of their useful life. Recently the City has accelerated the replacement of small diameter AC mains and revised the R&R forecast to target 5 miles of main replacement each year. To maintain this sustainable level of replacement, which can keep the system operational at current levels of service, the current level of rate funded capital will need to be increased gradually over the next several years. It can be seen that the current forecast, as presented in Figure ES-1, has a relatively smooth level of replacement costs for a majority of the forecast period. The annual average level of expenditure over the 75-year period is $11 million, in 2012 dollars.

While there are peak years in the latter part of the 75-year period that will require use of R&R reserves, the overall plan has levelized the future needs based on the revised useful life of the pipelines. This smoothing of the replacement plan minimizes the overall need for fund balance in the R&R reserve. This does not imply that additional funding of the R&R reserve is not necessary, simply that the level of the R&R reserve can be lower than previously projected. As noted, R&R funds are necessary to fund future replacements and offset peak year construction periods towards the latter part of the 75-year period. As the City begins to gradually increase annual rate funded capital to fund 5 miles of main replacement each year, to approximately $11 million to $12 million per year, the City will be able to replace assets and maintain the level of service to its customers on a sustainable basis. This R&R program should help avoid significant pipe failures and maintain intergenerational equity among customers.

As noted previously, the average annual R&R expenditures are approximately $11 million. However, there is a period between 2038 and 2070 that R&R funding must increase to approximately $12 million in order to build the reserve for the peak construction period. As the City updates the forecast assumptions every five years, and revises the expenditures in the future, this increased funding need may be mitigated.

It is important to make a commitment to fund this level of on-going R&R needs on an annual basis. Whenever project costs or R&R reserve funding is deferred, it *increases* the overall long-term costs of the program and system. In order to have adequate funding for the R&R program, it is important to maintain a minimum R&R reserve balance. This reserve balance should be a minimum of the average annual R&R expenditures. This provides the City with one years average expenditures should revenues not meet targeted or budgeted levels, and allows for the use of R&R reserves during higher than average R&R expenditure years. With the 30 year period of an average of $12 million in rate funding needed each year, a minimum reserve level of $12 million should be maintained. In case of unexpected changes in conditions, and for added financial stability and security in funding the R&R program each year, the reserve balance could be maintained between $12 million and $20 million, to provide almost two years of funding the R&R program.

Overall Summary

Bellevue is one of the few cities in the Northwest with a proactive and comprehensive utility asset management plan in place. The AM Plan files project the asset replacement costs over a 75-year period. The Excel files contain a number of assumptions regarding useful life of assets and unit costs for rehabilitation and replacement. Each class of assets has the essential assumptions contained within that particular asset's tab, but definitions of asset failure, leaks and breaks, and data source for these assumptions and decisions would enhance the City's AM Plan, especially for future use and updating. It would be prudent practice to document the assumptions, data sources, and cost basis within the file or in an associated written report or Plan.

Overall, the City's assumptions for asset replacement appear to be reasonable. Some asset class useful life assumptions may be optimistic while others are conservative. Review and adjustment of the useful life assumptions and costs for individual pump stations and useful lives for types of reservoirs would be good points of focus for updating the forecast.

Additionally, once the utility achieves replacement of 5 miles of water main per year, the program will essentially be pay-as-you-go, at roughly $11 million per year (2012$). An increase in funding to approximately $12 million per year may be necessary for approximately 30 years in order to develop adequate reserves to fund peak replacement periods in the latter part of the 75-year time period. As the City formally updates the forecast every 5 years, if the peak construction periods in the latter half of the forecast are smoothed over time, this assumption can be reviewed and adjusted, as necessary. To verify there are always adequate funds for the R&R program, the City should maintain an R&R reserve minimum of at least $12 million. Additional reserve funding can provide additional financial stability and surety that the R&R program costs can continue to be covered.

Cursory Review of the City of Bellevue Water Utility Asset Management Plan

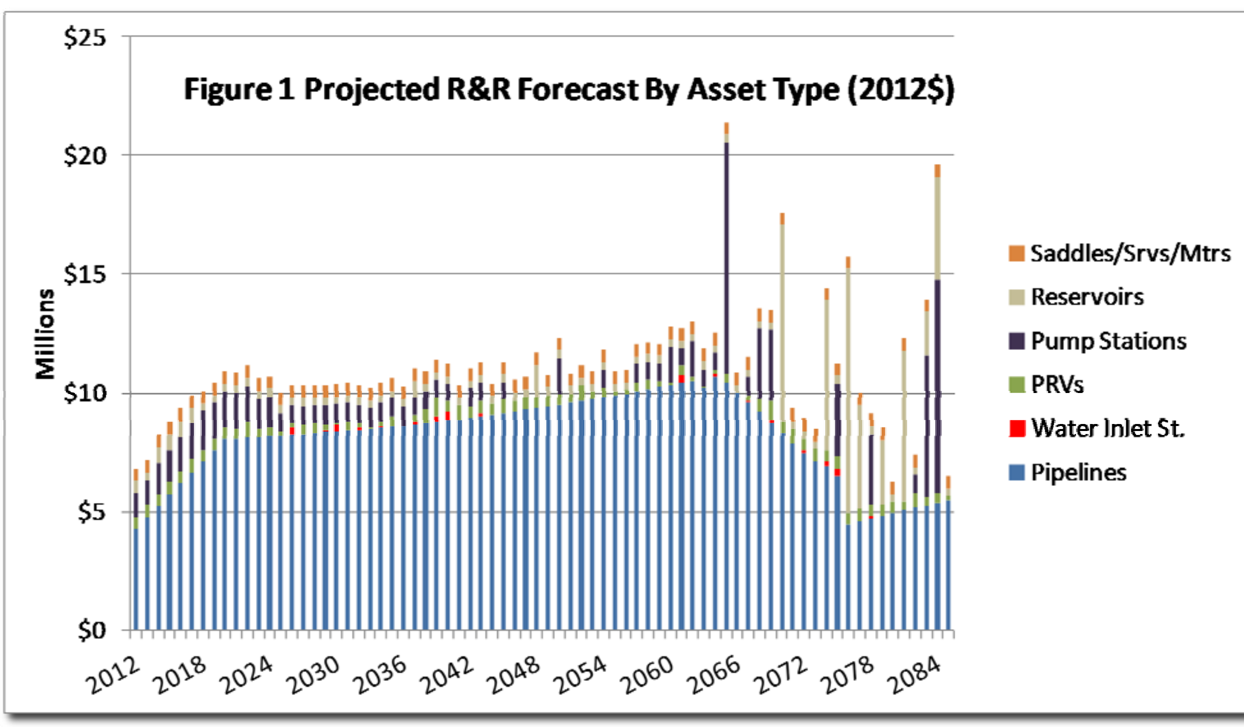
Introduction

HDR Engineering, Inc. (HDR) was retained by the City of Bellevue (City) to conduct a review of their long-term Asset Management Plan (AM Plan) for the water utility (utility). The City also requested that this review be expedited and completed within 30 business days. Thus, it was necessary to provide a high level, cursory review of the Plan. The water utility projects rehabilitation and replacement capital projects for all significant utility assets. The Asset Management Plan consists of two primary Microsoft Excel files, which the City provided electronically to HDR. Upon initial review of these files, HDR requested additional information in order to make informed observations of the assumptions and results contained within the two Excel files.

For purposes of applying the appropriate resources for technical review of the various types of assets that were requested by the City, HDR divided the review into three general categories: pipeline assets, vertical assets, and a cursory financial review of the Plan's impacts. The process of review, observations, and conclusions for the City's consideration are described below in each of these three component areas.

Overall View of the City's Water Utility Assets

The overall asset management plan 75-year forecast has relatively smooth total replacement projections through 2064. Then larger projects begin to come on line for replacement of major facilities as they reach the end of their useful lives. The City has stated that it intends to smooth these larger increases that are out in the future years. While the City has determined the total asset replacement needs for the 75-year time period, their financing focus, at this time, is on the next twenty to forty year forecast. Figure 1 presents the City's water system AM Plan over the 75-year period.

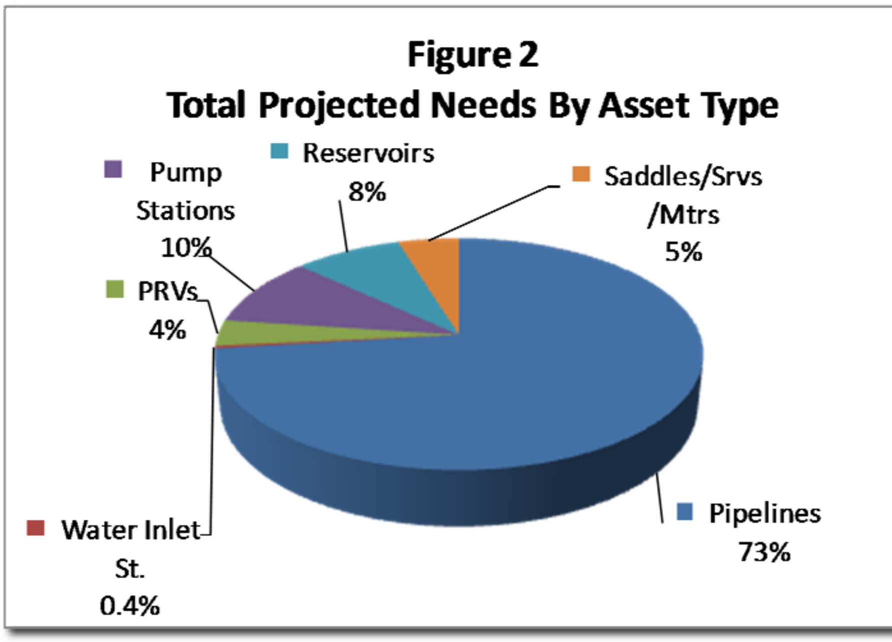


The water mains, or pipelines, were the primary focus of the study, because they make up the largest portion of the assets (over 70% of total water assets to be replaced). Secondly, the vertical assets, or pump station, reservoirs, PRVs and other facilities were reviewed. Lastly, HDR conducted a cursory financial review of the impact of the Asset Management Plan on the water utility's portion of the Renewal and Replacement reserve.

Table 1 provides an overall summary of the AM Plan replacement cost forecast by asset type.

TABLE 1 SUMMARY OF THE RELATIVE PORTIONS OF THE WATER SYSTEM ASSET REPLACEMENT COSTS					
Water Mains	Saddles/Services And Meters	Pump Stations	Reservoirs	PRVs	Water Inlet Stations
73.0%	4.7%	9.7%	8.4%	3.7%	0.4%

Figure 2 presents the relative portions of the AM Plan by asset graphically.



The City stated that their primary focus in this round of asset renewal forecasting has been on pipelines, and in particular on Asbestos Cement (AC) pipelines. The vertical assets have been reviewed based on readily available data. The City intends to provide further focus on the vertical assets in future years. These three reviews are described below.

Review of the Water Utility Water Main Assets

Water mains comprise a significant portion (approximately 73%) of the City's total water system asset replacement costs. This section focuses on assessing the reasonableness of the City's current water main replacement strategy. This section is organized in the following manner:

1. **Water Main System Characteristics** – A cursory review of the City's water main system characteristics and potential impact on the replacement strategy.
2. **Current Water Main Replacement Strategy** – A summary of the City's current water main replacement strategy which will be assessed in this section.
3. **State of the Industry** – A brief summary of the state of the industry as it relates to the water main replacement strategy.
4. **Bellevue Performance** – A cursory assessment the City's water main system performance.
5. **Findings** – Documentation of the findings of this cursory assessment of the City's water main replacement strategy in terms of its reasonableness relative to industry standards.
6. **Recommendations for Consideration** – Documentation of identified opportunities for improvement based on this cursory review of the City's water main replacement strategy.

Water Main System Characteristics

This section summarizes Bellevue's water main system in terms of replacement cost and miles of pipe by the following criteria:

- Material
- Diameter
- Age

The material, diameter, and age of a water main system may impact the risk of failure, the cost to mitigate that risk, and ultimately the size and shape of the long term system renewal plan. Therefore, it is important to understand the characteristics of the Bellevue system prior to assessing the long term renewal plan. Various other factors, including operating pressure fluctuations, soils, soil compaction, construction methods and other conditions can also affect risk of failure. However, data on these other factors was not readily available for this review.

All mileage is based on data obtained from Bellevue's GIS. All replacement values are based on Bellevue's assumed 2012 unit replacement cost as documented below in Table 2. Unit replacement costs vary by the size of the pipe to be installed. These unit costs are based on historic replacement cost data experienced by Bellevue and are in line with industry standards for long-term water main renewal planning.

