# CITY OF ALGONA

**KING COUNTY** **WASHINGTON**

# WATER SYSTEM PLAN

**G&O #12503**
**JULY 2013**
**UPDATED DECEMBER 2013**

Gray & Osborne, Inc.
CONSULTING ENGINEERS

# CITY OF ALGONA

KING COUNTY WASHINGTON

CITY of the GREAT BLUE HERON
ALGONA

## WATER SYSTEM PLAN

WARREN W. PERKINS
STATE OF WASHINGTON
33786
REGISTERED
PROFESSIONAL ENGINEER

7/1/13

**G&O #12503**
**JULY 2013**

Gray & Osborne, Inc.
CONSULTING ENGINEERS

# TABLE OF CONTENTS

## CHAPTER 3 – SYSTEM ANALYSIS

## CHAPTER 4 – CONSERVATION PROGRAM

## CHAPTER 5 – WELLHEAD PROTECTION PROGRAM



## CHAPTER 6 – OPERATION AND MAINTENANCE PROGRAM



## CHAPTER 7 – CONSTRUCTION STANDARDS



## CHAPTER 8 – CAPITAL IMPROVEMENT PROGRAM

## CHAPTER 9 – FINANCIAL ANALYSIS

# LIST OF TABLES

# LIST OF FIGURES

# APPENDICES

# EXECUTIVE SUMMARY

The City of Algona Water System Plan (Plan) provides a long-term planning strategy for the City's water system over the 6- and 20-year planning periods. The objectives of this Plan are to evaluate the performance and adequacy of the existing City of Algona water system, to determine what will be necessary to meet the infrastructure demands for the next 20 years, and to identify compliance issues that may affect operation of the water system. The Plan was prepared in accordance with the Washington Administrative Code (WAC) 246-290.

The following elements are required by the Department of Health (DOH) to be addressed in this Plan.

- Chapter 1: Water system history, inventory of facilities, policies and the relationship of this Plan to other planning documents.

- Chapter 2: Basic planning data including existing and future estimates of population, water consumption, and water production.

- Chapter 3: Identification of system performance standards and analysis of water quality, source capacity, storage capacity, and distribution system hydraulic capacity.

- Chapter 4: Discussion of existing and future water conservation measures.

- Chapter 5: An Outline of the City of Auburn's Wellhead Protection Program.

- Chapter 6: Operation and maintenance plan.

- Chapter 7: Discussion of the City's Water Facility Construction Standards.

- Chapter 8: Discussion of proposed capital improvement projects to address system deficiencies.

- Chapter 9: A discussion of the combined water utility's historical financial operations as well as a discussion on funding of capital improvements identified in Chapter 8.

Based on City population projections, growth within the City of Algona is anticipated to be modest, with an average annual growth rate of approximately 1.55 percent. Water demand projections consider the growth in population along with increased water demand for the Boeing facility and the Auburn 400 commercial/industrial area. The projected average day demand for 2032 including the Boeing facility and the Auburn 400 is approximately 410,000 gallons per day (gpd). Projected 2032 peak day demand is approximately 1,000,000 gpd.

The City of Algona purchases its entire source of supply from the City of Auburn. The 2002 Agreement with the City of Auburn states that Auburn will provide source capacity for the City of Algona. This Agreement shows projected maximum day demands for the City of Algona to reach 1.14 mgd in 2014. The source capacity analysis in this Plan indicates that the projected peak day demand for the City of Algona is not anticipated to exceed 1.0 mgd by 2032.

The 2002 Agreement between Auburn and Algona establishes that Algona will financially participate in the construction of a new reservoir to be located in the Auburn service area. The City of Auburn constructed a 1.0 million gallon reservoir in 2010 and Algona was allocated 180,000 gallons of storage in the new facility.

The 180,000 gallons of storage capacity required to serve Algona was dependent on the City of Algona maintaining at least 100,000 gallons of storage in its service area. Algona has since chosen to discontinue use of their existing 100,000 gallon reservoir. Therefore, the City of Algona will need to secure an additional 100,000 gallons of storage capacity, for a total of 280,000 gallons, from the City of Auburn. Based on the storage analysis completed in this Plan, this volume is projected to be adequate to meet the storage requirements for the City of Algona through 2032.

A hydraulic model of the City's water system, using the $H_2$ONet hydraulic modeling software, was used to assess the water system's ability to meet peak day, peak hour, and fire flow demands. Various distribution system improvements are identified to meet fire flow requirements or to replace undersized aging water mains.

Approximately $674,000 worth of distribution system projects are recommended in the six-year planning period. Most of these projects will provide additional looping in the distribution system and increase available fire flow. Financial participation in Auburn's reservoir for an additional 100,000 gallons of storage capacity is estimated at approximately $185,000.

The financial status of the City's combined water utility fund is described in Chapter 9 of this Plan. Past revenue and expenses are detailed, along with a discussion relating to financing of capital improvement projects. The City may choose to fund the capital improvement projects from future rate increases and/or existing reserves available for capital projects.

# CHAPTER 1

# DESCRIPTION OF WATER SYSTEM

## WATER SYSTEM OWNERSHIP AND MANAGEMENT

The City of Algona, incorporated in 1955, is a Code City that operates under Title 35A RCW. The City operates a public water system that serves customers within the City limits. The water system is publicly owned and is governed by an elected Mayor and five-member City Council. The City's mailing address is:

City of Algona
402 Warde Street
Algona, Washington 98001-8505

Algona's water system Department of Health identification number is 01450 V. Figure 1-1 is a vicinity map.

## SYSTEM BACKGROUND

### HISTORY OF WATER SYSTEM DEVELOPMENT AND GROWTH

The water system that serves the City of Algona was originally constructed in 1960 by King County Water District No. 101. In the early 1960s, a 100,000-gallon steel reservoir was constructed for the water system. This reservoir is located at a site west of 59th Avenue South and near the extension of 5th Avenue North. In 1970, the water district was deactivated and the City of Algona assumed the maintenance and operations responsibilities for the system. The original source of supply for the water system was the City of Auburn. Water was purchased from Auburn with delivery through a 4-inch master meter located on Boundary Boulevard at Celery Avenue. In August 1975, a well was drilled by the City in the NW 1/4, SW1/4, Sec. 25, T21N, R4EWM, in the city limits of Algona. This 500 gpm well was placed into service during 1978 and served the entire City except the two industrial areas. An interlocal agreement for emergency water supply was established between Algona and Auburn in 1978.

The Boeing Welded Duct Facility (Boeing) and the Auburn 400 Industrial Park (Auburn 400) continued to receive City of Auburn water after the drilling of the City of Algona well. Boeing was billed for water service by Algona, and the Auburn 400 was billed by the City of Auburn.

On May 23, 1996, the City's well collapsed. On the same day, the City of Auburn began to supply emergency water via the existing Auburn intertie. Due to several factors, including Auburn's supply surplus, the ability of the existing infrastructure to supply water to the City of Algona, Boeing, and the Auburn 400, Algona elected to resume the purchase of water from the City of Auburn. Resolution 550-96 by the City of Algona established an interlocal agreement for the purchase of water from the City of Auburn on August 20, 1996. This interlocal agreement was termed the Auburn Intertie Project and the agreement is included in Appendix B. Under this agreement and to ensure adequate water supply, four master meter stations were to be constructed in addition to the one serving Boeing. Two master meter stations were constructed in 2001 located at Boundary Boulevard and Industry Drive North and at Boundary Boulevard and Milwaukee Avenue. A third master meter was installed in 2002 near the West Valley Highway and 10th Avenue North as part of a commercial development. The fourth master meter, which was proposed to be located on 1st Avenue, is no longer needed due to improvements constructed in 2003 along Chicago Avenue and improvements made in 2002 as part of the Junction plat. An updated interlocal agreement between the City of Auburn and the City of Algona was signed in 2002. This agreement is also included in Appendix B.

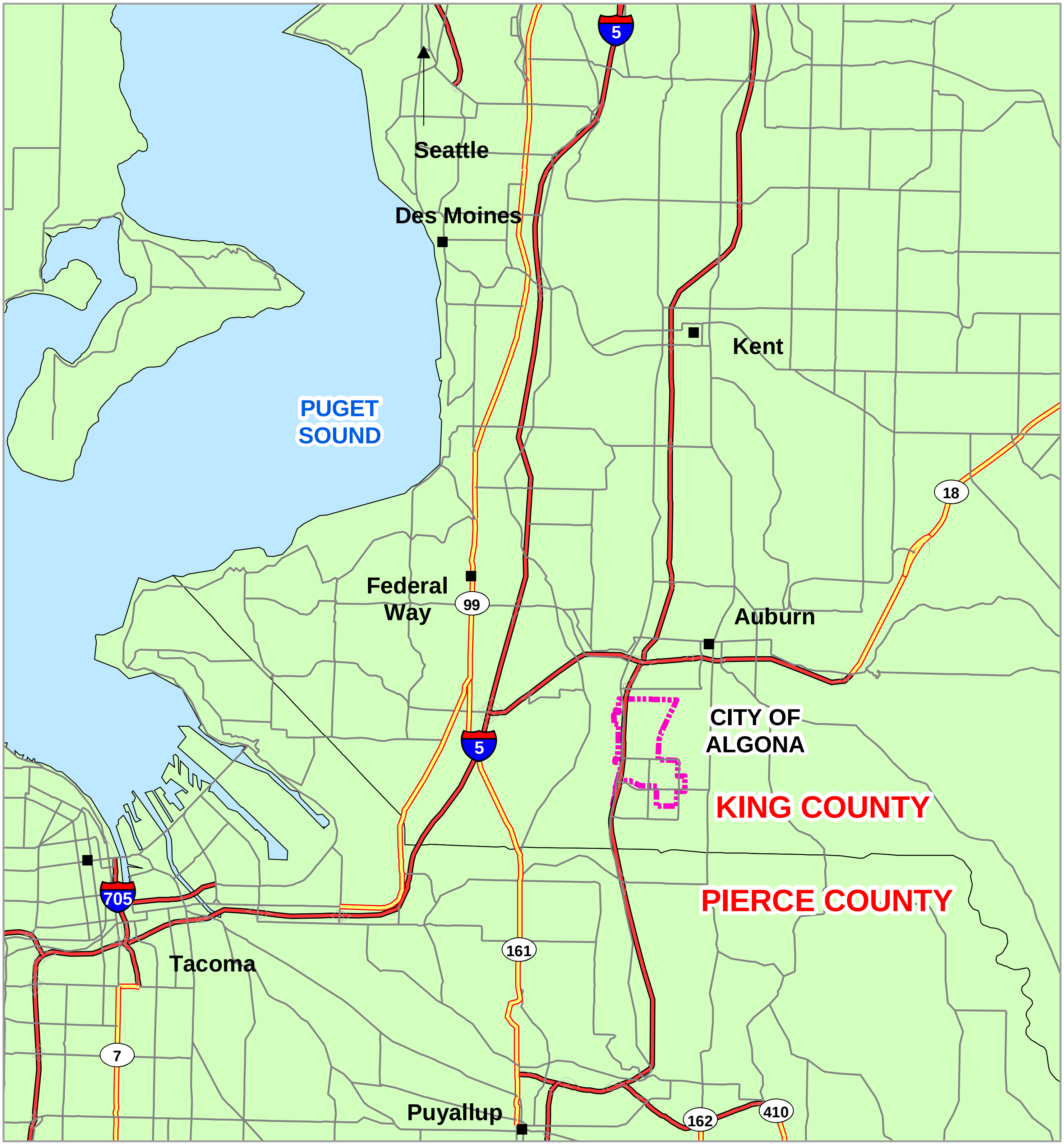
## PROJECTS COMPLETED SINCE THE 2006 WATER SYSTEM PLAN

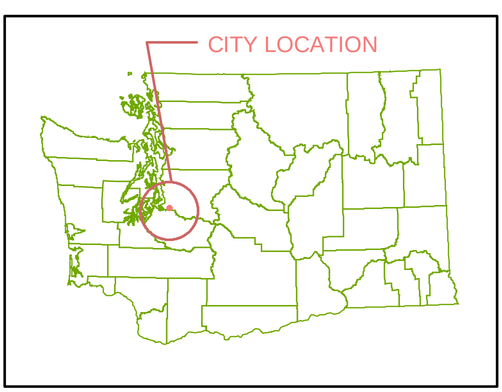
Table 1-1 provides the projects listed in the Capital Improvement Plan (CIP) included in the City of Algona's 2006 *Water System Plan*. The table identifies either the status of each project or the date the project was completed.

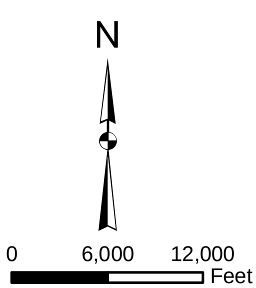
### TABLE 1-1

### Projects Completed from 2006 Water System Plan CIP

| Project No. | Project Description | Status or Year Completed |
|---|---|---|
| **2004 through 2009 CIP** | | |
| ST-1 | Financial Participation in Auburn Reservoir | Completed 2013 (1) |
| D-1 | Water main along Warde Street to Washington Boulevard | Completed 2008 |
| D-2 | Water main adjacent to SR 167, 2nd Avenue South to 3rd Avenue South | Completed 2012 |
| D-6 | Water main along West Valley Highway, 1st Avenue to 5th Avenue North | Completed 2013 |
| D-7 | Water main along West Valley Highway, 1st Avenue South to 5th Avenue South | Segment from 4th Avenue South to 5th Avenue South Completed 2012 |
| D-3 | Water main along 5th Avenue South, Washington Boulevard South to Milwaukee Boulevard South | Not yet completed |
| D-4 | Water main along 5th Avenue South, Tacoma Boulevard South to Seattle Boulevard South | Not yet completed |
| D-5 | Water main along West Valley Highway, 9th Avenue North to 6th Avenue North | Not yet Completed |




CITY OF ALGONA

WATER SYSTEM PLAN
FIGURE 1-1
LOCATION MAP

Gray & Osborne, Inc.
CONSULTING ENGINEERS

L:\ALGONA\12503 WSP 2012\GIS\FIGURE 1-1 LOCATION.mxd

**TABLE 1-1 – (continued)**

**Projects Completed from 2006 Water System Plan CIP**

| Project No. | Project Description | Status or Year Completed |
|---|---|---|
| **2009 through 2024 CIP** | | |
| D-8 | Water main along 2nd Avenue North, west of Main Street | Not yet Completed |

(1) Algona has purchased 180,000 gallons of storage from Auburn and has the option to purchase an additional 100,000 gallons.

## GEOGRAPHY

Algona is situated in the White River Valley. Algona's city limits are contiguous with the City of Auburn on the North and East and the City of Pacific on the South. The west boundary adjoins unincorporated King County approximately 400 feet west of and parallel to SR 167. Figure 1-2 shows Algona's city limits and Urban Growth Area (UGA) boundary.

Algona's elevation is generally between 65 feet and 85 feet above sea. The higher elevations within Algona all lie west of the West Valley Highway and include some steep slopes. A watershed divide runs through the City at approximately 4th Avenue North. The North basin flows to Mill Creek and eventually into the Green/Duwamish River. The South basin flows into Government Ditch and into the White River. The White River flows into the Puyallup River and eventually discharges into Commencement Bay at Tacoma.

## CLIMATE

The climate in Algona is characterized by high rainfall and low evaporation rates in winter while summers are moderate and relatively dry. The City's average winter daytime temperature is in the mid-40s and the summer average daytime temperature is in the 70s. Most precipitation (approximately 35 inches annually) occurs during October through March. The City occasionally experiences flooding which generally is a result of conveyance capacity of local streams mainly downstream of Algona.

## ADJACENT PURVEYORS

The City of Algona is surrounded by several adjacent purveyors, including the City of Auburn, the City of Pacific, and the Lakehaven Utility District. The City of Auburn borders Algona on the North and East sides and is the current source of water to the Algona water system. The Lakehaven Utility District borders the City of Algona on the west. The City of Pacific borders Algona on the south. Algona and Pacific have a manually operated emergency intertie, which is located at the intersection of Milwaukee Boulevard South and 5th Avenue South. The City of Pacific serves two commercial accounts and approximately 22 residential accounts located inside the Algona City limits on 5th Avenue South and in the southeast portion of the City (Figure 1-2).

## INVENTORY OF EXISTING FACILITIES

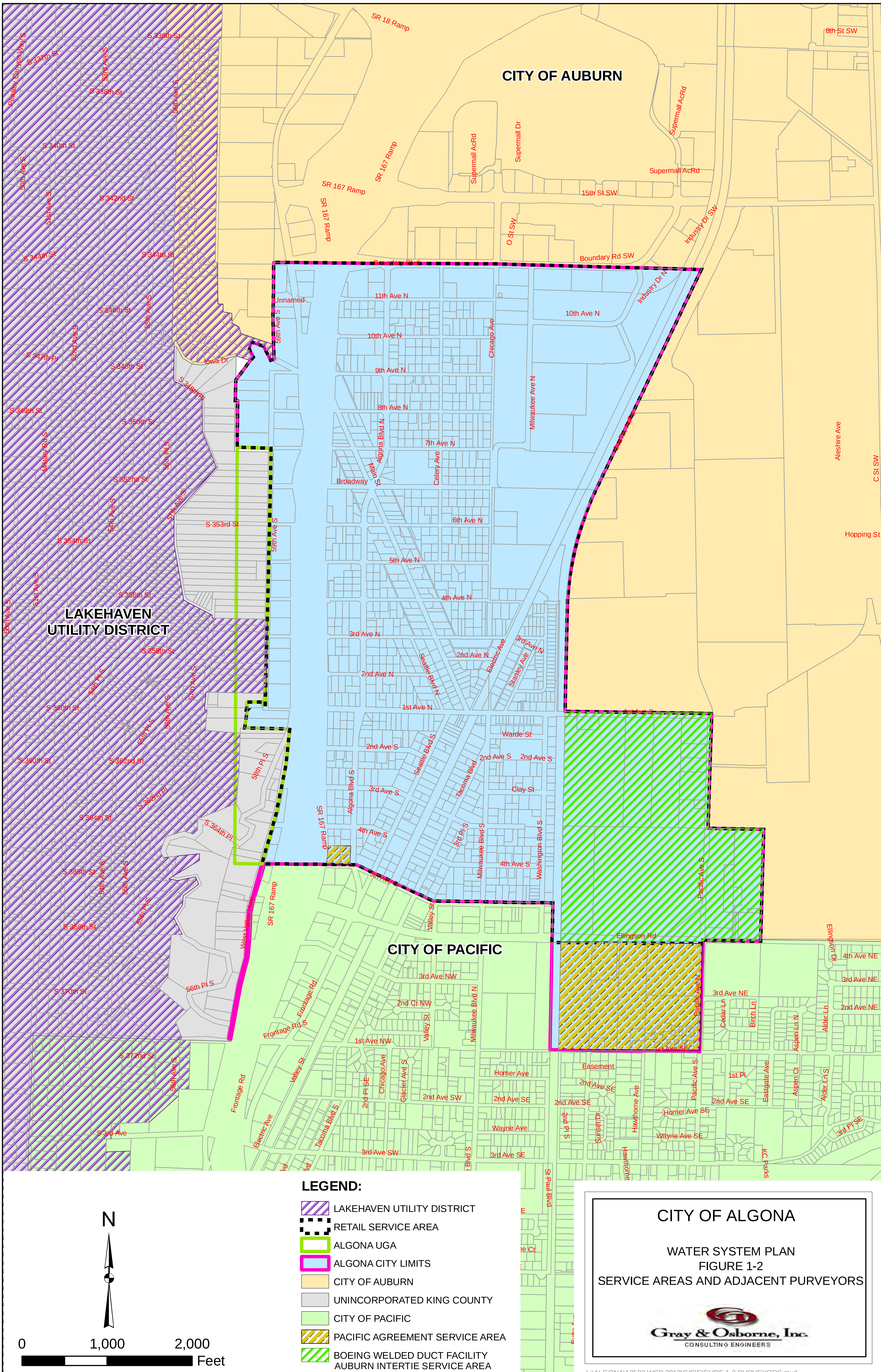
### SOURCE OF SUPPLY

The City of Auburn has been the sole source of water to the Algona water system since May 23, 1996. The Auburn Intertie Project, approved by both Auburn and Algona in August 1996, secured Auburn as the sole source of water for Algona in the foreseeable future. The 2002 Agreement between the City of Algona and the City of Auburn governs the amount of supply Auburn will provide to Algona. The Agreement lists Algona's projected demands for 2014 as 525,000 gpd for the average day and 1,114,000 gpd for the maximum day. The Agreement states that more supply may be available if agreed to by both parties. The City of Auburn 2009 *Comprehensive Water Plan* provides a detailed description of the City of Auburn water system. Table 1-2 provides a description of Auburn's source capacity. The maximum production capacity shown in Table 1-2 is the pumping capacity.

**TABLE 1-2**

**City of Auburn Source Capacity Data and Treatment Data**
**(Source: City of Auburn Pers. Comm. Dan Repp Dated August 29, 2013)**

| Source | Treatment | Maximum Production Capacity (gpm)[5] |
|---|---|---|
| Coal Creek Springs | Chlorine, Corrosion Control through pH adjustment | Approx. 4,980 |
| West Hill Springs | Chlorine | Approx. 600 |
| Well 1[1] | None | 2,200 |
| Well 2[2] | Corrosion Control through pH adjustment[2] | 1,600 |
| Wells 3A and 3B[3] | Chlorine | 0 |
| Well 4 | Chlorine | 2,600 |
| Well 5 | None | 650 |
| Well 5A | Chlorine | 180 |




CITY OF ALGONA

WATER SYSTEM PLAN
FIGURE 1-2
SERVICE AREAS AND ADJACENT PURVEYORS

**TABLE 1-2 – (continued)**

**City of Auburn Source Capacity Data and Treatment Data**
**(Source: City of Auburn Pers. Comm. Dan Repp Dated August 29, 2013)**

| Source | Treatment | Maximum Production Capacity (gpm)(5) |
|---|---|---|
| Well 6(2) | Corrosion Control through pH adjustment(2) | 1,800 |
| Well 7 | Chlorine, Corrosion Control through pH adjustment(2) | 2,000(4) |
| Tacoma Intertie | Chlorinated, pH adjustment | 1,250 |

(1) In 1998, Well 1 output began to decrease as a result of what appeared to be decreasing water levels. The pumping rate was therefore decreased from 2,100 gpm to 1,600 gpm. A video inspection of the well indicated no apparent problems with well construction. This Well is currently being rebuilt is expected to be under construction in 2013.
(2) Pumps to Fulmer Field Corrosion Control Treatment Facility.
(3) Wells 3A and 3B are currently operated in standby mode because of high concentrations of manganese.
(4) Well 7 currently pumps to the Valley distribution system, but will likely pump directly to the Fulmer Field Corrosion Control Treatment Facility in the future.
(5) Pumping capacity.

The City of Auburn has constructed two corrosion control facilities to adjust the pH of the several of its sources. The corrosion control facilities include the Fulmer Field Corrosion Control Facility and the Coal Creek Springs Corrosion Control Facility. The facilities are designed to adjust the pH from approximately 6.5 to 7.5 by stripping carbon dioxide from the water through the use of aeration towers.

The City of Auburn's water rights are summarized in Table 1-3.

**TABLE 1-3**

**City of Auburn Water Rights**
**(Source: Ecology Letter Dated August 20, 2013)**

| Source | Water Right | Date | Instantaneous Quantity (Qi) Water Rights | | Annual Quantity (Qa) Water Rights | |
|---|---|---|---|---|---|---|
| | | | gpm | mgd | Ac-Ft/Yr | mgd |
| Coal Creek Springs | Certificate 857 | 1925 | 6,730 | 9.70 | 9,410 | 8.4 |
| West Hill Springs | Claim (1973 file date) | 1907 | 625 | 0.90 | 1,010 | 1.00 |

**TABLE 1-3 – (continued)**

**City of Auburn Water Rights**
**(Source: Ecology Letter Dated August 20, 2013)**

| Source | Water Right | Date | Instantaneous Quantity (Qi) Water Rights | | Annual Quantity (Qa) Water Rights | |
|---|---|---|---|---|---|---|
| | | | gpm | mgd | Ac-Ft/Yr | mgd |
| Well 1 | Certificate 3560-A | 1957 | 2,200 | 3.17 | 2,480 | 2.21 |
| Well 2 | G1-00277 C | 1972 | 2,400 | 3.46 | | |
| Well 3A & 3B | G1-23629 C | 1980 | 2,800 | 4.03 | 3,600 | 3.21 |
| Well 4 | G1-20391 C | 1972 | 2,800 | 4.03 | 3,600 | 3.21 |
| Well 5 | G1-23633 C | 1980 | 1,000 | 1.44 | 720 | 1.04 |
| Well 5A | G1-25518 P | 1989 | 167 | 0.24 | | |
| Well 6 | | | | | | |
| Well 7 | | | | | | |
| **Total (mgd)** | | | 18,722 | 26.97 | 20,820 | 18.59 |
| **Other Rights** | | | | | | |
| Algona | G1-22769 P | 1976 | 500 | 0.72 | 175 | 0.16 |

Appendix C contains information from the Auburn 2009 *Comprehensive Water Plan* that further describes Auburn's sources of supply and water rights. City of Auburn Wells 1, 3A, 3B, and 4 are located the closest to Algona, between 1.0 and 1.5 miles east of the Algona city limits. West Hill Springs is located approximately two miles north of Algona at the base of West Hill. Auburn's other major producing source, Cold Creek Springs, is located approximately three miles southeast of the City.

## STORAGE

Algona owns a 100,000-gallon steel reservoir located west of the West Valley Highway on what would be the extension of 5th Avenue North. This reservoir has been abandoned. The City should have this reservoir demolished and removed before it becomes a safety hazard.

Per the terms of the 1996 and 2002 Agreements with Auburn, the City of Algona agreed to financially participate in the construction of a new Auburn reservoir, and receive a storage allotment of 180,000 gallons. In 2010 the City of Auburn built a new 1.0 MG reservoir in the Lakeland Hills portion of Auburn's service area and Algona was allotted an 180,000 gallon portion.

Per the terms of the 1996 and 2002 Agreements with Auburn, the City of Algona agreed to maintain their 100,000-gallon reservoir or, alternately, provide the storage otherwise.

Because the City of Algona has chosen to no longer use their existing 100,000-gallon reservoir, Algona will need to purchase an additional 100,000 gallons of storage from Auburn.

## TRANSMISSION AND DISTRIBUTION

Algona's water transmission and distribution system is shown on Figure 1-3. Currently, there are five interties with the City of Auburn water system. Three of these interties are used as the primary source of supply for the Algona water system. One intertie serves the Boeing facility directly, and another intertie is normally closed and serves as an emergency source of supply. All Auburn interties are metered. As specified in the 2002 Agreement, the City of Auburn is responsible for operation and maintenance of the interties and calibration of the master meters. Table 1-4 provides a description of each intertie. An emergency intertie with the City of Pacific is also available, located at the intersection of Milwaukee Avenue South and 5$^{th}$ Avenue South in Pacific. This 8-inch intertie is currently unmetered and is for emergency use only. No written agreement exists between Algona and Pacific for use of this intertie at this time.

There are no restrictions on flow at any of the interties feeding Algona. However, since Algona does not produce any water the flow direction under typical operating conditions will be into Algona. The flow rate is dependent upon the hydraulic gradient at each of the intertie locations. The metered interties have 8-inch meters. AWWA recommends a "high normal flow rate" for turbine meters of 1,600 gpm and a "maximum flow rate" of 2,400 gpm. Flow through any two of the metered interties is sufficient to meet the largest fire flow demand in Algona, 2,500 gpm.

The Pacific intertie is an 8-inch pipe connecting the two systems with a closed valve. The hydraulic grade line in Pacific is approximately 10 feet higher than in Algona, so flow would be to Algona under normal circumstances. The valve is normally closed and must be manually opened. The valve is opened on an "as needed" basis based upon mutual agreement of both cities at the time of need. This intertie has not been used in many years. The valve was most recently exercised by City of Pacific staff. There is currently no written agreement between the two cities governing the use of this intertie. The City of Algona should work with the City of Pacific to develop an interlocal agreement regarding use of the intertie.

The City of Algona water system includes about 16 miles of piping, ranging in size from 4-inch to 12-inch as presented in Table 1-5. The pipe material is predominantly asbestos cement in the 4-inch to 6-inch size range. Information contained in previous Water System Plans indicates that all of the AC pipe was installed in about 1960.

**TABLE 1-4**

**Auburn/Algona Intertie Characteristics**

| Auburn/Algona Intertie Locations | Meter Size, in. |
|---|---|
| Intersection of Milwaukee Avenue and Boundary Boulevard | 8-inch |
| Intersection of Industry Drive North and Boundary Boulevard | 8-inch |
| West Valley Highway, at Approx. 10th Avenue North | 8-inch |
| Boeing Welded Duct Facility intertie. 200 lf east of the intersection of 1st Avenue and Perimeter Road. (Not contiguous with the Algona distribution system) | 6-inch |
| Boundary Boulevard and Celery Avenue (Emergency Intertie-Normally Closed) | 8-inch |

**TABLE 1-5**

**Distribution System Pipe Inventory Including Auburn 400 Area**

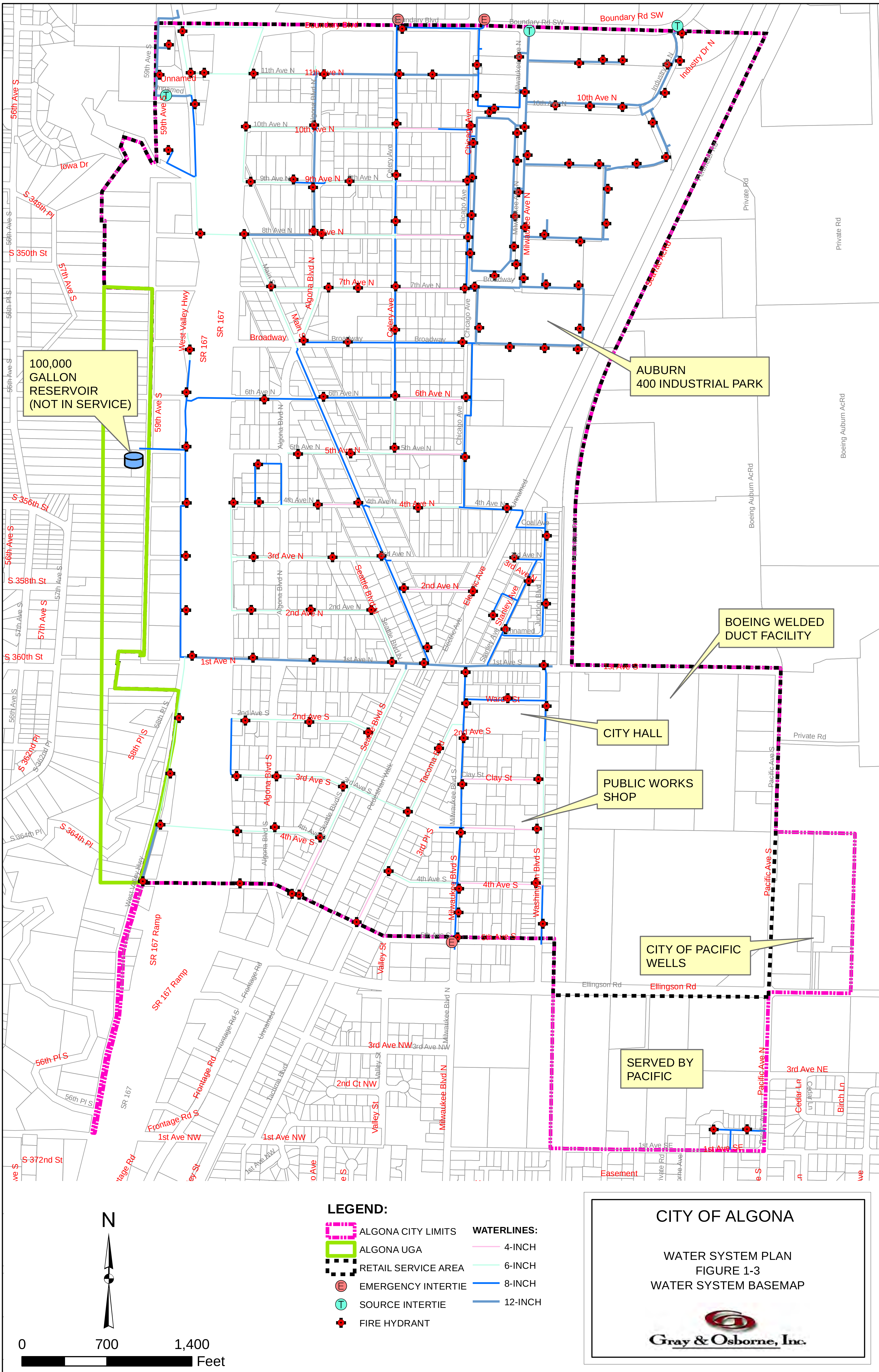
| Diameter | Length (Feet) | Percentage |
|---|---|---|
| 12-inch | 21,585 | 25% |
| 8-inch | 26,991 | 31% |
| 6-inch | 30,516 | 36% |
| 4-inch | 7,118 | 8% |
| **TOTAL** | **86,210** | **100%** |

The distribution system includes five crossings of SR-167. In 1996, the Auburn 400 Industrial Park was connected to the rest of the City's distribution system by construction of a water main extension from Broadway Street North to Chicago Avenue North in the Auburn 400 area. Auburn serves the Boeing Welded Duct Facility through a master meter located on 1st Avenue.

In addition to the pipes listed above, the water system includes approximately 108 fire hydrants, 303 valves and three blowoffs. Many of the fire hydrants installed in 1960 are the older two or three port, 4-3/4-inch valve type. These should be replaced with modern 5-1/4-inch valve type hydrants when pipelines are replaced. All hydrants are well maintained and functional. Some of the hydrants are connected to undersized 4-inch water mains.

## PRESSURE ZONES

Water service within the City's water system is provided by a single pressure zone. Historically, the water system pressure was determined by overflow elevation in the City's 100,000-gallon reservoir. Currently the hydraulic grade line (HGL) of Algona's




CITY OF ALGONA

WATER SYSTEM PLAN
FIGURE 1-3
WATER SYSTEM BASEMAP

Gray & Osborne, Inc.

water system is established by that of the City of Auburn's Valley pressure zone, which has an HGL of approximately 245 feet.

## SERVICE AREAS

In accordance with the Washington State Municipal Water Law (MWL), the City is required to designate a retail service area within which it has a duty to serve all customers, and if appropriate, also designate a future service area and a wholesale service area. A map of service areas for the City can be found on Figure 1-2.

### EXISTING SERVICE AREA

The City currently serves the majority of customers within its city limits, with the exception of areas served by intertie with the City of Auburn or from water mains owned by the City of Pacific. These areas are shown on Figure 1-2.

### RETAIL SERVICE AREA

The City acknowledges that it has a duty to serve all new connections within its designated retail service area. The retail service area is required to include the existing service area and areas where new service will be provided. The City defines the extent of its retail service area as the area's it currently serves within the City Limits, as shown on Figure 1-2.

While the City has a duty to serve new connections within the Retail Service Area, there are four threshold factors that must be met prior to providing service. These are:

1. The City has sufficient water rights to provide service.
2. The City has sufficient capacity to serve water in a safe and reliable manner.
3. The service request is consistent with adopted local plans and development regulations.
4. Service can be provided in a timely and reasonable manner.

### FUTURE SERVICE AREA

The current UGA extends slightly beyond the Algona City limits to the west, and it is expected that the City's future service area will be the Urban Growth Area. Expansion is restricted to the north and east by the City of Auburn, to the south by the City of Pacific, and beyond the UGA to the west by steep and unstable terrain. Future growth within the City will be the result of filling in or redevelopment of existing developed areas.

### ZONING AND LAND USE

The City most recently adopted a new zoning map in 2006 as part of the update to their Comprehensive Plan. The majority of the City east of the West Valley Highway is zoned single-family residential, with commercial and/or industrial areas west of the West Valley Highway and in the Auburn 400 and Boeing areas. Community commercial zoning is located primarily along 1st Avenue, with some additional areas in the northwest and southwest portions of the City. Figure 1-4 is a current zoning map for the City of Algona.

## SERVICE AREA AGREEMENTS

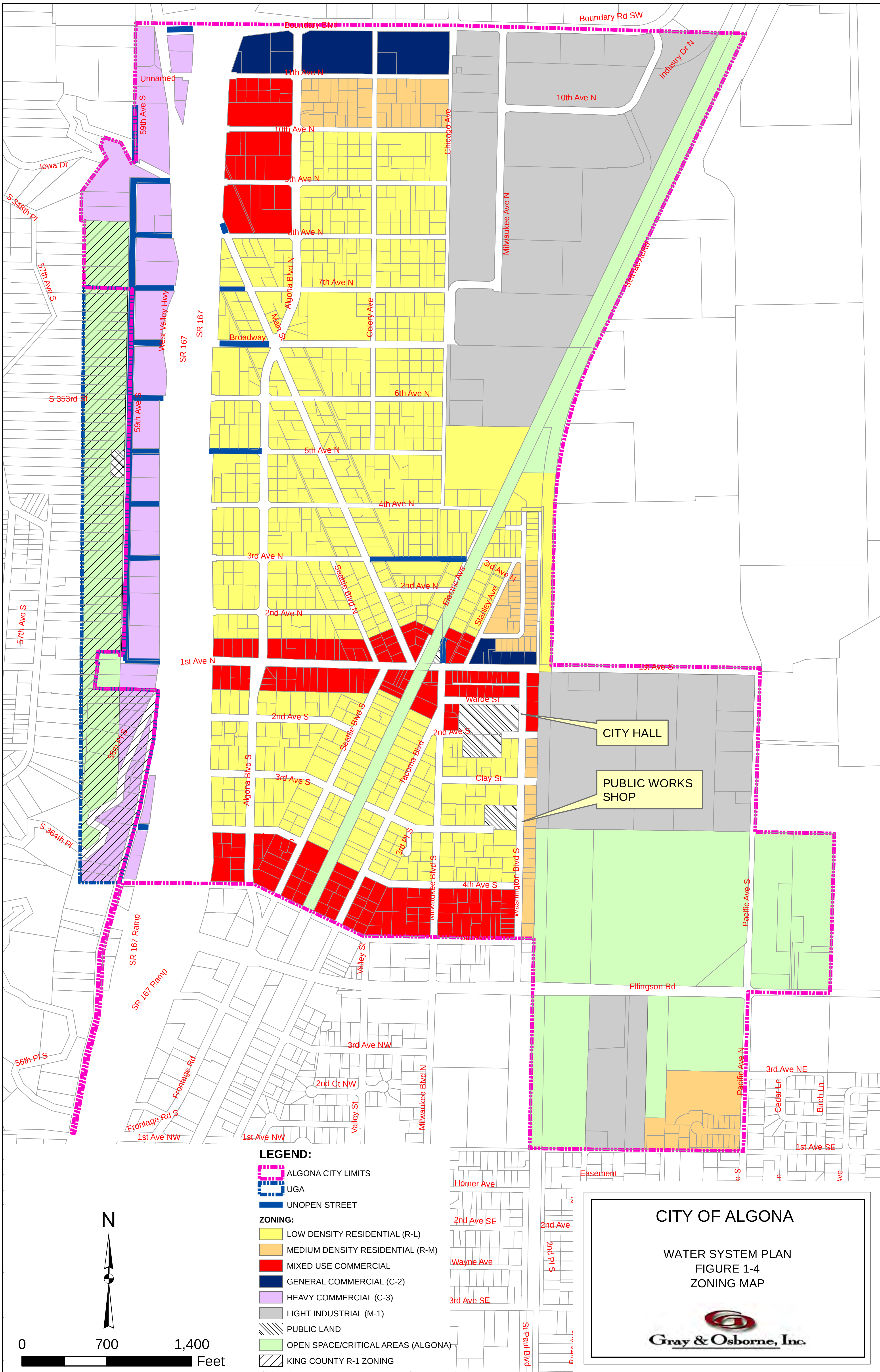
The City of Algona has had an emergency interlocal service agreement with the City of Auburn since 1978. As a result of the May 23, 1996 failure of the City of Algona's well, the 1996 Algona Intertie Project Agreement was signed, which provided Algona with source water from the City of Auburn. The 1996 Algona Intertie Project Agreement was superseded by the 2002 Algona/Auburn Intertie Agreement No. 3A (Appendix B) which is currently in effect.

The 2002 agreement specifies that Algona shall convey to Auburn Algona's well and any and all associated water rights by Bill of Sale. Algona agreed to participate in the construction of a new Auburn reservoir and purchase 180,000 gallons of storage. The agreement also requires Algona to implement a conservation program, and either maintain the existing 100,000 gallons of storage, or elect to increase their participation in the future Auburn reservoir. A number of additional requirements relating to construction of master meters, easements, service areas, construction of a future reservoir, projected Algona water needs, and project costs are outlined in the agreement. Agreement No. 3A presented water supply projections only through 2014. Increases beyond the limits in the agreement would need to negotiated as an amendment.

No agreement with the City of Pacific intertie currently exists for use of the emergency intertie. The City of Algona does not currently have a written agreement with the City of Pacific for service to connections within the City of Algona.

## SERVICE AREA POLICIES AND CONDITIONS OF SERVICE

Service area policies are discussed in the Table 1-6.



CITY OF ALGONA
WATER SYSTEM PLAN
FIGURE 1-4
ZONING MAP
Gray & Osborne, Inc.
LEGEND:
ALGONA CITY LIMITS
UGA
UNOPEN STREET
ZONING:
LOW DENSITY RESIDENTIAL (R-L)
MEDIUM DENSITY RESIDENTIAL (R-M)
MIXED USE COMMERCIAL
GENERAL COMMERCIAL (C-2)
HEAVY COMMERCIAL (C-3)
LIGHT INDUSTRIAL (M-1)
PUBLIC LAND
OPEN SPACE/CRITICAL AREAS (ALGONA)
KING COUNTY R-1 ZONING
(SOURCE: R.W. THORPE JAN 26, 2005)
N
0
700
1,400
Feet
CITY HALL
PUBLIC WORKS SHOP
Boundary Rd SW
Boundary Blvd
Industry Dr N
11th Ave N
10th Ave N
9th Ave N
8th Ave N
7th Ave N
6th Ave N
5th Ave N
4th Ave N
3rd Ave N
2nd Ave N
1st Ave N
1st Ave S
2nd Ave S
3rd Ave S
4th Ave S
Warde St
Clay St
Broadway
Chicago Ave
Milwaukee Ave N
Celery Ave
Algona Blvd N
Main St
Seattle Blvd N
Electric Ave
Stanley Ave
Seattle Blvd S
Tacoma Blvd
3rd Pl S
Algona Blvd S
Milwaukee Blvd S
Washington Blvd S
Pacific Ave S
Ellingson Rd
Unnamed
59th Ave S
Iowa Dr
S 348th Pl
57th Ave S
West Valley Hwy
SR 167
S 353rd St
58th Pl S
S 364th Pl
SR 167 Ramp
56th Pl S
Frontage Rd
Frontage Rd S
1st Ave NW
Valley St
3rd Ave NW
2nd Ct NW
Milwaukee Blvd N
Pacific Ave N
3rd Ave NE
Cedar Ln
Birch Ln
1st Ave SE
Easement
Homer Ave
2nd Ave SE
2nd Ave
2nd Pl S
Wayne Ave
3rd Ave SE
St Paul Blvd

**TABLE 1-6**

**Service Area Policies**

| Policy Description | Reference |
|---|---|
| The City will provide water service within its retail service area when requested and when service can be provided complying with the four threshold factors. | Established by adoption of this Water System Plan<br>AMC 13.02.030 |
| The design of all improvements to the City system or improvements to be connected to the City system shall meet or exceed the standards adopted by the City. | City of Algona Development Manual, Resolution No. 477-92 |
| Financing system extensions. The cost of making additions, betterments and extensions to the existing water system shall be paid from such sources and by such means as decided by the council. Developer-paid extensions should be required for expansion of water facilities. | AMC 13.02.260 and Algona Comprehensive Plan, Approved Aug. 1, 1995 |
| Latecomers agreements will be considered by the City Council on a case by case basis if requested by a developer. The maximum term of latecomers agreements will be 5 years. | AMC 13.02.260 |
| Satellite systems. The City does not currently wish to provide service to satellite systems. | Established by adoption of this Water System Plan |
| Prohibits cross connections and establishes responsibility of water system customers to maintain backflow prevention assemblies. | AMC 13.02.160 |
| The City of Algona requires each new water service to be metered. | AMC 13.02.100 |
| The City of Algona requires extensions to the water system to be made in accordance with the plans submitted by the City Engineer and approved by the Council. | AMC 13.02.230 |
| Service rate and connection charge policies. | AMC 2.50 |
| Direct connection policy. Establishes a radius around an existing water main requiring new customers to connect directly to that main | No Established Policy |
| Annexation Policy, stating that proposed development outside the corporate limits is or is not required to have an annexation commitment so as not to protest annexation at the time it may occur. | Not Established Policy |

### APPLICATIONS FOR NEW SERVICE

Applications for new water service must meet the requirements of Algona Municipal Code (AMC) Chapter 13.02. Applications for new water service must be made in writing to the Office of the City Clerk on the City's form. Applications must state the purpose for which the water will be used and must be made by the property owner or authorized representative. The application will be reviewed per the four threshold criteria presented for retail water service and the City will make a determination to accept or reject the application within 30 days. If an application is rejected the applicant can appeal that decision to the City Council.

## RELATED PLANNING DOCUMENTS

### CITY OF ALGONA 2006 WATER SYSTEM PLAN

The last water system planning document prepared for the City of Algona was completed by Gray & Osborne in 2006. This document was used as the framework for the current Plan. The 2006 Plan presented historical water use, projected water use and developed a capital improvement plan for the City to implement. Since the previous Plan was published the City has completed a water main along Warde Street, constructed a water main along SR 167 between 2$^{nd}$ Avenue South and 3$^{rd}$ Avenue South and constructed a water main along West Valley Hwy from 5$^{th}$ Avenue South to the city limits.

### CITY OF ALGONA 2004 DRAFT COMPREHENSIVE PLAN

The City of Algona is in the process of developing the latest version of the City's Comprehensive Plan, required for Growth Management Act Compliance. This plan includes goals, objectives, and policies that will in some cases have an impact on the formation of the Water System Plan. The Plan contains population growth projections, defines the City's UGA and contains a land use plan that is the model for existing City of Algona zoning.

### CITY OF AUBURN 2009 WATER SYSTEM PLAN

The City of Auburn contracted with Carollo Engineers to complete the City of Auburn 2009 Water Comprehensive Plan. This plan provides a description of the Auburn water system and future planning for the system. This document is relevant to Algona's water system since Auburn supplies water to Algona. Algona has agreed to purchase capacity in Auburn's reservoirs to meet storage requirements, thus the Auburn plan storage analysis will be referenced in this Plan. Relevant excerpts from this plan, including the conservation plan, source and storage analyses, are included in Appendix C.

## 1989 SOUTH KING COUNTY COORDINATED WATER SYSTEM PLAN

South King County Coordinated Water System Plan (Economic and Engineering Services Inc., October, 1989). The Coordinated Water System Plan (CWSP) contains an interlocal agreement for establishing water utility service area boundaries. This Agreement, which has been signed by the City, is included in Appendix B.

# CHAPTER 2

# BASIC PLANNING DATA

## CURRENT POPULATION, NUMBER OF SERVICES, AND WATER USE

### RESIDENTIAL POPULATION

Future water use is typically forecasted by using past water use and population trends. Table 2-1 presents information showing the past population growth for the City of Algona.

**TABLE 2-1**

**Historic Population Growth**

| Year | City of Algona Population[1] | Average Annual Growth Rate |
|---|---|---|
| 2003 | 2,661 | 3.74% |
| 2004 | 2,692 | 1.16% |
| 2005 | 2,773 | 3.01% |
| 2006 | 2,833 | 2.16% |
| 2007 | 2,886 | 1.87% |
| 2008 | 2,932 | 1.59% |
| 2009 | 2,974 | 1.43% |
| 2010 | 3,014[2] | 1.34% |
| 2011 | 3,055 | 1.36% |
| 2012 | 3,070 | 0.49% |

(1) Source: Washington State Office of Financial Management estimates.
(2) Official 2010 Census Population for the City of Algona.

### SERVICE CONNECTIONS

The City of Algona currently serves 947 residential units. This number includes all single-family residential connections and multi-family units. Multi-family customers are billed per unit, rather than per metered connection, and are not tracked separately from single-family residential customers by the billing system. The City maintains a count of multi-family units. Table 2-2 summarizes historical water service connection data, including single family and multi-family residential, commercial, church, public, industrial connections and inactive connections.

## TABLE 2-2

### Water Service Connections

| Year | Single-Family | Multi-Family | Comm.(2) | Church | Public(3) | Industrial(4) | Inactive(5) | Total |
|---|---|---|---|---|---|---|---|---|
| 2007 | 907 | 40 | 42 | 2 | 6 | 1 | 18 | 1,016 |
| 2008 | 923 | 40 | 43 | 2 | 6 | 1 | 15 | 1,030 |
| 2009 | 916 | 40 | 43 | 2 | 6 | 1 | 28 | 1,036 |
| 2010 | 915 | 40 | 43 | 2 | 6 | 1 | 31 | 1,038 |
| 2011 | 907 | 40 | 42 | 2 | 6 | 1 | 28 | 1,026 |

(1) Multi-family residential connections equal to number of dwelling units not number of metered connections.
(2) Includes the Auburn 400 Industrial Park.
(3) Public connections are City facilities.
(4) Current industrial connection is to the Boeing Welded Duct Facility.
(5) Inactive connections are exclusively single family units that have either been turned off by request or due to non-payment.

The City of Algona's customer service connections are fully metered. The majority of system meters are 3/4 inch. There are currently only three connections with meters larger than 2 inches, two 3-inch meters and one 6-inch meter.

## HISTORIC PURCHASED WATER AND PEAK DAY DEMAND

Water purchased by the City of Algona from the City of Auburn is metered at four interties and meter readings are taken each month. Data for water production was provided by the City of Auburn. Maximum day demand (MDD) for purchased water is not available. According to the DOH *Water System Design Manual* (December 2009), when MDD data is not available, a peaking factor can be estimated from the Maximum Month Average Day Demand (MMAD). For Western Washington DOH recommends a factor of 1.7 to estimate MDD from MMAD. Historical average day and maximum month average day water usage over the last 6 years is shown in Table 2-3. As shown in the table the City's highest demand year was 2009 and demands have decreased since then. Calculated maximum day demands and a MMD/ADD peaking factor are also presented. The average peaking factor is 2.33, the minimum peaking factor is 1.92 in 2008 and the maximum peaking factor is 2.70 in 2006. The minimum and maximum peaking factors were considerably lower and higher, respectively, than any other factors and are not considered representative of current demands. The average without the minimum and maximum peaking factors is 2.35. A higher peaking factor is more conservative for planning purposes, so an MDD/ADD peaking factor of 2.5 has been chosen to predict future max day demands.

**TABLE 2-3**

**Historical Water Purchased and Peak Day Demand**

| Year | Average Day Demand[1] (gpd) | Max Month | Max Month Average Day Demand (gpd) | Calculated Max Day Demand[2] (gpd) | MDD/ADD Factor |
|---|---|---|---|---|---|
| 2006 | 318,215 | August | 504,993 | 858,488 | 2.70 |
| 2007 | 325,644 | July | 472,538 | 803,314 | 2.47 |
| 2008 | 329,017 | August | 370,978 | 630,662 | 1.92 |
| 2009 | 357,856 | July | 496,846 | 844,638 | 2.36 |
| 2010 | 324,299 | August | 409,595 | 696,312 | 2.15 |
| 2011 | 304,680 | September | 432,494 | 735,239 | 2.41 |

(1) Combined production of the four Auburn interties, including Boeing.
(2) Calculated using 1.7 x MMAD.

## HISTORIC WATER CONSUMPTION

Table 2-4 summarizes the water consumption by customer class for the City of Algona over the last four years. Water consumption data was provided by the City of Algona billing records. Water consumption prior to 2008 was not available for this analysis due to billing software incompatibility.

**TABLE 2-4**

**Historical Annual Water Consumption by Customer Class**

| Customer Class | Consumption (gpd) | | | |
|---|---|---|---|---|
| | 2008 | 2009 | 2010 | 2011 |
| Residential | 167,321 | 181,096 | 172,022 | 167,298 |
| Commercial[1] | 72,039 | 77,386 | 78,739 | 74,587 |
| Church | 337 | 203 | 223 | 82 |
| Public | 2,089 | 2,480 | 1,371 | 1,875 |
| Industrial (Boeing)[2] | 65,062 | 80,745 | 58,670 | 64,379 |
| **Total** | **306,848** | **341,910** | **311,025** | **308,221** |

(1) Includes Auburn 400 customers.
(2) Boeing consumption provided from Algona billing records.

The water consumption for the last 4 years for the largest water users is summarized in Table 2-5.

**TABLE 2-5**

**Large Water Users**

| **Customer Class** | **Consumption (gpd)** | | | |
|---|---|---|---|---|
| | **2008** | **2009** | **2010** | **2011** |
| **Boeing** | **65,062** | **80,745** | **58,670** | **64,379** |
| **Auburn 400 Industrial Park** | | | | |
| SCS Refrigeration | 13,211 | 10,503 | 12,222 | 13,032 |
| Fletcher's | 9,405 | 7,209 | 8,345 | 7,800 |
| Tim's Cascade | 13,619 | 14,265 | 15,860 | 15,122 |
| Tharco | 3,711 | 3,230 | 1,459 | 1,582 |
| Calwest (851) | 3,875 | 6,392 | 6,084 | 5,695 |
| Benson | 2,013 | 2,117 | 3,062 | 3,480 |
| KC Solid Waste | 3,805 | 5,685 | 11,634 | 10,431 |
| Wilsonart | 1,960 | 1,482 | 1,045 | 879 |
| **AUBURN 400 TOTAL** | **51,599** | **50,883** | **59,711** | **58,021** |

As shown in Table 2-5, the average day consumption for the Boeing Welded Duct facility has averaged approximately 67,000 gpd over the last four years, varying from approximately 58,000 to 81,000 gpd. Boeing accounts for approximately 21 percent of the City's total consumption. SCS Refrigeration, Tim's Cascade and Fletcher's average day water use has remained fairly consistent over the last 4 years. In total these three users have accounted for approximately 11 percent of the City's total consumption. King County Solid Waste operates a transfer station within Algona. This facility has experienced an almost threefold increase in water usage over the last 4 years. The reason for this increase usage is not known.

## DISTRIBUTION SYSTEM LEAKAGE

Distribution System Leakage (DSL) is defined as the difference between total metered source production and authorized consumption. DSL includes any water loss due to leaks, unathorized uses such as illegal service connections, accounting errors, inaccurate source and customer meters, and water leaving the system for unmetered usage such as flushing of mains and fire flows. If a system keeps records of flushing, fire flows and other unmetered but credibly estimated uses these can be included in the total for authorized consumption. For analysis of DSL the production and consumption of the Boeing Welded Duct Facility has been removed, as the Boeing facility is served directly from the City of Auburn via a wholesale intertie and there is no Algona owned distribution system in that area. A DSL analysis for water for the City of Algona is shown in Table 2-6.

**TABLE 2-6**

**Distribution System Leakage**

| Year | Total Production(1) (gallons) | Authorized Consumption(1) (gallons) | Distribution System Leakage (gallons) | Distribution System Leakage (%) | 3-Year Rolling Average (%) |
|---|---|---|---|---|---|
| 2008 | 97,330,056 | 89,126,356 | 8,113,700 | 8.34% | - |
| 2009 | 101,108,816 | 95,288,550 | 5,820,266 | 5.76% | - |
| 2010 | 96,012,280 | 91,167,153 | 4,845,127 | 5.05% | 6.38% |
| 2011 | 88,480,920 | 89,773,433 | -1,292,513(2) | 0.00% | 3.60% |

(1) Not including Boeing consumption from Auburn system.
(2) Authorized consumption exceeded total production for 2011. The reason for this is unknown.

The City changed out approximately 60 percent of its meters, including all three large meters, in 2011 when it went to an AMR system. The reduction in DSL may have been, in part, due to improved metering or potentially is due to differences in schedule for reading production and consumption meters. A DSL of zero percent is presented for 2011 and is used to calculate the three-year rolling average. As shown in Table 2-6, the City's three-year rolling average distribution system leakage is currently below 10 percent. DSL is further discussed in Chapter 4, Water Conservation Program.

## EQUIVALENT RESIDENTIAL UNITS (ERUS)

The concept of Equivalent Residential Units (ERUs) is a way to express water use by non-residential customers as an equivalent number of residential customers. ERUs are calculated by dividing the total volume of water utilized in the single-family residential (SFR) customer class by the total number of active residential connections. This number defines the average SFR water use. The volume of water used by other customer classes can then be divided by the average SFR water use to determine the number of equivalent residential units utilized by other customer classes.

The City of Algona does not track multi-family residential water use separately from single-family residential water use. The City does, however, bill their multi-family residential customers according to unit, rather than by meter. The number of residential connections and the total residential water usage includes both single-family and multi-family residential. Multi-family customers within Algona are primarily four unit complexes or smaller. Currently, there are 40 multi-family units representing less than 5 percent of total connections. For this analysis the ERU will be calculated using total residential water use and total residential units.

Table 2-7 summarizes the City's ERU value for 2008 through 2011.

**TABLE 2-7**

**ERU Values**

| | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|
| Residential Consumption (gpd) | 167,321 | 181,096 | 172,022 | 167,298 |
| Residential Units | 963 | 956 | 955 | 947 |
| **ERU Value (gpd/ERU)** | **174** | **189** | **180** | **177** |

As shown in Table 2-7, the City's ERU value has remained fairly constant over the last 4 years. The average value for 2008 through 2011 is 180 gpd/ERU. This value will be used to project future water use.

Table 2-8 summarizes the number of ERUs for the City in 2011, based on the 2011 ERU value of 177 gpd/ERU. The Auburn 400 Industrial Park and the Boeing facility (industrial) are broken out separately from the other commercial consumption within the City of Algona.

**TABLE 2-8**

**2011 ERUs**

| Class | 2011 Consumption (gpd) | ERUs(1) |
|---|---|---|
| Residential | 167,298 | 929 |
| Commercial(2) | 16,566 | 92 |
| Church | 82 | 0.5 |
| Public | 1,875 | 10 |
| **Subtotal** | **185,821** | **1,032** |
| Auburn 400 | 58,021 | 322 |
| Industrial (Boeing) | 64,379 | 358 |
| **Total** | **308,221** | **1,712** |

(1) Based on the average ERU value of 180 gpd/ERU.
(2) Auburn 400 Industrial Park consumption removed from this figure.

# PROJECTED POPULATION AND WATER USE

## PROJECTED POPULATION

Growth within the City of Algona is anticipated to be modest because the majority of property within the City has already been developed. The population of the City in 2032, based upon an analysis of the holding capacity of vacant lands is expected to be 3,636 persons. To reach the City's holding capacity in 20 years the average annual growth rate would be 0.85 percent, based on a 2012 population of 3,070 and a 2032 population of 3,636. Additional growth could occur in the form of redevelopment of lower density areas into higher densities, which would allow for additional population. Population growth data is available from the Puget Sound Regional Council (PSRC) which produces population forecasts based on locally adopted plans, regional growth and economic factors. The most recent forecast for the area which contains Algona, known as Forecast Analysis Zone (FAZ) 3110 was produced in 2006. The FAZ containing Algona also includes the City of Pacific. The average annual growth rate from the PSRC forecast for 2010 to 2020 is 2.36 percent and for 2020 to 2030 is 1.55 percent. The PSRC 2006 Forecasts have been used extensively for planning purposes, but there are limitations to their applicability. For the City of Algona the PRSC forecast growth rate of 2.36 percent for 2010 to 2020 is considered unrealistic given the historical growth in recent years as presented in Table 2-1 and the fact that very little developable land remains within the city limits. The forecast annual growth rate of 1.55 percent, as presented for 2020 to 2030, is more reflective of past growth. A growth rate of 1.55 percent is also more conservative than the 0.85 percent based on the City's developable lands. Population projections shown in Table 2-9 are based on an annual growth rate of 1.55 percent.

**TABLE 2-9**

**Service Area Population Projections(1)**

| Year | Population |
|---|---|
| 2012 | 3,070 |
| 2013 | 3,118 |
| 2014 | 3,166 |
| 2015 | 3,215 |
| 2016 | 3,265 |
| 2017 | 3,316 |
| 2018 | 3,367 |
| 2022 | 3,581 |
| 2032 | 4,176 |

(1) Based on an average annual growth rate of 1.55 percent.

## WATER DEMAND FORECASTING

### Boeing and Auburn 400

As shown in Table 2-5, water consumption for the Boeing facility has varied from a low of approximately 59,000 gpd to a peak consumption of 81,000 gpd in 2009, with an average of approximately 67,000 gpd. As a conservative estimate, future consumption requirements for the Boeing facility are projected to remain constant at the highest consumption seen over the last 4 years, approximately 81,000 gpd.

Water consumption for the Auburn 400 Industrial Park has varied from a low of approximately 51,000 gpd to a peak consumption of 60,000 gpd in 2009, with an average of approximately 55,000 gpd. The majority of the Auburn 400 area is developed. As a conservative estimate, future consumption requirement for the Auburn 400 is projected to remain constant at the highest consumption seen over the last 4 years, approximately 60,000 gpd.

The total estimate water usage for Boeing and the Auburn 400 is 141,000 gallons per day, which is equal to 783 ERUs.

**Residential and Commercial Customers**

Water demands for the City of Algona residential, church, public, and remaining commercial customers (other than Boeing and the Auburn 400) are projected based on the projected increases in population growth. The number of ERUs for these customer classes was 1,053 in 2011, based on an ERU value of 180 gpd/ERU (see Table 2-8). The projected average day consumption for the City's customers, excluding Boeing and the Auburn 400, are shown in Table 2-10.

**TABLE 2-10**

**Projected Average Day Consumption, Excluding Boeing and Auburn 400**

| Year | Projected ERUs, Excluding Boeing and Auburn 400(1) | Projected Average Day Consumption, Excluding Boeing and Auburn 400 (gpd)(2) |
|---|---|---|
| 2012 | 1,058 | 190,440 |
| 2013 | 1,074 | 193,320 |
| 2014 | 1,091 | 196,380 |
| 2015 | 1,108 | 199,440 |
| 2016 | 1,125 | 202,500 |
| 2017 | 1,142 | 205,560 |
| 2018 | 1,160 | 208,800 |
| 2022 | 1,234 | 222,120 |
| 2032 | 1,439 | 259,020 |

(1) ERUs are projected based on a growth rate of 1.55 percent.
(2) Projected average day consumption is based on an ERU value of 180 gpd/ERU.

**Total Projected Average Day Purchased Water Requirements**

The total projected average day consumption for all City customers is summarized in Table 2-11, along with the projected average day purchased water requirements. Distribution system leakage is projected to remain at the current 3-year rolling average of 2.46 percent.

**TABLE 2-11**

**Total Projected Average Day Consumption and Purchased Water Requirements**

| Year | Projected Boeing and Auburn 400 Average Day Consumption (gpd) | Projected Average Day Consumption, Excluding Boeing and Auburn 400 (gpd) | Total Projected Average Day Consumption (gpd) | Projected Total ERUs(1) | Projected Distribution System Leakage (gpd)(2) | Projected Average Day Purchased Water Requirements (gpd) |
|---|---|---|---|---|---|---|
| 2012 | 141,000 | 190,440 | 331,440 | 1,841 | 10,810 | 342,250 |
| 2013 | 141,000 | 193,320 | 334,320 | 1,857 | 10,904 | 345,224 |
| 2014 | 141,000 | 196,380 | 337,380 | 1,874 | 11,004 | 348,384 |
| 2015 | 141,000 | 199,440 | 340,440 | 1,891 | 11,104 | 351,544 |
| 2016 | 141,000 | 202,500 | 343,500 | 1,908 | 11,204 | 354,704 |
| 2017 | 141,000 | 205,560 | 346,560 | 1,925 | 11,304 | 357,864 |
| 2018 | 141,000 | 208,800 | 349,800 | 1,943 | 11,409 | 361,209 |
| 2022 | 141,000 | 222,120 | 363,120 | 2,017 | 11,844 | 374,964 |
| 2032 | 141,000 | 259,020 | 400,020 | 2,222 | 13,047 | 413,067 |

(1) Based on an ERU value of 180 gpd/ERU, which is the average ERU value over the last 4 years.
(2) Based on the current 3-year rolling average value of 3.26 percent DSL.

## PROJECTED MAXIMUM DAY AND PEAK HOUR PURCHASED WATER REQUIREMENTS

Maximum day demands for projections are calculated based on the average day to maximum day peaking factor of 2.50 established earlier in this Chapter.

The maximum quantity of water produced in a one-hour period during a maximum day demand is the peak hour demand. If precise records of peak hour demand are not available, peak hour is often expressed in terms of a peaking factor. A peaking factor is defined as the ratio of peak hour to the maximum day demand. It is generally accepted that peak hour factors range from 1.5 to 2.5. The DOH Water System Design Manual, December 2009, provides a methodology for calculating peak hour demand (PHD). The generalized equation is as follows:

$$PHD = (MDD/1440)[(C)(N) + F] + 18$$

*Where:*

PHD = *Peak Hourly Demand, (gallons per minute, gpm)*
C= *Coefficient Associated with Ranges of ERUs*
N= *Number of Service Connections, ERUs*
F= *Factor Associated with Ranges of ERUs*
MDD= *Maximum Day Demand, (gpd/ERU)*

The values for C and F of the peak hour demand formula are taken from the DOH Water System Design Manual, Table 5-1. C is equal to 1.6 and F is equal to 225. Projections for peak hour production are calculated using this formula.

Table 3-12 shows the projected average day, maximum day, and peak hour purchased water requirements for the City of Algona.

**TABLE 2-12**

**Projected Average Day, Maximum Day and Peak Hour Purchased Water Requirements**

| Year | Projected Average Day Purchased Water Requirements (gpd) | Projected Maximum Day Purchased Water Requirements (gpd) | Projected Peak Hour Purchased Water Requirements (gpm) |
|---|---|---|---|
| 2013 | 345,224 | 863,061 | 1,050 |
| 2014 | 348,384 | 870,960 | 1,058 |
| 2015 | 351,544 | 878,860 | 1,067 |
| 2016 | 354,704 | 886,759 | 1,076 |
| 2017 | 357,864 | 894,659 | 1,085 |
| 2018 | 361,209 | 903,023 | 1,094 |
| 2022 | 374,964 | 937,409 | 1,132 |
| 2032 | 413,067 | 1,032,668 | 1,238 |

# CHAPTER 3

# SYSTEM ANALYSIS

## INTRODUCTION

The ability of a water utility to meet current and future demands is an important consideration in water system planning. In addition to demand considerations, water quality plays a major role in determining the adequacy of a water system. The three components which will be analyzed in this chapter include:

1. System Design Standards
2. Water Quality and Facility Analysis
3. System Deficiencies

The design standards identify the criteria that are applicable to the City. The water quality and facility analysis then compares these design standards to the City's existing facilities and water quality. Based on this comparison, a summary of water system deficiencies is provided.

## SYSTEM DESIGN STANDARDS

Performance and design criteria typically address the sizing and reliability requirements for source, storage, distribution, and fire flow. WAC 246-290 contains general criteria and standards that must be followed in development of public water systems. The design standards for the following subjects are discussed below:

- **General Facility Standards**

    1. Average and Peak Day Demand
    2. Peak Hour Demand
    3. Storage Requirements
    4. Fire Flow Rate and Duration
    5. Minimum System Pressure
    6. Minimum Pipe Sizes
    7. Backup Power Requirements
    8. Valve and Hydrant Spacing
    9. Other System Policies

DOH relies on various publications, agencies, and the City itself to establish design criteria. The following gives a brief description of the referenced performance and design standards.

- **<u>WAC 246-290, Group A Public Water Systems</u>, Washington State Board of Health (March 2012).**
  This is the primary drinking water regulation utilized by the Washington State Department of Health (DOH) to assess capacity, water quality, and overall compliance with drinking water standards.

- **<u>Water System Design Manual (WSDM)</u>, Washington State Department of Health (DOH) (December 2009).**
  These standards will serve as guidance for the preparation of plans and specifications for Group A public water systems in compliance with WAC 246-290.

Table 3-1 lists the suggested DOH Water System Design Manual guidance and the City of Algona's policies with regard to each standard for general facility requirements.

**TABLE 3-1**

**General Facility Requirements**

| **Standard** | **DOH Water System Design Manual (December 2009)** | **City of Algona Standard** |
|---|---|---|
| Average Day and Maximum Day Demand | Average Day Demand (ADD) and Maximum Day Demand (MDD) should be determined from metered water use data. Lacking daily source meter records, monthly source meter records can be used to estimate MDD. DOH recommends a MDD to Maximum Month Average Day (MMAD) ratio of 1.7 for systems within Western Washington. | ADD = metered production data<br>MDD = 1.7 x MMAD<br>MDD = 2.50 x ADD<br>(Determined in Chapter 2) |
| Peak Hour Demand | Peak hour demand is determined using the following equation:<br>PHD = (MDD/1440)[(C)(N) + F] + 18<br>C = Coefficient from DOH Table 5-1<br>N = Number of connections, ERUs<br>F = Factor of range from Table 5-1 of the DOH Design Manual | Peak hour demand was calculated using the DOH formula. |
| Source | Capacity must be sufficient to meet MDD. | Same as DOH Water System Design Manual, Chapter 7. |
| Minimum System Pressure | The system should be designed to maintain a minimum of 30 psi in the distribution system under peak hour demand and 20 psi under fire flow conditions during MDD. | Maintain pressure above 60 psi as currently provided by Auburn. |
| Minimum Pipe Sizes | The diameter of a transmission line shall be determined by hydraulic analysis. The minimum size distribution system line shall not be less than 6-inches in diameter. | The minimum distribution line size shall be 8-inches. Pipes may be resized by the hydraulic model. |

## TABLE 3-1 – (continued)

## General Facility Requirements

| Standard | DOH Water System Design Manual (December 2009) | City of Algona Standard |
|---|---|---|
| Storage | The sum of:<br>Operational Storage Volume sufficient to prevent pump recycling.<br>Equalizing Storage $V_{ES} = (Q_{PH} - Q_S) * 150$<br>Standby Storage<br>$V_{SB} = 2 * [(ADD * N) - t_m * (Q_S - Q_L)]$<br>No less than 200 gallons per ERU<br>Fire Suppression Storage $V_{FSS} = NFF * T$<br>ADD = average day demand, gpd/ERU<br>N = number of ERU's<br>$Q_{PH}$ = peak hour demand, gpm<br>$Q_S$ = capacity of all sources, excluding emergency sources, gpm<br>$Q_L$ = capacity of largest source, gpm<br>$t_m$ = daily pump source run time, min (1440)<br>NFF = needed fire flow, gpm<br>T = fire flow duration, min | Algona's storage is provided by the City of Auburn. Algona will use Auburn's equalizing storage calculation of $V_{ES} = 0.25 * MDD$. Standby storage and fire suppression storage are calculated per the WDOH Manual and noting that Algona is a consecutive water system. |
| Fire Flow Standard | The minimum fire flow shall be determined by the local fire authority or WAC 246-293 for systems within a critical water supply service area (CWSSA). | The City of Algona's fire flow requirements are based on the Uniform Fire Code, which was adopted by the City. The following fire flow requirements are used for planning purposes:<br>Single Family Residential: 1,000 gpm<br>Medium Density Residential, Mixed Use or General Commercial: 1,500 gpm<br>Heavy Commercial or Light Industrial: 2,500 gpm |
| Reliability Recommend-ations | • Sources capable of supplying MDD within an 18-hour period<br>• Sources meet ADD with largest source out of service<br>• Back-up power equipment for pump stations unless there are two independent public power sources<br>• Provision of multiple storage tanks<br>• Standby storage equivalent to ADD x 2, with a minimum of 200 gpd/ERU<br>• Low and high level storage alarms<br>• Looping of distribution mains when feasible<br>• Pipeline velocities not > 8fps at PHD<br>• Flushing velocities of 2.5 fps for all pipelines | Algona has adopted Auburn's general reliability goal to provide "consistent and reliable" service. Auburn provides water to Algona in multiple locations and from multiple sources and reservoirs, thus providing a high level of reliability and redundancy (see Appendix C page 3-8). |

**TABLE 3-1 – (continued)**

**General Facility Requirements**

| Standard | DOH Water System Design Manual (December 2009) | City of Algona Standard |
|---|---|---|
| Valve and Hydrant Spacing | Sufficient valving should be placed to keep a minimum of customers out of service when water is turned off for maintenance or repair. Fire hydrants on lateral should be provided with their own auxiliary gate valve. | Hydrants are required every 600 feet in residential areas and at every 300 feet in commercial areas. Valves are required at a maximum spacing of 1,000 feet or at tees. |

# WATER QUALITY STANDARDS

The Safe Drinking Water Act (SDWA) of 1974, amended in 1986, established specific roles for the federal and state governments and for public water suppliers. The federal government, specifically the EPA, is authorized to develop national drinking water regulations and oversee the implementation of the act. The state governments are expected to adopt the federal law into state law, and accept the primary responsibility for implementation and enforcement of the law. Public water suppliers are assigned the day-to-day responsibility of meeting the regulations.

Table 3-2 lists the existing and future drinking water regulations and the status of each regulation. This table indicates that several regulations are applicable to the City of Algona, and several additional regulations establish source water quality standards and are applicable to the City of Auburn.

Existing state law contains regulations of bacteriological contaminants, inorganic chemicals and inorganic physical parameters (IOCs), volatile organic chemicals (VOCs), synthetic organic compounds (SOCs), trihalomethanes (THMs), and radionuclides. Several additional drinking water regulations will become effective in the next ten years, and these new regulations will define new regulatory requirements for sulfate, radionuclides, additional IOCs and SOCs, arsenic, and additional disinfection by-products.

**TABLE 3-2**

**Drinking Water Regulation Summary**

| Rule | Contaminants Affected | Effective Date |
|---|---|---|
| Existing WAC 246-290 (includes Lead/Copper Rule and Phase II/V Rule) | Bacteriological, IOC, VOC, SOC, THM, Radionuclides | In Effect |
| GWI Portion of Existing WAC 246-290 | City of Auburn Sources have been determined non-GWI | In Effect |
| Radionuclides | Radionuclides | In Effect |
| Consumer Confidence Report | None, reporting only | In Effect |
| Phase VIb | IOC, SOC | In Effect |
| Arsenic Rule | Arsenic | In Effect |
| Radon | Radon | In Effect |
| Groundwater Rule | Bacteriological | In Effect |
| Stage 1 Disinfectants/Disinfection By-Products Rule | TTHMs, HAA5, Chlorite, Bromate | In Effect |
| Stage 2 Disinfectants/Disinfection By-Products Rule | Additional public health protection from DBP and microbial pathogens | In Effect |
| Surface Water Treatment Rule (1) | Large Surface Water Systems or Systems determined to be GUI: Microbial Contaminants | In Effect |
| Long-Term 1 Enhanced Surface Water Treatment Rule | Bacteriological | In Effect |
| Long-Term 2 Enhanced Surface Water Treatment Rule | Bacteriological | In Effect |

(1) All water comes from Auburn, which may receive treated surface water from Tacoma.

Minimum standards for water quality are specified in terms of Maximum Contaminant Levels (MCLs). Primary MCLs are based on chronic and/or acute human health effects. Secondary MCLs are based on factors other than health effects, including aesthetics. MCLs are specified in WAC 246-290 and described in the following pages and tables. Water quality data and a water quality monitoring schedule are presented later in this chapter.

## BACTERIOLOGICAL

Baceriological testing of drinking water is regulated by the Total Coliform Rule. Coliform bacteria is a general category of bacteria routinely monitored in potable water systems. Not all coliform bacteria are pathogenic but they are relatively easy to identify in laboratory analysis and represent an indicator organism. This means that if coliform bacteria are detected, then other pathogenic organisms may also be present. Bacterial contamination of a potable water system can cause a number of waterborne diseases, so coliform analysis is strictly monitored and regulated by the DOH.

The Coliform Monitoring Rule specifies two types of violations, "nonacute MCL" and "acute MCL." A purveyor is required to notify both the DOH and system consumers if either MCL violation occurs. A violation of bacteriological MCLs occurs during routine sampling when:

- Coliform is detected in more than one sample in a single month (nonacute MCL);

- Coliform is present in a set of repeat samples collected as a follow-up to a sample with fecal coliform or E. coli presence (acute MCL); or

- Fecal coliform or E. coli is present in a repeat sample after coliform was detected in the routine sample (acute MCL).

## RESIDUAL DISINFECTANT

According to WAC 246-290-300, systems providing surface water disinfection treatment or receiving water that has been disinfected shall measure residual disinfectant concentration within the distribution system daily. A disinfectant residual must be maintained throughout the distribution system.

## GROUNDWATER RULE

### Introduction

The federal Groundwater Rule (GWR) aims to protect people served by groundwater sources from bacteria and viruses. The GWR establishes a risk-targeted approach to identify water systems susceptible to fecal contamination. Water systems can comply with the monitoring portion of this rule in two basic ways: compliance monitoring of treatment that provides at least 4-log virus inactivation or removal, or triggered source monitoring if treatment is not provided or does not provide at least 4-log virus inactivation. The City, as a system which receives finished groundwater from another public water system, will comply with the GWR by notifying Auburn of positive coliform samples and notifying its own customers if required by DOH.

**Monitoring Requirements and Analysis**

No new routine sampling is required by the GWR. The GWR requires triggered source water monitoring within 24 hours of receiving a positive total coliform distribution system sample. Since the City of Auburn provides finished water supply to the City of Algona, the City must notify Auburn within 24 hours of receiving a positive total coliform sample. Auburn is then responsible for complying with the requirements to sample each individual well that was in operation at the time the routine sample was taken. Source water samples are to be analyzed for E. coli in accordance with EPA guidelines, and the results reported to DOH. If one of the triggered source samples is E. coli positive DOH will either require corrective actions or will direct the City of Auburn to collect five additional source water samples from the same source within 24 hours.

Corrective actions are required if a significant deficiency is identified, or if the initial triggered source samples or one of the five additional sources sample test positive for E. coli. Water systems are required to implement at least one of the following corrective actions:

- Correct all significant deficiencies identified by sanitary surveys.
- Provide an alternative source of water.
- Eliminate the source of contamination.
- Provide treatment that reliably achieves at least 4-log (99.99%) removal of viruses.

The GWR increases the frequency that DOH conducts sanitary surveys on water system facilities from every 5 years to every 3 years. The purpose of a sanitary survey is to identify deficiencies in the system where contamination can occur. Water systems may be allowed to stay on a 5-year schedule if they either provide 4-log treatment of viruses or have no total coliform MCL violations, have no more than one total coliform monitoring violation since the last sanitary survey and have no unresolved significant deficiencies in the current survey.

Water systems are required under the GWR to provide public notification for a number of situations or violations. The City, as a consecutive system, must provide notification to its customers if it the City of Auburn notifies it of an E. coli positive source sample result.

The City’s last sanitary survey was competed by DOH on March 27, 2012 and found the system to be in good condition with no significant deficiencies.

**Surface Water Treatment Rule**

The Surface Water Treatment Rule (SWTR) established water quality requirements for surface water sources and groundwater sources that are under the direct influence of surface water (i.e., GWI sources). The purpose of the SWTR is to protect against acute health risks from waterborne microbiological contaminants. Requirements for adequate disinfection and contact time are established. Filtration may be required in order to meet water quality standards and source requirements. Treatment technique requirements are established, instead of MCLs, for *Giardia lamblia*, viruses, heterotrophic plate count bacteria, *Legionella*, and turbidity. Disinfection with or without filtration must achieve at least 99.9 percent removal and/or inactivation of *Giardia lamblia* cysts and 99.99 percent removal and/or inactivation of viruses.

**Interim Enhanced Surface Water Treatment Rule**

The purpose of the Interim Enhanced Surface Water Treatment Rule (IESWTR) is to improve control of microbial pathogens, specifically the protozoan Cryptosporidium, in drinking water and address risk trade-offs with disinfection byproducts. The rule requires systems to meet strengthened filtration requirements as well as to calculate levels of microbial inactivation to ensure that microbial protection is not jeopardized if systems make changes to comply with disinfection requirements of the D/DBP Rule. The IESWTR applies to public water systems that use surface water or ground water under the direct influence of surface water and serve more than 10,000 people.

**Long-Term 1 Enhanced Surface Water Treatment Rule**

The Long-Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR) applies to public water systems that use surface water or groundwater under the direct influence of surface water and serve fewer than 10,000 persons. The LT1ESWTR builds upon the framework established for systems serving a population of 10,000 or more in the IESWTR.

**Long-Term 2 Enhanced Surface Water Treatment Rule**

The Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) further enhances requirements established in other surface water regulations. LT2ESWTR applies to all public water systems that use surface water or a groundwater source that is under the direct influence of surface water. This Rule requires additional sampling and reservoir requirements.

## INORGANIC PHYSICAL AND CHEMICAL CHARACTERISTICS

Primary and secondary MCLs for inorganic physical and chemical characteristics are summarized in Tables 3-3 and 3-4. Sampling and compliance for these constituents is performed by the City of Auburn at each of its sources of supply.

### TABLE 3-3

### Water Quality Standards for Inorganic Chemicals[1]

| Chemical | Primary MCL (mg/L) |
|---|---|
| Antimony (Sb) | 0.006 |
| Arsenic (As) | 0.01 |
| Asbestos | 7 million fibers/liter |
| Barium (Ba) | 2.0 |
| Beryllium (Be) | 0.004 |
| Cadmium (Cd) | 0.005 |
| Chromium (Cr) | 0.1 |
| Cyanide (HCN) | 0.2 |
| Fluoride (F) | 4.0 |
| Mercury (Hg) | 0.002 |
| Nickel (Ni) | 0.1 |
| Nitrate (as N) | 10.0 |
| Nitrite (as N) | 1.0 |
| Selenium (Se) | 0.05 |
| Sodium (Na) | 20[2] |
| Thallium (Tl) | 0.002 |
| **Chemical** | **Secondary MCL (mg/L)** |
| Chloride (Cl) | 250.0 |
| Fluoride (F) | 2.0 |
| Iron (Fe) | 0.3 |
| Manganese (Mn) | 0.05 |
| Silver (Ag) | 0.1 |
| Sulfate ($SO_4$) | 250.0 |
| Zinc (Zn) | 5.0 |

(1) Source: DOH Drinking Water Regulations (WAC 246-290-310).

(2) Although an MCL has not been established for sodium, the EPA has also established a recommended level of 20 mg/L for sodium as a level of concern for those consumers that may be restricted for daily sodium intake in their diets.

**TABLE 3-4**

**Water Quality Standards for Inorganic Physical Characteristics(1)**

| Characteristic | MCL | MCL Type |
|---|---|---|
| Turbidity (Groundwater Sources) | 1.0 NTU | Primary |
| Color | 15 Color Units | Secondary |
| Hardness | None Established | Secondary |
| Specific Conductivity | 700 mhos/cm | Secondary |
| Total Dissolved Solids (TDS) | 500 mg/L | Secondary |

(1) Source: DOH Drinking Water Regulations, effective April 1999.

## VOLATILE ORGANIC COMPOUNDS AND SYNTHETIC ORGANIC COMPOUNDS

There are currently 21 regulated VOCs and 30 regulated SOCs. A list of these compounds and their MCLs is included in the Appendix E. Sampling and compliance for these constituents is performed by the City of Auburn at each of its sources of supply.

## GWI DETERMINATION

Systems are required to provide filtration treatment for groundwater sources that are under the direct influence of surface water (GWI sources). The DOH will determine which sources are GWI sources based on a review of existing data and, if required, collect water quality and microscopic particulate analysis data. GWI sources are subject to the requirements of the surface water treatment rule.

## RADIONUCLIDES

Table 3-5 summarizes radionuclide MCLs as defined by WAC 246-290. Radionuclide samples are required once every four years.

**TABLE 3-5**

**Radionuclide MCLs**

| Parameter | MCL |
|---|---|
| Radium—226 | 5 pCi/L |
| Radium—228 | 5 pCi/L |
| Combined Radium-226 and Radium-228 | 5 pCi/L |
| Uranium | 30 µg/L |
| Gross alpha particle activity, excluding uranium | 15 pCi/L |
| Beta particle and photon radioactivity from man-made radionuclides | 4 millirem |

## CONSUMER CONFIDENCE REPORT

The Consumer Confidence Report Rule requires community water system purveyors to prepare and distribute an annual report of water quality analyses to their customers. The City is required to submit the Consumer Confidence Report (CCR) to its customers before the 1st of July each year. A copy of the City of Algona's 2011 CCR is included in Appendix E.

## LEAD AND COPPER RULE

In 1991, the EPA promulgated the Federal Lead and Copper Rule. The State of Washington adopted this rule in 1995, with minimal changes. The Lead and Copper Rule is intended to reduce the tap water concentrations of lead and copper that can occur when corrosive source water causes lead and copper to leach from water meters and other plumbing fixtures.

Ninety percent (90%) of distribution system lead samples collected according to the procedures outlined in State law must have concentrations below the "Action Level" of 0.015 mg/L. Similarly, 90 percent of copper samples must have concentrations less than 1.3 mg/L. Systems exceeding the action levels are required to provide public notification and implement a program for reducing lead and copper levels.

## DISINFECTANTS/DISINFECTION BYPRODUCTS RULE (DBPR)

The Stage 1 DBPR became effective in February 1999. The compliance deadline for small systems was January 2004. This rule is aimed at water systems that introduce a disinfectant during any part of the treatment process. The DBPR establishes residual disinfectant concentrations and maximum contaminant levels for disinfection byproducts.

The requirements established by Stage 1 of the DBPR are summarized in Table 3-6. Compliance is based on the running annual average of the samples taken.

**TABLE 3-6**

**Stage 1 D/DBP Rule Standards**

| Parameter | Stage 1 MCL |
|---|---|
| TTHM (total Trihalomethanes) | 80 µg/L |
| HAA5 (sum of 5 haloacetic acids) | 60 µg/L |
| Bromate | 10 µg/L |
| Chlorite | 1.0 mg/L |
| Residual Chlorine | 4.0 mg/L |
| Effective Date | In Effect |
| Applicable to Algona | No |

## STAGE 2 DISINFECTANTS/DISINFECTION BYPRODUCTS RULE (DBPR)

Stage 2 of the D/DBP Rule was published in January 2006 and compliance with the new regulations begins in 2012. Under Stage 2 of the D/DBP Rule, the MCLs for TTHM and HAA5 remain 80 µg/L and 60 µg/L, respectively; however, compliance with the MCL is based on the locational running annual average (LRAA) of each individual sample site instead of the running annual average of all sample sites combined. This means that the annual average at each site must be below the MCL. The number of samples taken is dependant on the population served. Systems serving between 500 and 9,999 people must collect two samples per year.

The City's Stage 2 sampling locations were selected in the 2008 Initial Distribution System Evaluation (IDSE) Report. The City chose to implement the Standard Monitoring Plan approach developed by the EPA for the completion of their ISDE requirements. This process involves one year of increased monitoring for TTHM and HAA5 in addition to the data being collected under Stage 1. The City performed monitoring for Stage 2 by collecting 2 samples quarterly between November 2007 and August 2008.

The selected Stage 2 monitoring locations along with 2008 peak DBP monitoring results are detailed in Table 3-7. In all cases the test results were well below the MCLs for TTHM and HAA5.

**TABLE 3-7**

**Stage 2 D/DBP Initial Monitoring Results**

| Location | Parameter | 11/15/2007 | 2/5/2008 | 5/7/2008 | 8/6/2008 |
|---|---|---|---|---|---|
| Site #1: Milwaukee Boulevard North | TTHM(1) | ND | ND | ND | ND |
| | HAA5(2) | ND | ND | ND | ND |
| Site #2: Washington Boulevard South | TTHM(1) | 2.1 | 0.6 | ND | 2.4 |
| | HAA5(2) | ND | ND | ND | 1.2 |

(1) TTHM (total Trihalomethanes) MCL = 80 μg/L
(2) HAA5 (sum of 5 haloacetic acids) MCL = 60 μg/L

## WATER QUALITY MONITORING SCHEDULE

Water quality monitoring is required for regulatory compliance to monitor water system conditions and for treatment plant operation. Table 3-8 summarizes water quality monitoring requirements for parameters that are required on a regular basis.

**TABLE 3-8**

**City of Algona Water Quality Monitoring Schedule**

| Parameter | Sample Location | Frequency | Notes |
|---|---|---|---|
| Coliform Bacteria | Distribution | Monthly | 3 samples each month(1) |
| Asbestos | Distribution System | One Sample every 9 years | From distribution system in area with AC pipe |
| Lead/Copper | Distribution System | Currently required to take on set of samples every 3 years | All water purchased from Auburn. Auburn has implemented corrosion control treatment. |
| Chlorine Residual | Distribution System | Daily | Also required when collecting coliform samples |
| D/DBPs | Distribution System | Annually | Two locations for TTHMs and HAA5. |
| Inorganics | Source | Not Required | Auburn responsibility |
| Nitrate | Source | Not Required | Auburn responsibility |
| Nitrite | Source | Not Required | Auburn responsibility |
| VOCs/SOCs | Source | Not Required | Auburn responsibility |
| Radionuclides | Source | Not Required | Auburn responsibility |

(1) Refer to the City's Coliform Monitoring Plan in Appendix E.

# WATER QUALITY ANALYSIS

Water quality can be affected by both the source and the distribution system. As such, some water quality standards are sampled from the source (e.g., VOCs/SOCs) and some are sampled from the distribution system (e.g., coliforms). Because Auburn provides the City of Algona's water, both cities are responsible for monitoring different aspects of Algona's water quality. A discussion of the quality of the source and distribution system follows.

## SOURCE (CITY OF AUBURN) WATER QUALITY

Brief summaries of the water quality data for all of Auburn's sources is presented in this section. A copy of Auburn's Water Quality Chapter from their 2009 *Water Comprehensive Plan* is included in Appendix E.

### Volatile Organic Compounds and Synthetic Organic Compounds

The MCLs for the 21 regulated VOCs and 30 regulated SOCs are available in Appendix E. A review of Auburn's water quality data for VOCs and SOCs indicates that Auburn has remained in compliance since 1995. In testing for SOCs from 2003 and for VOCs from 2003 and 2007 the following VOCs were detected: trichloroethylene and tetrachloroethylene. These compounds were detected in Wells 2 and 6. The detected levels range from 0.7 to 1.5 μg/L, which are below drinking water MCLs of 5 μg/L for both compounds.

### Inorganic Physical and Chemical Characteristics

Table 3-9 summarizes Auburn's inorganic water quality parameters at each of the Auburn sources. Data for this table is provided by the Auburn 2009 *Water Comprehensive Plan* which presents a review of Auburn's inorganic data from 2003 to 2007. The concentration of manganese in Well 7 exceeds the secondary MCL. While these levels do not pose a health risk, they can create aesthetic problems because of the potential to cause black residue deposits in pipes and plumbing fixtures. Since 2007 water from Well 7 has been treated at the Fulmer Corrosion Control Treatment Facility and does not go directly to the distribution system. Treated water from the corrosion control facility had a total manganese level of below the secondary MCL. Results the arsenic level at Well 4 was at the MCL of 0.01 mg/L. It is anticipated that Auburn will be in compliance with the Arsenic MCL of 0.01 mg/L.

## TABLE 3-9

### Summary of Auburn Water Quality Data (2003 to 2007 Averages)
### (Source: Auburn 2009 Water Comprehensive Plan)

| Water Quality Parameter(1) | MCL (mg/L) | Coal Creek Springs (mg/L) | West Hill Springs (mg/L) | Well 2 (mg/L) | Well 4 (mg/L) | Well 5 (mg/L) | Well 5A (mg/L) | Well 6 (mg/L) | Well 7 (mg/L ) | Fulmer CCTF(2) (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Primary MCLs** | | | | | | | | | | |
| Arsenic | 0.01 | <0.002 | <0.002 | <0.002 | 0.01 | 0.002 | 0.002 | 0.003 | 0.002 | 0.002 |
| Fluoride | 4 | <0.2 | <0.2 | <0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | <0.2 |
| Nitrate (as N) | 10 | 1.5 | 4.7 | 3.6 | 1.6 | 0.9 | <0.2 | <0.2 | <0.2 | <0.2 |
| Sodium(3) | 20(4) | 5 | 9 | 13 | 7 | 8 | 6 | 14 | 13 | 12 |
| Turbidity | 1 NTU | 0.4 | 0.2 | 1.8 | 17 | 1.5 | 0.2 | 0.7 | 0.5 | 0.3 |
| **Secondary MCLs** | | | | | | | | | | |
| Chloride | 250 | 33 | 7 | 10 | 3 | 3 | 2 | 5 | 8 | 8 |
| Color | 15 | <5 | <5 | 5 | 10 | 5 | 5 | <5 | <5 | <5 |
| Hardness | -- | 60 | 130 | 132 | 68 | 95 | 67 | 96 | 112 | 105 |
| Iron | 0.3 | <0.1 | <0.1 | <0.1 | <0.1 | 0.19 | <0.1 | <0.1 | <0.1 | <0.1 |
| Manganese(4) | 0.05 | <0.01 | <0.01 | 0.03 | 0.01 | <0.01 | <0.01 | <0.01 | **0.07** | 0.02 |
| Silver | 0.1 | <0.01 | <0.01 | 0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Sulfate | 250 | 6 | 15 | 16 | 11 | 9 | 6 | 16 | 16 | 13 |

(1) Parameters not detected include antimony, barium, beryllium, cadmium, chromium, copper, cyanide, lead, mercury, nickel, nitrite, selenium, silver, thallium, and zinc.