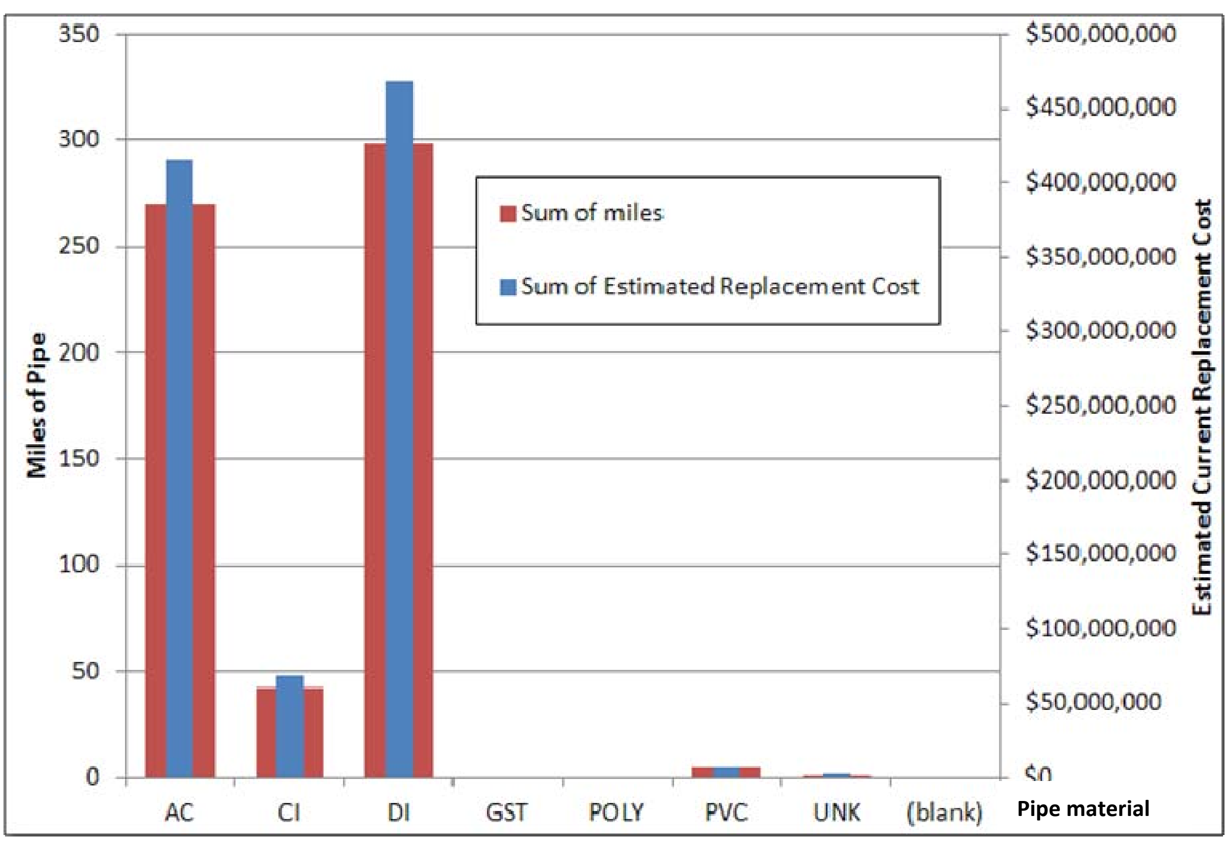
TABLE 2 REPLACEMENT COSTS	
8-inch	$285
12-inch	$330
16-inch	$375
20-inch	$430
24-inch	$495

In a cost analysis of other King County water main replacement projects, using King County tabula data, these costs appeared slightly low. The City's replacement costs also have accounted for the current low-bid construction cost climate. Since the City is using specific data based on actual replacement cost experience within the City, the City's costs may be more specifically applicable to the City's contracting procedures, etc. They fall in the range of expected replacement costs, but may be slightly on the low side of that range.

Material

The Bellevue water main system is predominantly comprised of AC and Ductile Iron (DI) pipe. The system contains a moderate amount of Cast Iron (CI) pipe. Polyethylene (Poly), Polyvinyl, Chloride (PVC), and Galvanized Steel (GST) are present but not common in the system. Of the three most common materials, AC and CI pipe failures are more likely to be brittle and/or significant in nature than DI failure. Therefore, many utilities choose to focus additional renewal resources on these materials classes.

Figure 3 – Miles of Water Main Replacement Cost by Type of Material

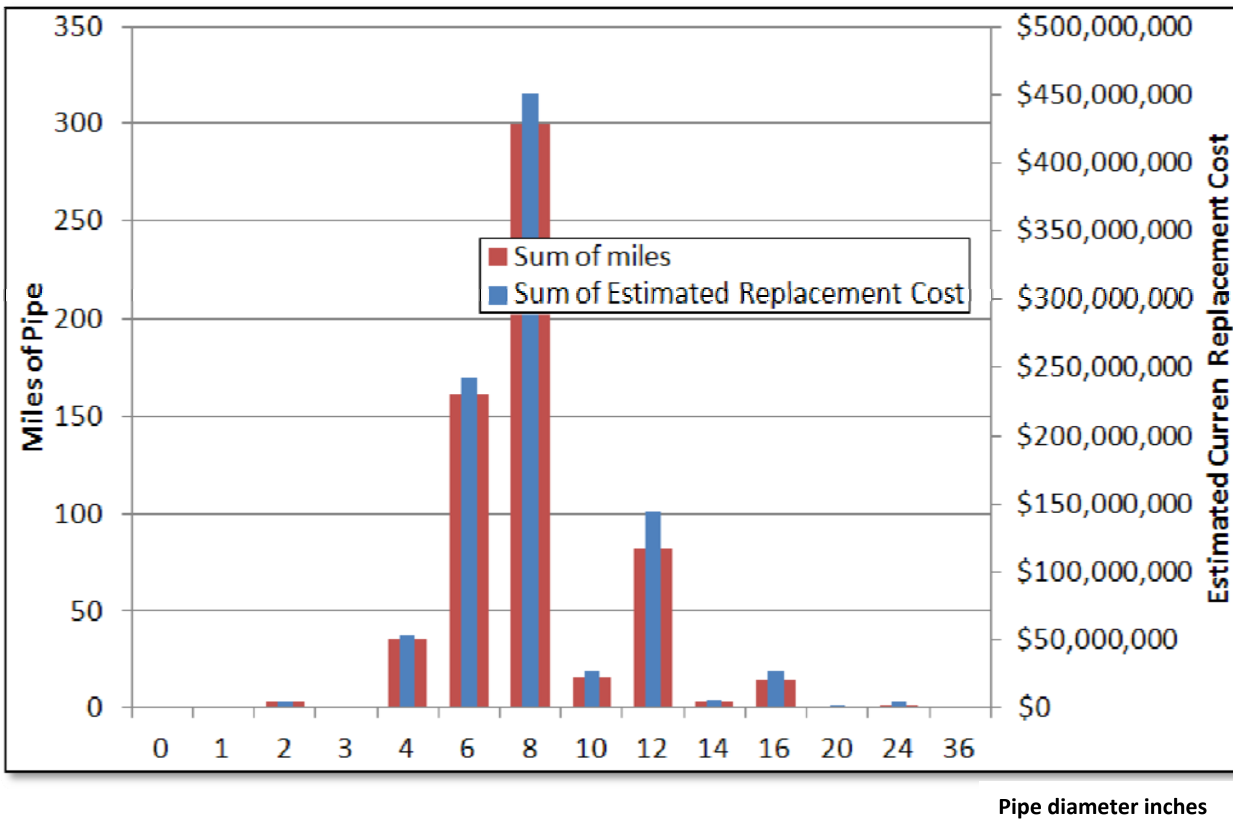


Diameter

The Bellevue water main system is predominantly composed of 6-inch and 8-inch diameter pipe. Pipe diameters are as small as 1-inch and as large as 36-inches in diameter. It is assumed that pipe of 0 inches is pipe of unknown diameter.

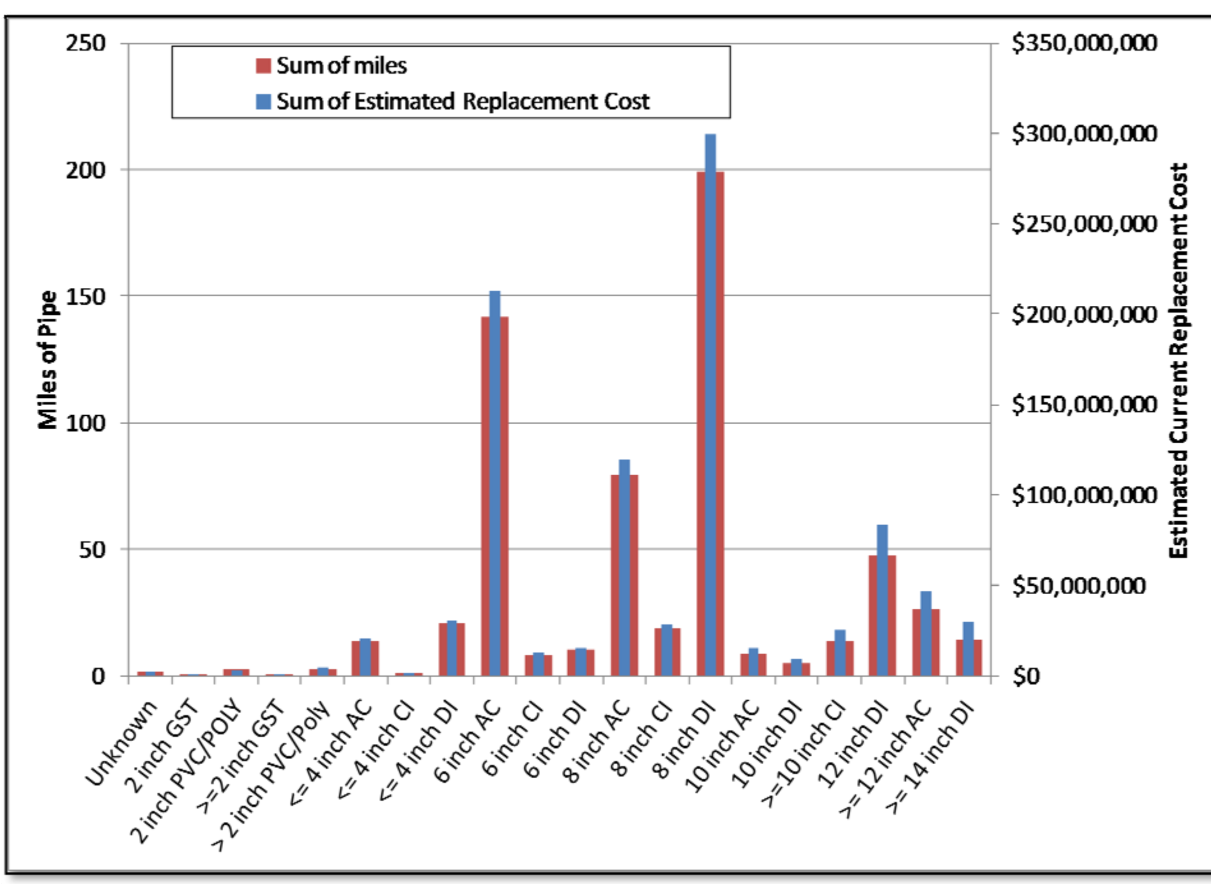
Generally speaking, the consequence of failure increases as the diameter of the pipe increases. Of course, there are exceptions, such as a small diameter line servicing a hospital or other key facility. Risk of failure in these situations can have additional consequences. Conversely, the likelihood of failure of large diameter pipe is typically lower than small diameter pipe due to structural strength of larger diameter pipes, increased design standards, construction quality, and testing.

Figure 4 – Miles of Water Main Replacement Cost by Pipe Diameter



Combining material and diameter provides yet another view of the system characteristics.

Figure 5 – Miles of Water Main Replacement Cost by Pipe Material and Diameter

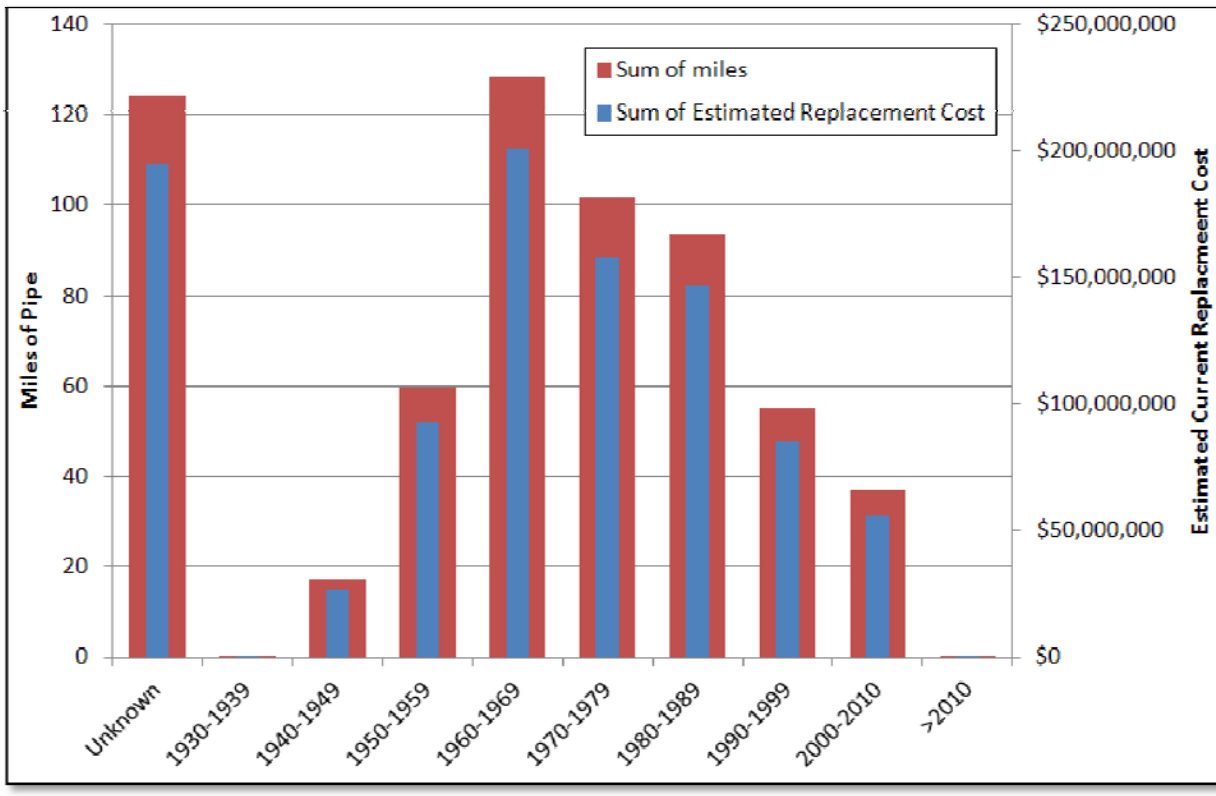


Installation Year

The Bellevue water main system is predominantly composed of pipe installed in the 1960s-1980s. Approximately 20% of the system does not have a known installation date. Based on interviews with staff, it is believed that pipe with unknown installation dates are generally pre-1960. Staff estimated that the average age of pipes of unknown installation date would likely be 50-60 years. For the purposes of this study, unknown pipe was assumed to be 55 years old (i.e. installed in 1956). Based on this assumption, the length weighted average installation date in the system is 1971 and the average age in 2012 will be 41 years.

Generally speaking, as buried water pipes age, the likelihood of structural failure increases. Of course, there are other factors, as noted above, that can increase the likelihood of failure, pressure, soils, construction methods, etc. However, many utilities do focus renewal resources on older portions of the system.

Figure 6 – Miles of Water Main Replacement Cost by Time Period of Installation



Summary of the City's Current Water Main Replacement Strategy

This section summarizes the City's current water main replacement strategy which is to be assessed. There are three major factors that drive the City's current water main replacement strategies. They are:

- The vast majority of the oldest water mains are asbestos cement pipes which:
  - Have much shorter useful lives than cast or ductile iron pipe
  - Are more likely to fail catastrophically (burst as opposed to leak) than cast or ductile iron pipe
- Failure rate experience, as shown in the chart below, shows that AC pipes are far more likely to fail, especially at the smaller diameters. This is likely caused by the thinner wall thicknesses and lower structural strength of smaller diameter pipe. The amount of small diameter AC pipe that is approaching its end of life is of sufficient quantity that replacement rates must be increased if current service levels are to be maintained.
- The need to identify a plan that can be reasonably implemented with adequate contractors available, minimize overall disruption to the community, and can be financed without undue hardship to the City's customers.

Based on the above factors, the City's current strategy for water mains replacement is to focus on replacing AC pipe over the next 55 to 65 years. Pipe replacement prioritization is generally based on estimated risk. In general, the program starts with replacing the 4-inch pipe that is most likely to fail then moves to replacing 6-inch, and then the larger diameter AC pipes. Bellevue's program ramps up from the 1.5 miles of pipe replaced per year in 2008 to 5 miles of pipe replaced per year starting in 2018. The 5-miles per year would continue at that rate through 2073 at which time it would start to ramp down as the amount of AC pipe becomes smaller. Under this replacement strategy the oldest age for the various AC pipe sizes would be:

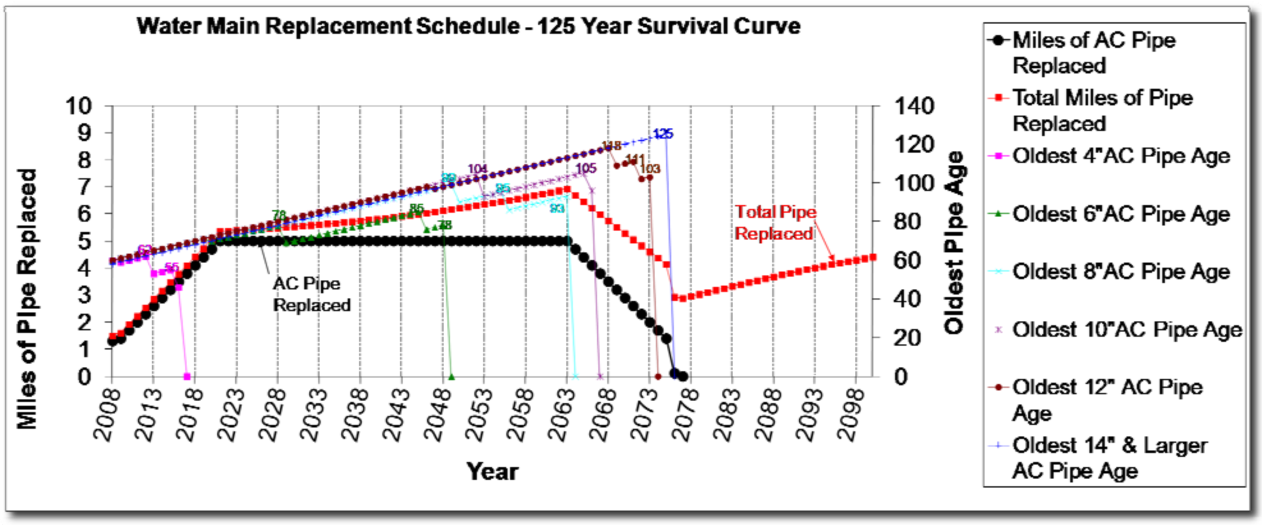
4-inch – 61 years old

6-inch – 85 years
8-inch – 99 years
10-inch – 105 years
12-inch – 118 years

In addition to the five miles of AC mains that are replaced each year, it is expected that a lesser but increasing amount of non-AC mains will need replacement.

The current replacement strategy for water mains is illustrated in the following chart.

Figure 7 –Water Main Replacement Survival Curves by Material and Diameter of Pipe



HDR reviews the current state of asset management in the industry prior to commenting on the City's R&R program for the water utility.

State of the Industry

This section summarizes the state of the industry as it relates to Bellevue's water main replacement strategy. Much of the research documented comes from a concurrent project for the Water Research Foundation, Project No. 4367, "Answers to Challenging Infrastructure Questions", which synthesizes many years of research.

How long does a pipe last?

Typical service life expectancies of water mains can range from 50 years to over 150 years. Desired service levels, utility risk aversion thresholds, pipe material, pipe dimensions, pressure range, loads, ph of water, soil types, pipe install date, groundwater, climate, construction quality, and construction methods are only a few of the variables that drives the service life of pipes.

When should a pipe be replaced rather than repaired?

Determining the optimum point for replacing a pipe used to be viewed as an economic optimization problem that should account for social, economic, and environmental costs. The theory goes that as a pipe ages, O&M, repair, and failure risk costs increase to the point where the net cost of ownership is lower to replace the pipe rather than to continue to operate and repair it. This is the point in time a pipe should be replaced. If the pipe is replaced too early, there is an economic loss due to replacing a pipe before the end of its economic useful life. If the replacement of the pipe is delayed too long, there is an economic loss when additional money is spent for emergency repairs that should have been avoided.

Many economic optimization models have been developed over the past twenty years. A 1985 Water Research Foundation study showed that annual rates as high as 900 breaks per 100 miles per year might be needed to justify replacement of a pipe (O'Day, et al., 1985). A more recent study (Damodaran, et al., 2005) remarked that the commonly used industry replacement rule of thumb of "3 breaks per pipe per year" was equivalent to 1,500 breaks per 100 miles per year, a frequency 60 times higher than the US average. Numerous utility managers have justifiably decided that break rates this high, if applied broadly, would not be viable.

While the theory behind the economic optimization model seems to be founded in sound logic, limitations in terms of accurately and cost effectively evaluating the likelihood of failure and valuing the consequence of failure of mains makes a purely economic driven model beyond the current ability of the industry to apply in the real world. Until the industry overcomes these limitations, replacement programs are most commonly quantified by setting reasonable service level targets (e.g. annual break rate) based customer and regulatory needs.

What is the appropriate level of service in terms of main break rates?

The answer to this question varies by utility but is typically driven by customer willingness to pay for various service levels. Based on a U.S. EPA commissioned study prepared by the AWWA summarizing available research entitled “Distribution System Inventory, Integrity and Water Quality”, the average break rate was estimated at between 23 and 27 annual breaks per 100 miles. The Water Research Foundation report, “Distribution System Performance Evaluation” suggested a “reasonable goal for main breaks for a system in North America is 25 to 30 per 100 miles per year”.

The performance levels provided above should only be used as broad indicators of current performance in the US. Each utility should assess the level of service desired and the willingness to pay for such service prior to setting service level goals. Additionally, service level goals may vary within a utility to account for relative differences in the consequence of failure of various water mains. For example, AC pipe typically fails in a more catastrophic manner than ductile iron pipe and therefore a lower performance threshold may be desirable.

Summary of Bellevue’s Performance

This section summarizes Bellevue’s water main system performance relative to national performance standards identified in the previous section. Performance is measured in terms of annual breaks per 100 miles of water main owned. This is the most commonly used performance metric in the industry of water main integrity. This metric excludes breaks and leaks caused by “dig-ups” as this type of break is not indicative of the condition of mains. This metric also excludes breaks and leaks at other “non-main” assets such as valves, hydrants, saddles, and services.

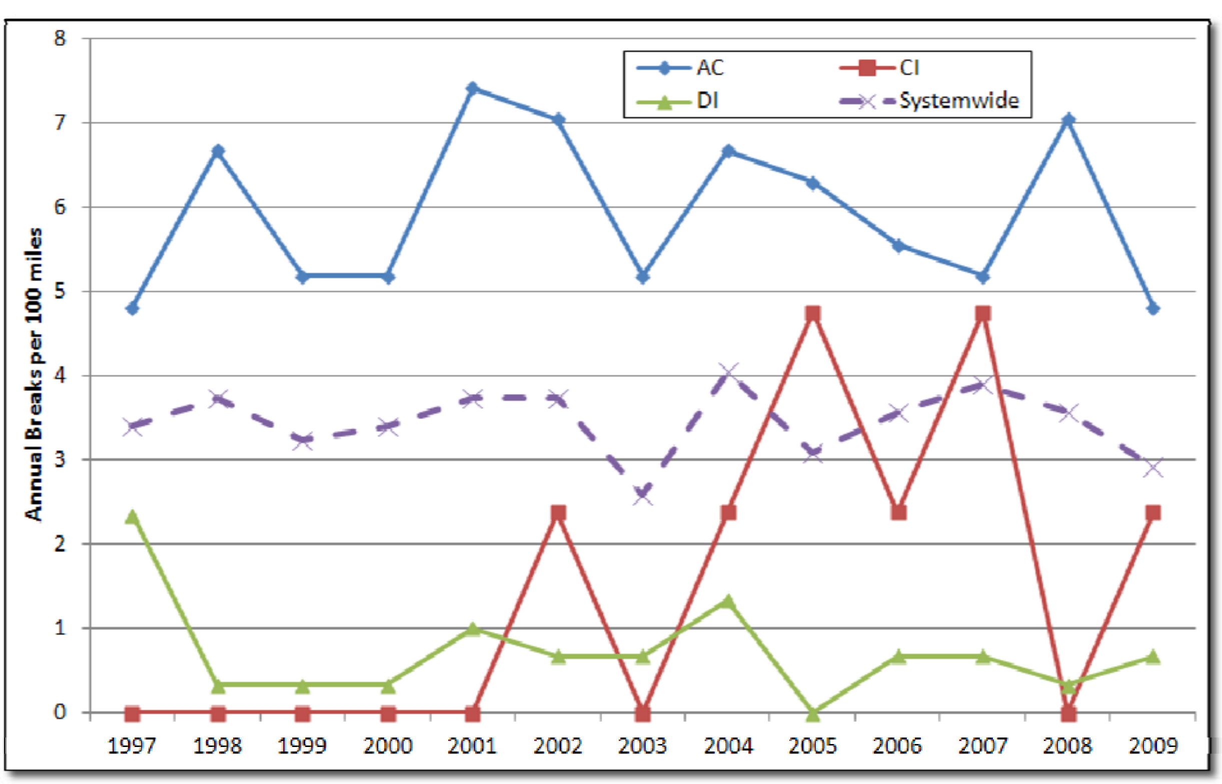
Break Rate by Material

The graph below summarizes Bellevue’s annual performance between 1997 and 2009 by material. The dashed line represents system wide performance for all material types. The average break rate is approximately 3.5 per 100 miles. The overall performance of Bellevue’s system is significantly better than the national average. The system wide year to year break rate is very consistent over the thirteen years of available data. That is, when using break rate as an indicator of system performance, performance has remained relatively consistent over time.

The solid lines represent Bellevue’s break rate by material for the three most prevalent materials in the system. AC pipe breaks at the highest rate followed by CI and DI pipe. In terms of break rate trends by material, AC and DI pipe are not exhibiting a strong trend. CI pipe may be experiencing an increasing break rate trend but due to its relatively small size (in terms of miles of pipe), it is too early to definitely say an upward trend exists.

Note, for the purposes of this cursory study, performance rates were calculated based on the current composition of the system. If significant changes to the system have occurred over time (e.g. growth and/or pipe replacement), those changes would not be accounted for.