(2) Since 2007 Wells 2, 6 and 7 are represented by samples collected from Fulmer Corrosion Control Treatment Facility (CCTF)

(3) Although an MCL has not been established for sodium, the EPA has also established a recommended level of 20 mg/L for sodium as a level of concern for those consumers that may be restricted for daily sodium intake in their diets.

(4) Well 7 exceeded the manganese secondary MCL. However, since 2007 the output of Well 7 is put through the Fulmer CCTF which meets the MCL. Data for total dissolved solids was not collected because conductivity was less than 700 micromhos/cm.

### Radionuclides

According to the Auburn 2009 *Water Comprehensive Plan*, radionuclide samples were collected in 2002 at all sources. Sampled constituents were all below their respective MCLs. Sampling at Fulmer CCTF and at Well 5B was conducted in 2006 for Gross Alpha Particles and Radium-228. Again sampled constituents were all below their respective MCLs.

### Groundwater Under the Direct Influence of Surface Water (GWI Sources)

As part of the Surface Water Treatment Rule, effective since 1993, treatment to remove giardia and viruses is required for groundwater sources that are determined to be under the direct influence of surface water (GWI Sources). The City of Auburn’s sources have been determined to be non GWI sources by DOH. Testing was most recently completed on the Coal Creek Springs sources and according to the City of Auburn 2009

Water System Plan DOH informed the City that the source was not GWI in a letter dated February 6, 2004. The DOH will notify the City of Auburn of any future monitoring requirements.

## DISTRIBUTION (CITY OF ALGONA) WATER QUALITY

### Total Coliform Rule Monitoring

Since the previous Plan, coliform has been detected in three of Algona's routine coliform samples; once in February 2008, once in July 2012 and once in August 2012. In all cases repeat samples were taken and were negative. The City currently collects three coliform samples per month from the distribution system, in accordance with the City's Coliform Monitoring Plan. An updated Coliform Monitoring Plan, included in Appendix E, identifies 12 distribution system coliform sample sites with 24 repeat sample locations. The sampling sites are rotated with each site sampled three times per year.

### Chlorine Residual

Chlorine residual is measured when routine or repeat coliform samples are taken. City staff report a consistent chlorine residual of 0.3 to 0.4 mg/L.

### Stage 2 Disinfection Byproducts

Stage 2 Disinfection Byproducts Rule compliance sampling began April 2012. So far the City has only sampled one location.

**TABLE 3-10**

**Stage 2 D/DBP Initial Monitoring Results**

| Location | Constituent | Sample Date | | LRAA | MCL |
|---|---|---|---|---|---|
| | | 2/7/2012 | 10/12/2012 | | |
| 440 Washington Boulevard | TTHM | 2.7 | 4.1 | 3.4 | 80 |
| | HAA5 | < 15 | < 15 | 0 | 60 |

(1) TTHM (total Trihalomethanes) MCL = 80 μg/L
(2) HAA5 (sum of 5 haloacetic acids) MCL = 60 μg/L

### Asbestos Monitoring

Asbestos is listed a primary inorganic contaminant. However, it is not routinely included in IOC samples for public water systems. Since the City's water distribution system has greater than 10 percent asbestos cement pipe installed, an asbestos sample must be collected from the distribution system at least once every 9 years.

The last asbestos monitoring sample was taken in April, 2012. Asbestos levels were undetectable.

**Lead and Copper**

The City of Algona collects samples regularly for lead and copper as directed by DOH. Results for the previous 6 years of copper sampling and lead sampling are presented in Tables 3-11 and 3-12, respectively.

**TABLE 3-11**

**Algona Copper Test Results**

| Year | Action Level (mg/L) | Maximum Concentration (mg/L) | 90th Percentile Concentration (mg/L) |
|---|---|---|---|
| 2011 | 1.3 | 1.40 | 1.1 |
| 2010 | 1.3 | 1.70 | 1.2 |
| 2009 | 1.3 | 1.40 | 1.1 |
| 2008 | 1.3 | 1.00 | 0.78 |
| 2007 | 1.3 | 1.20 | 0.95 |
| 2006(1) | 1.3 | 2.00 | 1.37 |
| 2006(1) | 1.3 | 1.60 | 1.42 |

(1) Two rounds of samples taken in 2006.

**TABLE 3-12**

**Algona Lead Test Results**

| Year | Action Level (mg/L) | Maximum Concentration (mg/L) | 90th Percentile Concentration (mg/L) |
|---|---|---|---|
| 2011 | 0.015 | 0.0060 | 0.0050 |
| 2010 | 0.015 | 0.0120 | 0.0040 |
| 2009 | 0.015 | 0.0080 | 0.0020 |
| 2008 | 0.015 | 0.0030 | 0.0070 |
| 2007 | 0.015 | 0.0320 | 0.0020 |
| 2006(1) | 0.015 | 0.0020 | 0.0020 |
| 2006(1) | 0.015 | 0.0060 | 0.0055 |

As shown in Table 3-11 the City's copper levels are currently lower than the action level, but they exceeded the action level during both rounds of sampling in 2006. The reason for the elevated copper levels in 2006 is unknown. Similar testing performed by the City of Auburn for that same year shows a 90$^{th}$ percentile copper concentration of 0.46 mg/L. As shown in Table 3-12 the City's lead levels were below the Action Level at all times.

The City of Auburn has been required to provide treatment for many of its groundwater sources after exceeding the copper action level in two rounds of customer tap sampling in 1992 and 1993. The City of Auburn was required to complete a corrosion control study in 1995. This study recommended pH adjustment by aeration as the optimal corrosion control treatment.

According to the City of Auburn 2009 *Water System Plan*, the City of Auburn and DOH entered into a Bilateral Compliance Agreement (BCA) in 1996 that identified the method and laid out a schedule for design and construction of corrosion control facilities in compliance with the Lead and Copper Rule requirements. In early 2000, the BCA was amended to include treatment of Wells 6 and 7 and to revise the design and construction schedule.

Two corrosion control facilities were constructed in 2002. One facility is located at the Coal Creek Springs Pump Station on Howard Road and the second at Fulmer Field Park. The Coal Creek Springs Facility treats water from Coal Creek Springs and Well 4 in the future. The Fulmer Field Park Facility treats water from any combination of Wells 2, 6 and 7. The facilities are designed to adjust the pH from approximately 6.5 to 7.5 by stripping carbon dioxide from the water through the use of aeration towers.

## FACILITY ANALYSIS

### SOURCE OF SUPPLY

The 2002 Agreement with Auburn established that Auburn will provide source capacity for the City of Algona. The 2002 Agreement only shows projected demands for Algona through 2014, and states that "Additional water supply may be available as mutually agreed to in writing by the Auburn City Council and the Algona City Council." For this analysis future demands will be compared with the 2014 limit and recommendations for increased capacity, if necessary, will be made. Tables 3-13 and 3-14 compare the projected average and maximum day demands from Chapter 2 respectively with the 2014 limits shown in the 2002 Agreement.

**TABLE 3-13**

**Average Day Source of Supply Analysis**

| Year | Projected Algona Average Day Demand (gpd) | 2002 Agreement Supply Limit (gpd) | Surplus (gpd) | Surplus ERUS(1) |
|---|---|---|---|---|
| 2013 | 345,224 | 525,000 | 179,776 | 400 |
| 2014 | 348,384 | 525,000 | 176,616 | 392 |
| 2018 | 361,209 | 525,000 | 163,791 | 364 |
| 2022 | 374,964 | 525,000 | 150,036 | 333 |
| 2032 | 413,067 | 525,000 | 111,933 | 249 |

(1) Based on an average ERU value of 180 gpd/ERU as established in Chapter 2.

**TABLE 3-14**

**Maximum Day Source of Supply Analysis**

| Year | Projected Algona Maximum Day Demand (gpd) | 2002 Agreement Supply Limit (gpd) | Surplus (gpd) | Surplus ERUS |
|---|---|---|---|---|
| 2013 | 863,100 | 1,114,000 | 250,900 | 558 |
| 2014 | 871,000 | 1,114,000 | 243,000 | 540 |
| 2018 | 903,000 | 1,114,000 | 211,000 | 469 |
| 2022 | 937,400 | 1,114,000 | 176,600 | 392 |
| 2032 | 1,032,700 | 1,114,000 | 81,300 | 181 |

(1) Based on an average ERU value of 180 gpd/ERU as established in Chapter 2.

As shown in Tables 3-13 and 3-14, the City's projected average and maximum day demands through the 20-year planning period will be in compliance with the supply limits designated in the 2002 with Auburn. The maximum supply designated in the 2002 Agreement will be sufficient to supply the City's water needs through 2032 and additional capacity should not be required.

## STORAGE

The 2002 Agreement with Auburn establishes that Algona will financially participate in the construction of a new reservoir to be located in the Auburn service area. The new 1.0 MG Lakeland Hills Reservoir No. 6 was constructed in 2010 and came online early 2012. Algona was allocated 180,000 gallons of storage in this new facility. The 2002 Agreement states "Algona's minimum financial participation shall provide for construction of storage volume capacity of 180,000 gallons, inclusive of standby, equalization, and fire protection volume storage. Such 180,000-gallon capacity is in addition to Algona's existing 100,000-gallon reservoir storage in its westerly service area." Per the agreement, Algona must do one of the following:

- Maintain at least 100,000 gallons of storage in its service area;
- Increase participation in the future Auburn reservoir by 100,000 gallons; or
- Obtain 100,000 gallons of storage from another source.

The City has discontinued the use of the 100,000-gallon reservoir and is evaluating options for additional storage.

Since Algona has established an agreement to receive source of supply from Auburn and to receive a storage capacity allocation in Auburn's storage facilities, this report will summarize the storage analysis in the 2009 Auburn *Water Comprehensive Plan*. The total storage requirement in the Auburn Plan and in this analysis will be the sum of equalizing, fire, and emergency (standby) storage volumes.

**Equalizing Storage**

The equalizing storage requirement is 25 percent of the maximum day demand, as defined by the City of Auburn's Plan (page 5-35).

$$V_{ES} = 1{,}032{,}668 * 0.25 = 258{,}200\ gal$$

**Standby Storage**

Any one of the master meters serving Algona is capable of providing average day demand. Assuming that each of the master meters is a source of supply to Algona.

$$V_{SD} = 2 * \left[ \left( ADD * N \right) - t_m \left( Q_S - Q_L \right) \right] = 0$$

**Fire Suppression Storage**

The 2009 Auburn *Water Comprehensive Plan* identified a maximum fire storage volume of 960,000 gallons, equivalent to a 4,000 gallon fire flow for 4 hours (page 5-37). As discussed in this Chapter, the City of Algona has set a maximum fire flow goal for commercial and industrial areas in the City of Algona of 2,500 gpm for 2 hours. Since the Auburn fire flow storage volume exceeds that of Algona, and Algona is utilizing Auburn's reservoirs for storage, no separate fire flow storage requirement is specified for Algona.

**Standby Storage**

The 2009 Auburn *Water Comprehensive Plan* contains the following text regarding calculation of emergency (standby) storage:

> Page 5-36, "The City (of Auburn) should provide either sufficient water to meet two days of the maximum day demands with the largest supply facility or pump in each service area out of service or sufficient water to meet two days of MDD using only reliable sources and reliable pump stations in each service area. The emergency storage volume will be calculated as the more conservative of the two criteria."

Referring to Auburn's Valley Service Area, which contains the Algona master meter stations, the 2009 Auburn *Water Comprehensive Plan* states the following:

> Page 5-40, "With the existing reliable sources and reservoirs, the Valley currently does not have sufficient storage. However, the service area will need 12.97 MG of additional storage by the year 2014, and 21.17 MG of additional storage by the year 2028. These storage needs can be met by a combination of rehabilitating Well 1 and Coal Creek Springs, adding backup power to Wells 4 and 7, constructing a new 2.0-MG Valley Reservoir, and purchasing additional water."

The City of Auburn is working to correct this storage deficiency and the future storage analysis, with improvements, shows sufficient storage in the Valley Zone for 2014 and 2028.

The 2001 Auburn Water Comprehensive Plan stated that storage in the Valley Zone must be sufficient to meet the requirements of both the Valley service area and IA3 (Interlocal Agreement No. 3, which was the Algona Supply Agreement at the time). The 2009 Auburn Water Comprehensive Plan does not include projected demands for Algona in calculating required storage. The reason for this difference is not known. Since Algona operates as an uninterruptible wholesale customer of Auburn, the City of Auburn's storage analysis should count Algona in the total demand for the Valley Zone and therefore towards the required emergency storage. As Auburn's sources provide for all of Algona's demands and the 2002 agreement stipulates the volume of maximum day demand that is available to Algona, it is Auburn's responsibility to maintain reliable source capacity or maintain sufficient emergency storage to supply max day demands for both the Valley Zone and Algona.

Table 3-15 summarizes the storage requirements for the City of Algona through 2032.

**TABLE 3-15**

**City of Algona Storage Requirements Equalizing Storage**

| Year | Projected ERUs | Projected Algona Maximum Day Demand (gpd) | Equalizing (1) Storage (gallons) | Standby Storage (gallons) | Fire Suppression Storage (gallons) |
|---|---|---|---|---|---|
| 2013 | 1,857 | 863,100 | 215,000 | 0 | 0 |
| 2014 | 1,874 | 871,000 | 217,800 | 0 | 0 |
| 2015 | 1,891 | 878,900 | 219,700 | 0 | 0 |
| 2016 | 1,908 | 886,800 | 221,700 | 0 | 0 |
| 2017 | 1,925 | 894,700 | 223,700 | 0 | 0 |
| 2018 | 1,943 | 903,000 | 225,800 | 0 | 0 |
| 2022 | 2,017 | 937,400 | 234,400 | 0 | 0 |
| 2032 | 2,222 | 1,032,700 | 258,200 | 0 | 0 |

(1) Minus 25 percent of Algona's maximum day demand.

Since Algona is a consecutive water system to Auburn, it may use the storage available to it through the Auburn system. The intertie agreement specifies that Auburn has been allocated up to 280,000 gallons of storage, should Algona purchase the additional 100,000 gallons. Auburn's fire suppression storage is larger than Algona's, thus fire suppression storage specific to Algona is within Auburn's fire suppression storage. Standby storage is not needed due to the multiple water sources provided by Auburn.

The City of Algona has participated financially in the construction of the City of Auburn's 1.0 MG Lakeland Hills Reservoir No. 6 and purchased 180,000 gallons of storage. As discussed earlier the City of Algona has discontinued use of the 100,000-gallon reservoir. To date the City has not yet agreed to purchase an additional 100,000 gallons from the City of Auburn. The City of Algona will need to purchase this additional storage in order to comply with the 2002 agreement and to provide sufficient storage to meet their storage requirements. A total volume of 280,000 gallons of storage would be sufficient to supply the City's storage needs through 2032. The City should demolish its abandoned reservoir before it becomes a safety hazard.

## DISTRIBUTION SYSTEM HYDRAULIC MODELING

The City's water system was analyzed using MWHSoft's $H_2$ONet hydraulic modeling software, which operates in an AutoCAD computer-aided design and drafting environment. The City's $H_2$ONet model was updated using the City's water base maps.

### Development and Calibration of Hydraulic Model

The calibration of a hydraulic model provides a measure of assurance that the model is an accurate and realistic representation of the actual system. The hydraulic model of the

City's water system was calibrated using data obtained from fire hydrant tests at various locations throughout the water system. Four fire hydrant tests were conducted, with the assistance of City personnel, on September 20, 2012. Hydrant testing uses two hydrants, one outfitted with a pressure gauge and one with a diffuser nozzle. The diffuser nozzle is equipped with a device called a pitot tube which is used to measure flow. Testing procedures were as follows, the hydrant with the pressure gauge is opened and static pressure is read. Then the second hydrant with the diffuser nozzle is opened, flow is measured with the pitot tube and a residual pressure is recorded at the first hydrant. Field results were used to calibrate the hydraulic model through verification and adjustment of pipe type, sizes, roughness coefficients, and elevations. In general a Hazen Williams "C" factor of 130 was used for newer pipe in the system and a "C" factor of 110 was used for the older pipe.

The City of Auburn Reservoir No. 2, with an overflow elevation of 249 feet, is located approximately two miles NE of Algona. Between the Auburn reservoir and the City of Algona lies the majority of Auburn's source capacity and a looped 16-inch distribution system. The three supply interties with the Auburn system were modeled as reservoirs with water surfaces of 245 feet based on the static pressures measured. During the calibration runs, average day water system demands were input into the model.

Algona is supplied water through three master meters from Auburn. Each of these master meters is equipped with an 8-inch turbine meter to measure flow. The American Water Works Association (AWWA) recommends a "High Normal Flow Rate" of 1,600 gpm and a "Maximum Flow Rate" of 2,400 gpm for 8-inch turbine meters. Flow through any two of the metered interties is sufficient to meet the largest fire flow demand in Algona, 2,500 gpm.

Locations for hydrant flow tests are presented in Table 3-16. The values measured in the hydrant flow tests compared to the model output values are summarized in Table 3-17.

**TABLE 3-16**

**Hydrant Flow Testing Locations**

| Test # | Location | Measured Static Pressure (psi) | Measured Residual Pressure (psi) | Measured Flow (gpm) |
|---|---|---|---|---|
| 1 | West Valley Highway and 6th Avenue North | 70 | 62 | 1,060 |
| 2 | 5th Avenue North and Main Street | 73 | 68 | 1,300 |
| 3 | 5th Avenue South and Milwaukee Boulevard | 73 | 62 | 1,290 |
| 4 | West Valley Highway and 5th Avenue South | 70 | 50 | 1,190 |

## TABLE 3-17

### Hydraulic Model Calibration Data

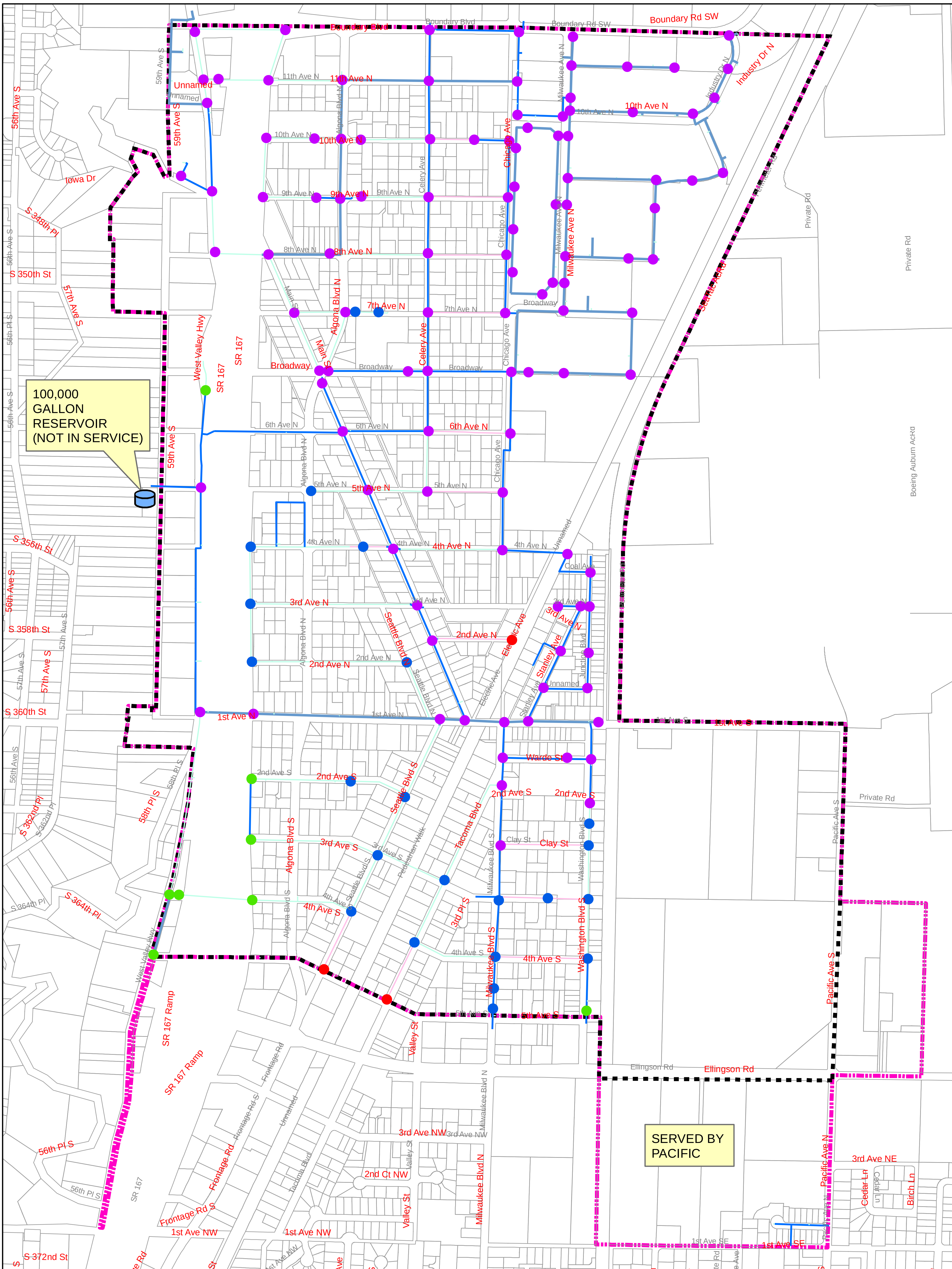
| Test # | Flow (gpm) | Static Pressure (psi) | | | Residual Pressure (psi) | | | Static – Residual(1) |
|---|---|---|---|---|---|---|---|---|
| | | Field | Model | Difference | Field | Model | Difference | Difference |
| 1 | 1,060 | 70 | 70 | 0 | 62 | 61 | 1 | -1 |
| 2 | 1,300 | 73 | 74 | -1 | 68 | 69 | -1 | 0 |
| 3 | 1,290 | 73 | 73 | 0 | 62 | 57 | 5 | -5 |
| 4 | 1,190 | 70 | 71 | -1 | 50 | 40 | 10 | -9(2) |

(1) Difference in error of static pressure measurements and residual pressure measurements.
(2) Calibration was unable to match this testing location with the field results.

The DOH Water System Design Manual does not require any set standard for hydraulic model calibration. However, an error of 5 percent of pressure is generally considered acceptable. Calibration of the hydraulic model produced results that met the field test data within the 5 percent margin except for residual pressure at tests 3 and 4. For residual pressure the error in Tests 3 and 4 was 8 percent and 20 percent respectively. In the case of Test 3 the error results in lower pressure in the model, which is conservative and can be accepted. In the case of Test 4 the error is much larger than what is generally considered acceptable. For this location an additional test was performed and roughly the same field results were measured. This confirmed the field results and determined that the model was reporting low results.

### Peak Hour Demand Modeling Results

According to WAC 246-290, a water system must maintain a minimum pressure of 30 psi in the distribution system under peak hour demand conditions. The City's existing distribution system has been modeled under 2018 and 2032 peak hour demand conditions. Table 3-18 lists the minimum pressures seen in the distribution system under 2032 peak hour demand. Results for the entire system are included in Appendix F.




N

0 700 1,400 Feet

**LEGEND:**

**2032 FIRE FLOW:**
- 1000 GPM OR LESS
- 1001 TO 1500 GPM
- 1501 TO 2500 GPM
- 2501 GPM OR GREATER

**WATERLINES:**
- 4-INCH
- 6-INCH
- 8-INCH
- 12-INCH
- RETAIL SERVICE AREA
- ALGONA CITY LIMITS

CITY OF ALGONA

WATER SYSTEM PLAN
FIGURE 3-1
EXISTING SYSTEM AVAILABLE FIRE FLOW
(2032 MAX DAY DEMAND)

Gray & Osborne, Inc.

**TABLE 3-18**

**Lowest System Pressures Under Peak Hour Demand Conditions**

| Node Number | Minimum Pressures Under 2018 Peak Hour Demand | Minimum Pressures Under 2032 Peak Hour Demand |
|---|---|---|
| J-143 | 64.7 | 64.5 |
| J-120 | 64.8 | 64.7 |
| J-122 | 65.1 | 65.0 |
| J-121 | 65.3 | 65.2 |
| J-145 | 65.4 | 65.2 |
| J16 | 65.8 | 65.7 |
| J-144 | 65.8 | 65.7 |
| J-30 | 66.0 | 65.9 |
| J-31 | 66.4 | 66.3 |
| J-20 | 66.6 | 66.5 |

As shown in Table 3-18, pressures in the City's distribution system are well above the minimum 30 psi requirement under 2018 and 2032 peak hour demand conditions.

**Fire Flow Modeling Results**

The DOH *Water System Design Manual* states that a water system should be designed to provide adequate fire flow under maximum day demand conditions, while maintaining a minimum system pressure of 20 psi.

Fire flow standards are established by the adoption by the City of the Uniform Fire Code (UFC) and by the 1989 *Coordinated Water System Plan*. The UFC contains the more stringent of the fire flow standards, with minimums of 1,000 gpm for single-family residences and 1,500 gpm for multi-family residences, commercial buildings, and industrial buildings. The City has set a goal to meet fire flows of 2,500 gpm in areas zoned heavy commercial and light industrial. These areas are along the West Valley Highway and in the Auburn 400 area.

The available fire flows for representative nodes throughout the system are listed below in Table 3-19. These nodes represent the lowest available fire flow areas when compared with each fire flow standard. A comprehensive list of the available fire flow is included in Appendix F. Figure 3-1 is a color coded map showing the node numbers along with the available fire flow under 2032 maximum day demands.

## TABLE 3-19

### Existing System Available Fire Flow under 2032 Maximum Day Demand Conditions(1)

| Node Number | Location | Zoning | Fire Flow Requirement (gpm) | Available Fire Flow(2)(3)(4) (gpm) | CIP Project |
|---|---|---|---|---|---|
| J-137 | 2nd Avenue North and Electric Avenue | Low Density Residential | 1,000 | **476** | D-6 |
| J-168 | 4th Avenue North and Main Street | Low Density Residential | 1,000 | 1,375 | - |
| J-32 | 2nd Avenue South and SR 167 | Low Density Residential | 1,000 | 1,450 | - |
| J-148 | 3rd Avenue South and SR 167 | Low Density Residential | 1,000 | 1,456 | - |
| J12 | 7th Avenue North and Algona Boulevard | Low Density Residential | 1,000 | 1,456 | - |
| J-147 | 5th Avenue South and Seattle Boulevard South | Mixed Use Commercial | 1,500 | **595** | D-1 |
| J-153 | 5th Avenue South and Tacoma Boulevard South | Mixed Use Commercial | 1,500 | **601** | D-1 |
| J-29 | 5th Avenue South and Washington Boulevard South | Medium Density Residential and Mixed Use Commercial | 1,500 | **1,364** | D-4 |
| J-28 | 4th Avenue South and Washington Boulevard South | Medium Density Residential and Mixed Use Commercial | 1,500 | 1,422 | - |
| J-37 | 4th Avenue South and SR 167 | Mixed Use Commercial | 1,500 | 1,489 | - |
| J-146 | 4th Avenue South and Seattle Boulevard South | Mixed Use Commercial | 1,500 | 1,636 | - |
| J16 | 4th Avenue South and West Valley Highway | Heavy Commercial | 2,500 | **1,406** | D-5 |
| J-120 | Broadway Street and West Valley Highway | Heavy Commercial | 2,500 | 3,141 | D-3 |
| J-145 | 5th Avenue South and West Valley Highway | Heavy Commercial | 2,500 | **1,391** (5) | - |
| J-122 | 5th Avenue North and West Valley Highway | Heavy Commercial | 2,500 | 3,165 | D-4 |
| J-220 | Boundary Boulevard and West Valley Highway | Heavy Commercial | 2,500 | **2,491** | - |

(1) Nodes shown are representative of lowest available flows throughout the water system. See Figure 3-1 and Appendix F for available fire flows system wide.
(2) Bold denotes a fire flow deficiency.
(3) The Available Fire Flows shown are the flows available at a minimum pressure of 20 psi anywhere within the system.
(4) Fire flow is generally limited by pressure at the node, not pressure constraints elsewhere in the system (Appendix F).
(5) See Table 3-17 regarding this node.

As shown in Table 3-19 and Figure 3-1, isolated areas throughout the distribution system cannot meet the fire flow requirements established by the UFC and the City's goal of 2,500 gpm in heavy commercial and industrial areas. Areas deficient in fire flow are primarily on the south end of the distribution system on 4-inch and 6-inch water mains, as well as areas along the West Valley Highway. Capital Improvement projects have been proposed to correct the listed system deficiencies. Available fire flows after the implementation of the listed CIP projects are shown in Table 3-20. The CIP projects listed will be sufficient to allow the entire distribution system to meet fire flow requirements.

**TABLE 3-20**

**Available Fire Flow under 2032 Maximum Day Demand Conditions with CIP Improvements**

| Node Number | Location | Zoning | Fire Flow Requirement (gpm) | Available Fire Flow (gpm) |
|---|---|---|---|---|
| J-137 | 2nd Avenue North and Electric Avenue | Low Density Residential | 1,000 | 2,429 |
| J-168 | 4th Avenue North and Main Street | Low Density Residential | 1,000 | 1,353 |
| J-32 | 2nd Avenue South and SR 167 | Low Density Residential | 1,000 | 1,500 |
| J-148 | 3rd Avenue South and SR 167 | Low Density Residential | 1,000 | 1,509 |
| J12 | 7th Avenue North and Algona Blvd | Low Density Residential | 1,000 | 1,616 |
| J-147 | 5th Avenue South and Seattle Boulevard South | Mixed Use Commercial | 1,500 | 1,881 |
| J-153 | 5th Avenue South and Tacoma Boulevard South | Mixed Use Commercial | 1,500 | 2,000 |
| J-29 | 5th Avenue South and Washington Boulevard South | Medium Density Residential and Mixed Use Commercial | 1,500 | 2,245 |
| J-28 | 4th Avenue South and Washington Boulevard South | Medium Density Residential and Mixed Use Commercial | 1,500 | 2,246 |
| J-37 | 4th Avenue South and SR 167 | Mixed Use Commercial | 1,500 | 1,903 |
| J-146 | 4th Avenue South and Seattle Boulevard South | Mixed Use Commercial | 1,500 | 2,067 |
| J16 | 4th Avenue South and West Valley Highway | Heavy Commercial | 2,500 | 2,637 |
| J-120 | Broadway Street and West Valley Highway | Heavy Commercial | 2,500 | 4,102 |
| J-145 | 5th Avenue South and West Valley Highway | Heavy Commercial | 2,500 | 2,814 |
| J-122 | 5th Avenue North and West Valley Highway | Heavy Commercial | 2,500 | 3,559 |
| J-220 | Boundary Boulevard and West Valley Highway | Heavy Commercial | 2,500 | 2,433 |

## SYSTEM DEFICIENCIES

### WATER QUALITY

The City of Algona water system is currently in compliance with all water quality regulations. The City should continue to track water quality test results as they are received to identify potential trends. Of particular interest would be the City's copper sample levels taken from customer taps. The current copper sample levels are below the action limits, but only by a small margin. If the City sees an increase in copper levels it must coordinate with Auburn to identify if treatment changes can be made at Auburn's Corrosion Control Facilities to reduce copper levels.

### SOURCE CAPACITY

The 2002 Agreement designates an average and maximum day supply through 2014. The Agreement states that additional water may be available if mutually agreed to. As shown in Tables 3-13 and 3-14, the City's projected average and maximum day demands through 2032 are in compliance with the supply designated in the 2002 Agreement with Auburn. The existing supply agreement provides sufficient capacity for the 20-year planning period. No additional interties with the City of Auburn are planned at this time.

### STORAGE

The 2002 Agreement stipulates that the City participate financially in the construction of 180,000 gallons of storage in Auburn's new Lakeland Hills Reservoir. The City has agreed to purchase the 180,000 gallons. In addition to the 180,000 gallon share in the new reservoir the 2002 Agreement requires the City to maintain use of their 100,000-gallon reservoir or find an alternative source of storage. As Algona no longer uses their existing 100,000-gallon reservoir, the City will need to secure an additional 100,000 gallons of storage capacity from the City of Auburn or from some alternative source. As shown in the storage analysis the City's current, 6-year and 20-year storage requirements all exceed the 180,000 gallons currently agreed to, resulting in an immediate deficit. The City needs to find a replacement for the 100,000 gallons or storage in their reservoir. With the additional 100,000 gallons of storage, for a total storage capacity of 280,000 gallons, the City will have sufficient storage to meet the 20-year storage requirement.

### DISTRIBUTION SYSTEM

As shown in Figure 3-1, isolated areas throughout Algona's distribution system cannot meet the minimum fire flow requirements specified by the UFC or the fire flow goal of 2,500 gpm set by the City for heavy commercial or light industrial areas. These areas are primarily along the West Valley Highway and in the southern portion of the distribution system. CIP projects have been identified to correct these deficiencies. These projects include installing new water mains to create loops and upsizing water mains. CIP project descriptions and costs are provided in Chapter 8.

## SANITARY SURVEY FINDINGS

The most recent DOH Sanitary Survey was completed on March 27, 2012. The City's water system was found to be in good condition and no significant deficiencies were observed. As a result of the Sanitary Survey DOH made a number of recommendations that the City will need to address. A summary of DOH recommendations follows.

### Emergency Intertie Agreement with City of Pacific

The Cities of Algona and Pacific have an emergency intertie in the form of a closed valve near the intersection of 5$^{th}$ Avenue South and Milwaukee Avenue South. The Cities should work together to develop an agreement that defines the conditions under which the intertie can be used, the amount of water available, the standard procedures for operating the intertie, O&M responsibilities for the intertie, and the cost of water.

### Update Coliform Monitoring Plan

The City should update the locations of their coliform monitoring map to reflect the installation of sampling station.

### Adopt a Formal Cross-Connection Control Program

The City's previous water system plan addressed some of the requirements for developing a cross connection control program, but a complete program has not yet been enacted. Development of a formalized Cross Connection Control Program is being conducted as a part of this Water System Plan. The City's Cross-Connection Control Program is summarized in Chapter 6, Operations and Maintenance, and is included as Appendix H.

### Form Water Use Efficiency Goals

The City has not yet adopted water use efficiency goals that are consistent with the Water Use Efficiency (WUE) Rule and Municipal Water Law. As a part of this Water System Plan, WUE goals have been established through a public forum. Chapter 4 discusses the City's water conservation program.

### Replacement Schedule for AC pipe and Asbestos Monitoring

A significant portion of the City's distribution system is made up of Asbestos Cement (AC) pipes. These pipes were installed mainly in the 1960s and make up the majority of the City's 4-inch and 6-inch pipes. In many places, including the City of Algona, AC pipe has proved to have a limited life span and is a potential source of failure due to its brittle nature. DOH recommended the City develop an AC pipe replacement program that will work to eliminate AC pipe within a reasonable time frame. A proposed AC pipe replacement schedule is included in Chapter 8, CIP.

Systems with AC pipe are required to take water samples for asbestos every 9 years. During recent monitoring asbestos levels in the City's water were undetectable.

# CHAPTER 4

# CONSERVATION PROGRAM

## OBJECTIVE

The objective of this chapter is to assess the development and implementation of the City of Algona's water conservation program to promote efficient water use. A conservation program generally includes an analysis of existing water rights. However, the City of Algona purchases its entire water supply from the City of Auburn and, therefore, does not maintain water rights.

## WATER USE EFFICIENCY RULE PLANNING REQUIREMENTS

The Washington Legislature passed the Water Use Efficiency Act of 1989 (43.20.230 RCW), which directs the Department of Health (DOH) to develop procedures and guidelines relating to water use efficiency. In response to this mandate, the Department of Ecology (Ecology), the Washington Water Utilities Council, and DOH jointly published a document titled *Conservation Planning Requirements* (1994). In 2003, the Municipal Water Supply - Efficiency Requirements Act (Municipal Water Law) was passed as Engrossed Second House Bill 1338 and amended the RCW to require additional conservation measures. The Municipal Water Law, among other things, directed DOH to develop the Water Use Efficiency Rule (WUE Rule), which was adopted in October 2006. WUE rule requirements are presented in WAC 246-290 Part 8. The WUE Rule is outlined and compliance guidance is provided in the *Water Use Efficiency Guidebook* (Third Edition), published January 2011 by the Washington State DOH.

The WUE Rule sets stringent requirements for public water purveyors. The WUE Rule is comprised of four sections:

1. Planning requirements
2. Distribution leakage standard
3. Metering requirements
4. Goal setting and performance reporting requirements

This chapter of the Plan includes all aspects of the WUE Rule planning requirements, including leakage evaluation, data collection and reporting, demand forecasting, and evaluation and selection of water use efficiency measures.

## DISTRIBUTION SYSTEM LEAKAGE

The WUE Rule requires that water distribution systems have a distribution system leakage (DSL) rate less than 10 percent of finished water production. Compliance with the 10 percent requirement is determined based on a 3-year rolling average. Distribution system leakage is defined as the difference between total water production and authorized consumption. Authorized consumption is the volume of water authorized for use by the water system. This includes metered water consumption by customers and known or credibly estimated unbilled or unmetered uses as well. Unmetered authorized consumption may include uses such as cleaning of reservoirs, firefighting, and system flushing.

For the past 3 years, the City has averaged about two water main breaks and five service line breaks per year.

As shown in Table 4-1 the City's 3-year rolling average Distribution System Leakage is currently 2.46 percent. This is in compliance with the WUE Rule's 10 percent maximum allowable leakage requirement.

**TABLE 4-1**

**Distribution System Leakage**

| Year | Total Production(1) (gallons) | Authorized Consumption(2) (gallons) | Distribution System Leakage (gallons) | Distribution System Leakage (%) | 3-Year Rolling Average (%) |
|---|---|---|---|---|---|
| 2008 | 97,330,056 | 88,493,676 | 8,836,380 | 9.08% | - |
| 2009 | 101,108,816 | 95,325,225 | 5,783,591 | 5.72% | - |
| 2010 | 96,012,280 | 92,109,575 | 3,902,705 | 4.06% | 6.29% |
| 2011 | 88,480,920 | 89,002,330 | -521,410(3) | 0.00% | 3.26% |

(1) Not including Boeing Intertie data from Auburn.
(2) Not including Boeing consumption from Algona.
(3) Authorized consumption exceeded total production for 2011. The reason for this is unknown.

## WATER USE DATA COLLECTION

Collection of water use data is critical to ensuring efficient use of water resources. Water use data allows the water system to calculate leakage, forecast demands, identify areas of potential efficient water use, evaluate success of existing WUE program, describe the water supply characteristics and aid in water management decision making. The water use data and water demand forecasts for the City are presented in Chapter 2 of this Plan. All City sources of supply and all customer services are metered.

A summary of the City's water use data required by the *Water Use Efficiency Rule* is presented in Table 4-2.

**TABLE 4-2**

**Summary of Water Use Data Collection**

| Required Data Type[1] | Unit of Measure | Collection Frequency | Comments |
|---|---|---|---|
| Water Service Connections | Connections | Annual | Customer Billing Records |
| Source of Supply Meter Readings | Cubic Feet | Monthly | Master meters are read on a monthly basis. |
| Wholesale Water Purchased | Cubic Feet | Monthly | Purchased from Auburn |
| Peak Month | Cubic Feet | Annual | Peak month is tabulated monthly based on master meter readings |
| Distribution System Leakage | Gallons and Percent | Annual | Based on annual purchased water and consumption. Reported to DOH annually. |
| Unmetered, Unbilled Authorized Uses | Gallons | Annual | Calculated from City records of flushing, testing and construction uses. |
| Single-Family Service Meter Readings | Cubic Feet | Bimonthly | |
| Multi-family Service Meter Readings | Cubic Feet | Bimonthly | |
| Industrial/Commercial Service Meter Readings | Cubic Feet | Monthly | |
| Population Served | Persons | Annual | Washington State Office of Financial Management |
| Economic Data | | | See existing water rates in Table 4-3. |
| Conservation Data | | | See water forecasting in Table 4-5. |

(1) Water use data collection requirements are based on DOH 2011 Water Use Efficiency Guidebook.

## WATER USE EFFICIENCY PROGRAM

The City's water use efficiency program is detailed below. According to the 2002 Auburn/Algona Intertie Agreement 3A (2002 Agreement), Algona is required to implement a conservation program that is, at a minimum, consistent with Auburn's conservation program. A copy of Auburn's conservation program is included in Appendix C. The conservation program shall include field testing for leak detection, repair of leaks and public information actions equal to Auburn's public information actions.

## CITY OF AURBURN WATER USE EFFICIENCY PROGRAM

The City of Auburn's current water use efficiency program is presented in the 2009 Water System Plan. The City of Auburn's water use efficiency goal for 2009-2014 is a reduction of 1-percent per year in the Equivalent Residential Unit (ERU) value. Auburn's water use efficiency program measures include the following:

- School Outreach;
- Speaker's Bureau;
- Program Promotion;
- Theme Shows/Fairs;
- Water Audits;
- Bills Showing Consumption History;
- Water Saving Device Kits;
- Conservation Pricing;
- Water Efficient Toilet or Clothes Washer Rebates.

## PAST CITY OF ALGONA WATER CONSERVATION PROGRAM

The City's past water conservation program was defined the City's 2006 Water System Plan which was prepared prior to the WUE Rule. The City's goal at the time was a 10 percent reduction in water use over the five years after the Plan was adopted. The City's water conservation program consisted of the following measures:

- Source and service meter installation and calibration;
- Promotion of the Conservation Program;
- Water conservation tips in the included with bills several times per year;
- Water conservation handouts available to customers at City hall counter;
- Providing water conservation tips on the City website;
- Lost and Unaccounted for Water/Leak Detection and Repair Program;
- Overage charge water rate to promote conservation;
- Monitoring customer accounts and alerting customers to abnormally high consumption indicating a potential leak.

The City's water usage since adopting the water conservation program defined in the 2006 Water System Plan has decreased. In 2003, the ERU value was 193 gpd and in 2011 it was 177 gpd, which corresponds to a reduction of 1 percent per year. This indicates that the City's past water conservation program has been effective at reducing water usage.

## NEW WATER USE EFFICIENCY PROGRAM

Under the WUE Rule, the City Council must set water use efficiency goals and measure progress each year toward meeting these goals. Goals must include a measurable outcome, address water supply efficiencies (supply-side goal) or water demand efficiencies (customer-side goal), and include an implementation schedule. At a minimum the City is required to establish one customer-side goal. Goals must be established through a public process that gathers input from water system customers. The City must also evaluate or implement efficiency measures to help meet these goals.

### WUE Goal Setting

As a part of the Water System Plan process the City of Algona has established one customer-side goal through a public process. The City's customer-side goal is to reduce the ERU value by 1 percent per year for the next 6 years. This goal is consistent with the City of Auburn's WUE goal.

## MANDATORY CONSERVATION MEASURES TO BE IMPLEMENTED

The following conservation measures are required to be implemented by all public water system.

### Source Meter Installation

The installation of flow meters on each source of supply is required for all water systems to measure the amount of water entering the distribution system.

Level of Implementation

The City of Algona's source interties with the City of Auburn are fully metered. Algona established an interlocal agreement for the purchase of water from the City of Auburn on August 20, 1996. This interlocal agreement was termed the Auburn Intertie Project. Based on the terms of this agreement, Algona installed three master meter stations. Two master meter stations were constructed in 2001 and are located at Boundary Boulevard and Industry Drive North and at Boundary Boulevard and Milwaukee Avenue. A third master meter was installed in 2002 near the West Valley Highway and 10$^{th}$ Avenue North as part of a commercial development.

### Service Meter Installation

All water systems are required to install individual service meter. The metering program shall include periodic tests and repairs.

Level of Implementation

All service connections in Algona are metered and the City requires all future connections to have meters. The City recently deployed an automatic meter reading (AMR) system which collects customer meter readings wirelessly. During the development of the AMR system older customer meters were also replaced with new units.

**Perform Meter Calibration**

Water systems are required to perform meter testing and calibration per manufacturer's recommendations.

Level of Implementation

The City's source meters are owned and operated by the City of Auburn which is responsible for testing and repair of the meters as necessary. The City's older service meters were recently replaced with new meters as a part of the AMR project. The City performs testing of service meters as requested by customers or when needed to resolve billing irregularities.

**Educate Customers Annually**

Water systems are required to educate customers at least once a year on the importance of using water efficiently. Educational efforts may include distribution of DOH brochures, bill inserts, or notifications included with the annual consumer confidence report. Education should also include information about efficient plumbing fixtures.

Level of Implementation

The 2002 interlocal agreement states that Algona's Conservation Program "shall, at a minimum, be consistent with Auburn's conservation program and include public information actions equal to Auburn's public information actions." For many of these elements, Algona will work with Auburn to ensure cost-effective implementation.

The City of Algona distributes conservation brochures at its public utilities counter including a Water Facts card produced by The Water Conservation Coalition of Puget Sound and a flyer titled Household Water Use Tips produced by DOH. Several times per year the City will include a conservation tips sheet in the water bills sent to customers. The City of Algona website includes water saving information for outdoor and indoor water use.

**Implement a Water Loss Action Control Plan if DSL Exceeds 10 Percent**

If a system's distribution system leakage exceeds 10 percent, the water use efficiency program must also implement a Water Loss Control Action Plan (WLCAP) that includes assessing data accuracy and collection methods, leak detection and repair, and other measures to reduce DSL. Determining the amount and location of DSL may greatly improve water conservation efforts. A regular and systematic program of finding and repairing leaks in transmission and distribution system mains should be conducted. Field testing for leak detection, followed by leak repair is required by the 2002 Agreement with Auburn.

Level of Implementation

The City's DSL rate is currently less than 10 percent so implementation of a WLCAP is not required. However, the City's capital improvement plan includes $2,500 for leak detection every three to 5 years.

## MANDATORY MEASURES TO BE EVALUATED

The following conservation measures are required to be evaluated by all public water systems for potential implementation in the water use efficiency program. If a measure from this category is implemented it can be counted towards the City's total required supplementary measures.

**Evaluate Rates That Encourage Water Demand Efficiency**

It is required that water systems evaluate a rate structure that encourages efficient use of water. This evaluation involves describing the existing water rates and if the existing rate does not encourage efficiency, evaluating either an inclining block rate or a seasonal rate that would encourage efficiency.

Studies have shown that conservation pricing is an effective incentive that results in a change in behavior and efforts to save water. The effect that price has on water use has been well documented, and provides an explanation and a means to effectively quantify the savings in water based on the *price elasticity* of water.

The concept of price elasticity is based on the cause and effect relationship between water use and price. American Water Works Association (AWWA) publication *M1 Principals of Water Rates, Fees and Charges* defines price elasticity as "…the responsiveness of water use to price changes." Further explanation of the AWWA definition of price elasticity is stated as follows:

> *"A price (or income) elasticity indicates the percentage change in water sales that is likely to result from a given percentage change in price (or income). Thus, a price elasticity of –0.3 means that, other things being*

> *equal, a 10 percent price increase will result in a 3 percent reduction in water use."*

Though cost is an important factor that directly affects water use, it is important to note that it is not the only factor. Other factors that influence water use include climate, precipitation, and customer demographics.

Level of Implementation

The City's current water rates are summarized in Table 4-3. The City currently has a residential and commercial/industrial base rate that includes 500 cubic feet (cf) of water per month, with commodity charge of $2.00 per 100 cubic feet (ccf) for all water usage in excess of 501 cf. The City's intent with its water rate structure is to encourage conservation by the implementation of the commodity charge.

**TABLE 4-3**

**Water System Service Charge and Volume Charge(1)**

| Size of Service | Quantity Allowed per Month | Monthly Service Charge | Overage Volume Charge |
|---|---|---|---|
| 3/4-inch metered residential | 500 cf | $22.54 | $2.00/ccf |
| Multiple residential units | 500 cf/unit | $22.54/unit | $2.00/ccf /unit |
| Residential units where water has been disconnected per Section 13.02.200 | - | $11.50 | - |
| Un-metered residential uses(2) | 500 cf/unit | $22.54/unit | $2.00/ccf |
| Un-metered multiple residential uses(2) | 500 cf/unit | $22.54/unit | $2.00/ccf /unit |
| Commercial/industrial uses: | | | |
| Up to 1 inch | 500 cf | $23.59 | $2.00/ccf |
| 1 inch | 500 cf | $27.20 | $2.00/ccf |
| 2 inch | 500 cf | $31.02 | $2.00/ccf |
| 3 inch | 500 cf | $34.25 | $2.00/ccf |
| 4 inch | 500 cf | $37.03 | $2.00/ccf |
| Large Industrial/Manufacturing uses | 0 | $18.67 | $1.52/ccf |

(1) Source: Algona Ordinance No. 1039-10.
(2) Un-metered residential uses include apartment or duplex housing that has one meter to serve multiple units. In this case, the City bills the owner.

**Evaluate Reclaimed Water Opportunities for Systems with 1,000 or More Connections**

Systems with 1,000 or more service connections are required to evaluate opportunities for reclaimed water to help reduce the demand for potable water. Evaluation of reclaimed water includes collection information on reclaimed water opportunities including, potential uses, reclaimed water production and distribution facilities, barriers to reclaimed water implementation, contractual obligations or agreement that limit the use of reclaimed water and any existing uses of reclaimed water.

Level of Implementation

The City currently does not have any plans to implement reclaimed water. Uses for reclaimed water such as golf course and parks are limited within the City's service area. There is no source and no distribution system for reclaimed water in the vicinity of the City. The City's sewer system conveys flows to the King County Regional Wastewater System which flows to King County's South Treatment Plant, located in Renton. The South Treatment Plant provides treatment and discharges the majority of treated wastewater through a marine outfall into Puget Sound. King County plans identify uses for reclaimed water at the South Treatment Plant as limited to onsite uses, nearby sports fields, parks and a wetland plants nursery. There are no current plans by King County for reclaimed water service to the City of Algona. Due to the lack of large users and lack of any source of reclaimed water, use of reclaimed water is not feasible for the City of Algona at this time. The City of Auburn water use efficiency program states that an evaluation of reclaimed water use savings will be conducted and Auburn will implement reclaimed water as a conservation measure if a specific opportunity arises. Auburn's program identifies the irrigation customer class as the most likely user for reclaimed water. The City of Algona will cooperate with the City of Auburn if future development of a reclaimed water system occurs, per the efficiency requirements of the 2002 Water Supply Contract.

## SUPPLEMENTARY WATER USE EFFICIENCY MEASURES IMPLEMENTED

In addition to the mandatory water conservation measures, water systems are required to implement a number of supplemental measures that promote achievement of their WUE goals. As the City falls under the category of 1,000 to 2,499 connections it is required to implement a minimum of five water use efficiency measures. The City currently implements eight supplementary measures. Supplementary measures are as follows:

### Water Bill Showing Consumption History

Water utility bills that show consumption history can help customers monitor their water consumption trends. These bills give feedback to customers on their own attempts to conserve and give a reference that helps in identifying leaks or changes in water usage that customers might otherwise not be aware of.

Level of Implementation

The City currently presents a graph of past usage on all bills that go to customers. As the City serves four customer categories which all receive bills showing consumption history this measure counts as four supplementary measures.

**Additional Customer Education**

Providing education about water conservation to customers promotes water conservation. If education is provided more than once a year it counts as a WUE measure.

Level of Implementation

The City provides customer assistance by distributing DOH water conservation literature several times per year and by, including water conversation tips on its website. In addition the City provides assistance to customers at the utilities counter or when they call in for information. As the City serves four customer categories which all receive customer education about conservation this measure counts as four supplementary measures.

**Leak Detection and Repair Program**

Finding and repairing leaks is an essential method for controlling DSL as well as maintaining the integrity of the water distribution system. Leak detection services can be contracted out or performed by water system staff.

Level of Implementation

The City of Algona has previously contracted out leak detection surveys and has had the entire system surveyed on a three year schedule. Any leaks discovered have been repaired. In 2012 the City purchased leak detection equipment and City staff will now perform surveys.

## RECOMMENDED FUTURE WATER USE EFFICIENCY MEASURES

The City should consider future implementation of the following conservation measures:

- Distribution of indoor/outdoor conservation kits
- Landscape Management

**Distribution of Indoor/Outdoor Conservation Kits**

Distribution of water conservation kits has proven to be a cost effective conservation measure in other communities. A typical indoor water conservation kit might contain a 2.5 gpm shower head, shower timer, 1.5 gpm faucet aerator, toilet flow device (bag), toilet leak detection tablets, and informational materials. An outdoor kit may contain a water saving hose nozzle, hose timer, soaker hose, lawn watering calendar, or soil moisture indicator.

Table 4-4 provides an example of water savings realized from indoor water saving devices.

**TABLE 4-4**

**Indoor Water Savings Devices**

| Device | Unit Cost/500 | Expected Water Savings | Service Life (years) |
|---|---|---|---|
| Toilet Bag | $0.36 | 2.5 gpcd | 3 |
| Low Flow Shower Head | $2.00 | 7.0 gpcd | 15 |
| Shower Timer | $0.78 | 25 gpcd | 3 |
| Faucet Aerator | $0.28 | 1.0 gpcd | 15 |
| Toilet Leak Dye Tablets | $0.04 | 20.0 gpcd | 5 |
| **Total** | $3.46 | 30.5 gpcd | |

(1) Prices vary depending on manufacturer and volume purchased. The above costs were based on a bulk volume of 500 units, per Niagara Conservation (800) 831-8383. Prepackaged kits can be provided by the manufacturer, but at a greater cost.

Toilet bags displace water from the toilet reservoir and generally save 0.5 to 0.7 gallons per flush. Low flow shower heads discharge 2.5 to 3.0 gpm, while standard shower heads discharge 5 to 8 gpm. Faucet aerators attach directly to water faucets and entrain air into the water stream to break the stream into fine droplets to reduce water use. Leak detection tablets are designed to diagnose leaking toilet flapper valves. Dye present in the toilet bowl indicates the flapper valve is leaking and should be replaced.

Based on the cost, expected water savings, and service life of these devices, the City should provide information regarding water conservation kits to its customers. In addition, the City could make the individual devices or kits available at City Hall for distribution to interested customers. A notice to their availability could be inserted within a water bill.

**Landscape Management**

Landscaping is important and integral to residential neighborhoods across the United States. Outdoor watering in the summer is the major source of peak demands on water utilities during summer months. The Water Conservation Coalition of Puget Sound reports: “From May through September, water use in our region nearly doubles, primarily for lawns and gardens. Experts estimate that 50 percent or more this water goes to waste, due to evaporation, runoff, or simply overwatering.” It would be beneficial if the City would provide outdoor water conservation information and water saving devices to its residential customers. The City's customer assistance methods, including its website and brochures are means to provide education relating to outdoor water conservation.

The City currently irrigates the grounds at City Hall and the ball field. The City should review its irrigation procedures and see if any water savings can be realized.

## WATER RIGHTS EVALUATION

The water rights for the water that supplies Algona are held by the City of Auburn. A water rights evaluation is not included in this Plan. Future updates of the Auburn Water System Plan should incorporate Algona's consumption in a water rights evaluation. Algona's existing water rights certificates were transferred to Auburn as part of the 1996 Agreement with Auburn.

## WATER SHORTAGE RESPONSE PLAN

The City purchases all of its water from the City of Auburn through metered interties. The City's contract with Auburn states that if Auburn's source of supply is reduced Algona will curtail their use by a similar percentage. If the City is unable to receive sufficient supply from Auburn, the City of Algona has an emergency intertie with the City of Pacific that could be used. However, in the event the City of Auburn has a water shortage, it is possible that the City of Pacific will also have a water shortage. If this were the case, the City of Algona would likely have to truck water in for supply. In the event of a water shortage, the City of Algona will coordinate efforts with the City of Auburn and the City of Pacific.

## ANNUAL PERFORMANCE REPORTING

The City must submit a performance report to DOH by July 1 each year. This annual report must include:

- Total source production and customer consumption;
- Distribution system leakage in percentage and volume; and
- Description of current WUE goals, schedule and progress towards meeting goals.

DOH has developed an online reporting form that must be used by water systems to file their annual report. Previous year's WUE annual performance reports are also available on the DOH website.

## WATER DEMAND FORECAST

The water demand forecast is presented in Chapter 2 of this Plan and is based on current measured water use and anticipated population growth. The City of Algona's water efficiency goal is to reduce the ERU value by 1-percent per year for the next 6 years, consistent with the City of Auburn's current conservation goal. The demand forecasts presented in Table 4-5 incorporate a 1-percent annual reduction in ERU value.

**TABLE 4-5**

**Projected Purchased Water Requirements with Conservation**

| Year | Projected Average Day Purchased Water Requirements (gpd) | Projected Average Day Purchased Water Requirements with Conservation (gpd) | Average Day Purchased Water Savings with Conservation (gpd) |
|---|---|---|---|
| 2013 | 345,200 | 341,300 | 3,900 |
| 2014 | 348,300 | 340,600 | 7,700 |
| 2015 | 351,500 | 339,700 | 11,800 |
| 2016 | 354,600 | 338,900 | 15,700 |
| 2017 | 357,800 | 338,000 | 19,800 |
| 2018 | 361,100 | 337,000 | 24,100 |
| 2022 | 374,900 | 350,000 | 24,900 |
| 2032 | 413,000 | 385,500 | 27,500 |

# CHAPTER 5

# WELLHEAD PROTECTION PROGRAM

## INTRODUCTION

Water purveyors using groundwater are required by Federal and State law to implement Wellhead Protection Programs (WHPPs). WHPPs are intended to prevent contamination of groundwater sources. This is accomplished by establishing Wellhead Protection Areas (WHPAs) around wells, identifying existing sources of groundwater contamination and managing potential sources of groundwater contamination. The City of Algona's water supply is provided by the City of Auburn, which maintains a number of groundwater sources. The City of Auburn 2009 Water System Plan discusses wellhead protection in Chapter 6, Section 8, Groundwater Management. The City of Auburn's Wellhead Protection Plan that was most recently updated by Robinson Noble in September 2008 and is included as Appendix K of the 2009 Auburn Water System Plan. The City of Auburns Wellhead Protection Plan is summarized in this Chapter and is included as Appendix C. Auburn is solely responsible for developing and enforcing the wellhead protection program for its sources. The Algona city limits are not included in any of Auburn's identified WHPAs.

## THE CITY OF AUBURN WELLHEAD PROTECTION PROGRAM

The City of Auburn's wellhead protection areas were first delineated by Pacific Groundwater Group (PGG) in 1997 and were updated in 2000. As a part of Auburn's 2009 Water System Plan Update Robinson, Noble & Saltbush, Inc. performed a hazard analysis within the wellhead protection areas.

### WELLHEAD PROTECTION AREAS

Wellhead protection areas are delineated based on projected travel-time of groundwater within the aquifer. These areas represent the capture zone for each source for a specific time period. Typically travel-time boundaries are delineated for time periods of 6 months, 1 year, 5 years and 10 years. The 10-year boundary delineates the overall wellhead protection areas. A map of the City of Auburn's Wellhead Protection Areas is included as a part of the WHPP which is included as Appendix C.

### POTENTIAL CONTAMINATE SOURCES

The Auburn Wellhead Protection Plan included an inventory of potential contaminate sources within the wellhead protection area. This analysis was performed by an environmental database research firm called Parcel Insight. A total of 27 federal and state databases were reviewed for known or potential contaminant sites within a 4.5 mile radius of the center of Auburn. A total of 352 sites or categories of land-use were identified as potential hazards to Auburn's ground water sources. These potential hazards were ranked according to four factors including, proximity to the WHPA, type of contamination, distance from wells to potential hazard and type of contaminated media. With a ranked and prioritized inventory of contaminant sources the WHP implementation process addresses each potential hazard in systematic manner.

### PROTECTION STRATEGIES AND IMPLEMENTATION TASKS

The Auburn Wellhead Protection Program includes management strategies to prevent contamination of groundwater sources. The WHPP provides 26 specific tasks for the City of Auburn to complete for implementation of the wellhead protection program. These tasks include:

- Signage within the WHPA;
- Education of the public;
- Proper zoning within the WHPA;
- Annual review of the environmental databases; and
- Cooperation between Auburn and appropriate enforcement and emergency response agencies.

The WHPP tasks City of Auburn staff with prioritization and implementation of the identified wellhead protection tasks.

## CITY OF ALGONA REPONSIBILITES

The City of Auburn's identified Wellhead Protection Areas do not include the City of Algona's city limits or urban growth area. As such, there are no actions that the City must take at this time.

# CHAPTER 6

# OPERATION AND MAINTENANCE PROGRAM

## WATER SYSTEM MANAGEMENT AND PERSONNEL

The City of Algona is governed by a mayor and five member City Council. Water system staff includes a Public Works Director, Public Works Supervisor and two utility workers. The current Public Works Supervisor is James Griess, who also serves as the City's Utility Foreman and Sewer and Street Superintendent. The certification status of City water utility staff is shown below:

| | |
|---|---|
| James Griess | Public Works Supervisor<br>Certification: WDM-2<br>Operator Number: 006847 |
| Salvador Marez | Water Operator<br>Certification: WDM-1, CCS<br>Operator Number: 011416 |

It is the City's goal to further strengthen its existing operator certification status. These goals are met by continuing to provide the opportunity for all water system personnel to become certified and to maintain and increase their level of certification. City staff will also obtain continuing education unit (CEU) credits as required by State law.

## SYSTEM OPERATION AND CONTROL

### MAJOR SYSTEM COMPONENTS

Algona receives source water and storage capacity from the City of Auburn. The hydraulic grade line in Algona is controlled by that of Auburn's Valley Pressure Zone. The City of Auburn source operation is controlled by City of Auburn reservoir levels. Flow to Algona is recorded through a series of master meters but is not otherwise controlled.

### PREVENTIVE MAINTENANCE PROGRAM

The most cost-effective method for maintaining a water system is to provide a planned preventive maintenance (PM) program. A planned PM program can provide the optimum level of maintenance activities for the least total maintenance cost. The routine maintenance procedures for each system component follow.

## Distribution System Valve and Hydrant Maintenance

City staff exercise hydrants annually, at a minimum. Currently, valves are not exercised on a regular basis.

The City will implement a distribution valve exercising program on an annual basis. Valves that do not close tight should be removed, repaired or replaced. An important aspect of distribution system valve maintenance is to ensure distribution valves are completely open. A partially closed valve can seriously reduce peak day operation and fire flow supply. Appendix G contains example maintenance reporting forms.

## Dead-End Waterlines

Flushing of all dead-end mains will be accomplished twice each year or more often if water quality complaints should occur. Prior to purchase of water from Auburn, the entire distribution system was flushed annually and dead-end lines were flushed on a monthly basis. The flushing schedule is being re-evaluated now that water used for flushing must be purchased. At a minimum, the annual flushing will be continued.

## Meters

Accurate water metering is an essential financial and conservation oriented component of water system infrastructure. A substantial amount of revenue may be lost through inaccurate metering of residential, commercial and industrial accounts. The maintenance and calibration of the Auburn Intertie master meters is the responsibility of the City of Auburn. Without accurate master or source meter readings, the City cannot determine distribution system leakage volumes and comply with the Water Use Efficiency Rule and the conservation requirements of the 2002 Agreement with Auburn. Service meters, including all Algona residential and commercial customer meters, will be calibrated and/or replaced according to the following schedule:

- 3/4-inch and 1-inch meters will be tested every 10 years and replaced, if necessary. Replacement is recommended if it is cheaper to replace meters than to test and if necessary, repair meters.
- 2-inch through 4-inch meters will be tested and calibrated every 3 to 5 years.
- 4-inch and larger meters will be tested and calibrated every 1 to 3 years.

Beginning in 2010 the City implemented a radio based automatic meter reading system throughout the distribution system. The new radio read system utilizes Sensus Flexnet Technology. Meters are read using a mobile radio receiver. This system replaced the touch read and manual system the City had been using previously. As a part of this project the City replaced approximately 600 older incompatible meters and installed new registers and meter transmitter units on all meters. This system is anticipated to have a 20-year lifespan, governed by the battery life of the transmitters.

### Inventory of Materials

The City will establish and maintain an inventory of parts and supplies including the appurtenances needed to make emergency repairs. At a minimum the materials on hand and included in the inventory should include the materials necessary to repair leaks for every size and type of pipe in the system. Spare valves in sizes 8 inch and smaller will be included in this inventory.

### Recommended Schedule

Table 6-1 is a listing and schedule of normal maintenance and operations activities. The frequency listed is a minimum and the actual frequency should be adjusted as necessary to meet system requirements.

**TABLE 6-1**

**Preventive Maintenance Schedule**

| Maintenance Activity | Frequency |
|---|---|
| Check distribution system and note any suspected leaks. | Daily (1) |
| Check and record master meter readings. | Twice per Week (2) |
| Collect routine coliform samples | Monthly |
| Read commercial meters | Monthly |
| Read residential meters | Every 2 Months |
| Flush dead-end lines | Semi-Annually |
| Exercise hydrants | Annually |
| Exercise valves | Annually |
| Visit and inspect Out of Service City Reservoir | Annually |

(1) City crews will generally drive every City street at least once per week as part of routine utility maintenance.
(2) Daily readings recommended in July and August to establish peak day use.

## EMERGENCY RESPONSE PROGRAM

Water utilities have the responsibility to provide an adequate quantity and quality of water in a reliable manner at all times. To do this, utilities must reduce or eliminate the effects of natural disasters, accidents, and intentional acts that could compromise the ability of the City to provide safe and reliable water service.

The Public Works Supervisor or his designated assistant will be in direct charge. The telephone number for the Public Works Office is (253) 833-2741. After hours or weekend calls will be directed to the Algona Police Department. The Police Department will contact the staff member with the after hours duty. In the event of a major disaster damaging the water system and where telephone service is interrupted, the following procedures are to be followed:

- All City personnel will report to the City Hall office.
- City field personnel shall conduct a survey to determine if City facilities are damaged and to estimate the level of damage.
- City personnel must first complete the survey so that the Public Works Supervisor can schedule repairs in the most effective and timely manner possible. Repairs to be most effective must be prioritized and then completed according to that schedule.
- Due to the area of the water system and the small size of the staff, it is expected that any major disaster may require outside help from other agencies, which may be over stressed if the emergency is widespread.

Table 6-2 is an emergency phone list. The City will coordinate response efforts with the City of Auburn in the event of an emergency.

**TABLE 6-2**

**Emergency Phone List**

| Agency/Group | Contact | Phone Number |
|---|---|---|
| Fire/Police | -- | 911 |
| City of Algona Public Works | Jimmy Griess | 1-253-833-2741 |
| City of Auburn | Public Works – Water | 1-253-931-3048 |
| Chemical Supplies | Jones Chemical Inc. | 1-253-572-9034 |
| Chemical Supplies | Univar | 1-713-644-3171 |
| Pipe/Fitting Suppliers | Pacific Water Works Supply | 1-253-761-0828 |
| Pipe/Fitting Suppliers | H.D. Fowler | 1-253-863-8300 |
| Testing Lab | King County Health Dept. | 1-206-339-5270 |
| Testing Lab | Water Management Laboratory | 1-253-531-3121 |
| Washington State Dept. of Health | N.W. Regional Office, Paige Igoe, P.E. | 1-253-395-6764 |
| City of Pacific | City Hall | 1-253-833-8486 |
| King County | Emergency Management | 1-206-296-3830 |
| King County | 24 Hour Number | 1-206-296-8100 |
| Puget Sound Energy | Main Number | 1-888-225-5773 |

**TABLE 6-2 – (continued)**

**Emergency Phone List**

| Agency/Group | Contact | Phone Number |
|---|---|---|
| CenturyLink | Main Number | 1-800-573-1311 |
| Comcast | Main Number | 1-800-Comcast |
| State Wide One-Call | Utility Locates | 1-800-424-5555 |
| Gray & Osborne, Inc. | Seattle Number | 1-206-284-0860 |

### Power Failure

Various types of weather can cause loss of power, such as wind, lightning, freezing rain, freezing snowstorm. Algona does not have any water system components that use electric power as source and storage are provided from Auburn. Auburn's West Hill Springs flow by gravity to Auburn Valley pressure zone, Auburn's Coal Creek Springs and either Well 3A or 3B have standby generators, and Auburn's portable generator is available to operate an additional well.

### Severe Earthquake

| System Component | Action |
|---|---|
| Distribution System: Distribution and transmission mains may be broken | • Isolate broken sections and repair |

### Severe Snowstorm

Heavy snowfall may bring motor vehicle traffic to a standstill. Employees may not be able to reach problem area.

| System Component | Action |
|---|---|
| Distribution System: Transportation to monitor system and make repairs will be limited | • Plow streets if necessary and if equipment is available<br>• Have chains and other snow gear ready for maintenance equipment and vehicles<br>• Valve locations should be kept current and made available for maintenance personnel |

### High Water and Flooding

Heavy snowmelt and/or rains cause the water level to rise and reach a flood level.

| System Component | Action |
|---|---|
| Distribution System: Majority of distribution system above flood level | Check chlorine residuals throughout distribution system |

### Contamination of Water Supply

Contamination of water supply for such items as main breaks or pollution from an isolated source. Notification procedures for bacteriological contamination are provided in Figure 6-1.

| Distribution System Contamination |
|---|
| • Close valves if possible to isolate source |
| • Notify Auburn if widespread or if source appears to be in the Auburn service area |
| • Repair and or remove source of pollution |
| • Flush previously contaminated section and test until free of contamination prior to resumption of use |

## SAFETY PROCEDURES

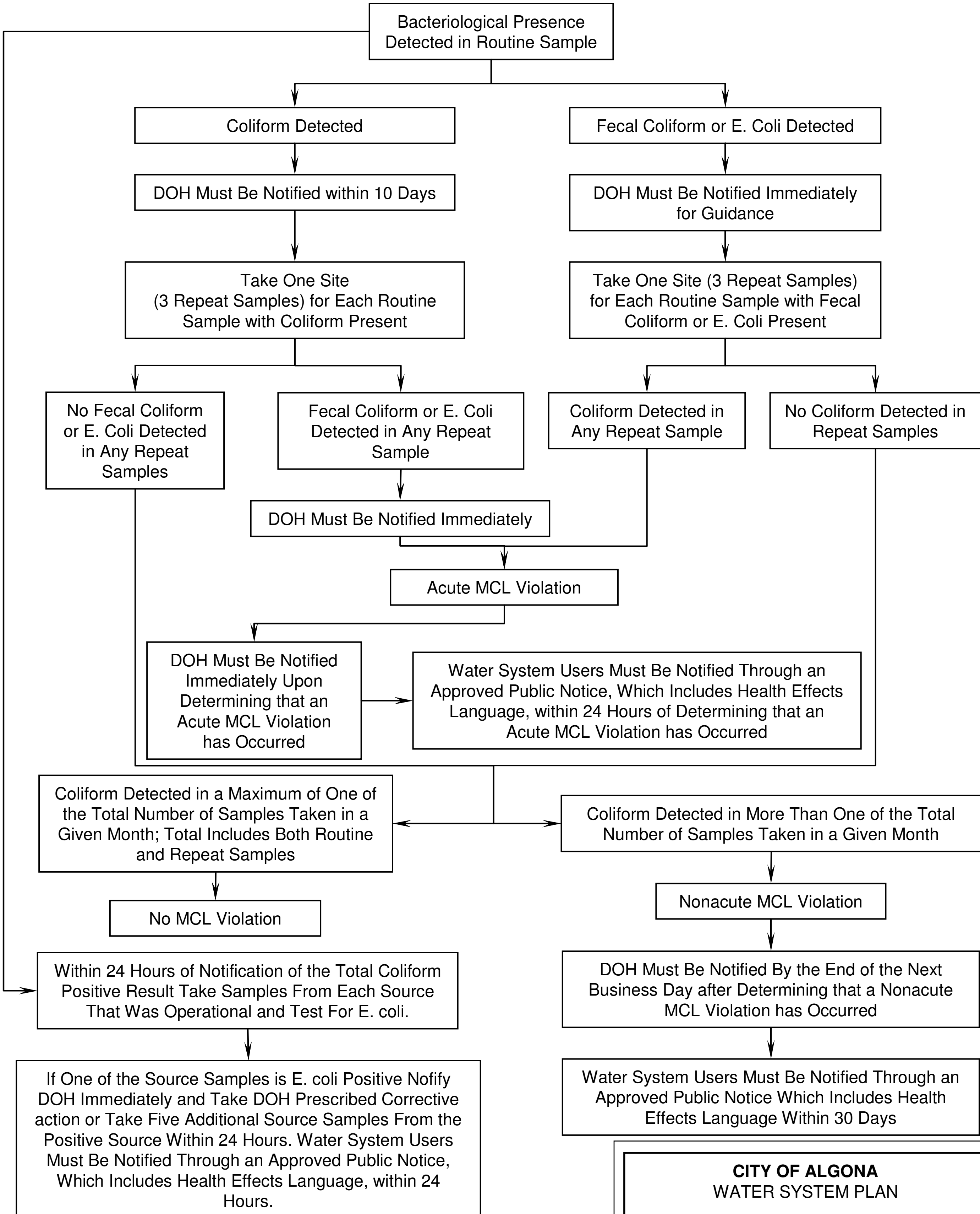
The work place hazards for the Algona water system are limited due to the nature of the water system. The City does not have its own sources of supply or storage and therefore does not have to deal with chemicals for treatment. Staff is trained in confined space entry and asbestos-cement pipe handling and follows the guidelines outlined in the City's Safety Manual.

## CROSS-CONNECTION CONTROL PROGRAM

Per the requirements of WAC 246-290-100 the City of Algona is required to develop a Cross-Connection Control Program (CCCP) which protects the public water supply from contamination due to backflow of non-potable liquid, solid or gas from connected customer systems. The City's CCCP is based upon the requirements of WAC 246-290-490.

### PROGRAM SCHEDULING AND PERSONNEL REQUIREMENTS

Section 13.02.160 of the Algona Municipal Code contains the City's cross connection control ordinance. This ordinance states that "any such cross-connection now existing or hereafter installed is hereby declared subject to immediate termination of water service




DOH: Washington State Department of Health
Northwest Regional Office (253) 395-6750
After-Hours Hotline (877) 481-4901

**CITY OF ALGONA**
WATER SYSTEM PLAN

FIGURE 6-1
BACTERIOLOGICAL PRESENCE
DETECTION PROCEDURE

Gray & Osborne, Inc.
CONSULTING ENGINEERS

and any such cross-connection shall be abated immediately." The code, included in Appendix H, states the conditions where cross-connection control devices are required.

The City is in the process of updating their list of cross-connection control devices. Since the completion of the last Plan one City water operator has acquired a cross-connection control specialist certification.

**PRIORITY SERVICE LIST AND SURVEILLANCE PROGRAM**

There are three categories of business establishments that may pose a hazard to the water system. Category one services pose the highest degree of hazard and include the following facilities:

- Printers
- Medical laboratories
- Chemical companies
- Radiator shops
- Battery, fertilizer, and paint manufacturers
- Pest control businesses
- Janitorial companies

Category two services are considered less hazardous than category one and include the following:

- Doctor, dentist, and veterinarians' offices
- Blood banks
- Drug rehabilitation centers
- Car washes
- Photo labs
- Commercial laundries
- Nursing homes and hospitals

The least hazardous service category includes the following types of businesses:

- Food processing facilities
- Dairy establishments
- Beverage and candy manufactures
- Massage and health spas
- Motels and schools with pool, spa, or sauna facilities

## NEW AND EXISTING CROSS-CONNECTION DEVICES

New and existing cross-connection devices will be cataloged and checked initially by City staff. The City will perform initial evaluations starting in early 2013. It is the responsibility of the customer to ensure proper testing of the devices on an annual basis thereafter. A condition for new services should be an evaluation by the cross connection control certified City staff to determine if a backflow device is needed.

## CROSS-CONNECTION CONTROL PROGRAM RECORD KEEPING

A critical program element is the maintenance of accurate records in support of an aggressive cross-connection control program. The City will have a file for each service with a cross-connection device at City Hall and at the City Shop. Annual testing results for the devices can then be recorded in each respective file.

# CHAPTER 7

# CONSTRUCTION STANDARDS

## OBJECTIVE

The objective of this chapter is to document the City's design and construction standards. The City is seeking authority to not submit project reports and construction documents to WDOH alternative review process for construction of new and replaced water distribution facilities. The City will keep, and submit to WDOH as required, records including Engineering Design Review Reports and Construction Completion Reports for all water-related projects as required by State law. If a set of Construction Standards are in an approved Water System Plan, a purveyor needs no further approval from DOH for distribution main projects, provided the methods and materials used are in conformance with the approved standards.

## SYSTEM STANDARDS, POLICIES AND PROCEDURES

The City has developed construction standards, for improvements within the public right-of-way and/or easements, improvements required within the right-of-way, proposed right-of-way, or any improvements intended for maintenance by the City. These standards are published as a stand-alone document entitled the *City of Algona Development Guidelines and Public Works Standards*.

## PROJECT REVIEW PROCEDURES

For water main construction or other system improvements, project reports and construction documents are submitted to the City for review and approval. Construction documents, which do not meet the standards, are returned for resubmittal if the deviation is significant, or returned with corrections noted if the deviation is minor. Construction may not proceed unless a professional engineer has stamped the drawings and the City's Engineer has signed the drawings "approved."

## DESIGN AND CONSTRUCTION STANDARDS

Appendix D has copies of the water design and construction standards.

Any improvements not specifically covered by the City's Construction Standards must meet or exceed WSDOT's *2014 Standard Specification for Road, Bridges, & Municipal Construction*, and any current amendments to said document. The *Standard Specifications* are regularly updated and those updates are assumed to be adopted by the City unless action is taken to the contrary.

## CONSTRUCTION INSPECTION PROCEDURES

The City inspects all new construction during and after construction to ensure that projects are constructed in accordance with the construction standards. This inspection includes being present during pressure test procedures and, if applicable, disinfection procedures and water quality sampling procedures to ensure that all have been properly performed. As-builts of the final system are to be submitted for each project. Service will not be provided until all requirements are satisfied.

If a Construction Report is required for the project by WAC 246-290-040, the report is to be prepared by the developer for the new development and by the City's Engineer for other system improvements. New development Construction Reports are submitted to the City for review and approval. System Improvement Construction Reports are submitted to the Department of Health for review and approval.

# CHAPTER 8

# CAPITAL IMPROVEMENT PROGRAM

This chapter presents the City's 6-year Capital Improvement Plan (CIP) in accordance with the requirements of WAC 246-290. Water system capital improvements have been scheduled and prioritized on the basis of water quality concerns, component reliability, regulatory requirements, growth, system benefit, and financial priority. For the proposed projects identified in this Chapter, individual project descriptions and preliminary project cost estimates are presented in Appendix I. Figure 8-1 presents a water system base map showing the locations of the proposed improvement projects. Rate impacts associated with capital project financing are discussed in Chapter 9.

In the future, other projects may arise that are not identified as part of the City's CIP presented in this Chapter. Such projects may be deemed necessary for ensuring water quality, preserving emergency water supply, meeting unforeseen regulatory requirements, accommodating transportation improvements or addressing unforeseen problems with the City's water system. Due to budgetary constraints, the completion of these projects may require that the proposed completion date for projects in the CIP be rescheduled. The City retains the right to reschedule proposed projects and to expand or reduce the scope of proposed projects, as best determined by the City Council when new information becomes available for evaluation. Each capital improvement project will be reevaluated to consider the most recent planning efforts of local jurisdictions as the proposed completion date for the project approaches. The City retains the right to be flexible in scheduling its capital improvement projects to accommodate other unforeseen projects.

## PROPOSED IMPROVEMENTS

### PROJECT ST-1: FINANCIAL PARTICIPATION IN AUBURN RESERVOIR

The 2002 Interlocal Agreement between Auburn and Algona states that the City will maintain use of their existing 100,000-gallon reservoir or provide for 100,000 gallons of storage through other means. Because the City has chosen to abandon their existing reservoir, the City will need to purchase an additional 100,000 gallons of storage from Auburn.

The estimated financial contribution for an additional 100,000 gallons of storage is based on a proportionate share of the construction cost of the new Auburn Lakeland Hills Reservoir No 6. The new Auburn reservoir had a construction cost of approximately $1,820,000 and has at total volume of 1.0 MG, which corresponds to approximately $1.82/gallon. For an additional 100,000 gallons share the City of Algona will need to pay approximately $185,000.

The City should demolish its abandoned 100,000-gallon reservoir prior to it becoming a safety hazard. The City may be able to have the reservoir removed for little cost if the Contractor can salvage the metal and sell it for scrap.

**Total Project Cost: $185,000**

**WATER MAIN ALONG WEST VALLEY HIGHWAY, 5TH AVENUE NORTH TO 1ST AVENUE**

Construction of approximately 1,750 LF of 8-inch water main along West Valley Highway, between 5th Avenue North and 1st Avenue. This project replaces an undersized 6-inch AC water main and improves available fire flow along West Valley Highway. Existing infrastructure at this location does not meet fire flow requirements of the current zoning. This project was completed in September 2013.

**Total Project Cost: $311,000**

**PROJECT D-1: WATER MAIN ALONG SEATTLE BOULEVARD SOUTH, 5TH AVENUE SOUTH AND TACOMA BOULEVARD SOUTH**

Construction of approximately 1,600 LF of 8-inch water main along Seattle Boulevard South from 4th Avenue South to 5th Avenue South, along 5th Avenue South from Seattle Boulevard South to Tacoma Boulevard South and along Tacoma Boulevard South from 5th Avenue South to 4th Avenue South. This project provides looping, replaces undersized 4-inch AC water main and improves available fire flow. Existing infrastructure at this location does not meet fire flow requirements of the current zoning. The portion of this project along 5th Avenue South would be located within the ROW of the City of Pacific and may require a franchise agreement.

**Total Project Cost: $363,000**

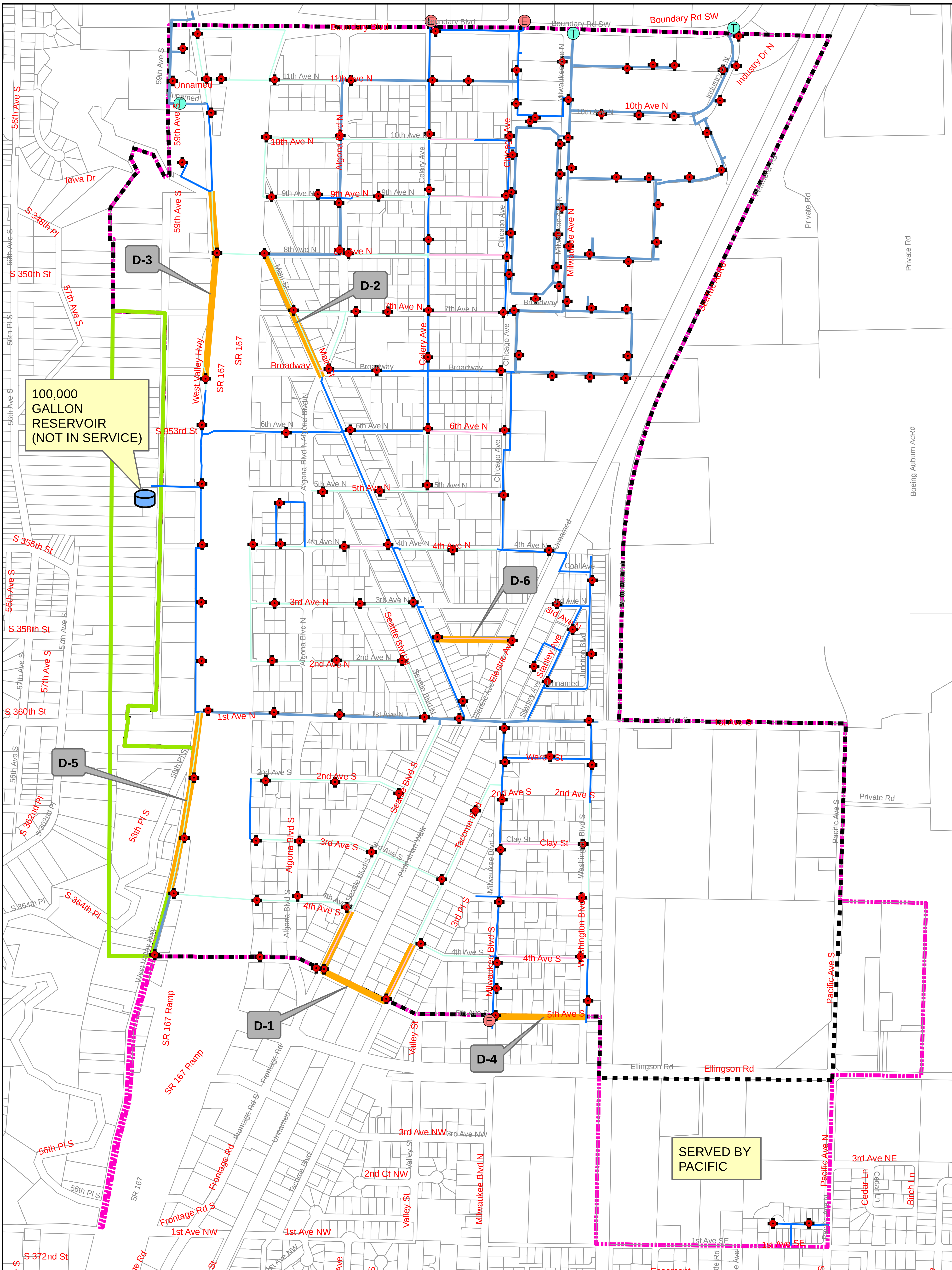
**PROJECT D-2: WATER MAIN ALONG MAIN STREET FROM 8TH AVENUE NORTH TO BROADWAY STREET**

Construction of approximately 1,200 LF of 8-inch water main along Main Street from 8th Avenue North to Broadway Street, to provide improved capacity and to replace undersized 6-inch AC pipe.

**Total Project Cost: $310,000**

**PROJECT D-3: WATER MAIN ALONG WEST VALLEY HIGHWAY, 9TH AVENUE NORTH TO BROADWAY STREET**

Construction of approximately 1,300 LF of 8-inch water main along West Valley Highway, between 9th Avenue North and Broadway Street. This project improves fire




**LEGEND:**

- EMERGENCY INTERTIE
- SOURCE INTERTIE
- FIRE HYDRANT

**WATERLINES:**

- 4-INCH
- 6-INCH
- 8-INCH
- 12-INCH
- CIP PROJECTS
- ALGONA UGA
- RETAIL SERVICE AREA
- ALGONA CITY LIMITS

CITY OF ALGONA

WATER SYSTEM PLAN
FIGURE 8-1
PROPOSED CIP PROJECTS

Gray & Osborne, Inc.

flows along West Valley Highway, provides looping and increases redundancy for the City's crossings of SR 167. Existing infrastructure at this location does not meet fire flow requirements of the current zoning.

**Total Project Cost: $451,000**

### PROJECT D-4: WATER MAIN ALONG 5TH AVENUE SOUTH, BETWEEN WASHINGTON BOULEVARD SOUTH AND MILWAUKEE BOULEVARD SOUTH

Construction of approximately 700 LF of 8-inch water main along 5th Avenue South, between Washington Boulevard South and Milwaukee Boulevard South, to provide looping, improve available fire flow and distribution system redundancy if the emergency intertie with the City of Pacific. Existing infrastructure at this location does not meet fire flow requirements of the current zoning. This project would be located within the ROW of the City of Pacific and may require a franchise agreement.

Total Project Cost: 189,000

### PROJECT D-5: WATER MAIN ALONG WEST VALLEY HIGHWAY, 1ST AVENUE TO 4TH AVENUE SOUTH

Construction of approximately 1,400 LF of 12-inch water main along West Valley Highway, between 1st Avenue and 4th Avenue South. This project replaces an undersized 6-inch AC water main and improves available fire flow along West Valley Highway. Existing infrastructure at this location does not meet fire flow requirements of the current zoning.

**Total Project Cost: $487,000**

### PROJECT D-6: WATER MAIN ALONG 2ND AVENUE NORTH, EAST OF MAIN STREET

Construction of approximately 560 LF of 8-inch water main along 2nd Avenue North, east of Main Street. This project replaces an undersized 4-inch AC water main and improves available fire flow at a location with a fire flow deficiency.

**Total Project Cost: $147,000**

### PROJECT D-7: REPLACEMENT OF AC WATER MAINS

The City will continue to replace existing AC water mains throughout the distribution system. These water mains were installed in the 1960s and are reaching the end of their service life. Whenever possible, replacement projects will occur concurrently with road improvement and developer projects to reduce costs of road restoration. Priority will be placed on replacing 4-inch AC lines, which will be upsized to at least 8-inch. This will also have the effect of improving available flows throughout the distribution system. The City currently has approximately 32,000 LF of 4-inch and 6-inch AC pipe that is not scheduled for replacement by an individual CIP project. Replacement of the City's entire stock of AC pipe within the 20-year planning period would require the replacement of approximately 1,600 LF of AC pipe per year. As a goal the City will replace one city block or approximately 700 LF of AC water main per year.

**Annual Project Cost: $184,000**

**TABLE 8-1**

**Capital Improvement Projects**

| Project | Project Name | Description and Purpose | Estimated Project Cost 2012 Dollars(1) | Projected Date |
|---|---|---|---|---|
| ST-1 | Financial Participation in Auburn Reservoir(2) | Storage Capacity | $185,000 | 2014 |
| D-1 | Water main along Seattle Boulevard South, 5th Avenue South and Tacoma Boulevard South | Looping and Fire Flow Improvements | $363,000 | 2016 |
| D-2 | Water Main along Main Street from 8th Avenue North to Broadway Street | Fire Flow Improvements | $310,000 | 2019-2032 |
| D-3 | Water main along West Valley Highway, 9th Avenue North to Broadway Street | Looping and Fire Flow Improvements | $451,000 | 2019-2032 |
| D-4 | Water main along 5th Avenue South, between Washington Boulevard South and Milwaukee Boulevard South | Looping and Fire Flow Improvements | $189,000 | 2019-2032 |
| D-5 | Water main along West Valley Highway, 1st Avenue to 4th Avenue South | Fire Flow Improvements | $487,000 | 2019-2032 |
| D-6 | Water main along 2nd Avenue North, west of Main Street | Fire Flow Improvements | $147,000 | 2019-2032 |
| D-7 | Replacement of AC Water Mains | Removal of AC Water Mains from Distribution System | $184,000 | Annual |

(1) Capital project cost estimates are tied to the November 2012 Seattle Engineering News Record (ENR) Construction Cost Index (CCI) of 9413.

(2) Algona will need to purchase additional storage capacity from Auburn because the City no longer uses their 100,000-gallon reservoir.

# CHAPTER 9

# FINANCIAL ANALYSIS

This chapter contains an analysis that describes how the City can finance the water system improvements outlined in the Chapter 8, Capital Improvement Program. The potential funding sources, financial status of the water utility, the funding required to pay for the scheduled improvements, and the impact of water improvements on water rates are presented.

## FINANCIAL STATUS OF EXISTING WATER UTILITY

### CURRENT WATER RATES

Water rates and charges for the City of Algona were set in Ordinance No. 1039-10, effective November 2010 and were updated in June 2013, Ordinance 1076-13, as a result of the development of this Plan. The City charges for water service on a monthly basis. Water service rates consist of a monthly base charge that is dependent on the meter size. Customers consuming more than the amount of water included in the base fee per month are charged for water consumption per 100 cubic feet (cf) based on meter readings every two months. Tables 9-1 and 9-2 list the City's past and current schedule of rates and charges.

**TABLE 9-1**

**Monthly Water Service Base Charges(1)**

| | Ordinance 1039-10 | | Ordinance 1076-13 | |
|---|---|---|---|---|
| **Meter Size/Customer Type** | **Usage Allowed per Month (cf)** | **Monthly Service Charge** | **Usage Allowed per Month (cf)** | **Monthly Service Charge** |
| 3/4–inch Metered Residential | 500 cf | \$22.54 | 400 cf | \$22.54 |
| Multiple Residential Units (apartments, duplexes, etc.) Per unit | 500 cf | \$22.54 | 400 cf | \$22.54 |
| Disconnected Residential Units | 0 cf | \$11.50 | 0 cf | \$11.50 |
| Unmetered Residential Uses (Per Unit) | 500 cf/unit | \$22.54 | 400 cf | \$22.54 |
| Unmetered Multiple Residential Uses (Per Unit) | 500 cf/unit | \$22.54 | 400 cf | \$22.54 |
| Commercial/Industrial up to 1-Inch Meter | 500 cf | \$23.59 | 400 cf | \$23.59 |
| Commercial/Industrial 1-Inch Meter | 500 cf | \$27.20 | 400 cf | \$27.20 |
| Commercial/Industrial 2-Inch Meter | 500 cf | \$31.02 | 400 cf | \$31.02 |
| Commercial/Industrial 3-Inch Meter | 500 cf | \$34.25 | 400 cf | \$34.25 |
| Commercial/Industrial 4-Inch Meter | 500 cf | \$37.03 | 400 cf | \$37.03 |
| Large Industrial/Manufacturing Uses | 0 cf | \$19.14 | Category deleted | |

**TABLE 9-2**

**Monthly Volume Rates(1)**

| Customer Type | Ordinance 1039-10 Volume Rate | Ordinance 1076-13 Volume Rate |
|---|---|---|
| Residential | $2.00 per 100 cf | $2.46 per 100 cf |
| Commercial/industrial | $2.00 per 100 cf | $2.46 per 100 cf |
| Large Industrial/Manufacturing | $1.52 per 100 cf | Category Deleted |

(1) City of Algona Ordinance No. 1076-13.