Figure 8 – Break Rate Per 100 Miles, by Year and by Pipe Material

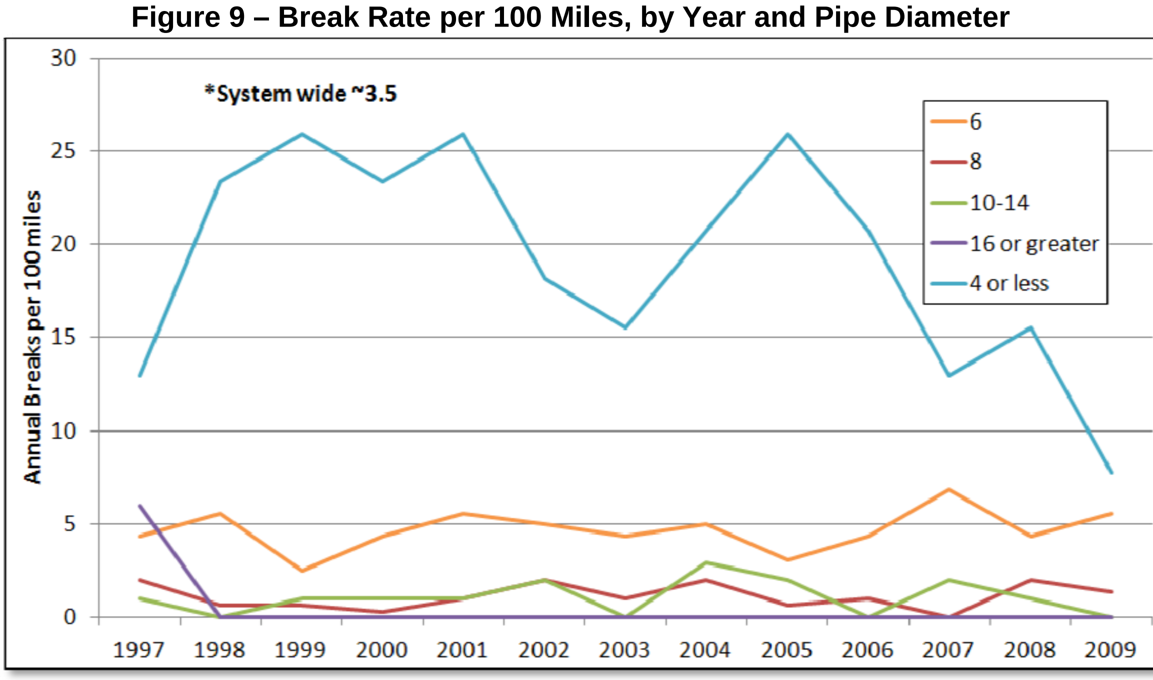


Break rate by Diameter

The graph below summarizes Bellevue's annual performance between 1997 and 2009 by diameter. The average break rate for all diameters is approximately 3.5 per 100 miles. The system wide year to year pattern is very consistent. The overall performance of Bellevue's system is significantly better than the national average. Bellevue's small diameter pipes are breaking at a higher rate than large diameter pipes. This is very common in the industry as larger diameter pipes typically have more rigorous design standards, greater structural strength in wall thickness, construction quality is higher, and acceptance and testing standards are higher.

It appears as though there could be a downward trend developing in terms of the break rate for pipes less than 4-inches. This could be a result of Bellevue's current reinvestment focus on small diameter AC pipes or it could be a function of white noise in the data due to the relatively short period of data available for an asset class of this size.

Figure 9 – Break Rate per 100 Miles, by Year and Pipe Diameter



QualServ Benchmark

Another commonly used benchmarking study is the QualServ Benchmarking Program from AWWA and the Water Environment Federation. The "water distribution system integrity rate" is calculated as the total number of breaks and leaks times 100 divided by the length of the distribution system. Unlike the benchmarking measure above, this measure includes break and leaks associated with dig-ins, valves, hydrants, saddles, services, and other appurtenances. While the industry in general is moving away from the Qualserv definition because it does not measure the integrity of water mains as accurately, the enormous amount of participation and data collected over the years still make this a valuable comparison. Based on data obtained, Bellevue's rate under this measure is 13. The table below summarizes national and regional averages reported by utilities in the 2005 version of the report. This measure confirms that Bellevue's system is performing well above the top quartile of water utilities both nationally and regionally, when viewing the system as a whole.

Table 3 – QualServ Number of Breaks/100 Miles, by Utility Region, Size and Type (AWWA Benchmarking – Performance Indicators for Water & Wastewater Utilities; 2005)

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	16.9	36.4	59.6	52
	South	32.9	63.6	137.7	53
	Midwest	33.2	47.3	66.9	28
	Northeast	13	29.2	68.9	15
Size	>500,000	33.8	70.5	135.3	30
	100,001–500,000	27.7	52.1	94.2	51
	50,001–100,000	30.2	37.8	57.3	25
	10,000–50,000	10.9	35.4	98.6	35
	<10,000	13.7	21.4	39.5	11
Type	Combined	24.1	50.8	112.3	99
	*Wastewater	na	na	na	0
	Water	16.2	36.7	60	53
	All Participants	22.9	43.6	78.7	153

*na = not applicable, insufficient sample size.

The City is more concerned with the small diameter AC pipe that has a higher failure rate per 100 miles and when it fails, it fails catastrophically, causing not only utility system damage, but private property damage, service disruptions, and large impacts to customer service and customer perception of utility services. Part of the City's desire to increase the AC main replacement gradually over the next several years is to prevent these catastrophic failures and to maintain a high level of customer satisfaction with utility services.

City Water Main System Renewal Plan Findings

This section documents the findings of this cursory assessment of the City's water main replacement strategy. Four focus areas were identified:

1. Unit Cost Assumptions
2. Size of Renewal Program
3. Programmatic Renewal Program Focus
4. Pipe Prioritization and Selection Process

Unit Cost

All replacement values are based on Bellevue's assumed 2012 unit replacement cost as documented below. Unit replacement costs vary by the size of the pipe to be installed. ***These unit costs are based on historic replacement cost data experienced by Bellevue and are in line with industry standards for long term water main renewal planning.*** Bellevue should continue to analyze actual unit cost data and revise these unit costs accordingly. Recent stagnant or declining unit costs are neither historically typical nor anticipated to continue over the life of this renewal plan. Therefore, HDR recommends the City continue to consider unit cost inflation factors in the long term renewal forecast.

Size of Renewal Program

Bellevue currently estimates that average water main service lives range from approximately 60 years for its 4-inch AC pipe to 125 years for CI and DI pipe. ***Bellevue's estimated service life is in line with currently accepted industry standards for useful service life of between 50 and over 150 years.*** The actual useful life of any given pipeline will depend on a number of factors including the pipe material and dimensions, construction techniques and quality, and the operating and external environments.

Long range forecasts should be periodically updated as new environmental, condition and failure data is obtained. This will ensure that Bellevue continues to be proactive in assessing newly available data and adjusting the future reinvestment plan accordingly.

Programmatic Renewal Program Focus

The current programmatic main renewal focus is summarized in the graph below. Generally, there are five phases to this program:

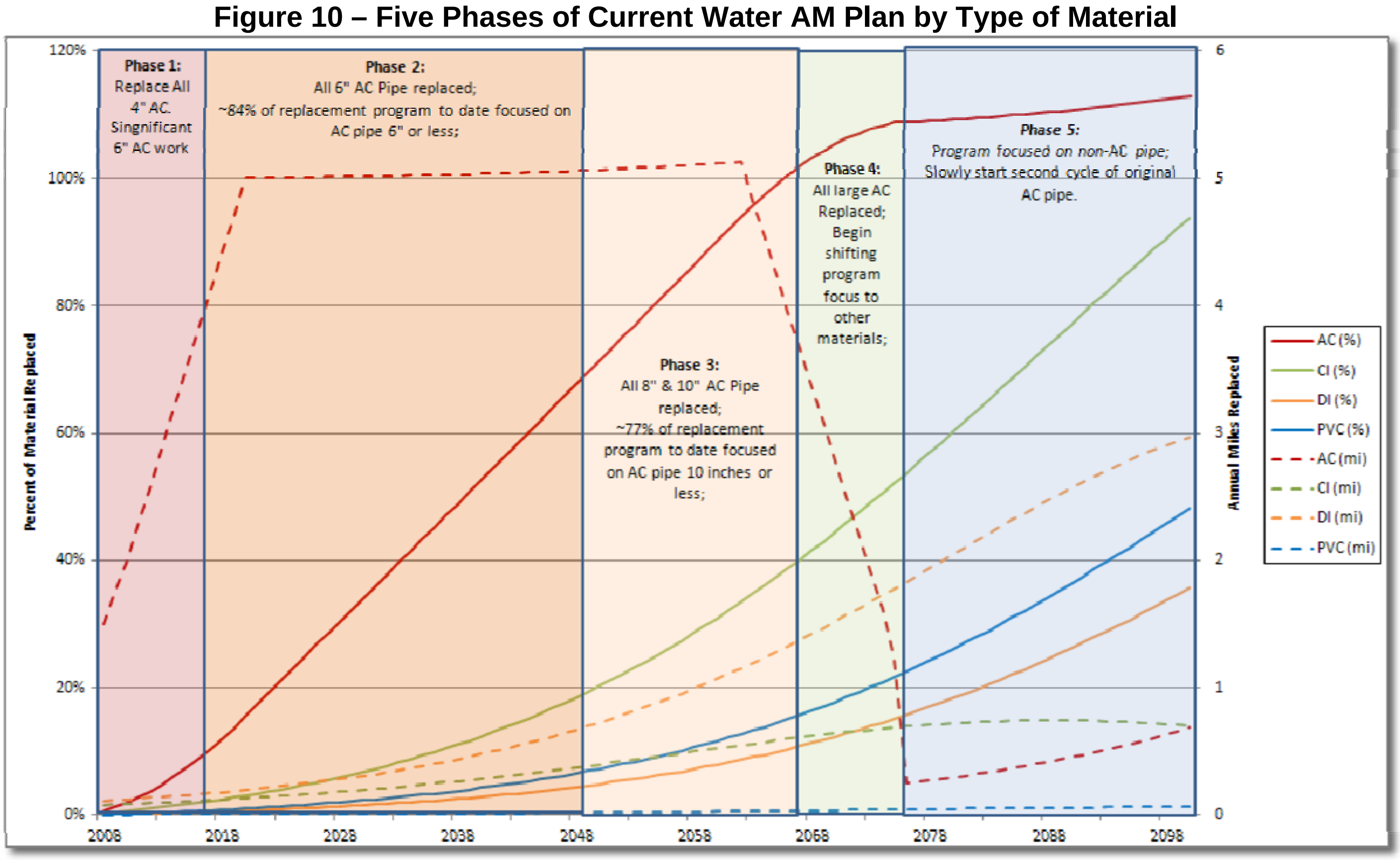
- Phase 1 (2008 to approximately 2016) – Primary focus on replacing all 4-inch AC with some strategic 6-inch AC replacement

- Phase 2 (approximately 2017 to approximately 2050) – Primary focus on replacing 6-inch AC with strategic replacement of other AC and non-AC pipe
- Phase 3 (approximately 2051 to approximately 2066) – Primary focus on replacing all 8 and 10-inch AC with strategic replacement of larger diameter AC on other non-AC pipe
- Phase 4 (approximately 2067 to approximately 2076) – Shift focus to replacing non-AC large diameter AC
- Phase 5 (approximately 2077 on) – Non-AC pipe replacement (no more AC pipe in system)

Small diameter AC pipe represent the asset class with the highest break rate. AC also tends to fail in a brittle nature which typically increases the consequence of such a failure. Once a break occurs, it typically expands down the line. Additionally, pipe less than four inches has a much greater probability of not meeting current City standards for pressure and/or fire flow (note this was not evaluated as part of this study). Therefore, ***the near term programmatic focus is in line with common industry practices if Bellevue's goal is to limit the number of breaks in the system.*** As with most long term plans, it is critical to revisit them on a regular basis to ensure conditions and goals have not changed. Cast iron pipe can also often fail in a brittle and consequential ways and recent trends show that break rate could be on the rise for that asset class. Additionally a focus on smaller diameter pipe may lead to increased breaks on larger mains which are typically more significant in nature than breaks on smaller pipes.

HDR recommends re-evaluating the programmatic focus of the main renewal program at a minimum of once every five years.

Figure 10 – Five Phases of Current Water AM Plan by Type of Material



Pipe Prioritization and Selection Process

Once an investment program is sized and an annual dollar amount is allotted, the next step is to develop an approach to select the pipes that will actually be replaced. Bellevue has a robust program focused on using the data it collects to determine the risk associated with each AC pipe. This analysis is the basis for determining which AC pipe should be replaced first. This process includes the use of "observation" data (i.e. visual condition assessment of active pipe that is exposed for various reasons in the normal course of system maintenance), lab testing, break rates, O&M input, pipe age, and consequence of failure data. The analysis weights the length of the pipe. This assessment serves as a preliminary prioritization tool. Ultimately, other factors such as the geographic location of priority pipes, potential hydraulic limitations, and non-water program driven projects are accounted for prior to final selection of pipes. ***This process is in line with common industry practices and would be considered above average based on similarly sized utilities.***

Water Main Recommendations for Consideration

This section documents identified opportunities for improvement based on this cursory review of the City's water main replacement strategy.