## CURRENT SYSTEM DEVELOPMENT FEES

The City's system development fees (also known as connection charges or GFCs) are specified in Ordinance No. 946-04, Section 8, effective March 2004. These charges are applicable only to new customers connecting to the system and are intended to repay existing customers for facilities already installed and to provide funds for constructing new facilities. In addition to the system development fee, a new customer is charged an installation fee to cover the cost of installing the service connection and meter. Table 9-3 lists system development fees and Table 9-4 lists the installation fees.

**TABLE 9-3**

**Water System Development Fees(1)**

| Customer Type | System Development Fees |
|---|---|
| Single Family Residential and Mobile Homes | $940 |
| Multiple Dwelling Units | $545 per living unit |
| All other properties except City properties; the rate shall be based upon the total daily use divided by 800 gallons per ERU | $940 per ERU |

(1) City of Algona Ordinance No. 946-04.

**TABLE 9-4**

**Water System Installation Fees(1)**

| Meter Size | Installation Fees |
|---|---|
| 3/4-inch meter | $1,000 |
| 1-inch and over meter | Actual cost plus 15%, not less than $1,000 |
| 3/4-inch meter installation only, with water service installed by the developer, as approved by the City Engineer | $200 |
| 1-inch and over meter installation only, with water service installed by the developer, as approved by the City Engineer | Actual cost plus 15%, in no case less than $200 |

(1) City of Algona Ordinance No. 946-04.

## HISTORICAL EXPENSES

The City operates a combined water and sewer utility operating fund. The operating fund (No. 402) segregates each expense as either water or sewer related. Fund balances however are combined water and sewer balances. The City pays for historically paid for some capital projects from the operating fund. Table 9-5 provides the historical utility operating expenses for the years 2009-2012.

**TABLE 9-5**

**Historical Water Operating Expenses (Fund No. 402)**

| Water Operating Expense | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|
| Salaries | $104,629 | $106,060 | $108,428 | $105,766 |
| Benefits | $38,209 | $35,449 | $43,087 | $41,658 |
| Uniform Allowance | $123 | $621 | $281 | $248 |
| Supplies | $11,035 | $6,716 | $11,808 | $12,504 |
| Gas, Oil and Fuel | $2,623 | $3,010 | $3,966 | $3,766 |
| Water Purchased for Resale | $246,273 | $218,281 | $259,369 | $263,143 |
| Small Tools | $0 | $200 | $191 | $440 |
| Professional Services | $5,487 | $8,061 | $19,716 | $43,526 |
| Communications | $4,171 | $3,599 | $4,985 | $5,010 |
| Travel and Training | $1,341 | $1,687 | $1,710 | $1,750 |
| Operating Rentals | $4,238 | $4,241 | $4,422 | $4,220 |
| Insurance | $4,552 | $5,347 | $5,622 | $6,348 |
| Public Utilities | $3,851 | $3,578 | $3,515 | $3,498 |
| Repairs and Maintenance | $2,844 | $660 | $5,634 | $6,720 |
| Miscellaneous | $4,927 | $5,349 | $5,816 | $5,390 |
| Regional Water Assoc. | $0 | $0 | $0 | $0 |
| Excise Taxes | $26,279 | $22,666 | $24,818 | $45,450 |
| **Total Operating Expenses** | **$460,582** | **$425,526** | **$503,368** | **$549,435** |
| Capital Expenses | $5,003 | $5,944 | $28,418 | $190,324 |
| **Total Operating Fund Expenses** | **$465,586** | **$431,470** | **$531,786** | **$739,759** |

The water capital improvement fund (No. 404) itemizes capital expenses of the water utility. Table 9-6 lists the historical water capital improvement fund expenses for the years 2009-2012.

**TABLE 9-6**

**Historical Capital Improvement Expenses (Fund No. 404)**

| Capital Expenses | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|
| Public Works Vehicle | $0 | $10,763 | $0 | $0 |
| Radio Read Meter | $0 | $6,724 | $231,547 | $21,614 |
| Waterline 2nd to 3rd and 4th to 5th | $0 | $0 | $0 | $461,209 |
| B&O Taxes | $56 | $0 | $0 | $17 |
| **Total Capital Expenses** | **$56** | **$17,487** | **$231,547** | **$482,840** |

## HISTORICAL REVENUES

The water utility records revenues in two accounts, the water and sewer operating fund (No. 402) and the water capital improvement fund (No. 404). Water utility revenues for the years 2009-2011 are shown in Tables 9-7. This table presents only revenues directly related to the water utility.

**TABLE 9-7**

**Historical Water Fund Revenues**

| Operating Revenue (Fund No. 402) | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|
| Water Services | $502,437 | $484,907 | $493,564 | $508,102 |
| Water Installation Fees | $2,050 | $0 | $0 | $1,000 |
| **Total Operating Revenue (Water)** | **$504,487** | **$484,907** | **$493,564** | **$509,102** |
| **Capital Revenue (Fund No. 404)** | | | | |
| Water System Development | $3,760 | $0 | $0 | $940 |
| Investment Interest | $3,042 | $1,221 | $811 | $734 |
| Interfund Transfer(1) | $0 | $0 | $0 | $350,000 |
| **Total Capital Revenue** | **$6,802** | **$1,221** | **$811** | **$351,674** |

(1) Interfund transfer in 2012 was from the general fund to pay for purchase of storage in Auburn's Lakeland Reservoir.

## SUMMARY OF CURRENT FINANCIAL STATUS

Table 9-8 presents a summary of the operating fund and capital fund cash flows. Comparing operating expenses and revenues, the water utility generated positive net operating revenue in 2009 and 2010. Reserves declined in 2011 and 2012. The capital fund showed a negative net revenue each year except 2009. In response to the financial review as part of the development of this Water System Plan the City raised rates (Ordinance 1076-13) which takes effect on July 1, 2013

**TABLE 9-8**

**Historical Cash Flow**

| **Operating Fund (Water)** | **2009** | **2010** | **2011** | **2012** |
|---|---|---|---|---|
| Total Operating Revenues | $504,487 | $484,907 | $493,564 | $509,102 |
| Total Operating Expenses | $460,582 | $425,526 | $503,368 | $549,435 |
| Total Capital Expense | $5,003 | $5,944 | $28,418 | $190,324 |
| **Net Revenue/(Loss)** | **$43,904** | **$59,381** | **($9,804)** | **($40,334)** |
| **Capital Fund** | | | | |
| Total Capital Revenues | $6,802 | $1,221 | $811 | $351,674 |
| Total Capital Expenses | $56 | $17,487 | $231,547 | $482,840 |
| **Net Revenue/(Loss)** | **$6,746** | **($16,266)** | **($230,736)** | **($131,165)** |

## PROJECTED EXPENSES, REVENUES, AND RESERVES

Projected growth in water demand is required to estimate expenses associated with providing water (supplies and utilities) and to estimate future revenues. Chapter 2 projects a 1.55 percent average annual water system growth through year 2032. Table 9-9 presents the factors used in projecting future expenses and revenues.

**TABLE 9-9**

**Summary of Projection Development Factors**

| **Factors** | **Annual Percentage Increase** |
|---|---|
| COLA (Cost of Living Adjustment) | 3.00% |
| Benefits | 3.00% |
| Inflation | 2.50% |
| State Water Excise Tax | 5.03% |
| City Growth Rate | 1.55% |

### PROJECTED EXPENSES

Table 9-10 summarizes projected water utility expenses for the years 2013 through 2018. Future expenses have been projected based on a review of the historical expenses from 2009 through 2012, the rate increase per Ordinance 1076-13 and the potential impact of inflation and growth on each expense. Historical expenses that appear stable or have been growing are projected using the 2012 expenses while historical expenses that show significant variation from year to year are projected using the average expenses from 2009 through 2012. Growth factors for projected expenses are presented in Table 9-9. Wholesale water purchased from Auburn for resale is based upon Auburn's adopted fee schedule. Auburn's rate is scheduled to increase significantly over the next 6 years.

## TABLE 9-10

### Summary of Projected Water Operating Expenses

| **Operating Expenses** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** |
|---|---|---|---|---|---|---|
| Salaries(1) | $117,000 | $121,000 | $125,000 | $129,000 | $133,000 | $137,000 |
| Benefits(1) | $57,000 | $59,000 | $61,000 | $63,000 | $65,000 | $67,000 |
| Uniform Allowance(2) | $520 | $540 | $560 | $580 | $600 | $620 |
| Supplies(2) | $17,900 | $18,300 | $18,800 | $19,300 | $19,800 | $20,300 |
| Gas, Oil and Fuel(2) | $3,840 | $3,940 | $4,040 | $4,140 | $4,240 | $4,350 |
| Wholesale water from Auburn(3)(4) | $280,000 | $314,000 | $330,000 | $347,000 | $364,000 | $382,000 |
| Small Tools(2) | $510 | $520 | $530 | $540 | $550 | $560 |
| Professional Services(2) | $44,100 | $45,200 | $46,300 | $47,500 | $48,700 | $49,900 |
| Communications(2) | $5,100 | $5,200 | $5,300 | $5,400 | $5,500 | $5,600 |
| Travel and Training(2) | $1,540 | $1,580 | $1,620 | $1,660 | $1,700 | $1,740 |
| Operating Rentals(2) | $4,300 | $4,400 | $4,500 | $4,600 | $4,700 | $4,800 |
| Insurance(2)(3) | $6,600 | $6,900 | $7,200 | $7,500 | $7,800 | $8,100 |
| Public Utilities(2) | $3,500 | $3,600 | $3,700 | $3,800 | $3,900 | $4,000 |
| Repairs and Maintenance(2)(3) | $6,200 | $6,500 | $6,800 | $7,100 | $7,400 | $7,700 |
| Miscellaneous(2) | $6,200 | $6,400 | $6,600 | $6,800 | $7,000 | $7,200 |
| Regional Water Association(2) | $1,540 | $1,580 | $1,620 | $1,660 | $1,700 | $1,740 |
| Excise Taxes(5) | $27,600 | $31,600 | $33,700 | $36,000 | $38,400 | $41,000 |
| **Total Operating Expenses** | **$583,450** | **$630,260** | **$657,270** | **$685,270** | **$713,990** | **$743,610** |

(1) Projected at COLA rate.
(2) Projected at inflation rate.
(3) Projected at forecast water system growth rate.
(4) Future water costs for 2013 to 2017 are projected based on adopted Auburn water rate increases.
(5) Calculated based on State Water Excise Tax Rate.

The City's Capital Improvement Plan (Chapter 8) identifies $859,000 in projects planned over the next 6 years and an additional $1,584,000 in project costs within the 20-year planning period. Table 9-11 provides a summary of projected capital improvement costs for years 2013 through 2018. Each project cost has been projected based on the inflation rate in Table 9-9 from 2012 dollars to the year planned.

# TABLE 9-11

## Projected 6-Year Capital Improvement Project Expenses

| **Projects**[1] | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | |
|---|---|---|---|---|---|---|---|
| ST-1: Financial Participation in Auburn Reservoir | | $185,000 | | | | | |
| Water main along West Valley Highway, 5th Avenue North to 1st Avenue [2] | $340,000 | | | | | | |
| D-1: Water main along Seattle Boulevard South, 5th Avenue South and Tacoma Boulevard South | | | | $390,000 | | | |
| D-2: Water Main along Main Street from 8th Avenue North to Broadway Street | | | | | | | $310,000 |
| D-3: Water main along West Valley Highway, 9th Avenue North to Broadway Street | | | | | | | $451,000 |
| D-4: Water main along 5th Avenue South, between Washington Boulevard South and Milwaukee Boulevard South | | | | | | | $189,000 |
| D-5: Water main along West Valley Highway, 1st Avenue to 4th Avenue South | | | | | | | $487,000 |
| D-6: Water main along 2nd Avenue North, west of Main Street | | | | | | | $147,000 |
| D-7: Replacement of AC Water Mains | | | | | | | |
| **Total Capital Expenses** | **$340,000** | **$185,000** | **$0** | **$390,000** | **$0** | **$0** | **$1,584,000** |

(1) See Chapter 8 for descriptions of proposed capital improvement projects.
(2) Completed in fall 2013.

## PROJECTED REVENUES

Projected future water system revenues for the maintenance fund and the capital fund are shown in Table 9-12 and Table 9-13, respectively. Future water sale revenue and water connection revenue is projected using the annual growth rates presented in Table 9-9, the new water rates starting in July 2013 through 2014, and a 5 percent annual increase starting in January 2015.

### TABLE 9-12

### Water Operating Revenues (Fund No. 402)

| Water Revenues | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|
| Water Sales(1) | $549,000 | $629,000 | $671,000 | $716,000 | $764,000 | $815,000 |
| Water Connections(2) | $15,000 | $15,000 | $16,000 | $16,000 | $16,000 | $16,000 |
| **Total Revenue** | **$564,000** | **$644,000** | **$687,000** | **$732,000** | **$780,000** | **$831,000** |

(1) Water sales revenue is based on budgeted 2012 water sales escalated at the population growth rate and the City's annual water rate increase, and a 5 percent rate increase annually starting in 2015.
(2) Based on projected number of new connections per year and $1000 per connection.

### TABLE 9-13

### Water Capital Revenues (Fund No. 404)

| Revenue | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|
| Water System Development(1) | $7,520 | $14,100 | $15,040 | $15,040 | $15,040 | $15,040 |
| Investment Interest | $750 | $750 | $750 | $750 | $750 | $750 |
| Interfund Transfers(2) | $315,000 | $185,000 | | $390,000 | | |
| **Total Capital Revenue** | $323,270 | $199,850 | $15,790 | $405,790 | $15,790 | $15,790 |

(1) Based on projected number of new connections per year and $940 per connection.
(2) Transfer in of money from other funds to pay for capital projects.

Table 9-14 shows the resulting cash flow generated from the projected expenses (Tables 9-10 and 9-11) and revenues (Tables 9-12 and 9-13). Reserves are anticipated to decrease in 2013, 2014 and 2016 as City implements capital improvement projects. The City should evaluate and ensure that it has sufficient reserves, prior to proceeding with the water main looping and fire flow project, D-2.

**TABLE 9-14**

**Cash Flows**

| **Operating Cash Flows** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** |
|---|---|---|---|---|---|---|
| Water Operating Revenue | $557,000 | $644,000 | $687,000 | $732,000 | $780,000 | $831,000 |
| Sewer Operating Revenue | $701,510 | $729,520 | $759,530 | $790,540 | $822,550 | $855,560 |
| Total Miscellaneous Revs. | $3,790 | $3,880 | $3,980 | $4,080 | $4,180 | $4,280 |
| Water Operating Expenses | ($583,450) | ($630,260) | ($657,270) | ($685,580) | ($713,990) | ($743,610) |
| Sewer Operating Expenses | ($726,300) | ($755,700) | ($786,300) | ($818,100) | ($851,200) | ($885,700) |
| Capital Expenditures | ($6,000) | ($6,200) | ($6,400) | ($6,600) | ($6,800) | ($7,000) |
| Transfer to Capital Fund | ($315,000) | ($185,000) | $0 | ($390,000) | $0 | $0 |
| **Net Operating Revenue** | **($368,450)** | **($199,760)** | **$540** | **($373,660)** | **$34,740** | **$54,530** |
| **Capital Cash Flows** | | | | | | |
| Capital Revenue | $7,520 | $14,100 | $15,040 | $15,040 | $15,040 | $15,040 |
| Investment Interest, Refunds, etc. | $750 | $750 | $750 | $750 | $750 | $750 |
| Transfers from Maintenance Fund | $315,000 | $185,000 | | $390,000 | | |
| Capital Expenses | ($340,300) (1) | ($185,000) | | ($390,000) | | |
| **Net Capital Revenue** | **($17,030)** | **$14,850** | **$15,790** | **$15,790** | **$15,790** | **$15,790** |
| **Total Net Revenue** | **($385,480)** | **($184,910)** | **$16,330** | **($357,870)** | **$50,530** | **$70,320** |

(1) The 8-inch water main on West Valley Highway from 1st Avenue to 5th Avenue North was completed in fall 2013.

## FUTURE RESERVE BALANCES

Utilizing the projected expenses and revenues as listed in Table 9-14 future operating reserve balances are projected in Table 9-15. Start of year reserve balances for both funds are based on reserve balances as of the end of December 2012.

**TABLE 9-15**

**Water Utility Reserve Balances**

| **Water Utility Reserves** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** |
|---|---|---|---|---|---|---|
| Start of Year Reserves | $1,355,632 | $970,152 | $785,242 | $801,572 | $443,702 | $494,232 |
| (+) Net Operating Revenue | ($368,450) | ($199,760) | $540 | ($373,660) | $34,740 | $54,530 |
| (+) Net Capital Revenue | ($17,030) | $14,850 | $15,790 | $15,790 | $15,790 | $15,790 |
| End of Year Reserves | $970,152 | $785,242 | $801,572 | $433,702 | $494,232 | $564,552 |

# RECOMMENDATIONS

The water rates presented are set through 2014. We recommend that the City continue with separating the Water and Sewer utility Funds and that it continue to monitor the reserve balances in the water fund. Annual rate increases of 5 percent per year starting in January 2015 are assumed in the financial projections. The City should be capable of maintaining the fund balances and completing a modest capital improvement program.

The CIP includes the acquisition of an addition 100,000 gallons of storage from Auburn to replace the City's out of service reservoir, and a water main project along the south end of Seattle Boulevard, along 5th Avenue South and along Tacoma Boulevard.

Finally, current system development fees should be periodically reviewed. Even though the City does not produce their own water or provide storage, current system development fees are low when compared to fees paid in other cities.

## AVAILABLE CAPITAL PROJECT FUNDING SOURCES

The following are funding sources available for financing construction of water utility facilities.

| | |
|---|---|
| **Grants:** | Community Development Block Grant (CDBG)<br>Community Investment Fund (CIF)<br>US Economic Development Administration (US EDA)<br>US EPA State and Tribal Assistance Grant (STAG)<br>USDA Forest Service, Rural Assistance Program<br>USDA Rural Development (RD) |
| **Loans:** | Public Works Trust Fund (PWTF)<br>Community Economic Revitalization Board (CERB)<br>Drinking Water State Revolving Fund<br>USDA Rural Development (RD) |
| **Bonds:** | Revenue Bonds<br>General Obligation Bonds |
| **Other:** | Utility Local Improvement Districts (ULID) |

### COMMUNITY DEVELOPMENT BLOCK GRANT (CDBG)

The Community Development Block Grant program is a competitive source of federal funding for a broad range of community development projects. A primary requirement of the CDBG program is that the project must principally benefit at least 51 percent of the low-to-moderate income residents of the project area. The State typically receives about $7 million in federal funds per funding cycle. CDBG has several grant programs including General Purpose, Community Investment Fund, Planning Only, and Imminent Threat. The General Purpose program provides grant funds for the design, construction, or reconstruction of water and sewer systems up to $1,000,000. The Community Investment Fund is similar to General Purpose, but the projects must be rated as one of the three top projects on the county's WA-CERT list. The Planning Only program includes projects such as comprehensive plans, community development plans, capital improvement plans, and other plans such as land use and urban environmental design, economic development, floodplain and wetlands management, transportation, and utilities. Planning Only grants are limited to $35,000 for a single applicant or $50,000 for a joint applicant. The Imminent Threat program typically has $300,000 available for all applicants, is only provided on a one-time basis for minor mitigation projects, and the project is not eligible under the PWTF program.

Eligible applicants for the CDBG programs include cities and towns with less than 50,000 people or counties with populations less than 200,000. Though port districts and economic development districts are not eligible to apply directly, a city or county can submit a joint application and include these entities as partners.

## COMMUNITY INVESTMENT FUND (CIF)

The Community Investment Fund partners with CDBG to fund projects that benefit at least 51 percent low-to-moderate income residents. The objective of the CIF fund is to provide an opportunity for eligible jurisdictions to access funds throughout the year on a funds available basis. Grants are generally awarded to those projects that are high priority, ready to proceed, and serve a population with at least 51 percent low-to-moderate income residents. Grant funds can be obtained in the amount of approximately $1 million.

To qualify for CIF, the project must be rated as one of the top three of the local WA-CERT Priority Rating Process, serve a minimum of 51.5 percent low-to-moderate income residents, and receive at least 65 points on the application.

## PUBLIC WORKS TRUST FUND (PWTF)

The Public Works Trust Fund is a revolving loan fund designed to help local governments finance public works projects through low-interest loans and technical assistance. The PWTF, established in 1985 by legislative action, offers loans substantially below market rates payable over periods ranging up to 20 years. To be eligible for the PWTF programs, an applicant must be a local government such as a city, county, or a special purpose utility district.

The State Legislature has stopped contributing funds to this program. Its future is uncertain.

## COMMUNITY ECONOMIC REVITALIZATION BOARD (CERB)

The Community Economic Revitalization Board's prime mission is to partner with business and industry and local governments to maintain and create jobs. Established by the Legislature in 1982, CERB provides low-interest loans, and in unique circumstances, grants to help finance local public infrastructure necessary to develop or retain stable business and industrial activities. Projects eligible for funding include roads, domestic and industrial water systems, sanitary and storm sewers, port facilities, and general purpose industrial buildings.

Typically, CERB provides loans in the amount of $1 million and, where applicable, grants in the amount of $300,000. The interest rate is tied to the current cost of a 10-year bond and a local match of 10 percent is required.

Eligible applicants include Washington State subdivisions in partnership with private enterprise. If there is no economic partner, a local government can produce a feasibility study that documents realistic job retention or creation. Applications must be submitted 45 days prior to a regularly scheduled CERB Meeting, which typically meets in January, March, July, and November.

**DRINKING WATER STATE REVOLVING FUND (DWSRF)**

In 1996, Congress established the Drinking Water State Revolving Fund through the reauthorization of the federal Safe Drinking Water Act. The program is managed by the Washington State Department of Health and the Washington State Public Works Board. The purpose of the program is to provide low-interest loans to assist publicly- and privately-owed water systems improve drinking water and protect public health.

Eligible publicly owned water systems include city and county governments, public utility districts, and special purpose districts. Privately-owned systems are eligible as long as they are a Group A system.

Eligible projects include the following:

- Water systems that exceed health standards;
- Replacement of aging infrastructure;
- Acquisition of real property;
- Planning and design costs;
- Water conservation projects;
- Reservoirs (clear wells) that are part of a treatment process;
- Distribution reservoirs (finished water);
- Existing systems who elect to connect to a municipal system;
- Upgrade to or creation of a Group A system.

Maximum award per water system is $4,000,000 and for combining systems an award of $6,000,000 is available. DWSRF requires a 1 percent loan fee, but no local match. A summary of interest rates and loan terms follows:

**TABLE 9-16**

**DWSRF Loan Terms**

| Interest Rate | Repayment period |
|---|---|
| 1.4% Fixed | 5 years |
| 2.5% Fixed | 20 years or life of project, whichever is less |

## USDA RURAL DEVELOPMENT, RURAL UTILITY SERVICES (RUS)

The RD Rural Utility Service administers a loan and grant program to improve the quality of life and promote economic development in rural areas.

Rural Development has a loan program that, under certain conditions, includes a limited grant program. Grants may be awarded when the annual debt service portion of the utility rate exceeds 1.0 percent to 1.5 percent of the municipality's median household income.

In addition, RD has a loan program for needy communities that cannot obtain funding by commercial means through the sale of revenue bonds. The loan program provides 30- to 40-year loans at an interest rate that is based on federal rates and varies with the commercial market. RD loans are revenue bonds with a 1.1 debt coverage factor.

Eligible projects include the construction, expansion, extension or improvement of rural water, sanitary sewers, solid waste disposal, storm, and wastewater disposal facilities.

Basic criteria for obtaining funds under the RUS program follows:

- Dependent on inability to obtain funds from other sources at reasonable terms.

- A 45 percent grant is available if the median household income of the service area exceeds 80 percent of the statewide non-metropolitan median household income.

- A 75 percent grant is eligible if the service area is below the higher of the poverty line or 80 percent of the state non-metropolitan median household income, and the project is necessary to alleviate a health and safety issue. However, RD rarely awards this level of grant funding.

Eligible applicants municipalities; counties; non-profit corporations, associations, or cooperatives; and federally-recognized Indian tribes in rural areas with populations of less than 10,000.

## US ECONOMIC DEVELOPMENT ADMINISTRATION (US EDA)

US EDA offers competitive grants up to $1 million for projects within Region 10. Projects are selected locally by an economic development district and submitted to Congress for competitive selection among other regions in the US. Similar to CERB, applicants must have an industrial partner ready to proceed or a feasibility study that establishes realistic job creation.

## US EPA STATE AND TRIBAL ASSISTANCE GRANT

Local jurisdictions within the State of Washington can apply to the State and Tribal Assistance Grant program through the office of their local Congressional representative. The Congressional representative will work to add the regional project as a line item to the VA/HUD Appropriations Bill. Applicants can obtain grant funds up to approximately $2 million.

## US FOREST SERVICE – WATER AND WASTEWATER

Forest Service grants are available through the Rural Community Assistance Program to rural communities that are dependent on natural resources. Project proposals must show a broad community benefit that result in greater ability to improve economically, socially, or environmentally. The project must have the potential for economic development and/or job creation/retention. An application must be located within 100 miles of a Forest Service office and be able to document a history of at least 15 percent dependency on forest products. Grant funds are available for components of planning and design and are limited to $50,000. However, for year 2005 the Forest Service had no funds to distribute.

## REVENUE BONDS – WATER AND WASTEWTER

The most common source of funds for construction of major utility improvements is the sale of revenue bonds. These are tax-free bonds issued by a city. The major source of funds for debt service on revenue bonds is from monthly sewer service charges. In order to make qualify to sell revenue bonds marketable to investors, the bonds typically have contractual provisions for the city to meet debt coverage requirements. The City must show that its annual net operating income (gross income less operation and maintenance expenses) is must be equal to or greater than a factor, typically 1.2 to 1.4 times the annual debt service on all par debt. If a coverage factor has not been specified it will be determined at the time of any future bond issues.

## GENERAL OBLIGATION BONDS – WATER AND WASTEWATER

By council action or special election, a city may issue general obligation bonds to finance most any project of general benefit to the city. The bonds are repaid by tax assessments levied against all privately owned properties within the City. Owners of vacant property would be assessed because the property would not otherwise contribute to the cost of a specific improvement. This type of bond issue is usually reserved for municipal improvements that are of general benefit to the public, such as arterial streets, bridges, lighting, municipal buildings, firefighting equipment, parks, community centers, and water and wastewater facilities. General obligation bonds are the most attractive bonds to investors because they are backed by the municipality's full taxing authority and carry the lowest rate of interest of any type of bond that a city may issue.

Disadvantages of general obligation bonds include the following:

- Voter approval is often required. The City would incur the legal costs of drafting a ballot measure and pay for the cost of holding a special election. There is also the additional cost of investing staff time in public education for the need of the project, and there is always uncertainty as to the outcome of elections.

- There are legal, as well as practical limits on the amount of general obligation debt a City can issue. Financing capital improvements through general obligation debt reduces the ability of the City to issue additional general obligation debt, which is often the only source of outside financing for many general government facilities.

## UTILITY LOCAL IMPROVEMENT DISTRICTS

Another potential source of funds for improvements can be obtained through the formation of Utility Local Improvement Districts (ULIDs) involving a special assessment made against properties benefiting by the improvements. ULID bonds are further backed by a legal claim to the revenues generated by the utility, similar to revenue bonds.

Sewer system expansion is a frequent application of ULID financing. Typically, a ULID is formed by the city at the written request (by petition) of the property owners within a specific section of the service area. Upon receipt of a sufficient number of signatures or petitions, and acceptance by the City Council, the local improvement area is formed. Therefore, a sewer system is designed for that particular area in accordance with the City's sewer comprehensive plan. Each separate property in the ULID is assessed in accordance with the special benefits the property receives from the water or wastewater system improvements. A citywide ULID could form part of a financing package for large-scale capital projects such as sewer line extensions or replacements that benefit all residents in the service area. The assessment places a lien on the property that must be paid in full upon sale of the property. ULID participants have the option of paying their assessment immediately upon receipt, thereby reducing the portion of the costs financed by the ULID bonds.

The advantages of ULID financing, as opposed to rate financing, to the property owner include:

- The ability to avoid interest costs by early payment of assessments.
- If the ULID assessment is paid in installments, it may be eligible to be deducted from federal income taxes.
- Low-income senior citizens may be able to defer assessment payments until the property is sold.
- Some Community Block Grant funds are available to property owners with incomes near or below poverty level. Funds are available only to reduce assessments.

The major disadvantage to the ULID process is that it may be politically difficult to approve formation. The ULID process may be stopped if 40 percent of the property owners protest its formation. Also, there are significant legal and administrative costs associated with the ULID process, which increases total project costs by approximately 30 percent over other financing options.

# APPENDIX A

# DOH PROJECT APPROVAL AND SUBMITTAL FORMS

# WATER FACILITY INVENTORY

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

# Water System Plan Submittal Form

This form must be completed and submitted along with the Water System Plan (WSP). It will expedite review and approval of your WSP. **All water systems should contact their regional planner before developing any planning document for submittal.**

| | | |
|---|---|---|
| City of Algona | 01450 V | |
| 1. Water System Name | PWS ID# or Owner ID# | System Owner Name |
| James M. Griess | (253) 833-2741 | PW Supervisor |
| Contact Name for Utility | Phone Number | Title |
| 402 Warde ST | Algona | WA 98001 |
| Contact Address | City | State Zip |
| Warren Perkins, P.E. | (206) 284-0860 | Project Manager |
| 2. Project Engineer | Phone Number | Title |
| 701 Dexter Avenue North, Suite 200 | Seattle | WA 98009 |
| Project Engineer Address | City | State Zip |
| | | |
| 3. Billing Contact Name (required if not the same as #4) | Billing Phone Number | Billing Fax Number |
| | | |
| Billing Address | City | State Zip |

4. How many services are presently connected to the system? 1,026
5. Is the system expanding? (seeking to extend service area or increase number of approved connections) ☒ Yes ☐ No
6. If number of services is expected to increase, how many new connections are proposed in the next six years? 94
7. If the system is private-for-profit, is it regulated by the State Utilities and Transportation Commission? ☐ Yes ☒ No
8. Is the system located in a Critical Water Supply Service Area (i.e., have a Coordinated Water System Plan)? ☒ Yes ☐ No
9. Is the system a customer of a wholesale water purveyor? ☒ Yes ☐ No
10. Will the system be pursuing additional water rights from the State Department of Ecology in the next twenty years? ☐ Yes ☒ No
11. Is the system proposing a new intertie? ☐ Yes ☒ No
12. Do you have projects currently under review by the Department of Health? ☐ Yes ☒ No
13. Are you requesting distribution main project report and construction document submittal exception, and if so, does the WSP contain standard construction specifications for distribution mains? ☒ Yes ☐ No
14. Are you requesting distribution related project report and construction document submittal exception, and if so, does the WSP contain distribution facilities design and construction standards, including internal engineering review procedures? ☐ Yes ☒ No
15. The purveyor is responsible for sending a copy of the WSP to adjacent utilities for review or a letter notifying them that a copy of the WSP is available for their review and where the review copy is located. Has this been completed? ☒ Yes ☐ No
16. The purveyor is responsible for sending a copy of the WSP to all local governments within the service area. (County and City Planning Departments, etc). Has this been completed? ☒ Yes ☐ No
17. Are you proposing a change in the place of use of your water right? ☐ Yes ☒ No

If answer to questions 7,8, 11, 15and/or 16 is "yes," list who you sent the WSP to: King County, Lakehaven Utility District, City of Pacific, City of Auburn

Is this plan: ☒ an Initial Submittal ☐ a Revised Submittal

Please enclose the following number of copies of the WSP:

**3** copies for Northwest and Southwest Regional Offices **OR 2** copies for Eastern Regional Office (We will send one copy to Ecology)
**1** additional copy if you answered "yes" to question 7. _______ Total copies attached

***Please return completed form to the Office of Drinking Water regional office checked below.***

**☒ Northwest Drinking Water Operations**
**Department of Health**
**20425 72nd Avenue South, Suite 310**
**Kent, WA 98032-2358**
**(253) 395-6750**

**☐ Southwest Drinking Water Operations**
**Department of Health**
**PO Box 47823**
**Olympia, WA 98504-7823**
**(360) 236-3030**

**☐ Eastern Drinking Water Operations**
**Department of Health**
**16201 East Indiana Avenue Suite 1500**
**Spokane Valley, WA 99216**
**(509) 329-2100**

If you need this publication in an alternate format, call (800) 525-0127. For TTY/TDD, call (800) 833-6388.

# WATER FACILITIES INVENTORY (WFI) FORM

ONE FORM PER SYSTEM

Quarter: 1
Updated: 12/04/2012
Printed: 1/14/2013
WFI Printed For: On-Demand
Submission Reason: No Change

**RETURN TO: Northwest Regional Office, 20425 72nd Ave S STE 310, Kent, WA, 98032**

| 1. SYSTEM ID NO. | 2. SYSTEM NAME | 3. COUNTY | 4. GROUP | 5. TYPE |
|---|---|---|---|---|
| 01450 V | ALGONA WATER DEPT | KING | A | Comm |

| 6. PRIMARY CONTACT NAME & MAILING ADDRESS | 7. OWNER NAME & MAILING ADDRESS | 8. Owner Number 000078 |
|---|---|---|
| JAMES M. GRIESS [PW SUPERVISOR]<br>CITY OF ALGONA PUBLIC WORKS<br>402 WARDE ST<br>ALGONA, WA 98001 | ALGONA, CITY OF<br>DAVID HILL<br>402 WARDE ST<br>ALGONA, WA 98001 | TITLE: MAYOR |
| STREET ADDRESS IF DIFFERENT FROM ABOVE | STREET ADDRESS IF DIFFERENT FROM ABOVE | |
| ATTN<br>ADDRESS<br>CITY STATE ZIP | ATTN<br>ADDRESS<br>CITY STATE ZIP | |

| 9. 24 HOUR PRIMARY CONTACT INFORMATION | 10. OWNER CONTACT INFORMATION |
|---|---|
| Primary Contact Daytime Phone: (253) 833-2741 | Owner Daytime Phone: (253) 833-2897 |
| Primary Contact Mobile/Cell Phone: (253) 261-1580 | Owner Mobile/Cell Phone: (253) 261-1372 |
| Primary Contact Evening Phone: (xxx) xxx-xxxx | Owner Evening Phone: (xxx) xxx-xxxx |
| Fax: \| E-mail: XXXXXX | Owner Fax Phone: \| E-mail: XXXXXX |

**WAC 246-290-420(9) requires that water systems provide 24-hour contact information for emergencies.**

**11. SATELLITE MANAGEMENT AGENCY - SMA (check only one)**

- [x] Not applicable (Skip to #12)
- [ ] Owned and Managed
- [ ] Managed Only
- [ ] Owned Only

SMA NAME: ______________________ SMA Number:

**12. WATER SYSTEM CHARACTERISTICS (mark all that apply)**

- [x] Agricultural
- [x] Commercial / Business
- [x] Day Care
- [x] Food Service/Food Permit
- [ ] 1,000 or more person event for 2 or more days per year
- [ ] Hospital/Clinic
- [x] Industrial
- [ ] Licensed Residential Facility
- [ ] Lodging
- [ ] Recreational / RV Park
- [x] Residential
- [ ] School
- [ ] Temporary Farm Worker
- [ ] Other (church, fire station, etc.): ______________________

**13. WATER SYSTEM OWNERSHIP (mark only one)**

- [ ] Association
- [x] City / Town
- [ ] County
- [ ] Federal
- [ ] Investor
- [ ] Private
- [ ] Special District
- [ ] State

**14. STORAGE CAPACITY (gallons)**: 0

| 15 Source Number | 16 SOURCE NAME<br>LIST UTILITY'S NAME FOR SOURCE AND WELL TAG ID NUMBER.<br>Example: WELL #1 XYZ456<br>IF SOURCE IS PURCHASED OR INTERTIED, LIST SELLER'S NAME<br>Example: SEATTLE | 17 INTERTIE<br>INTERTIE SYSTEM ID NUMBER | 18 SOURCE CATEGORY: WELL | WELL FIELD | WELL IN A WELL FIELD | SPRING | SPRING FIELD | SPRING IN SPRING FIELD | SEA WATER | SURFACE WATER | RANNEY / INF. GALLERY | OTHER | 19 USE: PERMANENT | SEASONAL | EMERGENCY | 20 SOURCE METERED | 21 TREATMENT: NONE | CHLORINATION | FILTRATION | FLUORIDATION | IRRADIATION (UV) | OTHER | 22 DEPTH: DEPTH TO FIRST OPEN INTERVAL IN FEET | 23 CAPACITY (GALLONS PER MINUTE) | 24 SOURCE LOCATION: 1/4, 1/4 SECTION | SECTION NUMBER | TOWNSHIP | RANGE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S02 | AUBURN (4) | 03350 V | | | | | | | | | | | X | | | Y | X | | | | | | | 770 | | | 00N | 00E |
| S03 | PACIFIC | 65300 W | | | | | | | | | | | | | X | N | X | | | | | | | 900 | | | 00N | 00E |

# WATER FACILITIES INVENTORY (WFI) FORM - Continued

| 1. SYSTEM ID | 2. SYSTEM NAME | 3. COUNTY | 4. GROUP | 5. TYPE |
|---|---|---|---|---|
| 01450 V | ALGONA WATER DEPT | KING | A | Comm |

| | ACTIVE SERVICE CONNECTIONS | DOH USE ONLY! CALCULATED ACTIVE CONNECTIONS | DOH USE ONLY! APPROVED CONNECTIONS |
|---|---|---|---|
| 25. SINGLE FAMILY RESIDENCES (How many of the following do you have?) | 0 | 1096 | Unspecified |
| A. Full Time Single Family Residences (Occupied 180 days or more per year) | 1021 | | |
| B. Part Time Single Family Residences (Occupied less than 180 days per year) | 0 | | |
| 26. MULTI-FAMILY RESIDENTIAL BUILDINGS (How many of the following do you have?) | | | |
| A. Apartment Buildings, condos, duplexes, barracks, dorms | 22 | | |
| B. Full Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied more than 180 days/year | 75 | | |
| C. Part Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied less than 180 days/year | 0 | | |
| 27. NON-RESIDENTIAL CONNECTIONS (How many of the following do you have?) | | | |
| A. Recreational Services and/or Transient Accommodations (Campsites, RV sites, hotel/motel/overnight units) | 0 | 0 | |
| B. Institutional, Commercial/Business, School, Day Care, Industrial Services, etc. | 43 | 43 | |
| 28. TOTAL SERVICE CONNECTIONS | | 1139 | |

**29. FULL-TIME RESIDENTIAL POPULATION**

A. How many residents are served by this system 180 or more days per ? 3000

| 30. PART-TIME RESIDENTIAL POPULATION | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A. How many part-time residents are present each month? | | | | | | | | | | | | |
| B. How many days per month are they present? | | | | | | | | | | | | |

| 31. TEMPORARY & TRANSIENT USERS | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A. How many total visitors, attendees, travelers, campers, patients or customers have access to the water system each month? | | | | | | | | | | | | |
| B. How many days per month is water accessible to the public? | | | | | | | | | | | | |

| 32. REGULAR NON-RESIDENTIAL USERS | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A. If you have schools, daycares, or businesses connected to your water system, how many students daycare children and/or employees are present each month? | | | | | | | | | | | | |
| B. How many days per month are they present? | | | | | | | | | | | | |

| 33. ROUTINE COLIFORM SCHEDULE | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**35. Reason for Submitting WFI:**

☐ Update - Change ☐ Update - No Change ☐ Inactivate ☐ Re-Activate ☐ Name Change ☐ New System ☐ Other ________________

**36. I certify that the information stated on this WFI form is correct to the best of my knowledge.**

SIGNATURE: ____________________________________________________________

DATE: ____________________________________________

PRINT NAME: ____________________________________________________________

TITLE: ____________________________________________

| WS ID | WS Name |
|---|---|
| 01450 | ALGONA WATER DEPT |

**Total WFI Printed: 1**

# APPENDIX B

# AUBURN/ALGONA AGREEMENTS

RESOLUTION NO. 689-02

**A RESOLUTION OF THE CITY OF ALGONA, WASHINGTON AUTHORIZING THE MAYOR TO EXECUTE INTER-LOCAL AGREEMENT NO. 3A MODIFYING THE WATER SYSTEM INTERTIE PROJECT AGREEMENT BETWEEN THE CITY OF ALGONA AND THE CITY OF AUBURN.**

**WHEREAS,** the City of Algona adopted Resolution No. 550-96 establishing inter-local agreement No. 3 with the City of Auburn on August 20, 1996; and

**WHEREAS,** estimated project costs in Inter-local Agreement No. 3 were underestimated; and

**WHEREAS,** it is the desire of Algona and Auburn to finalize Inter-local Agreement No. 3 with respect to facilities constructed and agree on a method of payment for constructed and proposed facilities

**NOW THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF ALGONA AS FOLLOWS:**

The Algona City Council hereby authorizes the Mayor of the City of Algona to execute Water System Intertie Agreement No. 3A with the City of Auburn, attached hereto as exhibit "A."

**Passed this 6TH day of November, 2002, and signed in authentication of its passage this 6TH day of November.**

**ATTEST:**

Danielle M. Stafford, City Clerk

Glenn Wilson, Mayor

# WATER SYSTEM INTERTIE AGREEMENT
## Algona/Auburn Intertie Agreement No. 3A

THIS AGREEMENT made and entered into by and between the City of Auburn, hereinafter referred to as "Auburn", and, the City of Algona, hereinafter referred to as "Algona", for the purposes of modifying Interlocal Agreement 3 between Algona and Auburn and establishing a payment schedule for the system intertie between the respective parties,

WITNESSETH:

WHEREAS, both Cities have executed Interlocal Agreement 3 (IA#3) for the Algona Intertie Project dated August 19, 1996; and

WHEREAS, both Cities agreed that the following facilities were to be built and funded in part or in whole by Algona as a part of IA#3:

1. Five (5) Meter Stations
2. A Future Reservoir in Lakeland Hills
3. Wells 6 and 7; and

WHEREAS, this agreement identifies one time capital facilities charges for the above referenced projects that serve to increase the capacity of service to the City of Algona; and

WHEREAS, Algona agreed to deed over its primary Water Right(s) (instantaneous flow rate (Qi) of 500 gpm, annual flow rate (Qa) of 175 acre feet per year), well facilities and well property protection zone easement to Auburn in exchange for Auburn providing a portion of the Algona long term water supply; and

WHEREAS, the Cities agreed to terminate a number of preexisting agreements; and

WHEREAS, Algona agreed to implement a water conservation program consistent with Auburn's conservation program; and

WHEREAS, Algona agreed to maintain its 100,000 gallons of system storage, participate in an additional 100,000 gallons of storage in the Auburn system or provide for the storage otherwise; and

WHEREAS, Algona granted Auburn permission to construct, own, operate, maintain, repair and replace Auburn water facilities within Algona right of way at Auburn expense; and

WHEREAS, the Boeing Company "Welded Duct Facility" was transferred to Algona as a direct service customer and the existing meter was converted to a master meter; and

WHEREAS, a 180,000 gallon share of the IA#3 proposed 1.7 million gallon Lakeland Hills Reservoir was to be financed by Algona in accordance with the Algona January 1997 Water

System Plan and with Auburn storage criteria in accordance with the schedule contained in Exhibit D of IA#3; and

WHEREAS, Auburn agreed to provide Algona up to 525,000 gallons of average day demand (ADD) and 1,114,000 gallons of maximum day demand (MDD) through 2014; and

WHEREAS, the estimated project costs were shown in Exhibit D of IA#3 and those estimated costs were understated; and

WHEREAS, the Algona City well and associated water rights were not completely conveyed by Algona to Auburn as intended under IA#3, and

WHEREAS, it is the desire of Algona and Auburn to finalize the IA#3 agreement with respect to facilities constructed and agree on a method of payment for constructed and proposed facilities

**NOW, THEREFORE, IT IS MUTUALLY AGREED** as follows:

In order to provide for the construction and operation of water supply facilities, piping and meters for a water supply intertie, and reservoir capacity, all between Auburn and Algona, the Participants mutually agree:

1. Interlocal Agreement 3 (IA#3) for the Algona Intertie Project between the City of Algona and the City of Auburn, dated August 19, 1996 and adopted by City of Auburn Resolution No. 2770 is hereby superceded by this Agreement.

2. Algona shall convey to Auburn Algona's City well and any and all associated water rights by Bill of Sale, included as Exhibit F. The well location is depicted on Exhibit A. In addition, Algona shall convey a Well Site Easement included as Exhibit G, and Access Easement included as Exhibit H for the aforementioned well. All costs for said conveyances will be included within the costs of projects planned under this Agreement. In event of future well abandonment by Auburn, any and all related easements shall be vacated by Auburn, and Algona and others shall no longer be bound thereby.

3. Algona shall have and implement a conservation program. The conservation program shall, at a minimum, be consistent with Auburn's conservation program and include field testing for leak detection, repair of leaks and public information actions equal to Auburn's public information actions. Algona's water conservation plan shall be included in the 2002 Algona Water System Plan.

4. So long as it continues to purchase wholesale water from Auburn, Algona shall continue to maintain and provide no less than the existing storage in its 100,000 gallon reservoir in its westerly service area. Alternately, Algona may elect to increase participation by 100,000 gallons within the future Auburn reservoir per Exhibit B herein, or acquire storage otherwise (such as

·aven Utility District) and terminate the continued operation of the existing reservoir ...ty service area.

5. Algona hereby grants Auburn the right to construct, own, operate, maintain, repair, and replace Auburn's municipal water system including pipes, fire hydrants, valves, meters, and other appurtenances located within Algona right-of-way as shown on Exhibit A, in perpetuity per the terms and conditions herein.

5.1. Auburn shall provide to Algona copies of available record drawings showing the location of Auburn's water system within Algona right-of-way.

5.2. Except for the normal operation of Auburn's water system, Auburn shall notify Algona prior to any major waterline improvements or replacements which may interfere with or disrupt any other utilities and/or passage of traffic within Algona. Algona shall notify Auburn prior to any street or other utility improvement which may interfere or disrupt Auburn's water system.

5.3. Auburn shall be responsible to pay for costs associated with improvements to Auburn's water system including necessary street patches. In the event that Algona constructs any street improvements on those rights-of-way containing Auburn's water system, Auburn shall be responsible to adjust all water system appurtenances to finish grade, including lowering or raising said pipelines at conflict with Algona improvements.

6. Algona agrees to financially participate in the supplemental supply development of a portion of Auburn's Well # 6 and Well # 7, in accordance with Exhibit D.

7. This Agreement shall include construction and operation of up to five individual master meter stations. Three master meter stations, including the one currently serving the Boeing "Welded Duct Facility", and two installed under IA#3 are as shown on Exhibit A. The remaining two meter stations will be located and constructed at the discretion of Algona. For adequate water distribution to be obtained, it may also be necessary for Algona to construct additional piping and connections, at its own expense.

8. Algona agrees to transfer title to Auburn for any water lines between existing master meter stations and the existing Auburn mains. Any piping between future master meter stations and Auburn mains will be similarly transferred by Algona to Auburn. Title will be transferred with a bill of sale and the water pipe will be regulated under Paragraphs 5 and 13 of this Agreement.

9. This Agreement shall include future construction of a reservoir by Auburn within the Lakeland Hills development area within Pierce County, Washington. The volume of the new reservoir is presently estimated to be approximately 2.65 million gallons, and this capacity is to be shared with Algona. Financial participation is to be based on a capacity percentage basis by any and all municipalities sharing in the capacity, whether the actual storage volume usage for

any such municipality is directly derived from the reservoir or not. Algona's capacity shall be 180,000 gallons, exclusive of the provision of Paragraph 4 of this Agreement.

10. Algona projects the need for supply source in the following quantities:

| Year | Average Daily Demand (mgd) | Maximum Daily Demand (mgd) |
|---|---|---|
| 2004 | 0.457 | 0.945 |
| 2009 | 0.491 | 1.029 |
| 2014 | 0.525 | 1.114 |

11. Additional water supply may be available as mutually agreed to in writing by the Auburn City Council and the Algona City Council.

12. Respective facility ownership, capacity rights, and responsibility for operation, maintenance, and renewal and/or replacement (r/r) are as specifically described in Exhibit B. Operational parameters shall be as specifically defined in Exhibit C.

13. Distribution water pipelines within the city limits of a Participant shall be owned and the responsibility of that Participant, with the exception of Auburn facilities specifically identified on Exhibit A, and permitted by Paragraph 5.

14. Retail customers whose property lies within the city limits of a Participant shall be the retail customers of that Participant.

15. For Auburn facilities within Algona, as specifically identified on Exhibit A, Algona hereby grants a franchise to Auburn.

16. Auburn shall design, construct and maintain its facilities constructed under this Agreement in accordance with the design standards described in the 2001 Auburn Comprehensive Water Plan, and the updates thereto.

17. Both Participants shall exercise good faith and use best efforts in estimating project costs. However, the foregoing notwithstanding, each Participant shall be responsible for and shall pay for one hundred percent (100%) of its actual, proportionate share of the project costs, regardless of the estimate. The project costs are estimated as shown in Exhibit D. The Participants shall maintain individual cost records of their expenses for the project. Auburn will maintain overall coordinated project cost records. Algona has the right to review the design of each project in Exhibit D, prior to the project being bid. Auburn shall allow sufficient time in the project schedule for this review. Should potential cost savings to the design be identified that are not in conflict with accepted industry design standards, Algona and Auburn shall work in good faith and cooperatively to incorporate the potential cost savings into the final design.

18. The Participants shall fully finance and pay for their proportionate share of cost as shown in Exhibit D. Algona shall deposit funds with Auburn to perform the project work for the proposed facilities in accordance with the schedule shown in Exhibit E. As future actual costs of projects in Exhibit D are determined, Auburn will notify Algona of such updates and the authorized representatives will execute an update to Exhibit D which will supercede all prior dated versions of Exhibit D.

19. Auburn has prepared a cost of service study to determine the cost of service to its customers. A customer classification for "wholesale-Algona" has been created, and rates for service charges are based on a rate study for this customer classification. Auburn will regularly update the cost of service analysis. Wholesale water rates to Algona will be based on costs of providing the service.

20. For purposes of this Agreement, each Participant identifies its authorized representative as the "Mayor" of Algona and as the "City Engineer" of Auburn.

21. The Participants shall meet as needed for project coordination.

22. The Participants shall be responsible for design, construction management, and commissioning of all facilities to be constructed in accordance with ownership of the facility. Responsibilities may be assigned otherwise by agreement of the Participants' authorized representatives.

23. It is acknowledged and agreed that in the event Auburn experiences any system failure or decreased capacity for any reason, the supply to Algona may be curtailed to an equal percentage of use as Auburn's curtailment is implemented. Such curtailment shall be imposed by Algona on Algona retail customers immediately and simultaneously as such curtailment is imposed by Auburn on Auburn retail customers.

24. It is the intent of Auburn to provide the water described in Paragraph 10 whenever it is available subject to the limitations described in Paragraph 23. Auburn shall use reasonable diligence and best efforts to provide immediate notice in the event it becomes aware that it may not be able to fulfill the requirements of Paragraph 10 for any reason.

25. Auburn possesses the short-term (approximately five (5) years) capacity to meet the storage requirements for Algona. Long-term storage requirements for Algona shall be met by Algona financial participation within the next increment of storage to be constructed by Auburn. Algona's minimum financial participation shall provide for construction of storage volume capacity of 180,000 gallons, inclusive of standby, equalization, and fire protection volume storage. Such 180,000 gallon capacity is in addition to Algona's existing 100,000 gallon reservoir storage in its westerly service area.

26. Algona's water supply needs above the 0.525 mgd average daily demand, and the 1.114 mgd maximum daily demand, both identified in Paragraph 10 will be dependent upon negotiation of an amendment to this Agreement.

27. This Agreement shall remain in full force unless terminated by mutual agreement of the Participants.

28. This Agreement may be amended only in writing by approval signed by the Participants.

29. The authorized representatives shall have authority to update Exhibits attached hereto. The Exhibits shall be updated and/or revised only upon written agreement signed by the Participants' authorized representatives. Updates must be ratified by each Participant's City Council.

30. Algona agrees to indemnify, defend and hold harmless Auburn, its officers, directors, employees and agents, and their successors and assigns, from any and all costs or claims arising out of or in any way resulting from Algona's default, failure of performance, or negligent conduct associated with this Agreement. It is further agreed that Auburn shall provide water to Algona consistent with its provision of water to all of its retail water customers, and the failure of the Auburn water system to deliver flow to Algona, in whole or in part, as described in this Agreement, so long as Auburn is providing water to Algona consistent with its provision of water to the rest of its retail water customers, and consistent herewith, shall not give rise to an action against Auburn, and Algona agrees to indemnify, defend and hold harmless Auburn, its officers, directors, employees and agents, and their successors and assigns, from any and all costs or claims arising out of or in any way resulting from any such failure of the Auburn water system to deliver flow to Algona, in whole or in part. This indemnification provision shall include, but is not limited to, all claims against Auburn by an employee or former employee of Algona or their contractors and, as to such claims, Algona expressly waives all immunity and limitation of liability under Title 51 RCW.

Auburn agrees to indemnify, defend and hold harmless Algona, their officers, directors, employees and agents, and their successors and assigns, from any and all costs or claims arising out of or in any way resulting from Auburn's default, or negligent conduct associated with this Agreement. This indemnification provision shall include, but is not limited to, all claims against Algona by an employee or former employee of Auburn or its contractors and, as to such claims, Auburn expressly waives all immunity and limitation of liability under Title 51 RCW.

31. The parties shall make good faith efforts to resolve by informal discussion any dispute arising under or in connection with this Agreement. If at any time either party to this Agreement determines that such informal discussions will not result in a resolution of the dispute, such party may request formal discussion by both parties. If formal discussion by the parties does not resolve the dispute, a settlement conference shall be held within thirty (30) days of the unsuccessful resolution meeting. The settlement conference will be held at the Seattle office of Judicial Arbitration and Mediation Services, Inc. ("JAMS"). The complaining party must contact JAMS to schedule the conference. The parties may agree on a retired judge from the JAMS panel. If they are unable to agree, JAMS will provide a list of three available judges and each party may strike one. The remaining judge will serve as the mediator at the settlement conference.

32. If any provision of this Agreement is invalid or unenforceable the remaining provisions shall remain in force and effect.

IN WITNESS WHEREOF, the Participants hereto have caused this Agreement to be executed by their proper Officers on the date shown below.

City of Auburn

By: ______________________

Its: Mayor

Date: 10/21/02

Attest by: ______________________

Approved as to Form by: ______________________

City of Algona

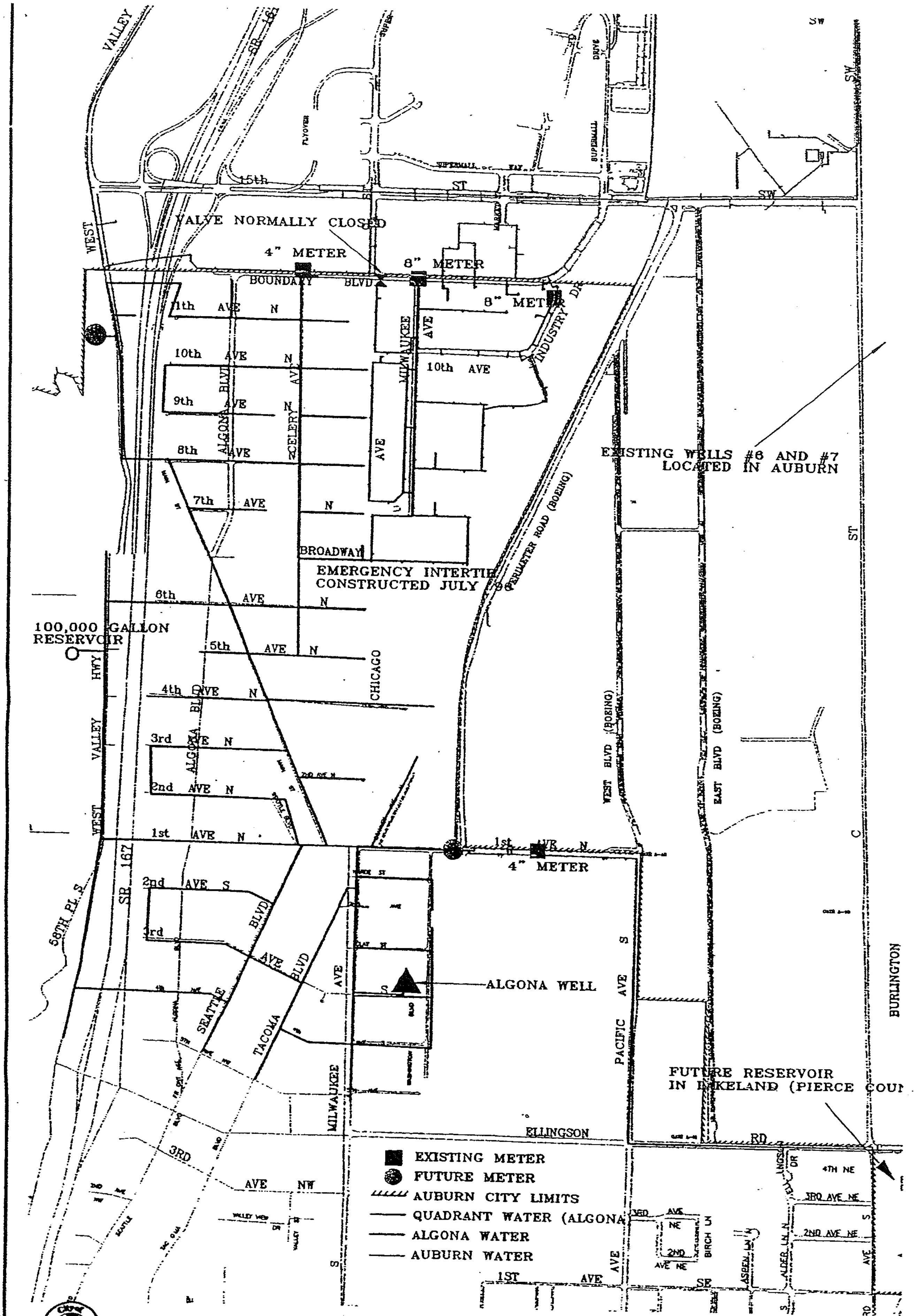
By: ______________________

Its: Mayor

Date: 11-6-02

Attest by: ______________________

Approved as to Form by: ______________________




# EXHIBIT A – FACILITIES LAYOUT PLAN
## IA #3A
## ALGONA INTERTIE PROJECT

SCALE: 1"=800'

*Exhibit A*
*Facilities Layout Plan*

WATER SYSTEM INTERTIE AGREEMENT
Algona/Auburn Intertie Agreement No. 3A
(continued)

**Update Approval**

1. Auburn: ______________________________, Dated: ______________

   Algona: ______________________________, Dated: ______________

2. Auburn: ______________________________, Dated: ______________

   Algona: ______________________________, Dated: ______________

3. Auburn: ______________________________, Dated: ______________

   Algona: ______________________________, Dated: ______________

*Exhibit B*
*Facility Ownership, Capacity Rights, Operation, Maintenance, and Renewal and Replacement Responsibilities*
to
WATER SYSTEM INTERTIE AGREEMENT
**Algona/Auburn Intertie Agreement No. 3A**

| Facility | Location | Facility Ownership | Capacity Rights | Operation, Maintenance, & Renewal/Replacement Responsibility |
|---|---|---|---|---|
| Meter Station 1, existing for Boeing | 200' easterly of the Intersection of 1st Avenue North and Perimeter Road | Auburn | 100% Algona | Auburn |
| Meter Station 2, existing | Intersection of Milwaukee Avenue and Boundary Boulevard | Auburn | 100% Algona | Auburn |
| Meter Station 3, existing | Intersection of Industry Drive North and Boundary Boulevard | Auburn | 100% Algona | Auburn |
| Meter Station 4 future | Presently unknown, but probably near intersection of West Valley Highway and Boundary Boulevard extended | Auburn | 100% Algona | Auburn |
| Meter Station 5 future | Presently unknown, but probably near intersection of UP RR and 1st Avenue North | Auburn | 100% Algona | Auburn |
| Algona Well, existing | +/-150' northwesterly of intersection of Washington Boulevard and 3rd Ave South | Auburn | 100% Auburn | Auburn |
| Lakeland Hills Reservoir, future | Lakeland Hills, Pierce County | Auburn | 180,000 gallons Algona; remainder Auburn | Auburn |
| Supply (Qi) existing supplemental water rights | Well #6, Fulmer Field Well #7, City Park | Auburn | 1,114,000 gpd Algona; remainder Auburn | Auburn |

*Exhibit B*
*Facility Ownership, Capacity Rights, Operation, Maintenance, and Renewal and Replacement Responsibilities*
to
**WATER SYSTEM INTERTIE AGREEMENT**
**Algona/Auburn Intertie Agreement No. 3A**
**(continued)**

**Update Approval**

1. Auburn: ______________________________, Dated: ______________

   Algona: ______________________________, Dated: ______________

2. Auburn: ______________________________, Dated: ______________

   Algona: ______________________________, Dated: ______________

*Exhibit C*
*Project Criteria*
to
**WATER SYSTEM INTERTIE AGREEMENT**
**Algona/Auburn Intertie Agreement No. 3A**

Project Criteria:

- Meter Stations to be sized on flow volume criteria as opposed to line size.
- Maximum (Qi) daily demand flow is 1.114 million gallons per day for total of all meter stations supply to Algona, except in case of fire or emergency.
- Maximum annual (Qa) average daily demand flow is 0.525 million gallons per day for total of all meter stations supply to Algona.
- Each meter station shall be calibrated annually for the first three years of operations, and thereafter at the discretion of Auburn.
- Reservoir capacity for Algona is 180,000 gallons of the estimated 2.65 mg total capacity in the proposed Lakeland Hills Reservoir.
- Total of all meter stations supply to Algona necessary for peak hourly flow and fire flow shall be determined by Algona, and such data provided to Auburn for meter station design and/or station design review.

**Update Approval**

1. Auburn: ______________________________, Dated: _______________

   Algona: ______________________________, Dated: _______________

2. Auburn: ______________________________, Dated: _______________

   Algona: ______________________________, Dated: _______________

*Exhibit D*
*Project Cost Estimate*
to
WATER SYSTEM INTERTIE AGREEMENT
Algona/Auburn Intertie Agreement No. 3A

| | IA#3 | | Incurred Costs To Date | |
|---|---|---|---|---|
| Description | Estimated Cost | Expenditures to Date | Auburn | Algona |
| METER STATIONS | (includes allied costs) | | | |
| 2-inch @ Boeing | N/A | N/A | N/A | N/A |
| 8-inch @ Industry Drive | $25,740 | $76,723 | $31,757 | $44,966 |
| 8-inch @ Milwaukee | $25,740 | $76,723 | $31,757 | $44,966 |
| 8-inch (Future) | $28,600 | N/A | 0% | 100% |
| 8-inch (Future) | $31,460 | N/A | 0% | 100% |
| **Subtotal Meter Stations** | **$111,540** | **$153,446** | **$63,514** | **$89,932** |
| **SUPPLY FACILITIES** | | | | |
| Well #6 | | $1,057,507 | $990,514 | $66,993 |
| Well #7 | | $2,387,050 | $2,235,829 | $151,221 |
| **Subtotal Supply Facilities** | **$1,787,500** | **$3,444,557** | **$3,226,343** | **$218,214** |
| **PRELIMINARY COSTS** | | | | |
| Algona Well/Water Rights Conveyance | $5,000 | $5,000 | $5,000 | $0 |
| Algona Water Rights | N/A | N/A | $30,000 | ($30,000) |
| Well Easements | $2,000 | $2,000 | $2,000 | $0 |
| SKCRWA JOA Development | $5,800 | $5,800 | $0 | $5,800 |
| COS/Rate Study | $1,627 | $1,627 | $0 | $1,627 |
| **Subtotal Preliminary Costs** | **$14,427** | **$14,427** | **$37,000** | **($22,573)** |
| **COSTS TO DATE** | **N/A** | **$3,612,430** | **$3,326,857** | **$285,573** |
| **PAYMENTS TO DATE** | **N/A** | **N/A** | **($3,326,857)** | **($85,300)** |
| **BALANCE OWING** | **N/A** | **N/A** | **$0** | **$200,273** |
| **STORAGE FACILITIES** | | | | |
| Lakeland Hills Res. | $2,700,000 | N/A | $2,520,000 | $180,000 |
| **Subtotal Storage Facilities** | **$2,700,000** | **N/A** | **$2,520,000** | **$180,000** |
| **Estimated Total PROJECT COST** | **$4,613,467** | **$6,312,430** | **$5,846,857** | **$465,573** |

**Update Approval**

1. Auburn: ______________________________, Dated: ______________

   Algona: ______________________________, Dated: ______________

2. Auburn: ______________________________, Dated: ______________

   Algona: ______________________________, Dated: ______________

*Exhibit E - Project Schedule*
to
WATER SYSTEM INTERTIE AGREEMENT
**Algona/Auburn Intertie Agreement No. 3A**

| Activity | Date |
|---|---|
| Execute Interlocal Agreement #3 | Completed |
| Complete master meter stations design for initial two stations | Completed |
| Algona to provide well, water rights and easements conveyance to Auburn | November 2002 |
| Award master meter stations construction contract | Completed |
| Complete construction of master meter stations #2 and #3 | Completed |
| Final master meter stations and conveyance project cost accounting | Completed |
| Interim payment of $85,300 from Algona | Completed |
| Final Auburn Wells 6 and 7 cost accounting | Completed |
| Execute Interlocal Agreement #3A | November 2002 |
| Future construction of master meter stations #4 and #5 | To be determined |
| Algona to provide $200,273 to Auburn for partial payment of cost incurred to date | 31 March 2003 |
| Algona to provide $180,000 to Auburn for partial payment for future Reservoir | Due at Construction Contract Award |
| Final project cost accounting | 31 March 2008 |
| Final IA #3A balancing payment from Algona | 30 April 2008 |

*Exhibit E - Project Schedule*
to
WATER SYSTEM INTERTIE AGREEMENT
**Algona/Auburn Intertie Agreement No. 3A**

## Update Approval

1. Auburn: ________________________________, Dated: ________________

   Algona: ________________________________, Dated: ________________

2. Auburn: ________________________________, Dated: ________________

   Algona: ________________________________, Dated: ________________

*Exhibit F – Bill of Sale for Algona's Well*
to
**WATER SYSTEM INTERTIE AGREEMENT**
**Algona/Auburn Intertie Agreement No. 3A**
**(follows)**

Return Address
City of Auburn
City Clerk
25 West Main
Auburn, WA 98001

20030113000704
PACIFIC NW TIT BS 25.00
PAGE 001 OF 007
01/13/2003 09:44
KING COUNTY, WA

Above this line reserved for recording information

## BILL OF SALE

| | | | |
|---|---|---|---|
| Reference # (if applicable) | N/A | Additional on page | ____ |
| Grantor/Borrower | 1) City of Algona | 2) | |
| | | Additional on page | ____ |
| Grantee/Assignee/Beneficiary: | City of Auburn | | |
| Legal Description/STR | NW, SW1/4, 25-21-4E | Additional on page | 6 |
| Assessor's Tax Parcel ID# | 954300-0570 | | |

7/25 PNWT W4881-12

KNOW ALL MEN BY THESE PRESENTS that for and in consideration of the sum of ONE DOLLAR ($1 00), and for the consideration of incorporating the facilities into the City system, and other good and sufficient consideration, receipt whereof is hereby acknowledged, the undersigned Grantor City of Algona, a Municipal Corporation in King County, Washington, do by these presents hereby convey, setover, assign, transfer and warrant to the City of Auburn, a Municipal Corporation in King County, Washington, a well and waterworks supplying water for public use, the associated ground water right (EXHIBIT 'A', Certificate Number GI-22769C), and all appurtenances or any other associated public facility generally consisting of a ten (10) inch casing to approximately 65 feet below ground surface Situated within the following described real property

See EXHIBITS 'B' AND 'C' ATTACHED HERETO AND BY THIS REFERENCE MADE A PART HEREOF.

and the said Grantor(s) hereby warrant(s) that they are the sole owner(s) of all the property above conveyed, that they have full power to convey the same and that they will defend the title of the said Grantee against any and all persons lawfully making claim thereto, and indemnify the City of Auburn for any costs, including Attorney fees in defending title.

IN WITNESS WHEREOF the Grantor(s) has/have executed these presents this 6th day of November, 2002

City of Algona, GRANTOR

GLENN WILSON, MAYOR

STATE OF WASHINGTON)
)ss
County of King )

I certify that I know or have satisfactory evidence that Glenn Wilson is the person who appeared before me, and said person acknowledged that he/she signed this instrument, on oath stated that he/she was authorized to execute the instrument and acknowledged it as the Mayor of The City of Algona, a Municipal Corporation, to be the free and voluntary act of such party for the uses and purposes mentioned in this instrument.

Dated 11-6-02

DANIELLE M. STAFFORD
COMMISSION EXPIRES
NOTARY
PUBLIC
11-30-04
STATE OF WASHINGTON

Danielle M Stafford
Notary Public in and for the State of Washington
residing at Pierce County
My appointment expires 11-30-04

File: 4.1
REF H \FORMS\FC089 (R 4/01)

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

# CERTIFICATE OF WATER RIGHT

☐ Surface Water (Issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the Department of Ecology.)

☒ Ground Water (Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology.)

| PRIORITY DATE | APPLICATION NUMBER | PERMIT NUMBER | CERTIFICATE NUMBER |
|---|---|---|---|
| December 10, 1976 | G1-22769 | G1-22769P | G1-22769C |

NAME

CITY OF ALGONA

| ADDRESS (STREET) | (CITY) | (STATE) | (ZIP CODE) |
|---|---|---|---|
| 402 Warde Street | Algona | Washington | 98002 |

*This is to certify that the herein named applicant has made proof to the satisfaction of the Department of Ecology of a right to the use of the public waters of the State of Washington as herein defined and under and specifically subject to the provisions contained in the Permit issued by the Department of Ecology and that said right to the use of said waters has been perfected in accordance with the laws of the State of Washington and is hereby confirmed by the Department of Ecology and entered of record as shown.*

PUBLIC WATER TO BE APPROPRIATED

SOURCE

Well

TRIBUTARY OF (IF SURFACE WATERS)

| MAXIMUM CUBIC FEET PER SECOND | MAXIMUM GALLONS PER MINUTE | MAXIMUM ACRE FEET PER YEAR |
|---|---|---|
| | 500 | 175.0 |

QUANTITY, TYPE OF USE, PERIOD OF USE

Municipal supply - continuously

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION—WITHDRAWAL

400 feet east and 1200 feet south from west quarter corner of Sec 25

| LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION) | SECTION | TOWNSHIP N. | RANGE (E. OR W.) W.M. | W.R.I.A. | COUNTY |
|---|---|---|---|---|---|
| NW¼SW¼ | 25 | 21 | 4 E | 10 | King |

RECORDED PLATTED PROPERTY

| LOT | BLOCK | OF (GIVE NAME OF PLAT OR ADDITION) |
|---|---|---|
| 28 | 4 | Woods Algona Add. Div 1 |

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

Area served by City of Algona

PROVISIONS

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 RCW 90 03 380, 90 03 390, and 90 44 020

This certificate of water right is specifically subject to relinquishment for nonuse of water as provided in RCW 90 14 180

Given under my hand and the seal of this office at Redmond Washington, this 15th day of November, 19 78.

Department of Ecology

by ROBERT K McCORMICK, Regional Manager

ENGINEERING DATA

OK

FOR COUNTY USE ONLY

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

# PROOF OF APPROPRIATION OF WATER

| | |
|---|---|
| | GI - 22760P |

NAME OF PERMITTEE
CITY OF ALGONA

POST OFFICE ADDRESS: 402 Warde Street — Algona — WA — 98002

Well

Municipal Water Supply

April 12, 1977

YES [x] NO [ ]

711

520 gal per minute

Average 11,774 CF per day

YES [x] NO [ ]

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS USED (USE ADDITIONAL SHEET IF NECESSARY)

Well site Block 4, Lots 23-30, Woods Algona Division No. 1 as recorded in book of Plats, Vol 10 Page 35, records of King County, Washington

Water used in City of Algona, Washington
Description of City Limits All that portion of Sections 23, 24, 25, 26 and 35 and 36 Township 21 North Range 4 East, W.M. described as follows
BEGINNING at the northwest corner of the southeast one-quarter of Section 23, Township 21 North, Range 4 East W.M. and running thence easterly along the North line of said southeast one-quarter to the northeast corner thereof; thence easterly along the north line of the southwest one-quarter of Section 24, Township 21 North, Range 4 east, W.M. to a point on the easterly margin of the joint C.M. & St. P. & O.W.R.R. Railway's right-of-way thence southwesterly along said easterly margin to an intersection with the northerly margin of the right-of-way of South 350th Street thence easterly along said northerly margin of South 350th Street to an intersection with the easterly margin of the right-of-way of 76th Avenue South thence southerly along said easterly margin of 76th Avenue South to an intersection with the northerly line of the Southwest one-quarter of the Southeast one-quarter of Section 25, Township 21

STATE OF WASHINGTON
County of King } ss

OK FEES
ISSUE CERTIFICATE
PER PERMIT
10-24-78
USE LEGAL ON PERMIT

I John E. Matchett being first duly sworn depose and say that I have read the above and foregoing proof of appropriation that I know the contents thereof and that the facts therein stated are true

IN WITNESS WHEREOF I have hereunto set my hand this 10th day of October 1978

John E. Matchett
Permittee's Signature

Subscribed and sworn to before me this 10th day of October 1978

Margaret S. Grase
Notary Public

ECY 040-1-26

**EXHIBIT "B"**

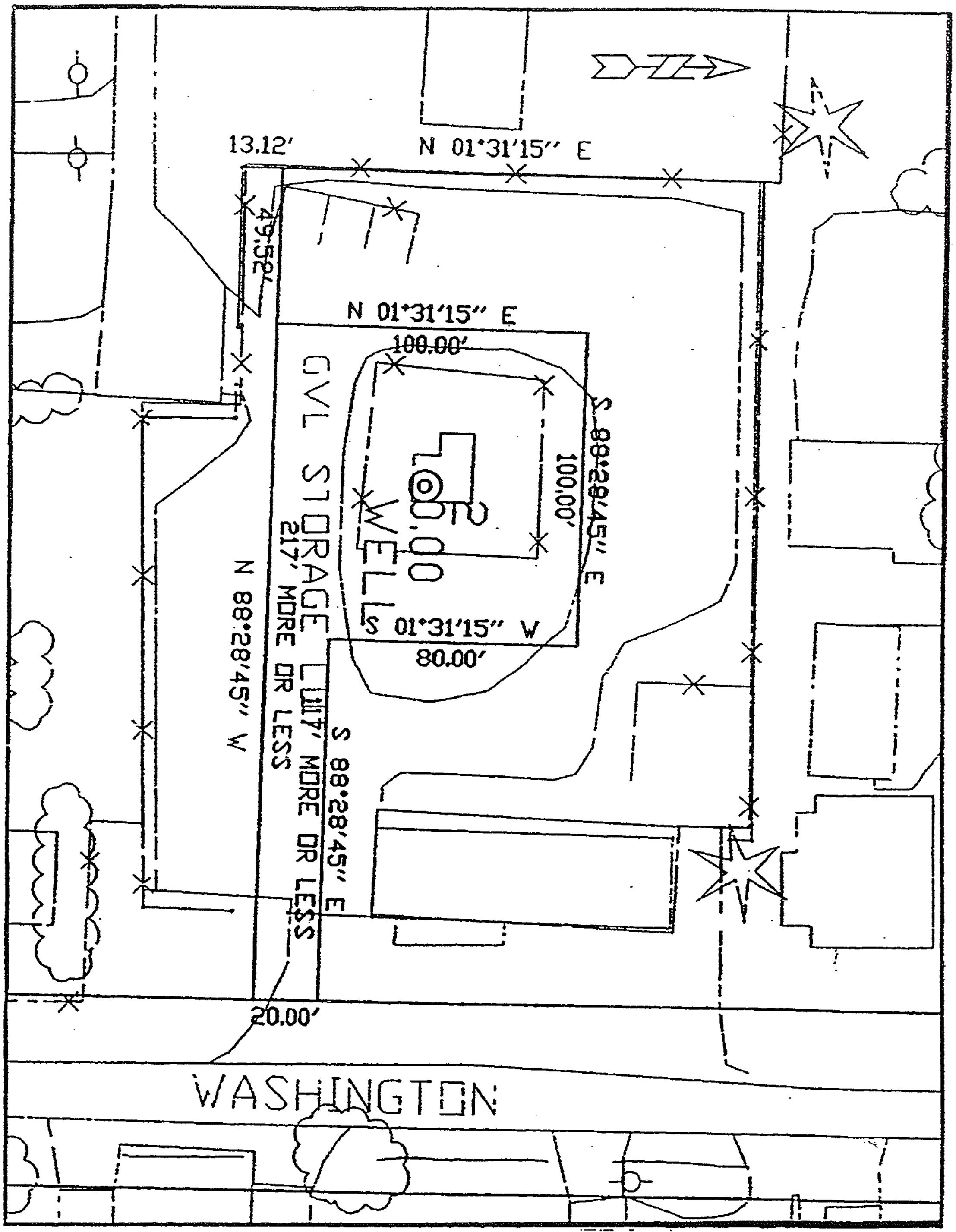
## ALGONA WATER WELL EASEMENT
## 3RD AVENUE SOUTH AND WASHINGTON BOULEVARD

THAT PORTION OF LOTS 23 AND 24 AND 25 AND 26 AND 27 AND 28 AND 29 AND 30, ALL IN BLOCK 4 OF WOOD'S ALGONA ADDITION, DIVISION NUMBER 1 TO THE CITY OF SEATTLE AS RECORDED IN VOLUME 19 OF PLATS, PAGE 36, RECORDS OF KING COUNTY, WASHINGTON, DESCRIBED AS FOLLOWS

BEGINNING AT THE SOUTHWEST CORNER OF SAID LOT 30, THENCE NORTH 01°31'15" EAST ALONG THE WEST BOUNDARY OF SAID LOT 30, A DISTANCE OF 13 12 FEET, THENCE SOUTH 88°28'45" EAST, 49 52 FEET TO THE TRUE POINT OF BEGINNING, THENCE NORTH 01°31'15" EAST, 100 00 FEET, THENCE SOUTH 88°28'45" EAST, 100 00 FEET, THENCE SOUTH 01°31'15" WEST, 80 00 FEET, THENCE SOUTH 88°28'45" EAST, 117 FEET MORE OR LESS TO THE WEST MARGIN OF WASHINGTON BOULEVARD, THENCE SOUTHERLY 20 00 FEET MORE OR LESS ALONG SAID WEST MARGIN OF WASHINGTON BOULEVARD TO A POINT WHICH BEARS SOUTH 88°28'45" EAST FROM SAID TRUE POINT OF BEGINNING; THENCE NORTH 88°28'45" WEST, 217 FEET MORE OR LESS TO SAID TRUE POINT OF BEGINNING

SITUATE IN THE NORTHEAST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 25, TOWNSHIP 21 NORTH, RANGE 4 EAST, W M

**EXHIBIT "C"**



13.12'
N 01°31'15" E
49.52'
N 01°31'15" E
100.00'
100.00'
S 88°28'45" E
S 01°31'15" W
80.00'
GVL STORAGE LOT
217' MORE OR LESS
N 88°28'45" W
S 88°28'45" E
217' MORE OR LESS
20.00'
WASHINGTON

20021230001158.001

Return Address
City of Auburn
City Clerk
25 West Main
Auburn, WA 98001

20021230001158
PACIFIC NW TIT EAS
PAGE 001 OF 004
12/30/2002 09:58
KING COUNTY, WA

Said document(s) was filed for record by Pacific Northwest Title as accommodation only. It has not been examined as to proper execution or as to its affect upon title.

Above this line reserved for recording information

4/22 PNWT
W48605-12

# EASEMENT

Well Site Easement

| | | | |
|---|---|---|---|
| Reference # (if applicable) | N/A | Additional on page | ____ |
| Grantor/Borrower | 1) City of Algona | 2) | |
| | | Additional on page | ____ |
| **Grantee/Assignee/Beneficiary:** | **City of Auburn** | | |
| Legal Description/STR | NW, SW1/4, 25-21-4E | Additional on page | 3 |
| Assessor's Tax Parcel ID# | 954300-0570 | | |

For and in consideration of the sum of one dollar ($1 00) and other good and valuable consideration in hand paid, receipt of which is hereby acknowledged, and for benefits to be derived by the Grantor herein, Grantor, City of Algona, a municipal corporation of King County, Washington, hereby conveys and warrants to the City of Auburn, Grantee herein, a municipal corporation of King County, Washington, its successors and assigns, a perpetual Nonexclusive Easement under, over, through and across the following described real property for the purpose of operating, maintaining, installing and decommissioning a well and waterworks supplying water for public use AND APPURTENANCES THEREOF, said real property being described as follows

SEE EXHIBITS "A" AND "B" ATTACHED HERETO AND BY THIS REFERENCE MADE A PART HEREOF

This easement is given under the threat of and in lieu of Eminent Domain

**Said Grantee** shall have the absolute right, at times as may be necessary, for immediate entry upon said Easement for the purpose of maintenance, inspection, construction, repair, reconstruction or decommissioning of the above improvements without incurring any legal obligation or liability therefore

**Said Grantee** shall have the absolute right to place any type of driving surface within said Easement deemed necessary by the Grantee

**Said Grantor** shall not in any way block, restrict or impede access and egress to or from said Easement, and/or in any way block, restrict or impede full use of the real property within the above-described Easement by said Grantee for the above-described purposes Said Grantor may fence across said Easement and/or along the boundaries of said Easement provided that a gate is constructed in said fence Said gate shall be of sufficient length and location to allow the Grantee full use of, and access and egress to and from the real property within the above-described Easement If said gate is to be locked, keys shall be provided to the Grantee

This Easement shall be a covenant running with the above-described real property and burden said real estate, and shall be binding on the successors, heirs and assigns of all parties hereto

Dated this 6th day of November, 2002

City of Algona, GRANTOR

GLENN WILSON, MAYOR

STATE OF WASHINGTON)
)ss
County of King )

I certify that I know or have satisfactory evidence that Glenn Wilson
and
is/are the person(s) who appeared before me, and said **individual(s)** acknowledged that he/she/they signed this instrument and acknowledged it to be his/her/their free and voluntary act for the uses and purposes mentioned in this instrument

Dated 11-30-04

DANIELLE M. STAFFORD
COMMISSION EXPIRES
NOTARY
PUBLIC
11-30-04
STATE OF WASHINGTON

Danielle M Stafford
Notary Public in and for the State of Washington
residing at Pierce County
My appointment expires 11-30-04

REF H \FORMS\FC087 (4/98)

**EXHIBIT "A"**

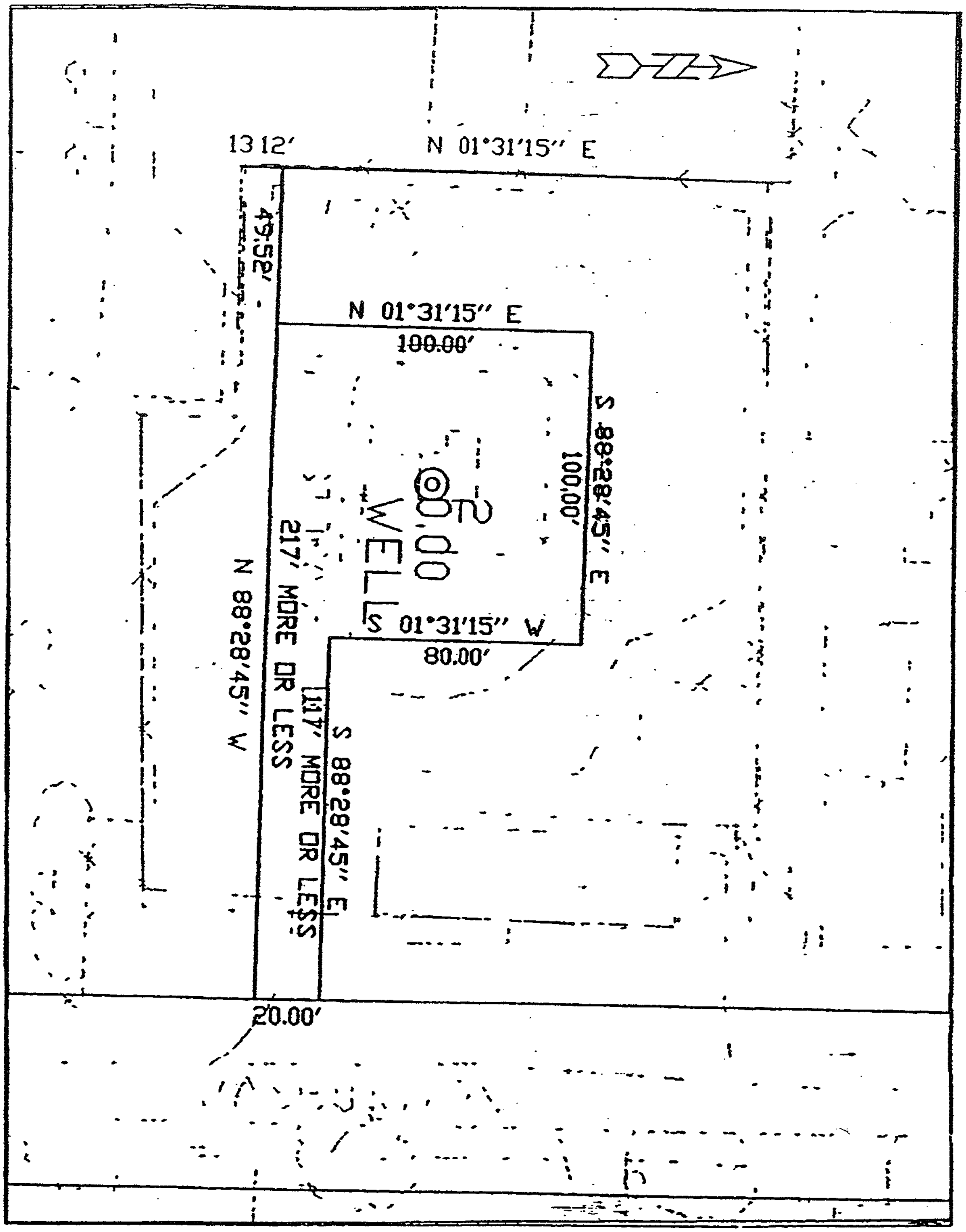
# ALGONA WATER WELL EASEMENT
# 3RD AVENUE SOUTH AND WASHINGTON BOULEVARD

THAT PORTION OF LOTS 23 AND 24 AND 25 AND 26 AND 27 AND 28 AND 29 AND 30, ALL IN BLOCK 4 OF WOOD'S ALGONA ADDITION, DIVISION NUMBER 1 TO THE CITY OF SEATTLE AS RECORDED IN VOLUME 19 OF PLATS, PAGE 36, RECORDS OF KING COUNTY, WASHINGTON, DESCRIBED AS FOLLOWS

BEGINNING AT THE SOUTHWEST CORNER OF SAID LOT 30, THENCE NORTH 01°31'15" EAST ALONG THE WEST BOUNDARY OF SAID LOT 30, A DISTANCE OF 13 12 FEET, THENCE SOUTH 88°28'45" EAST, 49 52 FEET TO THE TRUE POINT OF BEGINNING, THENCE NORTH 01°31'15" EAST, 100.00 FEET, THENCE SOUTH 88°28'45" EAST, 100 00 FEET; THENCE SOUTH 01°31'15" WEST, 80 00 FEET, THENCE SOUTH 88°28'45" EAST, 117 FEET MORE OR LESS TO THE WEST MARGIN OF WASHINGTON BOULEVARD; THENCE SOUTHERLY 20 00 FEET MORE OR LESS ALONG SAID WEST MARGIN OF WASHINGTON BOULEVARD TO A POINT WHICH BEARS SOUTH 88°28'45" EAST FROM SAID TRUE POINT OF BEGINNING, THENCE NORTH 88°28'45" WEST, 217 FEET MORE OR LESS TO SAID TRUE POINT OF BEGINNING

SITUATE IN THE NORTHEAST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 25, TOWNSHIP 21 NORTH, RANGE 4 EAST, W M

# EXHIBIT "B"


13.12'
N 01°31'15" E
49.52'
N 01°31'15" E
100.00'
S 88°28'45" E
100.00'
WELL
S 01°31'15" W
80.00'
N 88°28'45" W
217' MORE OR LESS
117' MORE OR LESS
S 88°28'45" E
20.00'

20021230001157.001

20021230001157

PACIFIC NW TIT EAS 22.00
PAGE 001 OF 004
12/30/2002 09:58
KING COUNTY, WA

Return Address
City of Auburn
City Clerk
25 West Main
Auburn, WA 98001

This document is filed for record by Pacific Northwest Title as accommodation only. It has not been examined as to proper execution or as to its effect upon title

Above this line reserved for recording information

4/22 PNWT
W48605-12

# EASEMENT

Access Easement

| | | | |
|---|---|---|---|
| Reference # (if applicable) | N/A | Additional on page | |
| Grantor/Borrower | 1) City of Algona | 2) | |
| | | Additional on page | |
| **Grantee/Assignee/Beneficiary:** | **City of Auburn** | | |
| Legal Description/STR | NW, SW 1/4, 25-21-4E | Additional on page | 3 |
| Assessor's Tax Parcel ID# | 954300-0570 | | |

For and in consideration of the sum of one dollar ($1 00) and other good and valuable consideration in hand paid, receipt of which is hereby acknowledged, and for benefits to be derived by the Grantor herein, Grantor, City of Algona, a municipal corporation of King County, Washington, hereby conveys and warrants to the City of Auburn, Grantee herein, a municipal corporation of King County, Washington, its successors and assigns, a perpetual Nonexclusive Easement under, over, through and across the following described real property for the purpose of ingress and egress, said real property being described as follows

SEE EXHIBITS "A" AND "B" ATTACHED HERETO AND BY THIS REFERENCE MADE A PART HEREOF

This easement is given under the threat of and in lieu of Eminent Domain

**Said Grantee** shall have the absolute right, at times as may be necessary, for immediate entry upon said Easement for the purpose of maintenance, inspection, construction, repair or reconstruction of the above improvements without incurring any legal obligation or liability therefore

**Said Grantee** shall have the absolute right to place any type of driving surface within said Easement deemed necessary by the Grantee

**Said Grantor** shall not in any way block, restrict or impede access and egress to or from said Easement, and/or in any way block, restrict or impede full use of the real property within the above-described Easement by said Grantee for the above-described purposes Said Grantor may fence across said Easement and/or along the boundaries of said Easement provided that a gate is constructed in said fence Said gate shall be of sufficient length and location to allow the Grantee full use of, and access and egress to and from the real property within the above-described Easement If said gate is to be locked, keys shall be provided to the Grantee

This Easement shall be a covenant running with the above-described real property and burden said real estate, and shall be binding on the successors, heirs and assigns of all parties hereto

Dated this 6th day of November, 2002

City of Algona, GRANTOR

Glenn Wilson

GLENN WILSON, MAYOR

STATE OF WASHINGTON)
)ss
County of King )

I certify that I know or have satisfactory evidence that Glenn Wilson
and
is/are the person(s) who appeared before me, and said individual(s) acknowledged that he/she/they signed this instrument and acknowledged it to be his/her/their free and voluntary act for the uses and purposes mentioned in this instrument

Dated 11-6-02

DANIELLE M. STAFFORD
COMMISSION EXPIRES
NOTARY
PUBLIC
11-30-04
STATE OF WASHINGTON

Danielle M Stafford
Notary Public in and for the State of Washington
residing at Pierce County
My appointment expires 11-30-04

REF H \FORMS\FC087 (4/98)

## EXHIBIT "A"

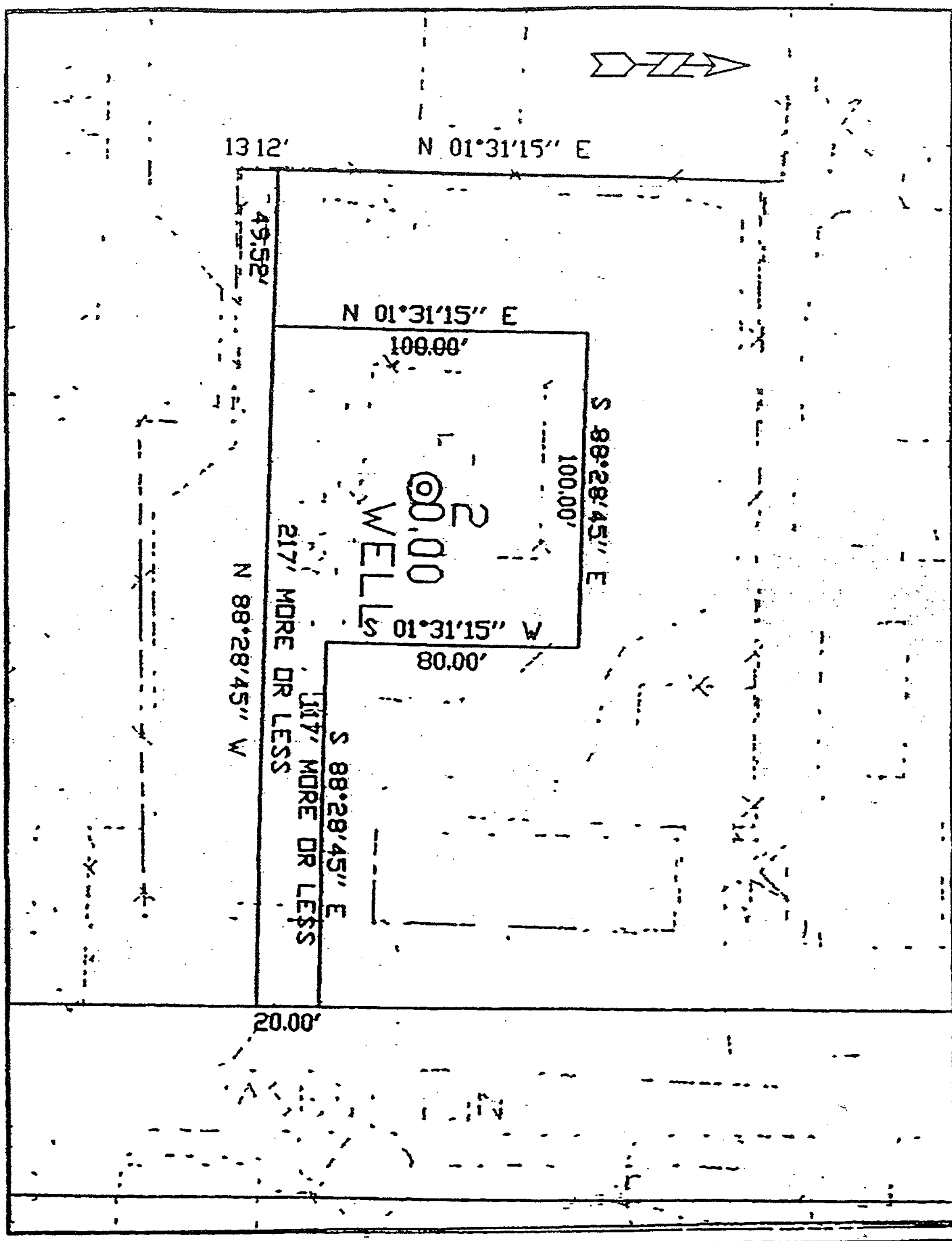
# ALGONA WATER WELL EASEMENT
# 3RD AVENUE SOUTH AND WASHINGTON BOULEVARD

THAT PORTION OF LOTS 23 AND 24 AND 25 AND 26 AND 27 AND 28 AND 29 AND 30, ALL IN BLOCK 4 OF WOOD'S ALGONA ADDITION, DIVISION NUMBER 1 TO THE CITY OF SEATTLE AS RECORDED IN VOLUME 19 OF PLATS, PAGE 36, RECORDS OF KING COUNTY, WASHINGTON, DESCRIBED AS FOLLOWS

BEGINNING AT THE SOUTHWEST CORNER OF SAID LOT 30, THENCE NORTH 01°31'15" EAST ALONG THE WEST BOUNDARY OF SAID LOT 30, A DISTANCE OF 13.12 FEET, THENCE SOUTH 88°28'45" EAST, 49 52 FEET TO THE TRUE POINT OF BEGINNING; THENCE NORTH 01°31'15" EAST, 100 00 FEET, THENCE SOUTH 88°28'45" EAST, 100.00 FEET, THENCE SOUTH 01°31'15" WEST, 80 00 FEET, THENCE SOUTH 88°28'45" EAST, 117 FEET MORE OR LESS TO THE WEST MARGIN OF WASHINGTON BOULEVARD; THENCE SOUTHERLY 20 00 FEET MORE OR LESS ALONG SAID WEST MARGIN OF WASHINGTON BOULEVARD TO A POINT WHICH BEARS SOUTH 88°28'45" EAST FROM SAID TRUE POINT OF BEGINNING, THENCE NORTH 88°28'45" WEST, 217 FEET MORE OR LESS TO SAID TRUE POINT OF BEGINNING

SITUATE IN THE NORTHEAST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 25, TOWNSHIP 21 NORTH, RANGE 4 EAST, W M

# EXHIBIT "B"


13.12'
N 01°31'15" E
49.52'
N 01°31'15" E
100.00'
S 88°28'45" E
100.00'
2
0.00
WELL
S 01°31'15" W
80.00'
N 88°28'45" W
217' MORE OR LESS
117' MORE OR LESS
S 88°28'45" E
20.00'

# INTERLOCAL AGREEMENT 3
FOR THE
## ALGONA INTERTIE PROJECT
BETWEEN THE
## CITY OF ALGONA
AND THE
## CITY OF AUBURN

ORIGINAL

### I. PROJECT TITLE AND SCOPE

This project shall be known as the Algona Intertie Project. The project scope shall include construction and operation of water supply facilities, piping and meters for a water supply intertie between the City of Auburn ("Auburn" herein) and the City of Algona ("Algona" herein), jointly termed the Participants. The project also includes Algona's commitment to financially participate in a future reservoir to be constructed by Auburn. The proposed project facilities are identified on Exhibit A.