1. **Enhanced observation data collection**. The intent of Observation data is to cost effectively capture data that could support condition assessment and decision making at a pipe and/or system level. Such data would be collected any time an active main is exposed (e.g. main repair, service connection, etc.) to support more cost effective data collection. Data currently collected includes a visual assessment of the exterior condition, interior condition, soil type, and moisture level. While the information historically collected is useful, there are opportunities to enhance the quality, consistency, and type of data collected. When feasible, strategically collecting coupons or mechanically testable segments, measuring metallic pipe wall thickness (using an ultrasonic gauge and pit depth gauge), removing metallic pipe rust, coatings, and graphite, tracking pressure ranges versus pipe failures (especially associated with fire flow tests), and measuring soil resistivity should be considered.
2. **Document breaks and recreate history since 2010.** Since the conversion to Maximo 7, Bellevue has not been able to consistently document break history which is a central component of the long term pipe renewal planning process. Finalize and implement the break/leak documentation protocol and recreate the break history where missing (2010 to present).
3. **Reduce the number of pipe assets managed.** Currently, the extent of a pipe asset is based on valves, couplings, reducers, structures, tees, crosses, and bends. This has resulted in the GIS having too many pipe assets to effectively support O&M and CIP planning. Currently, there are over 29,000 assets and the median length of those assets is 54 feet. As a result it much more difficult to consistently tie info collected (repair, break, flushing, condition assessment) to an asset or review the history of an asset. This can limit the ability to use the data collected.
4. **Expand condition assessment activities.** Where practical, consider expanding the existing practices for post replacement condition assessment activities. Consider obtaining a representative sample in terms of all pipe replaced (note this may take several samples if the condition of the pipe replaced changes condition significantly). Continually evaluate whether the City is getting good “bang for your buck”. Note, as the City is already doing, this information can also be valuable in refining the “table top condition assessment approach” used to identify which pipes should be replaced next.
5. **Enhanced CIP forecasting model.** As Bellevue continues to collect more break, observation, and condition assessment data, consider developing a data driven service life estimate and updating the CIP forecast model accordingly. Evaluate the usefulness of research models on AC pipe management to help determine if the current life-expectancies assumed by the forecast are reasonable.
6. **Continuous evaluation of break history.** Continue to evaluate break history based on various pipe characteristics that may lead to increased risk of failure. Characteristics could include material, diameter, age, geographic location, pressure, geologic conditions and soil resistivity. Analysis should support programmatic condition assessment and renewal programs as well as support useful life assumptions.
7. **Pipe Prioritization and Selection Process** - Currently, Bellevue has a robust asset based pipe prioritization and replacement selection process. This process includes the use of “observation” data (i.e. visual condition assessment of active pipe that is exposed for various reasons in the normal course of system maintenance), lab testing, break rates, O&M input, pipe age, and consequence of failure data. Currently, this process is primarily focused on prioritizing small diameter AC mains for replacement. Consider expanding this assessment to all pipes in the system and focusing replacement projects on pipes with known structural issues, regardless of which asset class the main is associated with.

Review of Saddles, Services, and Meters

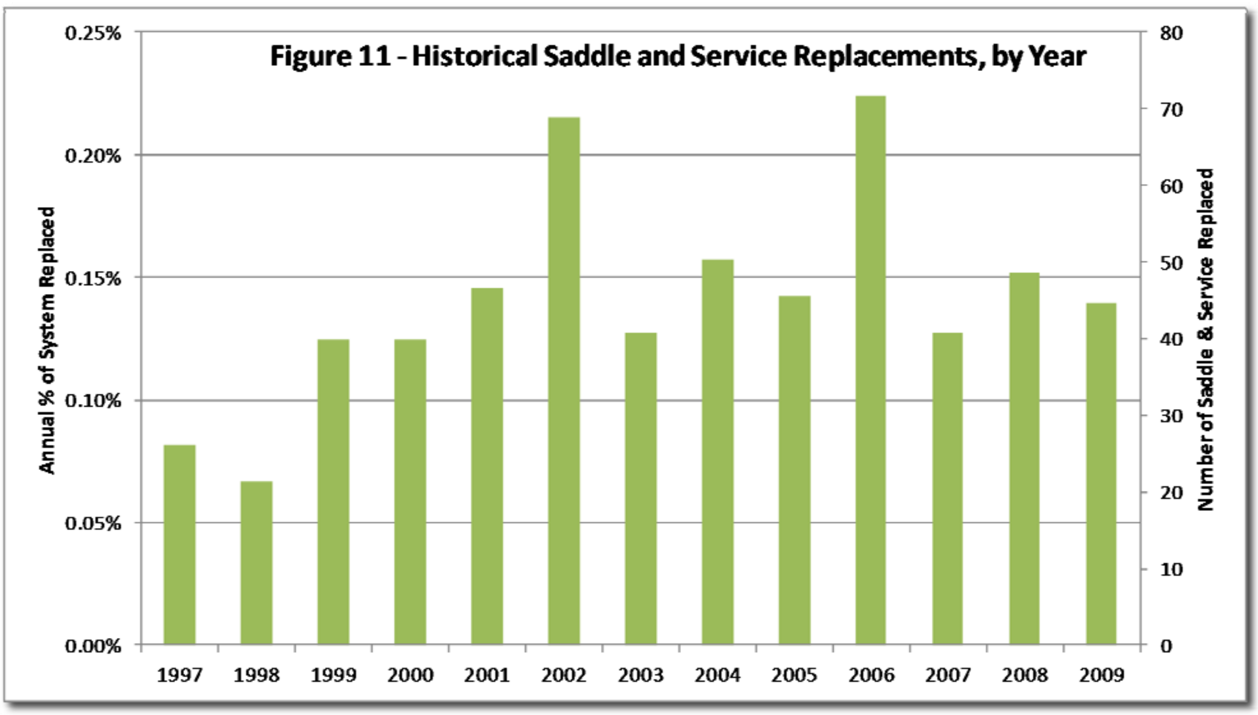
This section evaluates the CIP forecast for saddles, services, and meters. The saddles, services and meters account for 5% of the system’s total asset projected replacement cost. Bellevue does not maintain an asset database for these assets. The City has estimated the number of saddles and services owned as 33,000. Although there is some proactive replacement, Bellevue’s approach to saddle and service infrastructure renewal is predominantly based on a “run to failure” model. The total number of saddle and service failures is generally on the order of 50 per year. The failure consequences of these assets are usually less severe than the failure of other significant water utility assets.

The City also attempts to assess the condition of these assets when potholing is required for other CIP projects. If the condition assessment shows the asset is in poor condition, Bellevue will proactively replace the deteriorated asset before failure. These assets are also replaced as part of main replacement projects. This renewal approach is relatively common in the industry due to the relatively low consequence of failure associated with a failure at a saddle or service and because condition assessment is difficult and not cost effective unless construction activities are required for another reason in the area. The City should continue to leverage and document opportunity condition assessment work where the cost of condition assessment is significantly mitigated.

The replacement history for saddles and services based on asset failure or condition assessment is summarized below. This excludes saddles and services replaced where the primary driver was mainline replacement projects. The failure rate relative to the system size is very low (less than a quarter of one percent). Additionally, there is no strong trend in terms of increasing or decreasing failure rates.

Meter replacements are generally performed by the Operations and Maintenance Division. Larger commercial meter replacements that require more extensive work such as vault replacement are performed as part of the CIP program.

Bellevue's "run to failure" saddle and service replacement plan is in line with industry practices. HDR recommends that the City reevaluate the long-term funding forecast on a regular interval (approximately once every three to five years) or if the break rate moves significantly in one direction of the other. This will ensure that Bellevue continues to be proactive in assessing newly available data and adjusting the future reinvestment plan accordingly.



Based on historic replacement costs at the time of failure, Bellevue estimates the replacement cost at $3,500 per saddle and service. This is a reasonable unit cost.

Review of the Water Utility Vertical Assets

Vertical assets include pump stations, reservoirs, inlet stations, PRVs and other related infrastructure. These assets account for approximately 23% of total system asset replacement cost. Each asset class was reviewed separately.

Pump Stations

Bellevue currently has 22 pump stations in the system. The replacement cost of this asset class represents approximately 10% of the total system replacement cost. The City began a comprehensive pump station rehabilitation program beginning in 2005, with a pump station study completed in 2007.

The City uses a life cycle replacement interval of 100 years, with rehabilitation every 25 years. A life cycle replacement cost $3 million and $750,000 is assumed, respectively. EPA publications indicate an effective life for pumps at 40 years and motors at 35 years. Veolia estimated a pump's effective live at 24 to 32 years. Therefore the City of Bellevue's 25 year rehabilitation cycle appears reasonable.

HDR reviewed the assumptions and data contained within the AM Plan file for pump stations had the following conclusions and recommendations for the City's consideration.

Recommendations for Consideration – Pump Stations

- A life cycle replacement interval of 100 years should be considered a maximum potential life and acknowledges the City's commitment to maintaining the structures on a thorough and on-going basis. EPA publications indicate that buildings (civil) are usually assigned an effective life of 75 years. However, this interval may vary based on the original quality of construction of the pump station and the equipment contained there in. For example a pump station built using reinforced concrete standards will outlast a structure made of concrete masonry units. Further consideration of expected service life of water pump stations will have to be considered on a case by case basis.
- The life cycle replacement cost of $3 million and the rehabilitation cost of $750,000 are reasonable at a planning level. However, opportunities do exist to more closely plan these costs:
  - Size, configuration and quality of construction were not provided and thus more accurate cost estimating may be realized when these factors are taken into consideration.
  - For the most part higher rehabilitation costs are realized at the 50 year life (typical roof replacement or seismic upgrades occur at this interval). Adjusting for higher rehabilitation costs at the 50-year life and slightly lower rehabilitation costs at the 25 and 75 year life may provide more probable results.

- Reviewing each pump station's condition and estimated rehabilitation costs on a case by case basis over the next five to ten years. The City will then be able to assess more precisely when the rehabilitations should occur and what those projects costs may entail, given specific capacities of each pump station, horse power, etc.
- Some inconsistencies were noted in the intervals when water pump stations were identified as needing rehabilitation. Further discussion with the City determined that this was done to smooth the earlier year's rehabilitation projects to avoid peak years with large project costs. This smoothing is based in part on some prior known pump station project needs, and setting the end date, for the 100 year life. From the 100-year life the City worked backwards to establish approximate 25-year rehabilitation dates, while "smoothing" project costs.

Reservoirs

There are 27 drinking water reservoirs in the City's water utility system with a combined capacity of 42.5 million gallons. (Four additional reservoirs are joint-use reservoirs with other entities, which are responsible for operations and maintenance of them.) This asset class comprises 8.4% of the asset replacement total for the water utility. The assumptions for reservoir replacement timing and cost were reviewed within the City's AM Plan file.

The City has chosen a water reservoir expected service life of 125 years for steel tanks, 100 years for pre-stressed concrete, and 75 years for concrete reservoirs. The American Concrete institute recommends a 60 year life cycle for reinforced concrete reservoirs. Based on experience within HDR, the expected life of a pre-stressed concrete tank is expected to be 75 to 80 years, and the maximum potential life of a steel tank is somewhere between 100 and 125 years for welded tanks, not bolted tanks.

The Steel Tank Institute provides examples of tanks that are over 100 years old on their website. Additionally, EPA suggests an expected life of 50 – 60 years. Therefore, the range could be 50 – 60 years for the design life and 100 – 125 years for the maximum potential useful life of welded steel tanks. Likewise, effective useful life of a tank can be affected by the construction standards adhered to during initial construction. That is, tanks built in the 1930's may not realize a 100 year life, while tanks built in the 1980's may be more likely to achieve a maximum potential tank life. There would be a balancing between level of maintenance and cost necessary to maintain an older structure versus advances in technology that may make a tank obsolete.

TABLE 4
TYPE OF RESERVOIR AND USEFUL LIFE

Type of Material	City AM Plan Useful Life, years	Typical Useful Life, years
Steel Tank – welded[1]	125	60 - 125
Concrete	75	60
Pre-stressed Concrete	100	75 – 80

1] Maximum potential useful life ranges from 100 – 125 years.

Construction cost of $2.00 per gallon is used by the City in the models for the replacement cost. HDR has seen new reservoir construction costs ranging between $1.50 per gallon to $4.00 per gallon, depending on the particular site conditions for various locations. The cost of $2.00 per gallon is in the common range of cost per gallon seen in our practice for new construction, which could be representative of the complete rehabilitation costs.

The City's assumptions within the models state that a tank requires $1 per gallon of investment during its useful life, but only $0.50 per gallon is capitalized. These costs are estimates based on limited City data on cost experience. Other projects are considered to be maintenance type projects and are not capitalized (coatings for example). The City should evaluate the condition and estimated rehabilitation costs for each reservoir on a case by case basis, due to the variability in typical useful life and construction costs of the various types of reservoirs. This can lead to more accurate forecasting of actual projected replacement costs. For example, pre-stressed concrete tank replacement should be less than those tanks of welded steel construction.

Recommendations for Consideration – Reservoirs

- The life cycles proposed by the City of Bellevue may be optimistic. The replacement life cycles could be adjusted with more data on maintenance costs when the cost of maintenance exceeds expected replacement cost threshold.
- The cost of replacement and rehabilitation is reasonable considering that the City of Bellevue capitalizes the cost of lining reservoirs and does not capitalize tank coatings.
- Inconsistencies were noted in intervals that the tanks are being planned for replacement/rehabilitation. Also, some facilities were missing cost data. In discussions with the City, it was explained that some of the tanks are cost-shared with other water providers, and therefore some data is not available. Additionally, some inconsistencies exist due to capital costs that were already in the budget (2014 through 2017) and efforts to smooth the project cost totals to provide for smoother rate transitions.
- The cost of rehabilitation and replacement of the reservoirs should be further refined to reflect the type of material and condition of the reservoir such that actual timing and projected costs of reservoir replacement can be fine-tuned.

PRVs

PRVs comprise approximately 3.7% of total water system replacement costs. Bellevue's water system includes over 150 PRVs that supply water throughout Bellevue. These PRVs provide system-wide pressure optimization to all zones and customers. When the PRVs sense a drop in system pressure, these valves open wider to provide additional water to fight fires or in response to other supply deficiencies.

The AM Plan assumes a 30-year replacement cycle at a cost of $80,000. Replacement criteria include service requirements, safety, maintenance history, age, and availability of replacement parts. This portion of the AM Plan file did have more detailed information about some of the PRVs historical data and primary function of the PRVs.

HDR staff are aware of PRV's that have been in service for over 50 years. HDR contacted vendors to discuss effective life cycles, which are stated to be 60 years. There is very little to wear out in a PRV, but replacement parts are not often available after 50 years.

Recommendations for Consideration – PRVs

Upon review of the data within the file, HDR had the following observations for consideration:

- The life cycle replacement interval of 30 years at a cost of $80,000 for PRV stations is reasonable at a planning level. However, opportunities do exist to more closely plan these costs. Consider the following for future planning efforts.
    - Increase the life cycle interval to 50 years for the replacement of epoxy-coated PRV's with replacement/rehabilitation of the PRV vaults or housing structures every 30 years. For the older, non-epoxy type PRVs, 30 year replacement assumptions are appropriate.
    - Criticality of a PRV station is also important to consider. Whether a PRV is primary or secondary should be included in the determining the timing of replacement. Primary stations should be prioritized over older secondary PRVs, where the results of a failure are greater with primary stations.

Although an $80,000 average replacement cost may be acceptable, closer scrutiny of costs to replace the PRV's accounting for the size of the PRV stations (such as a single PRV station versus a station with 3 PRVs) may provide more exacting results. Any shifts in the overall assumptions and cost estimates for PRVs will not significantly affect the overall Am Plan forecast, as these PRV assets represent a small portion of the overall system replacement forecasted expenses.

Financial Review of the Water Utility Asset Management Plan

As part of this study the City requested that HDR perform an independent review of the financial impacts of the Asset Management Plan on the water utility share of the Asset Renewal and Replacement Reserve and provide an estimate of the annual level of funding needed to support the AM Plan. To begin this review, HDR reviewed the related financial policies the City has developed for the Waterworks Utilities along with the projected R&R funding plan.

Financial Policy Review Regarding Financing Asset Replacement

The City has an extensive set of financial policies governing financial planning city-wide, and also has developed specific policies for the Waterworks Utilities. Per these financial policies, the following parameters are known. The City develops a biennial budget in the even years, for the following two years. The current budget for 2011-2012 was developed in 2010 and the 2013-2014 budget is currently being developed this year. Within the creation of the budget, a 7-year capital investment plan (CIP) is developed. Project costs and timing are updated as changes become known. Long-term capital improvements related to renewals and replacements are based on the long-term R&R forecast (the AM Plan) to provide an estimate of future R&R needs. This financial information is adjusted for inflation and then entered into the City's financial and rate forecasting model for the water utility, which is updated early in the year to provide the Early Outlook Forecast in April. Budget information is refined for submittal around the June/July time period of even years, for the next two years. The approval process through management and the City Council then begins.

The financial policies also state that any city funded capital asset over $25,000 that involves either new physical construction, reconstruction or replacement of an existing asset is capitalized. The policies indicate the following principles:

- The City has a preference for rate funded CIP, over debt financing.
- Financial planning for long-term CIP should result in:
  - Smooth rate transitions,
  - Maintaining high credit ratings
  - Providing financial flexibility, and
  - Achieve intergenerational equity.

The policies also establish an Asset Renewal and Replacement Reserve (R&R reserve) in order to fund future utility asset replacements, and to provide Intergenerational equity by contributing to the R&R Reserve at a minimum level of depreciation expense, to reflect the deterioration of assets in service, and a maximum level reflecting the annual cost of replacement. In this way, future customers are not burdened with all replacement costs when system components need to be replaced. This has been a practice of the utility since the late 1990's.

The policies also call for review of the policies and updating as needed. As part of this brief review, the City has requested HDR review the need for continuing these on-going contributions to the R&R reserve, given the revisions to the level of water main replacements within the Asset Management Plan.

Asset Renewal and Replacement Reserve

As of January 1, 2011 the water utility beginning fund balance in the R&R Reserve was approximately $25 million. This level of funding has accumulated over a number of years, with the intention of the funds being available as asset replacements increase in future years, as the asset useful lives come to an end. As a result of the increase in small diameter AC pipe breaks and catastrophic failures in the early 2000's, the City reviewed it's asset replacement plan for the AC pipes and began a more accelerated replacement program, particularly related to small diameter AC pipes. The purpose in doing this is three fold:

- To maintain current levels of service
- To avoid large and on-going repair costs for pipes having repeated failures; choosing the most cost effective approach to providing a given level of service
- To avoid claims against the City from property damage caused by these catastrophic failures.

Given the accelerated plan for replacement, the current 7-year CIP replacement component and the long-term water main projections are consistently higher than the previous financial forecast had assumed. The City had been replacing AC pipe at a level equal to approximately 1.5 miles per year and the accelerated program calls for an average of 5 miles per year by 2018. It is critical that the City continue to gradually increase main replacement from the 1.5 miles per year (in 2008) to 5 miles per year by 2018 and maintain the 5 miles per year throughout the replacement of the AC water mains. Any deferral of funding the water main replacement program will increase the overall replacement costs due to inflation, increasing risk of AC main failures and associated damages, which can result in increased rate adjustments over current rate projections. By accelerating the renewal program to this level over a ten year period the City will maintain intergenerational equity with current customers paying for the replacement of pipelines that they benefit from, while customers in the future will also be paying for replacement of the water mains from which they benefit.

Through its rate forecasting and budgeting process the City accounts for inflationary costs. This is essential as the cost of replacing 5 miles of main each year will increase with inflation. In addition to the pipeline replacements, the forecast includes approximately one pump station and/or reservoir rehabilitation or replacement each year. By funding one pump station and reservoir replacement on an annual basis it will help smooth the replacement curve.

Within the utility financial planning arena, it is a recommended practice to maintain a capital reserve balance to meet future capital improvement and replacement needs. By maintaining a reserve, asset replacement can take place even if unforeseen conditions occur, or the utility has a catastrophic failure of a major asset. The R&R reserve will provide the City with the ability to smooth future rate adjustments during greater than average capital replacement periods. In years when larger replacement projects are needed, the reserve can fund a portion of those projects, allowing the rates to increase incrementally, rather than short-term increases for specific project(s).

The average annual replacement needs during the next 75 years is $11 million in 2012 dollars. This includes pipelines, pump stations, reservoirs and other miscellaneous asset replacements. Given this level of replacement needs it is recommended that the City maintain a minimum of one year's replacement costs in the R&R reserve. However, in order to prevent future deferrals, it is prudent practice to have more than one year's replacement projects in the reserve. Based on the review of the City's AM Plan it is recommended that the City strive to maintain a balance of $12 to $20 million in the reserve for the purposes of using the reserve funds as described above. This level of reserve balance will need to be adjusted for inflation over time. At least once every five years this reserve balance range should be reviewed. As the City implements the replacement projects there may be years where the reserve level will temporarily dip below the minimum reserve level to help fund one of the larger pump station or reservoir replacement projects. This is an acceptable practice as long as the financial forecasts show that the reserve level is restored gradually in the following years. This will help to minimize rate impacts and allow for smooth rate transitions related to implementation of the AM Plan.

As noted above, the annual target funding level is $11 million in 2012 dollars. However, there here is approximately a 30-year period (2039 to 2069) when the contributions to R&R needs must be $12 million in 2012 dollars. In these years, when the funding level from rates exceeds the expenditure, the balance will go to the reserve to build a balance to help fund the peak years in the latter part of the next 75-year period. During the peak construction periods, the reserve will help fund amounts over the average annual rate funded level of $12 million (2012$).

In the long-term, in the years 2018 to 2085, the annual capital expenditure for asset replacement is relatively level, increasing slightly over time, with some years lower or higher than others. Over time the City can levelize the overall totals in the latter part of the forecast period. In this way, when there are large project costs, less replacement work on other assets may be completed, or in the lower years, additional funding can be transferred to the R&R reserve to be there for the years when larger projects occur. This can help smooth the rate transitions in the future.

Capital projects that will be in addition to replacement projects to meet regulatory requirements or for expansion will need to rely on other types of funding, or will create a need for larger rate adjustments.

Financial Review Summary

The City maintains the water utility assets in a fiscally responsible manner. In the past the City has used an Asset Renewal and Replacement Reserve to save for future replacement expenditures. The City plans to gradually accelerate the level of AC main replacement to 5 miles per year. Water main replacement, combined with pump station and reservoir rehabilitation and replacement each year, along with other miscellaneous assets, represent the total R&R forecast for the utility. Given this level of annual replacement needs it is recommended that the utility gradually increase the level of annual rate funded capital to approximately $11 million (2012$). It may also be necessary for the City to increase the level of annual rate funded capital to $12 million (2012$) during approximately 30 years of the current AM Plan forecast to fund peak period construction. In the long-term, the utility's R&R reserve should be maintained at a minimum level of $12 to $20 million (in 2012$, and adjusted for inflation in future years) to avoid deferral of R&R projects in the future. The recommended annual level of rate funding and R&R reserve balances will allow the City to sustain its AM Plan and maintain intergenerational equity in renewal and replacement of the system.

Overall Study Summary

The City is one of the few cities in the Northwest with a proactive utility asset inventory and management plan in place. The City's financial policies have provided a basis for managing the water utility assets in a financially responsible and proactive manner. The AM Plan files project the asset replacement costs over a 75-year period. The Excel files contain a number of assumptions regarding useful life of assets and unit costs for replacement. As HDR reviewed the files, we requested additional data that the City has used to develop the AM files. It would be prudent practice to document the assumptions, data sources, and cost basis within the file. Each class of assets does have the essential assumptions contained within that particular asset's tab, but definitions of failure, breaks, and data source for these assumptions and decisions would enhance the City's AM Plan, especially for future use and updating.

Overall, the City's assumptions for asset replacement appear to be reasonable. Consideration of the useful life assumptions for reservoirs would be a good point of focus for review and consideration, as noted above. Additionally, it appears the purpose and use of the R&R Reserve Fund for the water utility could be adjusted to reflect the utilities current financial needs, given the accelerated Small Diameter AC Pipe Replacement program. Such consideration could include reduction of on-going transfer to the R&R Reserve for the water utility, except in years when replacement project costs are lower than the average, when transfers should make up the difference to the average. These funds then can be available to help mitigate rate adjustments in future years.

HDR appreciates the opportunity to review and comment on City's long-term Water Utility Asset Management Plan and we hope that our information and comments are of assistance as the City determines water utility rehabilitation and replacement funding needs for the future.

Appendix X

Completed Projects

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Appendix X
Completed Projects

This Appendix provides additional information on capital projects completed since 2007. These projects are listed in Section 9.2.

D.1 CIP W-16 Small Diameter Water Main Replacement

This program focuses primarily on replacing short-lived small diameter asbestos cement (AC) pipe, which yields a secondary benefit of increasing the emergency fireflow available to neighborhoods. This investment will ramp up water pipeline replacement to 5 miles/year by 2018, and then be adjusted with inflation to maintain the 5 miles/yr replacement rate. At that rate, water pipe will need to last on average 100-125 years. Pipes are selected for replacement based on risk of failure (likelihood and consequence), failure history, and coordination with other construction, such as planned street overlays (which reduce restoration costs).

Recent projects completed under CIP W-16 are listed in Table D-1.

D.2 W-16 Pressure Reducing Valve (PRV) Rehabilitation

This ongoing program consists of the rehabilitation or replacement of old and deteriorating pressure reducing valves (PRVs) throughout the water service area. The number of pressure reducing valves that are rehabilitated varies from year to year based on the annual program budget and the rehabilitation costs, but over the long term should average about 3 PRVs per year. Replacement criteria include service requirements, safety, maintenance history, age, and availability of replacement parts.

Recent projects completed under CIP W-67 are listed in Table D-2.

D.3 W-69 Minor (Small) Water Capital Improvement Projects

This ongoing program pays for small improvements to Bellevue's water system to resolve deficiencies, improve efficiencies, or resolve maintenance problems, often in conjunction with other programs such as the Transportation overlay program. Projects are prioritized based on criteria including public safety/property damage, maintenance frequency, operator safety, environmental risk, reliability and efficiency gains, coordination with other city projects or development activity, and level of service impact. Recent projects are listed in Table D-3.

D.4 W-82 Fire Hydrant Improvements

This program replaces non-standard hydrants that have outdated two-port connections, thereby improving the rate of water flow and reducing response time in the event of a fire. As of 2012, there are 32 remaining 2-port hydrants. Based on the current budget, these will be replaced by approximately 2022.

D.5 W-85 Structural/Seismic Reservoir Rehabilitation

This program funds reservoir retrofit or replacement to avoid or mitigate earthquake damage, and ensures reservoirs can maintain at least a minimal level of system functionality following a seismic event. It also funds reservoir rehabilitation for age or use related deterioration. There are 27 drinking water reservoirs in the system with a combined capacity of 42.5 million gallons. A 1993 reservoir study evaluated the seismic vulnerability of 21 of the reservoirs and recommended further evaluation and/or upgrade for 12 of these reservoirs.

Recent projects completed under CIP W-85 are listed in Table D-4.

D.6 W-91 Water Pump Station Rehabilitation

This program was established in 2005 to rehabilitate Bellevue's twenty-two water pump stations. Based on a needs assessment of each pump station, improvements can range from basic improvements to complete reconstruction. The rehabilitation work always includes replacing the mechanical and electrical equipment, adds on-site emergency power generation as needed, and resolves structural deficiencies and life/safety issues as needed.

Recent projects completed under CIP W-91 are listed in Table D-5.

D.7 W-92 Reservoir Water Quality Upgrades

This program was established to make improvements related to water quality, sampling and monitoring at reservoir sites. Projects completed under CIP W-92 are listed in Table D-6.