The contents of all Exhibits attached hereto are incorporated herein by this reference as though fully set forth herein. The Exhibits attached hereto are:

1. Exhibit A - FACILITIES LAYOUT PLAN
2. Exhibit B - FACILITY OWNERSHIP, CAPACITY RIGHTS, OPERATION, MAINTENANCE, AND RENEWAL AND REPLACEMENT RESPONSIBILITIES
3. Exhibit C - PROJECT CRITERIA
4. Exhibit D - PROJECT COST ESTIMATE
5. Exhibit E - PROJECT SCHEDULE
6. Exhibit F - ALGONA WELL FACILITY AND WATER RIGHT CONVEYANCE
7. Exhibit G - WELL AND INGRESS \ EGRESS EASEMENT

### II. RECITALS

WHEREAS, this Interlocal Agreement 3 ("IA3" herein) is consistent with the Joint Operating Agreement ("JOA" herein) of the South King County Regional Water Association ("SKCRWA" herein) dated July 26, 1995; and

WHEREAS, it is the intent of Algona to obtain a portion of its long-term water supply needs from Auburn and it is the intent of Auburn to provide Algona with a portion of its long-term water supply needs; and

WHEREAS, Auburn has the necessary water system capacity to meet a portion of Algona's long-term public water supply needs; and

WHEREAS, pursuant to Section 4. C. of the JOA, for wholesale or emergency water supply purposes, the following interties exist or are expected to exist in the near future for the Participants to this IA3 which is consistent therewith:

1. Algona
   - City of Auburn,
   - Lakehaven Utility District (future), and
   - City of Pacific

2. Auburn

- City of Algona,
- City of Bonney Lake,
- Covington Water District,
- City of Kent (emergency only),
- Lakehaven Utility District (future),
- Muckleshoot Indian Tribe (future),
- City of Pacific, and
- King County Water District #111; and

WHEREAS, pursuant to Chapter 35 RCW, municipalities are authorized to enter into interlocal agreements for services;

NOW, THEREFORE, in order to provide for the construction and operation of water supply facilities, piping and meters for a water supply intertie, and reservoir capacity, all between Auburn and Algona, the Participants mutually agree:

## III. CONDITIONS OF SERVICE

**A.** Estimated project costs as shown in Exhibit D are hereby reviewed and approved by Algona and Auburn.

**B.** As a condition precedent to Auburn providing a portion of the long-term water supply to Algona as described in paragraph V. C., Algona shall convey to Auburn Algona's City well as shown on Exhibit A, along with a well property protection zone easement as shown on Exhibit A, and any and all associated water rights. The cost of such conveyances will be included within the Project Costs. In the event of future well abandonment by Auburn, any and all related easements, such as for a wellhead protection zone, shall be vacated by Auburn, and Algona and others shall no longer be bound thereby.

**C.** The Participants hereby concurrently terminate, with the execution of this IA3, pre-existing agreements and those associated with the following documents:

> **1.** "Water Service Agreement," dated April 21, 1981, between Algona and Auburn, executed for purposes of serving the Quadrant Corporation plat called Auburn 400 Corporate Park;
>
> **2.** Letter correspondence from Pat Nevins, Director of Public Works for Auburn, to Mayor August Schuman for Algona, dated August 30, 1984, setting forth billing conditions and rates pertaining to Algona's purchases of water from Auburn;
>
> **3.** "Interlocal Agreement Between the City of Auburn and the City of Algona for the Sale of Water," dated September 8, 1992, executed for purposes of serving The Boeing Company welded duct facility.
>
> **4.** "Interlocal Agreement Between the City of Auburn and the City of Algona for the Use of Certain Streets Located Within the City of Algona Designated as Ellingson Road, Pacific Avenue South and First Avenue South by the City of Auburn for a Water Distribution System," dated September 8, 1992, executed for purposes of serving the Boeing Company welded duct facility.

D. Algona shall develop and implement a conservation program within 180 days of the execution of this IA3. The conservation program shall include field testing for leak detection and repair. The leak detection field investigation and repairs shall be planned to complete field testing and repair of Algona's complete water system within three years of the execution of this IA3. The conservation program shall, at a minimum, be consistent with Auburn's conservation program and include public information actions equal to Auburn's public information actions.

E. So long as it continues to purchase wholesale water from Auburn, Algona shall continue to maintain and provide no less than the existing storage in its 100,000 gallon reservoir in its westerly service area. Alternately, Algona may elect to increase participation by 100,000 gallons within the future Auburn reservoir per Exhibit B herein, or acquire storage otherwise (such as from Lakehaven Utility District) and terminate the continued operation of the existing reservoir in its westerly service area.

F. Algona hereby grants Auburn the right to construct, own, operate, maintain, repair, and replace Auburn's municipal water system including pipes, fire hydrants, valves, meters, and other appurtenances located within Algona right-of-way as shown on Exhibit A, in perpetuity per the terms and conditions herein.

Auburn shall provide to Algona copies of available record drawings showing the location of Auburn's water system within Algona right-of-way.

Except for the normal operation of Auburn's water system, Auburn shall notify Algona prior to any major waterline improvements or replacements which may interfere with or disrupt any other utilities and/or passage of traffic within Algona. Algona shall notify Auburn prior to any street or other utility improvement which may interfere or disrupt Auburn's water system.

Auburn shall be responsible to pay for costs associated with improvements to Auburn's water system including necessary street patches. In the event that Algona constructs any street improvements on those rights-of-way containing Auburn's water system, Auburn shall be responsible to adjust all water system appurtenances to finish grade, including lowering or raising said pipelines at conflict with Algona improvements.

## IV. FIRST IN TIME FIRST IN RIGHT

It is the intent of Auburn to create a first in time, first in service approach to wholesale of water within the limitations of Auburn's water rights and/or supply capacity. Auburn agrees that future interlocal agreements or interlocal agreement amendments pertaining to the supply of wholesale water to Algona or other purveyors by Auburn shall be subject to the terms and conditions of this IA3.

## V. PROJECT DESCRIPTION

A. The Project contemplates use of master meter stations and flow control facilities as necessary to measure peaking factors and the volume of water supplied.

B. The project shall include supply development as a portion of Auburn's well # 6 and well # 7. Currently Auburn is developing the two wells with a planned Qi of 10 mgd, with construction completion scheduled for 1998, and primary water rights acquisition scheduled for 1999.

C. The Project shall include five individual master meter stations. One master meter station, the one currently serving the Boeing welded duct facility, currently exists. At such time as conditions precedent to this IA3 have been met, construction will be commenced upon two additional master meter stations. The first to be constructed will be located on Industry Drive North, immediately south of Boundary Boulevard. The second to be constructed will be located on Milwaukee Avenue, immediately south of Boundary Boulevard. The remaining two meter stations will be located and constructed at the discretion of Algona.

For adequate water distribution to be obtained, it shall also be necessary for Algona to construct additional piping and connections, at its own expense, such as to the Quadrant system,

D. The Project shall include a reservoir, to be constructed in the future by Auburn, and presently expected to be located within the Lakeland Hills development area within Pierce County, Washington. The present reservoir construction schedule expects the construction to occur during the late 1990's. The volume of the new reservoir is presently estimated to be approximately 1.7 million gallons, and this capacity is to be shared with multiple municipalities, including Auburn and Algona. Financial participation is to be based on a capacity percentage basis by any and all municipalities sharing in the capacity, whether the actual storage volume usage for any such municipality is directly derived from the reservoir or not. Algona's capacity shall be 180,000 gallons, exclusive of the provision of Paragraph III. E.

E. Algona projects the need for supply source in the following quantities:

| Year | Average Daily Demand (mgd) | Maximum Daily Demand (mgd) |
|---|---|---|
| 1996 | 0.415 | 0.846 |
| 1998 | 0.423 | 0.863 |
| 2000 | 0.427 | 0.871 |
| 2004 | 0.457 | 0.945 |
| 2009 | 0.491 | 1.029 |
| 2014 | 0.525 | 1.114 |

F. Additional water supply may be available as mutually agreed to by the Auburn City Council and the Algona City Council.

G. Respective facility ownership, capacity rights, and responsibility for operation, maintenance, and renewal and/or replacement (r/r) are as specifically described in Exhibit B. Operational parameters shall be as specifically defined in Exhibit C.

H. Distribution water pipelines within the city limits of a Participant shall be owned and the responsibility of that Participant, with the exception of Auburn facilities specifically identified on Exhibit A, and permitted by Paragraph III. F.

I. Retail customers whose property lies within the city limits of a Participant shall be the retail customers of that Participant.

J. For Auburn facilities within Algona, as specifically identified on Exhibit A, Algona hereby grants a franchise to Auburn.

K. Auburn shall design, construct and maintain its facilities constructed under IA3 in accordance with the design standards described in the 1995 Auburn Comprehensive Water Plan.

## VI. PROJECT COSTS

Both Participants shall exercise good faith and use best efforts in estimating project costs. However, the foregoing notwithstanding, each Participant shall be responsible for and shall pay for one hundred percent (100%) of its actual, proportionate share of the project costs, regardless of the estimate. The project costs are estimated as shown in Exhibit D. The Participants shall maintain individual cost records of their expenses for the project. Auburn will maintain overall coordinated project cost records.

## VII. PROJECT FINANCING

A. The Participants shall fully finance and pay for their proportionate share of cost as shown in Exhibit D. Algona shall deposit funds with Auburn to perform the project work for the proposed facilities in accordance with the schedule shown in Exhibit E.

B. Auburn shall fund two master meters to be immediately installed and include in future monthly service charges an additional amount of $1,000 each month to Algona for recovery of Auburn's funding of purchase and installation of the two master meters. Such additional charges shall continue until Algona has paid the principal in full and has paid interest on the outstanding principal at the rate of 5.5% simple annual.

## VIII. SERVICE CHARGES

Auburn has prepared a cost of service study to determine the cost of service to its customers. A customer classification for "wholesale" has been created, and rates for service charges shall be based on a rate study for the wholesale customer classification. Auburn will regularly update the cost of service analysis. Wholesale water rates will be based on costs of providing the service. Cost of developing the initial Cost of Service Study and Rate Study will be included within the project costs.

## IX. ADJUSTMENTS TO THE SERVICE CHARGES

Adjustments to the service charges will be made in accordance with Section 4. H. of the JOA.

## X. PROJECT COORDINATION

A. For purposes of this IA3, each Participant identifies its authorized representative as the "Mayor" of Algona and as the "City Engineer" of Auburn.

B. The Participants shall meet as needed for project coordination.

C. The Participants shall be responsible for design, construction management, and commissioning of all facilities to be constructed in accordance with ownership of the facility. Responsibilities may be assigned otherwise by agreement of the Participants' authorized representatives.

## XI. LIMITATIONS ON AUBURN'S CAPACITY

A. It is acknowledged and agreed that in the event Auburn experiences any system failure or decreased capacity for any reason, the supply to Algona may be curtailed to an equal percentage of use as Auburn's curtailment is implemented. Such curtailment shall be imposed by Algona on Algona retail customers immediately and simultaneously as such curtailment is imposed by Auburn on Auburn retail customers.

B. It is the intent of Auburn to provide the water described in Paragraph V. E. whenever it is available subject to the limitations described in paragraph XI. A. Auburn shall use reasonable diligence and best efforts to provide immediate notice in the event it becomes aware that it may not be able to fulfill the requirements of paragraph V. E. for any reason.

C. Auburn possesses the short-term (approximately three (3) years) capacity to meet the storage requirements for Algona. Long-term storage requirements for Algona shall be met by Algona financial participation within the next increment of storage to be constructed by Auburn. Algona's minimum financial participation shall provide for construction of storage volume capacity of 180,000 gallons, inclusive of standby, equalization, and fire protection volume storage. Such 180,000 gallon capacity is in addition to Algona's existing 100,000 gallon reservoir storage in its westerly service area.

D. Algona's water supply needs above the 0.525 mgd average daily demand, and the 1.114 mgd maximum daily demand, both identified in paragraph V. E. will be dependent upon negotiation of an amendment to this IA3.

## XII. TERM OF DURATION OF AGREEMENT

This IA3 shall remain in full force unless terminated by mutual agreement of the Participants.

## XIII. AMENDMENTS

A. This IA3 may be amended only in writing by approval signed by the Participants.

B. The authorized representatives shall have authority to update Exhibits attached hereto. The Exhibits shall be updated and/or revised only upon written agreement signed by the Participants' authorized representatives. Updates must be ratified by each Participant's City Council.

## XIV. DISPUTE RESOLUTION

A. Should a dispute arise between the Participants regarding the technical aspects of the planning, design, construction, funding, or operation of the facilities contemplated under IA3, the authorized representatives of the Participants, as defined in paragraph X. A. herein, shall meet and select one person who, along with the authorized representatives of the Participants, will form a dispute resolution panel to resolve the dispute. Should the dispute resolution panel not be able to reach a mutually satisfactory resolution, the dispute will be resolved as described below.

B. Legal disputes between the Participants to IA3 not resolved in accordance with paragraph XIV. A., shall be resolved through the use of mediation by a mediator mutually acceptable to the Participants with each Participant agreeing to equally share the cost of the mediator. Should the Participants not be able to satisfactorily resolve the dispute through mediation, the forum for resolution shall be King County Superior Court. The substantially prevailing party will be entitled to attorney fees and costs.

## XV. HOLD HARMLESS

Each Participant agrees to indemnify and hold harmless the other Participant from and against any loss, cost, damage, or expense of any kind and nature arising out of injury to person or damage to property in any manner caused by the negligent act or omission of the indemnified individual Participant in the performance of its work pursuant to or in connection with this IA3.

## XVI. SEVERABILITY

If any provision of this IA3 is invalid or unenforceable the remaining provisions shall remain in force and effect.

IN WITNESS WHEREOF, the Participants hereto have caused this IA3 to be executed by their proper Officers on the date shown below.

City of Auburn

By: Charles A. Booth

Its: Mayor

Date: 8/19/96

Attest by: Robin Wohlhueter

Approved as to Form by:

City of Algona

By: Glen Dickson

Its: mayor

Date: 8/20/96

Attest by:

Approved as to Form by: George S. Kelley

*Exhibit A*
*Facilities Layout Plan*
to
**Interlocal Agreement 3**
for
**Algona Intertie Project**
**(continued)**

**Update Approval**

1. Auburn: ______________________________, Dated: ______________

   Algona: ______________________________, Dated: ______________

2. Auburn: ______________________________, Dated: ______________

   Algona: ______________________________, Dated: ______________

3. Auburn: ______________________________, Dated: ______________

   Algona: ______________________________, Dated: ______________

*Exhibit B*
*Facility Ownership, Capacity Rights, Operation, Maintenance, and Renewal and Replacement Responsibilities*
to
**Interlocal Agreement 3**
for
**Algona Intertie Project**

| Facility | Location | Facility Ownership | Capacity Rights | Operation, Maintenance, & Renewal/Replacement Responsibility |
|---|---|---|---|---|
| Meter Station 1, existing for Boeing | 200' easterly of the Intersection of 1st Avenue North and Perimeter Road | Auburn | 100% Algona | Auburn |
| Meter Station 2, immediate installation | Intersection of Milwaukee Avenue and Boundary Boulevard | Auburn | 100% Algona | Auburn |
| Meter Station 3, immediate installation | Intersection of Industry Drive North and Boundary Boulevard | Auburn | 100% Algona | Auburn |
| Meter Station 4 future installation | Presently unknown, but probably near intersection of West Valley Highway and Boundary Boulevard extended | Auburn | 100% Algona | Auburn |
| Meter Station 5 future installation | Presently unknown, but probably near intersection of UP RR and 1st Avenue North | Auburn | 100% Algona | Auburn |
| Algona Well, existing | +/-150' northwesterly of intersection of Washington Boulevard and 3rd Ave South | Auburn | 100% Auburn | Auburn |
| Future Lakeland Hills Reservoir #2 | Lakeland Hills, Pierce County | Auburn | 10.5% Algona; remainder Auburn | Auburn |
| Supply (Qi) | Well #6, City Park<br>Well #7, Unknown | Auburn | 11.14% Algona; remainder Auburn | Auburn |

**Update Approval**

1. Auburn: ______________________________, Dated: ______________

   Algona: ______________________________, Dated: ______________

2. Auburn: ______________________________, Dated: ______________

   Algona: ______________________________, Dated: ______________

*Exhibit C*
*Project Criteria*
to
**Interlocal Agreement 3**
for
**Algona Intertie Project**

Project Criteria:

- Meter Stations to be sized on flow volume criteria as opposed to line size.
- Maximum (Qi) daily demand flow is 1.114 million gallons per day for total of all meter stations supply to Algona, except in case of fire or emergency.
- Maximum annual (Qa) average daily demand flow is 0.525 million gallons per day for total of all meter stations supply to Algona.
- Each meter station shall be calibrated annually for the first three years of operations, and thereafter at the discretion of Auburn.
- Reservoir capacity for Algona is 180,000 gallons of the estimated 1.7 mg total capacity in the proposed Lakeland Hills Reservoir 2.
- Total of all meter stations supply to Algona necessary for peak hourly flow and fire flow shall be determined by Algona, and such data provided to Auburn for meter station design.

**Update Approval**

1. Auburn: ________________________________, Dated: ________________

   Algona: ________________________________, Dated: ________________

2. Auburn: ________________________________, Dated: ________________

   Algona: ________________________________, Dated: ________________

# *Exhibit D*
## *Project Cost Estimate*
to
Interlocal Agreement #3
for
Algona Intertie Project

| Description | Total Est. Cost | Auburn Cost Percent | Auburn Cost Cost | Algona Cost Percent | Algona Cost Cost | Algona Cost by Year 1996 | 1997 | 1998 | 1999 | Future |
|---|---|---|---|---|---|---|---|---|---|---|
| METER STATION | | | | | | | | | | |
| 2-Inch Meter Station at Boeing | Existing | | N/A | | N/A | | | | | |
| 8-Inch Turbine Meter Station at Industry Drive | $18,000 | 0.0% | $0 | 100% | $18,000 | $18,000 | | | | |
| 8-Inch Turbine Meter Station at Miwaukee | $18,000 | 0.0% | $0 | 100% | $18,000 | $18,000 | | | | |
| 8-Inch Turbine Meter Station (Future) | $20,000 | 0.0% | $0 | 100% | $20,000 | | | $20,000 | | |
| 8-Inch Turbine Meter Station (Future) | $22,000 | 0.0% | $0 | 100% | $22,000 | | | | | $22,000 |
| PUMP STATIONS SUBTOTAL | $78,000 | | $0 | | $78,000 | $36,000 | $0 | $20,000 | $0 | $22,000 |
| STORAGE FACILITY | | | | | | | | | | |
| Lakeland Hills Rerservoir #2 (Note 1) (equalization storage) | $1,020,000 | 89.5% | $912,900 | 10.5% | $107,100 | | | $107,100 | | |
| Fire storage of 480,000 gallons is existing within valley reservoirs | $0.00 | 100.0% | $0 | 0.0% | $0 | | | $0 | | |
| Standby storage is not required in valley zone (multiple sources) | $0.00 | 100.0% | $0 | 0.0% | $0 | | | $0 | | |
| STORAGE FACILITY SUBTOTAL | $1,020,000 | | $912,900 | | $107,100 | $0 | $0 | $107,100 | $0 | $0 |
| SUPPLY FACILITY | | | | | | | | | | |
| Portion of Well #6 and Well #7 (Note 2) | $1,250,000 | 93.7% | $1,170,812 | 6.3% | $79,188 | | $79,188 | | | |
| SUPPLY FACILITY SUBTOTAL | $1,250,000 | | $1,170,812 | | $79,188 | $0 | $79,188 | $0 | $0 | $0 |
| TOTAL ESTIMATED CONSTRUCTION COST | $2,348,000 | 88.7% | $2,083,712 | 11.3% | $264,288 | $36,000 | $79,188 | $127,100 | $0 | $22,000 |
| PRELIMINARY PROJECT COSTS | | | | | | | | | | |
| Algona Well and Water Rights Conveyance | $5,000 | 100.0% | $5,000 | 0.0% | $0 | $0 | | | | |
| Algona Water Rights Value | in cost transfer | 100.0% | $30,000 | -100.0% | ($30,000) | ($30,000) | | | | |
| Wellhead protection zone easement | $2,000 | 100.0% | $2,000 | 0.0% | $0 | $0 | | | | |
| Development of Joint Operating Agreement - SKCRWA | $5,800 | 0.0% | $0 | 100.0% | $5,800 | $5,800 | | | | |
| Cost of Service Study / Rate Study | $1,627 | 0.0% | $0 | 100.0% | $1,627 | $1,627 | | | | |
| PRELIMINARY PROJECT COSTS SUBTOTAL | $14,427 | | $37,000 | | ($22,573) | ($22,573) | $0 | $0 | $0 | $0 |
| ALLIED COST | | | | | | | | | | |
| Contingency (10.0%) | $234,800 | 88.7% | $208,371 | 11.3% | $26,429 | $3,600 | $7,919 | $12,710 | | $2,200 |
| State Sales Tax (8.2%) | $192,536 | 88.7% | $170,864 | 11.3% | $21,672 | $2,952 | $6,493 | $10,422 | | $1,804 |
| Engineering Design (6.5%) | $152,620 | 88.7% | $135,441 | 11.3% | $17,179 | $2,340 | $5,147 | $8,262 | | $1,430 |
| Construction Engineering (7.5%) | $176,100 | 88.7% | $156,278 | 11.3% | $19,822 | $2,700 | $5,939 | $9,533 | | $1,650 |
| Legal (1.0%) | $23,480 | 88.7% | $20,837 | 11.3% | $2,643 | $360 | $792 | $1,271 | | $220 |
| Fiscal (1.0%) | $23,400 | 88.7% | $20,837 | 11.3% | $2,643 | $360 | $792 | $1,271 | | $220 |
| Administration (2.0%) | $46,960 | 88.7% | $41,674 | 11.3% | $5,286 | $720 | $1,584 | $2,542 | | $440 |
| Permits, Agency Approvals (2.0%) | $46,960 | 88.7% | $41,674 | 11.3% | $5,286 | $720 | $1,584 | $2,542 | | $440 |
| Engineering Surveys (2.5%) | $58,700 | 88.7% | $52,093 | 11.3% | $6,607 | $900 | $1,980 | $3,178 | | $550 |
| Land/ROW (2.3%) | $54,004 | 88.7% | $47,925 | 11.3% | $6,079 | $828 | $1,821 | $2,923 | | $506 |
| TOTAL ALLIED COST (43.0%) | $1,009,640 | | $895,996 | | $113,644 | $15,480 | $34,051 | $54,653 | $0 | $9,460 |
| TOTAL PROJECT COST | $3,372,067 | | $3,016,708 | | $355,359 | $28,907 | $113,239 | $181,753 | $0 | $31,460 |

Note 1: Algona will share in Lakeland Hill Reservoir #2 for 178,500 gallons of the estimated total of 1.7 mg.
Note 2: Algona will share in Well #6 & 7 development for 633,504 gallons of the estimated total of 10.0 mgd.

Exhibit "A" - Resolution No. 2770
City of Auburn - August 19, 1996

EXDDAL.XLS

8/13/96

*Exhibit D*
*Project Cost Estimate*
to
**Interlocal Agreement 3**
for
**Algona Intertie Project**
**(continued)**

**Update Approval**

1. Auburn: ______________________________, Dated: ______________

   Algona: ______________________________, Dated: ______________

2. Auburn: ______________________________, Dated: ______________

   Algona: ______________________________, Dated: ______________

3. Auburn: ______________________________, Dated: ______________

   Algona: ______________________________, Dated: ______________

*Exhibit E - Project Schedule*
to
**Interlocal Agreement 3**
for
**Algona Intertie Project**

| Activity | Date |
|---|---|
| Execute Interlocal Agreement | 19 August 1996 |
| Complete Meter Stations design for initial two stations | 15 September 1996 |
| Algona to provide wellhead protection zone easement, well conveyance, water rights conveyance, all to Auburn | 30 September 1996 |
| Award construction contract | 10 October 1996 |
| Complete construction of Master Meter Stations | 15 November 1996 |
| Conveyance formal completion of well, easement, and water rights | 31 October 1996 |
| Final Master Meter Stations and Conveyance project cost accounting | 15 December 1996 |
| Balancing Payment of immediate actions | 31 January 1997 |
| Algona to provide $100,000 deposit to Auburn | 30 June 1997 |
| Algona to provide $150,000 deposit to Auburn | 30 September 1998 |
| Final Project cost accounting | 1 November 1999 |
| Final Balancing Payment of IA3 | 31 December 1999 |

**Update Approval**

1. Auburn: ______________________________, Dated: ______________

   Algona: ______________________________, Dated: ______________

2. Auburn: ______________________________, Dated: ______________

   Algona: ______________________________, Dated: ______________

EXHIBIT F. **Algona Well Facility and Water Right Conveyance**

## WARRANTY DEED

The GRANTOR, THE CITY OF ALGONA, on this __ day of ___________, 1996, for and in consideration of the sum of $1.00, receipt of which is hereby acknowledged, and for benefits to be derived by the GRANTOR herein, hereby conveys and warrants to the CITY OF AUBURN, GRANTEE, the following well facility and any and all water right(s) (i.e., permit(s) and/or certificate(s)) situated in the County of King, State of Washington:

**Well Facility.** The well, piping, and appurtenances generally consist of 10 inch casing to approximately 65 feet below ground surface.

**Ground Water Right(s) (i.e., permit(s) and/or certificate(s)).** The Ground Water Right is to provide water on a continuous basis for municipal purposes pursuant to RCW 90.03.290. Further, this water right is to provide an instantaneous rate of withdrawal (Qi) of 500 gpm, and an annual quantity/rate of withdrawal (Qa) of 175 acre feet per year. As a water right applied to municipal purposes, the instantaneous (Qi) and annual (Qa) amounts authorized for withdrawal within the right(s) is not subject to relinquishment pursuant to RCW 90.14.140(2)(d).

Dated this ___day of ___________, 1996.

_______________________________
GRANTOR - CITY OF ALGONA

STATE OF WASHINGTON )
) ss
COUNTY OF KING )

On this _____day of ___________, 1996, before me, the undersigned, a Notary Public in and for the State of Washington, duly commissioned and sworn, personally appeared Glenn Wilson, to me known as the Mayor, for the City of Algona, the municipal jurisdiction that executed the above and foregoing instrument and acknowledged that he signed the same as the legally authorized representative of the City of Algona as his free and voluntary act and deed, for the uses and purposes therein mentioned.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal on the date hereinabove set forth.

_______________________________
NOTARY PUBLIC in and for the STATE of WASHINGTON, residing at ________
My Commission expires ________.

*AFTER RECORDING, RETURN TO:*

City of Auburn
25 West Main Street
Auburn, WA 98001-4998
ATTN: City Clerk

**EXHIBIT G**

*Well and Ingress / Egress Easement*

For and in consideration of the sum of one dollar ($1.00) and other good and valuable consideration, receipt of which is hereby acknowledged, and for benefits to be derived by the Grantor herein, Grantor, City of Algona, a Municipal Corporation of the State of Washington, hereby conveys and warrants to the City of Auburn, Grantee herein, a Municipal Corporation of the State of Washington, its successors and assigns, a perpetual Nonexclusive Easement under, over, through and across the following described real property for the purpose of laying, maintaining, and/or installing groundwater well facilities and appurtenances thereof, said real property being described as follows:

> Well and Protection Zone. A circle of land consisting of a 100 foot radius, centered on and surrounding the existing well facilities located on Lots 25-30 inclusive, Block 4, Woods Algona Addition, Division 1, according to the Plat thereof, as recorded in Volume 19 of Plats, page 36, in the records of King County, Washington.

**Said Grantee** shall have the absolute right, at times as may be necessary, for immediate ingress / egress over the regularly traveled portion of said Lots 25-30 inclusive, Block 4, for the purpose of maintenance, inspection, construction, operation, repair or reconstruction of the well facilities without incurring any legal obligation or liability therefore.

**Said Grantor** shall not in any way block, restrict or impede access and ingress / egress to or from said Easement, and/or in any way block, restrict or impede full use of the real property within the above-described Easement by said Grantee for the above-described purposes. Said Grantor may fence across said Easement and/or along the boundaries of said Easement provided that a gate is constructed in said fence. Said gate shall be of sufficient length and location to allow the Grantee full use of, and access and ingress / egress to and from the real property within the above-described Easement. If said gate is to be locked, keys shall be provided to the Grantee.

This Easement shall be a covenant running with the above-described real property and burden said real estate, and shall be binding on the successors, heirs and assigns of all parties hereto.

IN WITNESS WHEREOF, said corporation has caused this instrument to be executed by its property officers this _____ day of ____________________, 1996.

______________________________
GRANTOR

BY______________________________
GLENN WILSON, MAYOR

BY______________________________
, CITY CLERK

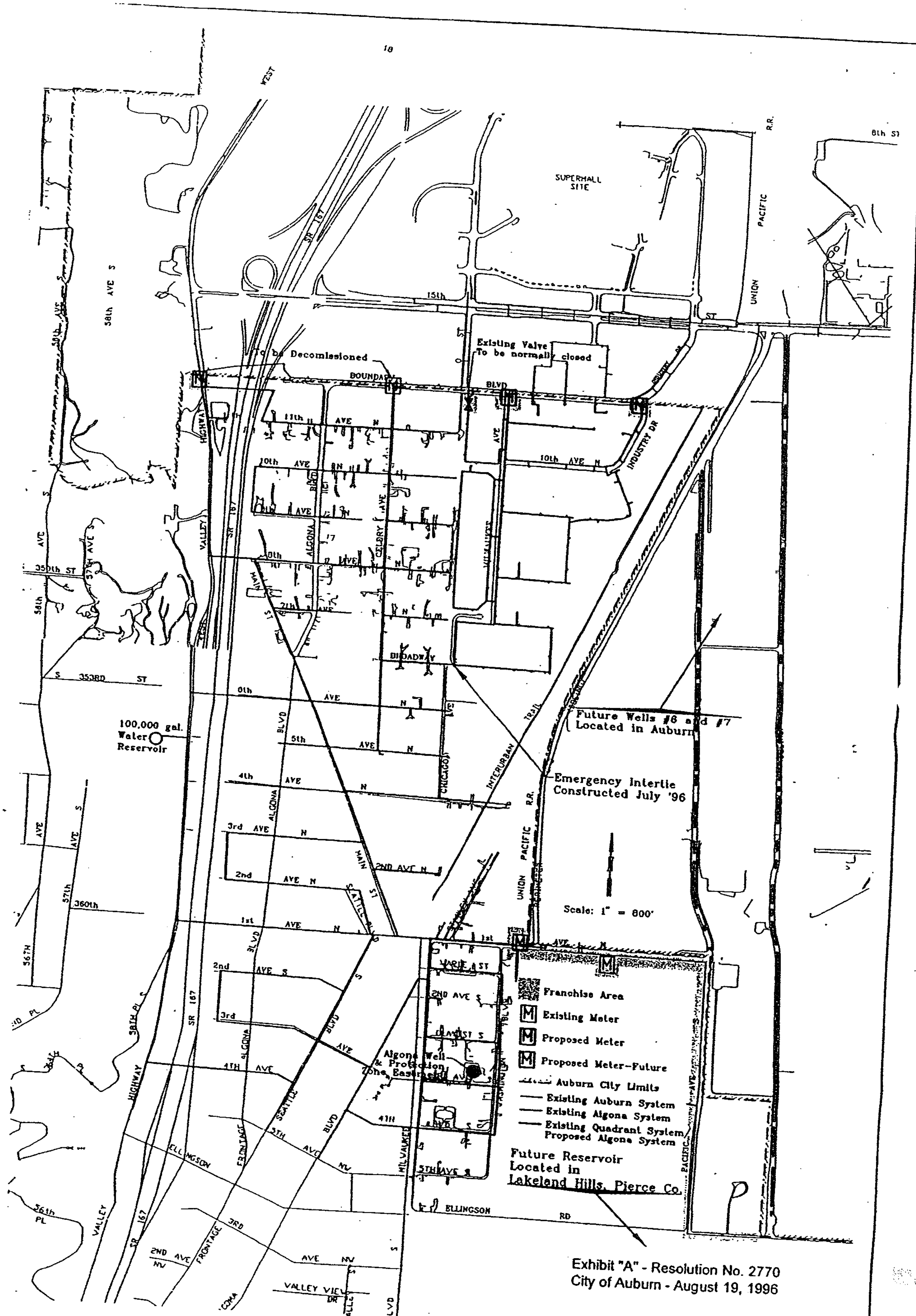


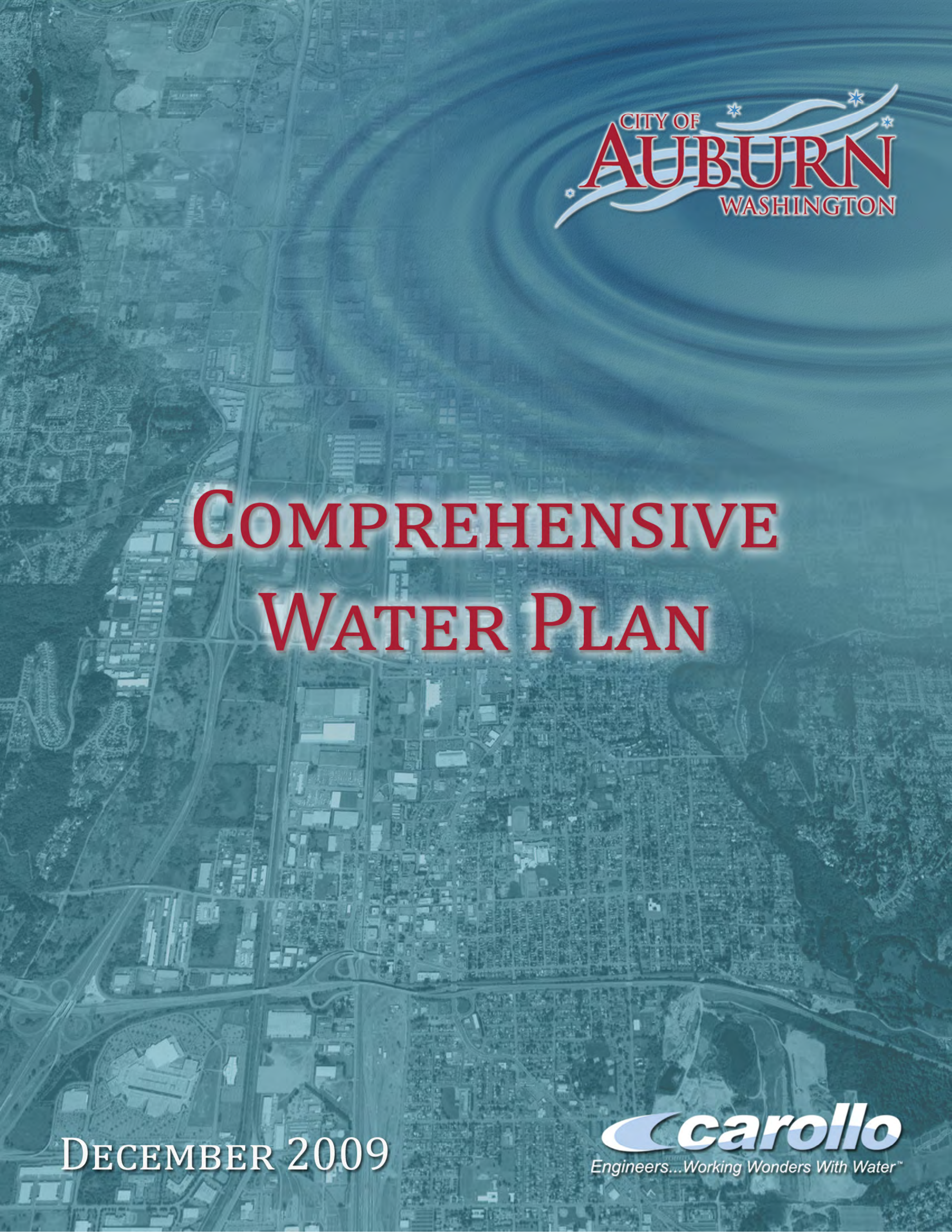

Exhibit "A" - Resolution No. 2770
City of Auburn - August 19, 1996

EXHIBIT A — FACILITIES LAYOUT PLAN
IA #3
ALGONA INTERTIE PROJECT

# APPENDIX C

# EXCERPTS FROM 2009 CITY OF AUBURN WATER SYSTEM PLAN

# AUBURN WELLHEAD PROTECTION PLAN



CITY OF AUBURN WASHINGTON

# COMPREHENSIVE WATER PLAN

DECEMBER 2009

carollo

Engineers...Working Wonders With Water™

# City of Auburn

## COMPREHENSIVE WATER PLAN

**December 2009**

Engineers...Working Wonders With Water™

1218 THIRD AVENUE • SUITE 1600 • SEATTLE, WASHINGTON 98101-3032 • (206) 684-6532 • FAX (206) 903-0419

CERTIFICATION

This Comprehensive Water Plan for the City of Auburn, 2009, was prepared in accordance with WAC 246-290-100, under the direction of the following Registered Professional Engineer:

DENNIS RAYBURN DOWDY
STATE OF WASHINGTON
30386
REGISTERED
PROFESSIONAL ENGINEER

12/1/2009
Dennis Rayburn Dowdy

## 2.4 ADJACENT WATER PURVEYORS

Several other water purveyors adjoin the City of Auburn RWSA. These include the cities of Algona, Bonney Lake, Kent, City of Pacific (Pacific) and City of Sumner (Sumner). Also included are the CWD, the LUD, WD#111, Highline Water District and the Muckleshoot Indian Tribe (MIT) Utility. Adjacent purveyors are shown on Figure 2.2 and described in the following paragraphs. Interties with these adjacent purveyors are discussed later in this Chapter.

### 2.4.1 City of Algona

Algona is located at the southwest corner of the City of Auburn’s RWSA. Until 1996, Algona provided water from a shallow well located at the intersection of 3rd Avenue South and Washington Boulevard. In 1996, the well failed and Algona entered into a water supply agreement with the City of Auburn (IA3, dated August 1996). The City of Algona and the City of Auburn superseded this agreement with a new agreement (IA3A October 2002) to reflect current status and update information and exhibits. The agreement calls for five meter stations between the two systems, a future reservoir in Lakeland Hills which will provide water to Algona, and Well 6 and Well 7 which also will provide water to Algona. Currently Algona is served through the metered Boeing Welded Duct Intertie (located west of Pacific Avenue off Ist Avenue) and by two intertie meter stations located at Boundary Boulevard and Industry Drive North and at Boundary Boulevard and Milwaukee Avenue. Both new stations include 8-inch meters. Algona serves a population of about 2,900 and maintains a hydraulic grade line of 245 feet. Algona's water right for the failed well was transferred to the City of Auburn as a provision of the interlocal agreement.

### 2.4.2 City of Bonney Lake

Bonney Lake is located south and east of the City of Auburn RWSA in Pierce County. Bonney Lake serves a population of about 30,500 through a combination of two well fields and two spring sources. The Bonney Lake water system operates over a total of 8 pressure zones with its 748-foot hydraulic grade line pressure zone adjacent to the City of Auburn RWSA.

In 1998, the City of Auburn and Bonney Lake entered into an agreement allowing Bonney Lake to provide interim water service to a portion of the City of Auburn’s PAA in Pierce County for a period of at least seven years after annexation by Auburn. At the end of the seven years, the City of Auburn has the option to serve the customers within the annexation area. Currently, Bonney Lake provides water service to approximately 1,773 City of Auburn customers.

Hazelwood Heights
30224 – 108th Avenue SE
Auburn, WA 98092

South Auburn Water Association
208 – 31st Street SE
Auburn, WA 98002

Logandale Water Association
6430 S 287th Street
Kent, WA 98032

## 2.6 INTERTIES

Under interlocal agreements water utilities use interties to move water between adjacent systems to meet supply needs, to increase reliability and to respond to emergencies. Cities water system interties are described in the sections that follow. The City has separated its interties into three groups: wholesale interties, emergency interties, and potential future interties. The Cities' interties are shown on Figure 2.3. The City's interlocal agreements are provided in Appendix E.

### 2.6.1 Wholesale Interties

The City of Auburn maintains wholesale supply interties with three adjacent water systems: Algona, CWD, and WD#111. The City of Auburn also has a supply contract with the Muckleshoot Indian Tribe and the Indian Health Service, dating from 1972, for services along a pipeline at 368th Street SE extending from the City Limits into the reservation.

### 2.6.2 City of Algona

The City of Auburn has supplied water to Algona on a regular basis since 1996. In 1996, Algona's well failed and Algona negotiated an interlocal agreement with the City of Auburn, IA3, to purchase specific quantities of water. A superseded agreement, IA3A October 2002, reflects the current status and updates information and exhibits. Currently, Algona is served through the metered Boeing Welded Duct intertie (located west of Pacific Avenue off Ist Avenue) and by two 8-inch intertie meter stations located at Boundary Boulevard and Industry Drive North and at Boundary Boulevard and Milwaukee Avenue. The agreement anticipates 0.491 mgd average and 1.029 mgd peak by 2009 and 0.525 mgd average and 1.114 mgd peak by 2014. In the event that the City of Auburn experiences any failure or decreased capacity, the supply of water to the Algona may be decreased by the same percentage that is experienced by the City of Auburn.

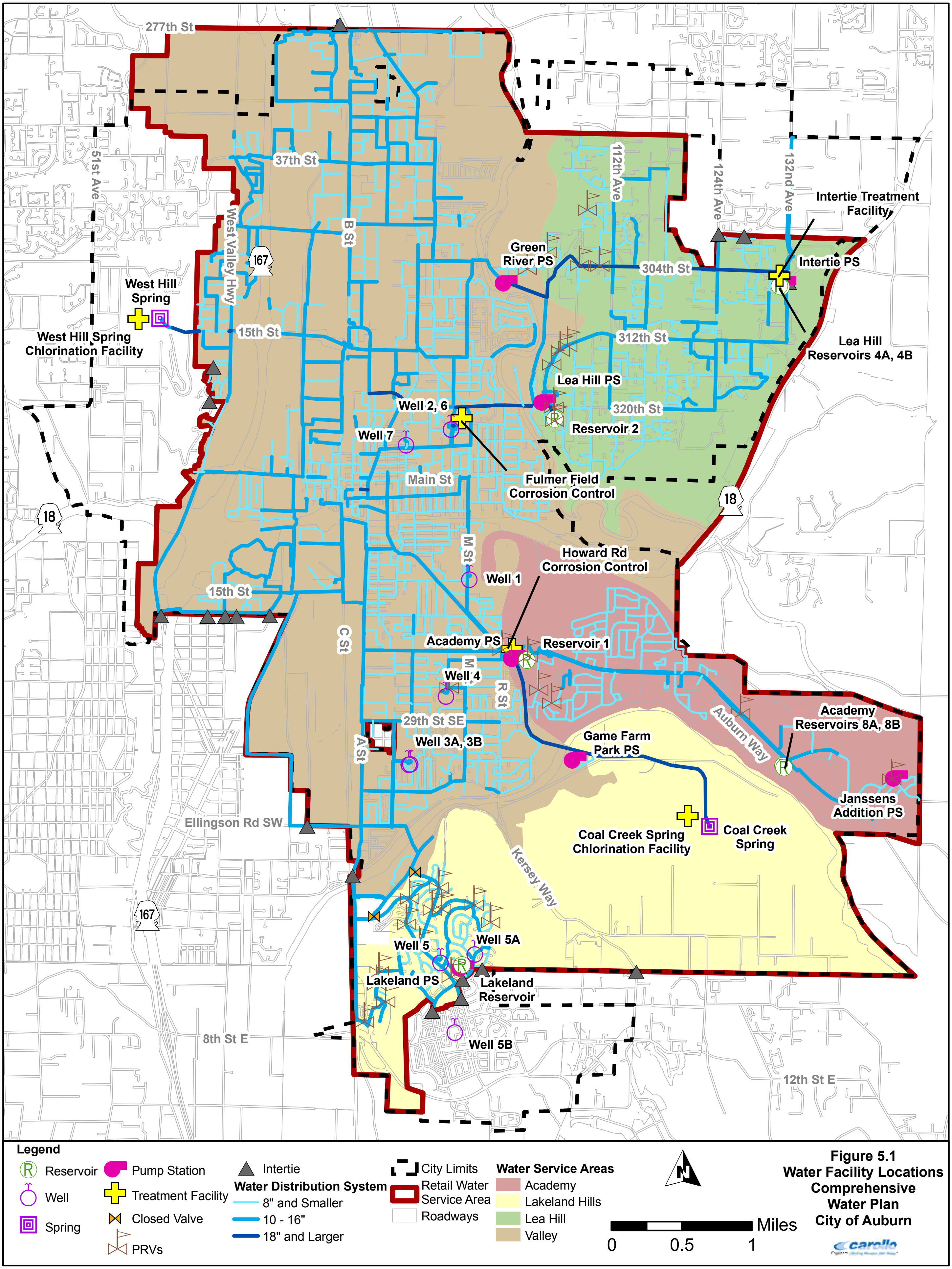



**Figure 5.1**
**Water Facility Locations**
**Comprehensive Water Plan**
**City of Auburn**

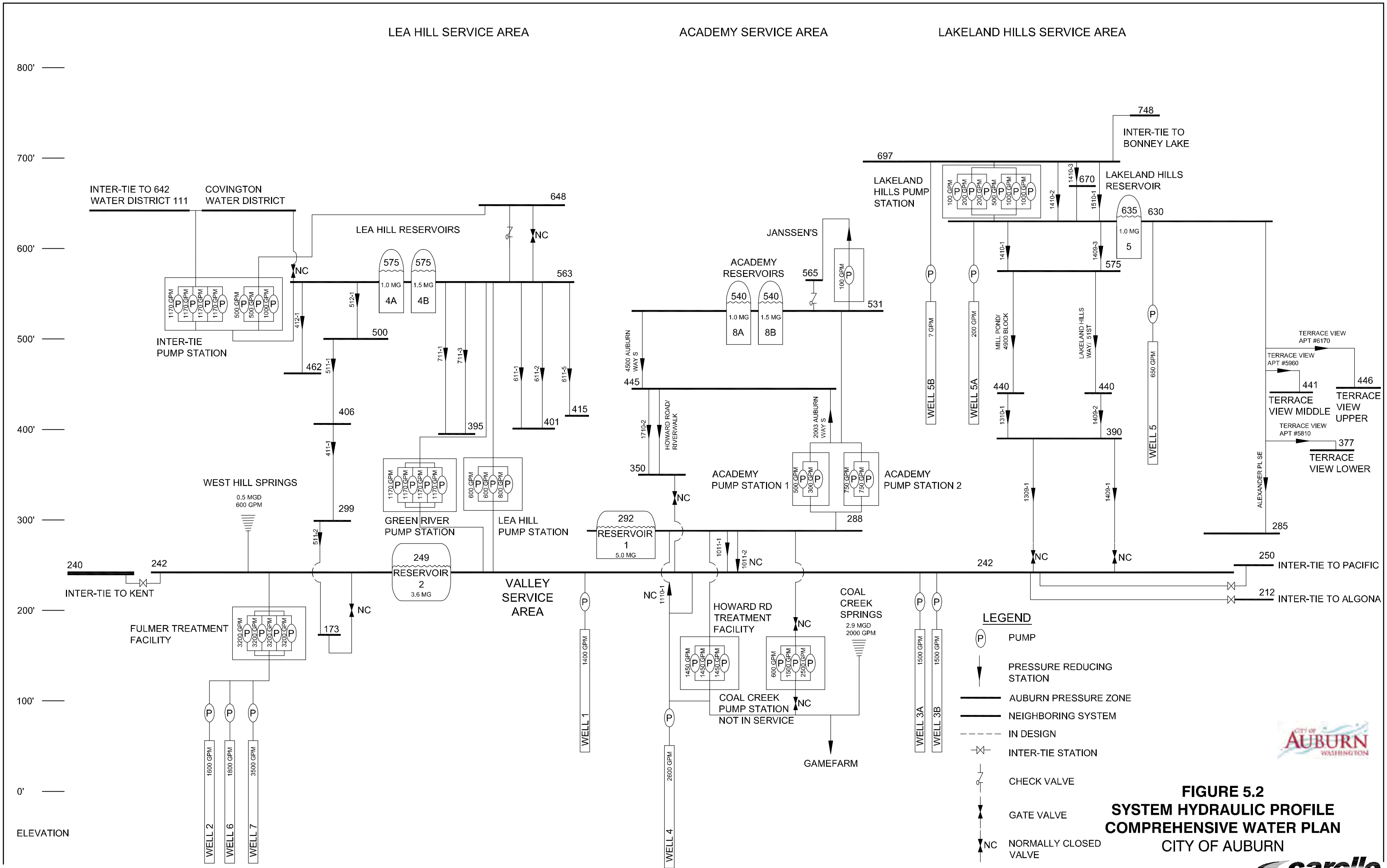



**FIGURE 5.2**
**SYSTEM HYDRAULIC PROFILE**
**COMPREHENSIVE WATER PLAN**
CITY OF AUBURN

C:\pw_working\projectwise\jsmith\dms38348\Figure 5.2 Hydraulic Profile 7-23-09 07:44am JSmith XREFS: AuburnBusinessLogo_Color_sm;

Last Saved By: TAS 7-23-09 07:44am

### 5.3.2 PRV System Analysis

#### 5.3.2.1 <u>Valley Service Area</u>

Pressure-reducing valves in the Valley Service Area provide adequate pressure distribution and no modifications are recommended at this time.

#### 5.3.2.2 <u>Lea Hill Service Area</u>

Three PRVs in the Lea Hill Service Area are recommended for upgrading or replacement to meet safety standards for ladder access and confined space entry, as their vaults are very small. These PRVs are located in the vicinity of SE 304th Street and 108th Avenue SE. A new 490 pressure zone and expanded booster zone may require additional PRVs when installed.

#### 5.3.2.3 <u>Academy Service Area</u>

In the Academy Service Area, the small PRV from the 531 zone to the 445 zone could be adjusted to a slightly lower pressure in the northern section of the pressure zone. In addition to service improvements, the PRV on 35th Way SE in Janssen's Addition should be upgraded or replaced to meet safety standards for ladder access and confined space entry. This PRV is extremely small to access and is located in the middle of the street requiring traffic control in half of the roadway during maintenance.

#### 5.3.2.4 <u>Lakeland Hills Service Area</u>

As discussed in the Analysis of the Lakeland Hills Service Area, new pressure zones are recommended for the lower end of the 575 and 390 zones. The PRV at 51st and Lakeland Hills Way SE should be reduced to 60 psi. Valve 4299 should be opened and valve 5063 should be closed to move the customers at the lower end of Francis CT SE from the 575 to the 390 pressure zone. Similarly, valve 2167 on Mill Pond Loop SE should be opened and the valve at Mill pond Drive SE and 52 St SE should be closed to move all of Mill Pond Loop SE from the 575 to the 390 pressure zone.

Additionally, the existing 697 boosted zone should be slightly expanded. Valve 3554 at the north intersection of Elizabeth Ave SE and Elizabeth Loop SE should be closed, and valve 3556 in the middle of Elizabeth Loop SE should be opened to move all of the customers on Elizabeth Loop SE to the 697 boosted pressure zone.

## 5.4 WATER SUPPLY FACILITIES

The City of Auburn uses a combination of springs and wells to supply the system. The City's water supplies are summarized in Table 5.2. Each facility is described below. Further review of capacity of these sources is discussed in Chapter 6.

| Table 5.2 Existing Water Supply Facilities<br>Comprehensive Water Plan<br>City of Auburn | | |
|---|---|---|
| **Well / Spring** | **Capacity, gpm(1)** | **Date Constructed** |
| Coal Creek | 2,000 | 1964, 1998(2) |
| West Hill | 600 | 1960 |
| 1 | 0 | 1960 |
| 2 | 1,600 | 2000 |
| 3A | 0 | 1983 |
| 3B | 0 | 1984 |
| 4 | 2,600 | 1985 |
| 5 | 650 | 1983 |
| 5A | 180 | 1990 |
| 5B | 0 | 2005 |
| 6 | 1,800 | 2000 |
| 7 | 2,000 | 1997 |

Notes:
(1) Data provided by the City.
(2) Initial facility including the south and middle collectors were constructed in 1964 while the north collector was constructed in 1998.

## 5.4.1 Existing System

### 5.4.1.1 Coal Creek Springs

Coal Creek Springs is a primary water supply for the City due to its capacity and because it is more economical to operate than other sources. The spring's collection system is located at the base of the Lake Tapps Upland at an elevation of approximately 190 feet. The system includes approximately 2,300 feet of collector pipe. Much of the system, including the south and middle collectors, was constructed in 1964. The south collector includes about 138 feet of 24-inch perforated concrete pipe connected to seven, 10-foot long, 8-inch well-screen laterals extending from the perforated concrete collection pipe into the foothill. The middle collector includes about 980 feet of 8-inch to 15-inch perforated concrete pipe and is located about 100 feet northeast of the south collector. The south and middle collectors are approximately five feet below the ground surface.

A third collector, the north collector, was added in 1998 to enhance system performance and to provide increased reliability. The third collector is about 15 feet below the ground surface and is located approximately 150 feet to the northeast of the middle collector. The 24-inch north collector is about 1,100 feet long and is constructed of perforated PVC pipe. Currently, the flow from this collector is by gravity. A large manhole was installed in the line to provide for the possibility that a future pump station could increase the flow from the line.

Each of the collectors is connected to an overflow structure and is metered before connection to a 24-inch transmission line to the chlorination station. Currently, the overflow from each of the collectors flows into an overflow pond, which discharges into nearby Coal Creek. Water supplied from Coal Creek Springs is chlorinated as described in Section 5.8.

From the Coal Creek Springs headworks, water flows by gravity through a 24-inch concrete pipe to the Howard Road Facility where it is pumped into Reservoir 1. Between the Coal Creek Springs headworks and the Howard Road Facility is a single connection that supplies potable water to Game Farm Wilderness Park.

#### 5.4.1.2 West Hill Springs

West Hill Springs is located near the extension of 15th Street NW, at an elevation of 305 feet. Water continuously flows into collection boxes, which are then piped through a 10-inch, ductile-iron pipe that carries the supply to the West Hill Spring Chlorination Facility, where chlorine is continuously added. Water then flows by gravity into the Valley Service Area.

Although the use of West Hill Springs as a potable water supply dates from before 1907, most of the current facilities and equipment have been completed since 1960. The most recent improvements included replacement of the collection boxes, as recommended in the 1995 Comprehensive Water Plan and a partial fencing of the watershed as recommended by the 2000 Water Comprehensive Plan.

#### 5.4.1.3 Well 1

Well 1 is located on M Street SE near 12th Street SE. Constructed in 1960, the well includes a masonry building and is equipped with a three-stage, centrifugal, turbine pump with a capacity of 2,100 gpm, driven by a 150-HP motor. Although the building and pump are now nearly 50-years old, routine maintenance and replacements occurred as needed. The pump is normally controlled by the water level in Reservoir 2, but can be controlled by Reservoir 1 as well.

In 1998, the well output began to fall as a result of what appeared to be decreasing water levels. The pumping rate of the well was reduced from 2,100 gpm to 1,600 gpm. In the fall of 1998, the pump was removed from the well, and a video inspection of the well was completed. The video revealed no apparent problems with well construction. Subsequently, the pump was reinstalled; however water levels in the well continued to decline. The well was shut down. The cause of the water level decline in Well 1 is not yet known, and as a result, further investigations are planned. Replacement of the well may be needed to meet future water supply demands

Chlorination is not normally done at Well 1. However, piping and equipment are available to allow portable chlorination equipment to be installed if required. On-site emergency power generation is not provided at Well 1; however, the facility is equipped with a manual transfer switch that allows the City to use a mobile generator set to operate the system when necessary.

#### 5.4.1.4 Wells 2 & 6

Wells 2 and 6 are located on the extension of K Street NE near 5th Street NE at Fulmer Field, a City park. Well 2 and the Well 2 house were replaced in 2000 with a new masonry building and pumping equipment as part of the City's corrosion control strategy. The new facility houses a new 2-stage 2400-gpm pump powered by a 125-HP motor (Well 2) and a 3,500 gpm, two-stage, vertical-turbine pump driven by a 200-HP motor (Well 6). Under the City's corrosion control strategy, Well 2 and 6 pump to the Fulmer Field Corrosion Control Treatment Facility, an air-stripping tower, located near Wells 2 and 6.

Since, the Fulmer Field Corrosion Control Treatment Facility is required to re-pump the water from Wells 2 and 6 into the Valley Service Area and to Reservoir 2, Wells 2 and 6 are functional only with operation of the Fulmer Field Treatment Facility. Chlorination and emergency power for both Wells 2 and 6 are housed in the Fulmer Field Corrosion Control Facility.

#### 5.4.1.5 Wells 3A & 3B

Wells 3A and 3B are located on the same site, off 37th Street SE on the extension of E Street SE. The wells are about 50 feet apart and were constructed in 1983 and 1984, respectively. The wells pump into the Valley service area.

Each well is equipped with a four-stage, centrifugal pump driven by a 125-HP motor, each with a capacity of about 1,650 gpm when pumping individually. Each well is enclosed in a manufactured metal building. A standby generator capable of running one pump at a time is available on site. The system is equipped with an automatic transfer switch.

The chlorination facilities at Wells 3A and 3B have been removed. Currently, Wells 3A and Well 3B are not operated because they produce water that contains high concentrations of manganese and treatment facilities do not exist.

#### 5.4.1.6 Well 4

Well 4, located off 25th Street SE on the extension of K Street SE, was constructed in 1985. The well is equipped with a 2,800-gpm, four-stage, centrifugal, turbine pump driven by a 300-HP motor. The well and equipment are housed in a masonry building. Well 4 may pump directly to Reservoir 1 or into the valley distribution system through a PRV. Well 4 serves as a primary backup to the Coal Creek Springs supply and is an important supply to the south end of the City's distribution system. The well is normally controlled by the water level in Reservoir 1. Gaseous chlorination is provided at this well.

#### 5.4.1.7 Well 5

Well 5 is one of three City wells that were constructed to serve the Lakeland Hills Development within the City's Lakeland Hills Service Area. Well 5 is located off Lakeland Hills Way SE and James Avenue SE and pumps into the Lakeland Hills distribution system and the Lakeland Hills Reservoir. The well was constructed in 1983 by the Lakeland Hills developer. It is equipped with a seven-stage submersible turbine pump, driven by a 125-HP motor. Although the pump was selected to deliver 1,000 gpm, pumping at that rate results in a large water level drawdown. Currently, Well 5 has a maximum production capability of 650 gpm. The well and equipment are housed in a double-high concrete vault. Well 5 does not have the facilities to support an emergency power supply and is not chlorinated.

#### 5.4.1.8 Well 5A

Well 5A, the second well serving the Lakeland Hills Service Area, was constructed in 1990 to supplement Well 5. Well 5A, located in Lakeland Hills Park, also pumps into Lakeland Hills distribution system and the Lakeland Hills Reservoir. The well is equipped with a ten-stage submersible turbine pump, driven by a 60-HP motor. The pump has a capacity of 250 gpm. The Well 5A controls and ancillary equipment are located in a masonry building, which houses the park restrooms, about 100 feet from the well itself.

Well 5A is equipped with chlorination facilities. A manual transfer switch is provided to allow operation of Well 5A using a portable emergency generator. Since the Well 5A facilities are located in a public park, the facility is not secured.

#### 5.4.1.9 Well 5B

Well 5B was constructed in 2005 and consists of a 600 gpm pump. The pumped water then proceeds through 4 Altec media filters to remove iron and manganese prior to disinfection. The treated water is then re-boosted with three small booster pumps with a total capacity of 700 gpm and a firm capacity of 420 gpm. The boosted water is stored in a 27,000 gallon treated water storage tank. The Well 5B facility is equipped with a 500 kW generator that can power the facility if power were interrupted.

As soon as Well 5B came on line the City discovered that the aquifer was not recovering. Well 5B was operated intermittently in 2005 and 2006 but was not operated since 2006.

#### 5.4.1.10 Well 7

Well 7 is located at E Street NE and Park Avenue in a city park inside the Backyard Idea Garden. The well was constructed in 1997. The well is housed in a masonry building equipped with a 3,500-gpm variable-stage, vertical-turbine pump driven by a 500 HP motor.

Well 7 pumps directly to the Fulmer Field Corrosion Control Treatment Facility. The treated water is re-pumped into the valley distribution system and Reservoir 2. If necessary, Well 7 can pump untreated directly to the Valley distribution system. Well 7 has elevated levels of manganese and is only operated in the summer when additional capacity is needed.

#### 5.4.1.11 Braunwood Well

The Braunwood well serves a small satellite water system located south of the White River and east of Kersey Way. The City acquired the well in 1989. The well is located off 47th Street SE. The well is housed in a concrete block building with a wood roof and is equipped with a submersible 25-gpm pump, a hydro-pneumatic pressure system, and an emergency generator system that was added in 1998.

#### 5.4.1.12 Algona Well

In 1996, the City acquired title to Algona Well 1 as a condition of meeting Algona's water supply needs. Because of pump operational problems the Algona Well was taken off line. The 500-gpm pump and associated piping have been removed from the well house, the building is demolished, but the well casing is still standing.

### 5.4.2 Supply Facilities Analysis

Due to the decline in production of several supply facilities, the City will need to perform hydrogeologic investigations of the existing wells. An annual well inspection and redevelopment program is recommended. Additionally, several systems are in need of back-up power and improved chlorination facilities. The following provides a summary of noted deficiencies and recommendations for each source.

#### 5.4.2.1 Coal Creek Springs

In general, the Coal Creek Springs collection system facility is in good condition, however the City is planning some additional cross connection security improvements to enhance operation. Improvements include new watertight manhole lids for the middle collector and installation of a new 24-inch overflow pipe for the South Collector that will discharge at the chlorination station overflow rather than at the pond. The City has noted a drop in capacity of the Spring since the max day reading of 3,500 gpm in 2001.

#### 5.4.2.2 West Hill Springs

The West Hills Spring system is in good condition. However, the watershed surrounding the spring is not completely fenced and further security improvements are planned.

#### 5.4.2.3 Well 1

The City is planning further investigation of the production loss of Well 1. A potential solution for reestablishing well production would be to relocate and re-drill Well 1. The improvements could include re-drilling a replacement well to the production aquifer and construction of a new masonry building, production pump and associated piping. At this time the City should consider installation of a permanent chlorination facility with on-site generation or hypochlorite.

#### 5.4.2.4 Wells 2 & 6

The two well pumps at Wells 2 & 6 are relatively new and in good condition. By the end of the planning period, the pumps will be almost 30 years old. Once the pumps are 20 years old, it is recommended that the City test electrical and hydraulic systems of the motors every 5 years to ensure proper function.

The City is currently having problems with the Well 2 screens and impellers as they recently removed 2.5 yards of sand from the Well 2 clear well. The City believes that the aquifer is collapsing around the screen. Further investigation may be needed by the City's hydrogeological consultant to understand this problem. The City has noted a drop in production from Wells 2 and 6 since the max day reading of 2,400 gpm for Well 2 in 2003 and 3,500 gpm for Well 6 in 2002.

#### 5.4.2.5 Wells 3A & 3B

Recommended treatment improvements for these wells are discussed in Section 5.7. Both Wells 3A and 3B are in good condition. This site has the capacity for multiple service options including a continued use of the existing facility with treatment or a new facility and re-drilled wells.

#### 5.4.2.6 Well 4

Well 4 is not provided with an on-site engine-generator, nor is it equipped for operation from a portable engine-generator. The well should be modified to provide an on site generator system with an automatic transfer switch to allow operation of Well 4 during a power failure. Because the pump is currently 23 years old, testing the motor, electrical and hydraulics of the well pump is recommended to ensure adequate function. When the Well 4 facility is upgraded, evaluating alternative chlorination practices is recommended to improve safety, such as on-site generation or hypochlorite. The City has noted a slight drop in production from Well 4 since the max day reading of 2,800 gpm in 2003.

#### 5.4.2.7 Well 5

Well 5 design does not meet the standards of other City wells. Though it remains functional, moderate corrosion was evident on the mechanical parts within the well facility. Any modifications or enhancements would require a new well house. Upgrading Well 5 to meet City standards is recommended, including providing full back-up power and on-site chlorination. Further investigation will be needed to understand how these improvements can be incorporated onto the existing site. The City has noted a drop in production from Well 5 since the max day reading of 730 gpm in 2002. A hydrogeologic evaluation should be performed to evaluate the aquifer drawdown.

#### 5.4.2.8 Well 5A

The Well 5A facility is in good condition. Testing the motor, electrical and hydraulics of the well pump is recommended to ensure adequate function. Additionally, the City should evaluate alternatives to improve the security of the Well 5A site.

Well 5A production appears to have dropped since the max day reading of 240 gpm in 2002. Additionally, the City has noticed that the aquifer is not recharging quickly around October. Further investigation may be needed by the City's hydrogeological consultant to understand this problem within the Lakeland Hills service area.

#### 5.4.2.9 Well 5B

The Well 5B facility is in good condition. The City has noted problems making hypochlorite and has noticed leaks in their instrumentation panel. However, the larger issue is with the aquifer regeneneration. A hydrogeologic evaluation should be performed to evaluate the aquifer drawdown.

#### 5.4.2.10 Well 7

Recommended treatment improvements for these wells are discussed in Section 5.7. Aside from the high manganese issues, Well 7 is in good condition. However, backup power facilities should be considered.

#### 5.4.2.11 Algona Well

The City is evaluating how to best use this supply in the future.

## 5.5 PUMP STATIONS

The City of Auburn operates and maintains several pump stations to move water throughout the piping network and to provide water at the required service pressures. A summary of City booster pump stations is provided in Table 5.3, and locations are shown in Figure 5.1. As stated in Chapter 3, City pump stations are expected to meet the MDD with the largest pump out of service. The criteria also recommends an installed or portable generator. Table 5.3 also presents the firm pump station capacity assuming the largest pump is out of service.

### 5.5.1 Existing System

#### 5.5.1.1 Academy Pump Stations 1 and 2

The City maintains two pump stations that pump water from Reservoir 1 into the Academy Hill Pressure zone. Both of the Academy Pump Stations are located on the Reservoir 1 site.

The primary Academy Pump Station (Pump Station 2) was constructed in 1980 and houses Pumps 3 and 4. The station consists of a masonry block building, two can-type pumps, a

#### 5.5.2.7 Lakeland Hills Pump Station

The Lakeland Hills Booster Pump Station is generally in good condition and the site is secured. The impellers for the larger pumps (4 though 6) have been shaved down, decreasing the pump's capacity. It is probable that the nameplate was not replaced when the impellers were shaved. If this is true, conducting a pump test to confirm the capacity of these pumps is recommended. All the pumps except for one were installed in 1990 and will be 20 years old in 2010. At this time, the motors, electrical equipment and hydraulics for each of the pumps should be tested to ensure that they are functioning adequately.

The Lakeland Hills Booster Pump Station is in need of new larger pumps, a back-up generator, and an expanded building. The new pumps are required for providing redundancy during peak demands with fire flow. The current reliable capacity with one pump out of service is 1,500 gpm. The station could be upgraded with new pumps or replaced in a new location, pending further analysis by the City.

Additionally, the hydraulic model predicts that the Peak Hour Demand in the area will reach 550 gpm in the boosted zone in 2014, and over 700 gpm in 2028, exceeding the existing skid package capacity. It is recommended that the pump station be upgraded to both meet PHD with the skid pump package, and have fire flow availability.

## 5.6 STORAGE FACILITIES

The City of Auburn currently maintains a total of 14.7 million gallons (MG) of water storage in seven water reservoirs located throughout the service area. Storage is provided in each of the City's major service areas. Figure 5.1 provides the location of each of the City storage reservoirs. A summary of the City storage reservoirs is provided in Table 5.4.

### 5.6.1 Existing System

#### 5.6.1.1 Reservoir 1

Reservoir 1, located in the southeast end of the Valley Service Area, is the primary storage location for water from the City's Coal Creek Springs supply. Constructed in 1975, this reservoir is a covered, pre-stressed concrete tank with a capacity of 5 MG. The reservoir serves as the water supply for the Academy Pump Stations and serves the Valley Service Area through Control Valve 1. Reservoir 1 is 184.6 feet in diameter and has an overflow elevation of 292.5 feet. The main purpose of Reservoir 1 is to provide storage for the Valley Service Area; therefore, Control Valve 1 is essential to limit the flow from the reservoir into the zone while still maintaining the essential supply into the south end of the Valley Service Area. In addition to water pumped from the Howard Road Treatment Facility, Reservoir 1 can be filled by water from the City' s Well 4.

| Table 5.4 Existing Storage Facilities<br>Comprehensive Water Plan<br>City of Auburn | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Reservoir Name** | **Location** | **Service Area** | **Volume (MG)** | **Height (ft)** | **Volume per Foot** | **Overflow Elevation** | **Year Const** |
| Reservoir 1 | 2004 Auburn Way S. | Valley | 5.0 | 25 | 200,000 | 292.5 | 1975 |
| Reservoir 2 | 32115 105th Place S. | Valley | 3.6 | 29.72 | 120,100 | 249.2 | 1975 |
| Reservoir 8A | 5002 Auburn Way S. | Academy | 1.2 | 72 | 16,325 | 540.5 | 1973 |
| Reservoir 8B | 5002 Auburn Way S. | Academy | 1.5 | 72 | 21,125 | 540.5 | 1980 |
| Reservoir 4A | 30502 132nd Ave S. | Lea Hill | 1.0 | 77 | 12,425 | 575.5 | 1965 |
| Reservoir 4B | 30502 132nd Ave S. | Lea Hill | 1.4 | 77 | 19,750 | 575.5 | 1983 |
| Reservoir 5 | 1118 57th Place SE | Lakeland Hills | 1.0 | 60 | 19,650 | 635.0 | 1981 |
| **Total Storage Volume** | | | **14.7** | | | | |

#### 5.6.1.2 Reservoir 2

Reservoir 2, located on the northeast side of the Valley Service Area, also serves the Valley Service Area. Reservoir 2, a 3.6-MG, underground, pre-stressed concrete tank, has public tennis courts on the concrete roof. The reservoir, constructed in 1975, has a diameter of 143 feet and an overflow elevation of 249.17 feet. Reservoir 2 "floats" on the system servicing the Valley Service Area. Reservoir 2 is filled by water from West Hill Springs or any of the City's Valley well-field wells, and from Reservoir 1, through Control Valve 1.

#### 5.6.1.3 Academy Reservoirs 8A and 8B

Two steel standpipes located just off Auburn Way South provide storage for the Academy Service Area. The reservoirs are normally operated in parallel. The Academy Reservoirs have an overflow elevation of 540.0 feet. The smaller reservoir, Academy Reservoir 8A, has a diameter of 60 feet and a total storage volume of 1.2 MG and was constructed in 1973. Academy Reservoir 8B has a diameter of 52.9 feet and a total storage volume of 1.5 MG and was constructed in 1973. Water is pumped to the Academy Reservoirs from City Reservoir 1 by the Academy Pump Stations.

#### 5.6.1.4 Lea Hill Reservoirs 4A and 4B

Storage in the Lea Hill Service Area is provided in two steel standpipes located along 132nd Avenue SE in the northeast corner of the City Water Service Area. The reservoirs, designated Reservoir 4A and Reservoir 4B, have capacities of 1 MG and 1.4 MG respectively. Both reservoirs have overflow elevations of 575 feet. Reservoir 4A, constructed in 1965, has a diameter of 46 feet. Reservoir 4B, constructed in 1983, has a diameter of 56 feet. Water is supplied to the Lea Hill reservoirs from the City's Valley Pressure Zone through the Lea Hill Pump Station.

#### 5.6.1.5 Lakeland Hills Reservoir

A single reservoir, designated Reservoir 5, provides storage for the Lakeland Hills Service Area. Reservoir 5 is a 53.25-foot diameter steel standpipe, with a total volume of 1.0 MG and an overflow elevation of 635 feet. Constructed in 1981, Reservoir 5 is located near the top of the Lakeland Hills development. Wells 5 and 5A supply the reservoir.

### 5.6.2 Storage Requirements

The City of Auburn reservoir storage requirements are based on the water system configuration, seasonal and daily variation in water-use patterns, and the reliability of various water system components.

Water storage volumes are comprised of five categories including Operational Storage, Equalizing Storage, Emergency Storage, Fire Flow Storage, and Dead Storage. These components of storage are shown schematically in Figure 5.8. The five components of distribution-system reservoir storage are defined below.

#### 5.6.2.1 Operational Storage

Operational storage is the volume used on a day-to-day basis to supply the water system while the sources of supply are in the "off" position. This volume is dependant on the sensitivity of the water level sensors controlling the pumps and is designed to prevent excessive cycling of the pump motors. Operational storage volume of at least 2 to 3 feet is typically provided.

#### 5.6.2.2 Equalizing Storage

Equalizing storage volume is the total volume needed to satisfy the Peak Hourly Demand (PHD) that exceeds the capacity of the supply system. The State of Washington Administrative Code (WAC) 246-290-253 requires that Equalizing storage be provided to provide peak demands and WAC 246-290-230 (5) states:

> New public water systems or additions to existing systems shall be designed with the capacity to deliver the design PHD quantity of water at 30 psi (210 kPa) under PHD flow conditions measured at all existing and proposed service water meters or along property lines adjacent to mains if no meter exists, and under the condition where all equalizing storage has been depleted.

Equalizing volume requirements are greatest on the day of MDD and are typically calculated based on a percentage of the MDD. Equalizing requirements of 25 percent of MDD (see criteria in Chapter 3) are used to compute equalizing storage requirements.

The equalizing storage volume should be within the normal operating storage volume of the reservoir. The operating storage volume of a reservoir is the volume of water contained between the normal high water level and low operating water level for the reservoir.

#### 5.6.2.3 Emergency Storage

Emergency storage volumes are required to supply reasonable system demands during a system emergency, such as the disruption of the water supply. Disruptions could be caused by transmission pipeline or equipment failure, power outage, valve failure, or other system interruptions, as discussed in Chapter 3. The computation of emergency storage requirements includes consideration of reasonable system disruptions that can be expected to occur within normal planning contingencies as discussed previously. Other major system emergencies, such as those created by an earthquake, are covered under emergency system operation planning.

The Water System Design Manual (August 2001, DOH) suggests that emergency storage be equal to two days of ADD with the largest source out of service. Additionally, the Water System Design Manual (August 2001, DOH) recommends that, at a minimum, the emergency storage not be less than 200 gal/ERU.

In lieu of applying the DOH recommendations, Chapter 3 states that:

> The City should provide either sufficient water to meet two days of the maximum day demands with the largest supply facility or pump in each service area out of service or sufficient water to meet two days of MDD using only reliable sources and reliable pump stations in each service area. The emergency storage volume will be calculated as the more conservative of the two criteria.

The City feels that this criteria is more conservative than the DOH recommendation of providing two days of ADD with the largest source out of service and that this analysis will better account for the unique aspects of the City's water system than applying a constant 200 gal/ERU for the emergency storage volume.

#### 5.6.2.4 Fire Storage

Since a fire can occur at any time during the day, the fire storage is required by the WAC (246-290-235). The City of Auburn provides fire storage in addition to emergency storage described above. WAC 246-290-230 (6) states that:

> If fire flow is to be provided, the distribution system shall also provide MDD plus the required fire flow at a pressure of at least 20 psi (140 kPa) at all points throughout the distribution system, and under the condition where the designed volume of fire suppression and equalizing storage has been depleted.

Fire flow demand is the quantity of water required for fire fighting as defined by applicable water system criteria and fire codes. Fighting fires often places the largest demands on a water system because a high volume of water must be supplied over a short time. Such demands require each component of the system to operate at its optimal condition. Consequently, the Washington State Insurance Service Office (ISO) recommends that water systems be designed to convey fire flows during a period of MDD with one major facility out of service.

Fire flows required by existing structures vary within the water service area. The system-wide requirement is 1,500 gpm for two hours for single-family residential units, while 2,500 gpm is required for a duration of 3 hours for all non-residential units except City Parks and open areas. The current maximum fire demand for each major service area is shown in Table 5.5

**Table 5.5 Maximum Fire Flows**
**Comprehensive Water Plan**
**City of Auburn**

| Service Area | Flow gpm | Duration hours | Quantity mg | Location |
|---|---|---|---|---|
| Valley | 4,000 | 4 | 0.96 | Various |
| Academy | 4,000 | 4 | 0.96 | Adventist Academy |
| Lea Hill | 4,000 | 4 | 0.96 | Wesley Homes Sr. Housing (Main Lodge) |
| Lakeland Hills | 3,125 | 3 | 0.56 | Auburn Elementary School at Lakeland |

#### 5.6.2.5 Dead Storage Volume

Dead storage volume is the volume at the bottom of the storage tank that cannot be used because it is physically too low to be withdrawn from the tank or, if withdrawn from the tank, would result in distribution system water pressures below the acceptable criteria of 20 psi during a fire. Storage volume is considered dead if it is located below the outlet pipe and cannot be used because of system hydraulic limitations, or it cannot be used because of water quality problems associated with the volume in this lowest portion of the tank. The dead volume calculations for each reservoir are summarized in Table 5.6.

.

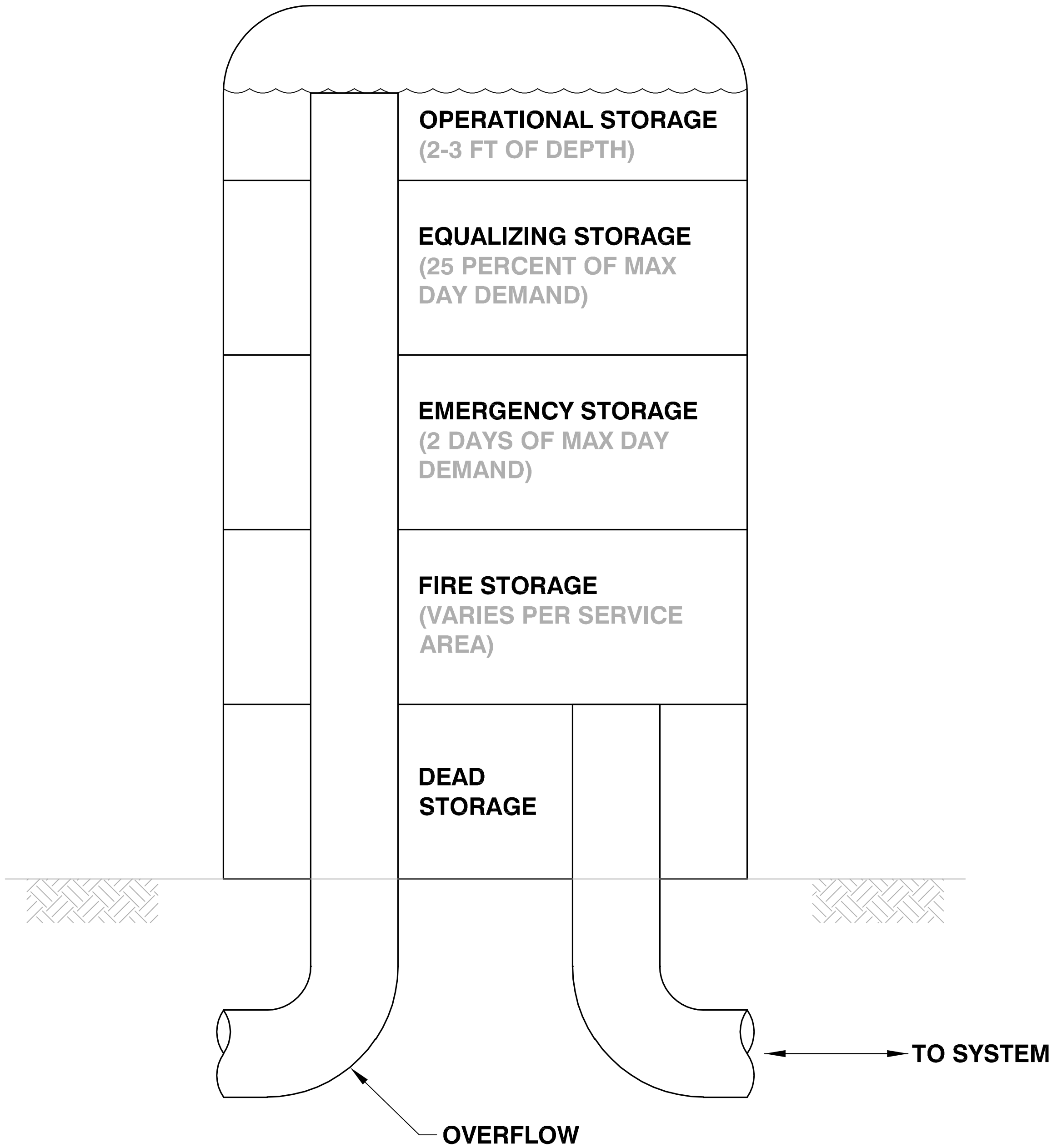



**FIGURE 5.8**
**STORAGE RESERVOIR COMPONENTS**
**COMPREHENSIVE WATER PLAN**
CITY OF AUBURN

carollo
Engineers...Working Wonders With Water ™

For the Lakeland Hill Reservoir 5, the pumps for the boosted zone can drain the reservoirs down to the elevation of the outlet. In the case of a fire, the high elevation houses, normally served by the reservoir, would be served by the boosted zone essentially eliminating the dead volume in these reservoirs. For the Lea Hill and Academy systems there are no PRVs connecting the boosted zones to the reservoir zones and thus the boosted zone cannot serve the reservoir zone during high flow events. However, the pumps serving the boosted zones can partially drain the dead volume, and thus the dead volume for the Lea Hill and Academy Reservoirs is actually slightly less than stated in Table 5.6. However, to be conservative, this reduction was ignored in this analysis.

**Table 5.6 Reservoir Dead Volume**
**Comprehensive Water Plan**
**City of Auburn**

| Reservoir | Base Elevation, ft | Maximum elevation within zone, ft | Required Tank Elevation(1), ft | Outlet Elevation, ft | Dead Volume, MG |
|---|---|---|---|---|---|
| Valley 1 | 267.50 | NA | NA | 268.50 | 0.20 |
| Valley 2 | 219.42 | 158.00 | 204.00 | 220.42 | 0.12 |
| Academy 8A + 8B | 468.00 | 444.00(2) | 490.00 | 468.00 | 0.83 |
| Lea Hill 4A + 4B | 498.00 | 468.00 | 514.00 | 499.00 | 0.50 |
| Lakeland 5 | 575.00 | 555.00 | 577.00(3) | 575.75(4) | 0.03 |

Notes:
(1) Assumes a minimum static pressure of 20 psi.
(2) Assumes fire flow delivered to the Janssen's Addition area.
(3) The boosted zone of Lakeland Hills can drain the tank down to the suction elevation of the booster pump (577.00 ft), thus providing fire flow service to elevated zones normally served by the reservoir.
(4) Installation of a planned mixing unit in the future will raise the outlet elevation.

### 5.6.3 Storage Analysis per Service Area

The four service areas were evaluated as separate systems to ensure each are provided with the required usable operational, equalizing, fire, and standby storage volumes. Required emergency storage for each service area is dependent on the supply to the service area. If a system has multiple supplies, storage criteria only require that the demands must be met while the largest supply is out-of-service. However, if a service area is served by a single supply, then demands must be met by storage until the supply can be returned to service. A description of the supply requirements used to evaluate each service area is described below.

#### 5.6.3.1 Valley Service Area

Storage for the Valley Service Area is contained within Reservoir 1 and 2, which have a combined available storage volume of 8.26 MG (8.58 MG less the total dead volume of 0.32 mg). Storage for the Valley Service Area must be sufficient to meet the demands within the service area as projected in Chapter 4. In addition, since the Academy and Lea Hill Service Areas are supplied from the Valley Service Area, the water available to offset the storage requirements for the Valley Service Area must be reduced by the MDD required by both Academy and Lea Hill as detailed in Table 5.7.

With the existing reliable sources and reservoirs, the Valley currently does not have sufficient storage. However, the service area will need 12.97 MG of additional storage by the year 2014, and 21.17 MG of additional storage by the year 2028. These storage needs can be met by a combination of rehabilitating Well 1 and Coal Creek Springs, adding backup power to Wells 4 and 7, constructing a new 2.0-MG Valley Reservoir, and purchasing additional water.

#### 5.6.3.2 Lea Hill Service Area

There is currently 1.89 MG of available storage provided in the two Lea Hill Reservoirs (2.39 MG total storage less 0.50 MG of dead volume). Storage for the Lea Hill Service Area must be sufficient to meet the demands for the service area, as projected in Chapter 4. The projected Lea Hill demands and storage requirements are shown in Table 5.8.

Based on the current available sources, the Lea Hill service area will run out of storage between the years 2008 and 2014, and by the year 2028 will need a total of 2.28 MG of storage. However, if backup power were to be added to the Green River Pump Station, no additional storage would be needed by the year 2028.

| **Table 5.7 Valley Storage Analysis (Existing) Comprehensive Water Plan City of Auburn** | | | |
|---|---|---|---|
| | **2008** | **2014** | **2028** |
| Projected MDD, mgd | 9.76 | 13.09 | 15.65 |
| Available Sources, mgd | | | |
| Coal Creek Springs | 2.88 | 2.88 | 2.88 |
| West Hill Springs | 0.86 | 0.86 | 0.86 |
| Well 1(1) | 0.00 | 0.00 | 0.00 |
| Well 2 | 2.30 | 2.30 | 2.30 |
| Well 3A | 0.00 | 0.00 | 0.00 |
| Well 3B | 0.00 | 0.00 | 0.00 |
| Well 4(1) | 3.74 | 3.74 | 3.74 |
| Well 6 | 2.59 | 2.59 | 2.59 |
| Well 7(1) | 2.88 | 2.88 | 2.88 |
| Total Source Capacity | 15.26 | 15.26 | 15.26 |
| Reliable Source Capacity(2) | 8.64 | 8.64 | 8.64 |
| Redundant Source Capacity(3) | 11.52 | 11.52 | 11.52 |
| **Controlling Source Capacity** | **8.64** | **8.64** | **8.64** |
| Offsite MDD, mgd | | | |
| Academy Service Area | 1.21 | 1.60 | 2.02 |
| Lea Hill Service Area | 1.87 | 2.13 | 2.93 |
| **Total Offsite Demands** | **3.08** | **3.73** | **4.95** |
| Total Available Redundant Source Capacity, mgd | 5.56 | 4.91 | 3.69 |
| Required Storage, MG | | | |
| Operational | 0.64 | 0.64 | 0.64 |
| Equalizing | 2.44 | 3.27 | 3.91 |
| Emergency | 8.40 | 16.36 | 23.92 |
| Fire flow | 0.96 | 0.96 | 0.96 |
| **Total Required Storage** | **12.44** | **21.23** | **29.43** |
| Existing Storage, MG | | | |
| Reservoir 1 | 4.80 | 4.80 | 4.80 |
| Reservoir 2 | 3.45 | 3.45 | 3.45 |
| **Total** | **8.26** | **8.26** | **8.26** |
| **Excess (Deficit) Existing Storage, mg** | **(4.18)** | **(12.97)** | **(21.17)** |

Notes:
(1) These wells do not have back-up power.
(2) Reliable capacity is reduced due to lack of back-up power to Wells 1, 4, and 7.
(3) Redundant capacity is capacity with largest source out of service (Well 4).

| Table 5.8 Lea Hill Storage Analysis (Existing)<br>Comprehensive Water Plan<br>City of Auburn | | | |
|---|---|---|---|
| | **2008** | **2014** | **2028** |
| Projected MDD, mgd | 1.87 | 2.13 | 2.93 |
| Available Sources, mgd | | | |
| Green River Pump Station(1) | 5.04 | 5.04 | 5.04 |
| Lea Hill Pump Station | 1.73 | 1.73 | 1.73 |
| **Firm Source Capacity** | **6.77** | **6.77** | **6.77** |
| **Reliable Source Capacity** | **1.73** | **1.73** | **1.73** |
| Required Storage, MG | | | |
| Operational | 0.06 | 0.08 | 0.08 |
| Equalizing | 0.47 | 0.53 | 0.73 |
| Emergency | 0.28 | 0.80 | 2.40 |
| Fire flow | 0.96 | 0.96 | 0.96 |
| **Total Required Storage** | **1.77** | **2.37** | **4.17** |
| Existing Storage, MG | | | |
| Reservoir 4A | 0.76 | 0.76 | 0.76 |
| Reservoir 4B | 1.13 | 1.13 | 1.13 |
| **Total** | **1.89** | **1.89** | **1.89** |
| **Excess (Deficit) Existing Storage, mg** | **0.12** | **(0.48)** | **(2.28)** |

Notes:
(1) The Green River Pump Station does not have back-up power, and is therefore not a reliable source.

#### 5.6.3.3 Academy Service Area

There is currently 1.89 MG of available storage provided in the two Academy Reservoirs (2.73 MG total storage less 0.84 MG of dead volume). Storage for the Academy Service Area must be sufficient to meet the demands for the service area as projected in Chapter 4. The projected Academy demands and storage requirements are shown in Table 5.9.

Based on the current available sources, the Academy service area will run out of storage between the years 2014 and 2028 and will need an additional 0.66 mg of storage by the year 2028. However, if the capacity of the Academy Pump Stations were increased, no additional storage would be required.

#### 5.6.3.4 Lakeland Hills Service Area

The Lakeland Hills Reservoir currently has 0.97 MG of available storage (1.0 MG total storage less 0.03 MG of dead storage).

| Table 5.9 Academy Storage Analysis (Existing) Comprehensive Water Plan City of Auburn | | | |
|---|---|---|---|
| | **2008** | **2014** | **2028** |
| Projected MDD, mgd | 1.21 | 1.60 | 2.02 |
| Available Sources, mgd | | | |
| Academy Pump Station 1 | 0.43 | 0.43 | 0.43 |
| Academy Pump Station 2 | 1.08 | 1.08 | 1.08 |
| **Firm Source Capacity** | **1.51** | **1.51** | **1.51** |
| **Reliable Firm Source Capacity** | **1.51** | **1.51** | **1.51** |
| Required Storage, MG | | | |
| Operational | 0.08 | 0.08 | 0.08 |
| Equalizing | 0.30 | 0.40 | 0.51 |
| Emergency | 0.00 | 0.18 | 1.02 |
| Fire flow | 0.96 | 0.96 | 0.96 |
| **Total Required Storage** | **1.34** | **1.61** | **2.56** |
| Existing Storage, MG | | | |
| Reservoir 8A | 0.83 | 0.83 | 0.83 |
| Reservoir 8B | 1.06 | 1.06 | 1.06 |
| **Total** | **1.89** | **1.89** | **1.89** |
| **Excess (Deficit) Existing Storage, mg** | **0.55** | **0.28** | **(0.66)** |

Storage for the Lakeland Hills Service Area must be sufficient to meet demands for the service area, as projected in Chapter 4. The projected Lakeland Hills demand and storage requirements are shown in Table 5.10.

Reservoir redundancy is not a criterion of the City. However, where an area is served by a single reservoir, like the Lakeland Hills Service Area, supply capacity needs to be sufficient to meet PHD and fire demand during the duration that the reservoir is out-of-service. Table 5.11 summarizes the capacity requirements for the Lakeland Hills Service Area.

To meet the current PHD and fire demand, a total of 5.89 mgd of source capacity is required. This is 4.69 mgd in excess of the 1.20 mgd available from Wells 5 and 5A. An additional source, pump station, or an emergency intertie is required in the near future to pump the 4.69 mgd deficit. However, if an additional reservoir were provided for the Lakeland Hills system, the sources would not be required to pump the PHD and fire demand. Given the cost of providing up to 5.41 mgd of pumping capacity by the year 2028, it will likely be more cost effective to provide a redundant reservoir for the Lakeland Hills service area.

Based on the current available sources and reservoirs, the Lakeland Hills service area is currently deficient in storage and will need an additional 1.76 MG of storage by 2028.

| Table 5.10 Lakeland Hills Storage Analysis (Existing) Comprehensive Water Plan City of Auburn | | | |
|---|---|---|---|
| | **2008** | **2014** | **2028** |
| Projected MDD, mgd | 0.78 | 0.97 | 1.18 |
| Available Sources, mgd | | | |
| Well 5(1) | 0.94 | 0.94 | 0.94 |
| Well 5A | 0.26 | 0.26 | 0.26 |
| **Total Source Capacity** | **1.20** | **1.20** | **1.20** |
| **Reliable/Redundant Source Capacity** | **0.26** | **0.26** | **0.26** |
| Required Storage, MG | | | |
| Operational | 0.03 | 0.03 | 0.03 |
| Equalizing | 0.20 | 0.24 | 0.30 |
| Emergency | 1.04 | 1.42 | 1.84 |
| Fire flow | 0.56 | 0.56 | 0.56 |
| **Total Required Storage** | **1.83** | **2.26** | **2.73** |
| Existing Storage, Reservoir 5, MG | 0.97 | 0.97 | 0.97 |
| **Excess (Deficit) Existing Storage, MG** | **(0.86)** | **(1.29)** | **(1.76)** |

Notes:
(1) Well 5 does not have back-up power and is therefore not a reliable source.

| Table 5.11 Lakeland Hills Source Capacity Requirements Comprehensive Water Plan City of Auburn | | | |
|---|---|---|---|
| | **2008** | **2014** | **2028** |
| Projected Demands, mgd | | | |
| PHD(1) | 1.39 | 1.73 | 2.10 |
| Fire Demand | 4.50 | 4.50 | 4.50 |
| **Total** | **5.89** | **6.23** | **6.60** |
| Available Sources, mgd | | | |
| Well 5(2) | 0.94 | 0.94 | 0.94 |
| Well 5A | 0.26 | 0.26 | 0.26 |
| Total Source Capacity | 1.20 | 1.20 | 1.20 |
| **Excess (Deficit) Source Capacity, mgd** | **(4.69)** | **(5.03)** | **(5.41)** |

Notes:
(1) Since only one reservoir is provided for the Lakeland Wills service area, the available sources need to be able to supply the PHD and fire demand.
(2) Well 5 does not have back-up power and is therefore not a reliable source.

### 5.6.4 Summary of Current Storage Analysis

The analysis of storage indicates that each of the service areas has sufficient storage for current conditions except for the Lakeland Hills and valley service areas, which are currently deficient. Additionally, all of the service areas will run out of storage within the next twenty years.

### 5.6.5 Future Conditions

To meet the future storage requirements, the following projects are recommended prior to the year 2014:

- Rehabilitate Well 1,
- Add backup power to Wells 4 and 7,
- Purchase water for the Valley Service Area,
- Add backup power to the Green River Pump Station,
- Construct new Lakeland Hills Reservoir, and
- Construct Terrace View Pump Station.

Additionally, the following projects are recommended to be in place by the year 2028:

- Rehabilitate Coal Creek Springs,
- Replace the pumps in Academy Pump Station 1, and
- Construct new Valley Service Area Reservoir.

As shown in Tables 5.12 through 5.15, the storage requirements for each service area can be met through the year 2028 if these projects are implemented.

**Table 5.12 Valley Storage Analysis (Future)**
**Comprehensive Water Plan**
**City of Auburn**

| | 2008 | 2014 | 2028 |
|---|---|---|---|
| Projected MDD, mgd | 9.76 | 13.09 | 15.65 |
| Available Sources, mgd | | | |
| **Coal Creek Springs** | 2.88 | 2.88 | **5.98** |
| West Hill Springs | 0.86 | 0.86 | 0.86 |
| **Well 1** | 0.00 | **3.20** | **3.20** |
| Well 2 | 2.30 | 2.30 | 2.30 |
| Well 3A | 0.00 | 0.00 | 0.00 |
| Well 3B | 0.00 | 0.00 | 0.00 |
| **Well 4** | 3.74 | 3.74 | 3.74 |
| Well 6 | 2.59 | 2.59 | 2.59 |
| **Well 7** | 2.88 | 2.88 | 2.88 |
| **Buy Water** | | **2.70** | **2.70** |
| **Total Source Capacity** | **15.26** | **21.14** | **24.24** |
| **Redundant Source Capacity** | **8.64** | **17.42** | **18.26** |
| Off Site MDD, mgd | | | |
| Academy Service Area | 1.21 | 1.60 | 2.02 |
| Lea Hill Service Area | 1.87 | 2.13 | 2.93 |
| **Total Off Site Demands** | **3.08** | **3.73** | **4.95** |
| Total Available Redundant Source Capacity, mgd | 5.56 | 13.69 | 13.31 |
| Required Storage, MG | | | |
| Operational | 0.64 | 0.64 | 0.64 |
| Equalizing | 2.44 | 3.27 | 3.91 |
| Emergency | 8.40 | 0.00 | 4.67 |
| Fire flow | 0.96 | 0.96 | 0.96 |
| **Total Required Storage** | **12.44** | **4.87** | **10.19** |
| Existing Storage, MG | | | |
| Reservoir 1 | 4.80 | 4.80 | 4.80 |
| Reservoir 2 | 3.45 | 3.45 | 3.45 |
| **New Valley Reservoir** | 0 | 0 | **2.00** |
| **Total (MG)** | **8.26** | **8.26** | **8.26** |
| **Excess (Deficit) Existing Storage, MG** | **(4.18)** | **3.39** | **0.07** |

| Table 5.13 Academy Storage Analysis (Future) Comprehensive Water Plan City of Auburn | | | |
|---|---|---|---|
| | **2008** | **2014** | **2028** |
| Projected MDD, mgd | 1.21 | 1.60 | 2.02 |
| Available Sources, mgd | | | |
| **Academy Pump Station 1** | 0.43 | 0.43 | **1.08** |
| Academy Pump Station 2 | 1.08 | 1.08 | 1.08 |
| **Firm Source Capacity** | **1.51** | **1.51** | **2.16** |
| **Reliable Firm Source Capacity** | **1.51** | **1.51** | **2.16** |
| Required Storage, MG | | | |
| Operational | 0.08 | 0.08 | 0.08 |
| Equalizing | 0.30 | 0.40 | 0.51 |
| Emergency | 0.00 | 0.18 | 0.00 |
| Fire flow | 0.96 | 0.96 | 0.96 |
| **Total Required Storage** | **1.34** | **1.61** | **1.54** |
| Existing Storage, MG | | | |
| Reservoir 8A | 0.83 | 0.83 | 0.83 |
| Reservoir 8B | 1.06 | 1.06 | 1.06 |
| **Total** | **1.89** | **1.89** | **1.89** |
| **Excess (Deficit) Existing Storage, MG** | **0.55** | **0.28** | **0.35** |

| Table 5.14 Lea Hill Storage Analysis (Future) Comprehensive Water Plan City of Auburn | | | |
|---|---|---|---|
| | **2008** | **2014** | **2028** |
| Projected MDD, mgd | 1.87 | 2.13 | 2.93 |
| Available Sources, mgd | | | |
| **Green River Pump Station** | 5.04 | **5.04** | **5.04** |
| Lea Hill Pump Station | 1.73 | 1.73 | 1.73 |
| **Firm Source Capacity** | **6.77** | **6.77** | **6.77** |
| **Reliable Source Capacity** | **1.73** | **6.77** | **6.77** |
| Required Storage, MG | | | |
| Operational | 0.06 | 0.08 | 0.08 |
| Equalizing | 0.47 | 0.53 | 0.73 |
| Emergency | 0.28 | 0.00 | 0.00 |
| Fire flow | 0.96 | 0.96 | 0.96 |
| **Total Required Storage** | **1.77** | **1.57** | **1.77** |
| Existing Storage, MG | | | |
| Reservoir 4A | 0.76 | 0.76 | 0.76 |
| Reservoir 4B | 1.13 | 1.13 | 1.13 |
| **Total** | **1.89** | **1.89** | **1.89** |
| **Excess (Deficit) Existing Storage, MG** | **0.12** | **0.32** | **0.12** |

| Table 5.15 Lakeland Hills Storage Analysis (Future)<br>Comprehensive Water Plan<br>City of Auburn | | | |
|---|---|---|---|
| | **2008** | **2014** | **2028** |
| Projected MDD, mgd | 0.78 | 0.97 | 1.18 |
| Available Sources, mgd | | | |
| Well 5 | 0.94 | 0.94 | 0.94 |
| Well 5A | 0.26 | 0.26 | 0.26 |
| **Terrace View Pump Station (firm)** | | **1.44** | **1.44** |
| **Total Source Capacity** | **1.20** | **2.64** | **2.64** |
| **Reliable Source Capacity** | **0.26** | **1.70** | **1.70** |
| Required Storage, MG | | | |
| Operational | 0.03 | 0.03 | 0.03 |
| Equalizing | 0.20 | 0.24 | 0.30 |
| Emergency | 1.04 | 0.00 | 0.00 |
| Fire flow | 0.56 | 0.56 | 0.56 |
| **Total Required Storage** | **1.83** | **0.84** | **0.89** |
| Existing Storage, MG | | | |
| Reservoir 5 | 0.97 | 0.97 | 0.97 |
| **New Lakeland Reservoir** | | **0.97** | **0.97** |
| **Total Available Storage** | **0.97** | **1.93** | **1.93** |
| **Excess (Deficit) Existing Storage, MG** | **(0.86)** | **1.10** | **1.04** |

## 5.7 WATER TREATMENT

Water treatment in the City of Auburn includes chlorination, corrosion control and metals removal. All wells, except Well 5, are equipped with some level of treatment, as discussed in Section 5.4 and described further as follows.

### 5.7.1 Existing System

#### 5.7.1.1 Coal Creek Springs Chlorination

One of the primary facilities for chlorination is the Coal Creek Springs chlorination station. The chlorination station is housed in a masonry building approximately 300 feet north from the collectors. As a major source of chlorinated water, Coal Creek Springs is used to maintain chlorine residuals in the Academy Service Area and south end of the Valley Service Area.

This chlorination station is equipped with two chlorinators. Gaseous chlorine is stored on site in a separate room. Alarms from the chlorination equipment are transmitted back to the Water Control Center in the Maintenance and Operation Facility. A chlorine residual analyzer is provided, providing high and low alarms to the Operations Center.

#### 5.7.1.2 West Hill Springs Chlorination

West Hill Springs is another source of continuous chlorination. At West Hill Springs, water continuously flows from the collection boxes to the on-site chlorination station, housed in a concrete block building. Chlorination at West Hill Springs, along with chlorination of Well 7, provides the majority of the chlorine residual in the north end of the Valley Service Area and in the Lea Hill Service Area.

Control is manual based on the average flow from the springs and the desired chlorine dosage. From the chlorination station, the supply flows by gravity into the Valley Service Area. Gaseous chlorine is stored on site in a separate room.

#### 5.7.1.3 Well 1

Supply from Well 1 is not normally chlorinated. However, piping and equipment are available to allow portable chlorination equipment to be installed if required.

#### 5.7.1.4 Wells 2 & 6

Pumped water from Wells 2 & 6 is treated and chlorinated at the Fulmer Field Corrosion Control Treatment Facility.

#### 5.7.1.5 Wells 3A & 3B

The chlorination facilities at Wells 3A and 3B have been removed. Currently, Wells 3A and Well 3B are not operated because they produce water that contains high concentrations of manganese.

#### 5.7.1.6 Well 4

Well 4 is equipped with gaseous chlorination facilities that are operated whenever the well is in service. Chlorination injection is controlled with the well pump and is either on or off.

#### 5.7.1.7 Well 5

Pumped water from Well 5 is not chlorinated.

#### 5.7.1.8 Well 5A

Well 5A is equipped with a chlorination system.

#### 5.7.1.9 Well 5B

Pumped water from Well 5B proceeds through four Altec media filters to remove iron and manganese prior to disinfection.

#### 5.7.1.10 Well 7

Pumped water from Well 7 is either treated at the Fulmer Field Facility or is chlorinated and directly pumped to the system. The chlorination system uses hypochlorite solution as a chlorine source. Due to high levels of Manganese, this well is used seasonally during high system demands.

#### 5.7.1.11 Fulmer Field Corrosion Control Treatment Facility

The Fulmer Field Corrosion Control Treatment Facility was constructed in 2004 and is located adjacent to the Fulmer Field City Park and Wells 2 and 6. The Fulmer Field Treatment Facility is housed in a masonry building and treats the water from Wells 2, 6, and 7. Chlorine is introduced into the system prior to the towers. The pH of the water from the wells is then adjusted by air-stripping in three 33,000 gallon air-stripping towers. Three 10,000 CFM blowers provide air. As the carbon dioxide is stripped from the water, the pH increases, which reduces the solubility of copper, allowing the water to be in compliance with the Lead and Copper rule. The treated water is then stored in the clearwell and re-boosted through four 3,200-gpm booster pumps back into the distribution system and Reservoir 2. Alternatively, chlorine can be manually introduced into the clearwell rather than prior to the towers. Chlorine is generated on site.

Also included is a 1,000 kW electric generator with a diesel fuel capacity of 2,000 gallons. This generator provides backup power for the treatment facility and Wells 2 and 6.

#### 5.7.1.12 Howard Road Corrosion Control Treatment Facility

The Howard Road Corrosion Control Treatment Facility was constructed in 2004 and is located near the existing Coal Creek Springs Pump Station. This Treatment Facility is housed in a masonry building and treats the water from Coal Creek Springs and Well 4. Chlorine is introduced into the system prior to the towers. The pH of the water from the wells is then adjusted by air-stripping in two 33,000 gallon air-stripping towers. Two 9,300 CFM blowers provide air. As the carbon dioxide is stripped from the water, the pH increases, which reduces the solubility of copper, allowing the water to be in compliance with the Lead and Copper rule. The treated water is then stored in the clearwell and re-boosted through three 2,100 gpm booster pumps into Reservoir 1. Also included is a 600 kW electric generator with a diesel fule capacity of 1,000 gallons.

#### 5.7.1.13 Intertie Pump Station

The Intertie Pump Station is equipped with a hypochlorite chlorination station.

### 5.7.2 Water Treatment Analysis

#### 5.7.2.1 General Water Quality Improvements

Recommended water quality improvements include converting the current chlorination systems to hypochlorite, at the West Hill Springs, Coal Creek Springs, and Well 4. Hypochlorite systems are a safer way to operate disinfection facilities.

#### 5.7.2.2 Well 7 Treatment

Manganese treatment is recommended for Well 7 to allow this well to be used year-round and to ensure better water quality.

#### 5.7.2.3 Wells 3A/3B Treatment

Manganese treatment is recommended to allow Wells 3A and 3B to be used.

## 5.8 DISTRIBUTION SYSTEM

### 5.8.1 Existing System

The City water transmission and distribution system includes nearly 250 miles of pipeline. Pipe size varies from 4 to 24 inches, with predominance of 8- and 12-inch diameter pipe. The information used for reviewing and analyzing the distribution system is based on a combination of limited mapping data and existing knowledge of facility conditions observed from previous field maintenance activities. The City continues to conduct field and records investigations to improve the accuracy and completeness of the system data regarding watermain size, type or age. The existing data show that over 90 percent of the distribution system is ductile-iron (DI) pipe. Pipes made of asbestos-cement, steel, and concrete cylinder pipe make up the remaining pipes in the system. Table 5.16 and Figure 5.9 provide a summary of the pipe sizes and materials within the Auburn system.

Some areas within the City system have distribution piping made of old cast iron with lead joint connections. The majority of this pipe is 4 to 6-inch diameter and typically has a shallow bury (2 to 3-feet of cover).

has a Qi of 20 gpm (0.03 mgd) and a Qa of 6.5 ac-ft/year (0.01 mgd). The place of use for the water right is a forty-acre area around the well.

#### 6.2.4.2 Algona Well 1

In 1996, the City acquired the title to Algona Well 1 as a condition of meeting Algona's water supply needs on a firm, uninterruptible basis, as agreed upon in the Wholesale Supply Interlocal Agreement 3 (IA3). The "Algona" well consists of a 10-inch casing to approximately 65 feet below ground surface. The agreement between the City and Algona was necessitated due to well pump operational problems at Algona Well 1 that led to the well being taken off line. The 500-gpm pump and associated piping have been removed from the well house and the building demolished. The well casing is still standing.

Algona Well 1 is a certificated water right (Certificate No. G1-22769C) with a priority date of 1976. This well has a Qi of 500 gpm (0.72 mgd) and a Qa of 175 ac-ft/year (0.16 mgd).

## 6.3 WATER RIGHTS

As described in the previous section, the City currently holds seven certificated groundwater rights, three supplemental groundwater rights, one certificated surface (spring) water right, and one claim (spring). Pursuant to a determination by the Ecology, Wells 1, 2, 3A, 3B, 4, 6 and 7 are considered a well field. This designation allows the City substantial flexibility in its management and use of its Valley Well Field.

The City's largest single source of supply is its Coal Creek Springs source, which is certificated to provide Qi of 9.70 mgd and a Qa of 8.40 mgd. Coal Creek Springs is located near the Muckleshoot Reservation and the White River and provides water to the Valley Service Area. Also providing water to the Valley service area are the West Hill Springs and the Algona Well.

In addition, the City holds groundwater rights for three wells (Wells 5, 5A and 5B) that are located within the Lakeland Hills Service Area. On November 13, 1995, the City submitted an application to Ecology (application number G1-27679) for the purpose of increasing the permitted rate of Qi for Well 5A by 83 gpm to a total Qi of 250 gpm. The City submitted the application of Qi increase in order to more fully meet its reliability criteria in the Lakeland Hills portion of the service area. In the course of submitting the application, the City made it clear that Well 5A, which operates as supplemental backup to Well 5, will operate only when Well 5 is not in operation or for purposes of periodic exercise to maintain readiness. If both wells are turned on simultaneously, the pumping of both sources would be throttled so as not to exceed the currently permitted combined instantaneous rates for both Wells 5 and 5A. Additionally, on August 1, 1997, the City filed a supplemental right application (application number G1-27829) with Ecology for the purpose of adding an additional point of withdrawal for Well 5B to the existing primary groundwater Well 5 water right. As part of this application, the City was not seeking additional Qi or Qa from this supplemental source and/or from its related primary source, Well 5. In 2004, Ecology issued a superseding certificate of water rights, combining the Upland Wells (current Wells 5, 5A and 5B and a future Well 5C) into one water right with a Qi of 1,000 gpm and a Qa of 720 ac-ft/year. This superseding water right resulted in a net decrease of 167 gpm of Qi for the Upland Wells.

The City currently holds certificated, primary water rights and/or claims with a total Qi of 26.7 mgd and a Qa of 23,300 ac-ft/year (20.8 mgd). This total does not include the Algona water right or the Braunwood water right, which are currently not available to serve the multi-source municipal water system. The addition of the Algona water right increases the City's Qi water right to 19,055 gpm (27.4 mgd) and their Qa water right to 23,475 ac-ft/year (21.0 mgd). A summary of the City's water rights is shown in Table 6.1.

**Table 6.1 Water Rights Summary**
**Comprehensive Water Plan**
**City of Auburn**

| Source | Instantaneous (Qi) | | Annual (Qa) | |
|---|---|---|---|---|
| | gpm | mgd | ac-ft/year | mgd |
| West Hill Springs | 625 | 0.9 | 1,010 | 0.9 |
| Coal Creek Springs | 6,730 | 9.7 | 9,410 | 8.4 |
| Valley Well Field | | | | |
| Well 1 | 2,200 | 3.2 | 1,120 | 1.0 |
| Well 2 | 2,400 | 3.5 | 3,840 | 3.4 |
| Well 3A and 3B | 2,800 | 4.0 | 3,600 | 3.2 |
| Well 4 | 2,800 | 4.0 | 3,600 | 3.2 |
| Well 6(1) | (3,500) | (5.0) | | |
| Well 7(1) | (3,500) | (5.0) | | |
| Total | 10,200(2) | 14.7(2) | 12,160 | 10.7 |
| Upland Well Field (Wells 5, 5A, 5B) | 1,000 | 1.4 | 720 | 0.6 |
| Total | **18,555** | **26.7** | **23,300** | **20.8** |
| Total + Algona(3) | **19,055** | **27.4** | **23,475** | **21.0** |

Notes:
(1) Wells 6 and 7 are supplemental to the Valley Well Field.
(2) The total does not include the Qi water rights for the supplemental Wells 6 and 7.
(3) Based on the wholesale water agreement with the City of Algona (IA3), the City acquired the 500 gpm, 175 ac-ft/year water right for the Algona Well 1.

## 6.4 PENDING WATER RIGHT APPLICATIONS

In 1996, Covington Water District (CWD) and King County Water District #111 (WD#111) executed the IA2 with the City of Auburn that included the development of primary water

## 6.8 GROUNDWATER MANAGEMENT

Section 1428 of the 1986 Amendments to the Federal Safe Drinking Water Act (SDWA) mandates that each state develop a wellhead protection program and that all federally defined public water systems (in Washington, Group A systems) using groundwater as its source implement a wellhead protection plan. In July 1994, the Washington Administrative Code (WAC) addressed requirements for Group A public water systems (WAC 246-290) and was modified to include mandatory wellhead protection measures. The legislative authority to require wellhead protection (WHP) planning can be found in the Revised Code of Washington (RCW) Chapters 43.20.050, 70.119A.060, and 70.119A.080.

The overall goal of the state WHP program is to prevent the contamination of groundwater used by Group A public water systems. This is to be accomplished by providing management zones around public wells, identifying existing groundwater contamination sources, and managing potential sources of groundwater contamination prior to their entry into the drinking water system. Under the WAC, local public water systems have the primary responsibility for developing and implementing local wellhead protection plans (WHPPs). However, due to the limited jurisdictional and regulatory authority afforded most purveyors, coordination with other local, State, and Federal agencies is essential to the successful implementation of a WHPP.

The DOH has developed regulations that require Group A water systems using groundwater sources to develop and implement the WHPP (WAC 246-290-135). The objective is to prevent releases of contaminants to groundwater in areas that contribute water to the public supply systems.

The basic elements of a WHPP include:

- Assessment of initial groundwater susceptibility for each water supply source.
- Delineation of the wellhead protection area (WHPA) that directly contributes groundwater to each water supply well.
- Inventory of land uses and identification of potential sources of contamination within each WHPA.
- Documentation of notification to owner/operators of known or potential hazards.
- Development of spill prevention plans and water contingency plans that minimize or eliminate the possibility of contamination to the groundwater supply and also development of options for maintaining water supply in the event the aquifer contributing to a source is contaminated.

The State of Washington WHPP applies to the City's wells.

### 6.8.1 Wellhead Protection Program

Pacific Groundwater Group (PGG) initially delineated the City of Auburn wellhead protection areas in 1997, and later updated them in 2000. As part of this plan, Robinson, Noble, & Saltbush Inc. used the modeled capture zones to perform a hazard assessment within the wellhead protection area. A detailed Well Head Protection Report is included in Appendix K.

### 6.8.2 Existing and Potential Contamination Hazard Identification

The inventory of potential contamination sources within the WHPA was performed according to the DOH publication: "*Inventory of Potential Contaminant Sources in Washington's Wellhead Protection Areas (1993)*." Parcel Insight (PI), an environmental database research company, reviewed 27 federal and state databases for any known or potential contaminant sites within a 4.5-mile radius of the center of the City of Auburn's service area. The sites in this radial search were narrowed further by their location in relation to WHPAs. An evaluation of various land-use categories and activities was also performed. The results of the contamination source inventory include a list of potential and known environmental hazards in proximity to the Auburn water system. From this process, 352 sites or categories of land-use activities were identified as known or potential hazards to the City's wells. These were prioritized and ranked such that the WHP implementation process can address each site or land use in a systematic manner (Appendix K). Each site was ranked according to four factors which include proximity of potential hazard to the WHPA; type of contamination; straight-line distance from the wells to the potential hazard; and type of contaminated media, whether potential or actual.

### 6.8.3 Protection Strategies and Implementation Tasks

The completion of wellhead protection planning provides no safeguards unless effective management strategies are implemented to prevent potential contamination of groundwater sources. With the hazards identified, the WHPP provides 26 specific tasks for the City to undertake to complete the process of implementing this wellhead protection program. These tasks include placing proper signage throughout the WHPA, education of the public, proper zoning within the WHPA, annual review of environmental databases, and the cooperation between the City and appropriate enforcement and emergency response agencies. These tasks are presented in a general order of importance and are expected to require implementation by City staff.

The strategic goals and implementation tasks provided in the WHP plan are typically work that is completed by internal City staff as a part of their on-going education/awareness efforts directed at their customer base. However, it is not uncommon that the full list of goals or tasks cannot be immediately adopted because there is insufficient staff time available.

Therefore, the City's first responsibility will be to prioritize its WHP goals and select which tasks to implement in order to achieve those goals. The City should pick the strategic goals that are most important to its overall goal of groundwater protection. The City will then define which implementation tasks will be needed to meet the defined goals. In both cases, prioritization is done using the criteria of: time to complete, staff availability, cost, immediacy or importance, practicality to complete given the City's current resources, or the necessary order of completion (some goals or tasks will logically precede others).

# WATER USE EFFICIENCY

As populations continue to climb, demand for limited water supplies is steadily increasing in the Pacific Northwest. Efficient water use is critical for water systems to support growth in their communities and provide water for other environmental uses. The efficient use of water helps ensure reliable water supplies are available for the City of Auburn (City) well into the future. It is important to the City to not only conserve water, which reduces use, but also promote efficient use, which both conserves water and reduces wasteful uses. The purpose of this chapter is to provide an analysis of the City's historic water conservation program and to evaluate the existing and proposed conservation and water use efficiency measures.

This chapter is formatted into two sections. The first section analyzes the previous conservation program by examining how it was formed, its program and goals, and analyzes the savings. The second section of this chapter presents the City's new 2009 Water Use Efficiency Program (WUE), and includes the new requirements, measures, and demand savings anticipated from the program.

## 8.1 PRIOR CONSERVATION PROGRAMS

### 8.1.1 History

The first formal water conservation program was developed by the City in 1995, a year after the Washington Department of Health (DOH) jointly published conservation guidelines as described below. The City's program included several conservation activities such as school outreach, program promotion, leak detection, meter repair/replacement, and conservation pricing. In 2001 the City enhanced the program and is currently using it today. This revised program will provide the basis of the historical review in this chapter.

In preparing the 1995 and the 2001 Water Conservation Programs, the City reviewed the 1990 South King County Coordinated Water System Plan (CWSP), and the state *Conservation Planning Requirements (CPR) - Guidelines and Requirements for Public Water Systems Regarding Water Use Reporting, Demand Forecasting Methodology, and Conservation Programs*. Other materials used to prepare the program included the *Water Conservation Bibliography for Public Water Systems*, and other materials and handouts prepared by the DOH to be used by utilities when implementing water conservation.

### 8.1.2 Regulatory Requirements

The Washington Water Utilities Council, DOH, and Department of Ecology jointly developed the CPR. Interim guidelines were first established in 1990, and subsequently finalized and approved in 1994. The DOH published the CPR in 1994, which was the basis of the City's 1995 and 2001 conservation programs.

In 2003, the Washington State Legislature passed Engrossed Second Substitute House Bill 1338, better known as the Municipal Water Law, to address the increasing demand on our state's water resources. The law established that all municipal water suppliers must use water more efficiently in exchange for water rights certainty and flexibility to help them meet future demand. The Legislature directed the DOH to adopt an enforceable WUE program, which became effective on January 22, 2007. The WUE program replaced the CPR. The new WUE requirements emphasize the importance of measuring water usage and evaluating the effectiveness of the WUE program.

The City of Auburn's 2000-2005 Conservation Program is comprised of measures and goals following the format of the CPR. The measures include four categories as presented in the Figure 8.1 below: Public Education, Technical Assistance, System Measures, and Incentives.


Figure 8.1 Conservation Program Diagram

Ultimately, the City chose to implement conservation measures (system measures) to meet the City's goal of reducing the retail water demand by 10 percent in the year 2005. These measures targeted various customer classes ranging from single family, multi-family, commercial, manufacturing/industrial, schools, city accounts, and irrigation.

### 8.1.2.1 2000-2005 Program Goals and Objectives

The City developed a set of conservation goals and objectives for the 2000-2005 program that were based, in part, on the results of the 1995 Water Conservation Program. The City also wanted to raise the visibility and performance of the Conservation Program. The focus was on implementing conservation measures targeted to the City's retail customers, considering all customer classes. The City selected the following goals for the 2000 Water Conservation Program:

- Reduce Water Demand by 10percent:
  - The top priority of the program was to reduce overall retail demand by 10 percent by 2005. The program targeted the residential customer class by establishing a goal of reducing residential demand by 16 percent. Goals for reducing demand were established for the other customer classes as shown in Figure 8.2 below.

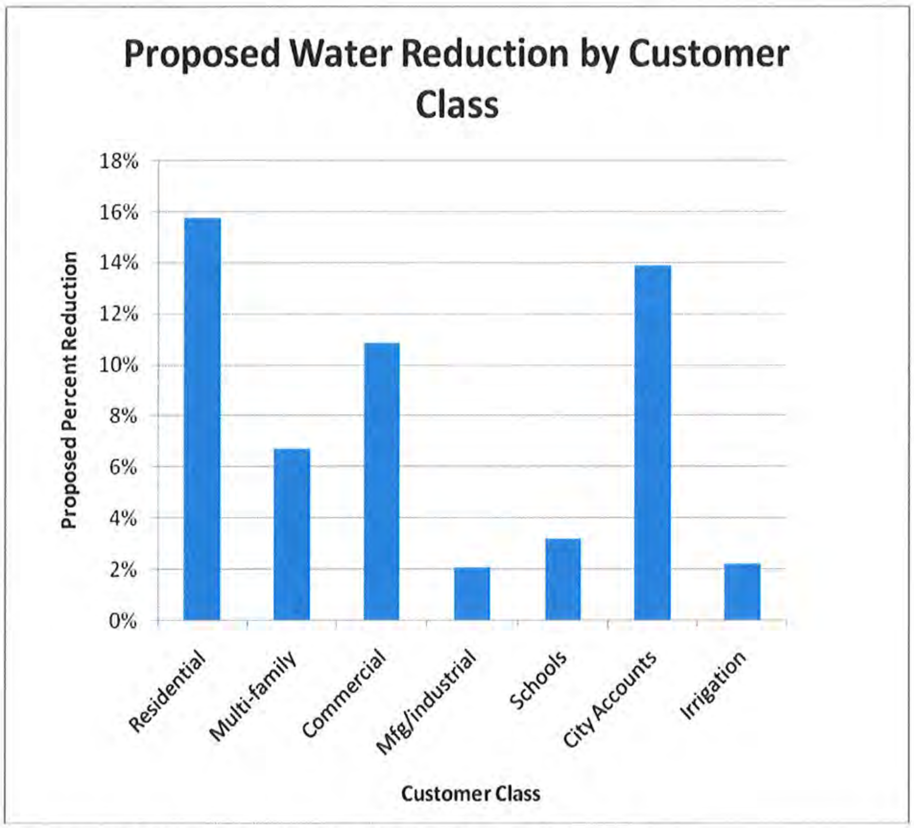



Figure 8.2 Proposed Water Reduction by Customer Class

- Community Leadership: Become a community leader in water conservation through example and public education.
  - Customer Support: Provide the service and support necessary to those water customers expressing a desire to conserve water as a part of their environmental ethic and as a means of minimizing water bills.
  - Regional Support: Support and participate in the *South King County Coordinated Water System Plan (SKC-CWSP)* and other applicable regional plans in order to maintain a reliable and adequate supply of water for the region.

– Regulatory Compliance: Design and manage a conservation program that meets or exceeds current regulations of DOH or other appropriate regulatory agencies.

### 8.1.3 Historical Seasonal Water Usage

The City took an innovative approach to evaluate the historical water usage by examining seasonal water use. Seasonal water use can have a huge impact on the system's ability to deliver water during peak demands. Using seasonal water data has become an important element in the City's new program. An analysis was performed on seasonal water use prior to implementing the conservation program, which identified the variation of water use for each customer class throughout the year. The winter months show a constant monthly usage, while summer months show an increase, peak, and decrease in water usage. Historically, residential customer classes would produce a large peak in the summer months; however, as a result of the City's conservation program, this peak has become relatively flat. Interestingly, the most dramatic peak was from the school customer class, which can be attributed to watering of play fields and landscaping. Figure 8.3 depicts the average demand from 2001 to 2007 for each customer class. The peaking factor comparing summer MDD to winter ADD is 2.01. These dramatic summer increases have influenced the City to create goals that will target reducing peaking factors during the summer months.

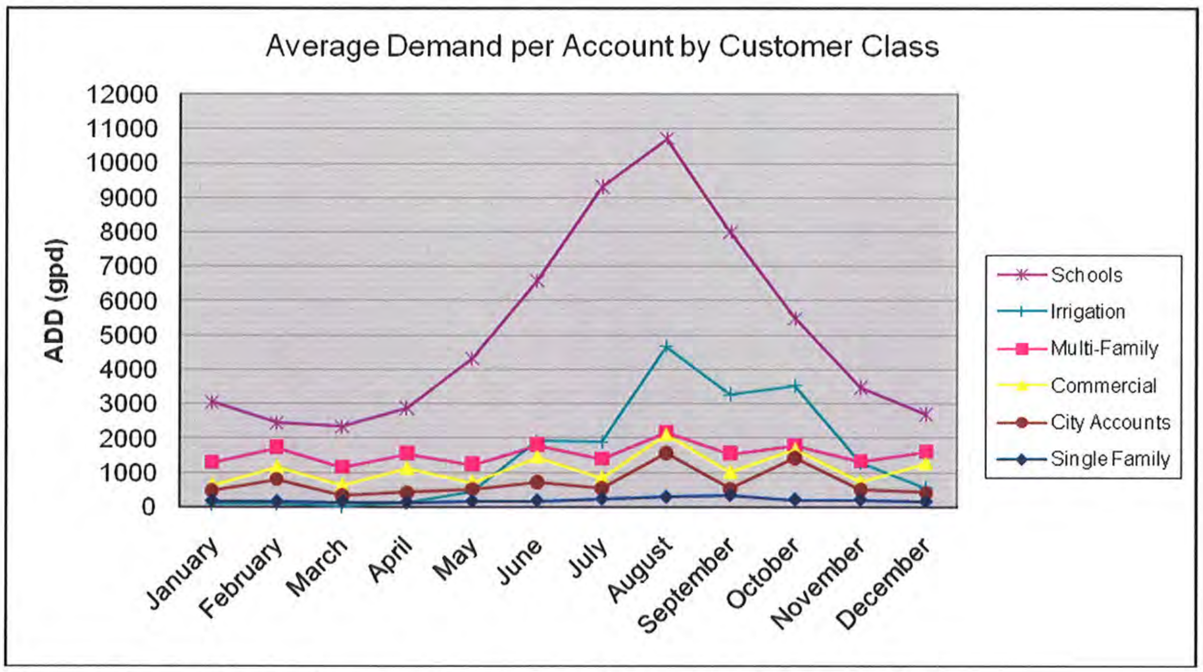



Figure 8.3 Monthly Average Demand per Account by Customer Class

### 8.1.4 Historic Water Savings

The City experienced a water savings in all customer classes from 2000-2005. More specifically, the City reduced their single family/duplex customer water use from 260 to 206 gallons per day, which contributed to meeting their goal of reducing water demand by 10 percent. The previous comprehensive planning period was from 2000 to 2005, however, the City did not initiate the update until 2007 and therefore Table 8.1 below shows the historic water use by customer class for 2000, 2007 and the savings during this time period. The 2007 demand per account is approximately 27 percent less than the 2000 demand.

**Table 8.1 Historical Water Savings by Customer Class**
**Comprehensive Water Plan**
**City of Auburn**

(Gallons per day per account)

| Classification | 2000 | 2007 | % change |
|---|---|---|---|
| Single-family/Duplex | 260 | 205 | -21% |
| Multifamily | 2,150 | 1,484 | -31% |
| Commercial | 1,150 | 1,315 | +14% |
| Mfg/Industry | 23,000 | 13,894 | -40% |
| Schools | 6,000 | 6,779 | +13% |
| City Accounts | 2,000 | 636 | -68% |
| Irrigation | 1,600 | 1,951 | +22% |
| Total | 36,160 | 26,264 | -27% |

### 8.1.5 Historical Distribution System Leakage

For the 2000 conservation program, the City performed leak detection and implemented other programs to meet the City's distribution system leakage goals. The City's goal was to reduce distribution system leakage for water to 10 percent or less within the planning period.

Historical distribution system leakage is shown in Table 4.7. The variation in percent of authorized consumption is largely due to flushing practices. The City maintained distribution system leakage at less than 10 percent of supply, which met their goal.

## 8.2 2009-2014 WATER USE EFFICIENCY PROGRAM

The development of the WUE program is the foundation for using water wisely. The 2009-2014 WUE program will be a continuation of the 2002-2005 conservation program with specific enhancements to the program to comply with current regulations and create an emphasis on efficient water usage rather than only conserving. The following sections includes requirements that are mandatory by the WUE program and shows the measures the City intends to continue implementing as well as recommended enhanced measures. The City will need to implement enhancements in order to achieve its overall goal.

### 8.2.1 Program Goals

Per the WAC 246-290-830(4)(a) all water purveyors with 1,000 or more connections were required to set efficiency goals through a public process. The deadline to do so was 01/22/2008. Because the City was still in the process of updating its Water Plan, the City continued its established goals from the previous 2001 plan. The proposed goal for the 2009-2014 WUE program will target a 1 percent reduction per year in Equivalent Residential Unit Values as defined in the Policy Chapter earlier herein. The WUE program measures are designed to help meet this established goal. This goal was posted to the City website in July 2009.

### 8.2.2 Program Requirements

The new WUE requirements emphasize the importance of measuring water usage and evaluating the effectiveness of the City's program. There are three fundamental elements of a WUE Program that the City will follow:

- **Planning Requirements** – Municipal water suppliers are required to:
  - Collect data
  - Forecast demand
  - Evaluate WUE measures
  - Calculate distribution system leakage
  - Implement a WUE program to meet their goals
- **Distribution Leakage Standard** – Municipal water suppliers are required to meet a distribution system leakage standard to minimize water loss from their distribution system.
- **Goal setting and performance reporting** – Municipal water suppliers are required to set WUE goals through a public process and report annually to their customers and DOH.

### 8.2.3 2009-2014 Program Measures

Under the new WUE requirements, a program measure may include water efficient devices, actions, business practices, or policies that promote efficient water use. As mentioned, the City is required to implement a minimum of nine WUE measures. Eight of the nine measures in this program were implemented in the previous plan.

WUE measures can target specific customer classes or a combination of customer classes. The WUE guidelines state that a measure can be counted for each class it is attributed to. For example, the water savings device kits measure is provided across multiple customer classes (single family, multifamily), which means it could be counted as two measures.

In order to achieve the program goals as stated, the City must enhance its program with new measures and also maintain the effectiveness of the previous program by continuing to implement the previous measures. The City will provide the required nine measures and is proposing to not double count measures that cross into multiple customer classes. The City will do this because it has successfully implemented the eight measures in the past and desires to continue its effective program further into the future. This is a conservative approach to reach the City's goals. Measures that are required, like system measures, are being implemented but do not count as part of the City's program as discussed later herein. The program measures are provided below and separated into measures previously implemented and new measures implemented in this new plan.

- **Previous Program Measures:**
  - School Outreach:
    School programs were arranged to educate students on efficient water usage. The City partnered with the Solid Waste Utility and Puget Sound Energy to have environmental programs taught to Auburn middle school and junior high school students. The original program called "*In Concert with the Environment*" was replaced by "Powerful Choices for the Environment". These programs educated students on many environmental issues, including water use, and how their actions can make a difference for the environment.
  - Speakers' Bureau:
    The City will seek speaking opportunities to discuss water use efficiency with a wide-audience spectrum. Topics could include water efficient fixtures and appliances, curbing seasonal peak demands, lawn watering practices, etc.
  - Program Promotion:
    The City will seek opportunities for television and/or radio public service announcements for water use efficiency, and submit news articles to local papers on efficient water usage especially during the spring and summer months.
  - Theme Shows/Fairs:
    The City will participate in local theme shows and fairs, providing portable water efficiency displays and distribution of water efficiency brochures and other materials. Water saving device kits could be distributed to interested single family and multiple family residential customers.
  - Water Audits:
    The City will conduct water audits for the City's "Top 10" water users and all city accounts. The audits will review items such as: recirculation of cooling water, reuse of cooling and process water, reuse of treated wastewater, efficient landscape irrigation, low water using fixtures, fixing leaks, and process modifications.
  - Bills Showing Consumption History:
    The City will continue to provide customer bills showing previous year's water usage. Showing the percentage increase/decrease in addition to water usage would provide customers with better information regarding efficient water

usage. Incorporate percentage increase/decrease calculation into the City's new billing system.

- Water Saving Device Kits:
  The City will participate in distribution of water use efficiency kits through education events such as speakers' bureaus, theme shows, fairs and through bill insert request forms.

- Conservation Pricing:
  The City will conduct a cost of service/rate study to determine the most appropriate water structures and rate levels to achieve the City's WUE goals, while generating sufficient revenues for utility operations. The study should include an analysis of alternative conservation-based water rate structures and associated impacts, including uniform rates by class, inverted block rates, seasonal rates, and excess use rates.

- **New Program Measures:**
  - Water Efficient Toilet or Clothes Washer Rebates:
    The City will provide rebates to customers that replace old toilets or clothes washers with new water efficient models. The City will explore options to partner with Puget Sound Energy on clothes washer replacements.
  - School Outdoor Water Use Reduction:
    The City will target schools in an effort to reduce their outdoor water consumption. Water audits and incentives to replace inefficient irrigation systems or landscaping (including turf) that use large qualities of water will be considered.
  - Other High Users:
    The City will evaluate the high volume users for water saving opportunities.

It is important to note that in addition to the water cost savings for the WUE measures, other benefits result, both to the utility and to its customers, from WUE activities. Such additional benefits could include:

- Significant customer energy savings because water heaters are the second largest energy users in the home. Hot water use can be reduced almost one-third by cost-effective WUE measures, such as water efficient fixtures and appliances. Significant energy savings can also occur for industrial processes requiring water heating and other power uses.
- Efficient landscaping and irrigation techniques save on maintenance costs.
- Reductions in water production decrease energy required by utilities to treat and distribute water and to collect and treat wastewater. Chemical costs are also reduced in water and wastewater operations.
- System measures could provide substantial benefits in addition to water production cost savings including:

- Identification of non-revenue water could result in recovery of unbilled revenue (inaccurate meters) and reduced unauthorized water usage (theft);
- Leak detection helps prevent major main breaks, which could result in significant repair costs to the utility;
- Leak detection reduces a utility's liability due to prevention of potential property damage;
- Repair and/or replacement of service and source meters allows a utility to recover unbilled water revenues.

### 8.2.4 Mandatory Measure requirements

In addition to the nine required measures discussed above, the WUE program requires supply side requirements that must be implemented. Any supply side measures that are implemented do not count towards the minimum number of measures discussed earlier. These are considered activities that the City implements to understand and control leakage including new meters, leak detection surveys, and water audits. Per the WUE requirements, the following measures must be implemented:

- Install production (source) meters
- Install consumption (service) meters
- Perform meter calibration
- Implement a water loss control action plan to control leakage
- Educate customers about water use efficiency practices

The measures that must be evaluated are:

- Evaluate rates that encourage water demand efficiency
- Evaluate reclamation opportunities

The City in the past has complied with these requirements and will continue to comply with these regulations.

### 8.2.5 Reclaimed Water

According to WAC 246-290-100 and the WUE requirements, water systems with over 1,000 connections must collect and evaluate information on reclaimed water opportunities. Evaluation of reclaimed water use is required in the WUE program and reclaimed water use can be used as a WUE program measure. Currently, the City plans to conduct an evaluation of reclaimed water use savings. The City will implement reclaimed water as a conservation measure and include this savings in the demand projections when specific opportunities arise.

The City may develop projects or consider participation in water reuse projects and programs developed by adjacent jurisdictions and others as appropriate. The efforts may include demonstration or pilot projects developed in accordance with applicable federal, state, and local laws and regulations. Changes to the City's development and service policies and regulations may be desirable in order to encourage the promotion of these programs and technologies and will be included.

Currently, the City considers the most likely user of reclaimed water to be the irrigation customer class. Total irrigation use for 2007 was 292,351 CCF, which is 218,678,548 gallons more than any other customer class throughout the service area. Attachment 9 of the Municipal Water Law that identifies potential reclaimed water users has been completed and is included in Appendix M.

### 8.2.6 Distribution System Leakage

Distribution system leakage is a significant element of the new WUE requirement although it is not considered a program measure. In the past, distribution leakage was referred to as "unaccounted-for-water". The WUE requirements now use the terms "authorized consumption" and "distribution system leakage." It is calculated as shown below.

Volume of Distribution System Leakage = Total Water Produced and Purchased – Authorized Consumption

Authorized consumption is considered water delivered to costumers by service meters, water sold to other water systems, and other authorized uses such as fire protection, flushing, construction, street cleaning, and other maintenance and operations practices. However, to be credited, this must be accounted for by metering or by estimating water use with credible means. All water that is not authorized is considered distribution system leakage.

The WUE Rule requires that the three-year average of distribution leakage be maintained at less than 10 percent of the supply. The City has made a significant commitment to maintain this status. The City has budgeted $275,000 just in 2009 towards leak detection, service meter replacement programs, and large meter replacement programs.

### 8.2.7 Projected Water Demand

The 2009-2014 WUE Program assumes water savings from retail customers only. In the tables below are the projected water requirements for the Retail Water Service Area with and without WUE, followed by projections of total water system demand with and without WUE. As shown in the tables, it is important to note retail demand is only one component of total system demand.

The water demand savings presented in this section are based upon the recommended WUE Program, discussed earlier herein, developed for the 6-year implementation period

(2009 through 2014). In the demand estimates, a one percent reduction was applied only to this 6-year planning period. After that, no reduction was applied which is represented in Figure 8.4.

Table 8.2 presents the comparison of projected water demand, both average day demand (ADD), and maximum day demand (MDD) for retail customers with and without WUE for the 20-year planning period. Figure 8.4 shows a graphical representation of the Table 8.2. As shown in the table, WUE measures are projected to result in an average day reduction in retail demand of 0.58 mgd by 2014, representing a reduction of approximately 6 percent. A reduction of 0.70 mgd is projected by year 2028. MDD is calculated at 1.8 times ADD. As shown in the Figure 8.4, WUE measures are projected to result in a reduction in retail MDD of 1.04 mgd by 2014, and approximately 1.27 mgd by the year 2028.

**Table 8.2 ADD & MDD Values with and without WUE**
**Comprehensive Water Plan**
**City of Auburn**

| **Average Day Demand** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2018** | **2028** |
|---|---|---|---|---|---|---|---|---|---|
| ADD w/o WUE | 7.52 | 7.90 | 8.29 | 8.67 | 9.06 | 9.44 | 9.83 | 10.68 | 12.03 |
| ADD w/ WUE | 7.52 | 7.81 | 8.10 | 8.39 | 8.67 | 8.96 | 9.25 | 10.05 | 11.32 |
| Savings | 0.00 | 0.10 | 0.19 | 0.29 | 0.38 | 0.48 | 0.58 | 0.62 | 0.70 |
| % Savings | 0% | 1% | 2% | 3% | 4% | 5% | 6% | 6% | 6% |
| **Maximum Day Demand** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2018** | **2028** |
| MDD w/o WUE | 13.62 | 14.31 | 15.01 | 15.70 | 16.40 | 17.10 | 17.79 | 19.33 | 21.78 |
| MDD w/ WUE | 13.62 | 14.14 | 14.66 | 15.18 | 15.71 | 16.23 | 16.75 | 18.20 | 20.50 |
| Savings | 0.00 | 0.17 | 0.35 | 0.52 | 0.69 | 0.87 | 1.04 | 1.13 | 1.27 |
| % Savings | 0% | 1% | 2% | 3% | 4% | 5% | 6% | 6% | 6% |

Approximately 0.1 full time employees are working on WUE measures currently and there is no proposed additional staff time in the future. The City also has budgeted for future regulatory requirements, which are to accommodate any unknown requirements that the City of Auburn will need to fulfill to be compliant.

Table 8.4 shows the City's budget for required WUE measures through the planning period. Although leak detection, large meter test/repair/replace, and service meter replacements are not considered to be measures in the official WUE program, the City has dedicated a significant portion of their budget to reduce leakage and inaccuracies with the meter replacement programs and leak detection and repair programs.

**Table 8.4 Budget for System Required WUE Measures**
**Comprehensive Water Plan**
**City of Auburn**

| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|
| Leak Detection & Repair | $25,000 | $28,000 | $29,100 | $30,300 | $31,500 | $32,800 |
| Large Meter Test/Repair/Replace | $50,000 | $55,000 | $57,200 | $59,500 | $61,900 | $64,400 |
| Service Meter Replacements | $200,000 | $200,000 | $208,000 | $216,300 | $225,000 | $234,000 |
| Total | $275,000 | $283,000 | $294,300 | $306,100 | $318,400 | $331,200 |

### 8.2.9 Cost Savings

The City has completed a cost analysis of their proposed WUE program using historical data and projected annual water savings. The City currently budgets approximately $53,000 annually for materials and professional services for their WUE program. This annual expenditure is budgeted and expended through the City's operation and maintenance budget.

The projected annual savings of water ranges from approximately 29 MG in 2009 to 41 MG in 2014. Based on the 2009 budget of $326,000 (sum of budgets for WUE program measures and supply side required measures), the projected unit cost of water saved by the City's program for 2009 is estimated to be $11,200 per MG and over $9,700 per MG in 2014 when adjusted for inflation and adjusted for increased annual water savings by the City customers. This is shown in Figure 8.6. The cost to produce one gallon of water is approximately $0.00287 in 2007 and $0.00328 in 2008.

According to the above cost to produce one gallon of water in 2008 and adjusted for inflation, the cost to produce 29 MG of water (the estimated amount of water saved in 2009) is approximately $98,000. Likewise, the cost to produce 41 MG (the estimated amount of water saved in 2014) is $170,000. For 2009, this number represents a return on investment of $0.30 per dollar put into the program. In 2014, the return is $0.43 per dollar put into the program. For the above WUE program budget, the approximate volume of water savings needed to equal the coast to produce that same amount of water (return on investment of $1 dollar for $1 dollar) is 96 MG.

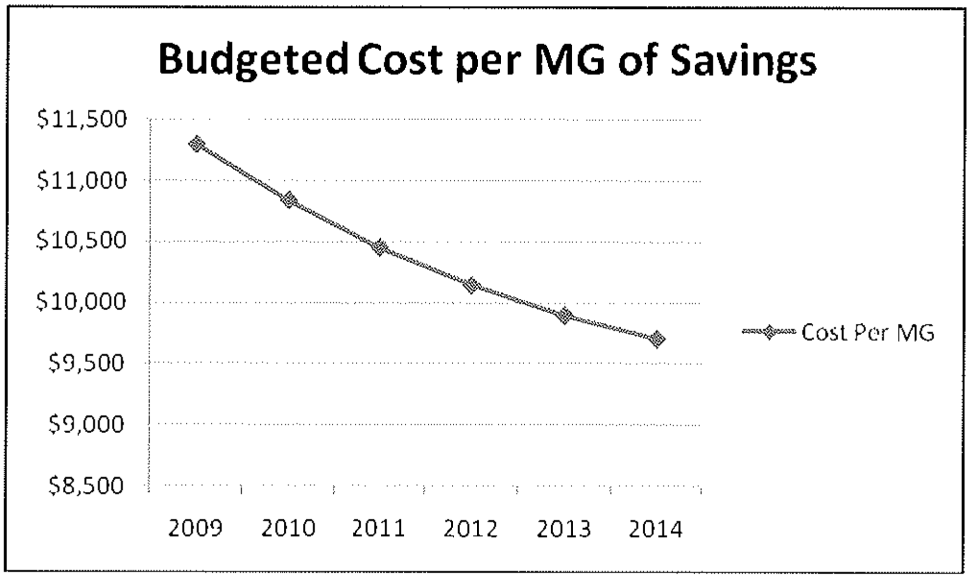



Figure 8.6 Budgeted Cost Per MG of Savings

### 8.2.10 Summary of Water Use Efficiency Program

The City, by implementing this new program, will provide for more efficient water use and support continued growth. This program will fulfill all the necessary requirements of the new WUE.

In conclusion, the City will maintain the target water use efficiency goal of one percent per year per ERU till 2014. This should reduce the 2008 ERU Planning Value of 230 gallon/day to 217 gallon/day by 2014. Through the implementation of the measures proposed and a staff position dedicated towards this program, this goal will be met.

# APPENDIX D

# CONSTRUCTION STANDARDS

# CITY OF ALGONA
# WATER SYSTEM CONSTRUCTION STANDARDS

## 1. GENERAL

The standards established by this chapter are intended to represent the minimum standards for the design and construction of water system facilities. Greater or lesser requirements may be mandated by the City due to localized conditions. Extensions, connections or modifications to the existing system shall be in compliance with the State Department of Health.

Off-site improvements to the existing system may be warranted based on (1) the condition and capacity of the existing water system and (2) impacts caused by the proposed development. These off-site improvements (in addition to “on-site improvements) shall be completed as determined by the City Engineer to mitigate impacts caused by the development.

The following minimum design, manufacturing and construction standards shall apply:

(a) American Water Works Association Standards.
(b) Water System Design Manual, Washington Department of Health (2009).
(c) Design criteria of federal agencies including the Federal Housing Administration, Department of Housing and Urban Development, the Federal Highway Administration, Department of Transportation and the Environmental Protection Agency.
(d) The WSDOT/APWA Standard Plans for Road and Bridge Construction, to be referred to as the “Standard Plans or Standard Details,” current edition as amended.
(e) NSF/ANSI 61

## 2. GENERAL REQUIREMENTS

A. Prior to construction, the Contractor shall notify the City for a preconstruction meeting.

B. Prior to any work being performed, the Contractor shall contact the Public Works Supervisor or City Engineer to set forth his proposed work schedule.

C. Work shall be performed only by contractors experienced in laying public water mains.

D. Contractor shall obtain approval of materials to be used from City's Public Works Supervisor and/or City Engineer prior to ordering of materials.

E. Water mains shall be laid only in dedicated, or to be dedicated, streets, rights-of-ways or easements shown on preliminary plats or which have been granted to the City.

F. The location of the water mains, valves, hydrants, and principal fittings including modifications shall be staked by the Developer. No deviation shall be made from the required line or grade. The Contractor shall verify and protect all underground and surface utilities encountered during the progress of this work.

G. All water services shall end within road right-of-way or easements.

H. All meters shall be installed by the City, and the Developer shall pay the current meter installation charge.

I. One sample station is required for development in size of 1 to 10 lots. One additional station is required for each additional 50 lots or portions thereof.

J. All new buildings and residences shall include in their water service a suitable pressure reducing valve to protect the plumbing from excessive pressures, unless waived in writing by the City.

K. All new construction shall comply with the current Cross-Connection Control requirements.

L. Cut in connections shall <u>not</u> be made on Fridays, holidays or weekends. All tapping sleeves and tapping valves shall be pressure tested prior to making connection to existing mains.

M. Contractor shall notify the Public Works Supervisor and obtain approval from him prior to any water shut-off or turn-on, affecting the water system, a minimum of 48 hours in advance.

N. Except as otherwise noted herein, all work shall be accomplished as recommended in applicable American Water Works Association (AWWA) Standards, and according to the recommendations of the manufacturer of the material or equipment concerned.

O. The pipe and fittings shall be inspected for defects before installation. All lumps, blisters and excess coal tar coating shall be removed from the bell and spigot end of each pipe, and the outside of the spigot and the inside of the bell shall be wire-brushed and wiped clean and dry, and free from oil and grease before the pipe is laid.

P. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. After placing a length of pipe in the trench, the spigot end shall be centered in the bell and pipe forced home and brought to correct line and grade. The pipe shall be secured in place with select backfill tamped under it. Precaution shall be taken to prevent dirt from entering the joint space. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a water-tight plug. If water is in the trench when work resumes, the seal shall remain in place until the trench is pumped completely dry. No pipe shall be laid in water or when trench conditions are unsuitable.

Q. The cutting of pipe for inserting fittings or closure pieces shall be done in a neat and workmanlike manner, without damage to the pipe or cement lining, and so as to leave a smooth end at right angles to the axis of the pipe. When pipe lengths are cut, the outer edge shall be beveled to prevent damage to the gasket during jointing of pipes.

R. Pipe shall be laid with bell ends facing in the direction of the laying, unless directed otherwise by the City. Wherever it is necessary to deflect pipe from a straight line, the amount of deflection allowed shall not exceed pipe manufacturer's recommendations.

S. For connection of mechanical joints, the socket, plain end of each pipe and gasket shall be cleaned of dirt before jointing, and shall be jointed according to manufacturer’s directions. Bolts shall be tightened alternately at top, bottom and sides, so pressure on gasket is even.

T. For connection of push-on joints, the jointing shall be done according to manufacturer’s recommendations, with special care used in cleaning gasket seat to prevent any dirt or sand from getting between the gasket and pipe. Lubricant to be used on the gasket shall be non-toxic and free from contamination. When a pipe length is cut, the outer edge of the cut shall be beveled with a file to prevent injury to the gasket during jointing.

U. Valves, fittings, plugs and caps shall be set and jointed to pipe in the manner as required. All dead ends on new mains shall be closed with dead end M.J. caps.

V. Fittings shall be “blocked” with poured-in-place concrete, with a firm minimum bearing against an undisturbed earth wall. Timber blocking will not be permitted. Thrust blocks shall be poured as soon as possible after setting the fittings in place to allow the concrete to "set" before applying the pressure test. The concrete thrust blocks shall be in place before beginning the pressure test. Anchor blocks shall be allowed to set sufficiently to develop the necessary bond strength between the reinforcing rods and the concrete anchor before beginning the pressure test.

W. Meter services and meter boxes shall be set to final grade and all adjustments shall be made prior to final pressure testing of the system. Service inlet shall be centered at inlet end of box and faced toward outlet end of box parallel with long sides.

X. Road restoration shall be per City design and construction standards. Developer and Contractor shall become familiar with all City conditions of required permits, and shall adhere to all conditions and requirements.

Y. Prior to final inspection, all pipelines shall be pressure tested and disinfected.

Z. Final bacteriological and pressure testing of the water main shall only be accomplished after, at a minimum, the first lift of asphalt is placed.

AA. The Developer shall be required, upon completion of the work and prior to acceptance by the City, to furnish the City with a written guarantee covering all material and workmanship for a period of two years after the date of final acceptance and he shall make all necessary repairs during that period at his own expense, if such repairs are necessitated as the result of furnishing poor materials and/or workmanship. The Developer shall obtain warranties from the contractors, subcontractors and suppliers of material or equipment where such warranties are required and shall deliver copies to the City upon completion of the work.

## 3. DESIGN STANDARDS

The design of water system improvements shall depend on their type and local site conditions. The design elements of water system improvements shall conform to City Standards as set forth herein.

A. Detailed plans shall be submitted for the City's review which provide the locations, size, and type of the proposed water system and points of connection.

B. Project plans shall have a horizontal scale of not more than 50 feet to the inch. Plans shall show:

1. Locations of streets, right-of-ways, existing utilities and water system facilities.

2. Ground surface, pipe type and size, and water valves and hydrants stationing.

3. All known existing structures, both above and below ground, which might interfere with the proposed construction, particularly sewer lines, gas mains, storm drains, overhead and underground power lines, and telephone lines and television cables.

4. All utility easements, and applicable County recording number(s).

C. Computations and other data used for design of the water system shall be submitted to the City for approval.

D. The water system facilities shall be designed and constructed in conformance with the Current version of the <u>Standard Specifications for Road, Bridge, & Municipal Construction</u> and current amendments thereto, State of Washington Department of Transportation, revised as to form to make reference to Local Governments and as modified by the City's requirements and standards.

E. All water main distribution pipeline construction shall have a minimum 36" cover from finished grade and 42-inch cover over transmission mains. Mains shall generally be located parallel to and 6 feet northerly or easterly of street centerline. Water mains shall be extended to the far property line(s) of the property being served. Off-site extensions may be required to hydraulically loop existing and new systems. Oversizing of water mains may be required to be installed per City’s current Water System Plan.

F. Fire hydrants are generally required approximately every 600 feet in residential areas, and every 300 feet in commercial areas. However, fire hydrants shall be furnished and installed at all locations as specifically mandated by the local fire marshal and/or per the International Building Code and the International Residential Code.

G. Fire hydrants on dead end streets and roads shall be located within approximately 300 feet from the frontage center of the farthest lot. Distances required herein shall be measured linearly along street or road.

H. Valves shall be installed at not more than 1,000-foot spacing. Valves shall be installed on all legs of all tees and crossed except fire hydrant tees.

I. Pipes connecting hydrants to mains shall be at least 6 inch in diameter and be less than 50 feet in length.

J. Dead end lines are not permitted except where the Developer can demonstrate to the City's satisfaction that it would be impractical to extend the line at a future date. Water mains on platted cul-de-sacs shall extend to the plat line beyond the cul-de-sac to neighboring property for a convenient future connection, and extended off-site to create a hydraulic loop, or, as minimum, have a 4-inch blow off assembly installed at the termination point.

K. Bends shall be included in the design as needed to maintain proper depth and spacing from other utilities. Bends shall be utilized so as not to exceed allowable deflection at pipe joints in accordance with pipe manufacturer's recommendations.

L. Provide thrust blocking and/or restrained joints at all fittings and bends in accordance with the City standards and conditions.

M. Provide anchor blocking at all up-thrust vertical bends in accordance with City standards.

N. Minimum size service lines between the water main and the water meter shall be 3/4 inch unless otherwise specified. All service lines shall be the minimum size specified by the Uniform Plumbing Code in accordance with fixture units. Single service connections are required unless a double service is specifically approved by the City.

## 4. MATERIALS

Materials and installation shall conform with requirements that have been established by the industry in its technical publications, such as ASTM, AWWA, WPCF, NSF/ANSI and APWA standards.

A. Water Mains & Fittings:

1. All materials shall be new and undamaged.

2. Unless otherwise approved or required by the City Engineer, the water main shall be ductile iron pipe class as shown below. The minimum nominal size for water mains shall be 8 inches, unless otherwise approved/required by City Engineer.

| <u>Class</u> | <u>Pipe Diameter</u> |
|---|---|
| Class 52 | 4" through 14" |
| 16" and larger | Class 50 |

EXCEPTION: 6-inch hydrant spools and pipelines located beneath rock or retaining walls shall be Class 53.

3. All fittings shall be cement-lined ductile iron.

4. The ductile iron pipe shall conform to ANSI/AWWA C151/A21.51-91 Standards, and current amendments thereto, except the ductile iron pipe shall be thickness Class 52 for 4-inch through 14-inch-diameter pipe (except for 6-inch hydrant spools which shall be Cl. 53) and Class 50 for 16" and larger. Grade of iron shall be a minimum of 60-42-10. The pipe shall be cement lined to a minimum thickness of 1/16", and the exterior shall be coated with an asphaltic coating. Each length shall be plainly marked with the manufacturer’s identification, year case, thickness, class of pipe and weight.

5. Joints shall be mechanical joint or push-on type, employing a single gasket, such as “Tyton,” except where otherwise calling for flanged ends. Bolts furnished for mechanical joint pipe and fittings shall be high strength ductile iron, with a minimum tensile strength of 50,000 psi.

6. Restrained joint pipe, where shown on the Plans shall be push-on joint pipe with “Fast Tight” gaskets as furnished by U.S. Pipe or equal for 12-inch diameter and smaller pipe and “TR FLEX” as furnished by U.S. Pipe or equal for 16-inch and 24-inch-diameter pipes. The restrained joint pipe shall meet all other requirements of the non-restrained pipe.

7. All pipe shall be jointed by the manufacturer’s standard coupling, be all of one manufacturer, be carefully installed in complete compliance with the manufacturer’s recommendations.

8. Joints shall be “made up” in accordance with the manufacturer’s recommendations. Standard joint materials, including rubber ring gaskets, shall be furnished with the pipe. Material shall be suitable for the specified pipe size and pressures.

9. All fittings shall be short-bodied, ductile iron complying with applicable ANSI/AWWA C110 or C153 Standards for 350 psi

pressure rating for mechanical joint fittings and 250 psi pressure rating for flanged fittings. All fittings shall be cement lined and either mechanical joint or flanged, as indicated on the Plans.

10. Fittings in areas shown on the Plans for restrained joints shall be mechanical joint fittings with a mechanical joint restraint device. The mechanical joint restraint device shall have a working pressure of at least 250 psi with a minimum safety factor of 2:1 and shall be EBAA Iron, Inc., MEGALUG, Star Pipe Products, or approved equal.

11. All couplings shall be ductile iron mechanical joint sleeves.

12. All of the new piping, valves and blocking shall have been installed, disinfected and tested up to the point of cutting into existing lines before the crossover is made. The crossover to the existing system shall be in full readiness, including the cut and sized specials. Forty-eight-hour notice shall be given the City in advance of the planned “cut-ins.” All sleeves shall be ductile iron.

B. Valves:

All valves 14 inch and larger shall generally be furnished and installed as butterfly valves. All valves 12 inch and smaller shall generally be furnished and installed as resilient seat gate valves.

1. Resilient-Seated Gate Valves

The gate valves shall be <u>ductile iron body</u> valves, iron disk completely encapsulated with polyurethane rubber and bronze, non-rising stem with “O” ring seals conforming to AWWA C509 or C515. The valves shall open counter-clockwise and be furnished with 2-inch square operating nuts except valves in vaults shall be furnished with handwheels. All surfaces, interior and exterior shall be fusion bonded epoxy coated, acceptable for potable water.

For applications with working pressure above 175 psi, a valve rated as 250 psi or higher shall be used.

Gate valves shall be Mueller A-2360 Series , or approved equal.

2. Butterfly Valves

Butterfly valves shall be ductile iron body of the tight closing rubber seat type with rubber seat either bonded to the body or mechanically retained in the body with no fasteners or retaining hardware in the flowstream. The valves shall meet the full requirements of AWWA C504, Class 150B except the valves shall be able to withstand 200 psi differential pressure without leakage. The valves may have rubber seats mechanically affixed to the valve vane. Where threaded fasteners are used, the fasteners shall be retained with a locking wire or equivalent provision to prevent loosening. Rubber seats attached to the valve vane shall be equipped with stainless steel seat ring integral with the body, and the body internal surfaces shall be epoxy coated to prevent tuberculations buildup, which might damage the disc-mounted rubber seat.

No metal-to-metal sealing surfaces shall be permitted. The valves shall be bubble-tight at rated pressures with flow in either direction, and shall be satisfactory for applications involving valve

operations after long periods of inactivity. Valve discs shall rotate 90 degrees from the full open position to the tight shut position.

Butterfly valves shall be Henry Pratt Company "*Groundhog,*" or Mueller "*Lineseal III.*"

3. Tapping Sleeves & Tapping Valves

The tapping sleeves shall be rated for a working pressure of 250 psi minimum and furnished complete with joint accessories. Tapping sleeves shall be constructed in two sections for ease of installation and shall be assembled around the main without interrupting service.

Mechanical joint style sleeves shall be ductile iron and comply with AWWA C110. Mechanical joint sleeves shall be cast by Clow, Dresser, Mueller, Tyler, U.S. Pipe or approved equal.

Tapping valves shall be provided with a standard mechanical joint outlet for use with ductile iron pipe and shall have oversized seat rings to permit entry of the tapping machine cutters. In all other respects, the tapping valves shall conform to the resilient seat gate valves herein specified with regards to operation and materials.

The tapping sleeve and valve shall be tested to 100 psi (air) prior to tapping the main.

The installation contractor for the tapping sleeves and valves shall be approved by the City.

The valves shall be set with stems vertical. The axis of the valve box shall be common with the axis projected off the valve stem. The tops of the adjustable valve boxes shall be set to the existing or established grade, whichever is applicable.

All valves with operating nuts located more than 4'-0" below finished grade shall be equipped with extension stems to bring the operating nut to within 18 inches of the finished grade.

At the top of the extension stem, there shall be a 2-inch standard operating nut, complete with a centering flange that closely fits the 5-inch pipe encasement of the extension stem. The valve box shall be set in a telescoping fashion around the 5-inch pipe cut to the correct length to allow future adjustment up or down.

Each valve shall be provided with an adjustable two-piece cast iron valve box of 5-inches minimum inside diameter. Valve boxes shall have a top section with an 18-inch minimum length. The valve boxes and covers shall be Olympic Foundry No. 940 or equal.

Valves located in easements or outside of paved areas shall have concrete collars with a minimum size of 2'-0" diameter by 4-inches thick.

4. Valve Markers

Provide a blue Carsonite valve marker post for each valve outside of asphalt.

Markers shall be placed at the edge of the right-of-way opposite the valve and set so as to leave 2'-0" of the post exposed above grade. The distance in feet and inches to the valve shall be clearly stenciled on the side facing the valve in black numerals 2-inches in height.

5. Pressure Reducing and Relief Valves

When street main pressure exceeds 80 psi, an approved pressure reducing valve with an approved pressure relief device shall be installed in the water service pipe near its entrance to the building to reduce the pressure to 80 psi or lower. Pressure at any fixture shall be limited to no more than 80 psi under no-flow conditions.

C. Fire Hydrants:

All fire hydrants shall be approved by the National Board of Fire Underwriters and conform to AWWA Specification C502, break-away type, in which the valve will remain closed if the barrel is broken. The hydrant barrel shall have a diameter of not less than 8-1/2 inches, and the valve diameter shall be not less than 5-1/4 inches. Each hydrant shall be equipped with two 2-1/2-inch hose ports (National Standard Thread), and one 4-1/2-inch pumper connection (National Standard Thread), with permanent Storz hydrant adaptor and Storz blind cap. Each hydrant shall be equipped with a suitable positive acting drain valve and 1-1/4-inch pentagonal operating nut (counter-clockwise opening). The fire hydrants shall be Waterous Pacer, M&H 929, or City approved equal. A blue pavement marker shall be furnished and installed in the pavement in front of each hydrant.

The holding spools between the gate valve and fire hydrant shall be made from 6-inch Class 53 ductile iron pipe, 0.34-inch wall thickness. The hydrant and gate valve shall be anchored in place using holding spools and mechanical joint restraint device. Holding spools with length in excess of 17 feet shall be supplied with an M. J. sleeve and mechanical joint restraint device.

The fire hydrants shall be painted per local fire marshal requirements with two coats of Preservative Brand caterpillar or international yellow paint. After installation, they shall be wire brushed and field painted with two additional coats of similar yellow enamel paint. Distance to the hydrant valve shall be clearly stenciled in black numerals 2 inches in height on the fire hydrant below the pumper port.

<u>Between the time that the fire hydrant is installed and the completed facility is placed in operation, the fire hydrant shall at all times be wrapped in burlap, or covered in some other suitable manner to clearly indicate that the fire hydrant is not in service.</u>

D. Blow-offs & Air Relief Assemblies:

Two-inch or 4-inch blowoff assemblies shall be installed at the terminus of all dead end water mains. Blowoffs utilized by the Contractor for flushing the water main shall be sufficient size to obtain 2.5 feet per second velocity in the main. Temporary blow-offs shall be removed and replaced with a suitably sized watertight brass plug.

Two-inch air and vacuum release valves shall be installed at principal high points in the system. See detail.

The installation of these items shall include connection piping, gate valve, valve box, and all accessories. Valve markers shall be optional with City.

E. Residential water service pipe shall be ¾-inch high plastic "Poly" pipe (no joints beneath pavement areas), meeting or exceed ASTM D2239, SDR-7 as manufactured by Driscopipe (CL 200), or City approved equal.

## 5. WATER PIPE TESTING & DISINFECTING

All pipelines shall be tested and disinfected prior to acceptance of work. The City will flush the waterline at the Developer's expense. All pumps, gauges, plugs, saddles, corporation stops, miscellaneous hose and piping, and measuring equipment necessary for performing the test shall be furnished, installed and operated by the Contractor. Feed for the pump shall be from a barrel or other container within the actual amount of "makeup" water, so that it can be measured periodically during the test period.

The pipeline shall be backfilled sufficiently to prevent movement of the pipe under pressure. All thrust blocks shall be in place and time allowed for the concrete to cure before testing. Where permanent blocking is not required, the Contractor shall furnish and install temporary blocking.

As soon as pipe is secured against movement under pressure, it may be filled with water. Satisfactory performance of all valves shall be checked while the line is filling.

Contractor shall preflush all water mains after water has remained in the main for 24 hours and before pressure testing the main.

After the pipe is filled and all air expelled, it shall be pumped to a test pressure of 250 psi, and this pressure shall be maintained for a period of not less than 30 minutes to insure the integrity of the thrust and anchor blocks. **The contractor/developer is cautioned regarding pressure limitations on butterfly**

**valves.** All tests shall be made with the hydrant auxiliary gate valves open and pressure against the hydrant valve. Hydrostatic tests shall be performed on every complete section of water main between two valves, and each valve shall withstand the same test pressure as the pipe with no pressure active in the section of pipe beyond the closed valve.

In addition to the hydrostatic pressure test, a leakage test shall be conducted on the pipeline. The leakage test shall be conducted at 150 psi for a period of not less than 1 hour. The quantity of water lost from the main shall not exceed the number of gallons per hour determined by the formula:

$$L = \frac{S*D*(\sqrt{P})}{266,400}$$

in which

L = Allowable leakage, gallons/hour
S = Gross length of pipe tested (feet)
D = Nominal diameter of the pipe (inches)
P = Average test pressure during the leakage test (psi)

Defective materials or workmanship, discovered as a result of the tests, shall be replaced by the Contractor at the Contractor's expense. Whenever it is necessary to replace defective material or correct the workmanship, the tests shall be rerun at the Contractor's expense until a satisfactory test is obtained.

As sections of pipe are constructed and before pipelines are placed in service, they shall be sterilized in conformance with the requirements of the State of Washington Department of Health Services.

The Contractor shall be responsible for flushing all water mains prior to water samples being acquired. The water mains shall be flushed at a rate to provide a minimum 2.5 feet per second velocity in the main.

In all disinfection processes, the Contractor shall take particular care in flushing and wasting the chlorinated water from the mains to assure that the flushed and chlorinated water does no physical or environmental damage to property, streams, storm sewers or any waterways. The Contractor shall chemically or otherwise treat the chlorinated water to prevent damage to the affected environment, particularly aquatic and fish life of receiving streams.

Chlorine shall be applied in one of the following manners, listed in order of preference, to secure a concentration in the pipe of at least 50 ppm.

1. Injection of chlorine-water mixture from chlorinating apparatus through corporation cock at beginning of section after pipe has been filled, and with water exhausting at end of section at a rate controlled to produce the desired chlorine concentration;

2. Injection similarly of a hypochlorite solution;

3. Other City preapproved method(s) selected by Developer/Contractor.

After the desired chlorine concentration has been obtained throughout the section of line, the water in the line shall be left standing for a period of 24 hours. Following this, the line shall be thoroughly flushed and a water sample collected. The line shall not be placed in service until a satisfactory bacteriological report has been received.

City forces only will be allowed to operate existing and new tie-in valves. The Contractor's forces are expressly forbidden to operate any valve on any section of line, which has been accepted by the City.

## 6. BACKFLOW PREVENTION

All water systems connected to the public water system shall have backflow prevention as required by WAC 246-290-490.

All services other than single family residential shall be provided with Washington State-approved backflow prevention located immediately behind and on the property side of the water service box. Irrigation, residential single-family fire meters, duplex, and multi-family residential connections shall require double check valve assemblies (DCVA). All other connections shall require reduced pressure backflow assemblies (RPBA). Commercial fire sprinkler system, if unmetered shall require reduced pressure detector assemblies (RPDA).

All irrigation using chemical feed, or water features, including decorative ponds, pools and fountains requiring make-up water shall be protected from backflow into the public water supply by a **minimum** of an approved air-gap to be located at the fill point of the pond or water feature. This "air-gap" shall be inspected by the City prior to filling. In all instances, the water supply used for filling purposes shall be protected by a double check valve assembly (DCVA) installed behind the meter for new construction or retrofitted as close as practical on modified systems.

## 7. SERVICE CONNECTIONS

Individual services to each property shall be installed and connected to the new water mains. New services from existing mains will be installed by the City. The Developer shall be responsible for permitting, traffic control, excavation to expose main, shoring to protect City employees, backfilling trench, and completion of all restoration.

Upon completion of the installation of the water main (before testing and disinfection) services shall be installed by connecting to the water main and extending the service line to the property line as shown on the Standard Details or approved equal. Larger service lines shall be of the type and style as designated in the Standard Details and shown on the Plans.

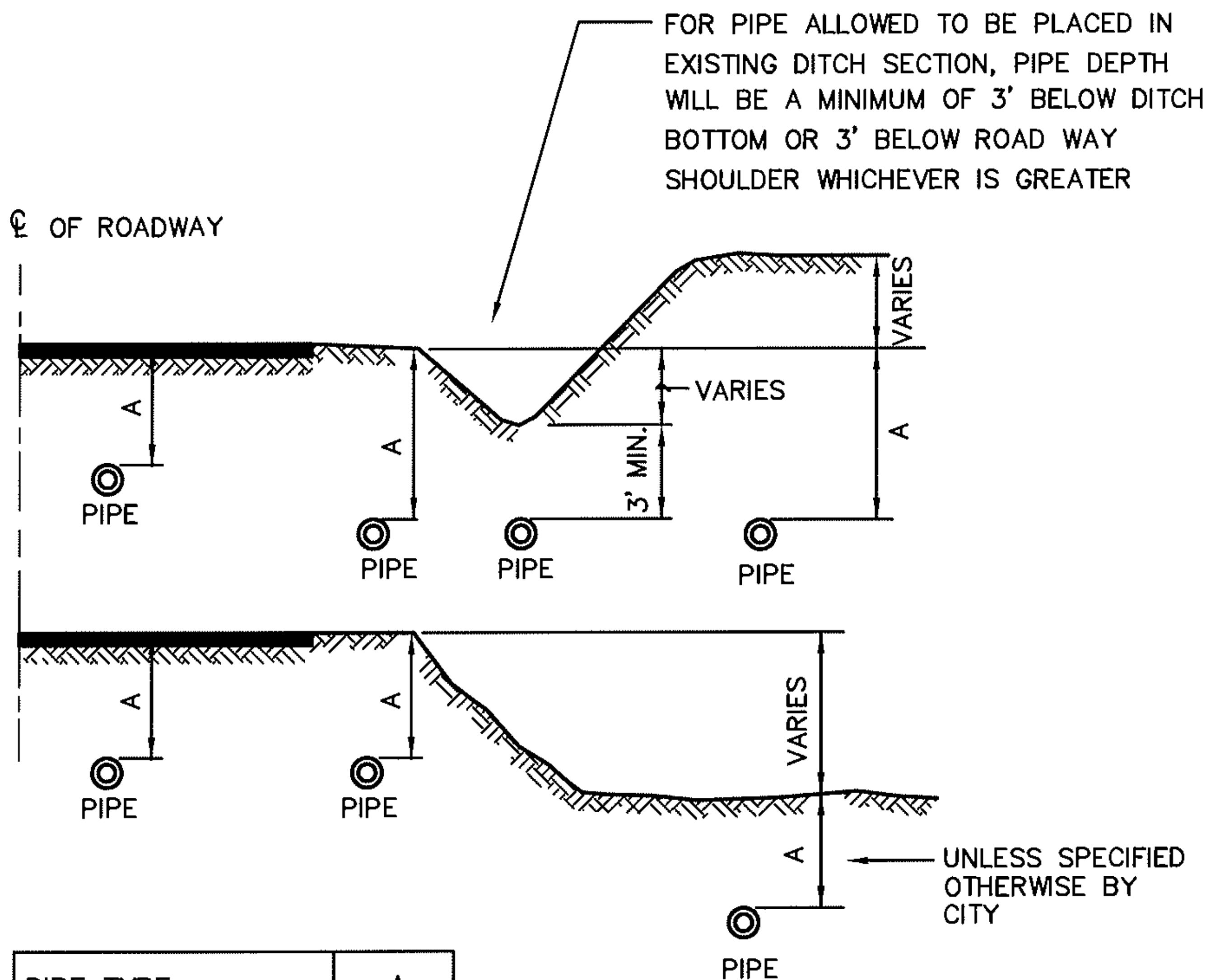
Corporation stops and the single meter shut-off valves shall be Mueller, Ford, or A.Y. McDonald with the type and style noted on the Standard Details or approved equal. Included as a part of the service connection shall be the furnishing and installation of the meter box complete with lid, set flush with the proposed finished grade of the lot in the designated location near the property line, all as shown on the Standard Details. The angle type of shut-off valve and angle type dual check valve shall be set inside the meter box in a proper position for installation of a future meter by the City.

Service lines between the main and the property line shall be placed at a trench depth sufficient to maintain a 3'-0" cover over the top of the service line for its full length, taking into consideration the final finished grade of the proposed street and the final finished grade of any storm ditches.

Upon completion of each service line as indicated herein, the Developer shall flush the service line to remove the debris that may interfere with the future meter installation, and further verify that the service line has full pressure and flow to the meter box.