D.8 W-98 Replacement of Large Commercial Water Meters

A 2003 Water Loss Study identified that older commercial meters 3-inches and larger may significantly under-register flows passing through them, and become less accurate over time. There are 279 of these meters in our system (out of over 35,000 total meters) which account for nearly 30% of the total volume of water sold. The study suggested the meters may under-read as much as 102 million gallons annually (retail value ~$400,000). The revenue lost by the meter inaccuracies affects both the water and sewer utilities, since sewer rates are based on winter water usage. This investment ensures equitable water charges by accurately measuring the water consumed. This results in more accurate rate allocation among user classes (residential and commercial customers), and reduced unaccounted (and non-revenue producing) water. A secondary program benefit is to resolve safety issues at 75 of the meters, which cannot currently be read remotely. Many of these oldest meters are in vaults which need to be replaced to accommodate the new meters, and to meet current safety/access standards. Vault replacement adds to the complexity and cost. The current budget funds replacement of 3-4 meters/year for locations where the vault must be replaced.

This program systematically replaces high-volume commercial water meters (3" and larger) as their performance accuracy declines. Recent projects completed under W-98 are listed in Table D-7.

D.9 W-99 Water Service Line and Saddle Replacement Program

This program replaces aging and deteriorating water service saddles (the component connecting the customer's water service line to the city-owned water line), and deteriorating water service lines (the pipes between the city's water main to the customer's water meter).

The City is responsible for maintaining approximately 33,000 water services and saddles. Varying soil conditions result in highly variable service life. The average expected life is 40-50 years with newer stainless steel saddles expected to last at least 85 years. Saddle and service line failures require emergency response, result in customer water service disruption until the line is repaired, and can damage roadways and private property. This program addresses the increasing need for replacement of aging and deteriorating service saddles and associated service lines. Specific projects will be identified through a service saddle condition assessment program (proactive) or by actual saddle failure (reactive). Recent projects completed under W-99 are listed in Table D-8.

D.10 W-101 Relocate Water WSDOT I-405/SR 520 Braids

Relocate up to three water pipes located within the state's right-of-way, to accommodate the state highway project. The state's project includes complete replacement of the NE 12th Street overpass bridge, where Bellevue has a 16-inch diameter transmission main that provides the primary water supply to Bellevue west of I-405.

Bellevue is legally obligated by State permits and agreements to relocate or modify its utilities to accommodate the State's project.

D.11 W-102 Relocate Water for WSDOT 520 Expansion

Relocate up to five water pipes located within the state's right-of-way, to accommodate the state highway project. Bellevue has three pipes hung from overpasses, and two that pass under the highway, within the vicinity of the WSDOT project. The crossings provide domestic water supply to customers north of SR520.

Bellevue is legally obligated by State permits and agreements to relocate or modify its utilities to accommodate the State's project.

Table D-1 – CIP W-16 Small Diameter Water Main Replacement Program

Sub-Project	Started	Completed
Newport Way at 150th Ave SE Watermain Replacement	2006	2007
Evergreen Point Road AC Main Replacement (SR 520 North)	2002	2007
NE 25th St at 134th Ave NE Small Dia Watermain Replacement	2002	2007
Water R&R Development	2002	Ongoing
AC Pipe Testing Program	2003	Ongoing
Meydenbauer Refill Modifications and 12" Water Main	2004	2007
2006 AC Main Replacement, Phase 1	2005	2008
2006 AC Main Replacement, Phase 2	2006	2008
2007 AC Main Replacement, Phase 1	2006	2008
Miscellaneous Watermain Rehab Projects	2006	Ongoing
2007 AC Main Replacement, Phase 2	2007	2010
Somerset - 146th Avenue SE AC Main Replacement	2007	2010
Bel-Red Inlet Station Pipe Replacement	2008	2010
Rosemont Blvd Overlay	2008	2008
2009 AC Main Replacement, Ph 1	2009	2010
2009 AC Main - NE 8th St West of 92nd	2009	2010
Eastgate - SE 42nd St Emergency AC Main Replacement	2009	2010
2010 AC Main Replacement, Ph 1	2010	2012
NE 26th St and 166th Ave NE Emergency AC Main Replacement	2010	2010
AC Main Replacement 2010, Ph 2	2010	2012
AC Main Replacement - 108th Ave SE	2010	2012
AC Main Replacement - SE 3rd St (101st - 104th Ave SE)	2010	2012
AC Main Replacement 2011, Ph 1	2010	2012
AC Main Replacement 2011, Ph 2	2010	2012
AC Main Emergency Replacement at 390 W. Lk. Samm Pkwy.	2010	2012
2011 Overlay Program - Utilities Sites	2011	2012
AC Main Replacement - 145th Pl SE - SE 22nd Pl (Lake Hills 520)	2011	2012
AC Water Main Easement Acquisition	2011	**2012**
AC Main Replacement 2012, Ph 1	2011	**2012**
AC Main Replacement 2012, Ph 2	2011	**2012**
AC Main Replacement 2012, Ph 3	2011	**2013**
AC Main Replacement - 540 W Lk Samm Pkwy SE	2012	2012
AC Main Replacement - 3945 W Lk Samm Pkwy SE	2012	**2013**
AC and CI Main Replacement - 120th Ave NE and NE 8th St	2012	**2013**
2012 Overlay Program - Utilities Sites	2012	**2013**
AC Main Replacement 2013, Ph 1	2012	2012
AC Main Replacement 2013, Ph 2	2012	**2013**
AC Main Replacement 2013, Ph 3	2012	2014
Overlay Program 2013 - Water	2013	**2013**
AC Main Replacement 2014, Ph 1	2013	2014
AC Main Replacement 2014, Ph 2	2013	2014
AC Main Replacement 2014, Ph 3	2013	2015
Newport Hills 470 SE 60th Watermain Repair	2013	2014

Table D-2 – CIP W-67 PRV & Commercial Meter Rehabilitation Program

Sub-Project	Started	Completed
Newport Way PRV at 150 Ave SE - Watermain Improvement	2006	2007
PRV Replacement 2006	2006	2008
PRV Replacement 2007 Phase 1	2006	2008
PRV Replacement 2007-2009	2007	2010
PRV Replacement 2009	2006	2010
Engineering and Inpspection Costs	2009	2010
PRV #41	2009	2010
Replace lids for 2 PRV's and 3 Commercial Meters	2009	2010
BHC #2 Package - 5 stations	2009	2010
BHC #3 Package - 5 stations	2009	2010
Engineering and Inpspection Costs	2009	2010
BHC and other Consultant Costs	2009	2010
PRV Repalcement 2010 Ph 1	2007	2012
PRV #67 Replacement 2011 @ Valley Green Condos Complex	2011	2012
PRV Repalcement 2010 Ph 2	2011	2012
PRV Replacement 2011 Ph 1	2011	2012
PRV Replacement 2012, Ph 1	2011	2012
PRV and Commercial Meter Vault Modifications 2011	2011	2011
PRV and Commercial Meter Vault Modifications 2012	2011	2012
PRV Replacement 2013	2011	2013
PRV and Commercial Meter Vault Modifications 2012	2011	2013

Table D-3 – CIP No. W-69 Minor Capital Improvement Program

Sub-Project	Started	Completed
Factoria/125th Ave SE Water Extension	2006	2007
Transfer to Bel-Red Inlet Project		
2006 Water Main Improvements	2006	2007
Cherry Crest Reservoir Roof Repairs 2007	2006	2010
Miscellaneous Minor CIP Projects	2007	Ongoing
Cougar Mountain No. 2 Coating and Joint Repair	2007	2007
Somerset No. 3 Reservoir and Pump Pump Station Improvements	2008	2008
Bel-Red Inlet Minor CIP	2008	2010
Miscellaneous Reservoir Projects	2009	Ongoing
Somerst #2 Reservoir Roof Repair	2009	2010
Somerst #3 Reservoir Roof Repair	2009	2010
Hoizon View #3 (2-million gallon)	2009	2010
CH 335 Altitude Valve, PRV #3 Electrical, PRV #70 Landscaping	2009	2010
Kelsey 450/Loop Dead End Water Mains NE 10th St & 144th Ave NE	2011	2012
Kelsey 450/Abandon AC Creek Crossing near NE 14th Pl and 144th	2011	Ongoing
Micro-Hydro Turbine Feasibility Study	2011	2012
Lakemont Blvd Fire Hydrant Relocation	2011	2012
PRV Installation Projects (SE 42nd St and 163rd Pl SE)	2011	Ongoing
Parksite and Crossroads North Reservoir Recoating 2011	2011	2012
Kirkland/Water District #1 Water Intertie at Yarrow Point	2011	Ongoing
Kirkland/Bellevue Water Intertie at 132nd Ave NE	2011	Ongoing
Clyde Hill 465 Reservoir Water Quality Improvement Project	2011	Ongoing
164th Avenue Minor Water Improvements (Service Saddles 2012)	2012	2012
Somerset Inlet Station - Manual Transfer Switch	2012	Ongoing
Richards Road Inlet Station Modifications	2012	Ongoing
Lake Hills 520 Zone Conversion and Model Update	2013	Ongoing
BSC SCADA Upgrade - Water	2013	Ongoing
Factoria Reservoir Site Drainage Modification	2013	Ongoing

Table D-4 – CIP W-85 Structural/Seismic Rehabilitation Program

Sub-Project	Started	Completed
Cherry Crest Reservoir Repairs 2005	2005	2008
Somerset No. 1 Structural Seismic Retrofit	2006	Ongoing
Reservoir Structural Coatings Evaluation	2007	2012
Miscellaneous Reservoir Structural Projects	2007	Ongoing
Somerset No. 2 Structural Seismic Retrofit	2011	Ongoing
Crossroads North Reservoir Structural Roof Repair	2011	Ongoing
NE 40th St Reservoir Structural Roof Repair	2011	Ongoing
Horizon View Reservoir No 3 Structural Wall Repair	2012	2012
Pikes Peak 4.5 MG Reservoir Project	2012	2012
Pikes Pk 550 Str Retrofit	2013	Ongoing
Meydenbauer roof leak repair	2013	Ongoing
Horizon View #1 Reservoir Repl	2013	Ongoing

Table D-5 – CIP W-91 Water Pump Station Rehabilitation Program

Sub-Project	Started	Completed
Bellevue Booster Pump Station Predesign Report	2006	2010
Newport Pump Station Rehabilitation	2008	2013
Horizon View No. 3 Pump Station Rehabilitation	2011	Ongoing
Horizon View No. 1 Pump Station Replacement	2013	Ongoing
Cougar Mountain No. 3 Pump Station Rehabilitation	2014	Ongoing

Table D-6 – CIP W-92 Reservoir Water Quality Upgrades

Sub-Project	Started	Completed
Clyde Hill 465 Water Quality Upgrade	2001	2010
Forest Hills Reservoir and Pump Stataion Chlorine Analyzer	2002	2010
Cougar Mtn #2 Chlorine Analyzer	2002	2010
Future WQ Projects - Consultant Design	2007	2010
Miscellaneous Reservoir Water Quality Projects	2008	2010

Table D-7 – CIP W-98 Replacement of Large Commercial Meters

Sub-Project	Started	Completed
2005 Commercial Meter Upgrades	2005	2007
Commercial Meter Upgrades 2007, Phase 1	2006	2008
Commercial Meter Installed by O&M	2006	2008
Commercial Meter Replacement - SE 3rd St (101st - 104th Ave SE)	2010	2012
Commercial Meter Replacement (2011)	2010	2013
PRV and Commercial Meter Vault Modifications 2012	2012	2014

Table D-8 – CIP W-99 Service Lines and Saddle Replacement Program

Sub-Project	Started	Completed
Service Lines and Saddle Replacement 2006, Phase 1	2006	2008
Service Lines and Saddle Replacement 2006, Phase 2	2006	2008
Service Lines and Saddle Replacement 2007, Phase 1	2006	2012
Service Saddles 2011/145th Pl SE Transportation Project	2011	2012
Service Saddles 2011/164th Avenue NE (NE 4th to Main St)	2011	2012

Appendix Y

Adjacent Utility Comments

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Lane, Douglas

From: Michael Gagliardo <mgagliardo@cascadewater.org>
Sent: Tuesday, January 12, 2016 3:43 PM
To: Lane, Douglas
Subject: RE: Bellevue Water System Plan

Doug
Cascade has reviewed the Draft City of Bellevue Water System Plan Update (the Plan) and provides the following comments:

- The Demand Projections in the Plan were prepared using a different methodology from the Demand Projection in the Cascade Transmission and Supply Plan (TSP). While the TSP Demand Projections were for Cascade Members as a group, Cascade did break out projections for individual Members. The Demand Projections in the Plan are not inconsistent with the Cascade projection for Bellevue.
- Water Utility Policies (Chapter 2)
  - Section 2-4 Service Area: Any Service Area expansions must be handled consistent the provisions of the Joint Municipal Utility Services Agreement
  - Section 2-6 Regional Policies: A general statement that The City is Member of Cascade and participates with and coordinates all regional activities through Cascade
- Water Use Efficiency (Chapter 5)
  - Page 5-4: The Built Green and WaterSense New Homes Initiative Program provides certifications for single and multi-family homes. Approximately 2500 higher efficiency fixtures were installed in 2014 (the figure for 2015 should be available in a few weeks).
- Appendix R Draft Shortage Management Plan
  - Section 2.1 – reference should be the 2012 Joint Municipal Utility Services Agreement (section 7.3 of that Agreement is the appropriate shortage section)
  - The Block Contract was also amended in 2013 (section references are appropriate)
- Please continue to coordinate Bellevue's request for a new inlet station on SPU's Tolt pipeline and potential development of existing wells with Cascade so that any changes in these areas are accomplished consistent with the Block Contract and the Joint Municipal Utility Services Agreement.

If there is any other input Cascade can provide please contact me.