**1-1/2-inch and Larger Meters**

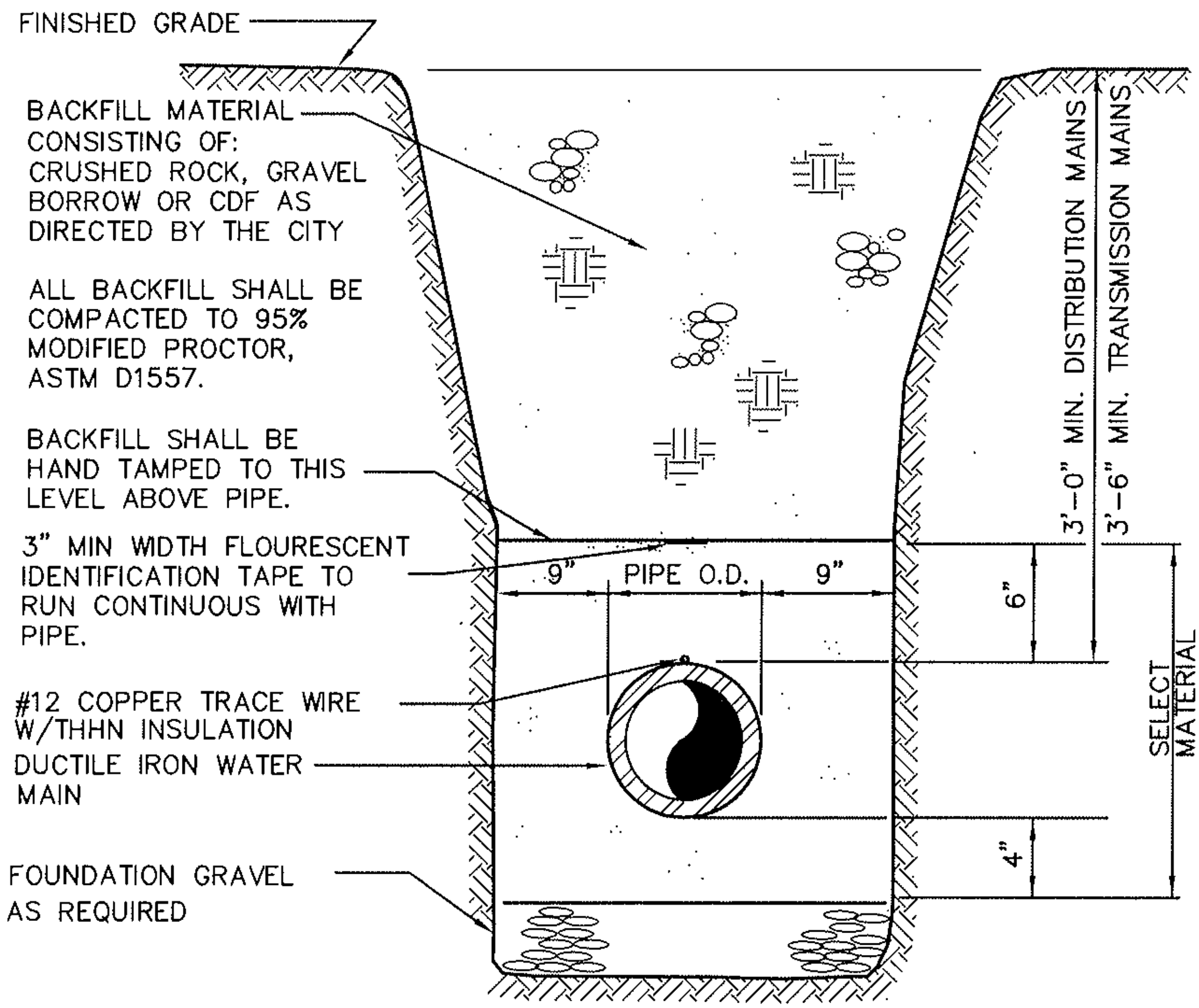
If extensions require water meters 1-1/2 inches or larger, then such entire meter installation, including valves, piping, vaults or meter boxes, drain lines and meters shall be furnished and installed by the Developer conforming to City standards. Activation of meter is subject to conformance with City requirements and payment of connection fees.




| PIPE TYPE | A |
|---|---|
| TRANSMISSION | 42" |
| DISTRIBUITION | 36" |

* MINIMUM DEPTH

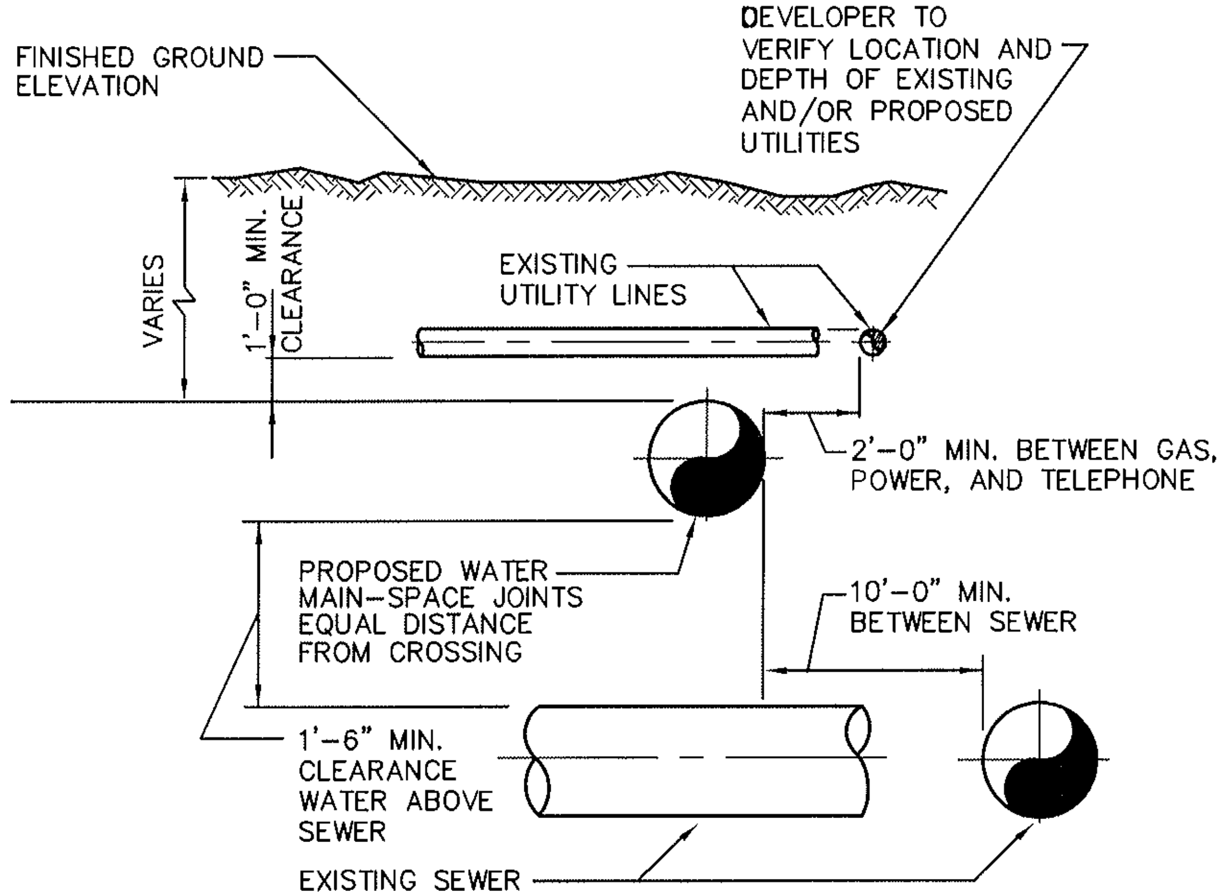
| CITY OF ALGONA | | | |
|---|---|---|---|
| WATER MAIN DEPTH REQUIREMENTS | | | |
| APPROVED: Warren W. Perkins 10/25/13<br>BY CITY DATE | | | DWG. NO.<br>WA–MAIN |
| DATE:<br>10/2012 | DRWN:<br>J.M. | CHKD:<br>W.P. | SCALE:<br>NONE |




NOTE:

BACKFILL MATERIAL AND COMPACTION SHALL BE IN CONFORMANCE WITH THE CITY'S STANDARDS AND/OR STATE OR COUNTY PERMIT REQUIREMENTS.

| CITY OF ALGONA | | | |
|---|---|---|---|
| WATER MAIN TRENCH SECTION | | | |
| APPROVED: Warren W. Perkins 10/25/13<br>BY CITY DATE | | | DWG. NO.<br>WA-MAIN2 |
| DATE:<br>10/2012 | DRWN:<br>J.M. | CHKD:<br>W.P. | SCALE:<br>NONE |

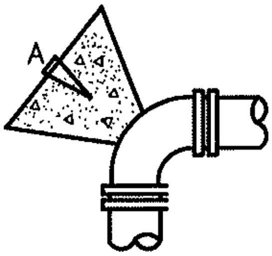



NOTES:

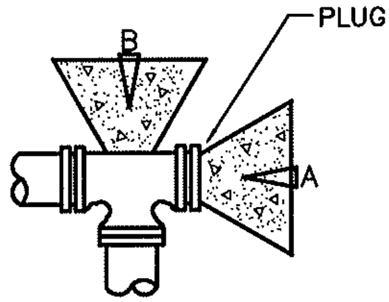
1. CDF ENCASEMENT (BEDDING) SHALL BE UTILIZED, IF APPROVED BY THE CITY, AT LOCALIZED UTILITY CROSSING IF MINIMUM PIPE SEPARATION (ELEVATION) CANNOT BE MAINTAINED OR ACHIEVED.

| CITY OF ALGONA | | | |
|---|---|---|---|
| TYPICAL UTILITY CROSSING | | | |
| APPROVED: Warren W. Perkins 10/25/13<br>BY CITY DATE | | | DWG. NO.<br>TYP–UTIL |
| DATE:<br>10/2012 | DRWN:<br>J.M. | CHKD:<br>W.P. | SCALE:<br>NONE |

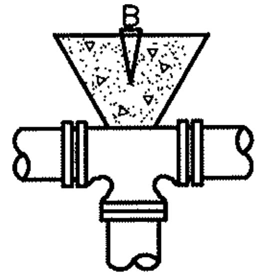
L:\ALGONA\12503 WSF 2012\STD DETAILS\WATER DETAILS\TYP-UTIL.DWG. 10/25/2013 12:21:41 PM. BY: W PERKINS



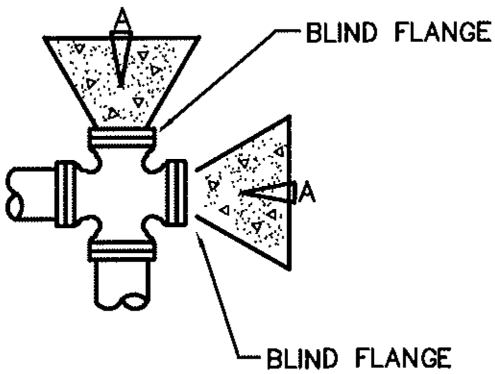

**90° BEND**



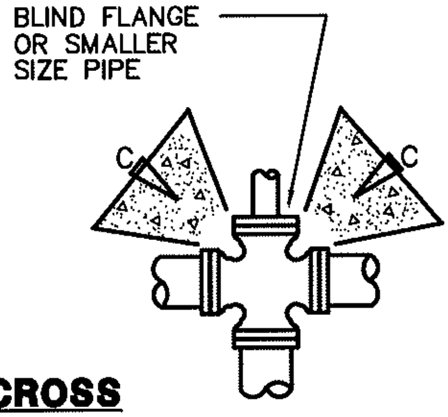

**TEE**



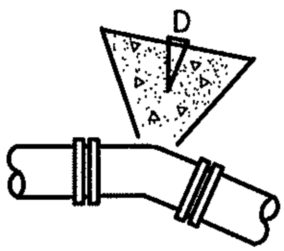

**TEE**



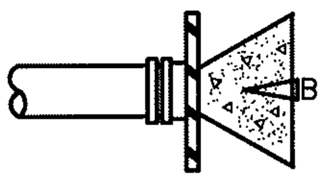

**CAPPED CROSS**



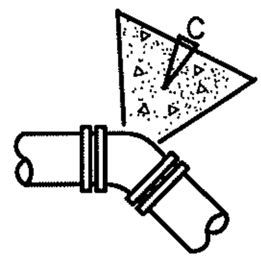

**CROSS**



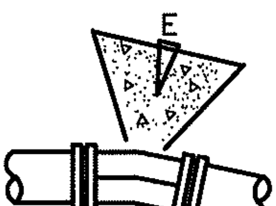

**22 1/2 ° BEND**




**CAP**




**45° BEND**




**11 1/4 ° BEND**

| | | | |
|---|---|---|---|
| CITY OF ALGONA | | | |
| THRUST BLOCK DETAIL (1 of 2) | | | |
| APPROVED: Warren W. Perkins 10/25/13<br>BY CITY DATE | | | DWG. NO.<br>THRU–BL02 |
| DATE:<br>10/2012 | DRWN:<br>J.M. | CHKD:<br>W.P. | SCALE:<br>NONE |

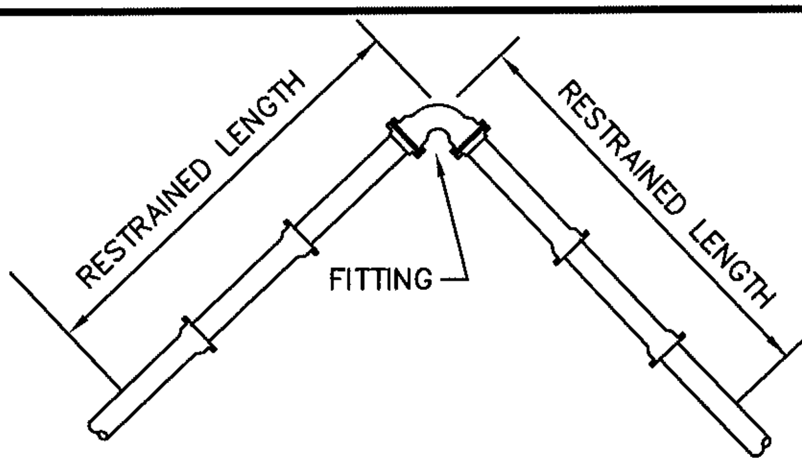
# THRUST BLOCK — TABLE
## MIN. BEARING AREA AGAINST UNDISTURBED SOIL SQUARE FEET

| PIPE SIZE | A($FT^2$) | B($FT^2$) | C($FT^2$) | D($FT^2$) | E($FT^2$) | X |
|---|---|---|---|---|---|---|
| 4" | 3 | 1 | 1 | 1 | 1 | NONE |
| 6" | 4 | 4 | 2 | 1 | 1 | NONE |
| 8" | 7 | 6 | 4 | 2 | 1 | 4 |
| 10" | 11 | 10 | 6 | 3 | 2 | 6 |
| 12' | 16 | 14 | 9 | 5 | 3 | 9 |
| 14" | 22 | 19 | 12 | 6 | 3 | 12 |
| 16" | 29 | 25 | 16 | 8 | 4 | 16 |
| 18" | 36 | 31 | 20 | 10 | 5 | 20 |
| 20" | 45 | 39 | 24 | 13 | 6 | 24 |
| 22" | 54 | 47 | 29 | 15 | 8 | 29 |
| 24" | 64 | 56 | 35 | 18 | 9 | 35 |
| 28" | 87 | 76 | 48 | 24 | 12 | 48 |
| 30" | 101 | 87 | 55 | 28 | 14 | 55 |
| 36" | 145 | 125 | 78 | 40 | 20 | 78 |
| 42" | 197 | 171 | 107 | 55 | 27 | 107 |
| 48" | 257 | 223 | 140 | 71 | 36 | 140 |

NOTES:

1. BEARING AREA OF CONCRETE THRUST—BLOCK BASED ON 200 PSI PRESSURE AND SAFE SOIL BEARING LOAD OF 2,000 POUNDS PER SQUARE FOOT.
2. AREAS MUST BE ADJUSTED FOR OTHER PIPE SIZES, PRESSURES AND SOIL CONDITIONS.
3. CONCRETE BLOCKING SHALL BE CAST IN PLACE AND HAVE A MINIMUM OF 1/4 SQUARE FOOT BEARING AGAINST THE FITTING. WRAP ALL FITTINGS IN 6 MIL PLASTIC PRIOR TO POURING BLOCK. NO CONCRETE SHALL BE PLACED NEAR BOLTS.
4. BLOCK SHALL BEAR AGAINST FITTINGS ONLY AND SHALL BE CLEAR OF JOINTS TO PERMIT TAKING UP OR DISMANTLING OF JOINT.
5. CONTRACTOR SHALL INSTALL BLOCKING ADEQUATE TO WITHSTAND FULL TEST PRESSURE AS WELL AS CONTINUOUSLY WITHSTAND OPERATING PRESSURE UNDER ALL CONDITIONS OF SERVICE.

| CITY OF ALGONA | | | |
|---|---|---|---|
| THRUST BLOCK DETAIL (2 of 2) | | | |
| APPROVED: Warren W. Perkins 10/25/13<br>BY CITY DATE | | | DWG. NO.<br>THRU—BL02 |
| DATE:<br>10/2012 | DRWN:<br>J.M. | CHKD:<br>W.P. | SCALE:<br>NONE |




| PIPE SIZE | 90° BEND | 45° BEND | 22 1/2° BEND | 11 1/4° BEND | TEE OR DEAD END CAP |
|---|---|---|---|---|---|
| | RESTRAINED LENGTH IN FEET | | | | |
| 4" | 40 | 17 | 8 | 4 | 30 |
| 6" | 55 | 23 | 11 | 6 | 39 |
| 8" | 73 | 31 | 15 | 8 | 53 |
| 10" | 88 | 37 | 18 | 9 | 67 |
| 12" | 103 | 43 | 21 | 10 | 82 |
| 16" | 133 | 55 | 27 | 13 | 110 |
| 18" | 145 | 60 | 29 | 15 | 124 |

NOTES:

1. RESTRAINED LENGTHS SHOWN ARE MINIMUM AND FOR LINEAL FEET REQUIRED ON EACH SIDE OF FITTING INDICATED.

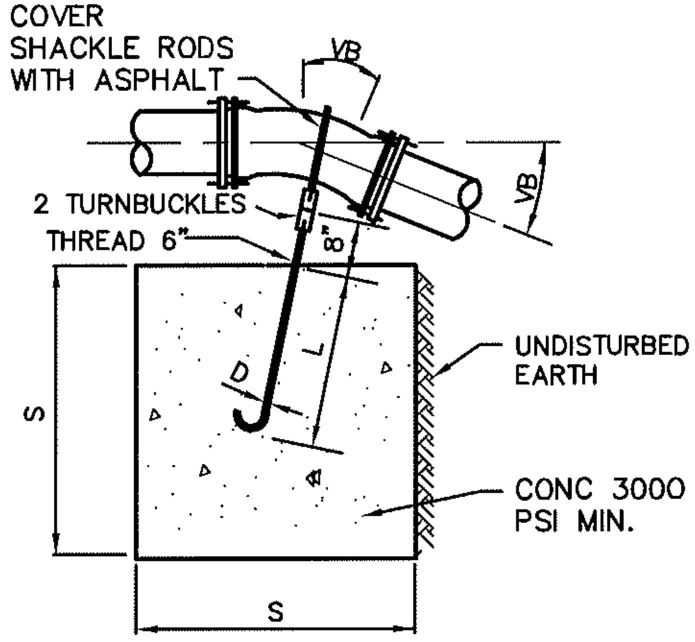
2. FOOTAGES ARE BASED ON 250 PSI PRESSURE AND 42 INCHES COVER. IF PRESSURE IS GREATER OR COVER IS LESS, THE RESTRAINED LENGTH SHALL BE INCREASED ACCORDINGLY

| CITY OF ALGONA | | | |
|---|---|---|---|
| THRUST RESTRAINT FOR DUCTILE IRON PIPE | | | |
| APPROVED: Warren W. Perkins 10/25/13<br>BY CITY DATE | | | DWG. NO. DUCT–PIP |
| DATE: 10/2012 | DRWN: J.M. | CHKD: W.P. | SCALE: NONE |

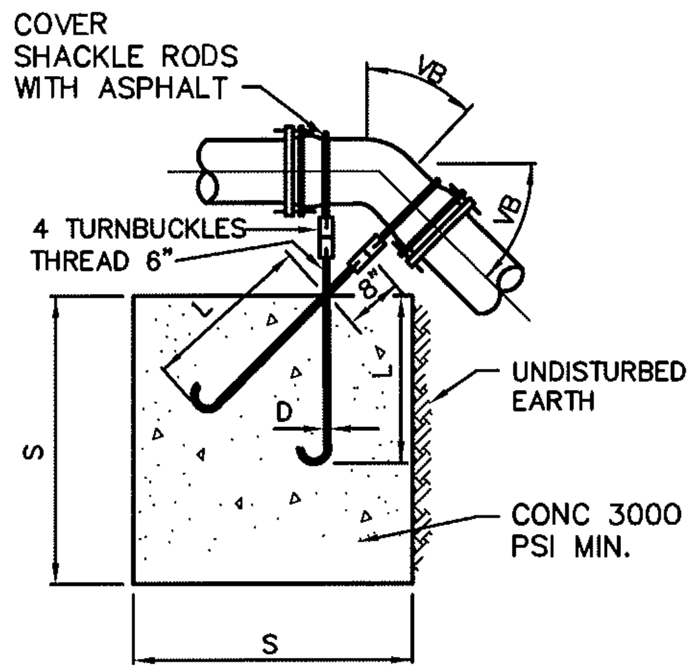
| | | | | | | |
|---|---|---|---|---|---|---|
| **TYPE "A" BLOCKING FOR 11 1/4°–22 1/2°–30° VERTICAL BENDS** | | | | | | |
| | | VB | | S | D | L |
| PIPE SIZE NOMINAL DIAMETER– INCHES | TEST PRESSURE PSI | VERTICAL BEND DEGREES | No. OF CU. FT. OF CONC. BLOCKING | SIDE OF CUBE LIN. FT. | DIAM. OF SHACKLE RODS (2) INCHES | DEPTH OF RODS IN CONCRETE LIN. FT. |
| 4" | 300 | 11 1/4 | 8 | 2 | 5/8" | 1.5 |
| | | 22 1/2 | 11 | 2.2 | | 2.0 |
| | | 30 | 17 | 2.6 | | |
| 6" | 300 | 11 1/4 | 11 | 2.2 | 5/8" | 2.0 |
| | | 22 1/2 | 25 | 2.9 | | |
| | | 30 | 41 | 3.5 | | |
| 8" | 300 | 11 1/4 | 16 | 2.5 | 5/8" | 2.0 |
| | | 22 1/2 | 47 | 3.6 | | |
| | | 30 | 70 | 4.1 | 3/4" | 2.5 |
| 12" | 250 | 11 1/4 | 32 | 3.2 | 5/8" | 2.0 |
| | | 22 1/2 | 88 | 4.5 | 7/8" | 3.0 |
| | | 30 | 132 | 5.1 | | |
| 16" | 225 | 11 1/4 | 70 | 4.1 | 7/8" | 3.0 |
| | | 22 1/2 | 184 | 5.7 | 1 1/8" | 4.0 |
| | | 30 | 275 | 6.5 | 1 1/4" | |
| 20" | 200 | 11 1/4 | 91 | 4.5 | 7/8" | 3.0 |
| | | 22 1/2 | 225 | 6.1 | 1 1/4" | 4.0 |
| | | 30 | 330 | 6.9 | 1 3/8" | 4.5 |
| 24" | 200 | 11 1/4 | 128 | 5.0 | 1" | 3.5 |
| | | 22 1/2 | 320 | 6.8 | 1 3/8" | 4.5 |
| | | 30 | 480 | 7.9 | 1 7/8" | 5.5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **TYPE "B" BLOCKING FOR – 45° VERTICAL BENDS** | | | | | | |
| | | VB | | S | D | L |
| 4" | 300 | 45 | 30 | 3.1 | 5/8" | 2.0 |
| 6" | | | 68 | 4.1 | | |
| 8" | | | 123 | 5.0 | | |
| 12" | 250 | | 232 | 6.1 | 3/4" | 2.5 |
| 16" | 225 | | 478 | 7.8 | 1 1/8" | 4.0 |
| 20" | 200 | | 560 | 8.2 | 1 1/4" | |
| 24" | | | 820 | 9.4 | 1 3/8" | 4.5 |

THIS TABLE REPRESENTS THE "MINIMUM" CONSTRUCTION STANDARD. APPROPRIATELY SIZED ANCHOR BLOCKS BASED ON EXISTING AND LOCAL CONDITIONS ARE REQUIRED




TYPE "A" BLOCKING

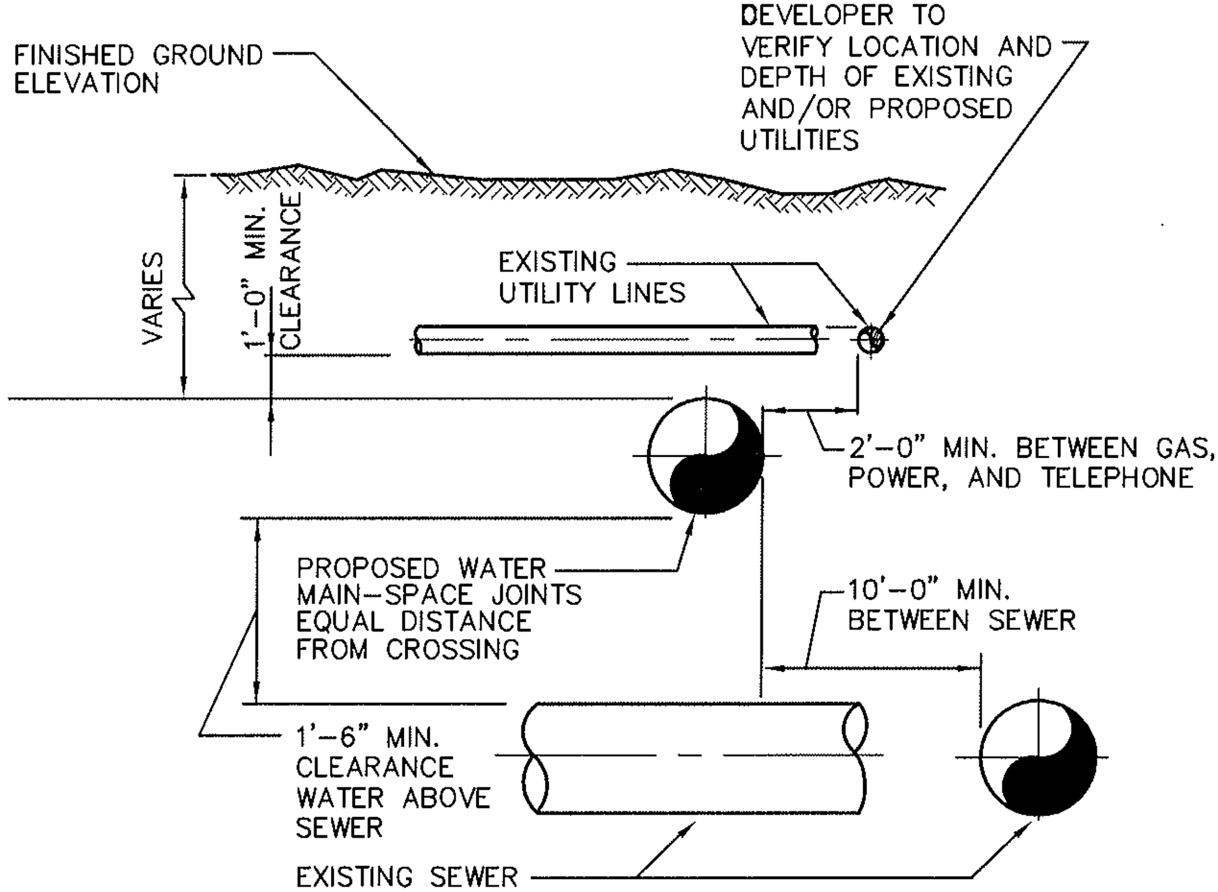



TYPE "B" BLOCKING

## CITY OF ALGONA

## VERTICAL ANCHOR BLOCK

| | | | |
|---|---|---|---|
| APPROVED: Warren W. Perkins 10/25/13 BY CITY DATE | | | DWG. NO. ANCH–BLO |
| DATE: 10/2012 | DRWN: J.M. | CHKD: W.P. | SCALE: NONE |

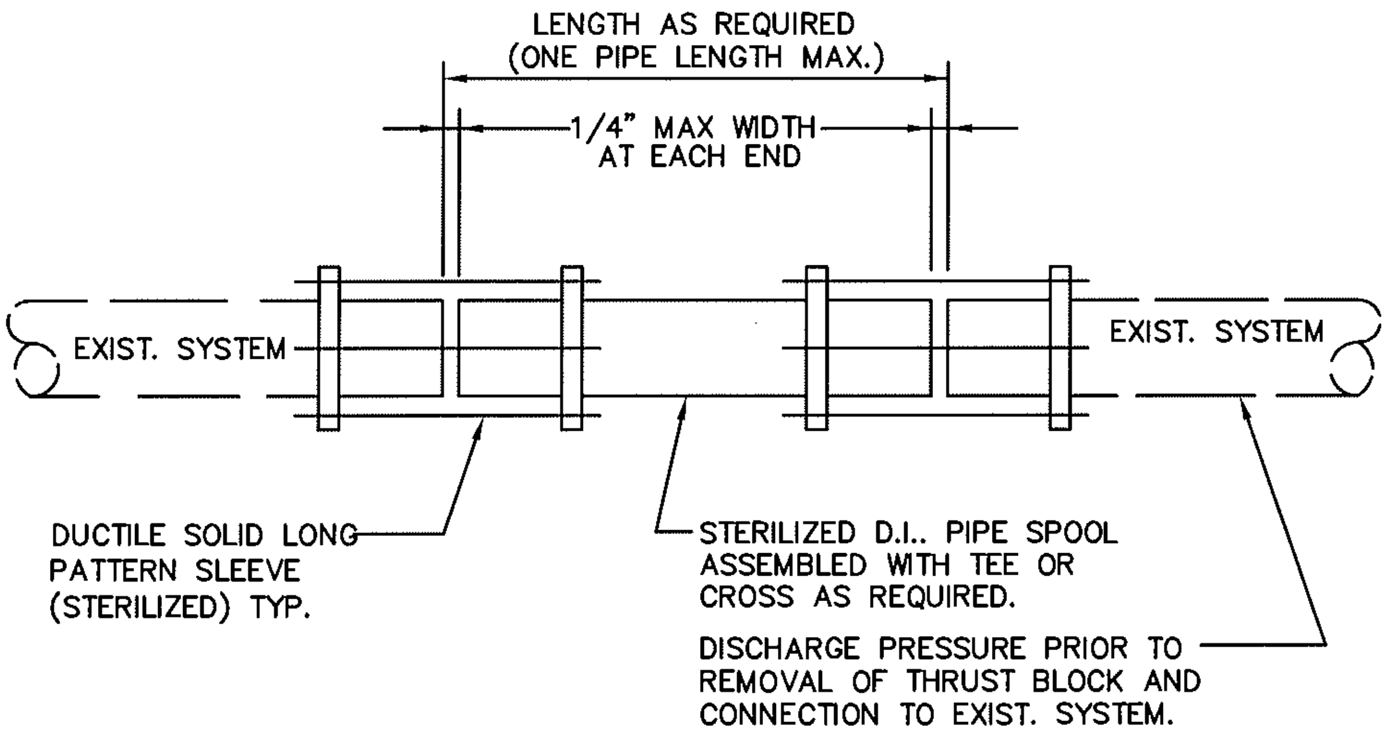



NOTES:

1. CDF ENCASEMENT (BEDDING) SHALL BE UTILIZED, IF APPROVED BY THE CITY, AT LOCALIZED UTILITY CROSSING IF MINIMUM PIPE SEPARATION (ELEVATION) CANNOT BE MAINTAINED OR ACHIEVED.

| CITY OF ALGONA | | | |
|---|---|---|---|
| TYPICAL UTILITY CROSSING | | | |
| APPROVED: 10/25/13 BY CITY DATE | | | DWG. NO. TYP-UTIL |
| DATE: 10/2012 | DRWN: J.M. | CHKD: W.P. | SCALE: NONE |

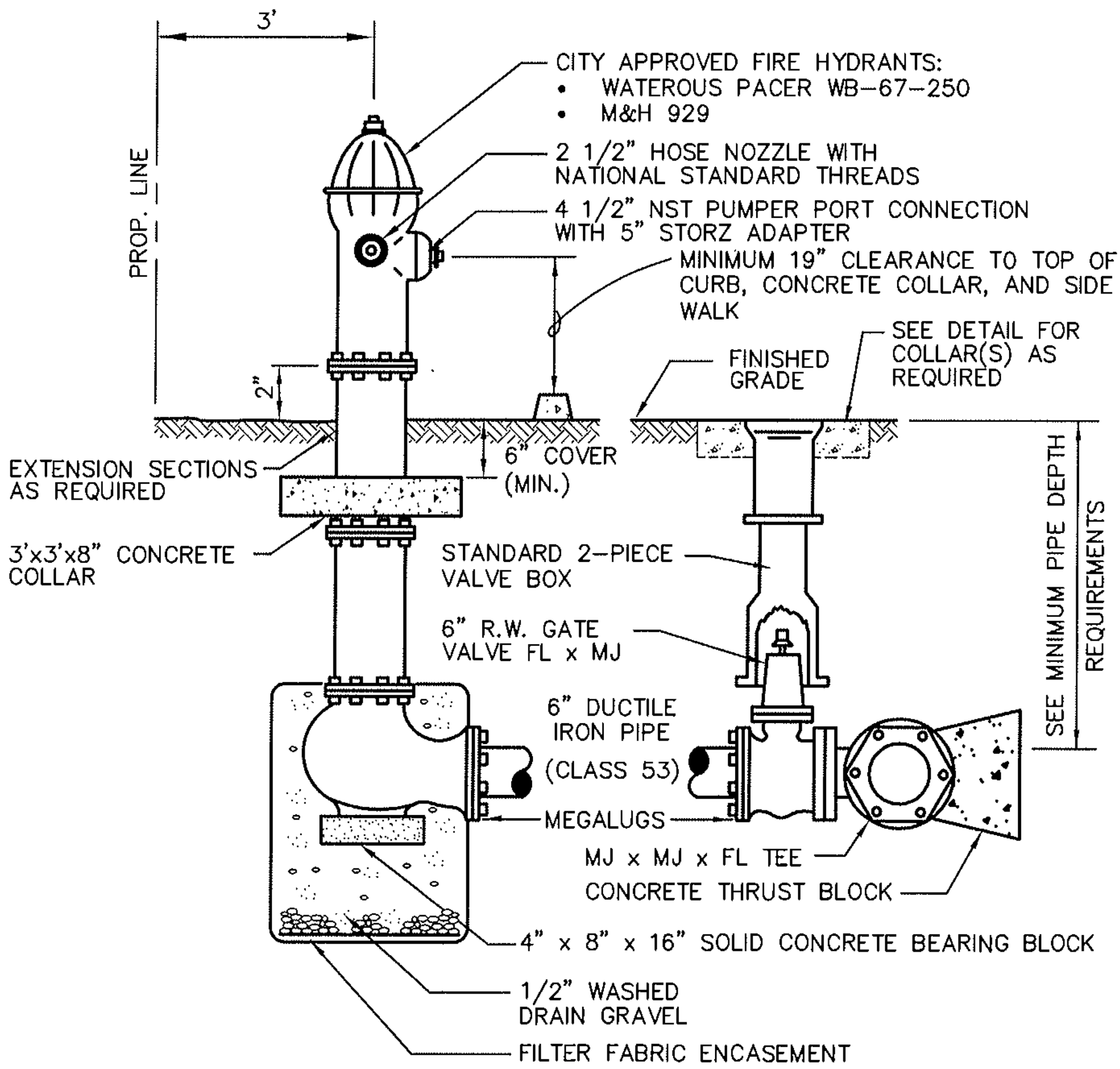
L:\ALGONA\12503 WSP 2012\STD DETAILS\WATER DETAILS\TYP-UTIL.DWG, 10/25/2013 12:21:41 PM, BY: W PERKINS




NOTE:

1. NO DEFLECTION SHALL BE ALLOWED AT EITHER COUPLING.
2. CUT–IN CONNECTIONS ON NON–D.I. PIPE SHALL USE EXTENDED RANGE COUPLING (ROMAC XR501 COUPLING OR EQUAL)
3. IN–LINE VALVE(S) IN EXISTING SYSTEM MAY BE REQUIRED AT THE SOLE DISCRETION OF THE CITY AT ALL NEW INTERTIE LOCATIONS. (NOTE: VALVE(S) ARE NOT SHOWN ABOVE FOR CLARITY)

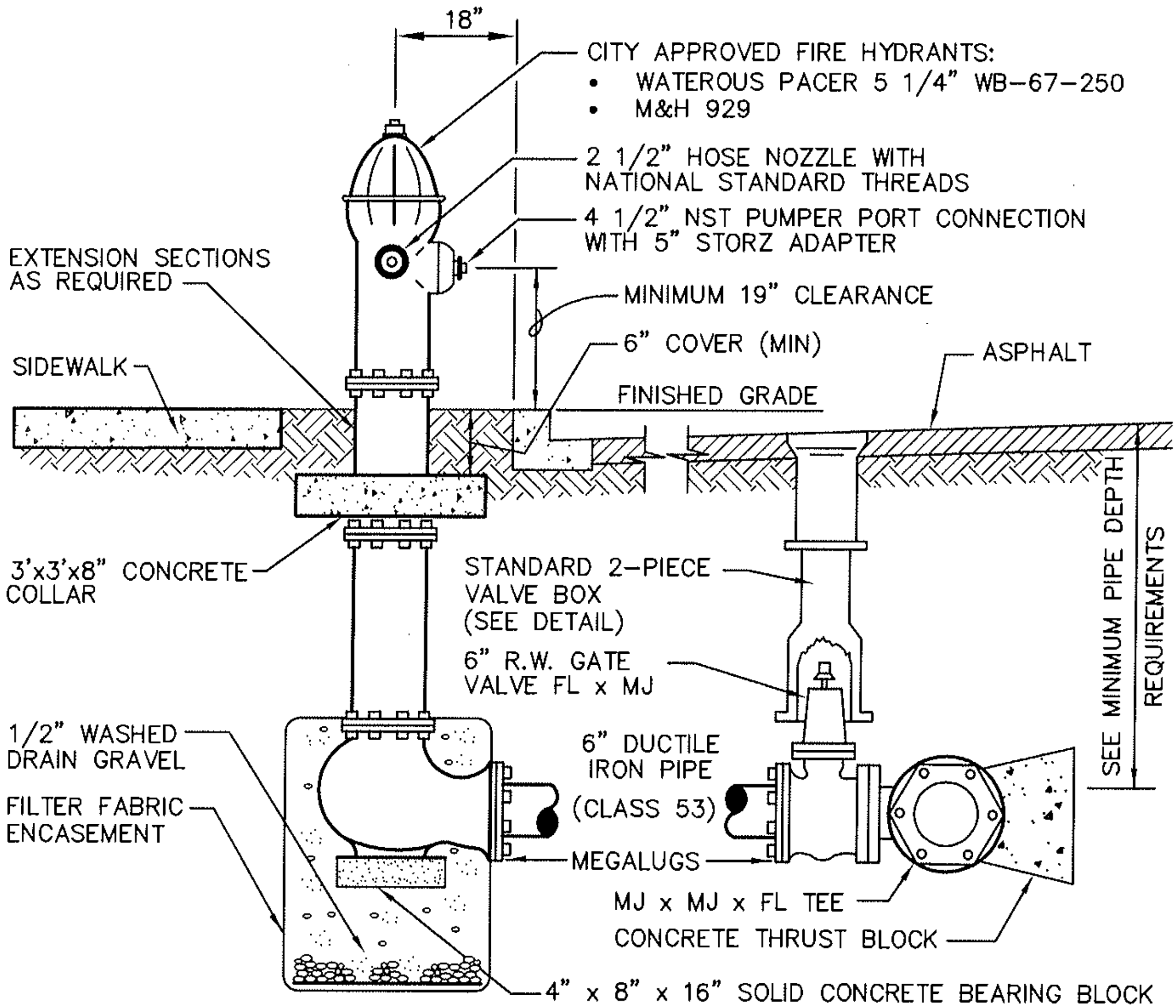
| | | | |
|---|---|---|---|
| CITY OF ALGONA | | | |
| CUT IN CONNECTION | | | |
| APPROVED: Warren W. Perkins 10/25/13<br>BY CITY DATE | | | DWG. NO.<br>CUT–CONN |
| DATE:<br>10/2012 | DRWN:<br>J.M. | CHKD:<br>W.P. | SCALE:<br>NONE |




NOTES:

1. FIRE HYDRANTS TO BE PAINTED WITH RUSTOLEUM ENAMEL SAFETY YELLOW.
2. INSTALL BLUE LANE REFLECTOR IN PAVEMNT.

| | | | |
|---|---|---|---|
| CITY OF ALGONA | | | |
| FIRE HYDRANT INSTALLATION (EXTRUDED CURB) | | | |
| APPROVED: Warren W. Perkins 10/25/13 BY CITY DATE | | | DWG. NO. FIRE-HYD |
| DATE: 10/2012 | DRWN: J.M. | CHKD: W.P. | SCALE: NONE |



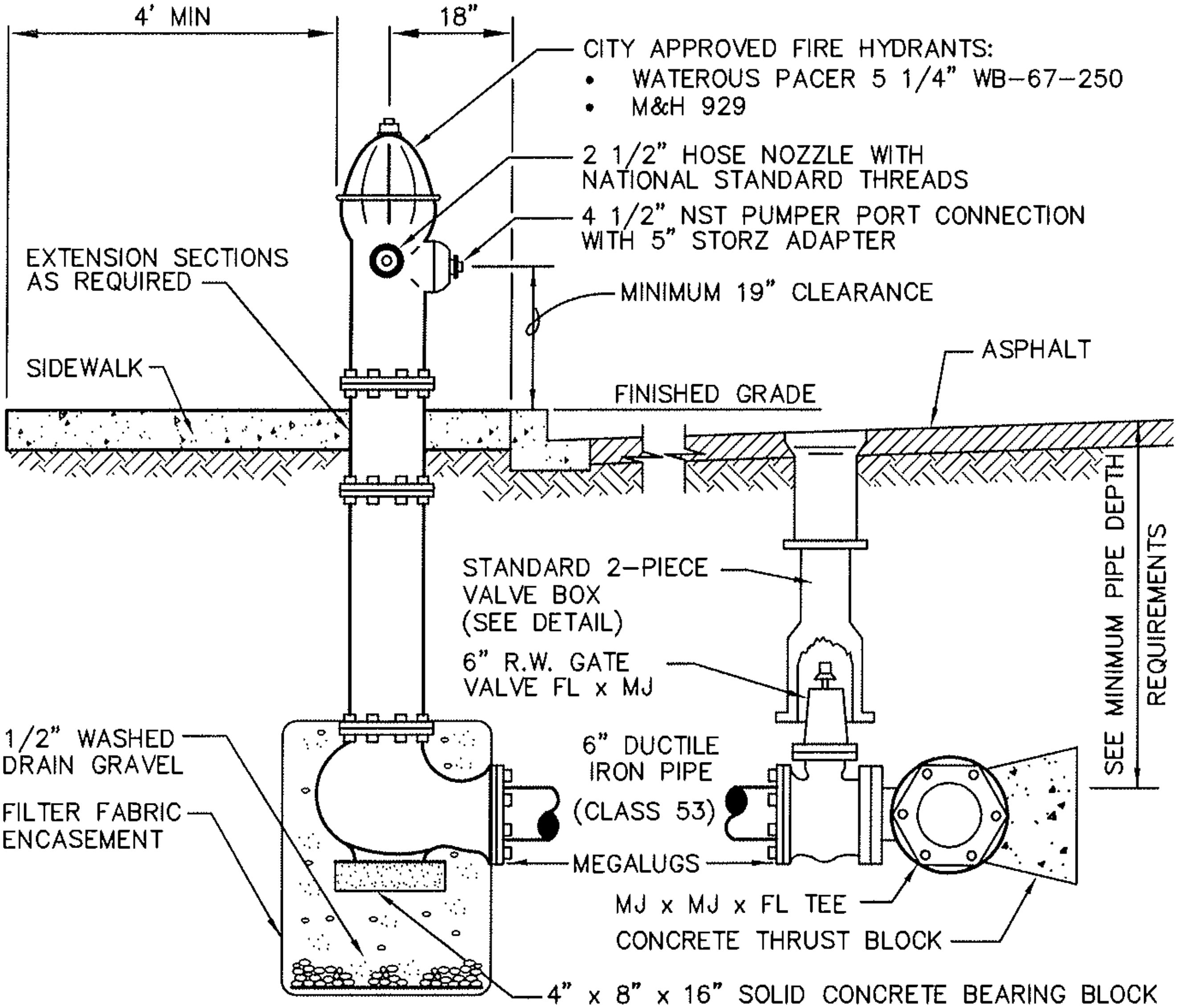

NOTES:

1. FIRE HYDRANTS TO BE PAINTED WITH RUSTOLEUM ENAMEL SAFETY YELLOW.
2. INSTALL BLUE LANE REFLECTOR IN PAVEMNT.

CITY OF ALGONA

FIRE HYDRANT IN PLANTER STRIP (CURB, GUTTER, SIDEWALK)

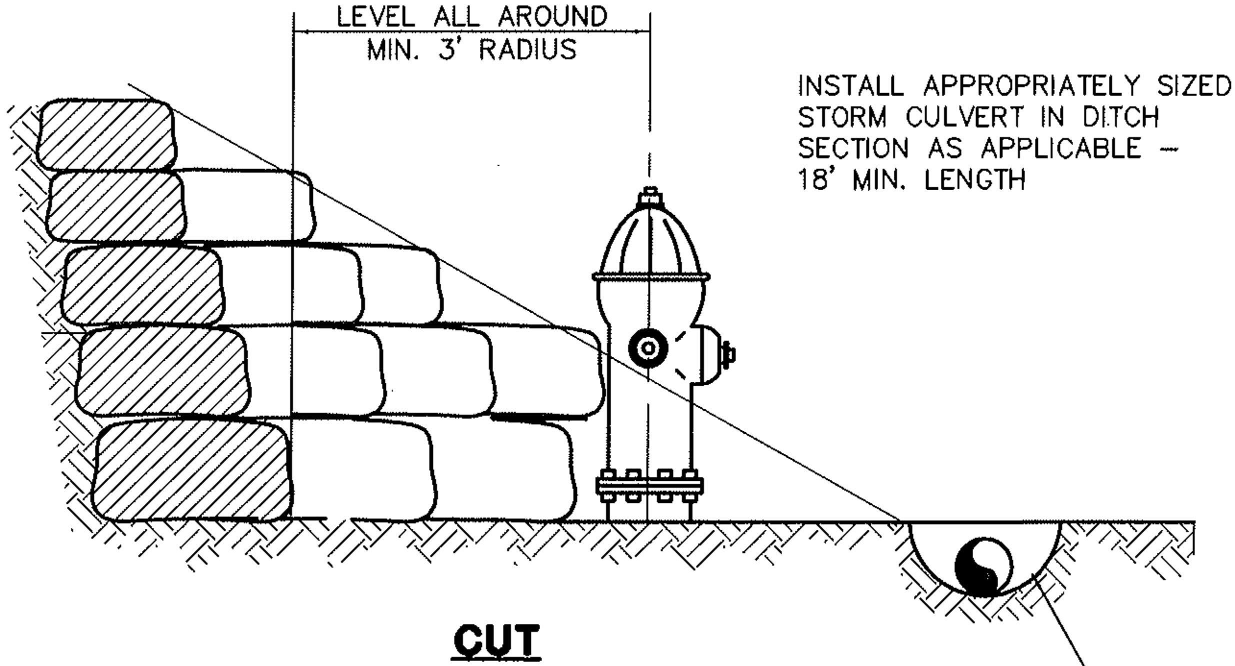
| APPROVED: Warren W. Perkins 10/25/13 BY CITY DATE | | | DWG. NO. FIRE-HYD2 |
|---|---|---|---|
| DATE: 10/2012 | DRWN: J.M. | CHKD: W.P. | SCALE: NONE |



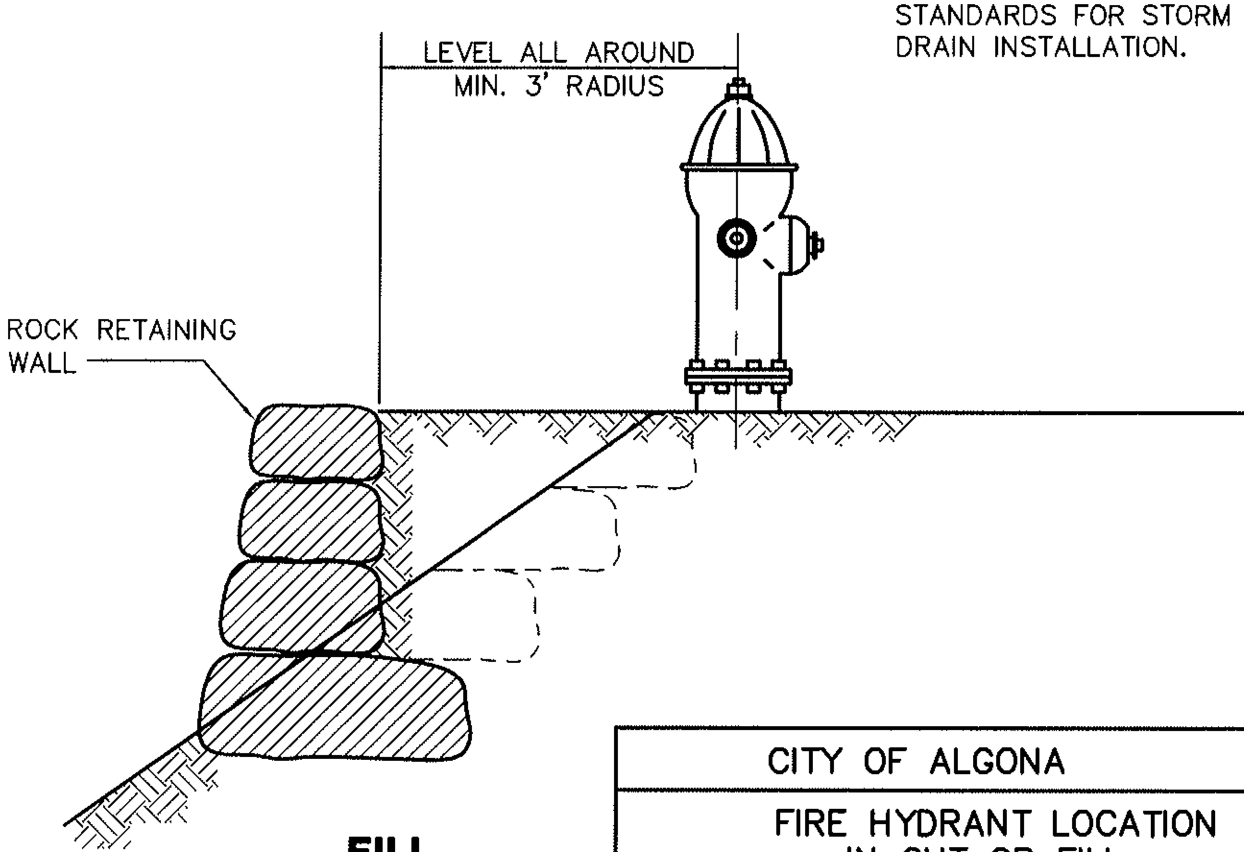

NOTES:

1. FIRE HYDRANTS TO BE PAINTED WITH RUSTOLEUM ENAMEL SAFETY YELLOW.
2. INSTALL BLUE LANE REFLECTOR IN PAVEMNT.

| CITY OF ALGONA | | | |
| --- | --- | --- | --- |
| FIRE HYDRANT IN SIDEWALK (CURB, GUTTER, SIDEWALK) | | | |
| APPROVED: Warren W. Perkins 10/25/13<br>BY CITY DATE | | | DWG. NO.<br>FIRE-HYD2 |
| DATE:<br>10/2012 | DRWN:<br>J.M. | CHKD:<br>W.P. | SCALE:<br>NONE |

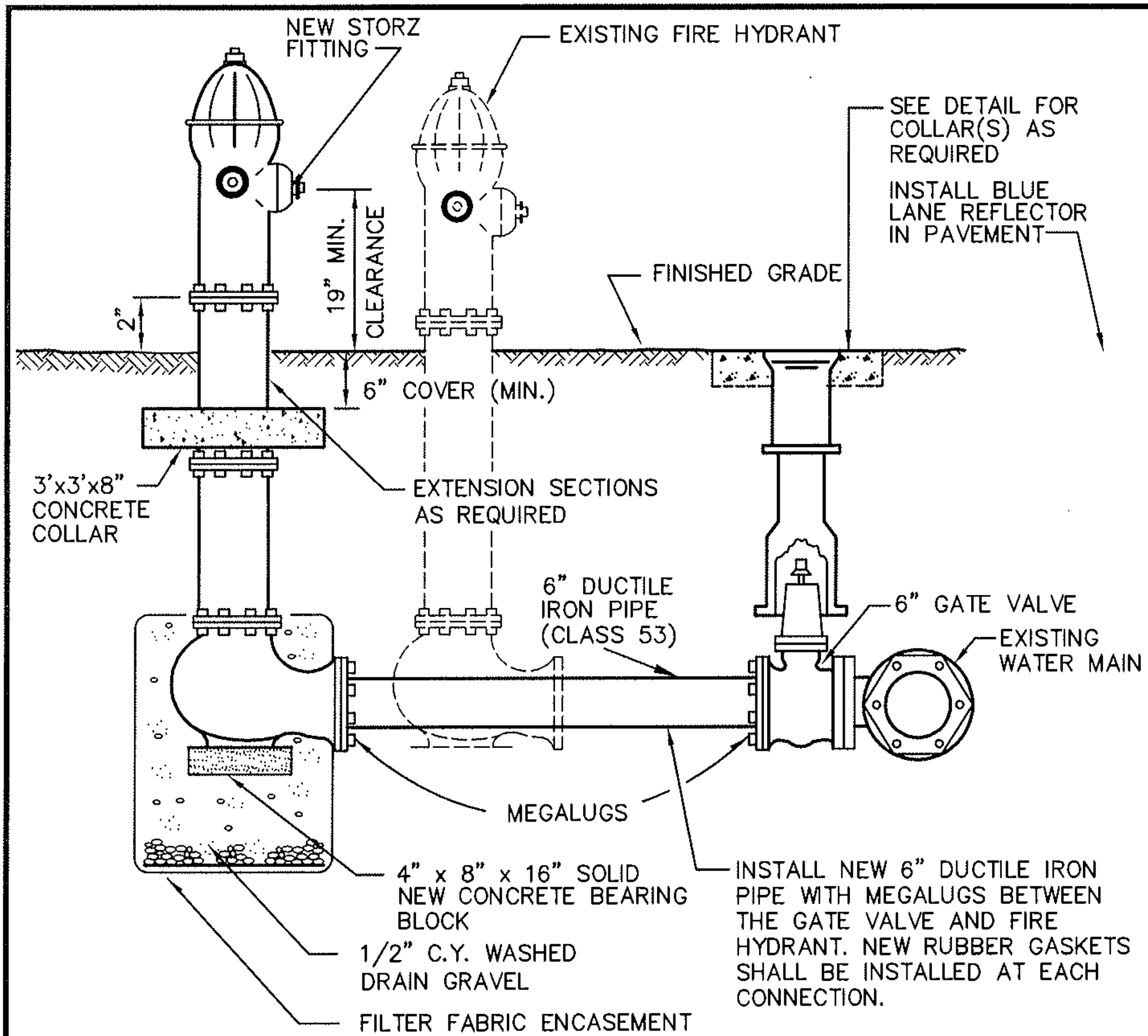



**CUT**




**FILL**

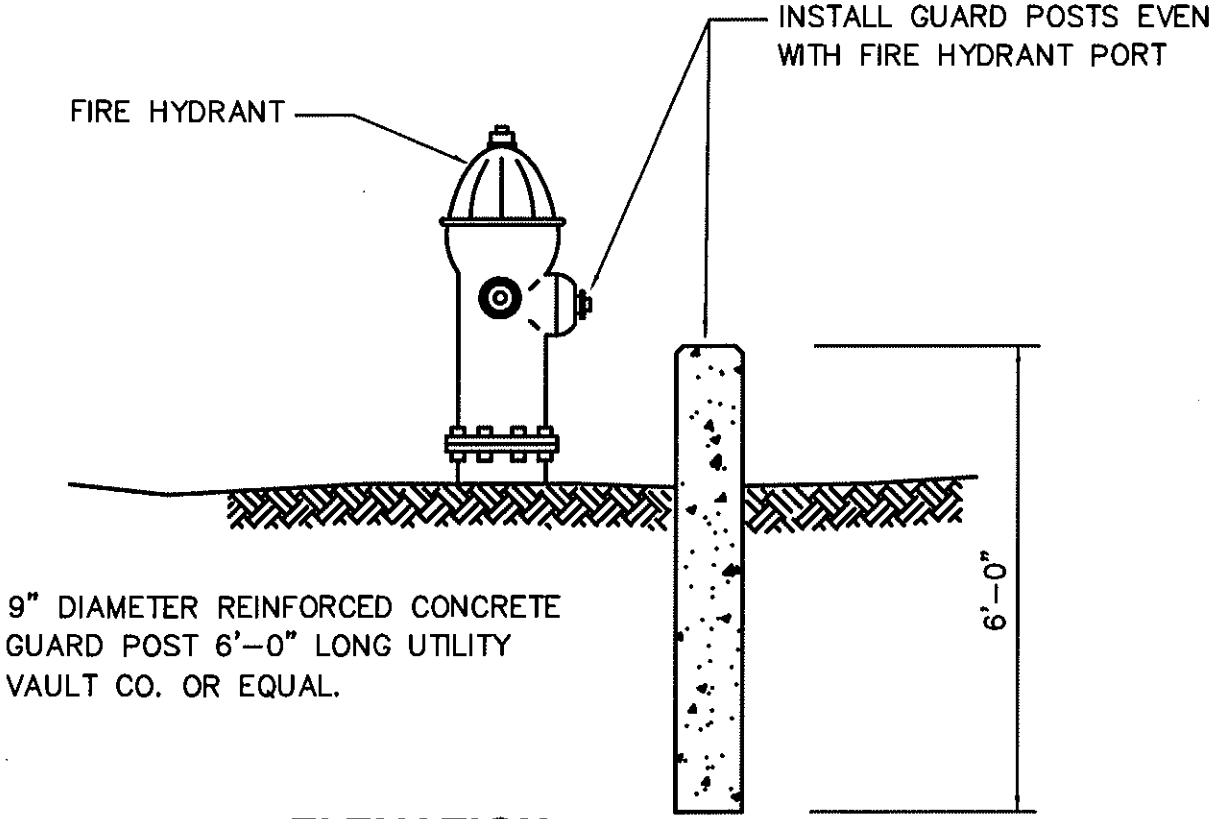
| | | | |
|---|---|---|---|
| CITY OF ALGONA | | | |
| FIRE HYDRANT LOCATION IN CUT OR FILL | | | |
| APPROVED: Warren W. Perkins 10/25/13<br>BY CITY DATE | | | DWG. NO.<br>FIRE–HYD4 |
| DATE:<br>10/2012 | DRWN:<br>J.M. | CHKD:<br>W.P. | SCALE:<br>NONE |



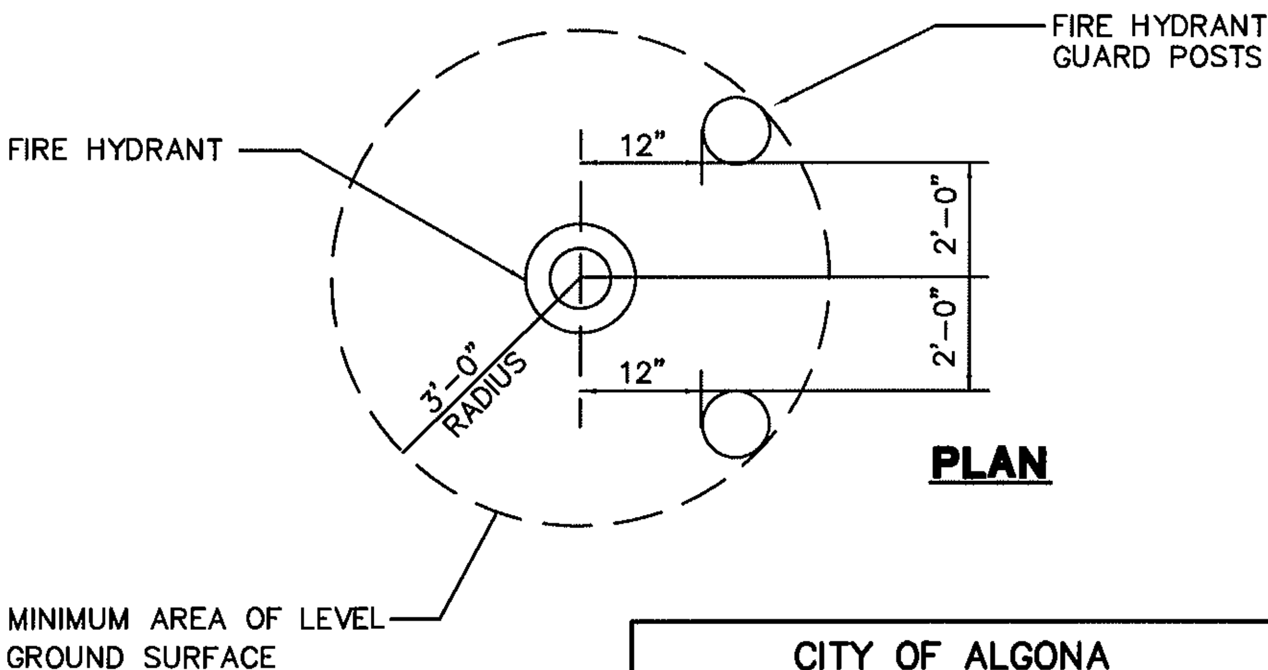

NOTES :

1. ALL RELOCATED 4 1/2" PUMPER PORTS ON FIRE HYDRANTS SHALL BE FITTED WITH 5" STORZ ADAPTOR.
2. PROVIDE MIN. 3' – 0" CLEARANCE AND LEVEL AREA AROUND RELOCATED HYDRANT.

| CITY OF ALGONA | | | |
|---|---|---|---|
| FIRE HYDRANT RELOCATION | | | |
| APPROVED: Warren W Perkins 10/25/13 BY CITY DATE | | | DWG. NO. FIRE–HYD3 |
| DATE: 10/2012 | DRWN: J.M. | CHKD: W.P. | SCALE: NONE |

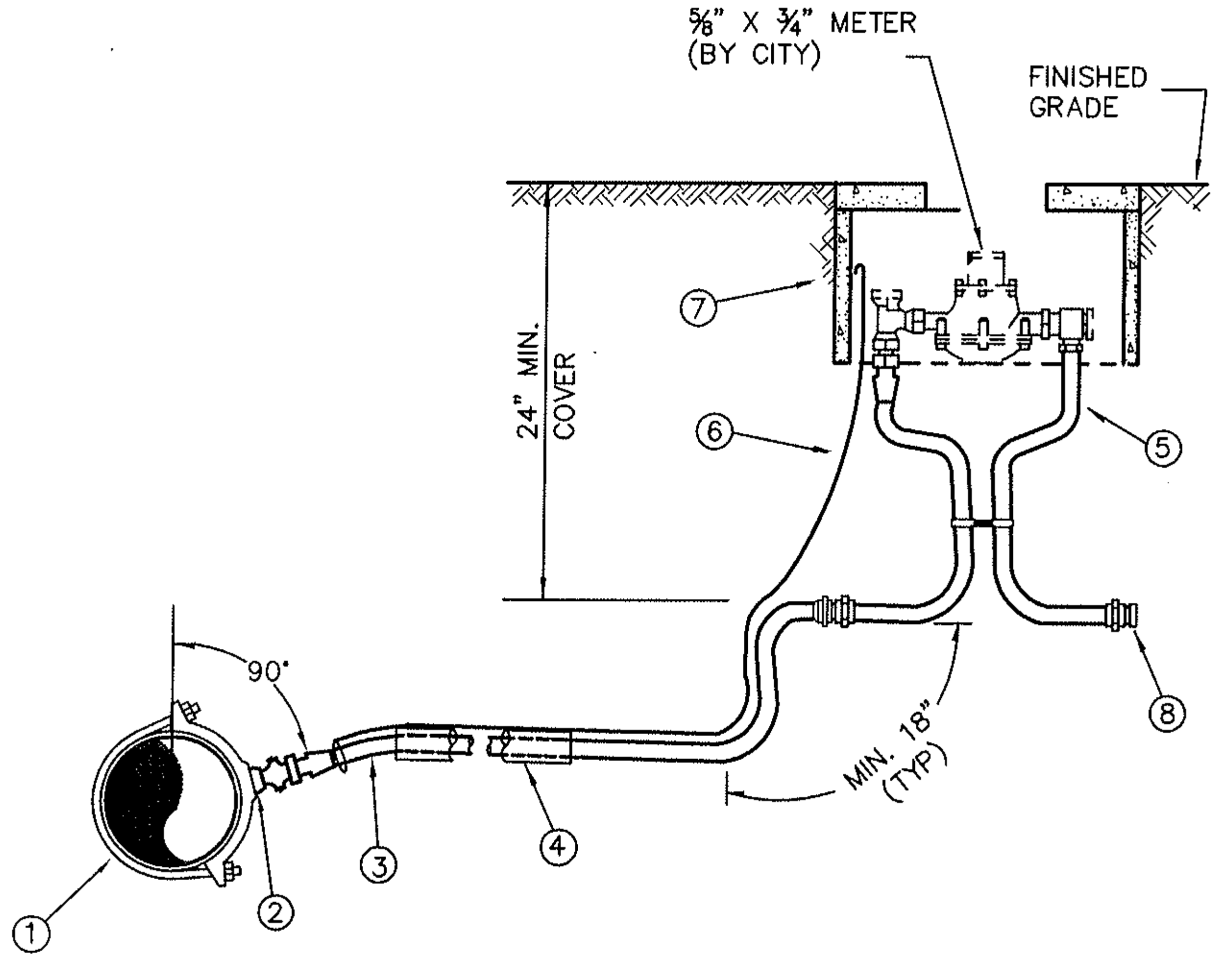



**ELEVATION**




**PLAN**

| CITY OF ALGONA | | | |
|---|---|---|---|
| FIRE HYDRANT GUARD POST INSTALLATION | | | |
| APPROVED: Warren W. Perkins 10/25/13<br>BY CITY DATE | | | DWG. NO. FIRE–HYD5 |
| DATE: 10/2012 | DRWN: J.M. | CHKD: W.P. | SCALE: NONE |




NOTES:

METER LOCATION TO BE IN PLANTER STRIP IF EXISTING OR BACK OR SIDEWALK.



| CITY OF ALGONA | | | |
|---|---|---|---|
| 1" AND SMALLER WATER SERVICE | | | |
| APPROVED: Warren W. Perkins 10/25/13<br>BY CITY DATE | | | DWG. NO.<br>WAT-SERV |
| DATE:<br>10/2012 | DRWN:<br>J.M. | CHKD:<br>W.P. | SCALE:<br>NONE |

LEGEND

1. SERVICE SADDLE – SINGLE STRAP FOR PIPE DIAMETERS LESS THAN 10" (ROMAC 101S OR EQUAL) AND DOUBLE STRAP FOR PIPE DIAMETERS 10" AND GREATER (ROMAC 202S OR EQUAL).

2. 3/4" OR 1" BALL STYLE CORP STOP MIP X PEP JOINT (MUELLER B–25029 OR EQUAL)

3. 1" (DOUBLE SERVICE) OR 3/4" (SINGLE SERVICE) (TYPICAL RESIDENTIAL) HIGH MOLECULAR (200 PSI, SDR 7) "POLY" PIPE (LENGTH AS REQUIRED)

4. INSTALL SERVICE LINE IN 2" PVC GUARD PIPE (SCH–80) WHEN BORING UNDER ROADWAY (3' MINIMUM BEYOND AND BENEATH PAVEMENT SECTION) OR AT UTILITY CROSSINGS AS DIRECTED BY CITY.

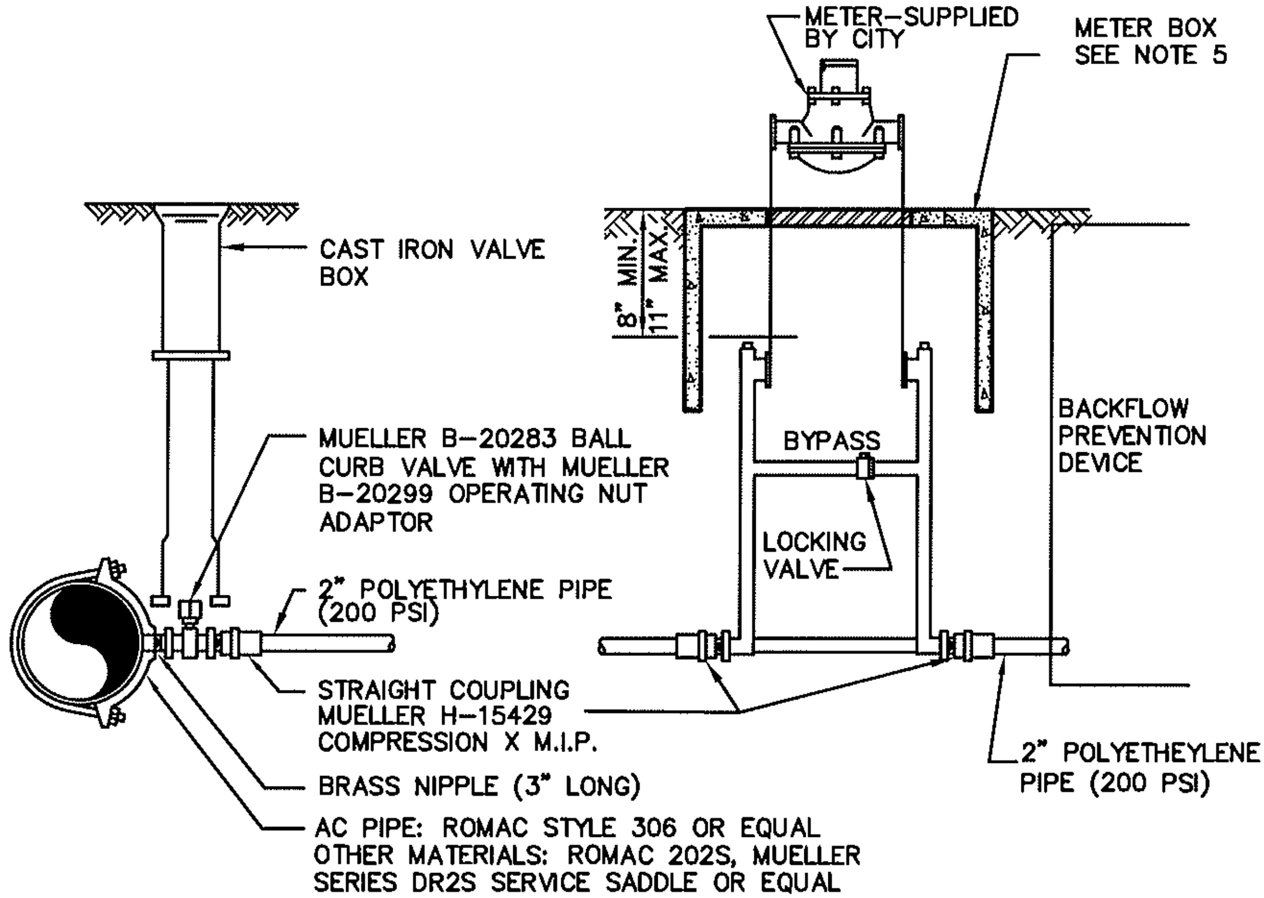
5. COPPER SETTER WITH ANGLE BALL VALVE AND ANGLE DOUBLE CHECK VALVE (MUELLER B2404–2A OR EQUAL)

6. #10 GAUGE COPPER WIRE w/ THHN BLUE PLASTIC INSULATION FROM MAINLINE TAP TO METER BOX AND EXPOSE 6" MINIMUM IN BOX (RUN INSIDE 2" PVC GUARD CONDUIT WHERE APPLICABLE). MINIMUM OF 1 WRAP AROUND SERVICE LINE EVERY 5' FEET.

7. METER BOX – FOGTITE NO.9 WITH HINGED LID DRILLED FOR TRPL HOLE FOR TOUCH READ METERS, H20 LOADING. (SET FLUSH WITH FINISHED GRADE)

8. PROVIDE APPROVED WATERTIGHT PLUG UNTIL CONNECTION TO PRIVATE SYSTEM IS MADE.

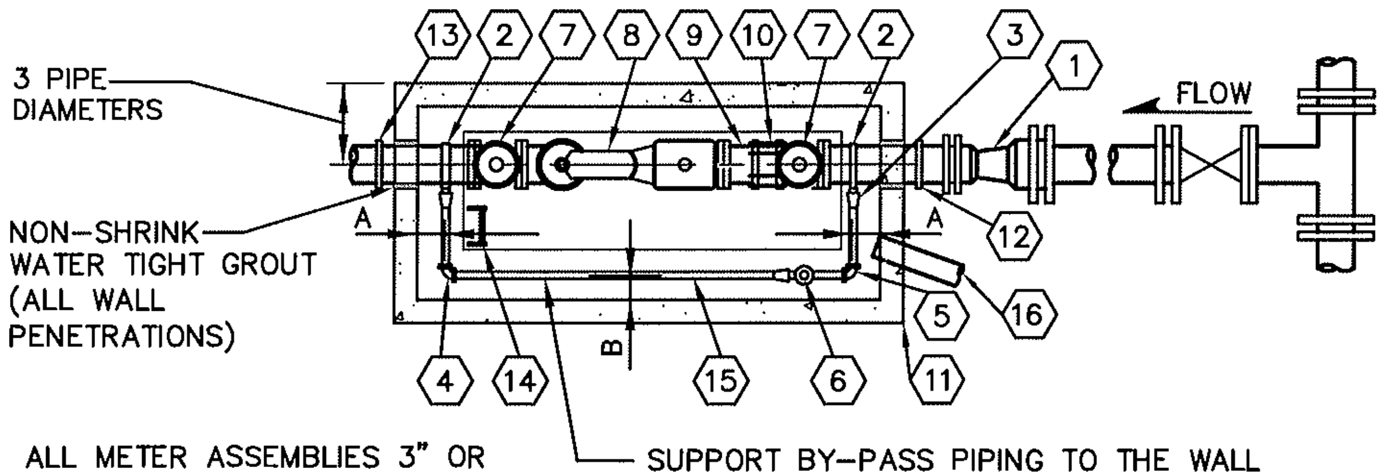
| CITY OF ALGONA | | | |
|---|---|---|---|
| 1" AND SMALLER WATER SERVICE | | | |
| APPROVED: Warren W. Perkins 10/25/13<br>BY CITY DATE | | | DWG. NO.<br>WAT–SERV |
| DATE:<br>10/2012 | DRWN:<br>J.M. | CHKD:<br>W.P. | SCALE:<br>NONE |




NOTES:

1. POLYETHYLENE PIPE SHALL HAVE #10 GAUGE COPPER WIRE w/ THHN BLUE PLASTIC INSULATION FROM MAINLINE TAP TO METER BOX AND EXPOSE 6" MINIMUM IN BOX (RUN INSIDE 2" PVC GUARD CONDUIT WHERE APPLICABLE). MINIMUM OF 1 WRAP AROUND SERVICE LINE EVERY 5'.
2. SERVICE FROM METER BOX TO STRUCTURE BY PROPERTY OWNER.
3. INDIVIDUAL SERVICES REQUIRED FOR EACH STRUCTURE.
4. METER SETTER MUELLER H–1423–99000 OR EQUAL
5. METER BOX – FOGTITE NO.2 WITH STEEL LID AND DRILLED FOR TRPL HOLE FOR TOUCH READ. BOX SHALL BE H–20 LOAD RATED WHERE REQUIRED.
6. EASEMENT PROVIDED TO CITY TO AND AROUND METERS LOCATED OUTSIDE R/W.
7. ALL SERVICES SHALL HAVE WASHINGTON STATE APPROVED RPBA FOR BACKFLOW PREVENTION. CONFIRM LOCATION OF ASSEMBLY WITH CITY. INITIAL AND ANNUAL TESTING REQUIRED. MULTIFAMILY ALLOWED TO USE DCVA IN LIEU OF RPBA.

| | | | |
|---|---|---|---|
| CITY OF ALGONA | | | |
| 1 1/2" & 2" WATER SERVICE | | | |
| APPROVED: Warren W. Perkins 10/25/13<br>BY CITY DATE | | | DWG. NO.<br>2–WAT |
| DATE:<br>10/2012 | DRWN:<br>J.M. | CHKD:<br>W.P. | SCALE:<br>NONE |




ALL METER ASSEMBLIES 3" OR LARGER SHALL BE REVIEWED AND APPROVED BY CITY.

## PLAN

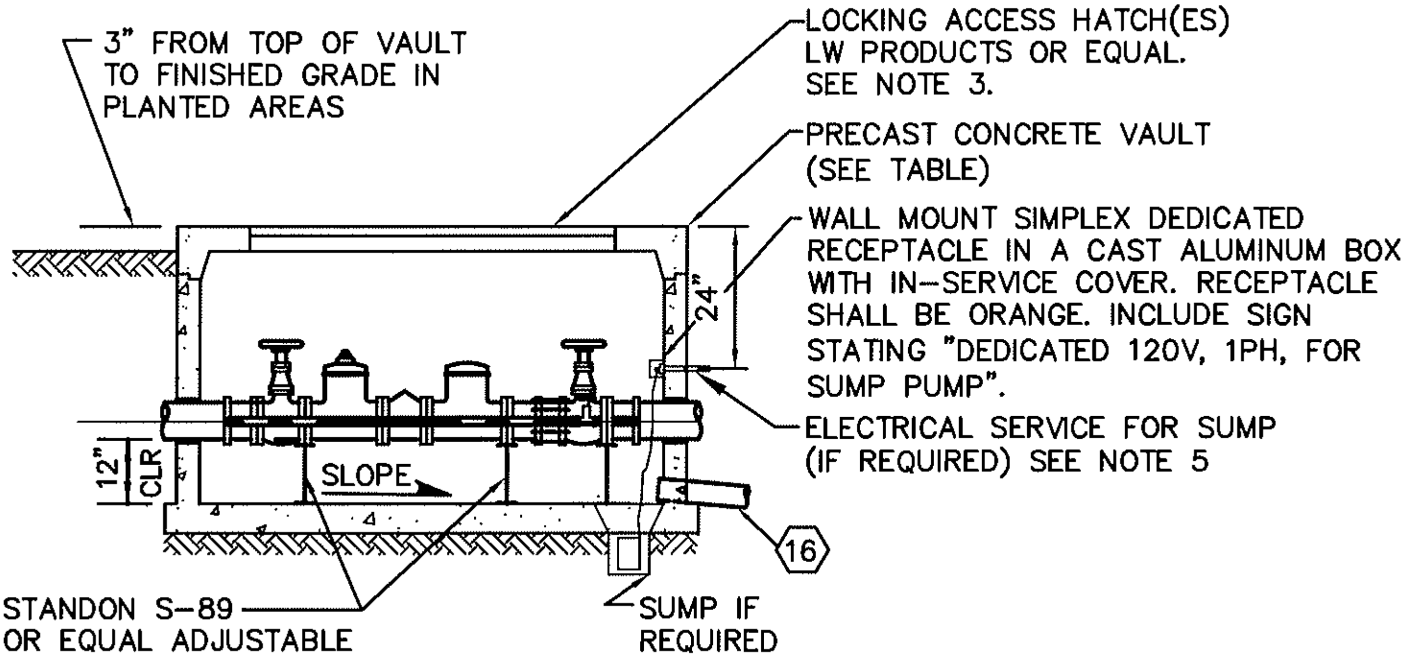
1. REDUCER, M.J.
2. SINGLE STRAP SERVICE CLAMP, ROMAC 101 WITH IPS TAP, OR EQUAL (1 1/2" OR 2" BYPASS, 4-INCH AND LARGER BYPASS REQUIRES D.I. TEE).
3. FITTINGS AS REQUIRED.
4. BEND CPLG COPPER TO COPPER MUELLER H-15525, OR EQUAL.
5. BEND CPLG, COPPER TO OUTSIDE I.P. THREAD MUELLER H-15530, OR EQUAL.
6. BALL VALVE WITH PADLOCK WING OR LOCK CAP, FORD B21-444W OR B21-666 WITH LOCK CAP OR B21-777 WITH LOCK CAP. SIZED TO LINE.
7. RESILIENT SEAT GATE VALVE, FL X FL SIZED TO METER.
8. 3" TO 10" SENSUS METER FOR IRRIGATION SERVICES AND 3" TO 10" COMPOUND METER IF FOR DOMESTIC SERVICE. READ IN CUBIC FEET WITH MXU RADIO UNIT AS SPECIFIED BY CITY SHALL BE FURNISHED AND INSTALLED BY CONTRACTOR.
9. D.I. PIPE SPOOL FL X PE LENGTH TO FIT.
10. FL CPLG. ADAPT.
11. PRECAST CONCRETE VAULT, UTILITY VAULT OR EQUAL, SEE PAGE 2 FOR SIZING AND REQUIREMENTS.
12. MEGA-LUG FOLLOWER INSTALLED ON INFLOW SIDE OF VAULT WITH CONCRETE THRUST BLOCK OR SHACKLE TO THRUST BLOCK TO PREVENT MOVEMENT IF METER IS REMOVED. (BLOCK NOT SHOWN)
13. DIELECTRIC CPLG. TO BUILDING SERVICE. SIZE AS REQUIRED.
14. GALV. STEEL OR ALUMINUM LADDER. SECURE TO VAULT LID AND FLOOR. COORDINATE LOCATION FOR ACCESS.
15. BY-PASS (SIZE BY TABLE BELOW).
16. 4" PVC TO CATCH BASIN OR DAYLIGHT. WHERE GRAVITY DRAIN IS NOT FEASIBLE, PROVIDE SUMP, ELECTRICAL SERVICE AND PUMP WITH DISCHARGE TO SURFACE DRAIN. PUMP SHALL BE 1/2 HP ZOELLER M-53, WITH CHECK VALVE ON DISCHARGE LINE.
17. ALL PIPES AND FITTTINGS 4-INCH OR LARGER SHALL BE DI., CL 52.

| METER SIZE | MAIN-LINE | BYPASS | A | B |
|---|---|---|---|---|
| 3" | 4" DI. | 2" COPPER | 9" | 4" |
| 3" | 4" DI. | 2" COPPER | 9" | 4" |
| 4" | 6" DI. | 4" DI. | 9" | 4" |
| 6" | 8" DI. | 4" DI. | 14" | 6" |
| 8" | 10" DI. | 8" DI. | 16" | 6" |

NOTES:
SEE PAGE 2 FOR ELEVATION AND NOTES.



| CITY OF ALGONA | | | |
|---|---|---|---|
| METER AND METER VAULT ASSEMBLY 3" THROUGH 10" | | | |
| APPROVED: Warren W. Rakin 10/25/13 BY CITY DATE | | | DWG. NO. 3-MM |
| DATE: 10/2012 | DRWN: J.M. | CHKD: W.P. | SCALE: NONE |




## ELEVATION

SEE DETAIL V-W16A FOR CALLOUTS

| METER SIZE | MAIN-LINE | MINIMUM I/S VAULT DIM. L | x W | x H | UTILITY VAULT CO APPROVED MODEL | MIN. HATCH OPENING |
|---|---|---|---|---|---|---|
| 3" | 4" DI. | 8'-4" | 4'-4" | 6'-2" | 4484-LA | 3' x 6' |
| 4" | 4" DI. | 8'-4" | 4'-4" | 6'-2" | 4484-LA | 3' x 6' |
| 6" | 6" DI. | 10'-6" | 5'-0" | 6'-2" | 5106-LA | 3' x 6' |
| 8" | 8" DI. | 12'-0" | 6'-0" | 6'-6" | 612-LA | 3' x 6' |
| 10" | 10" DI. | 14'-0" | 8'-0" | 6'-6" | 814-LA | 3' x 6' |

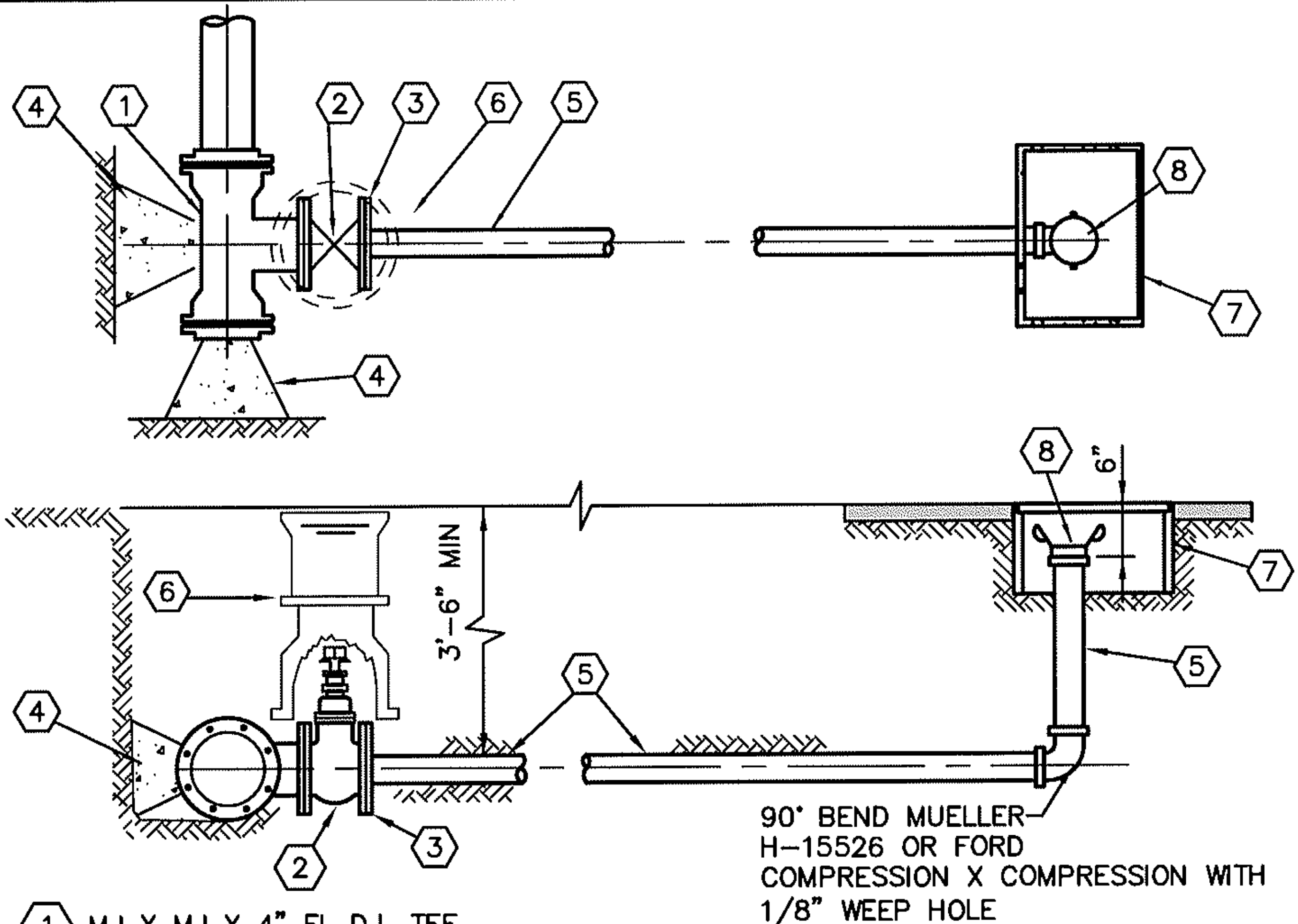
NOTES:

1. WASHINGTON STATE APPROVED REDUCED PRESSURE BACKFLOW PREVENTOR REQUIRED. SEE RPBA-2. CONFIRM INSTALLATION WITH CITY. INITIAL AND ANNUAL TEST REQUIRED.
2. METER SHALL BE INSTALLED SUCH THAT IT CAN BE READ WITHOUT ENTERING VAULT WITH ACCESS HATCH OPEN.
3. COORDINATE ORIENTATION OF HATCH(ES) TO PROVIDE CLEAR VERTICAL ACCESS TO METER ASSEMBLY, AND WITH LADDER LOCATION. VERIFY WITH CITY.
4. DRAIN DRAIN HATCH(ES) TO VAULT FLOOR WITH PVC PIPE AND FITTINGS.
5. 3/4" (MINIMUM) PVC SCH-40 CONDUIT. WIRING SHALL BE COMPLETELY SEALED 120V, UNDER GROUND. CONTRACTOR TO SEAL CONDUIT PENETRATION WITH NON-SHRINK GROUT. (NOT REQUIRED IF GRAVITY VAULT DRAIN PROVIDED).
6. ESMT TO BE PROVIDED TO CITY AROUND METERS LOCATED OUTSIDE RIGHT-OF-WAY.
7. SEE PAGE 1 FOR PLAN AND NOTES.

CITY OF ALGONA

METER AND METER VAULT ASSEMBLY 3" THROUGH 10"

| | | | |
|---|---|---|---|
| APPROVED: Warren W. Perkins 10/25/13 BY CITY DATE | | | DWG. NO. 3-MM |
| DATE: 10/2012 | DRWN: J.M. | CHKD: W.P. | SCALE: NONE |

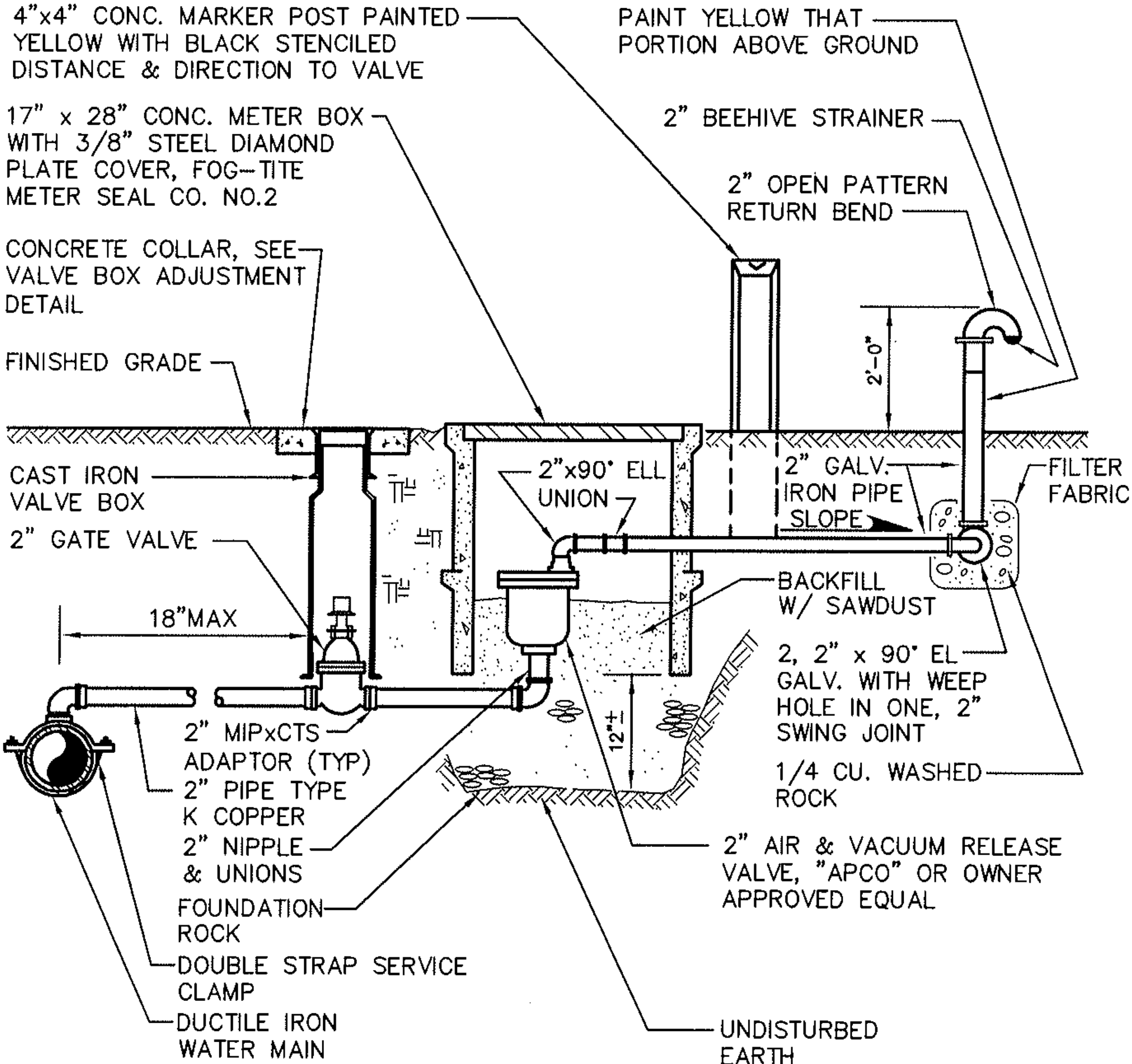



1. MJ X MJ X 4" FL D.I. TEE.
2. 4" AWWA RESILIENT SEAT GATE VALVE, FL X FL, WITH OPERATING NUT.
3. 4" BLIND FLANGE, TAPPED FOR 2". MAINS LARGER THAN 8" REQUIRE 4–INCH BLOW–OFF OR HYDRANT.
4. CONCRETE THRUST BLOCK.
5. 2" TYPE K COPPER PIPE.
6. CAST IRON VALVE BOX PER VALV–BOX
7. METER BOX – FOGTITE NO. 2. BOX SHALL BE H–20 LOAD RATED.
8. ALUMINUM CAM–LOCK AND CAP. DRILL 1/8" HOLE IN CAP. (PLASTIC CAM LOCK FITTING NOT ALLOWED)

NOTES

1. INSTALL DIELECTRIC COMPOUNDS FOR SEPARATION AT DISSIMILAR METALS.

| | | | |
|---|---|---|---|
| CITY OF ALGONA | | | |
| 2" BLOW–OFF ASSEMBLY | | | |
| APPROVED: Warren W. Perkins 10/25/13<br>BY CITY DATE | | | DWG. NO.<br>BLOW–OFF |
| DATE:<br>10/2012 | DRWN:<br>J.M. | CHKD:<br>W.P. | SCALE:<br>NONE |

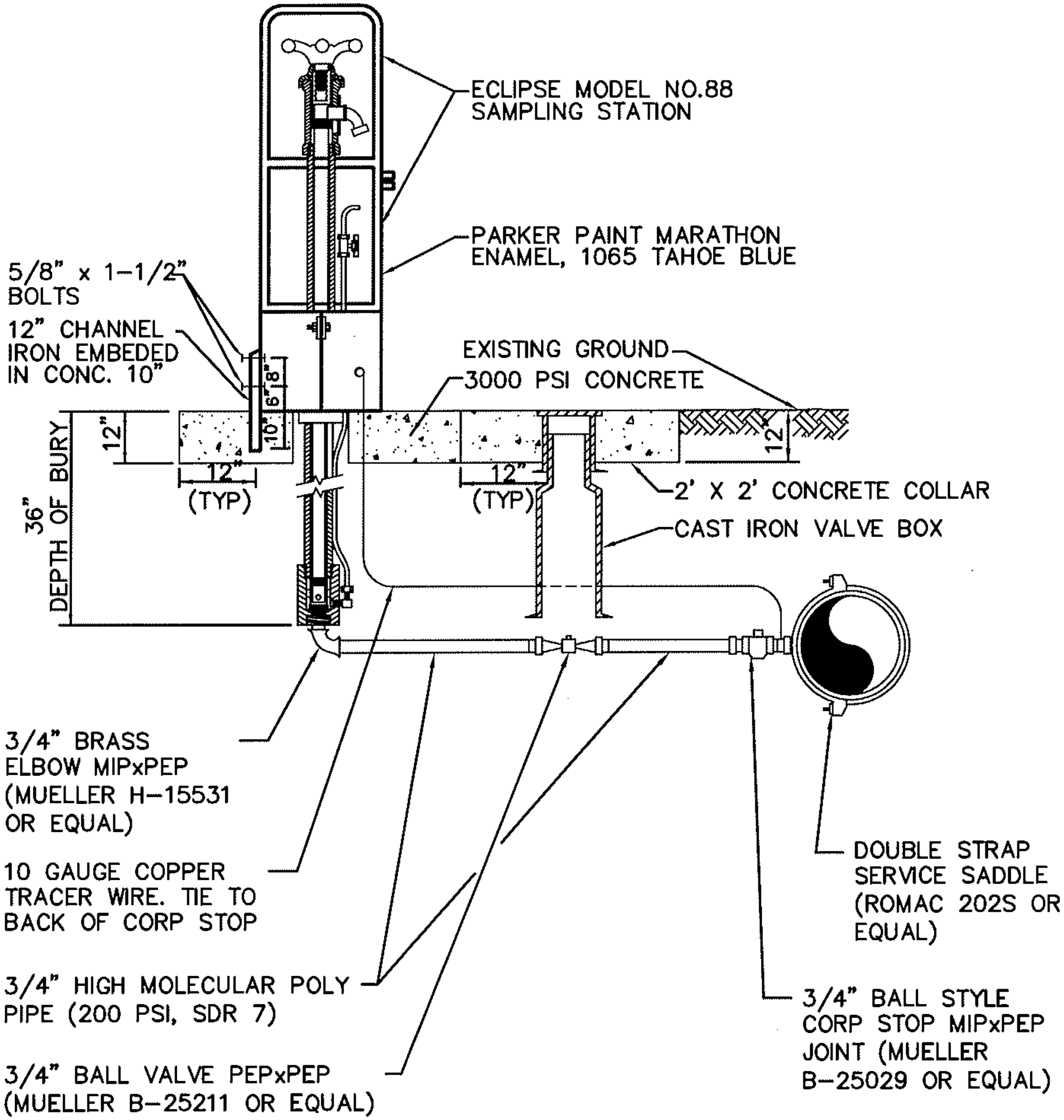



NOTES:

1. GATE VALVE: AWWA RESILIENT SEAL, THRD x THRD WITH OPERATING NUT
2. ALL PIPING BETWEEN DOUBLE STRAP SADDLE AND INLET SIDE OF COMBINATION AIR & VAC ASSEMBLY SHALL BE TYPE K COPPER
3. TAP MAIN AT SYSTEM HIGH POINT. LOCATION TO BE APPROVED BY THE CITY
4. PAINT PORTION ABOVE GROUND WITH TWO COATS RUSTOLEUM ENAMEL SAFETY YELLOW

| CITY OF ALGONA | | | |
|---|---|---|---|
| AIR & VACUUM RELEASE ASSEMBLY | | | |
| APPROVED: Warren W. Perkins 10/25/13<br>BY CITY DATE | | | DWG. NO.<br>AIR-RLS |
| DATE:<br>10/2012 | DRWN:<br>J.M. | CHKD:<br>W.P. | SCALE:<br>NONE |

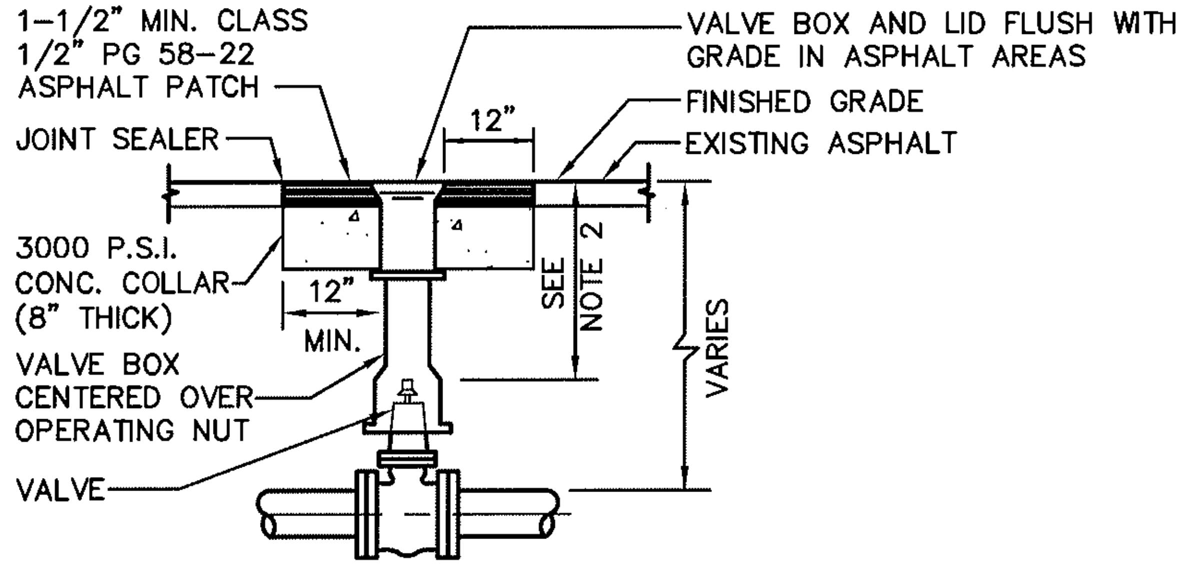
L:\ALGONA\12503 WSP 2012\STD DETAILS\WATER DETAILS\AIR-RLS.DWG. 10/25/2013 2:11:40 PM, 1:1, BY: W PERKINS



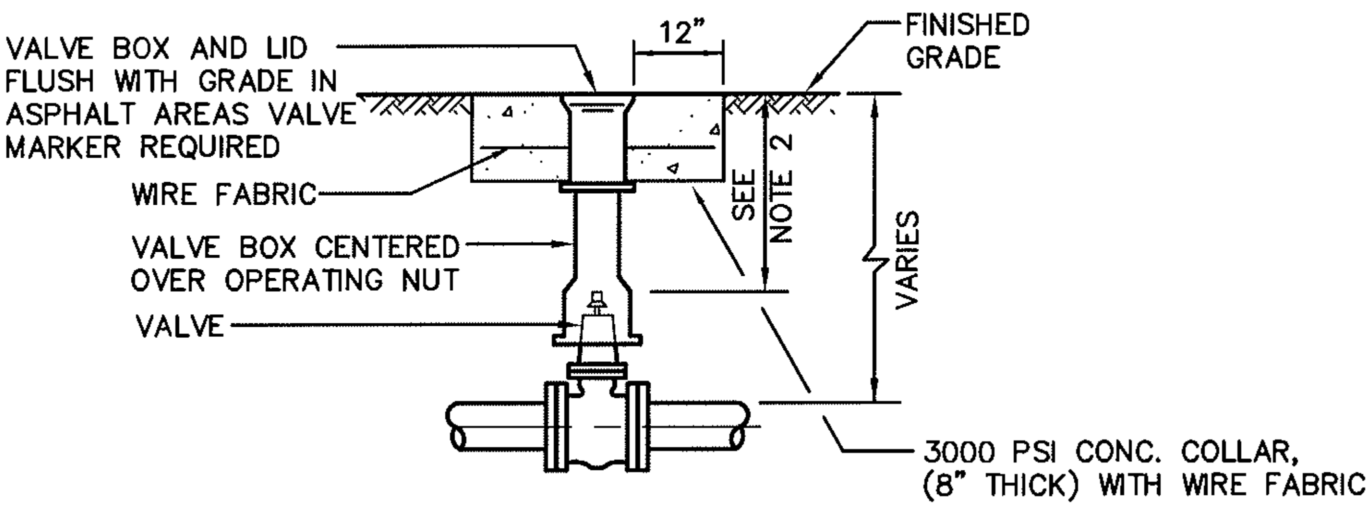

# CITY OF ALGONA

## WATER SAMPLING STATION

| | | | |
|---|---|---|---|
| APPROVED: [signature] 10/25/13 BY CITY DATE | | | DWG. NO. WAT-SAMP |
| DATE: 10/2012 | DRWN: J.M. | CHKD: W.P. | SCALE: NONE |




## VALVE BOX IN ASPHALT AREA



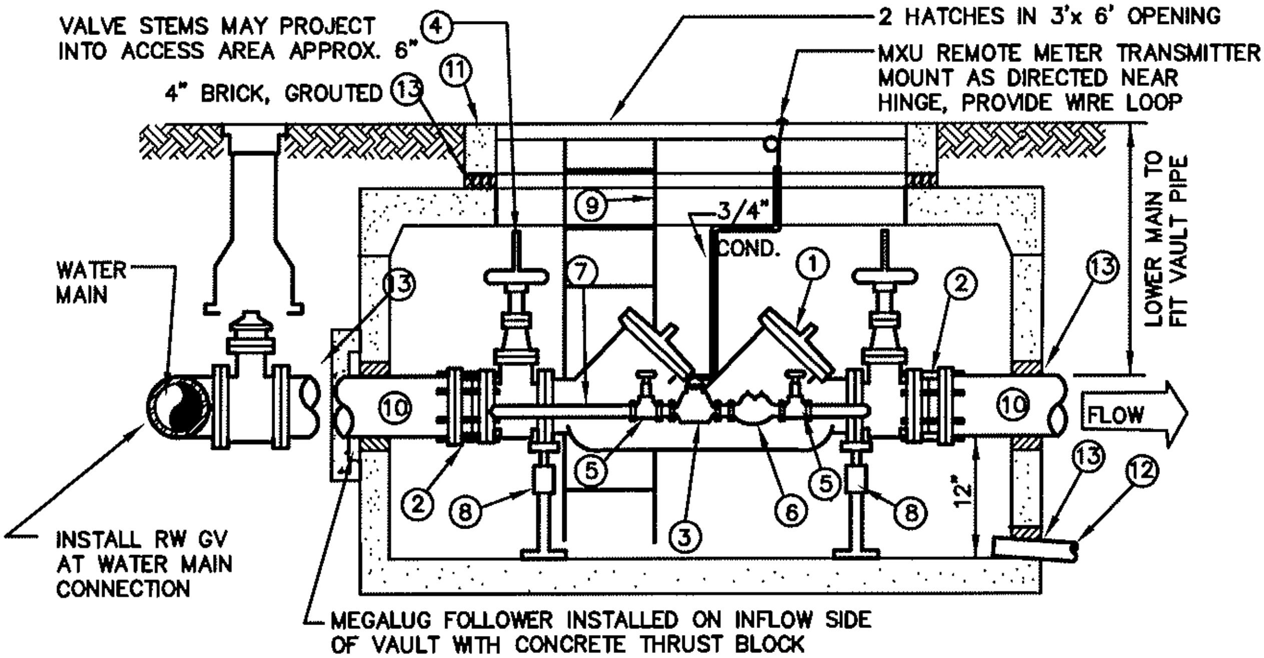

## VALVE BOX IN UNIMPROVED AREA

NOTES:

1. EACH VALVE SHALL BE PROVIDED WITH AND ADJUSTABLE CAST IRON VALVE BOX OF 5 INCHES (5") INSIDE DIAMETER. VALVE BOXES SHALL HAVE A TOP SECTION WITH AN EIGHTEEN INCH (18") MIN. LENGTH. THE VALVE BOX SHALL BE OLYMPIC FOUNDRY No. 940, EAST JORDAN IRON WORKS OR APPROVED EQUAL. VALVE BOX EARS SHALL BE PLACED IN LINE WITH PIPE IT SERVES.