MG

Michael A. Gagliardo
Director of Planning

t: 425.453.1503
f: 425.453.0953
c: 206.790.9713

cascadewater.org

Lane, Douglas

From: Robert Russell <rrussell@ccud.org>
Sent: Thursday, January 07, 2016 3:52 PM
To: Lane, Douglas
Subject: RE: Bellevue Water System Plan

Hi Douglas,

Todd and I reviewed the plan and did not find anything inaccurate and do not have any questions.

Thank you,

Robert Russell | General Manager
COAL CREEK UTILITY DISTRICT
6801 132ND PL SE | Newcastle, WA 98059
P:(425) 235-9200 | F:(425) 228-7429

From: DLane@bellevuewa.gov [mailto:DLane@bellevuewa.gov]
Sent: Thursday, January 7, 2016 3:41 PM
To: rrussell@ccud.org
Subject: RE: Bellevue Water System Plan

Hi Robert – just checking in. Do you have any questions or want to meet regarding Bellevue's plan?

Douglas Lane, PE
Water & Sewer Systems Senior Engineer
City of Bellevue
(425)452-6865
dlane@bellevuewa.gov

From: Robert Russell [mailto:rrussell@ccud.org]
Sent: Monday, November 09, 2015 7:59 AM
To: Lane, Douglas <DLane@bellevuewa.gov>
Subject: RE: Bellevue Water System Plan

Hi Doug,

I did receive it this morning.

Thank you,
Robert

Robert Russell | General Manager
COAL CREEK UTILITY DISTRICT

Lane, Douglas

From: Greg Neumann <GNeumann@kirklandwa.gov>
Sent: Thursday, December 10, 2015 10:13 AM
To: Lane, Douglas
Cc: Erin Devoto
Subject: Bellevue's WSP

Hey Doug,

As we spoke at the meeting today, Kirkland has no comments for Bellevue's draft WSP other than the potential emergency intertie at Points Dr and 96th Ave should probably be mentioned.

Thank you,
Greg Neumann
City of Kirkland
Water/Wastewater Supervisor
425-587-3910

King County

Utilities Technical Review Committee
Department of Natural Resources and Parks
King Street Center
201 South Jackson Street, Suite 512
Seattle, WA 98104-3855
www.kingcounty.gov

January 21, 2016

Douglas Lane, P.E.
City of Bellevue
450 110th Avenue NE
Bellevue, WA 98009-9012

Dear ~~Mr. Lane:~~ Doug

Thank you for submitting the City of Bellevue Water System Plan (Plan). The Plan was received on November 6, 2015. In accordance with King County Code 13.24, the King County's Utilities Technical Review Committee (UTRC) reviewed the Plan for consistency with the King County Comprehensive Plan and the King County Code (KCC).

In reviewing the Plan, the UTRC noted one an addition that is necessary before we can make a recommendation to the King County Council for approval of the Plan. Please include a signed State Environmental Policy Act threshold determination so that the UTRC can make its recommendation to the County Council.

The Plan acknowledges that several private water systems and numerous individual wells serve customers within the City's service area. Attached is a map of the Group A and B systems that are known to King County to be within the District's service area. The map is being provided to assist the City in planning future water service to these private water systems and well users.

Often times, the construction and/or maintenance of utility lines require work within the road right-of-way (ROW) for roads in unincorporated King County. When a utility has a proposed project within unincorporated King County, please contact the King County Department of Transportation (KCDOT), Road Services Division, Engineering Services Section for coordination with the County's annual overlay program. Failure to do so may result in the denial of the permit to work within the ROW once an overlay of the road section has been completed. Although each utility has a set of construction standards and specifications for their projects, when construction and or maintenance of utilities requires work within the road ROW for roads in unincorporated King County, please be aware that the current edition of the King County Road Design and Construction standards apply to any installation or work in these ROWs. Not adhering to these standards could result in the installation of non-specified and approved methods and/or materials that are out of the specifications for King County, and could potentially add additional costs to the purveyor for future repairs or adversely affect acceptance of those repairs/installations. The KCDOT- 2007 King County Road Design and Construction Standards can be found on the World Wide Web at: http://www.kingcounty.gov/transportation/kcdot/Roads/EngineeringServices/RoadStandards2007.aspx

It is our understanding that the City has one franchise; Franchise number 12004 that expires October 23, 2020. If your understanding of the current franchise agreement is different, please notify Christopher Young at (206) 477-9401 or by email at Christopher.Young@kingcounty.gov.

We look forward to seeing the final Plan and working with you to secure the King County Council's approval. The Council's action will represent King County's final action on the Plan.

If you have any questions or concerns about any of the information in this letter, please do not hesitate to call me at 206-477-538.

Sincerely,

Stephen Hirschey

Stephen Hirschey
Chair, Utilities Technical Review Committee

Attachment

cc Richard Rodriguez, Regional Planner, Washington State Department of Health

Lane, Douglas

From: King County Water District 117 <kcwd117@gmail.com>
Sent: Tuesday, January 12, 2016 10:19 AM
To: Lane, Douglas
Subject: Re: Bellevue Water System Plan

Hi Douglas,
Sorry for the delay in getting back to you. I needed to check on the pressures with one of my fellow commissioners who deals more directly with our consulting engineers, Stantec. We estimate the pressure at the intertie to be between 20 and 25 psi, based on the respective elevations of our storage tanks and the intertie.

I hope this helps.

Also, we had no comments on the water system plan.

Thanks,
Tom Gething

Sent from my iPad

On Dec 24, 2015, at 10:04 AM, <DLane@bellevuewa.gov> <DLane@bellevuewa.gov> wrote:

> Hi Tom:
>
> Could WD 117 provide any pressure data from your system, and/or pump operations data? This would be useful for Bellevue to assess whether there could be any backflow potential of well water into our system if the emergency valve was open (or leaking).
>
> Also please let me know if you have any comments on the Water System Plan – I'll assume no if I don't receive anything.
>
> Thanks very much, and happy holidays-
>
> Douglas Lane, PE
> Water & Sewer Systems Senior Engineer
> City of Bellevue
> (425)452-6865
> dlane@bellevuewa.gov
>
> "The contents of this electronic mail message do not necessarily reflect the official views of the elected officials or citizens of the City of Bellevue."
>
> ---
>
> **From:** KCWD 117 [mailto:kcwd117@gmail.com]
> **Sent:** Thursday, November 05, 2015 4:11 PM
> **To:** Lane, Douglas <DLane@bellevuewa.gov>
> **Cc:** Charlie Anderson <charlesanderson@gmail.com>; Doug Bacon <dbacon26@comcast.net>
> **Subject:** Re: Bellevue Water System Plan

Thanks, Douglas. I have forwarded this to the other commissioners. We'll review and if we have any questions or comments we'll get back to you soon. If you don't hear back from us, we are fine with the descriptions.

Tom

> On Nov 5, 2015, at 1:29 PM, DLane@bellevuewa.gov wrote:
>
> Dear Water District #117 Commissioners:
>
> The Draft City of Bellevue Water System Plan Update (the Plan) is currently available for public review and comment (click here). The Plan is prepared to support the City's water system planning, in accordance with Washington Administrative Code (WAC) 246-290-100 and King County Code (KCC) Title 13, Section 24.010.G.
>
> I'm writing to request the Hilltop Community's and Water District #117's review of the Plan. The website requests public comment by December 18, but for neighboring utilities I have asked for review by January 8, 2016, since that is approximately when I expect to get comments from the state and King County.
>
> The sections of the Plan that I believe should be relevant specifically to the Hilltop community include the following (all in Volume 1, except last bullet):
>
> - The City's service area boundaries are described on pages 1-6 and 1-7.
> - The connection (interties) between Bellevue and WD117 is described in pages 1-10 and 1-11.
> - WD117's well is mentioned on pages 1-32 and 1-33.
> - WD117 is mentioned in the discussion of the policy regarding requests for assumption (page 2-9). This policy remains unchanged from the last plan (2006 Water Comprehensive Plan), but the discussion language was updated where obsolete.
> - See footnote below Table 3-8 (page 3-10).
> - Interlocal agreements are in Volume 3. Hilltop/WD117 begins on page 321/670.
>
> Please let me know if you have any comments, or reply "no comments".
>
> Thanks very much for your time.
>
> Douglas Lane, PE
> Water & Sewer Systems Senior Engineer
> City of Bellevue
> (425)452-6865
> dlane@bellevuewa.gov
>
>

Lane, Douglas

From: KCWD#1 <KCWD1@comcast.net>
Sent: Thursday, November 05, 2015 3:29 PM
To: Lane, Douglas
Subject: Comments
Attachments: KCWD#1 Resolution 2015-7.PDF

Hello Doug,

The size of your Water System Plan document is amazing!

The only comment from us pertains to where to find us. Of course you have reached us via email and likely have our current address and phone number, but the ILA and amendments only show an address that we are no longer using. None of us thought to update it with the recent Amendment #2.

Maybe that does not matter because State law requires that the official notice of the District agent's contact information be via a resolution filed with the County Recorder's Office. I have attached that document for your use as you choose.

Bob Trimble, President
King County Water District #1
4640 95th Ave NE
Yarrow Point, WA 98004

425-450-0791

Lane, Douglas

From: Scott Thomasson <STHOMASSON@REDMOND.GOV>
Sent: Thursday, January 21, 2016 7:50 AM
To: Lane, Douglas; Scott Thomasson
Cc: Jeff Thompson
Subject: RE: Bellevue Water System Plan Comments

They look fine

From: DLane@bellevuewa.gov [mailto:DLane@bellevuewa.gov]
Sent: Tuesday, January 19, 2016 11:54 AM
To: Scott Thomasson
Cc: Jeff Thompson
Subject: Bellevue Water System Plan Comments

Hi Scott:

Thanks for meeting with us last Wednesday regarding Bellevue's Water System Plan. I'm preparing a comment log so DOH and Bellevue's Environmental Services Commission can review all the comments, and our responses. We also need to attached adjacent utility comments to the final Plan.

Since we got your comments verbally, I wanted to check that I accurately captured them in writing. Can you look at the list below and confirm?

Thanks again

Doug

Name	Date	Comments
Scott Thomasson (City of Redmond)	1/13/2016	Connections shown in Table 1-2 do not account for all connections with Redmond, such as joint-use mains.
Scott Thomasson (City of Redmond)	1/13/2016	Bellevue doesn't "supply" Redmond; we both are supplied by Cascade through joint-use facilities. "Wheeling" language doesn't capture this. See Redmond's Water System Plan for more appropriate language.
Scott Thomasson (City of Redmond)	1/13/2016	Future demand projections look high; are they consistent with Cascade's?
Scott Thomasson (City of Redmond)	1/13/2016	Redmond does not consider SPU's supply to be 2 sources (it would be difficult to get Cedar water up to Redmond), so we use 400 gal/ERU as emergency storage volume criteria for the in-town areas. Based on this criterion, Redmond's Overlake area has a storage deficiency. This is difficult to rectify with Bellevue's 200 gal/ERU storage criterion, since we share facilities in the Overlake area. This is unresolved.

City of Seattle
Seattle Public Utilities

January 6, 2016

Mr. Douglas Lane
City of Bellevue
P.O. Box 90012
Bellevue, WA 98009-9012

Subject: Comments to Draft City of Bellevue Water System Plan Update

Dear Mr. Lane:

Thank you for the opportunity to review and comment on the Draft City of Bellevue Water System Plan Update (the Plan). We offer the following general comments and more specific comments on data gaps and corrections to the information presented in the Plan, particularly as related to Seattle Public Utilities (SPU) and its water services to the City of Bellevue through its contract with Cascade Water Alliance.

1. The Plan recommends installation of additional inlet capacity to serve the West Operating Area from SPU's Tolt Eastside Supply LIne. SPU notes that the Tolt Eastside Supply Line is a pipeline constructed with bar wrapped pipe (BWP). This type of pipe is relatively difficult to install new taps on, and such installation requires specialized expertise not available to many contractors. It is SPU's experience that tapping BWP is best avoided, and would therefore encourage Bellevue to locate the new tap so that it can be supplied from existing factory installed but unused outlet on the pipeline, such as at SE 8 Street, Main Street, NE 8th Street, or the SPU cast iron 16-inch feeder line in Bel-Red Road which can be tapped easily anywhere along its length.

2. The Coliform Monitoring Plan included in Appendix U is dated 2007/2008. Please provide an updated Coliform Monitoring Plan for review when it is available. We recommend that you use the template provided by the Washington State Department of Health and include a map of sample locations, a standard operating procedure for sample collection and an E.coli Response Plan (which is part of the DOH template).

3. Please include the disinfection by-product (DBP) sample locations on Figure 7-1.

4. Please keep SPU apprised of the City's intended use and development of groundwater wells.

Ray Hoffman, Director
Seattle Public Utilities
700 5th Avenue, Suite 4900
PO Box 34018
Seattle, WA 98124-4018

Tel (206) 684-5851
Fax (206) 684-4631
TDD (206) 233-7241
ray.hoffman@seattle.gov

http://www.seattle.gov/util

5. Please note that new wholesale water sales outside of Bellevue's service area may be subject to terms and conditions in the 2nd Amended and Restated Declining Block Water Supply Agreement between the City of Seattle and the Cascade Water Alliance, more particularly, Section 3.6 of the agreement.

If you have any questions on our comments or need additional information, please contact me at 206-684-0839, or joan.kersnar@seattle.gov.

Sincerely,

Joan M Kersnar

Joan M. Kersnar, P.E.
Drinking Water Planning Manager

cc: Terri Gregg, Wholesale Contracts Manager, Seattle Public Utilities