2. 15" MINIMUM, 36" MAXIMUM FOR OPERATOR NUT. EXTENSION MAY BE REQUIRED.

| CITY OF ALGONA | | | |
|---|---|---|---|
| VALVE BOX ADJUSTMENT | | | |
| APPROVED: [signature] 10/25/13 BY CITY DATE | | | DWG. NO. VALV-BOX |
| DATE: 10/2012 | DRWN: J.M. | CHKD: W.P. | SCALE: NONE |

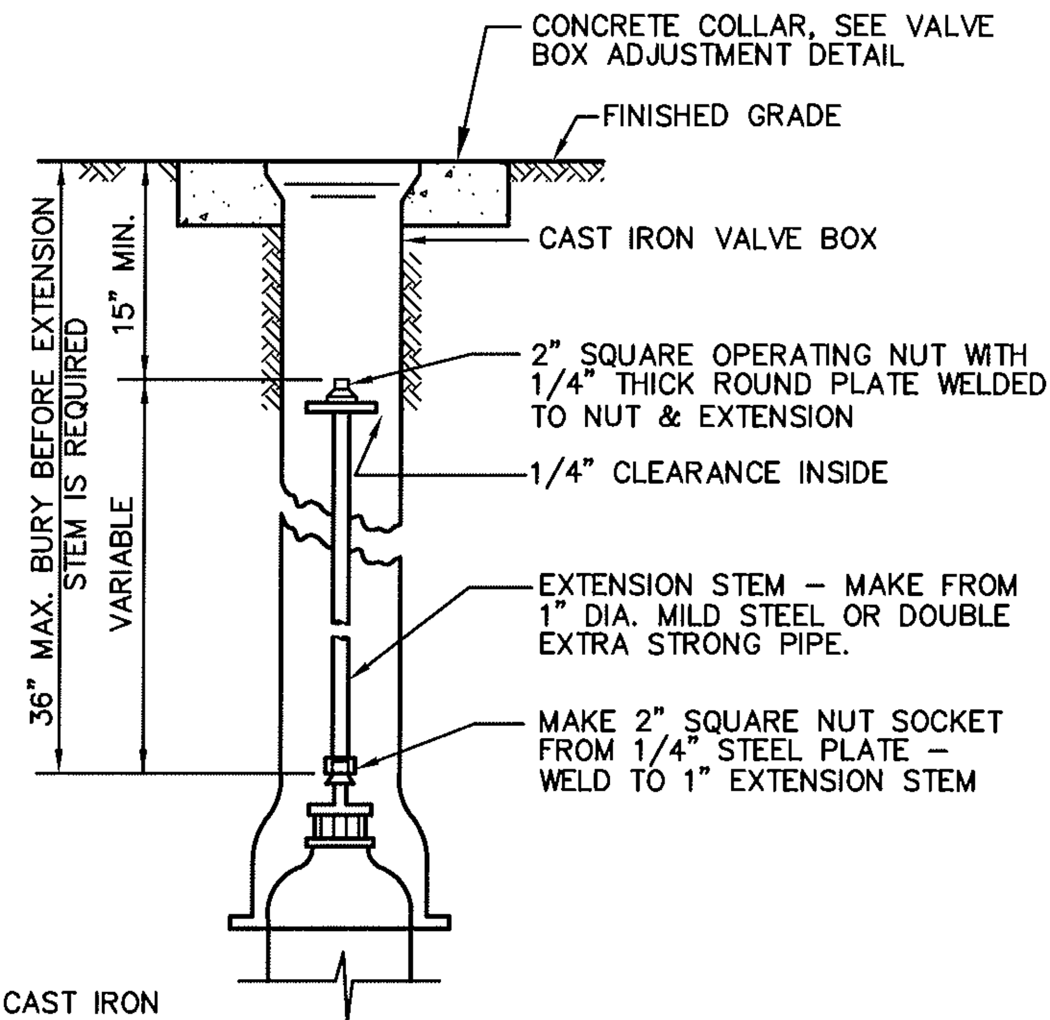


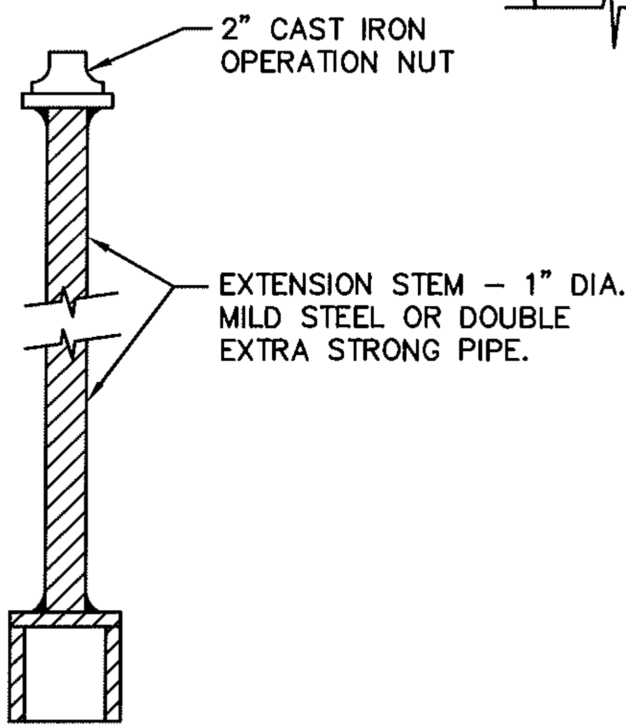

| NO. | DESCRIPTION |
|---|---|
| 1 | STATE APPROVED DOUBLE CHECK DETECTOR ASSEMBLY (DCDA) BACKFLOW PREVENTION ASSEMBLY WITH O.S.&Y. R.W. GATE VALVE |
| 2 | ROMAC STYLE 'FCA 501' FLANGED COUPLING ADAPTER |
| 3 | 5/8" x 3/4" SENSUS CUBIC FEET READING METER COMPLETE WITH SPUD NUT |
| 4 | LOCATE CENTER OF VALVE 15" FROM CENTER OF VAULT TO ALLOW STEMS TO EXTEND INTO ACCESS OPENING WHEN APPLICABLE |
| 5 | 3/4" SHUTOFF VALVE; BRASS GATE VALVE |
| 6 | STATE APPROVED 3/4" DOUBLE CHECK VALVE ASSEMBLY (DCVA) |
| 7 | BRASS OR TYPE K COPPER, DETECTOR CHECK PIPING (BY PASS LINE) |
| 8 | 2 EA. GALVANIZED ADJUSTABLE STANCHIONS (LOCATE AT ENDS OF DOUBLE CHECK ASSEMBLY) |
| 9 | GALVANIZED STEEL LADDER, LOCATE AS DIRECTED BY DISTRICT, SECURE TO VAULT. |
| 10 | PIPE SPOOL, CL. 52 D.I., PLAIN END |
| 11 | "UTILITY VAULT" OR APPROVED EQUAL WITH 4" BRICK AND ADJUSTABLE COVER;<br>ACCESS HATCHES: TWO #332P, EXCEPT 3 HATCHES FOR 10" DCDA<br>4" DCDC, USE 575LA + 57AT (4'-2" x 6'-6" x 4'-0" INSIDE<br>6" DCDC, 4484 LA + 57AT (4'-4" x 8'-4" x 6'-2" INSIDE<br>6" DCDC, 5106 LA + 57AT (5'-0" x 10'-6" x 4'-4" INSIDE<br>8" DCDC, 5106 LA + 57 AT (5'-0" x 10'-6" x 6'-2" OR 4'-4" INSIDE<br>10" DCDC, 5106 LA + 5106 AT (3HATCH) (5'-0" x 10'-6" x 6'-2" OR 4'-4") |
| 12 | 6" PVC DRAIN, DISCHARGE TO DAYLIGHT OR TO CATCH BASIN. MINIMUM SLOPE 1% UNLESS OTHERWISE APPROVED. ADD SCREENS AT BOTH ENDS. |
| 13 | WATERTIGHT GROUT, INLET AND OUTLET PIPE, DRAIN PIPE AND BRICK ACCESS OPENING |

**NOTE:**

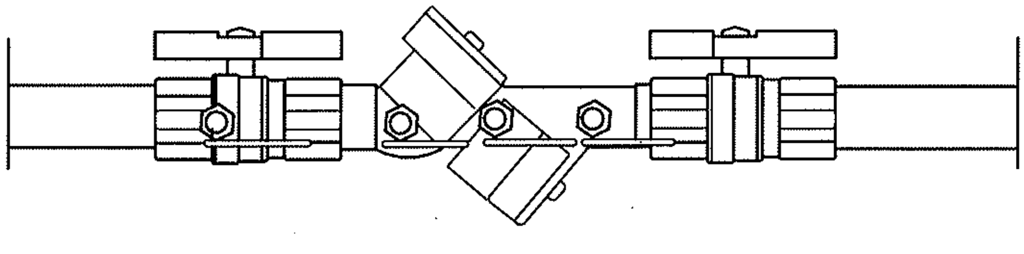
AFTER PRESSURE TEST AND PURITY SAMPLES ARE RECIEVED, A CERTIFED BACKFLOW TECHNICIAN SHALL SUPPLY DISTRICT WITH A WRITTEN TEST REPORT ON EACH BACKFLOW ASSEMBLY.

| CITY OF ALGONA | | | |
|---|---|---|---|
| DOUBLE-CHECK DETECTOR BACKFLOW PREVENTION ASSEMBLY | | | |
| APPROVED: Warren W. Perks 10/25/13<br>BY CITY DATE | | | DWG. NO. DCD-BPA |
| DATE: 10/2012 | DRWN: J.M. | CHKD: W.P. | SCALE: NONE |

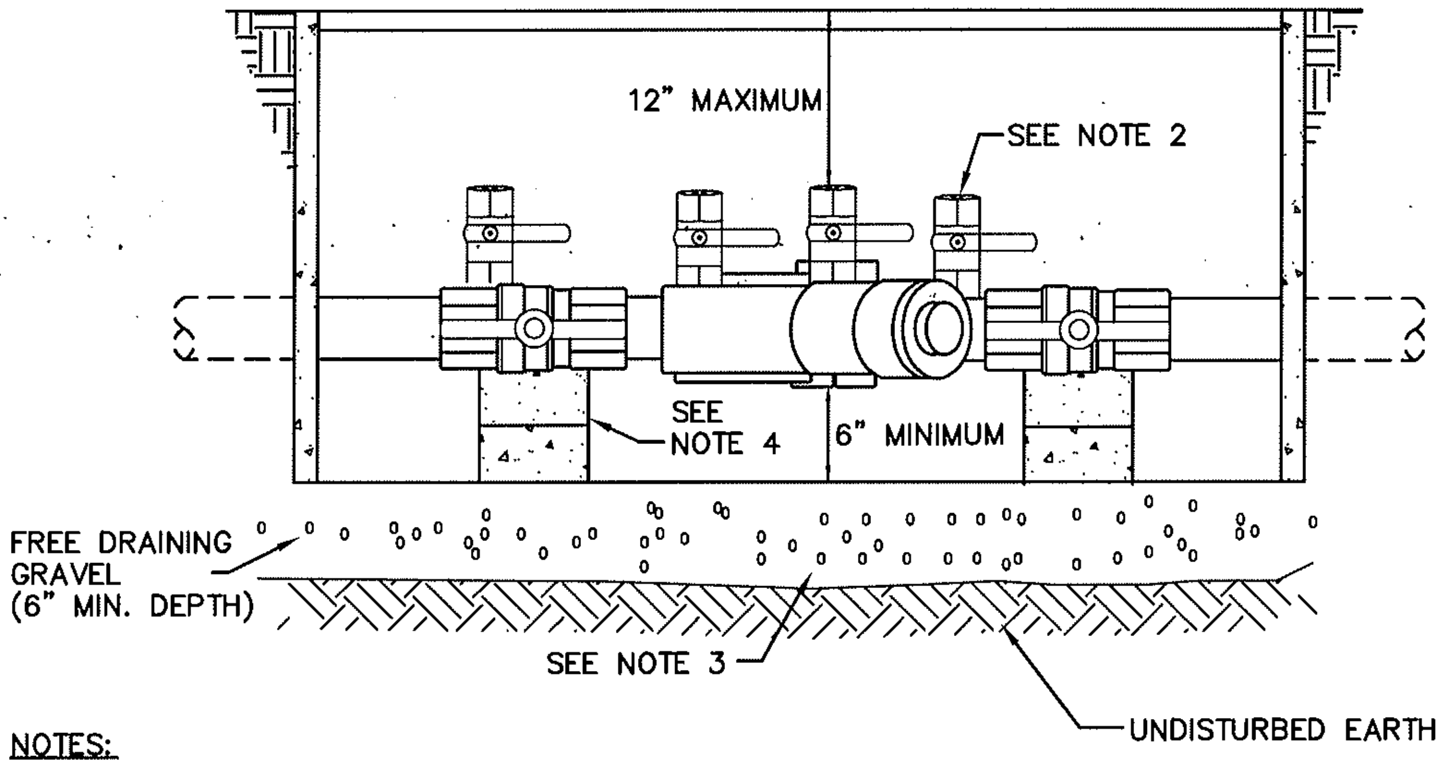



| CITY OF ALGONA | | | |
|---|---|---|---|
| WATER VALVE STEM EXTENSION | | | |
| APPROVED: Warren W. Parke 10/25/13<br>BY CITY DATE | | | DWG. NO.<br>WAT–VALV |
| DATE:<br>10/2012 | DRWN:<br>J.M. | CHKD:<br>W.P. | SCALE:<br>NONE |



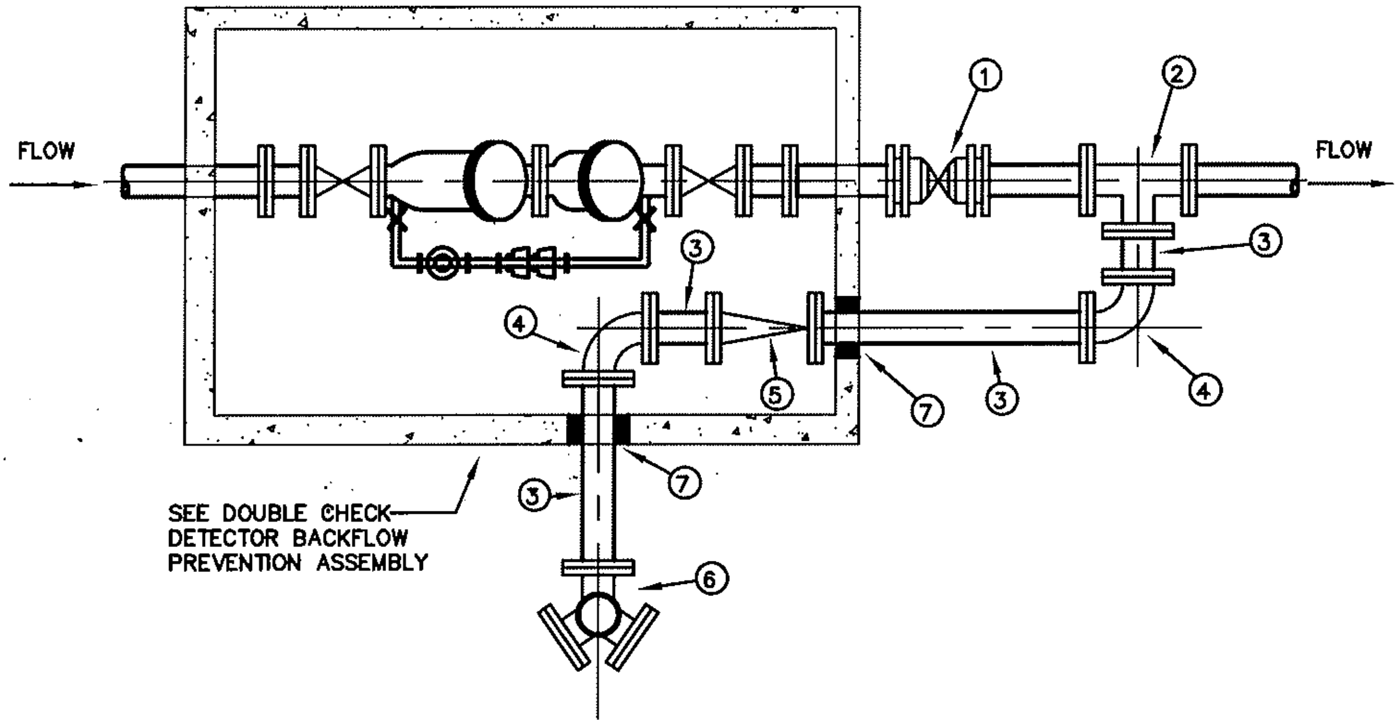
**PLAN VIEW**




NOTES:

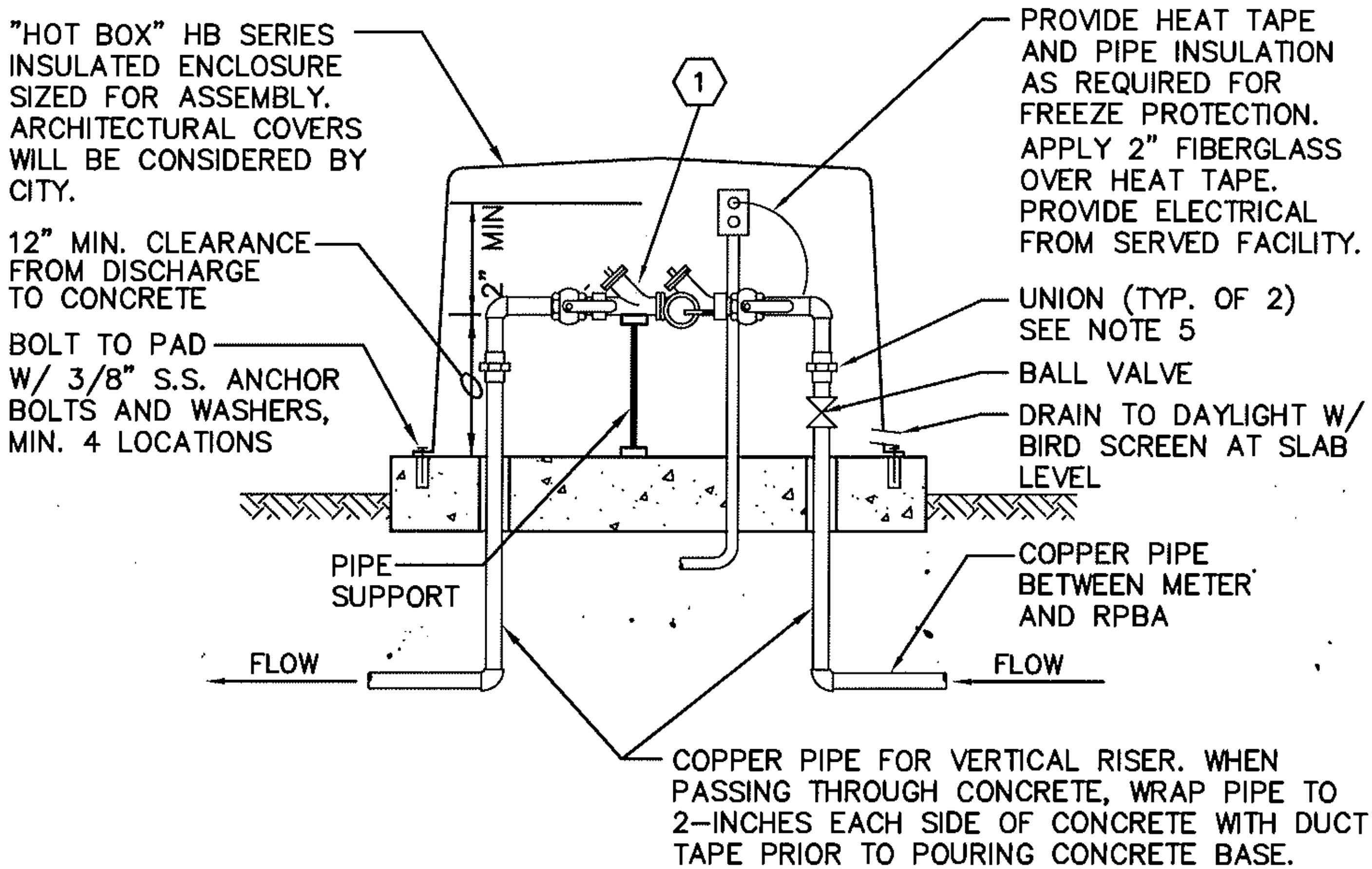
1. MINIMUM BOX SIZE 3/4"– 1" ASSEMBLIES, 10"x13"
   1 1/4"– 2" ASSEMBLIES, 14"x20"
2. ASSEMBLY MUST BE INSTALLED WITH TEST COCKS FACING UP OR TO ONE SIDE. INSTALL WATERTIGHT PLUGS IN ALL TEST COCKS.
3. SUFFICIENT DRAINAGE MUST BE PROVIDED TO PREVENT ASSEMBLY FROM BEING SUBMERGED.
4. PROVIDE SUPPPORT BLOCKS AS MAY BE REQUIRED.
5. PROVIDE A STRAINER WITH BLOW OUT VALVE AHEAD OF DEVICE IF REQUIRED BY CITY.
6. THOROUGHLY FLUSH THE LINE, PRIOR TO THE INSTALLATION OF THE DCVA.
7. PROTECT DEVICE FROM FREEZING BY INSTALLING IN STRUCTURE OR PER "HOT BOX" SHOWN IN REDUCED PRESSUREBACKFLOW DEVICE DETAIL.

| CITY OF ALGONA | | | |
|---|---|---|---|
| "INDIVIDUAL" DOUBLE CHECK DETECTOR ASSEMBLY | | | |
| APPROVED: 10/25/13 BY CITY DATE | | | DWG. NO. DBL–CHCK |
| DATE: 10/2012 | DRWN: J.M. | CHKD: W.P. | SCALE: NONE |




| NO. | DESCRIPTION |
|---|---|
| 1 | POST INDICATOR VALVE, MJ WITH MEGALUGS |
| 2 | 4" TEE, MJ WITH MEGALUGS |
| 3 | 4" DUCTILE IRON PIPE, CLASS 52 |
| 4 | 4" x 90° BENDS, MJ WITH MEGALUGS |
| 5 | 4" FLAPPER CHECK VALVE, MJ WITH MEGALUGS |
| 6 | FIRE DEPARTMENT CONNECTION, MJ WITH MEGALUGS. CONNECTION TO COMPLY WITH FIRE DEPARTMENT REQUIREMENTS. |
| 7 | WATERTIGHT GROUT |

| CITY OF ALGONA | | | |
|---|---|---|---|
| FIRE LINE CONNECTION | | | |
| APPROVED: [signature] 10/25/13<br>BY CITY DATE | | | DWG. NO.<br>FIRELINE |
| DATE:<br>10/2012 | DRWN:<br>J.M. | CHKD:<br>W.P. | SCALE:<br>NONE |




## REDUCED PRESSURE BACKFLOW DEVICE

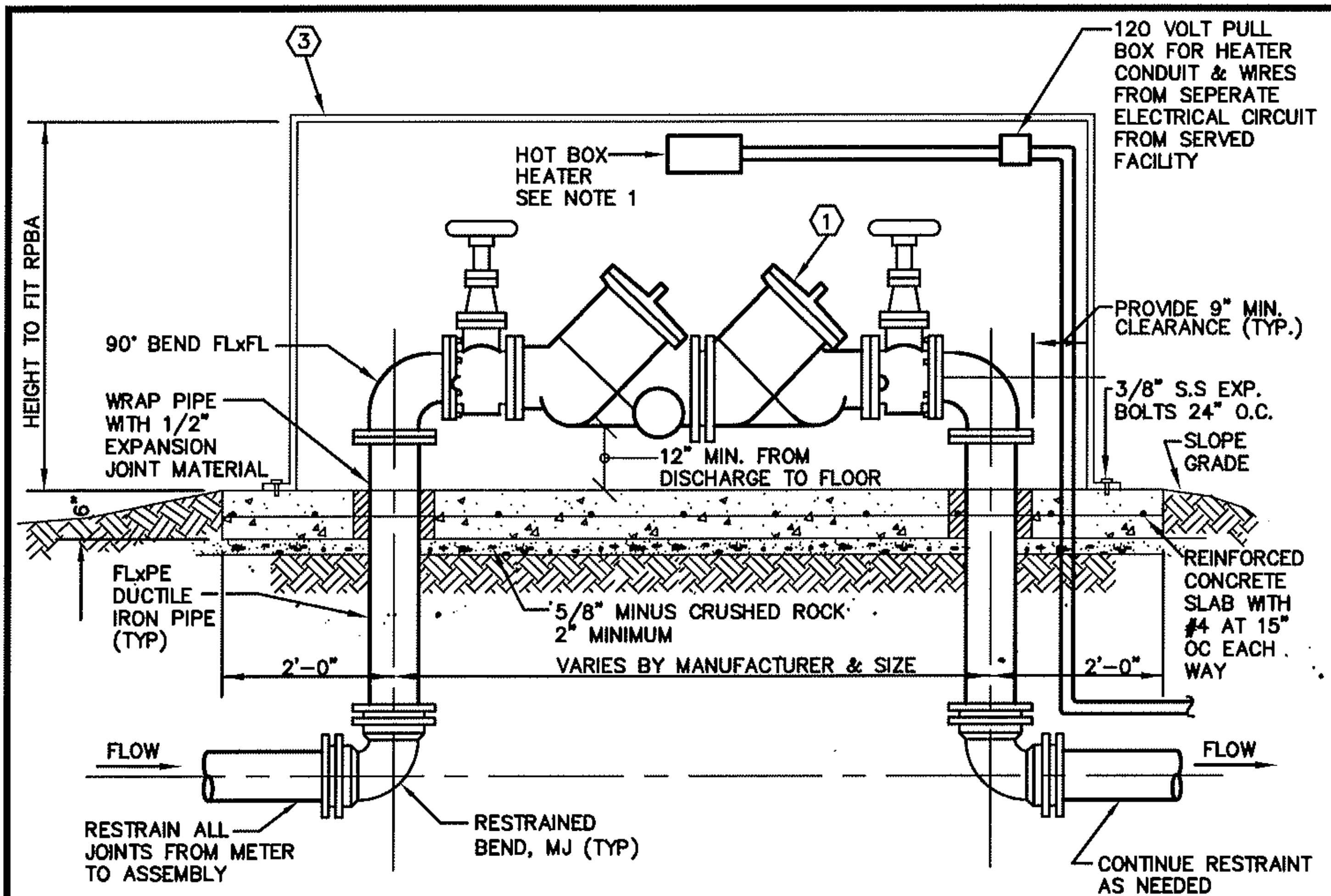
NOT TO SCALE

(1) WASHINGTON STATE APPROVED REDUCED PRESSURE BACKFLOW ASSEMBLY (RPBA) WITH TEST COCK PROTECTION AND BRONZE BODY BALL VALVE AT EACH END.

NOTES:

1. CONCRETE TO BE 2500 PSI (MINIMUM) MIX WITH AIR ENTRAINMENT.
2. COMPLETE ALL WORK IN ACCORDANCE WITH STATE, DISTRICT AND MANUFACTURER STANDARDS.
3. SYSTEM SHALL NOT BE PUT INTO SERVICE UNTIL RPBA IS APPROVED BY THE CITY AND TESTED/CERTIFIED BY A WASHINGTON STATE LICENSED TESTER.
4. RPBA IS CONSIDERED PART OF THE PRIVATE SYSTEM AND SHALL BE MAINTAINED BY THE PROPERTY OWNER WITH ANNUAL CERTIFICATION REQUIRED.
5. DIELECTRIC UNIONS SHALL BE USED TO SEPARATE DISSIMILAR MATERIALS.
6. NO BRANCH CONNECTIONS ALLOWED BETWEEN METER AND RPBA.

| CITY OF ALGONA | | | |
|---|---|---|---|
| REDUCED PRESSURE BACKFLOW ASSEMBLY 3/4" TO 2" | | | |
| APPROVED: Warren M. Perkins BY CITY | 10/25/13 DATE | | DWG. NO. RPBA |
| DATE: 10/2012 | DRWN: J.M. | CHKD: W.P. | SCALE: NONE |




(1) WASHINGTON STATE APPROVED REDUCED PRESSURE BACKFLOW ASSEMBLY (RPBA) WITH RESILIENT SEAT GATE VALVE EACH END

(2) NOT USED

(3) ALUMINUM "HOT BOX" MODELS 4 THROUGH 10 FOR RESPECTIVE SIZE RPBA SHALL BE MODIFIED TO FIT ABOVE HEIGHT REQUIREMENTS. VALVE STEM SHALL NOT EXTEND OUTSIDE OF BOX.

NOTES:

1. "HOT BOX" TO BE LOCATED OUTDOORS AND ACCESSIBLE TO CITY. ALTERNATE LOCATION REQUIRES CITY APPROVAL.
2. HEATERS AND WIRING SHALL BE RATED AT 2,000 WATT FOR 8" AND UNDER: 3,000 WATT FOR 10".
3. CONCRETE TO BE 2500 PSI (MINIMUM) MIX WITH AIR ENTRAINMENT.
4. COMPLETE ALL WORK IN ACCORDANCE WITH STATE, DISTRICT AND MANUFACTURER STANDARDS.
5. SYSTEM SHALL NOT BE PUT INTO SERVICE UNTIL RPBA IS APPROVED BY THE CITY AND TESTED/CERTIFIED BY A WASHINGTON STATE LICENSED TESTER.
6. RPBA IS CONSIDERED PART OF THE PRIVATE SYSTEM AND SHALL BE MAINTAINED BY THE PROPERTY OWNER WITH ANNUAL CERTIFICATION REQUIRED.
7. DRAIN TO DAYLIGHT WITH BIRD SCREEN LOCATED AT SLAB LEVEL (SIZED PER MANUFACTUERS RECOMMENDATION).
8. NO BRANCH CONNECTIONS ALLOWED BETWEEN METER AND RPBA.

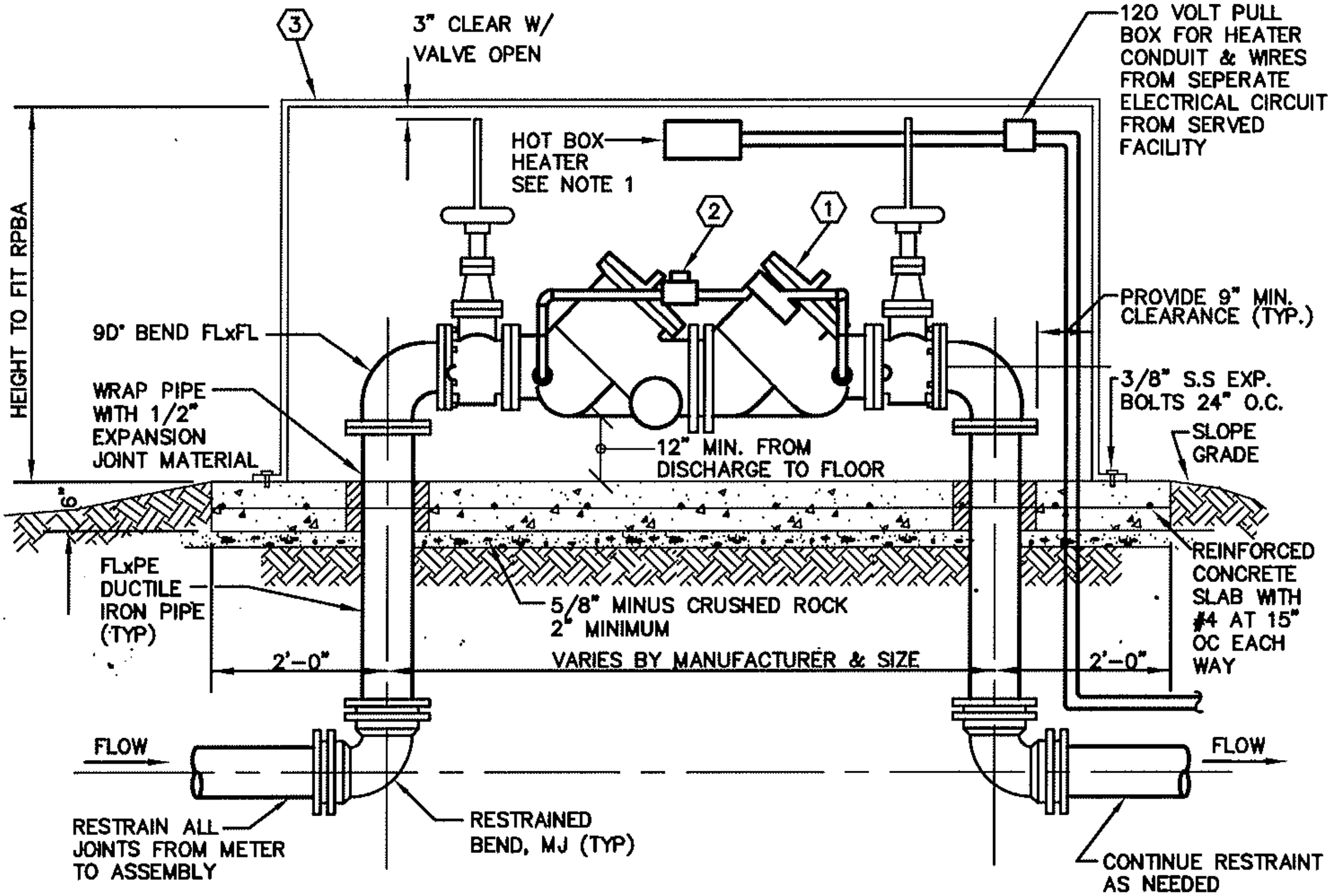
CITY OF ALGONA

REDUCED PRESSURE BACKFLOW ASSEMBLY 3" AND LARGER

APPROVED: [signature] 10/25/13
BY CITY DATE

DWG. NO. RPBA-2

| DATE: | DRWN: | CHKD: | SCALE: |
|---|---|---|---|
| 10/2012 | J.M. | W.P. | NONE |




(1) WASHINGTON STATE APPROVED REDUCED PRESSURE BACKFLOW ASSEMBLY (RPBA) WITH OS&Y RESILIENT SEAT GATE VALVE EACH END AND LOW FLOW METER ASSEMBLY.

(2) LOW FLOW BYPASS METER, INCLUDING 5/8"x3/4" SENSUS RADIO READ WATER METER WITH SENSUS AMR AND MXU RADIO UNIT, WASHINGTON STATE APPROVED DOUBLE CHECK VALVE ASSEMBLY (DCVA) AND 2 BRONZE BODY ISOLATION BALL VALVES, BRASS OR TYPE K COPPER PIPING.

(3) ALUMINUM "HOT BOX" MODELS 4 THROUGH 1D FOR RESPECTIVE SIZE RPBA SHALL BE MODIFIED TO FIT ABOVE HEIGHT REQUIREMENTS. VALVE STEM SHALL NOT EXTEND OUTSIDE OF BOX.

NOTES:

1. HEATERS AND WIRING SHALL BE RATED AT 2,000 WATT FOR 8" AND UNDER: 3,000 WATT FOR 10".
2. CONCRETE TO BE 2500 PSI (MINIMUM) MIX WITH AIR ENTRAINMENT.
3. COMPLETE ALL WORK IN ACCORDANCE WITH STATE, DISTRICT AND MANUFACTURER STANDARDS.
4. SYSTEM SHALL NOT BE PUT INTO SERVICE UNTIL RPBA IS APPROVED BY THE DISTRICT AND TESTED/CERTIFIED BY A WASHINGTON STATE LICENSED TESTER.
5. RPBA IS CONSIDERED PART OF THE PRIVATE SYSTEM AND SHALL BE MAINTAINED BY THE PROPERTY OWNER WITH ANNUAL CERTIFICATION REQUIRED.
6. DRAIN TO DAYLIGHT WITH BIRD SCREEN LOCATED AT SLAB LEVEL (SIZED PER MANUFACTUERS RECOMMENDATION).
7. NO BRANCH CONNECTIONS ALLOWED BETWEEN METER AND RPBA.

| CITY OF ALGONA | | | |
|---|---|---|---|
| REDUCED PRESSURE BACKFLOW DETECTOR 3" AND LARGER | | | |
| APPROVED: Warren W. Parks 10/25/13<br>BY CITY DATE | | | DWG. NO.<br>RPBA-2 |
| DATE:<br>10/2012 | DRWN:<br>J.M. | CHKD:<br>W.P. | SCALE:<br>NONE |

# APPENDIX E

# VOC/SOC MCLS

# CONSUMER CONFIDENCE REPORT

# COLIFORM MONITORING PLAN

# AUBURN WATER QUALITY DATA

## Regulated VOCs and SOCs

| Organic Chemical | Federal Regulation | Primary MCL (mg/L)[1] | Organic Chemical | Federal Regulation | Primary MCL (mg/L)[1] |
|---|---|---|---|---|---|
| **Volatile Organic Chemicals (VOCs)** | | | | | |
| Vinyl Chloride | Phase I | 0.002 | Monochlorobenzene | Phase II | 0.1 |
| Benzene | Phase I | 0.005 | Ortho-Dichlorobenzene | Phase II | 0.6 |
| Carbon Tetrachloride | Phase I | 0.005 | Styrene | Phase II | 0.1 |
| 1,2-Dichloroethane | Phase I | 0.005 | Tetrachloroethylene | Phase II | 0.005 |
| Trichloroethylene | Phase I | 0.005 | Toluene | Phase II | 1 |
| para-Dichlorobenzene | Phase I | 0.075 | Trans-1,2-Dichloroethylene | Phase II | 0.1 |
| 1,1-dichloroethylene | Phase I | 0.007 | Xylenes (total) | Phase II | 10 |
| 1,1,1-Trichloroethane | Phase I | 0.2 | Dichloromethane | Phase V | 0.005 |
| cis-1,2-Dichloroethylene | Phase II | 0.07 | 1,2,4-Trichloro-benzene | Phase V | 0.07 |
| 1,2-Dichloropropane | Phase II | 0.005 | 1,1,2-Thrichloro-ethane | Phase V | 0.005 |
| Ethylbenzene | Phase II | 0.7 | | | |
| **Synthetic Organic Chemicals (SOCs)** | | | | | |
| Arochlor | Phase II | 0.002 | 2,4,5-TP | Phase II | 0.05 |
| Aldicarb | Phase II[2] | 0.003 | Benzo(a)pyrene | Phase V | 0.0002 |
| Aldicarb sulfone | Phase II[2] | 0.003 | Dalapon | Phase V | 0.2 |
| Aldicarb sulfoxide | Phase II[2] | 0.004 | Di(2-ethylhexyl) adipate | Phase V | 0.4 |
| Atrazine | Phase II | 0.003 | Di(2-ethylhexyl) phthalate | Phase V | 0.006 |
| Carbofuran | Phase II | 0.04 | Dinoseb | Phase V | 0.007 |
| Chlordane | Phase II | 0.002 | Diquat | Phase V | 0.02 |
| Dibromochloro-propane | Phase II | 0.0002 | Endothall | Phase V | 0.1 |

## Regulated VOCs and SOCs (continued)

| Organic Chemical | Federal Regulation | Primary MCL (mg/L)[1] | Organic Chemical | Federal Regulation | Primary MCL (mg/L)[1] |
|---|---|---|---|---|---|
| 2,4-D | Phase II | 0.07 | Endrin | Phase V | 0.002 |
| Ethylene dibromide | Phase II | 0.00005 | Glyphosate | Phase V | 0.7 |
| Heptachlor | Phase II | 0.0004 | Hexachlorobenzene | Phase V | 0.001 |
| Heptachlor epoxide | Phase II | 0.0002 | Hexachloro Cyclopentadiene | Phase V | 0.05 |
| Lindane | Phase II | 0.0002 | Oxamyl (vydate) | Phase V | 0.2 |
| Methoxychlor | Phase II | 0.04 | Picloram | Phase V | 0.5 |
| Polychlorinated biphenyls (PCBs) | Phase II | 0.0005 | Simazine | Phase V | 0.004 |
| Pentachlorophenol | Phase II | 0.001 | 2,3,7,8-TCDD (dioxin) | Phase V | $3x10^{-8}$ |
| Toxaphene | Phase II | 0.003 | | | |

(1) 40 CFR 141.61(a) & (c); adopted by State Board of Health, effective April 1999

(2) Delayed; re-proposal of MCLs for aldicarb compounds expected in the future.

**Algona Water Utility - 2012 Water Quality Report**

Este reporte examina la calidad del agua de la ciudad. En resumen, el agua de la ciudad es segura.

The Algona Water Utility is providing you with our 2012 Water Quality Report. This report is a summary of information about drinking water quality. Included are details about where Algona water comes from, what it contains, and how it compares to standards set by Environmental Protection Agency.

Since 1996 the City of Algona has purchased its water from the City of Auburn. Auburn's water comes from a combination of deep wells and springs. Coal Creek Springs, Auburn's largest and second oldest supply source, developed for water supply in 1925. The springs are located south of the White River and are surrounded by a 220-acre resource protection area. West Hill Springs, Auburn's oldest supply, is located in the West Hill of Auburn and was purchased by the City in 1907. Although West Hill Springs is one of the smallest sources, it remains an important economical source of supply, which does not require pumping for use by customers. Auburn has sufficient supply sources to meet Algona's demands, even if any one well or spring is out of service for maintenance or repair. Currently the only treatment provided to the water supply is chlorination. Chlorine is added to the water supply to minimize the potential for any microbial growth within the water supply system.

**Required Health Information From The EPA**

**Health Issues**

Some people may be more vulnerable to contaminants in drinking water than the general population (contaminants are something in drinking water other than water). Immune-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. Environmental Protection Agency (EPA)/Centers for Disease Control (CDC) guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the EPA's Safe Water Drinking Hotline (800-426-4791).

**Contaminants and Regulations**

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not mean the water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA Safe Drinking Water Hotline (800-426-4791).

The sources of drinking water for both tap water and bottled water include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animal or from human activity. Microbial contaminants, such as viruses and bacteria, may come from septic systems, livestock, and wildlife. Inorganic contaminants, such as salts and metals, can be naturally occurring or result from urban stormwater runoff, septic systems, or fertilizer use. Pesticides and herbicides may come from a variety of sources such as agriculture, urban stormwater runoff, and residential uses. Organic chemical contaminants, including synthetic and volatile organic chemicals, are by-products of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, and septic systems. Radioactive contaminants can be naturally occurring or be the result of oil and gas production and mining activities.

In order to ensure that tap water is safe to drink, EPA prescribes regulations that limit the amount of certain contaminants in water provided by public water systems. Food and Drug Administration regulations set limits for contaminants in bottled water that are intended to provide similar protection for public health.

**Conserving Our Valuable Water Resource**

In cooperation with all the other water utilities in the region, we encourage our customers to use water wisely.

## Cross Connection Control Program - Protecting Our Water System From Contamination

A cross connection is a connection between water pipes and a source of contamination. Examples of cross connections include hose ends submerged in pools, hot tubs or buckets, irrigation systems and most hose-end spray applicators. Although the conditions are rare cross connections can be dangerous because they provide opportunities for contaminated fluids to be pulled back into the water system. To protect our water supply, avoid using hose-end sprayers, maintain an air gap by keeping the hose end above the water surface when filling containers, and install a backflow assembly on irrigation systems. Backflow assemblies require a plumbing permit, must be inspected by a cross connection specialist, and must be tested by a certified tester when installed, and yearly thereafter. For more information or a list of certified testers, call the Public Works at 253-833-2741.

## Water Quality Data Table

The table below lists all of the drinking water contaminants that were detected during 2012 (unless otherwise noted). The presence of contaminants in the water does not necessarily indicate that the water poses a health risk

### Important Drinking Water Definitions:

**MCLG**: Maximum Contaminant Level Goal: The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.
**MCL**: Maximum Contaminant Level: The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.
**AL**: Action Level: The concentration of a contaminant which, when exceeded, triggers treatment or other requirements which a water system must follow.

| **Parameter** | **Standards** | | **Sample Results** | | | **Additional Information** |
|---|---|---|---|---|---|---|
| | MCLG | MCL | Valley Wells and Springs | | | Typical Source/Comments |
| Inorganics Testing | | | | | | |
| Arsenic (ppb) | None | 10 | ND –2 | | | Erosion of natural deposits; run off from orchards; run off from glass and electronics production wastes. |
| Nitrate (ppm) | 10 | 10 | ND-3.4 | | | Natural deposits, fertilizer, septic tanks. |
| Lead** | | | | | | |
| Volatile Organics Test Results | | | | | | |
| Haloacetic Acids (ppb) | NA | 60 | ND – 10.7 | | | By-product of drinking water disinfection. |
| Total Trihalomethanes (ppb) | NA | 80 | ND- 16.3 | | | By-product of drinking water disinfection. |
| Unregulated Contaminant and Chlorine Residual Test Results | | | | | | |
| Sulfate (ppm) | None | 250 | 6 – 15 | | | Naturally present in the environment. |
| Chlorine Residual (ppm) | 4.0 (MRDL) | 4 (MRDLG) | ND-0.10-1.44 Average 0.71 | | | Measure of disinfectant added to water. |

**Units Description:**
**ND**: Not detected
**ppm**: parts per million, or milligrams per liter (mg/l)
**ppb**: parts per billion, or micrograms per liter (µg/l)
**NA**: Not applicable
**MFL**: million fibers per liter, used to measure asbestos concentration
**% Positive samples / month**: Percent of samples taken monthly that were positive

**Table Notes:**
* *Copper.* The water from Auburn's sources does not contain measurable levels of copper. However, copper can leach into the water from plumbing systems. In 2002 Auburn completed construction of two corrosion control facilities to adjust the pH of Auburn's water and minimize leaching of copper from our customer's plumbing. Monitoring in 2012 indicated that Auburn's water was in compliance with State and Federal regulations.
**Lead. The water from Auburn does not contain measurable levels of lead. However, lead can leach into the water from plumbing systems. Algona's testing showed that the 90$^{th}$ percentile was .40. One samples in ten exceeded the action level. This means the city will need to continue to do monitoring and testing.

For additional information contact Jimmy Griess, Public Works Supervisor at 253-833-2741.

# CITY OF ALGONA
# COLIFORM MONITORING PLAN

In the event of the detection of coliform, WDOH & Auburn must be notified as soon as possible and in not less than 24-hours.

| Main Numbers | After Hours |
|---|---|
| WDOH 253-395-6750 | WDOH 877-481-4901 |
| Auburn 253-931-3048 | Auburn 253-931-3048 |

## A. System Information

| Water System Name | County | System I.D. Number |
|---|---|---|
| City of Algona | King | 01450V |
| Sources: | Auburn Wells, Tacoma Intertie with Auburn | |
| Treatment: | Chlorination, pH adjustment. Treatment by Auburn and Tacoma. | |
| Storage: | Provided by Auburn | |
| Population | 3000 | |
| Number of Routine Samples Required Monthly by Regulation: 3 | Number of Sample Sites Needed to Represent the Distribution System: 12 | |

## B. Routine and Repeat Sample Locations

| Location/Address for Routine Sample Sites | Location/Address for Repeat Sample Sites |
|---|---|
| X1. 405 4th Avenue South | 1-1. Same |
| | 1-2. 401 4th Avenue South |
| | 1-3. 415 4th Avenue South |
| X2. 112 3rd Avenue South | 2-1. Same |
| | 2-2. 104 3rd Avenue South |
| | 2-3. 116 3rd Avenue South |
| X3. 402 Warde Street | 3-1. Same |
| | 3-2. 407 Warde Street |
| | 3-3. 415 Warde Street |

## B. - Continued

| Location/Address for Routine Sample Sites | Location/Address for Repeat Sample Sites |
|---|---|
| X4. 113 1st Avenue | 1-1. Same |
| | 1-2. 111 1st Avenue |
| | 1-3. 115 1st Avenue |
| | |
| X5. 121 3rd Avenue North | 2-1. Same |
| | 2-2. 150 3rd Avenue North |
| | 2-3. 201 3rd Avenue North |
| | |
| X6. 229 5th Avenue North | 3-1. Same |
| | 3-2. 296 5th Avenue North |
| | 3-3. 225 5th Avenue North |
| | |
| X7. 313 8th Avenue North | 3-1. Same |
| | 3-2. 309 8th Avenue North |
| | 3-3. 315 8th Avenue North |
| | |
| X8. 914 Celery Street | 3-1. Same |
| | 3-2. 1032 Celery Street |
| | 3-3. 901 Celery Street |
| | |

## B. Continued

| Location/Address for Routine Sample Sites | Location/Address for Repeat Sample Sites |
|---|---|
| **X9. 315 2nd Avenue North** | **2-1. Same** |
| | **2-2. 321 2nd Avenue North** |
| | **2-3. 309 2nd Avenue North** |
| | |
| **X10. 205 Stanley Court** | **3-1. Same** |
| | **3-2. 201 Stanley Court** |
| | **3-3. 209 Stanley Court** |
| | |
| **X11. 36042 West Valley Highway** | **3-1. Same** |
| | **3-2. 36102 West Valley Highway** |
| | **3-3. 36031 West Valley Highway** |
| | |
| **X12. 405 Seattle Boulevard South** | **3-1. Same** |
| | **3-2. 329 Seattle Boulevard South** |
| | **3-3. 407 Seattle Boulevard South** |
| | |

## Total Number of Monthly Samples – 3

If a routine sample is total coliform positive, the City will collect repeat samples as shown, three samples within 24 hours. One sample will be from the location that tested positive, one within 5 services downstream and one from within five services upstream. If one of the repeat samples is positive then an additional set of repeat samples must be collected. This process will continue until no coliforms are detected.

## C. Routine Sample Rotation Schedule

| Month | Routine Site(s) | Month | Routine Site(s) |
|---|---|---|---|
| January | 7,8,9 | July | 1,2,3 |
| February | 10,11,12 | August | 4,5,6 |
| March | 1,2,3 | September | 7,8,9 |
| April | 4,5,6 | October | 10,11,12 |
| May | 7,8,9 | November | 1,2,3 |
| June | 10,11,12 | December | 4,5,6 |

## D. Month Following Unsatisfactory Samples

| Description of Sample Collection Locations for Month Following Unsatisfactory Samples |
|---|
| If an unsatisfactory sample is collected then five routine samples will be collected the following month. The site that the unsatisfactory sample was taken from the three prescribed repeat sample locations, and the closest downstream routine sample location. |

## E. Sampling procedure

Water samples for bacteriological analysis are collected the 1st Tuesday of every month from three designated sites. All samples are collected from sampling stations. Prior to sampling the hose bibb is sprayed down with a 50/50 mix of water and 5% chlorine solution. The hose bibb is turned on for about a minute while washing it.

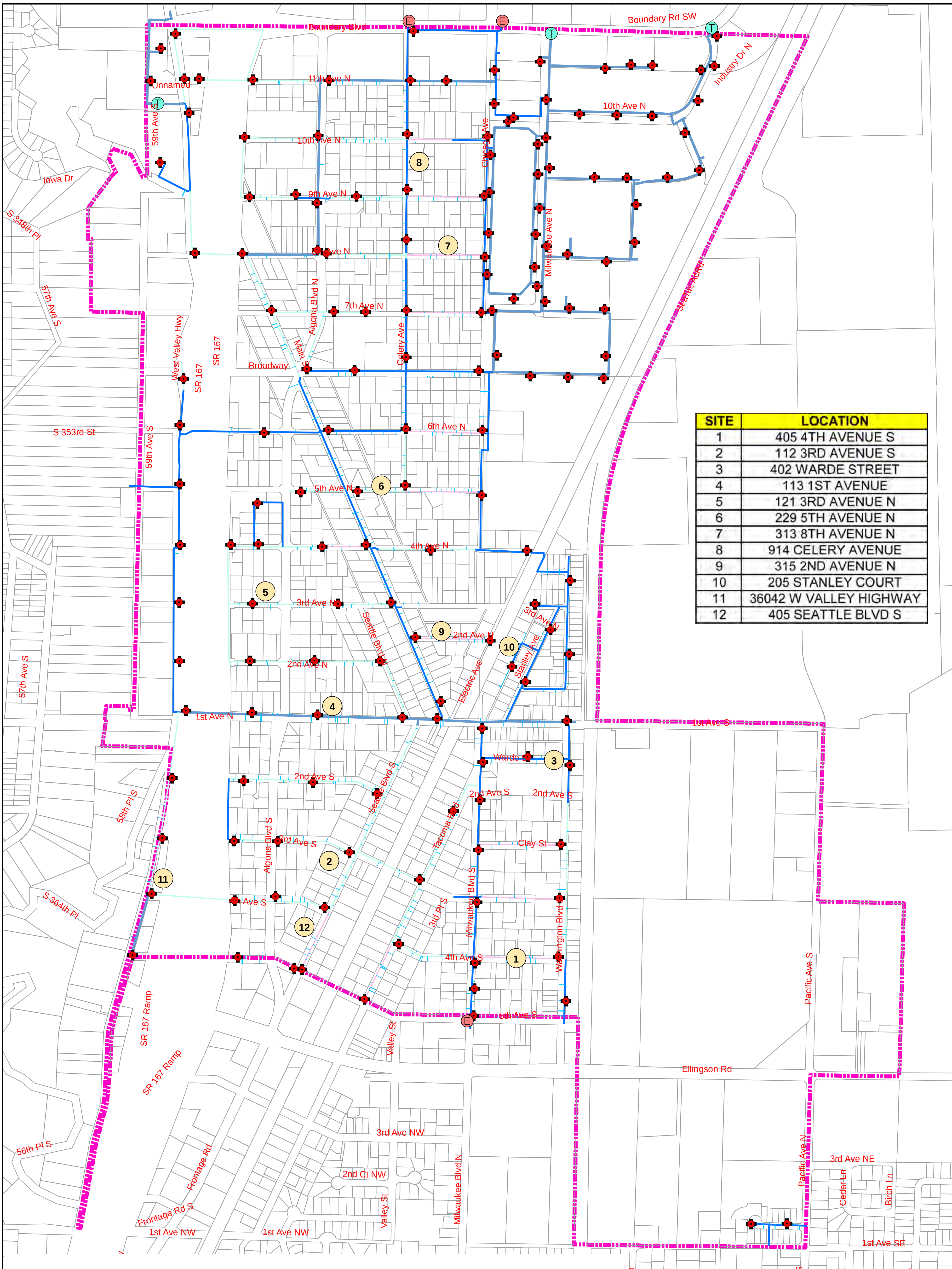
The chlorine residual concentration is recorded and then the water sample is collected into bottle prepared at the laboratory. When finished the samples are put in the refrigerator at city hall for same day pick up by Water Management Laboratory.

## F. Notification

If any routine sample is found to have coliform present, the City of Auburn as source provider to Algona, shall be notified as soon as possible and within no more than 24-hours. WDOH shall also be notified as soon as possible and within no more than 24-hours.

## G. Preparation Information

| System Name | Date Plan Completed | Dates Modified |
|---|---|---|
| City of Algona | June 15, 2006 | December 18, 2013 |
| **Name of Plan Preparer** / **Position** | | **Daytime Phone #** |
| Jimmy Griess / Water Distribution Manager | | (253) 261-1580 |
| **State Reviewer** | **Date Last Review** | |
| | | |




| SITE | LOCATION |
|---|---|
| 1 | 405 4TH AVENUE S |
| 2 | 112 3RD AVENUE S |
| 3 | 402 WARDE STREET |
| 4 | 113 1ST AVENUE |
| 5 | 121 3RD AVENUE N |
| 6 | 229 5TH AVENUE N |
| 7 | 313 8TH AVENUE N |
| 8 | 914 CELERY AVENUE |
| 9 | 315 2ND AVENUE N |
| 10 | 205 STANLEY COURT |
| 11 | 36042 W VALLEY HIGHWAY |
| 12 | 405 SEATTLE BLVD S |

N

0 700 1,400 Feet

**LEGEND:**

- E EMERGENCY INTERTIE
- T SOURCE INTERTIE
- FIRE HYDRANT
- 1 COLIFORM LOCATION

**WATERLINES:**

- WS
- 4-INCH
- 6-INCH
- 8-INCH
- 12-INCH
- ALGONA CITY LIMITS

# CITY OF ALGONA

WATER SYSTEM PLAN
COLIFORM MONITORING LOCATIONS

Gray & Osborne, Inc.

Document Path: L:\ALGONA\12503 WSP 2012\GIS\COLIFORM.mxd

# WATER QUALITY

## 7.1 INTRODUCTION

The purpose of this chapter is to review current and upcoming regulations relevant to the City of Auburn (City) and to review the City's Water Quality Monitoring Plan (WQMP). This chapter includes the following:

- Review of current and upcoming regulations
- Summary of the City's water quality monitoring programs
- Summary of recent water quality testing results
- Review of the City's WQMP
- Recommendations

## 7.2 WATER QUALITY REGULATIONS

The Safe Drinking Water Act (SDWA) of 1974 established primary drinking water regulations designed to ensure the distribution of safe drinking water. These regulations were the first to be implemented at all public water systems in the U.S., covering both chemical and microbial contaminants. These regulations consisted of standards for 18 parameters, referred to as the National Interim Primary Drinking Water Regulations. They remained in place for over 10 years with minor revisions, including a revised fluoride standard, addition of a total trihalomethanes standard, and interim regulations for radionuclides in potable water.

In 1986, Congress passed widespread amendments to the SDWA, which significantly altered the rate at which the United States Environmental Protection Agency (USEPA) was to set drinking water standards. These amendments resulted in a three-fold increase in the number of contaminants regulated. Also at that time, the National Interim and revised Primary Drinking Water Regulations promulgated prior to 1986 were redefined as National Primary Drinking Water Regulations.

The 1996 amendments to the SDWA greatly enhanced the existing law by recognizing source water protection, operator training, funding for water system improvements, and public information as important components of safe drinking water. Among others, the 1996 amendments required the USEPA to develop rules to balance risks between microbial pathogens and disinfection by-products (DBP), named the Microbial/Disinfection By-Product (M/DBP) Rules. Several rules emerged from this requirement, including the Stage 1 and Stage 2 Disinfectants and Disinfection By-Products Rules, and the Interim, Long Term 1 and Long Term 2 Enhanced Surface Water Treatment Rules.

The SDWA gives the USEPA authority to delegate primary enforcement responsibilities, or primacy, to individual states. Within the state of Washington, the Washington State Department of Health (DOH) was given authority to enforce drinking water regulations. To maintain authority to enforce drinking water regulations under the SDWA, a state must adopt drinking water regulations at least as stringent as the federal standards. The Washington regulations are contained in Title 246 of the Washington Administrative Code (WAC). The most recent revision of the WAC became effective February 14, 2008.

The City of Auburn's water system is classified as a Group A - Community Water System by the DOH. As a Group A system, the City is responsible for monitoring and complying with all applicable SDWA and WAC regulations pertaining to source water and distribution system water quality. USEPA regulations and accompanying state codes that pertain to the City are described herein. The regulations are divided into three categories: source water quality, distribution system water quality, and water quality programs.

The City of Auburn also owns and operates a smaller system located in southeast Auburn in the Hidden Valley Acres development. This system is classified as a Group A - Community Water System by the DOH. This system is not included in this plan.

### 7.2.1 Source Water Quality

Regulations that address source water quality for groundwater systems are described herein. The City does not have any supplies that are either surface water or groundwater under the direct influence (GWI) of surface waters. The 2001 Comprehensive Water Plan noted that a study was being conducted to determine whether the City's Coal Creek Springs is influenced by surface waters (GWI). In a letter dated February 6, 2004, the DOH documented its determination that the Coal Creek Springs source is not GWI and is classified as a groundwater source. As the City does not have any surface water or GWI supplies, regulations relevant to surface water supplies are not discussed herein. These regulations include: the Surface Water Treatment Rule; the Interim, Long Term 2 and Long Term 2 Enhanced Surface Water Treatment Rules; and the Filter Backwash Recycling Rule.

#### 7.2.1.1 Primary and Secondary Drinking Water Regulations

National Primary Drinking Water Regulations are currently set for 92 contaminants. Maximum contaminant levels (MCLs) and maximum contaminant level goals (MCLGs) have been established for 83 contaminants, while the remaining nine have treatment technique requirements. It was assumed for this evaluation that all treatment technique requirements are being addressed. A constituent's MCL is generally based on its public health goal (PHG), which is the level of a contaminant in drinking water below which there is no known or expected health risk. Monitoring of constituents with primary standards is addressed under WAC 246-290-300, with MCLs defined under WAC 246-290-310 and required follow-up actions for MCL violations addressed under WAC 246-290-320.

The USEPA has also established secondary standards for 15 contaminants to address the aesthetic quality of drinking water. Because the federal standards primarily address taste and odor, rather than health issues, they are often used only as a guideline. Monitoring of constituents with secondary standards is addressed under WAC 246-290-300, with secondary MCLs defined under WAC 246-290-310. For new community water systems, treatment for secondary contaminant MCL exceedences is required under WAC 246-290-320 (3)(d). For other public water systems, the WAC stipulates that the required follow-up action be determined by the DOH based on the degree of consumer acceptance of the water quality and their willingness to bear the costs of meeting the secondary standard.

#### 7.2.1.2 Arsenic Rule (2001)

In January 2001, the USEPA promulgated a new standard that requires public water systems to reduce arsenic levels in drinking water. The final rule became effective in January 2006 and applies to all community water systems and non-transient, non-community water systems, regardless of size. The rule not only establishes an MCL for arsenic (0.010 mg/L), based on a running annual average (RAA) of quarterly results and an MCLG for arsenic (zero), but also lists feasible technologies and affordable technologies for small systems that can be used to comply with the MCL. However, systems are not required to use the listed technologies in order to meet the MCL. The arsenic rule has been adopted by the Washington DOH as a revision to the arsenic MCL under WAC 249-290-310.

#### 7.2.1.3 Radionuclide Rule (2000)

On December 7, 2000, the USEPA announced updated standards for radionuclides. This rule became effective on December 8, 2003. All community water systems are required to meet the MCLs, presented in Table 7.1, and requirements for monitoring and reporting. All systems were required to complete initial monitoring and phase in the monitoring requirements, between December 8, 2003 and December 30, 2007. Initially, utilities were required to undergo four consecutive quarters of monitoring for gross alpha, combined radium-225/-228, and uranium. Only systems considered “vulnerable” were required to monitor for gross beta (quarterly samples), tritium, and strontium-90 (annual samples). The initial monitoring was used to determine if a system would have to perform reduced or increased monitoring. The Radionuclide Rule has been adopted by the Washington DOH; monitoring is addressed under WAC 246-290-300, the MCLs are defined under WAC 246-290-310 and required follow-up actions for MCL violations are addressed under WAC 246-290-320.

| Table 7.1 Radionuclide Regulation<br>Comprehensive Water Plan<br>City of Auburn | |
|---|---|
| **Constituent** | **MCL** |
| Combined Radium-226 and Radium-228 | 5 pCi/L |
| Gross Alpha Particle Activity (including Radium-226, but excluding radon and uranium) | 15 pCi/L |
| Tritium | 20,000 pCi/L |
| Strontium-90 | 8 pCi/L |
| Gross Beta Particle Activity | 50 pCi/L |
| Uranium | 30 µg/L |

#### 7.2.1.4 Groundwater Rule (2007)

The USEPA enacted the final Groundwater Rule (GWR) January 8, 2007, for the purpose of providing increased protection against microbial pathogens in public water systems that use untreated groundwater. The GWR applies to public water systems that serve groundwater as well as to any system that mixes surface and groundwater, if the groundwater is added directly to the distribution system and is provided to customers without treatment.

To implement the GWR, the USEPA is taking a risk-based approach to protect drinking water from groundwater sources that have been identified as being at the greatest risk of fecal contamination. This strategy includes four primary components:

1. Periodic sanitary surveys that require the evaluation of eight critical elements of a public water system and the identification of significant deficiencies (such as a well located near a leaking septic system).
2. Triggered source water monitoring when a system does not sufficiently disinfect drinking water to achieve 4-log (99.99 percent) virus removal and identifies a positive sample during its Total Coliform Rule monitoring and assessment monitoring (at state discretion) targeted at high-risk systems.
3. Corrective action required for any system with a significant deficiency or evidence of source water fecal contamination.
4. Compliance monitoring to ensure that treatment technology installed to treat drinking water reliably achieves 4-log virus inactivation.

The compliance date for triggered source water monitoring and the associated corrective actions, as well as compliance monitoring, is December 1, 2009. Because assessment monitoring is at the discretion of the state, there is no timeframe associated with assessment monitoring. Initial sanitary surveys must be completed by December 31, 2012.

However, for community water systems that have been identified by the state as outstanding performers (generally those that have treatment that provides 4 log virus inactivation or removal at all sources), the initial sanitary survey must be completed by December 31, 2014.

Many of the requirements of the GWR will be determined by the individual state agencies. The requirements of the GWR have not yet been adopted by the Washington DOH. However, the DOH has provided a Fact Sheet for Group A utilities with recommended actions to prepare for the GWR. These actions include the following:

- Correct deficiencies from the last sanitary survey.
- Install a sample tap at each wellhead.
- Know specifically where each well's water goes. Triggered source water monitoring will require monitoring of all sources, unless it can be shown that the area of concern in the distribution system is only served by a limited number of sources.
- Update your emergency response plan, to be ready to provide alternate water, if needed.
- If you currently treat groundwater from a well, contact your regional office engineer to confirm whether you currently achieve 4-log virus inactivation. Systems that treat to this level will not be required to conduct triggered source water monitoring, but will instead be required to meet treatment technique monitoring requirements.

The DOH has also indicated that they are not planning to require systems to perform assessment monitoring and that the sanitary surveys completed under the GWR will not differ significantly from those currently required.

#### 7.2.1.5 Unregulated Contaminants

There are two programs that address contaminants for which future regulatory requirements are being considered. The first is the USEPA Unregulated Contaminant Monitoring (UCM) Program, which is used to collect occurrence data for contaminants suspected to be present in drinking water, but that do not have health-based standards. Depending on their size, utilities are required to monitor for a select list of contaminants, which is reviewed every 5 years.

The second is the Contaminant Candidate List (CCL). The USEPA is required to establish a list of contaminants that aid in priority setting for the drinking water program. The USEPA conducts research on health, analytical methods, treatment technologies, effectiveness, costs, and occurrence for drinking water contaminants on the CCL. The second CCL (CCL2) included 51 contaminants; a regulatory determination on these contaminants is expected in 2009. The third CCL (CCL3) is scheduled for publication in 2009.

### 7.2.2 Distribution System Water Quality

Regulations that address distribution system water quality are described herein.

#### 7.2.2.1 Total Coliform Rule (1989)

The Total Coliform Rule (TCR) was promulgated in 1989, and established an MCLG of zero for total and fecal coliforms. The rule requires that less than 5 percent of distribution system samples collected each month be positive for the presence of total coliform bacteria. Positive samples must be further analyzed for *Escherichia coli (E. coli)* and fecal coliform. If two consecutive samples in the system are total coliform positive and one is also positive for fecal coliform or *E. coli*, it is considered an acute MCL violation, resulting in notification and further monitoring requirements.

Secondary disinfection is required under the TCR in accordance with the following:

- A minimum disinfectant residual of 0.2 mg/L free chlorine or 0.5 mg/L chloramines measured as total chlorine must be continually present at the entrance of the distribution system, with a detectable chlorine residual maintained throughout the distribution system.
- A sample with heterotrophic plate counts (HPCs) less than 500 cfu/100 mL is assumed to carry the required minimum residual.

The TCR has been adopted by the Washington DOH; monitoring requirements are defined under WAC 246-290-300, acute and nonacute MCL violations are defined under WAC 246-290-310 (2), and required follow-up actions are specified under WAC 246-290-320.

The TCR is currently under review by the USEPA to initiate possible revisions. In parallel with the review of the TCR, the USEPA is also considering a possible Distribution System Rule to address distribution system issues that have the potential to impact public health risk.

#### 7.2.2.2 Lead and Copper Rule (1991/2000)

The federal Lead and Copper Rule was finalized in June 1991. In lieu of MCLs, this rule established an action level for lead of 0.015 mg/L and for copper of 1.3 mg/L, and MCLGs of 0 mg/L for lead and 1.3 mg/L for copper. Exceeding the action level is not a violation, but triggers additional action including water quality parameter monitoring, corrosion control treatment, source water monitoring/treatment, public education, and lead service line replacement.

On January 12, 2000, the USEPA promulgated the Lead and Copper Rule Minor Revisions (LCRMR) to streamline requirements, promote consistent national implementation, and in many cases, reduce the burden on water systems. The LCRMR does not change the action levels or the rule's basic requirements to optimize corrosion control. The modified rule addresses seven broad categories:

1. Demonstration of optimal corrosion control.
2. Lead service line replacement requirements.

3. Public education requirements.
4. Monitoring requirements.
5. Analytical methods.
6. Reporting and record-keeping requirements.
7. Special primacy considerations.

State regulations for lead and copper monitoring are outlined in detail in WAC 246-290-300 (5).

#### 7.2.2.3 Stage 1 Disinfectants and Disinfection By-Products (1998)

The Stage 1 Disinfectants and Disinfection By-Products Rule (DBPR) was promulgated in December 1998. The portions of the Stage 1 DBPR relevant to the City are the MCLs for trihalomethanes (THMs) and haloacetic acids (HAAs) of 0.080 and 0.060 mg/L, respectively. Compliance with the THM and HAA MCLs is based on a system-wide RAA of quarterly samples taken in the distribution system. The Stage 1 DBPR also introduced a maximum residual disinfectant level (MRDLs) of 4 mg/L for free chlorine, based on an RAA of samples collected concurrent with TCR monitoring.

The Stage 1 DBPR requires the development of a monitoring plan, as described in WAC 246-290-300. The MCLs are defined in WAC 246-290-310 and the required follow-up actions in WAC 246-290-320.

#### 7.2.2.4 Stage 2 Disinfectants and Disinfection By-Products Rule (2006)

The Stage 2 DBPR was promulgated by the USEPA on January 4, 2006. The key provisions of the Stage 2 DBPR consist of:

- An Initial Distribution System Evaluation (IDSE) to identify distribution system locations with high DBP concentrations. Further information is provided below.
- Site-specific locational running annual averages (LRAAs) instead of system-wide RAAs to calculate compliance data. LRAAs will strengthen public health protection by eliminating the potential for groups of customers to receive elevated levels of DBPs on a consistent basis.

The MCLs for THM4 and HAA5 remain unchanged from the Stage 1 DBPR at 0.080 and 0.060 mg/L, respectively, although they will now be calculated as LRAAs.

The IDSE is the first step in Stage 2 DBPR compliance. It intends to identify sampling locations for Stage 2 DBPR compliance monitoring that represent distribution system sites with high THM and HAA levels. For systems serving more than 500 people, three options are available for the IDSE:

- 40/30 Waiver, which allows systems with no samples exceeding THM and HAA concentrations of 40 and 30 μg/L, respectively, during 8 consecutive quarters to apply to waive the IDSE requirements.

- Standard Monitoring Program (SMP), which involves a 1-year distribution system monitoring effort to determine locations that routinely show high THM4 and HAA5 concentrations.
- System-Specific Study (SSS), based on historical data and a system model.

The Washington DOH has not yet adopted the Stage 2 DBPR; IDSE Plans are being submitted directly to the USEPA.

### 7.2.3 Water Quality Programs

Required water quality programs are described herein.

#### 7.2.3.1 Consumer Confidence Reports

Under the 1996 amendments to the SDWA, community water systems are required to provide an annual Consumer Confidence Report (CCR). The annual reports must be distributed to customers and include information on the following:

- Drinking water sources.
- Definition of terms.
- Concentrations of any regulated constituents detected in the water, along with their respective maximum contaminant levels and maximum contaminant level goals.
- Information on health effects for any constituents at concentrations that exceed their respective MCLs.
- Concentrations of unregulated constituents, as required by the USEPA.

#### 7.2.3.2 Public Notification Rule

The Public Notification Rule (PNR) requires that public water systems notify their customers when they violate USEPA or State regulations (including monitoring requirements) or otherwise provide drinking water that may pose a risk to consumer's health. The original public notification requirements were established in the SDWA; the revised PNR was promulgated in 2000 as required by the 1996 SDWA amendments.

The PNR establishes three notification levels:

- Immediate Notice (Tier 1): In a situation where there is the potential for human health to be immediately impacted, notification is required within 24 hours.
- Notice As Soon As Possible (Tier 2): In a situation where an MCL is exceeded or water has not been treated properly, but there is no immediate threat to human health, notification is required as soon as possible and within 30 days.
- Annual Notice (Tier 3): In a situation where a standard is violated that does not directly impact human health, notice must be provided within one year, likely within the system's CCR.

Public notification requirements are addressed as part of the follow-up actions in WAC 246-290-320.

## 7.3 MONITORING PRACTICES

The City is primarily responsible for monitoring source and distribution system water quality, based on the monitoring programs described herein. This section documents current monitoring practices; recommended changes to those monitoring practices are discussed below in the review of the City's WQMP.

**National Primary and Secondary Drinking Water Regulations.** Compliance with primary and secondary MCLs is determined through the following monitoring programs:

- *Inorganic Chemical and Physical Parameter Monitoring*. This includes monitoring of the following primary constituents: antimony, barium, beryllium, cadmium, chromium, cyanide, fluoride, mercury, nickel, selenium, sodium, and thallium. The following constituents and physical parameters with secondary MCLs are also monitored: chloride, color, hardness, iron, manganese, specific conductivity, silver, sulfate, turbidity, total dissolved solids, and zinc. Monitoring of these constituents is only required once every 36-month compliance period; the current compliance period is from January 2008 through December 2010. However, the City typically monitors these constituents every 12 months, during the month of July. Samples are collected at each source, at the entry point following treatment. Additional testing for manganese is conducted at Well 5B when the source is in use. This source is treated with pressure filtration to remove manganese and iron and manganese samples are collected both before and after treatment.
- *Asbestos Monitoring*. Asbestos sampling is usually required once every 36-month compliance period. However, the City has a waiver that requires sampling only once every nine years at three distribution system sample sites. The current waiver lasts through 2010.
- *Nitrate and Nitrite Monitoring*. Nitrate (N) and nitrite (as N) are monitored once every 12 months, during the month of July. This reduced monitoring frequency is granted by the State after determining concentrations in the system are reliably and consistently less than the MCL. Samples are collected at all sources, at the entry point following treatment.
- *Volatile Organic Chemical (VOC) Monitoring*. At the majority of the City's sources, sampling is conducted for VOCs once during each 36-month compliance period; the current compliance period is from January 2008 through December 2010. This reduced sampling frequency is granted by the State to sources with no previous detection of any VOC in any collected sample. More frequent, annual, sampling is required for Wells 2 and 6, which are both currently represented by the corrosion control treatment facility at Fulmer Field Park. Sampling is conducted at all sources, at the entry point following treatment.

- *Synthetic Organic Chemical (SOC) Monitoring*. Sampling for SOCs is conducted for two consecutive quarters every 36 months. This reduced monitoring frequency is granted to systems that did not detect a contaminant during an initial compliance period. Sampling is conducted at all sources, at the entry point following treatment. There are a number of SOCs that have statewide waivers, including dioxin, endothall, glyphosphate, and ethylene dibromide and other soil fumigants. Monitoring of these constituents is waived through December 2010.
- *Radionuclide Monitoring*. Radionuclide monitoring currently consists of Radium-228 monitoring twice each 36-month compliance period at all entry points following treatment.

The City may be eligible to apply for waivers from the DOH that would reduce or eliminate sampling requirements for some of the above constituents during the January 2008 to December 2010 compliance period. In 2009, the DOH will notify the City of waiver options for this compliance period. However, City staff have indicated they do not intend to apply for the waivers, as sampling may need to be conducted to meet the requirements of the UCMR.

**Total Coliform Rule.** The City currently conducts monitoring at 52 TCR sites for total and fecal coliform. Sampling is conducted at one quarter of the routine sample locations each week during the first four weeks of a month. The City also monitors weekly for total and fecal coliform at Coal Creek Springs and West Hill Springs at their respective collector vaults as well as after treatment at West Hill Springs, Coal Creak Springs and at the corrosion control treatment facility at Fulmer Field Park and at four wholesale intertie sites on a weekly basis.

**Residual Disinfectant Concentration Monitoring.** Chlorine dosing and concentration levels are sampled daily at the system's chlorination sites. In addition, free chlorine concentrations are monitored concurrent with TCR monitoring.

**Stage 1 DBPR.** The City conducts annual monitoring of seven distribution system sample sites for THMs and HAAs. Monitoring is conducted during the month of peak temperature (assumed to be August).

**Lead and Copper Rule.** The City collects tap water samples from 30 distribution system sites once during each 36-month compliance period for lead and copper monitoring. The current compliance period is from January 2007 through December 2009.

## 7.4 WATER QUALITY EVALUATION

This section documents the City's past and projected future compliance with the water quality regulations discussed above.

### 7.4.1 Source Water Quality

Monitoring data for 2003 through 2007 for inorganic constituents, physical parameters, SOCs, and VOCs were reviewed. All constituents are currently below their respective MCLs and future compliance is anticipated.

Table 7.2 summarizes the inorganic chemical and physical constituents identified in the City's wells based on data provided by City staff. With the exception of one secondary contaminant, all regulated primary or secondary contaminants are well below their respective MCLs. Concentrations of manganese in Well 7 exceeded the secondary MCL in 2003, however levels have been below the MCL since 2003. Since 2007, Wells 2, 6 and 7 are represented by samples collected from the Fulmer Field Corrosion Control Treatment Facility (CCTF).

Separate monitoring for manganese was conducted at Well 5B during 2006. Well 5B is treated by pressure filtration to remove iron and manganese. When it is in operation, manganese samples are collected both before and after treatment. During operation in 2006, the concentration before treatment was 0.03 mg/L, which is below the secondary MCL; concentrations after treatment were below the detection limit.

Synthetic organic compounds were monitored in all of the City's sources in 2003; all constituents were below the detection limit. The City was granted a waiver for monitoring during the January 2005 through December 2007 compliance period and no SOC monitoring was conducted.

Volatile organic compound (VOC) were monitored in all the City's active sources in 2003 and 2007. In addition, annual sampling was conducted at Wells 2 and 6; these wells were represented by samples collected from the Fulmer Field CCTF starting in 2005.
Well 5B was also monitored in 2005, when it was restarted as an active source. The only VOCs detected during the sampling period were trichloroethylene and tetrachloroethylene detected in Wells 2 and 6. Detected concentrations are summarized in Table 7.3 and were well below their respective primary MCLs. Sample concentrations in all other years were below their respective detection limits. No VOCs were detected in the other sources.

**Table 7.2 Historical Inorganic Chemical Concentrations and Physical Properties**
**Comprehensive Water Plan**
**City of Auburn**

| Constituent | MCL | Units | Maximum Detected Concentration[1] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Coal Creek Springs | West Hill Spring | Well 2 | Well 4 | Well 5 | Well 5A | Well 6 | Well 7 | Fulmer CCTF |
| **USEPA Regulated (Primary)** | | | | | | | | | | | |
| Arsenic | 0.05 | mg/L | < 0.002 | < 0.002 | < 0.002 | 0.01 | 0.002 | 0.002 | 0.003 | 0.002 | 0.002 |
| Barium | 2 | mg/L | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| Cadmium | 0.005 | mg/L | < 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 |
| Chromium | 0.1 | mg/L | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Mercury | 0.002 | mg/L | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 |
| Selenium | 0.05 | mg/L | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Beryllium | 0.004 | mg/L | < 0.003 | < 0.003 | < 0.003 | < 0.003 | < 0.003 | < 0.003 | < 0.003 | < 0.003 | < 0.003 |
| Nickel | 0.1 | mg/L | < 0.04 | < 0.04 | < 0.04 | < 0.04 | < 0.04 | < 0.04 | < 0.04 | < 0.04 | < 0.04 |
| Antimony | 0.006 | mg/L | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Thallium | 0.002 | mg/L | < 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 |
| Cyanide | 0.2 | mg/L | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Fluoride | 4 | mg/L | < 0.2 | < 0.2 | < 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | < 0.2 |
| Nitrite-N | 1 | mg/L | < 0.2 | < 0.2 | 0.2 | < 0.2 | < 0.2 | < 0.2 | < 0.2 | < 0.2 | < 0.2 |
| Nitrate-N | 10 | mg/L | 1.5 | 4.7 | 3.6 | 1.6 | 0.9 | < 0.2 | 1.9 | 1.7 | 1.3 |
| Total Nitrate/Nitrite | 10 | mg/L | 1.5 | 4.7 | 3.6 | 1.2 | 0.9 | < 0.4 | 1.9 | 1.7 | 1.3 |
| **USEPA Regulated (Secondary)** | | | | | | | | | | | |
| Iron | 0.3 | mg/L | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.19 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| Manganese | 0.05 | mg/L | < 0.01 | < 0.01 | 0.03 | 0.01 | < 0.01 | < 0.01 | 0.03 | **0.07** | **0.02** |
| Silver | 0.1 | mg/L | < 0.01 | < 0.01 | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Chloride | 250 | mg/L | 33 | 7 | 10 | 3 | 3 | 2 | 5 | 8 | 8 |
| Sulfate | 250 | mg/L | 6 | 15 | 16 | 11 | 9 | 6 | 16 | 16 | 13 |

**Table 7.2 Historical Inorganic Chemical Concentrations and Physical Properties**
**Comprehensive Water Plan**
**City of Auburn**

| Constituent | MCL | Units | Maximum Detected Concentration[1] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Coal Creek Springs | West Hill Spring | Well 2 | Well 4 | Well 5 | Well 5A | Well 6 | Well 7 | Fulmer CCTF |
| Zinc | 5 | mg/L | < 0.2 | < 0.2 | < 0.2 | < 0.2 | < 0.2 | < 0.2 | < 0.2 | < 0.2 | < 0.2 |
| **State Regulated** | | | | | | | | | | | |
| Sodium | | mg/L | 5 | 9 | 13 | 7 | 8 | 6 | 14 | 13 | 12 |
| Hardness | | mg/L | 60 | 130 | 132 | 68 | 95 | 67 | 96 | 112 | 105 |
| Conductivity (micromhos/cm) | 700 | micromhos/cm | 132 | 288 | 273 | 152 | 218 | 133 | 228 | 246 | 236 |
| Turbidity (NTU) | | NTU | 0.4 | 0.2 | 1.8 | 17 | 1.5 | 0.2 | 0.7 | 0.5 | 0.3 |
| Color (color units) | 15 | Color Units | < 5 | < 5 | 5 | 10 | 5 | 5 | < 5 | < 5 | < 5 |
| Total Dissolved Solids[2] | 500 | mg/L | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **State Unregulated** | | | | | | | | | | | |
| Lead | | mg/L | < 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 |
| Copper | | mg/L | < 0.02 | 0.08 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 |

Notes:

(1) Based on monitoring conducted between 2003 and 2007. Wells 1, 3A and 3B were not in use during this time period and no monitoring was conducted. The Fulmer Corrosion Control Treatment Facility (CCTF) was monitored only in 2007 and replaced monitoring of Wells 2, 6, and 7.

(2) N/A - not applicable, no testing conducted; testing for total dissolved solids is only required if the specific conductivity is greater than 700 unhos/cm.

| Table 7.3 | Detected Volatile and Synthetic Organic Compounds<br>Comprehensive Water Plan<br>City of Auburn | | |
|---|---|---|---|
| **Constituent** | **Source, Year** | **Concentration (ug/L)** | **MCL (ug/L)** |
| Trichloroethylene | Well 2, 2003 | 1.2 ug/L | 5 ug/L |
| | Well 6, 2004 | 1.5 ug/L | |
| Tetrachloroethylene | Well 2, 2003 | 0.7 ug/L | 5 ug/L |
| | Well 6, 2004 | 1.6 ug/L | |

Radionuclide monitoring of all sources was conducted in 2002; levels in all sources were below their respective detection limits. Sampling for Gross Alpha Particle Activity and Radium-228 was conducted at the Fulmer Field CCTF and at Well 5B in 2006; levels in both sources were again below their respective detection limits.

#### 7.4.1.1 Groundwater Rule

As noted above, specific requirements under the GWR have not yet been established by the DOH. However, the City should take the actions recommended by the DOH to prepare for the GWR. These include:

- *Correct deficiencies from the last sanitary survey.* The last sanitary survey was completed by DOH in August 2008 in and found only minor deficiencies. The City should correct these deficiencies and respond to the DOH in writing, as requested.The issues identified in the survey and required actions are summarized in Table 7.4 below.
- *Install a sample tap at each wellhead.* The City already has the ability to sample each well; no action under this item is required.
- *Know specifically where each well's water goes in your distribution system*. The City's WQMP specifies the service area for each of the City's sources. The sources serve either Lakeland Hills or the remainder of the system. The City may want to better delineate the area of the distribution system affected by each well to limit the number of wells that must be sampled during triggered source water monitoring. This will not be necessary if the City is exempted from triggered source water monitoring by meeting disinfection requirements, as discussed below.
- *Update your emergency response plan to be ready to provide alternate water, if necessary*. It is not anticipated that the City's next sanitary survey will find significant deficiencies, nor that fecal indicators will be found in the City's sources. However, it is prudent to regularly review the City's emergency response plan for a source outage. This could be completed in conjunction with the recommended review of the City's Water Resource Protection Program, which includes water supply contingency plans.

| Table 7.4 | Summary of Issues Identified in 2008 Sanitary Survey<br>Comprehensive Water Plan<br>City of Auburn | |
|---|---|---|
| | **Issues/Recommended Improvements** | **Required Action (if any)** |
| **Sources and Treatment** | | |
| Coal Creek Springs | Need to route access hatch drains to discharge outside of vaults. Seal the hole in valve access cover on main/last vault. Address vault access cover security concerns. Verify how overflow system ties in with supply system. Clear overflow area so overflow can be routinely visually inspected. | Provide written status to DOH once openings are sealed and hatch drains are rerouted on Coal Creek collector vaults. |
| West Hill Springs | As telemetry controls are updated, it is recommended to add an automatic shutdown/diversion if disinfection fails. | |
| Howard Road and Fulmer Field Treatment Plants | Verify if the clearwell has an overflow and if so, that the overflow is appropriately screened and discharges to daylight. | Provide written notice to DOH of overflow design or alternative for treatment clearwells. |
| **Storage** | | |
| Reservoir 2 | For hatch, be sure to clean out gutter drain as needed to prevent trapped stormwater from entering tank. | |
| Lea Hill Reservoirs | When reasonable, evaluate modifications to inlet piping to promote adequate mixing and improved water quality. | |
| **Management and Operations** | | |
| Water System Plan (WSP) | Submit plan to avoid losing distribution design exemption and green (in compliance) operating permit status. | Provide written notice to DOH when WSP is submitted. |
| Water Facilities Inventory | Emergency intertie with adjacent water systems will be added to the City's Water Facilities Inventory. | |
| Total Coliform Rule | Include updated Coliform Monitoring Plan with the WSP. Update sample locations as needed to best represent distribution system. | Provide updated Coliform Monitoring Plan with WSP. |

- *If you currently treat groundwater from a well, contact your regional engineer to determine if you are providing 4-log virus inactivation or removal*. Chlorination is added at the majority of the City's wells. The exceptions are Wells 1, 3A, and 3B, which are currently not in service, and Well 5, which serves the Lakeland Hills area. The City should contact its regional engineer to determine whether chlorination at the remaining wells is sufficient to provide 4-log virus inactivation or removal. If so, triggered source water monitoring may not be required.

Additional actions under the GWR may be required; it is anticipated that such requirements will be communicated to the City by the DOH as they are adopted.

### 7.4.2 Distribution System Water Quality

The City has no current or anticipated challenges meeting distribution system water quality requirements, based on data provided by the City and input from City staff. The water quality data relevant to each regulation are summarized herein.

#### 7.4.2.1 Total Coliform Rule

Auburn prepared its original Coliform Monitoring Plan (CMP) in 1991 in accordance with the TCR and makes modifications as needed to continue compliance. The City has been in violation of the TCR once since the previous 2001 Comprehensive Plan during which greater than five percent of monthly distribution system samples collected tested positive for the presence of total coliform bacteria. Coliform bacteria were detected in 12 of the 120 samples collected during the month of June in 2001. From these samples, fecal coliform were detected in one sample. However, repeat samples at that site indicated no coliform present and no *E. coli* bacteria were reported in any of the samples. Although no source of contamination was determined, the City increased system flushing and the chlorination level to correct the problem.

Additional TCR testing results were reviewed for 2003 through 2007. Over this period, total coliforms were detected in only a single sample in October 2005 but did not result in a TCR violation.

The monitoring frequency under the TCR for total coliforms is based on the population served by the system. Previously, the City has served a population between 40,001 and 50,000 customers and compliance with the TCR required the City to collect 50 representative samples every month. However, this current Comprehensive Water Plan has estimated the current served population to be 50,900, as discussed in Chapter 4. In accordance with the TRC, systems that serve between 50,001 - 60,000 people are required to collect 60 representative samples every month. The City has the option of either identifying additional sample sites, or increasing the frequency of sampling at the existing sites.

The City uses two types of disinfectant for treatment, chlorine gas and sodium hypochlorite, which both produce free chlorine residuals in the distribution system. Monthly average chlorine residuals throughout the distribution system ranged from 0.64 to 0.67 mg/L over the period from 2004 to 2007, as summarized in Table 7.5. Although the range of chlorine residuals appears to vary throughout the year, the levels appear consistent from year to year.

**Table 7.5 Total Chlorine Residuals**
**Comprehensive Water Plan**
**City of Auburn**

| | Sample Results (mg/L) | |
|---|---|---|
| **Year** | **Average** | **Range** |
| 2004 | 0.64 | 0.23 - 1.25 |
| 2005 | 0.67 | ND - 1.29 |
| 2006 | 0.67 | 0.03 - 1.41 |
| 2007 | 0.65 | 0.030 - 1.09 |

Chlorine residuals at the 52 individual sites were also evaluated for the period from January through December 2007. Six of the 52 sites had average chlorine residuals less than 0.5 mg/L; average and minimum chlorine residuals for those six sites are presented in Table 7.6. Three of the sites had minimum residuals less than 0.05 mg/L, which is very close to the detection limit for free chlorine. The City may wish to evaluate and address the cause of the low chlorine residuals at these sites. This is consistent with the City's 2003 Sanitary Survey, which noted that there were a couple areas where the City should "keep an eye on" low chlorine residuals.

**Table 7.6 Sample Sites with Low Chlorine Residuals**
**Comprehensive Water Plan**
**City of Auburn**

| Site Number | Address | Average Residual (mg/L)(1) | Minimum Residual (mg/L)(1) |
|---|---|---|---|
| A-5 | 710 47 St SE | 0.32 | 0.04 |
| A-6 | 5110 Mill Pond Dr SE | 0.45 | 0.03 |
| A-7 | Elizabeth Ave SE | 0.25 | 0.03 |
| A-8 | 4431 47 St SE | 0.41 | 0.21 |
| A-9 | 2001 36 St SE | 0.44 | 0.23 |
| A-13 | 5208 Nathan Loop SE | 0.44 | 0.10 |

Note:
(1) Based on chlorine residual data collected between January and December 2007.

#### 7.4.2.2 Stage 1 and 2 Disinfectants/Disinfection By-products Rules

The City is easily meeting the requirements of the Stage 1 DBPR and is anticipated to meet the requirements of the Stage 2 DBPR. THM and HAA data collected under the Stage 1 DBPR are summarized in Table 7.7. Sample results from 2004 were well below the concentrations that the DOH uses to determine whether a water system qualifies for reduced monitoring (0.040 mg/L THMs; 0.030 mg/L HAAs). Therefore, starting in 2005, the City's THM and HAA monitoring has been conducted once per year during the month with the warmest water temperature (assumed to be August).

**Table 7.7 Historical Trihalomethane and Haloacetic Acid Concentrations Comprehensive Water Plan City of Auburn**

| Sample Site | Trihalomethane Concentration (μg/L) | | Haloacetic Acid Concentration (μg/L) | |
|---|---|---|---|---|
| | Average(1) | Max | Average1 | Max |
| 3615 Orchard St SE | 3.6 | 6.4 | 0.6 | 2.1 |
| 3705 West Valley Hwy N | 6.1 | 11.5 | 1.7 | 3.5 |
| 31512 115th Pl SE | 2.3 | 3.8 | 0.6 | 1.4 |
| 2001 36th St SE | 5.6 | 10.0 | 0.9 | 4.0 |
| 710 47th St SE(2) | ND | ND | ND | ND |
| 5208 Nathan Loop(2) | 2.0 | 6.1 | ND | ND |

Notes:
(1) Average concentrations calculated assuming a concentration of 0 μg/L for all non-detect samples.
(2) 47th and Nathan Loop monitoring results from 2005 - 2007 only.

In 2006, the USEPA approved the City's 40/30 certification, which meets the initial IDSE requirement of the Stage 2 DBPR without requiring additional sampling. A monitoring plan for the Stage 2 DBPR must be completed before the City is required to begin Stage 2 DBPR compliance monitoring starting in April of 2012. Since the last Comprehensive Plan was conducted in 2001, the City's current served population has exceeded 50,000 people and thus, monitoring will be required at eight Stage 2 sample sites. Until Stage 2 DBPR compliance monitoring begins, the City must continue to conduct Stage 1 DBPR monitoring.

#### 7.4.2.3 Lead and Copper Monitoring

Copper levels exceeded the action levels in samples collected in 1993. Based on these results, the City and the DOH entered into a Bilateral Compliance Agreement in 1996 that identified treatment options and schedules for the implementation of corrosion control facilities. New corrosion facilities at the Coal Creek Springs Pump Station and Fulmer Field Park were completed in 2002. The treatment systems use air stripping towers to remove naturally occurring carbon dioxide, increasing the pH. The systems treat water from Coal Creek Springs and Wells 2, 6, and 7, respectfully.

The Bilateral Compliance Agreement included requirements for increased monitoring following completion of the corrosion control facilities. The increased monitoring consisted of collecting at least 30 water samples in each 6-month period. Results from 2003 to 2006 are summarized in Table 7.8. Since the corrosion control facilities were constructed, the copper levels have been well below the action level.

**Table 7.8 Lead and Copper Concentrations**
**Comprehensive Water Plan**
**City of Auburn**

| Constituent | Sampling Year | | | | |
|---|---|---|---|---|---|
| | 2003 | 2004 | | 2005 | 2006 |
| | | Round 1 | Round 2 | | |
| Copper Concentrations (mg/L) | | | | | |
| Copper range | <0.02 - 2.55 | <0.02 - 2.55 | <0.02 - 3.07 | <0.02-1.03 | <0.02 - 0.64 |
| Copper 90th percentile | 0.24 | 0.24 | 1.05 | 0.64 | 0.46 |
| Lead Concentrations (mg/L) | | | | | |
| Lead range | <0.002 - 0.090 | <0.002 - 0.090 | <0.002 | <0.002-0.004 | <0.002 - 0.005 |
| Lead 90th percentile | <0.002 | <0.002 | 0.005 | <0.002 | 0.002 |

The City resumed lead and copper sampling on the regular schedule required under the LCR, starting in 2007. For the City, the LCR requires that at least 30 water samples be collected each 36-month compliance period. The current compliance period is from January 2007 through December 2010.

### 7.4.3 Water Quality Programs

The City's compliance with the water quality programs is as follows:

#### 7.4.3.1 <u>Consumer Confidence Reports</u>

The City's first CCR was distributed in October 1999, as required by DOH. Subsequent annual reports have been distributed in 2000 through 2008, as required.

#### 7.4.3.2 <u>Public Notification Rule</u>

The public notification requirements have been revised since the previous Comprehensive Water Plan. The new requirements reduce the period of time water suppliers have to inform customers of any situation that may immediately pose a health risk from 72 to 24 hours. For less serious problems, the City can combine notices and make them shorter and easier to understand. Additionally, the new requirements make the standard health effects language more concise, thus making it easier for the City to issue notices. The full public notification requirements can be found in 40 CFR 141.201 - 208, and in WAC 246 - 290 - 320. The City should review the new regulations to ensure City procedures are in compliance, if such a review has not yet been completed.

## 7.5 WATER QUALITY MONITORING PLAN REVIEW

The City's WQMP was reviewed for compliance with Washington DOH requirements. The most recent WQMP was revised on March 4, 2008; a copy of the WQMP is provided in Appendix L. Overall, the WQMP generally complies with all requirements, with the few exceptions noted below. Recommended changes are summarized in Table 7.9. In addition, the City is required to develop a monitoring plan for the Stage 2 DBPR by 2012; this plan should be included as an attachment to the WQMP.

**Table 7.9 Recommended Changes to the City's Water Quality Monitoring Plan**
**Comprehensive Water Plan**
**City of Auburn**

| Section | Recommended Change |
|---|---|
| 4. Monitoring Waivers | • The text states that the City has "applied for waivers during the 2005 - 2007 compliance cycle." Text should be amended to indicate that<br>– The City was granted waivers for the 2005 - 2007 compliance period<br>– It is the City's intention to not apply for waivers during the 2008 - 2010 compliance period. |
| 6. Monitoring Schedule | • The text notes that annual VOC testing is required for Wells 2 and 6. It would clarify to note that both wells are represented by the sample from the Fulmer Field CCTF.<br>• The text notes that Radium-228 monitoring is conducted during two consecutive quarters in each 36-month compliance period. According to discussion with the DOH, this should be replaced by monitoring for both Radium-228 and Gross Alpha Particle Activity, once each 36-month compliance period. |
| Coliform Monitoring Plan | • Based on the estimated current population served and anticipated increases in that population, the City will need to increase the number of coliform samples collected each month from 50 to 60 (in addition to the Hidden Valley system samples). The Coliform Monitoring Plan should be amended to indicate this increase, either be increasing the number of sample sites, or increasing the frequency of monitoring. |
| Inorganic Chemical and Physical Parameter Monitoring Plan | • The sampling schedule section indicates sampling is conducted every 12 months. For consistency, the City may want to amend the schedule to note sampling is required once each 36-month compliance period, but may be conducted annually. |

| Table 7.9 Recommended Changes to the City's Water Quality Monitoring Plan<br>Comprehensive Water Plan<br>City of Auburn | |
|---|---|
| **Section** | **Recommended Change** |
| Asbestos Monitoring Plan | • The sampling schedule section indicates sampling is conducted every 36 months. For consistency, the City may want to amend the schedule to note sampling is only required every 9 years if a waiver is granted, and is otherwise required once each 36-month compliance period. |
| Volatile Organic Chemical Monitoring Plan | • The analysis section indicates that trihalomethane monitoring is not included in this monitoring program and is addressed in the Trihalomethane Monitoring Procedure. This should instead refer to trihalomethane and haloacetic acid monitoring, and the Stage 1 DBPR monitoring plan.<br>• The sampling schedule section indicates that samples are collected every 36 months. The section should be revised to indicate that samples are required every 12 months from the Fulmer Field CCTF (Wells 2 and 6). |
| Radionuclide Monitoring Plan | • The analysis section indicates samples are monitored for Radium-226, Radium-228 and Gross Alpha Particle activity. Monitoring for Radium-226 is not required.<br>• The sampling location section indicates that samples are to be collected prior to treatment. Samples should instead be collected at each entry point to the system, downstream of treatment.<br>• The sampling schedule section indicates samples are to be collected twice every 36 months. Based on discussions with the DOH, sampling is required only once each 36-month compliance period. |
| Residual Disinfection Concentration Monitoring Plan | • In the City's 2003 sanitary survey, the DOH requested that the Game Farm Wilderness Park be added to the chlorine monitoring schedule, or used as a substitute for an existing site, as it is a compliance point for chlorination of the Coal Creek Springs source. |

## 7.6 RECOMMENDATIONS

The City is in compliance with all current regulatory requirements, including monitoring requirements. The following actions are recommended to maintain future compliance:

1. Take actions recommended by the DOH to prepare for the upcoming Groundwater Rule requirements, including:

    a. Correcting deficiencies identified in the 2008 Sanitary Survey.

    b. Updating the City's emergency response plan; and

    c. Contacting the City's regional office engineer to determine whether treatment provided at the City's wells is sufficient to provide 4-log virus inactivation or removal.

2. Prepare a monitoring plan for the Stage 2 DBPR prior to 2012, for inclusion in the City's WQMP.

3. Amend the City's Coliform Monitoring Plan to increase the number of samples collected per month to at least 60, in response to the City's population exceeding 50,000 people.

4. Review the City's public notification procedures to confirm they are in compliance with the 2000 revisions to the Public Notification Rule.

5. Complete the additional minor amendments to the City's WQMP, as noted above in Table 7.9.

# APPENDIX F

# HYDRAULIC MODELING RESULTS

| Fire Flow 2018 with Existing System | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fire Flow Design | | | | | | | | | | | |
| ID | Total Demand (gpm) | Critical Fire Node ID | Critical Fire Node Pressure (psi) | Critical Fire Node Head (ft) | Adjusted Fire-Flow (gpm) | Available Flow at Hydrant (gpm) | Critical Available Node ID | Critical Available Node Pressure (psi) | Critical Available Node Head (ft) | Adjusted Available Flow (gpm) | Design Flow (gpm) |
| J-10 | 1,004.24 | J-10 | 62.23 | 218.62 | 3,094.49 | 3,094.50 | J-10 | 20 | 121.16 | 3,094.50 | 3,094.49 |
| J-100 | 1,004.24 | J-100 | 65.75 | 224.93 | 3,721.65 | 3,721.65 | J-100 | 20 | 119.36 | 3,721.65 | 3,721.65 |
| J-12 | 1,004.24 | J-12 | 61.46 | 216.85 | 2,893.96 | 2,893.96 | J-12 | 20 | 121.16 | 2,893.96 | 2,893.96 |
| J-120 | 1,004.24 | J-120 | 59.59 | 222.12 | 3,153.17 | 3,153.29 | J-120 | 20 | 130.76 | 3,153.29 | 3,153.17 |
| J-121 | 1,004.24 | J-121 | 61.38 | 224.95 | 3,773.82 | 3,773.82 | J-121 | 20 | 129.46 | 3,773.82 | 3,773.82 |
| J-122 | 1,004.24 | J-122 | 59.68 | 221.54 | 3,185.29 | 3,185.29 | J-122 | 20 | 129.96 | 3,185.30 | 3,185.29 |
| J-123 | 1,004.24 | J-123 | 67.72 | 229.08 | 5,514.32 | 5,514.36 | J-123 | 20 | 118.96 | 5,514.36 | 5,514.32 |
| J-124 | 1,004.24 | J-124 | 67.09 | 229.23 | 5,375.41 | 5,375.42 | J-124 | 20 | 120.56 | 5,375.42 | 5,375.41 |
| J-125 | 1,004.24 | J-125 | 66.67 | 228.87 | 5,091.29 | 5,091.29 | J-125 | 20 | 121.16 | 5,091.30 | 5,091.28 |
| J-126 | 1,004.24 | J-126 | 65.65 | 226.52 | 4,356.81 | 4,356.81 | J-126 | 20 | 121.16 | 4,356.82 | 4,356.81 |
| J-127 | 1,004.24 | J-127 | 63.45 | 220.54 | 3,168.35 | 3,168.35 | J-127 | 20 | 120.26 | 3,168.35 | 3,168.35 |
| J-128 | 1,004.24 | J-128 | 66.28 | 226.97 | 4,631.90 | 4,631.92 | J-128 | 20 | 120.16 | 4,631.93 | 4,631.90 |
| J-129 | 1,004.24 | J-129 | 47.37 | 181.13 | 1,536.98 | 1,536.98 | J-129 | 20 | 117.96 | 1,536.98 | 1,536.98 |
| J-130 | 1,004.24 | J-130 | 47.27 | 182.5 | 1,557.79 | 1,557.84 | J-130 | 20 | 119.56 | 1,557.84 | 1,557.79 |
| J-132 | 1,004.24 | J-132 | 65.4 | 224.73 | 4,091.15 | 4,091.17 | J-132 | 20 | 119.96 | 4,091.17 | 4,091.15 |
| J-133 | 1,004.24 | J-133 | 64.35 | 222.11 | 3,604.14 | 3,604.15 | J-133 | 20 | 119.76 | 3,604.15 | 3,604.14 |
| J-135 | 1,004.24 | J-135 | 54.14 | 198.84 | 1,926.24 | 1,926.24 | J-135 | 20 | 120.06 | 1,926.24 | 1,926.24 |
| J-136 | 1,004.24 | J-137 | 63.96 | 220.91 | 3,436.71 | 3,440.36 | J-137 | 19.91 | 119.24 | 3,436.73 | 3,436.71 |
| J-137 | 1,004.24 | J-137 | -126.87 | -219.5 | 477.78 | 477.78 | J-137 | 20 | 119.46 | 477.78 | 477.78 |
| J-138 | 1,004.24 | J20 | 62.1 | 217.33 | 2,958.80 | 2,967.44 | J20 | 19.74 | 119.56 | 2,958.81 | 2,958.80 |
| J-139 | 1,004.24 | J-139 | 62.04 | 220.88 | 3,423.43 | 3,423.45 | J-139 | 20 | 123.86 | 3,423.46 | 3,423.43 |
| J-14 | 1,004.24 | J-14 | 62.19 | 216.92 | 2,923.44 | 2,923.44 | J-14 | 20 | 119.56 | 2,923.45 | 2,923.44 |
| J-140 | 1,004.24 | J-139 | 62.11 | 221.05 | 3,452.25 | 3,497.99 | J-139 | 18.87 | 121.25 | 3,452.28 | 3,452.25 |
| J-141 | 1,004.24 | J-145 | 60.43 | 221.47 | 3,456.21 | 3,547.63 | J-145 | 17.83 | 123.14 | 3,456.25 | 3,456.21 |
| J-142 | 1,004.24 | J-143 | 59.69 | 221.56 | 3,417.54 | 3,541.34 | J-143 | 17.05 | 123.16 | 3,417.57 | 3,417.54 |
| J-143 | 1,004.24 | J-143 | 58.86 | 219.63 | 3,111.00 | 3,111.01 | J-143 | 20 | 129.96 | 3,111.01 | 3,111.00 |
| J-144 | 1,004.24 | J-145 | 41.16 | 176.98 | 1,417.40 | 1,424.91 | J-145 | 19.57 | 127.16 | 1,417.50 | 1,417.40 |
| J-145 | 1,004.24 | J-145 | 40.64 | 175.8 | 1,401.03 | 1,401.13 | J-145 | 20 | 128.16 | 1,401.13 | 1,401.03 |
| J-146 | 1,004.24 | J-146 | 50.33 | 184.86 | 1,647.46 | 1,647.46 | J-146 | 20 | 114.86 | 1,647.46 | 1,647.46 |
| J-147 | 1,004.24 | J-147 | -64.99 | -84.5 | 597.5 | 597.51 | J-147 | 20 | 111.66 | 597.51 | 597.5 |
| J-148 | 1,004.24 | J-148 | 45.67 | 173.2 | 1,465.46 | 1,465.55 | J-148 | 20 | 113.96 | 1,465.55 | 1,465.46 |
| J-149 | 1,004.24 | J-149 | 58.19 | 202.4 | 2,126.53 | 2,126.53 | J-149 | 20 | 114.26 | 2,126.53 | 2,126.53 |
| J-150 | 1,004.24 | J-150 | 58.87 | 204.06 | 2,198.27 | 2,198.27 | J-150 | 20 | 114.36 | 2,198.27 | 2,198.27 |
| J-151 | 1,004.24 | J-151 | 59.01 | 205.3 | 2,237.65 | 2,237.65 | J-151 | 20 | 115.26 | 2,237.65 | 2,237.65 |
| J-152 | 1,004.24 | J-152 | 55.47 | 196.22 | 1,915.34 | 1,915.34 | J-152 | 20 | 114.36 | 1,915.34 | 1,915.34 |
| J-153 | 1,004.24 | J-153 | -61.11 | -73.14 | 603.17 | 603.18 | J-153 | 20 | 114.06 | 603.18 | 603.17 |
| J-154 | 1,004.24 | J-154 | 56.44 | 198.77 | 1,991.54 | 1,991.54 | J-154 | 20 | 114.66 | 1,991.54 | 1,991.54 |
| J-155 | 1,004.24 | J-155 | 57.24 | 208 | 2,299.26 | 2,299.27 | J-155 | 20 | 122.05 | 2,299.26 | 2,299.26 |
| J-156 | 1,004.24 | J-170 | 58.28 | 210.71 | 2,450.87 | 2,489.87 | J-170 | 18.61 | 119.16 | 2,450.87 | 2,450.87 |
| J-158 | 1,004.24 | J-158 | 50.78 | 189.59 | 1,712.04 | 1,712.04 | J-158 | 20 | 118.56 | 1,712.04 | 1,712.04 |
| J-159 | 1,004.24 | J-159 | 54.76 | 202.57 | 2,048.41 | 2,048.41 | J-159 | 20 | 122.36 | 2,048.41 | 2,048.41 |
| J-16 | 1,004.24 | J-18 | 61.91 | 218.89 | 3,103.25 | 3,134.90 | J-18 | 19.11 | 120.09 | 3,103.25 | 3,103.25 |
| J-160 | 1,004.24 | J-160 | 60.78 | 213.27 | 2,667.16 | 2,667.17 | J-160 | 20 | 119.16 | 2,667.17 | 2,667.16 |
| J-161 | 1,004.24 | J-161 | 56.71 | 207.97 | 2,274.37 | 2,274.37 | J-161 | 20 | 123.26 | 2,274.37 | 2,274.37 |
| J-162 | 1,004.24 | J-162 | 59.85 | 214.92 | 2,738.50 | 2,738.50 | J-162 | 20 | 122.96 | 2,738.50 | 2,738.50 |
| J-163 | 1,004.24 | J-163 | 61.02 | 217.63 | 3,005.68 | 3,005.69 | J-163 | 20 | 122.96 | 3,005.69 | 3,005.68 |
| J-164 | 1,004.24 | J-170 | 61.36 | 217.81 | 3,059.76 | 3,066.52 | J-170 | 19.81 | 121.92 | 3,059.77 | 3,059.76 |
| J-166 | 1,004.24 | J-166 | 61.97 | 219.81 | 3,276.29 | 3,276.31 | J-166 | 20 | 122.96 | 3,276.31 | 3,276.29 |
| J-168 | 1,004.24 | J-168 | 41.92 | 170.15 | 1,381.97 | 1,381.99 | J-168 | 20 | 119.56 | 1,381.99 | 1,381.97 |
| J-169 | 1,004.24 | J-169 | 64.82 | 224.6 | 3,951.50 | 3,951.51 | J-169 | 20 | 121.16 | 3,951.51 | 3,951.50 |
| J-170 | 1,004.24 | J-170 | 54.55 | 202.09 | 2,031.25 | 2,031.25 | J-170 | 20 | 122.36 | 2,031.25 | 2,031.25 |
| J-171 | 1,004.24 | J-170 | 61.95 | 219.16 | 3,223.64 | 3,271.01 | J-170 | 18.73 | 119.43 | 3,223.66 | 3,223.64 |
| J-172 | 1,004.24 | J-172 | 69.64 | 231.72 | 6,994.46 | 6,994.47 | J-172 | 20 | 117.16 | 6,994.47 | 6,994.46 |
| J-174 | 1,004.24 | J-174 | 62.81 | 215.95 | 2,691.73 | 2,691.57 | J-174 | 20 | 117.16 | 2,691.57 | 2,691.57 |
| J-176 | 1,004.24 | J-176 | 69.24 | 230.71 | 6,001.68 | 6,001.68 | J-176 | 20 | 117.06 | 6,001.69 | 6,001.68 |
| J-178 | 1,004.24 | J-178 | 69.15 | 229.59 | 5,327.53 | 5,327.53 | J-178 | 20 | 116.16 | 5,327.53 | 5,327.53 |
| J-18 | 1,004.24 | J-18 | 60.43 | 215.46 | 2,746.73 | 2,746.74 | J-18 | 20 | 122.16 | 2,746.74 | 2,746.73 |
| J-180 | 1,004.24 | J-180 | 65.91 | 227.1 | 4,303.47 | 4,303.90 | J-180 | 20 | 121.16 | 4,303.90 | 4,303.47 |
| J-182 | 1,004.24 | J-224 | 66.62 | 228.75 | 4,807.63 | 4,807.74 | J-224 | 20 | 121.16 | 4,807.74 | 4,807.63 |
| J-184 | 1,004.24 | J-184 | 62.13 | 213.38 | 2,524.46 | 2,524.33 | J-184 | 20 | 116.16 | 2,524.33 | 2,524.33 |
| J-186 | 1,004.24 | J-186 | 70.13 | 231.85 | 7,141.15 | 7,141.16 | J-186 | 20 | 116.16 | 7,141.17 | 7,141.15 |

| Fire Flow 2018 with Existing System | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fire Flow Design | | | | | | | | | | | |
| ID | Total Demand (gpm) | Critical Fire Node ID | Critical Fire Node Pressure (psi) | Critical Fire Node Head (ft) | Adjusted Fire-Flow (gpm) | Available Flow at Hydrant (gpm) | Critical Available Node ID | Critical Available Node Pressure (psi) | Critical Available Node Head (ft) | Adjusted Available Flow (gpm) | Design Flow (gpm) |
| J-188 | 1,004.24 | J-188 | 69.5 | 230.89 | 6,122.06 | 6,122.06 | J-188 | 20 | 116.66 | 6,122.07 | 6,122.06 |
| J-190 | 1,004.24 | J-190 | 63.88 | 220.22 | 3,042.68 | 3,042.68 | J-190 | 20 | 118.96 | 3,042.68 | 3,042.68 |
| J-192 | 1,004.24 | J-192 | 69.39 | 230.14 | 5,650.99 | 5,650.99 | J-192 | 20 | 116.16 | 5,650.99 | 5,650.99 |
| J-194 | 1,004.24 | J-194 | 69.54 | 230.48 | 5,856.90 | 5,856.90 | J-194 | 20 | 116.16 | 5,856.90 | 5,856.90 |
| J-196 | 1,004.24 | J-196 | 66.21 | 221.8 | 3,302.61 | 3,302.71 | J-196 | 20 | 115.16 | 3,302.70 | 3,302.61 |
| J-198 | 1,004.24 | J-198 | 70.71 | 231.98 | 7,282.99 | 7,283.00 | J-198 | 20 | 114.96 | 7,283.01 | 7,282.99 |
| J-20 | 1,004.24 | J-20 | 61.16 | 221.15 | 3,282.43 | 3,282.43 | J-20 | 20 | 126.16 | 3,282.43 | 3,282.43 |
| J-200 | 1,004.24 | J-210 | 69.26 | 232.04 | 7,149.82 | 7,269.19 | J-210 | 18.44 | 114.76 | 7,149.84 | 7,149.82 |
| J-202 | 1,004.24 | J-202 | 69.73 | 231.83 | 6,803.27 | 6,803.27 | J-202 | 20 | 117.06 | 6,803.28 | 6,803.27 |
| J-204 | 1,004.24 | J-204 | 63.6 | 217.79 | 2,828.55 | 2,828.55 | J-204 | 20 | 117.16 | 2,828.55 | 2,828.55 |
| J-206 | 1,004.24 | J-206 | 66.15 | 225.66 | 3,916.03 | 3,916.13 | J-206 | 20 | 119.16 | 3,916.13 | 3,916.03 |
| J-208 | 1,004.24 | J-208 | 65.5 | 221.46 | 3,242.25 | 3,242.33 | J-208 | 20 | 116.46 | 3,242.33 | 3,242.25 |
| J-210 | 1,004.24 | J-210 | 66.05 | 224.63 | 3,685.20 | 3,685.21 | J-210 | 20 | 118.36 | 3,685.20 | 3,685.20 |
| J-212 | 1,004.24 | J-212 | 66.85 | 224.28 | 3,639.84 | 3,639.84 | J-212 | 20 | 116.16 | 3,639.84 | 3,639.84 |
| J-214 | 1,004.24 | J-214 | 69.23 | 231.78 | 6,432.43 | 6,432.42 | J-214 | 20 | 118.16 | 6,432.43 | 6,432.43 |
| J-216 | 1,004.24 | J-216 | 65.46 | 233.07 | 7,173.56 | 7,173.55 | J-216 | 20 | 128.16 | 7,173.56 | 7,173.56 |
| J-218 | 1,004.24 | J-218 | 62.12 | 212.36 | 2,468.42 | 2,468.45 | J-218 | 20 | 115.16 | 2,468.45 | 2,468.42 |
| J-220 | 1,004.24 | J-220 | 60.88 | 213.5 | 2,493.60 | 2,493.62 | J-220 | 20 | 119.16 | 2,493.62 | 2,493.60 |
| J-222 | 1,004.24 | J-222 | 69.14 | 234.57 | 18,676.23 | 18,674.91 | J-222 | 20 | 121.16 | 18,675.06 | 18,675.06 |
| J-224 | 1,004.24 | J-224 | 64.55 | 223.97 | 3,536.97 | 3,537.02 | J-224 | 20 | 121.16 | 3,537.01 | 3,536.97 |
| J-226 | 1,004.24 | J-226 | 70.72 | 236.22 | 13,000.38 | 12,999.99 | J-226 | 20 | 119.16 | 12,999.96 | 12,999.96 |
| J-228 | 1,004.24 | J-232 | 66.49 | 235.44 | 12,220.27 | 12,220.12 | J-232 | 20 | 128.16 | 12,220.15 | 12,220.15 |
| J-23 | 1,004.24 | J-23 | 67.78 | 227.42 | 4,654.34 | 4,654.34 | J-23 | 20 | 117.16 | 4,654.35 | 4,654.34 |
| J-230 | 1,004.24 | J-232 | 65.97 | 234.25 | 8,144.68 | 8,144.62 | J-232 | 20 | 128.16 | 8,144.63 | 8,144.63 |
| J-232 | 1,004.24 | J-232 | 65.56 | 233.3 | 6,734.20 | 6,734.17 | J-232 | 20 | 128.16 | 6,734.18 | 6,734.18 |
| J-234 | 1,004.24 | J-234 | 66.3 | 235.02 | 12,243.77 | 12,243.94 | J-234 | 20 | 128.16 | 12,243.98 | 12,243.77 |
| J-236 | 1,004.24 | J-236 | 66.35 | 235.12 | 12,313.34 | 12,313.46 | J-236 | 20 | 128.16 | 12,313.51 | 12,313.34 |
| J-238 | 1,004.24 | J-238 | 68.34 | 234.71 | 12,660.84 | 12,660.88 | J-238 | 20 | 123.16 | 12,660.84 | 12,660.84 |
| J-24 | 1,004.24 | J-24 | 66.53 | 224.54 | 3,801.23 | 3,801.22 | J-24 | 20 | 117.16 | 3,801.23 | 3,801.22 |
| J-240 | 1,004.24 | J-240 | 67.92 | 234.74 | 12,097.70 | 12,097.67 | J-240 | 20 | 124.16 | 12,097.71 | 12,097.70 |
| J-242 | 1,004.24 | J-242 | 67.94 | 234.8 | 12,017.76 | 12,017.75 | J-242 | 20 | 124.16 | 12,017.79 | 12,017.76 |
| J-244 | 1,004.24 | J-244 | 67.97 | 234.87 | 12,094.90 | 12,094.92 | J-244 | 20 | 124.16 | 12,094.96 | 12,094.90 |
| J-246 | 1,004.24 | J-246 | 68.37 | 234.78 | 11,081.06 | 11,081.08 | J-246 | 20 | 123.16 | 11,081.11 | 11,081.06 |
| J-248 | 1,004.24 | J-248 | 69.65 | 234.74 | 11,907.22 | 11,907.37 | J-248 | 20 | 120.16 | 11,907.41 | 11,907.22 |
| J-25 | 1,004.24 | J-25 | 68.32 | 228.67 | 5,048.11 | 5,048.11 | J-25 | 20 | 117.16 | 5,048.11 | 5,048.11 |
| J-250 | 1,004.24 | J-250 | 69.6 | 234.63 | 11,451.93 | 11,452.05 | J-250 | 20 | 120.16 | 11,452.08 | 11,451.93 |
| J-252 | 1,004.24 | J-252 | 70.29 | 234.22 | 10,001.64 | 10,001.67 | J-252 | 20 | 118.16 | 10,001.69 | 10,001.64 |
| J-254 | 1,004.24 | J-254 | 71.07 | 234.03 | 9,557.88 | 9,557.89 | J-254 | 20 | 116.16 | 9,557.91 | 9,557.88 |
| J-256 | 1,004.24 | J-256 | 71.02 | 233.91 | 9,258.30 | 9,258.31 | J-256 | 20 | 116.16 | 9,258.32 | 9,258.30 |
| J-258 | 1,004.24 | J-258 | 69.28 | 233.89 | 9,076.98 | 9,076.98 | J-258 | 20 | 120.16 | 9,077.00 | 9,076.98 |
| J-26 | 1,004.24 | J-26 | 69.31 | 230.96 | 6,515.42 | 6,515.45 | J-26 | 20 | 117.16 | 6,515.46 | 6,515.42 |
| J-260 | 1,004.24 | J-260 | 69.75 | 233.98 | 9,394.04 | 9,394.05 | J-260 | 20 | 119.16 | 9,394.07 | 9,394.04 |
| J-262 | 1,004.24 | J-262 | 69.42 | 234.21 | 10,112.03 | 10,112.07 | J-262 | 20 | 120.16 | 10,112.09 | 10,112.03 |
| J-264 | 1,004.24 | J-264 | 69.5 | 234.41 | 10,971.18 | 10,971.29 | J-264 | 20 | 120.16 | 10,971.32 | 10,971.18 |
| J-266 | 1,004.24 | J-266 | 69.56 | 234.53 | 11,220.61 | 11,220.71 | J-266 | 20 | 120.16 | 11,220.75 | 11,220.61 |
| J-268 | 1,004.24 | J-268 | 69.57 | 234.56 | 11,328.70 | 11,328.81 | J-268 | 20 | 120.16 | 11,328.84 | 11,328.70 |
| J-27 | 1,004.24 | J-27 | 68.49 | 233.08 | 8,687.02 | 8,687.12 | J-27 | 20 | 121.16 | 8,687.14 | 8,687.02 |
| J-270 | 1,004.24 | J-94 | 67.76 | 234.38 | 11,079.71 | 11,101.46 | J-94 | 19.83 | 123.76 | 11,079.93 | 11,079.71 |
| J-272 | 1,004.24 | J-272 | 69.52 | 234.44 | 11,074.10 | 11,074.20 | J-272 | 20 | 120.16 | 11,074.23 | 11,074.10 |
| J-274 | 1,004.24 | J-274 | 68.54 | 234.19 | 9,773.98 | 9,774.00 | J-274 | 20 | 122.16 | 9,774.02 | 9,773.98 |
| J-276 | 1,004.24 | J-276 | 68.11 | 234.19 | 9,670.89 | 9,670.90 | J-276 | 20 | 123.16 | 9,670.92 | 9,670.89 |
| J-278 | 1,004.24 | J-278 | 68.61 | 234.35 | 10,122.07 | 10,122.09 | J-278 | 20 | 122.16 | 10,122.12 | 10,122.07 |
| J-28 | 1,004.24 | J-28 | 44.55 | 173.83 | 1,451.37 | 1,451.45 | J-28 | 20 | 117.16 | 1,451.45 | 1,451.37 |
| J-280 | 1,004.24 | J-280 | 68.7 | 234.55 | 10,805.54 | 10,805.59 | J-280 | 20 | 122.16 | 10,805.62 | 10,805.54 |
| J-282 | 1,004.24 | J-282 | 69.6 | 234.63 | 11,395.36 | 11,395.46 | J-282 | 20 | 120.16 | 11,395.50 | 11,395.36 |
| J-284 | 1,004.24 | J-284 | 67.82 | 234.52 | 10,431.31 | 10,431.33 | J-284 | 20 | 124.16 | 10,431.36 | 10,431.31 |
| J-286 | 1,004.24 | J-286 | 66.98 | 234.57 | 10,473.46 | 10,473.46 | J-286 | 20 | 126.16 | 10,473.49 | 10,473.46 |
| J-288 | 1,004.24 | J-288 | 49.8 | 182.94 | 1,615.18 | 1,615.34 | J-288 | 20 | 114.16 | 1,615.34 | 1,615.18 |
| J-29 | 1,004.24 | J-29 | 42.18 | 166.35 | 1,371.86 | 1,371.92 | J-29 | 20 | 115.16 | 1,371.92 | 1,371.86 |
| J-290 | 1,004.24 | J-290 | 61.2 | 218.23 | 3,073.53 | 3,073.54 | J-290 | 20 | 123.16 | 3,073.55 | 3,073.53 |
| J-292 | 1,004.24 | J-292 | 55.92 | 203.52 | 2,107.28 | 2,107.29 | J-292 | 20 | 120.64 | 2,107.29 | 2,107.28 |

| Fire Flow 2018 with Existing System | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fire Flow Design | | | | | | | | | | | |
| ID | Total Demand (gpm) | Critical Fire Node ID | Critical Fire Node Pressure (psi) | Critical Fire Node Head (ft) | Adjusted Fire-Flow (gpm) | Available Flow at Hydrant (gpm) | Critical Available Node ID | Critical Available Node Pressure (psi) | Critical Available Node Head (ft) | Adjusted Available Flow (gpm) | Design Flow (gpm) |
| J-30 | 1,004.24 | J-30 | 50.35 | 197.2 | 1,811.56 | 1,811.56 | J-30 | 20 | 127.16 | 1,811.56 | 1,811.56 |
| J-31 | 1,004.24 | J-31 | 47.73 | 190.16 | 1,650.03 | 1,650.13 | J-31 | 20 | 126.16 | 1,650.13 | 1,650.03 |
| J-32 | 1,004.24 | J-32 | 45.45 | 172.89 | 1,459.90 | 1,459.99 | J-32 | 20 | 114.16 | 1,459.99 | 1,459.90 |
| J-36 | 1,004.24 | J-143 | 59.03 | 220.04 | 3,169.21 | 3,402.83 | J-143 | 13.88 | 115.84 | 3,169.22 | 3,169.21 |
| J-37 | 1,004.24 | J-37 | 46.87 | 175.17 | 1,499.00 | 1,499.11 | J-37 | 20 | 113.16 | 1,499.11 | 1,499.00 |
| J-4 | 1,000.00 | J-4 | 63.39 | 219.29 | 3,174.45 | 3,174.45 | J-4 | 20 | 119.16 | 3,174.45 | 3,174.45 |
| J-40 | 1,004.24 | J-18 | 61.62 | 218.21 | 3,022.68 | 3,037.63 | J-18 | 19.57 | 121.16 | 3,022.68 | 3,022.68 |
| J-42 | 1,004.24 | J-42 | 66.03 | 222.29 | 3,430.64 | 3,430.86 | J-42 | 20 | 116.06 | 3,430.86 | 3,430.64 |
| J-66 | 1,004.24 | J-66 | 68.03 | 233 | 8,425.26 | 8,425.33 | J-66 | 20 | 122.16 | 8,425.35 | 8,425.26 |
| J-72 | 1,004.24 | J-72 | 67.59 | 227.49 | 4,679.56 | 4,679.57 | J-72 | 20 | 117.66 | 4,679.57 | 4,679.56 |
| J-74 | 1,004.24 | J12 | 61.67 | 214.32 | 2,601.04 | 2,601.10 | J12 | 20 | 118.15 | 2,601.06 | 2,601.04 |
| J-78 | 1,004.24 | J-78 | 69.72 | 231.01 | 6,375.51 | 6,375.51 | J-78 | 20 | 116.26 | 6,375.52 | 6,375.51 |
| J-80 | 1,004.24 | J-80 | 69.19 | 231.48 | 6,742.43 | 6,742.44 | J-80 | 20 | 117.96 | 6,742.45 | 6,742.43 |
| J-82 | 1,004.24 | J12 | 55.59 | 200.29 | 1,951.73 | 1,951.74 | J12 | 20 | 118.16 | 1,951.73 | 1,951.73 |
| J-84 | 1,004.24 | J-84 | 69.54 | 229.88 | 5,570.27 | 5,570.27 | J-84 | 20 | 115.56 | 5,570.27 | 5,570.27 |
| J-86 | 1,004.24 | J-86 | 68.75 | 230.46 | 5,848.17 | 5,848.17 | J-86 | 20 | 117.96 | 5,848.18 | 5,848.17 |
| J-88 | 1,004.24 | J-88 | 68.62 | 233.36 | 9,000.67 | 9,000.76 | J-88 | 20 | 121.16 | 9,000.78 | 9,000.67 |
| J-90 | 1,004.24 | J-90 | 67.55 | 232.9 | 8,081.26 | 8,081.30 | J-90 | 20 | 123.16 | 8,081.31 | 8,081.26 |
| J-92 | 1,004.24 | J-92 | 67.12 | 232.91 | 7,913.41 | 7,913.43 | J-92 | 20 | 124.16 | 7,913.45 | 7,913.41 |
| J-94 | 1,004.24 | J-94 | 67.22 | 233.14 | 8,223.02 | 8,223.04 | J-94 | 20 | 124.16 | 8,223.06 | 8,223.01 |
| J-96 | 1,004.24 | J-94 | 67.5 | 233.77 | 9,695.80 | 9,794.76 | J-94 | 19.1 | 122.08 | 9,695.96 | 9,695.80 |
| J-98 | 1,004.24 | J-98 | 67.1 | 228.86 | 4,793.02 | 4,793.15 | J-98 | 20 | 120.16 | 4,793.15 | 4,793.02 |
| J10 | 1,004.24 | J10 | 68.58 | 229.28 | 5,165.17 | 5,165.17 | J10 | 20 | 117.16 | 5,165.17 | 5,165.17 |
| J12 | 1,004.24 | J12 | 45.14 | 176.17 | 1,459.90 | 1,459.92 | J12 | 20 | 118.16 | 1,459.92 | 1,459.90 |
| J16 | 1,004.24 | J16 | 41.32 | 176.35 | 1,416.07 | 1,416.17 | J16 | 20 | 127.16 | 1,416.17 | 1,416.07 |
| J18 | 1,004.24 | J18 | 57.36 | 216.18 | 2,678.43 | 2,678.43 | J18 | 20 | 129.96 | 2,678.43 | 2,678.43 |
| J20 | 1,004.24 | J20 | 60.01 | 212.49 | 2,544.96 | 2,544.96 | J20 | 20 | 120.16 | 2,544.96 | 2,544.96 |

| | Fire Flow 2018 with Existing System | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Fire Flow | | | | | | | |
| | ID | Static Demand (gpm) | Static Pressure (psi) | Static Head (ft) | Fire-Flow Demand (gpm) | Residual Pressure (psi) | Available Flow at Hydrant (gpm) | Available Flow Pressure (psi) |
| | J-10 | 4.24 | 69.57 | 235.57 | 1,000.00 | 62.23 | 3,094.50 | 20 |
| | J-100 | 4.24 | 70.69 | 236.35 | 1,000.00 | 65.75 | 3,721.65 | 20 |
| | J-12 | 4.24 | 69.58 | 235.58 | 1,000.00 | 61.46 | 2,893.96 | 20 |
| | J-120 | 4.24 | 65.45 | 235.65 | 1,000.00 | 59.59 | 3,153.29 | 20 |
| | J-121 | 4.24 | 66.03 | 235.7 | 1,000.00 | 61.38 | 3,773.82 | 20 |
| | J-122 | 4.24 | 65.81 | 235.67 | 1,000.00 | 59.68 | 3,185.29 | 20 |
| | J-123 | 4.24 | 70.65 | 235.86 | 1,000.00 | 67.72 | 5,514.36 | 20 |
| | J-124 | 4.24 | 70.01 | 235.97 | 1,000.00 | 67.09 | 5,375.42 | 20 |
| | J-125 | 4.24 | 69.83 | 236.16 | 1,000.00 | 66.67 | 5,091.29 | 20 |
| | J-126 | 4.24 | 69.75 | 235.97 | 1,000.00 | 65.65 | 4,356.81 | 20 |
| | J-127 | 4.24 | 70.11 | 235.9 | 1,000.00 | 63.45 | 3,168.35 | 20 |
| | J-128 | 4.24 | 70.12 | 235.82 | 1,000.00 | 66.28 | 4,631.92 | 20 |
| | J-129 | 4.24 | 71.07 | 235.82 | 1,000.00 | 47.37 | 1,536.98 | 20 |
| | J-130 | 4.24 | 70.27 | 235.58 | 1,000.00 | 47.27 | 1,557.84 | 20 |
| | J-132 | 4.24 | 70.16 | 235.73 | 1,000.00 | 65.4 | 4,091.17 | 20 |
| | J-133 | 4.24 | 70.2 | 235.62 | 1,000.00 | 64.35 | 3,604.15 | 20 |
| | J-135 | 4.24 | 70.03 | 235.52 | 1,000.00 | 54.14 | 1,926.24 | 20 |
| | J-136 | 4.24 | 70.4 | 235.58 | 1,000.00 | 64.05 | 3,440.36 | 20 |
| | J-137 | 4.24 | 70.31 | 235.56 | 1,000.00 | -126.87 | 477.78 | 20 |
| | J-138 | 4.24 | 70.27 | 235.58 | 1,000.00 | 62.37 | 2,967.44 | 20 |
| | J-139 | 4.24 | 68.38 | 235.51 | 1,000.00 | 62.04 | 3,423.45 | 20 |
| | J-14 | 4.24 | 70.27 | 235.58 | 1,000.00 | 62.19 | 2,923.44 | 20 |
| | J-140 | 4.24 | 69.72 | 235.51 | 1,000.00 | 63.44 | 3,497.99 | 20 |
| | J-141 | 4.24 | 70.03 | 235.51 | 1,000.00 | 63.84 | 3,547.63 | 20 |
| | J-142 | 4.24 | 70.59 | 235.51 | 1,000.00 | 64.34 | 3,541.34 | 20 |
| | J-143 | 4.24 | 65.74 | 235.51 | 1,000.00 | 58.86 | 3,111.01 | 20 |
| | J-144 | 4.24 | 66.92 | 235.44 | 1,000.00 | 41.59 | 1,424.91 | 20 |
| | J-145 | 4.24 | 66.49 | 235.44 | 1,000.00 | 40.64 | 1,401.13 | 20 |
| | J-146 | 4.24 | 72.25 | 235.44 | 1,000.00 | 50.33 | 1,647.46 | 20 |
| | J-147 | 4.24 | 73.63 | 235.42 | 1,000.00 | -64.99 | 597.51 | 20 |
| | J-148 | 4.24 | 72.64 | 235.44 | 1,000.00 | 45.67 | 1,465.55 | 20 |
| | J-149 | 4.24 | 72.51 | 235.45 | 1,000.00 | 58.19 | 2,126.53 | 20 |
| | J-150 | 4.24 | 72.47 | 235.44 | 1,000.00 | 58.87 | 2,198.27 | 20 |
| | J-151 | 4.24 | 72.08 | 235.44 | 1,000.00 | 59.01 | 2,237.65 | 20 |
| | J-152 | 4.24 | 72.47 | 235.44 | 1,000.00 | 55.47 | 1,915.34 | 20 |
| | J-153 | 4.24 | 72.59 | 235.43 | 1,000.00 | -61.11 | 603.18 | 20 |
| | J-154 | 4.24 | 72.34 | 235.45 | 1,000.00 | 56.44 | 1,991.54 | 20 |
| | J-155 | 4.24 | 69.14 | 235.45 | 1,000.00 | 57.24 | 2,299.27 | 20 |
| | J-156 | 4.24 | 70.39 | 235.45 | 1,000.00 | 59.67 | 2,489.87 | 20 |
| | J-158 | 4.24 | 70.65 | 235.45 | 1,000.00 | 50.78 | 1,712.04 | 20 |
| | J-159 | 4.24 | 69.01 | 235.46 | 1,000.00 | 54.76 | 2,048.41 | 20 |
| | J-16 | 4.24 | 70.45 | 235.6 | 1,000.00 | 63.17 | 3,134.90 | 20 |
| | J-160 | 4.24 | 70.39 | 235.46 | 1,000.00 | 60.78 | 2,667.17 | 20 |
| | J-161 | 4.24 | 68.62 | 235.47 | 1,000.00 | 56.71 | 2,274.37 | 20 |
| | J-162 | 4.24 | 68.76 | 235.48 | 1,000.00 | 59.85 | 2,738.50 | 20 |
| | J-163 | 4.24 | 68.76 | 235.49 | 1,000.00 | 61.02 | 3,005.69 | 20 |
| | J-164 | 4.24 | 70.62 | 235.48 | 1,000.00 | 62.83 | 3,066.52 | 20 |
| | J-166 | 4.24 | 68.77 | 235.5 | 1,000.00 | 61.97 | 3,276.31 | 20 |
| | J-168 | 4.24 | 70.29 | 235.61 | 1,000.00 | 41.92 | 1,381.99 | 20 |
| | J-169 | 4.24 | 69.68 | 235.82 | 1,000.00 | 64.82 | 3,951.51 | 20 |
| | J-170 | 4.24 | 69 | 235.45 | 1,000.00 | 54.55 | 2,031.25 | 20 |
| | J-171 | 4.24 | 71.32 | 235.49 | 1,000.00 | 64.17 | 3,271.01 | 20 |
| | J-172 | 4.24 | 71.52 | 236.06 | 1,000.00 | 69.64 | 6,994.47 | 20 |
| | J-174 | 4.24 | 71.52 | 236.06 | 1,000.00 | 62.81 | 2,691.57 | 20 |
| | J-176 | 4.24 | 71.59 | 236.12 | 1,000.00 | 69.24 | 6,001.68 | 20 |
| | J-178 | 4.24 | 71.96 | 236.07 | 1,000.00 | 69.15 | 5,327.53 | 20 |
| | J-18 | 4.24 | 69.15 | 235.59 | 1,000.00 | 60.43 | 2,746.74 | 20 |
| | J-180 | 4.24 | 69.6 | 235.63 | 1,000.00 | 65.91 | 4,303.90 | 20 |
| | J-182 | 4.24 | 69.4 | 235.16 | 1,000.00 | 66.62 | 4,807.74 | 20 |
| | J-184 | 4.24 | 71.96 | 236.07 | 1,000.00 | 62.13 | 2,524.33 | 20 |
| | J-186 | 4.24 | 71.96 | 236.08 | 1,000.00 | 70.13 | 7,141.16 | 20 |

| | Fire Flow 2018 with Existing System | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Fire Flow | | | | | | | |
| | ID | Static Demand (gpm) | Static Pressure (psi) | Static Head (ft) | Fire-Flow Demand (gpm) | Residual Pressure (psi) | Available Flow at Hydrant (gpm) | Available Flow Pressure (psi) |
| | J-188 | 4.24 | 71.77 | 236.13 | 1,000.00 | 69.5 | 6,122.06 | 20 |
| | J-190 | 4.24 | 70.86 | 236.34 | 1,000.00 | 63.88 | 3,042.68 | 20 |
| | J-192 | 4.24 | 71.96 | 236.07 | 1,000.00 | 69.39 | 5,650.99 | 20 |
| | J-194 | 4.24 | 71.96 | 236.08 | 1,000.00 | 69.54 | 5,856.90 | 20 |
| | J-196 | 4.24 | 72.08 | 235.34 | 1,000.00 | 66.21 | 3,302.71 | 20 |
| | J-198 | 4.24 | 72.49 | 236.09 | 1,000.00 | 70.71 | 7,283.00 | 20 |
| | J-20 | 4.24 | 67.47 | 235.72 | 1,000.00 | 61.16 | 3,282.43 | 20 |
| | J-200 | 4.24 | 72.6 | 236.16 | 1,000.00 | 70.82 | 7,269.19 | 20 |
| | J-202 | 4.24 | 71.66 | 236.27 | 1,000.00 | 69.73 | 6,803.27 | 20 |
| | J-204 | 4.24 | 71.64 | 236.34 | 1,000.00 | 63.6 | 2,828.55 | 20 |
| | J-206 | 4.24 | 70.26 | 235.16 | 1,000.00 | 66.15 | 3,916.13 | 20 |
| | J-208 | 4.24 | 71.45 | 235.2 | 1,000.00 | 65.5 | 3,242.33 | 20 |
| | J-210 | 4.24 | 71.04 | 236.16 | 1,000.00 | 66.05 | 3,685.21 | 20 |
| | J-212 | 4.24 | 72.05 | 236.27 | 1,000.00 | 66.85 | 3,639.84 | 20 |
| | J-214 | 4.24 | 71.33 | 236.61 | 1,000.00 | 69.23 | 6,432.42 | 20 |
| | J-216 | 4.24 | 67.2 | 237.1 | 1,000.00 | 65.46 | 7,173.55 | 20 |
| | J-218 | 4.24 | 72.05 | 235.29 | 1,000.00 | 62.12 | 2,468.45 | 20 |
| | J-220 | 4.24 | 70.28 | 235.19 | 1,000.00 | 60.88 | 2,493.62 | 20 |
| | J-222 | 4.24 | 69.34 | 235.02 | 1,000.00 | 69.14 | 18,674.91 | 20 |
| | J-224 | 4.24 | 69.4 | 235.16 | 1,000.00 | 64.55 | 3,537.02 | 20 |
| | J-226 | 4.24 | 72.2 | 239.62 | 1,000.00 | 70.72 | 12,999.99 | 20 |
| | J-228 | 4.24 | 67.72 | 238.29 | 1,000.00 | 66.49 | 12,220.12 | 20 |
| | J-23 | 4.24 | 71.45 | 235.9 | 1,000.00 | 67.78 | 4,654.34 | 20 |
| | J-230 | 4.24 | 67.72 | 238.29 | 1,000.00 | 65.97 | 8,144.62 | 20 |
| | J-232 | 4.24 | 67.72 | 238.29 | 1,000.00 | 65.56 | 6,734.17 | 20 |
| | J-234 | 4.24 | 67.18 | 237.05 | 1,000.00 | 66.3 | 12,243.94 | 20 |
| | J-236 | 4.24 | 67.33 | 237.39 | 1,000.00 | 66.35 | 12,313.46 | 20 |
| | J-238 | 4.24 | 68.86 | 235.93 | 1,000.00 | 68.34 | 12,660.88 | 20 |
| | J-24 | 4.24 | 71.51 | 236.04 | 1,000.00 | 66.53 | 3,801.22 | 20 |
| | J-240 | 4.24 | 68.55 | 236.21 | 1,000.00 | 67.92 | 12,097.67 | 20 |
| | J-242 | 4.24 | 68.64 | 236.42 | 1,000.00 | 67.94 | 12,017.75 | 20 |
| | J-244 | 4.24 | 68.71 | 236.57 | 1,000.00 | 67.97 | 12,094.92 | 20 |
| | J-246 | 4.24 | 69.24 | 236.79 | 1,000.00 | 68.37 | 11,081.08 | 20 |
| | J-248 | 4.24 | 70.55 | 236.82 | 1,000.00 | 69.65 | 11,907.37 | 20 |
| | J-25 | 4.24 | 71.53 | 236.08 | 1,000.00 | 68.32 | 5,048.11 | 20 |
| | J-250 | 4.24 | 70.54 | 236.79 | 1,000.00 | 69.6 | 11,452.05 | 20 |
| | J-252 | 4.24 | 71.4 | 236.77 | 1,000.00 | 70.29 | 10,001.67 | 20 |
| | J-254 | 4.24 | 72.26 | 236.76 | 1,000.00 | 71.07 | 9,557.89 | 20 |
| | J-256 | 4.24 | 72.25 | 236.74 | 1,000.00 | 71.02 | 9,258.31 | 20 |
| | J-258 | 4.24 | 70.51 | 236.72 | 1,000.00 | 69.28 | 9,076.98 | 20 |
| | J-26 | 4.24 | 71.53 | 236.09 | 1,000.00 | 69.31 | 6,515.45 | 20 |
| | J-260 | 4.24 | 70.93 | 236.71 | 1,000.00 | 69.75 | 9,394.05 | 20 |
| | J-262 | 4.24 | 70.49 | 236.69 | 1,000.00 | 69.42 | 10,112.07 | 20 |
| | J-264 | 4.24 | 70.49 | 236.68 | 1,000.00 | 69.5 | 10,971.29 | 20 |
| | J-266 | 4.24 | 70.51 | 236.72 | 1,000.00 | 69.56 | 11,220.71 | 20 |
| | J-268 | 4.24 | 70.51 | 236.72 | 1,000.00 | 69.57 | 11,328.81 | 20 |
| | J-27 | 4.24 | 69.94 | 236.4 | 1,000.00 | 68.49 | 8,687.12 | 20 |
| | J-270 | 4.24 | 70.48 | 236.66 | 1,000.00 | 69.5 | 11,101.46 | 20 |
| | J-272 | 4.24 | 70.49 | 236.67 | 1,000.00 | 69.52 | 11,074.20 | 20 |
| | J-274 | 4.24 | 69.62 | 236.67 | 1,000.00 | 68.54 | 9,774.00 | 20 |
| | J-276 | 4.24 | 69.19 | 236.67 | 1,000.00 | 68.11 | 9,670.90 | 20 |
| | J-278 | 4.24 | 69.62 | 236.67 | 1,000.00 | 68.61 | 10,122.09 | 20 |
| | J-28 | 4.24 | 71.25 | 235.45 | 1,000.00 | 44.55 | 1,451.45 | 20 |
| | J-280 | 4.24 | 69.62 | 236.67 | 1,000.00 | 68.7 | 10,805.59 | 20 |
| | J-282 | 4.24 | 70.51 | 236.73 | 1,000.00 | 69.6 | 11,395.46 | 20 |
| | J-284 | 4.24 | 68.74 | 236.64 | 1,000.00 | 67.82 | 10,431.33 | 20 |
| | J-286 | 4.24 | 67.86 | 236.61 | 1,000.00 | 66.98 | 10,473.46 | 20 |
| | J-288 | 4.24 | 72.55 | 235.44 | 1,000.00 | 49.8 | 1,615.34 | 20 |
| | J-29 | 4.24 | 72.12 | 235.45 | 1,000.00 | 42.18 | 1,371.92 | 20 |
| | J-290 | 4.24 | 68.67 | 235.49 | 1,000.00 | 61.2 | 3,073.54 | 20 |
| | J-292 | 4.24 | 69.75 | 235.45 | 1,000.00 | 55.92 | 2,107.29 | 20 |

| | Fire Flow 2018 with Existing System | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Fire Flow | | | | | | | |
| | ID | Static Demand (gpm) | Static Pressure (psi) | Static Head (ft) | Fire-Flow Demand (gpm) | Residual Pressure (psi) | Available Flow at Hydrant (gpm) | Available Flow Pressure (psi) |
| | J-30 | 4.24 | 66.98 | 235.58 | 1,000.00 | 50.35 | 1,811.56 | 20 |
| | J-31 | 4.24 | 67.4 | 235.56 | 1,000.00 | 47.73 | 1,650.13 | 20 |
| | J-32 | 4.24 | 72.55 | 235.44 | 1,000.00 | 45.45 | 1,459.99 | 20 |
| | J-36 | 4.24 | 72.58 | 235.51 | 1,000.00 | 65.8 | 3,402.83 | 20 |
| | J-37 | 4.24 | 72.98 | 235.44 | 1,000.00 | 46.87 | 1,499.11 | 20 |
| | J-4 | 0 | 70.47 | 235.64 | 1,000.00 | 63.39 | 3,174.45 | 20 |
| | J-40 | 4.24 | 69.58 | 235.59 | 1,000.00 | 62.05 | 3,037.63 | 20 |
| | J-42 | 4.24 | 71.94 | 235.92 | 1,000.00 | 66.03 | 3,430.86 | 20 |
| | J-66 | 4.24 | 69.51 | 236.41 | 1,000.00 | 68.03 | 8,425.33 | 20 |
| | J-72 | 4.24 | 71.23 | 235.9 | 1,000.00 | 67.59 | 4,679.57 | 20 |
| | J-74 | 4.24 | 71.02 | 235.91 | 1,000.00 | 61.67 | 2,601.10 | 20 |
| | J-78 | 4.24 | 71.89 | 236.02 | 1,000.00 | 69.72 | 6,375.51 | 20 |
| | J-80 | 4.24 | 71.17 | 236.05 | 1,000.00 | 69.19 | 6,742.44 | 20 |
| | J-82 | 4.24 | 71.02 | 235.9 | 1,000.00 | 55.59 | 1,951.74 | 20 |
| | J-84 | 4.24 | 72.23 | 236.11 | 1,000.00 | 69.54 | 5,570.27 | 20 |
| | J-86 | 4.24 | 71.19 | 236.11 | 1,000.00 | 68.75 | 5,848.17 | 20 |
| | J-88 | 4.24 | 69.95 | 236.45 | 1,000.00 | 68.62 | 9,000.76 | 20 |
| | J-90 | 4.24 | 69.08 | 236.43 | 1,000.00 | 67.55 | 8,081.30 | 20 |
| | J-92 | 4.24 | 68.66 | 236.46 | 1,000.00 | 67.12 | 7,913.43 | 20 |
| | J-94 | 4.24 | 68.67 | 236.49 | 1,000.00 | 67.22 | 8,223.04 | 20 |
| | J-96 | 4.24 | 69.99 | 236.53 | 1,000.00 | 68.8 | 9,794.76 | 20 |
| | J-98 | 4.24 | 70.36 | 236.38 | 1,000.00 | 67.1 | 4,793.15 | 20 |
| | J10 | 4.24 | 71.52 | 236.06 | 1,000.00 | 68.58 | 5,165.17 | 20 |
| | J12 | 4.24 | 71.02 | 235.9 | 1,000.00 | 45.14 | 1,459.92 | 20 |
| | J16 | 4.24 | 66.92 | 235.44 | 1,000.00 | 41.32 | 1,416.17 | 20 |
| | J18 | 4.24 | 65.76 | 235.56 | 1,000.00 | 57.36 | 2,678.43 | 20 |
| | J20 | 4.24 | 70.01 | 235.58 | 1,000.00 | 60.01 | 2,544.96 | 20 |

| Fire Flow 2032 with Existing System | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fire Flow Design | | | | | | | | | | | |
| ID | Total Demand (gpm) | Critical Fire Node ID | Critical Fire Node Pressure (psi) | Critical Fire Node Head (ft) | Adjusted Fire-Flow (gpm) | Available Flow at Hydrant (gpm) | Critical Available Node ID | Critical Available Node Pressure (psi) | Critical Available Node Head (ft) | Adjusted Available Flow (gpm) | Design Flow (gpm) |
| J-10 | 1,004.84 | J-10 | 61.89 | 217.83 | 3,066.70 | 3,066.71 | J-10 | 20 | 121.16 | 3,066.71 | 3,066.70 |
| J-100 | 1,004.84 | J-100 | 65.64 | 224.69 | 3,708.33 | 3,708.33 | J-100 | 20 | 119.36 | 3,708.33 | 3,708.33 |
| J-12 | 1,004.84 | J-12 | 61.13 | 216.07 | 2,869.63 | 2,869.63 | J-12 | 20 | 121.16 | 2,869.64 | 2,869.63 |
| J-120 | 1,004.84 | J-120 | 59.44 | 221.77 | 3,141.72 | 3,141.96 | J-120 | 20 | 130.76 | 3,141.96 | 3,141.72 |
| J-121 | 1,004.84 | J-121 | 61.17 | 224.47 | 3,748.98 | 3,748.98 | J-121 | 20 | 129.46 | 3,748.98 | 3,748.98 |
| J-122 | 1,004.84 | J-122 | 59.45 | 221.01 | 3,165.24 | 3,165.24 | J-122 | 20 | 129.96 | 3,165.24 | 3,165.24 |
| J-123 | 1,004.84 | J-123 | 67.52 | 228.62 | 5,469.70 | 5,469.77 | J-123 | 20 | 118.96 | 5,469.77 | 5,469.70 |
| J-124 | 1,004.84 | J-124 | 66.91 | 228.83 | 5,337.83 | 5,337.86 | J-124 | 20 | 120.56 | 5,337.86 | 5,337.83 |
| J-125 | 1,004.84 | J-125 | 66.51 | 228.49 | 5,058.43 | 5,058.44 | J-125 | 20 | 121.16 | 5,058.44 | 5,058.43 |
| J-126 | 1,004.84 | J-126 | 65.45 | 226.04 | 4,325.91 | 4,325.93 | J-126 | 20 | 121.16 | 4,325.93 | 4,325.91 |
| J-127 | 1,004.84 | J-127 | 63.25 | 220.07 | 3,151.85 | 3,151.85 | J-127 | 20 | 120.26 | 3,151.85 | 3,151.85 |
| J-128 | 1,004.84 | J-128 | 66.05 | 226.43 | 4,594.14 | 4,594.18 | J-128 | 20 | 120.16 | 4,594.18 | 4,594.14 |
| J-129 | 1,004.84 | J-129 | 47.12 | 180.55 | 1,532.01 | 1,532.01 | J-129 | 20 | 117.96 | 1,532.01 | 1,532.01 |
| J-130 | 1,004.84 | J-130 | 46.91 | 181.66 | 1,549.81 | 1,549.87 | J-130 | 20 | 119.56 | 1,549.87 | 1,549.81 |
| J-132 | 1,004.84 | J-132 | 65.12 | 224.1 | 4,054.59 | 4,054.62 | J-132 | 20 | 119.96 | 4,054.62 | 4,054.59 |
| J-133 | 1,004.84 | J-133 | 64.04 | 221.39 | 3,570.86 | 3,570.88 | J-133 | 20 | 119.76 | 3,570.89 | 3,570.86 |
| J-135 | 1,004.84 | J-135 | 53.77 | 198.01 | 1,914.15 | 1,914.15 | J-135 | 20 | 120.06 | 1,914.15 | 1,914.15 |
| J-136 | 1,004.84 | J-137 | 63.63 | 220.14 | 3,404.29 | 3,408.02 | J-137 | 19.9 | 119.23 | 3,404.31 | 3,404.29 |
| J-137 | 1,004.84 | J-137 | -127.41 | -220.76 | 476.68 | 476.68 | J-137 | 20 | 119.46 | 476.68 | 476.68 |
| J-138 | 1,004.84 | J20 | 61.77 | 216.55 | 2,933.67 | 2,942.31 | J20 | 19.74 | 119.56 | 2,933.68 | 2,933.67 |
| J-139 | 1,004.84 | J-139 | 61.67 | 220.03 | 3,385.68 | 3,385.72 | J-139 | 20 | 123.86 | 3,385.72 | 3,385.68 |
| J-14 | 1,004.84 | J-14 | 61.85 | 216.14 | 2,899.08 | 2,899.08 | J-14 | 20 | 119.56 | 2,899.08 | 2,899.08 |
| J-140 | 1,004.84 | J-139 | 61.74 | 220.2 | 3,413.88 | 3,459.83 | J-139 | 18.86 | 121.24 | 3,413.92 | 3,413.88 |
| J-141 | 1,004.84 | J-145 | 60.06 | 220.6 | 3,415.76 | 3,509.03 | J-145 | 17.78 | 123.04 | 3,415.82 | 3,415.76 |
| J-142 | 1,004.84 | J-143 | 59.33 | 220.73 | 3,378.55 | 3,503.39 | J-143 | 17.03 | 123.1 | 3,378.59 | 3,378.55 |
| J-143 | 1,004.84 | J-143 | 58.5 | 218.81 | 3,078.69 | 3,078.71 | J-143 | 20 | 129.96 | 3,078.71 | 3,078.69 |
| J-144 | 1,004.84 | J-145 | 40.68 | 175.89 | 1,407.72 | 1,415.21 | J-145 | 19.57 | 127.16 | 1,407.80 | 1,407.72 |
| J-145 | 1,004.84 | J-145 | 40.17 | 174.71 | 1,391.56 | 1,391.64 | J-145 | 20 | 128.16 | 1,391.64 | 1,391.56 |
| J-146 | 1,004.84 | J-146 | 49.86 | 183.77 | 1,636.00 | 1,636.00 | J-146 | 20 | 114.86 | 1,636.00 | 1,636.00 |
| J-147 | 1,004.84 | J-147 | -65.6 | -85.89 | 595.46 | 595.47 | J-147 | 20 | 111.66 | 595.47 | 595.46 |
| J-148 | 1,004.84 | J-148 | 45.2 | 172.11 | 1,456.42 | 1,456.51 | J-148 | 20 | 113.96 | 1,456.51 | 1,456.42 |
| J-149 | 1,004.84 | J-149 | 57.76 | 201.41 | 2,109.71 | 2,109.71 | J-149 | 20 | 114.26 | 2,109.71 | 2,109.71 |
| J-150 | 1,004.84 | J-150 | 58.43 | 203.04 | 2,179.86 | 2,179.86 | J-150 | 20 | 114.36 | 2,179.86 | 2,179.86 |
| J-151 | 1,004.84 | J-151 | 58.59 | 204.32 | 2,219.33 | 2,219.33 | J-151 | 20 | 115.26 | 2,219.33 | 2,219.33 |
| J-152 | 1,004.84 | J-152 | 55.04 | 195.22 | 1,901.42 | 1,901.42 | J-152 | 20 | 114.36 | 1,901.42 | 1,901.42 |
| J-153 | 1,004.84 | J-153 | -61.68 | -74.44 | 601.18 | 601.19 | J-153 | 20 | 114.06 | 601.19 | 601.18 |
| J-154 | 1,004.84 | J-154 | 56.01 | 197.76 | 1,976.56 | 1,976.56 | J-154 | 20 | 114.66 | 1,976.56 | 1,976.56 |
| J-155 | 1,004.84 | J-155 | 56.82 | 207.01 | 2,278.52 | 2,278.52 | J-155 | 20 | 122.05 | 2,278.52 | 2,278.52 |
| J-156 | 1,004.84 | J-170 | 57.86 | 209.74 | 2,427.80 | 2,466.80 | J-170 | 18.61 | 119.16 | 2,427.80 | 2,427.80 |
| J-158 | 1,004.84 | J-158 | 50.33 | 188.56 | 1,700.09 | 1,700.09 | J-158 | 20 | 118.56 | 1,700.09 | 1,700.09 |
| J-159 | 1,004.84 | J-159 | 54.34 | 201.6 | 2,032.00 | 2,032.00 | J-159 | 20 | 122.36 | 2,032.00 | 2,032.00 |
| J-16 | 1,004.84 | J-18 | 61.58 | 218.12 | 3,075.73 | 3,107.78 | J-18 | 19.09 | 120.07 | 3,075.74 | 3,075.73 |
| J-160 | 1,004.84 | J-160 | 60.37 | 212.32 | 2,641.62 | 2,641.63 | J-160 | 20 | 119.16 | 2,641.63 | 2,641.62 |
| J-161 | 1,004.84 | J-161 | 56.3 | 207.03 | 2,254.90 | 2,254.91 | J-161 | 20 | 123.26 | 2,254.91 | 2,254.90 |
| J-162 | 1,004.84 | J-162 | 59.45 | 214.01 | 2,712.15 | 2,712.16 | J-162 | 20 | 122.96 | 2,712.16 | 2,712.15 |
| J-163 | 1,004.84 | J-163 | 60.64 | 216.75 | 2,974.99 | 2,975.01 | J-163 | 20 | 122.96 | 2,975.01 | 2,974.99 |
| J-164 | 1,004.84 | J-170 | 60.96 | 216.89 | 3,026.46 | 3,035.10 | J-170 | 19.76 | 121.8 | 3,026.48 | 3,026.46 |
| J-166 | 1,004.84 | J-166 | 61.59 | 218.95 | 3,241.36 | 3,241.39 | J-166 | 20 | 122.96 | 3,241.39 | 3,241.36 |
| J-168 | 1,004.84 | J-168 | 41.57 | 169.34 | 1,375.98 | 1,376.00 | J-168 | 20 | 119.56 | 1,376.00 | 1,375.98 |
| J-169 | 1,004.84 | J-169 | 64.57 | 224.03 | 3,920.40 | 3,920.41 | J-169 | 20 | 121.16 | 3,920.41 | 3,920.40 |
| J-170 | 1,004.84 | J-170 | 54.12 | 201.11 | 2,014.94 | 2,014.95 | J-170 | 20 | 122.36 | 2,014.95 | 2,014.94 |
| J-171 | 1,004.84 | J-170 | 61.55 | 218.26 | 3,187.83 | 3,236.95 | J-170 | 18.68 | 119.32 | 3,187.87 | 3,187.83 |
| J-172 | 1,004.84 | J-172 | 69.51 | 231.43 | 6,954.11 | 6,954.13 | J-172 | 20 | 117.16 | 6,954.14 | 6,954.11 |
| J-174 | 1,004.84 | J-174 | 62.67 | 215.64 | 2,684.21 | 2,684.11 | J-174 | 20 | 117.16 | 2,684.11 | 2,684.11 |
| J-176 | 1,004.84 | J-176 | 69.12 | 230.43 | 5,971.36 | 5,971.36 | J-176 | 20 | 117.06 | 5,971.37 | 5,971.36 |
| J-178 | 1,004.84 | J-178 | 69.02 | 229.3 | 5,303.28 | 5,303.28 | J-178 | 20 | 116.16 | 5,303.28 | 5,303.28 |
| J-18 | 1,004.84 | J-18 | 60.09 | 214.68 | 2,724.63 | 2,724.63 | J-18 | 20 | 122.16 | 2,724.64 | 2,724.63 |
| J-180 | 1,004.84 | J-180 | 65.78 | 226.82 | 4,289.50 | 4,289.50 | J-180 | 20 | 121.16 | 4,289.50 | 4,289.50 |
| J-182 | 1,004.84 | J-224 | 66.56 | 228.6 | 4,801.03 | 4,801.22 | J-224 | 20 | 121.16 | 4,801.21 | 4,801.03 |
| J-184 | 1,004.84 | J-184 | 61.99 | 213.06 | 2,517.90 | 2,517.80 | J-184 | 20 | 116.16 | 2,517.80 | 2,517.80 |
| J-186 | 1,004.84 | J-186 | 70.01 | 231.57 | 7,100.56 | 7,100.58 | J-186 | 20 | 116.16 | 7,100.59 | 7,100.56 |

| Fire Flow 2032 with Existing System | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fire Flow Design | | | | | | | | | | | |
| ID | Total Demand (gpm) | Critical Fire Node ID | Critical Fire Node Pressure (psi) | Critical Fire Node Head (ft) | Adjusted Fire-Flow (gpm) | Available Flow at Hydrant (gpm) | Critical Available Node ID | Critical Available Node Pressure (psi) | Critical Available Node Head (ft) | Adjusted Available Flow (gpm) | Design Flow (gpm) |
| J-188 | 1,004.84 | J-188 | 69.38 | 230.62 | 6,091.65 | 6,091.66 | J-188 | 20 | 116.66 | 6,091.67 | 6,091.65 |
| J-190 | 1,004.84 | J-190 | 63.77 | 219.96 | 3,033.52 | 3,033.33 | J-190 | 20 | 118.96 | 3,033.33 | 3,033.33 |
| J-192 | 1,004.84 | J-192 | 69.27 | 229.86 | 5,624.12 | 5,624.12 | J-192 | 20 | 116.16 | 5,624.13 | 5,624.12 |
| J-194 | 1,004.84 | J-194 | 69.41 | 230.2 | 5,828.68 | 5,828.68 | J-194 | 20 | 116.16 | 5,828.69 | 5,828.68 |
| J-196 | 1,004.84 | J-196 | 66.13 | 221.62 | 3,298.03 | 3,298.14 | J-196 | 20 | 115.16 | 3,298.14 | 3,298.03 |
| J-198 | 1,004.84 | J-198 | 70.59 | 231.71 | 7,242.88 | 7,242.90 | J-198 | 20 | 114.96 | 7,242.91 | 7,242.88 |
| J-20 | 1,004.84 | J-20 | 60.87 | 220.49 | 3,255.45 | 3,255.45 | J-20 | 20 | 126.16 | 3,255.45 | 3,255.45 |
| J-200 | 1,004.84 | J-210 | 69.15 | 231.78 | 7,110.74 | 7,230.14 | J-210 | 18.44 | 114.76 | 7,110.77 | 7,110.74 |
| J-202 | 1,004.84 | J-202 | 69.62 | 231.58 | 6,769.59 | 6,769.60 | J-202 | 20 | 117.06 | 6,769.60 | 6,769.59 |
| J-204 | 1,004.84 | J-204 | 63.49 | 217.53 | 2,820.72 | 2,820.53 | J-204 | 20 | 117.16 | 2,820.53 | 2,820.53 |
| J-206 | 1,004.84 | J-206 | 66.09 | 225.53 | 3,911.18 | 3,911.32 | J-206 | 20 | 119.16 | 3,911.32 | 3,911.18 |
| J-208 | 1,004.84 | J-208 | 65.44 | 221.32 | 3,238.72 | 3,238.81 | J-208 | 20 | 116.46 | 3,238.81 | 3,238.72 |
| J-210 | 1,004.84 | J-210 | 65.93 | 224.35 | 3,673.45 | 3,673.31 | J-210 | 20 | 118.36 | 3,673.30 | 3,673.30 |
| J-212 | 1,004.84 | J-212 | 66.74 | 224.02 | 3,629.20 | 3,628.94 | J-212 | 20 | 116.16 | 3,628.94 | 3,628.94 |
| J-214 | 1,004.84 | J-214 | 69.14 | 231.57 | 6,405.47 | 6,405.47 | J-214 | 20 | 118.16 | 6,405.48 | 6,405.47 |
| J-216 | 1,004.84 | J-216 | 65.39 | 232.92 | 7,143.04 | 7,143.04 | J-216 | 20 | 128.16 | 7,143.05 | 7,143.04 |
| J-218 | 1,004.84 | J-218 | 62.04 | 212.19 | 2,465.92 | 2,465.96 | J-218 | 20 | 115.16 | 2,465.96 | 2,465.92 |
| J-220 | 1,004.84 | J-220 | 60.82 | 213.35 | 2,491.08 | 2,491.10 | J-220 | 20 | 119.16 | 2,491.10 | 2,491.08 |
| J-222 | 1,004.84 | J-222 | 69.13 | 234.53 | 18,661.11 | 18,659.89 | J-222 | 20 | 121.16 | 18,660.04 | 18,660.04 |
| J-224 | 1,004.84 | J-224 | 64.48 | 223.82 | 3,533.35 | 3,533.41 | J-224 | 20 | 121.16 | 3,533.40 | 3,533.35 |
| J-226 | 1,004.84 | J-226 | 70.69 | 236.15 | 12,948.80 | 12,948.64 | J-226 | 20 | 119.16 | 12,948.61 | 12,948.61 |
| J-228 | 1,004.84 | J-232 | 66.46 | 235.38 | 12,158.31 | 12,158.44 | J-232 | 20 | 128.16 | 12,158.46 | 12,158.31 |
| J-23 | 1,004.84 | J-23 | 67.6 | 227 | 4,625.47 | 4,625.48 | J-23 | 20 | 117.16 | 4,625.48 | 4,625.47 |
| J-230 | 1,004.84 | J-232 | 65.94 | 234.18 | 8,114.53 | 8,114.49 | J-232 | 20 | 128.16 | 8,114.51 | 8,114.51 |
| J-232 | 1,004.84 | J-232 | 65.53 | 233.23 | 6,712.71 | 6,712.69 | J-232 | 20 | 128.16 | 6,712.70 | 6,712.70 |
| J-234 | 1,004.84 | J-234 | 66.29 | 234.98 | 12,170.02 | 12,170.30 | J-234 | 20 | 128.16 | 12,170.34 | 12,170.02 |
| J-236 | 1,004.84 | J-236 | 66.33 | 235.09 | 12,241.95 | 12,242.27 | J-236 | 20 | 128.16 | 12,242.32 | 12,241.95 |
| J-238 | 1,004.84 | J-238 | 68.31 | 234.65 | 12,619.49 | 12,619.54 | J-238 | 20 | 123.16 | 12,619.50 | 12,619.49 |
| J-24 | 1,004.84 | J-24 | 66.37 | 224.16 | 3,783.04 | 3,783.03 | J-24 | 20 | 117.16 | 3,783.04 | 3,783.03 |
| J-240 | 1,004.84 | J-240 | 67.89 | 234.68 | 12,049.47 | 12,049.44 | J-240 | 20 | 124.16 | 12,049.49 | 12,049.47 |
| J-242 | 1,004.84 | J-242 | 67.92 | 234.74 | 11,962.40 | 11,962.40 | J-242 | 20 | 124.16 | 11,962.45 | 11,962.40 |
| J-244 | 1,004.84 | J-244 | 67.94 | 234.81 | 12,033.63 | 12,033.66 | J-244 | 20 | 124.16 | 12,033.70 | 12,033.63 |
| J-246 | 1,004.84 | J-246 | 68.34 | 234.72 | 11,024.82 | 11,024.85 | J-246 | 20 | 123.16 | 11,024.88 | 11,024.82 |
| J-248 | 1,004.84 | J-248 | 69.62 | 234.66 | 11,835.73 | 11,835.95 | J-248 | 20 | 120.16 | 11,835.99 | 11,835.73 |
| J-25 | 1,004.84 | J-25 | 68.16 | 228.3 | 5,019.00 | 5,019.00 | J-25 | 20 | 117.16 | 5,019.01 | 5,019.00 |
| J-250 | 1,004.84 | J-250 | 69.57 | 234.55 | 11,384.33 | 11,384.50 | J-250 | 20 | 120.16 | 11,384.54 | 11,384.33 |
| J-252 | 1,004.84 | J-252 | 70.25 | 234.13 | 9,948.94 | 9,948.99 | J-252 | 20 | 118.16 | 9,949.01 | 9,948.94 |
| J-254 | 1,004.84 | J-254 | 71.04 | 233.94 | 9,509.79 | 9,509.81 | J-254 | 20 | 116.16 | 9,509.83 | 9,509.79 |
| J-256 | 1,004.84 | J-256 | 70.98 | 233.82 | 9,212.60 | 9,212.62 | J-256 | 20 | 116.16 | 9,212.64 | 9,212.60 |
| J-258 | 1,004.84 | J-258 | 69.24 | 233.8 | 9,031.14 | 9,031.16 | J-258 | 20 | 120.16 | 9,031.17 | 9,031.14 |
| J-26 | 1,004.84 | J-26 | 69.16 | 230.62 | 6,471.37 | 6,471.42 | J-26 | 20 | 117.16 | 6,471.43 | 6,471.37 |
| J-260 | 1,004.84 | J-260 | 69.71 | 233.89 | 9,345.43 | 9,345.46 | J-260 | 20 | 119.16 | 9,345.47 | 9,345.43 |
| J-262 | 1,004.84 | J-262 | 69.38 | 234.11 | 10,055.47 | 10,055.54 | J-262 | 20 | 120.16 | 10,055.56 | 10,055.47 |
| J-264 | 1,004.84 | J-264 | 69.46 | 234.31 | 10,904.95 | 10,905.09 | J-264 | 20 | 120.16 | 10,905.13 | 10,904.95 |
| J-266 | 1,004.84 | J-266 | 69.52 | 234.44 | 11,153.93 | 11,154.08 | J-266 | 20 | 120.16 | 11,154.11 | 11,153.93 |
| J-268 | 1,004.84 | J-268 | 69.53 | 234.47 | 11,260.96 | 11,261.12 | J-268 | 20 | 120.16 | 11,261.15 | 11,260.96 |
| J-27 | 1,004.84 | J-27 | 68.4 | 232.85 | 8,626.62 | 8,626.79 | J-27 | 20 | 121.16 | 8,626.80 | 8,626.62 |
| J-270 | 1,004.84 | J-94 | 67.71 | 234.26 | 11,002.72 | 11,032.38 | J-94 | 19.77 | 123.62 | 11,002.97 | 11,002.72 |
| J-272 | 1,004.84 | J-272 | 69.48 | 234.35 | 11,007.40 | 11,007.55 | J-272 | 20 | 120.16 | 11,007.58 | 11,007.40 |
| J-274 | 1,004.84 | J-274 | 68.5 | 234.1 | 9,721.69 | 9,721.72 | J-274 | 20 | 122.16 | 9,721.74 | 9,721.69 |
| J-276 | 1,004.84 | J-276 | 68.07 | 234.1 | 9,619.58 | 9,619.60 | J-276 | 20 | 123.16 | 9,619.63 | 9,619.58 |
| J-278 | 1,004.84 | J-278 | 68.57 | 234.26 | 10,068.05 | 10,068.09 | J-278 | 20 | 122.16 | 10,068.12 | 10,068.05 |
| J-28 | 1,004.84 | J-28 | 44.09 | 172.76 | 1,442.52 | 1,442.60 | J-28 | 20 | 117.16 | 1,442.60 | 1,442.52 |
| J-280 | 1,004.84 | J-280 | 68.66 | 234.47 | 10,745.65 | 10,745.71 | J-280 | 20 | 122.16 | 10,745.74 | 10,745.65 |
| J-282 | 1,004.84 | J-282 | 69.56 | 234.54 | 11,328.68 | 11,328.82 | J-282 | 20 | 120.16 | 11,328.85 | 11,328.68 |
| J-284 | 1,004.84 | J-284 | 67.79 | 234.44 | 10,375.96 | 10,375.98 | J-284 | 20 | 124.16 | 10,376.01 | 10,375.96 |
| J-286 | 1,004.84 | J-286 | 66.95 | 234.5 | 10,419.34 | 10,419.36 | J-286 | 20 | 126.16 | 10,419.38 | 10,419.34 |
| J-288 | 1,004.84 | J-288 | 49.35 | 181.88 | 1,604.76 | 1,604.76 | J-288 | 20 | 114.16 | 1,604.76 | 1,604.76 |
| J-29 | 1,004.84 | J-29 | 41.72 | 165.28 | 1,364.07 | 1,364.11 | J-29 | 20 | 115.16 | 1,364.11 | 1,364.07 |
| J-290 | 1,004.84 | J-290 | 60.81 | 217.35 | 3,041.54 | 3,041.56 | J-290 | 20 | 123.16 | 3,041.56 | 3,041.54 |
| J-292 | 1,004.84 | J-292 | 55.48 | 202.53 | 2,089.77 | 2,089.77 | J-292 | 20 | 120.64 | 2,089.77 | 2,089.77 |

| Fire Flow 2032 with Existing System | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fire Flow Design | | | | | | | | | | | |
| ID | Total Demand (gpm) | Critical Fire Node ID | Critical Fire Node Pressure (psi) | Critical Fire Node Head (ft) | Adjusted Fire-Flow (gpm) | Available Flow at Hydrant (gpm) | Critical Available Node ID | Critical Available Node Pressure (psi) | Critical Available Node Head (ft) | Adjusted Available Flow (gpm) | Design Flow (gpm) |
| J-30 | 1,004.84 | J-30 | 49.99 | 196.37 | 1,800.08 | 1,800.08 | J-30 | 20 | 127.16 | 1,800.08 | 1,800.08 |
| J-31 | 1,004.84 | J-31 | 47.37 | 189.32 | 1,640.43 | 1,640.55 | J-31 | 20 | 126.16 | 1,640.55 | 1,640.43 |
| J-32 | 1,004.84 | J-32 | 44.97 | 171.79 | 1,450.91 | 1,450.99 | J-32 | 20 | 114.16 | 1,450.99 | 1,450.91 |
| J-36 | 1,004.84 | J-143 | 58.68 | 219.22 | 3,135.71 | 3,369.70 | J-143 | 13.88 | 115.82 | 3,135.73 | 3,135.71 |
| J-37 | 1,004.84 | J-37 | 46.39 | 174.07 | 1,489.48 | 1,489.60 | J-37 | 20 | 113.16 | 1,489.60 | 1,489.48 |
| J-4 | 1,000.00 | J-4 | 63.07 | 218.55 | 3,147.30 | 3,147.31 | J-4 | 20 | 119.16 | 3,147.31 | 3,147.30 |
| J-40 | 1,004.84 | J-18 | 61.28 | 217.44 | 2,996.36 | 3,011.32 | J-18 | 19.57 | 121.16 | 2,996.37 | 2,996.36 |
| J-42 | 1,004.84 | J-42 | 65.86 | 221.9 | 3,415.77 | 3,415.77 | J-42 | 20 | 116.06 | 3,415.77 | 3,415.77 |
| J-66 | 1,004.84 | J-66 | 67.93 | 232.78 | 8,368.52 | 8,368.64 | J-66 | 20 | 122.16 | 8,368.65 | 8,368.52 |
| J-72 | 1,004.84 | J-72 | 67.4 | 227.06 | 4,649.85 | 4,649.85 | J-72 | 20 | 117.66 | 4,649.86 | 4,649.85 |
| J-74 | 1,004.84 | J12 | 61.47 | 213.87 | 2,590.42 | 2,590.60 | J12 | 20 | 118.15 | 2,590.55 | 2,590.42 |
| J-78 | 1,004.84 | J-78 | 69.59 | 230.71 | 6,340.56 | 6,340.58 | J-78 | 20 | 116.26 | 6,340.58 | 6,340.56 |
| J-80 | 1,004.84 | J-80 | 69.06 | 231.19 | 6,703.80 | 6,703.82 | J-80 | 20 | 117.96 | 6,703.82 | 6,703.80 |
| J-82 | 1,004.84 | J12 | 55.38 | 199.81 | 1,945.31 | 1,945.34 | J12 | 20 | 118.16 | 1,945.33 | 1,945.31 |
| J-84 | 1,004.84 | J-84 | 69.4 | 229.58 | 5,541.53 | 5,541.53 | J-84 | 20 | 115.56 | 5,541.54 | 5,541.53 |
| J-86 | 1,004.84 | J-86 | 68.62 | 230.17 | 5,817.61 | 5,817.61 | J-86 | 20 | 117.96 | 5,817.62 | 5,817.61 |
| J-88 | 1,004.84 | J-88 | 68.53 | 233.16 | 8,941.26 | 8,941.39 | J-88 | 20 | 121.16 | 8,941.40 | 8,941.26 |
| J-90 | 1,004.84 | J-90 | 67.46 | 232.7 | 8,029.70 | 8,029.77 | J-90 | 20 | 123.16 | 8,029.79 | 8,029.70 |
| J-92 | 1,004.84 | J-92 | 67.04 | 232.71 | 7,865.20 | 7,865.25 | J-92 | 20 | 124.16 | 7,865.26 | 7,865.20 |
| J-94 | 1,004.84 | J-94 | 67.14 | 232.96 | 8,172.99 | 8,173.04 | J-94 | 20 | 124.16 | 8,173.05 | 8,172.99 |
| J-96 | 1,004.84 | J-94 | 67.42 | 233.61 | 9,629.34 | 9,730.16 | J-94 | 19.08 | 122.05 | 9,629.56 | 9,629.34 |
| J-98 | 1,004.84 | J-98 | 67 | 228.63 | 4,772.65 | 4,772.65 | J-98 | 20 | 120.16 | 4,772.65 | 4,772.65 |
| J10 | 1,004.84 | J10 | 68.46 | 228.99 | 5,141.59 | 5,141.59 | J10 | 20 | 117.16 | 5,141.60 | 5,141.59 |
| J12 | 1,004.84 | J12 | 44.92 | 175.67 | 1,456.27 | 1,456.27 | J12 | 20 | 118.16 | 1,456.27 | 1,456.27 |
| J16 | 1,004.84 | J16 | 40.84 | 175.26 | 1,406.46 | 1,406.55 | J16 | 20 | 127.16 | 1,406.55 | 1,406.46 |
| J18 | 1,004.84 | J18 | 57.05 | 215.46 | 2,657.95 | 2,657.95 | J18 | 20 | 129.96 | 2,657.95 | 2,657.95 |
| J20 | 1,004.84 | J20 | 59.67 | 211.71 | 2,525.87 | 2,525.87 | J20 | 20 | 120.16 | 2,525.87 | 2,525.87 |

| | 2032 Fire Flow with Existing System | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Fire Flow | | | | | | | |
| | ID | Static Demand (gpm) | Static Pressure (psi) | Static Head (ft) | Fire-Flow Demand (gpm) | Residual Pressure (psi) | Available Flow at Hydrant (gpm) | Available Flow Pressure (psi) |
| | J-10 | 4.84 | 69.41 | 235.19 | 1,000.00 | 61.89 | 3,066.71 | 20 |
| | J-100 | 4.84 | 70.59 | 236.11 | 1,000.00 | 65.64 | 3,708.33 | 20 |
| | J-12 | 4.84 | 69.41 | 235.2 | 1,000.00 | 61.13 | 2,869.63 | 20 |
| | J-120 | 4.84 | 65.35 | 235.41 | 1,000.00 | 59.44 | 3,141.96 | 20 |
| | J-121 | 4.84 | 65.91 | 235.42 | 1,000.00 | 61.17 | 3,748.98 | 20 |
| | J-122 | 4.84 | 65.68 | 235.38 | 1,000.00 | 59.45 | 3,165.24 | 20 |
| | J-123 | 4.84 | 70.53 | 235.57 | 1,000.00 | 67.52 | 5,469.77 | 20 |
| | J-124 | 4.84 | 69.89 | 235.69 | 1,000.00 | 66.91 | 5,337.86 | 20 |
| | J-125 | 4.84 | 69.71 | 235.88 | 1,000.00 | 66.51 | 5,058.44 | 20 |
| | J-126 | 4.84 | 69.62 | 235.67 | 1,000.00 | 65.45 | 4,325.93 | 20 |
| | J-127 | 4.84 | 69.98 | 235.6 | 1,000.00 | 63.25 | 3,151.85 | 20 |
| | J-128 | 4.84 | 69.98 | 235.51 | 1,000.00 | 66.05 | 4,594.18 | 20 |
| | J-129 | 4.84 | 70.93 | 235.5 | 1,000.00 | 47.12 | 1,532.01 | 20 |
| | J-130 | 4.84 | 70.11 | 235.21 | 1,000.00 | 46.91 | 1,549.87 | 20 |
| | J-132 | 4.84 | 70.02 | 235.39 | 1,000.00 | 65.12 | 4,054.62 | 20 |
| | J-133 | 4.84 | 70.05 | 235.26 | 1,000.00 | 64.04 | 3,570.88 | 20 |
| | J-135 | 4.84 | 69.86 | 235.13 | 1,000.00 | 53.77 | 1,914.15 | 20 |
| | J-136 | 4.84 | 70.24 | 235.21 | 1,000.00 | 63.72 | 3,408.02 | 20 |
| | J-137 | 4.84 | 70.15 | 235.19 | 1,000.00 | -127.41 | 476.68 | 20 |
| | J-138 | 4.84 | 70.11 | 235.2 | 1,000.00 | 62.03 | 2,942.31 | 20 |
| | J-139 | 4.84 | 68.21 | 235.12 | 1,000.00 | 61.67 | 3,385.72 | 20 |
| | J-14 | 4.84 | 70.11 | 235.21 | 1,000.00 | 61.85 | 2,899.08 | 20 |
| | J-140 | 4.84 | 69.55 | 235.12 | 1,000.00 | 63.07 | 3,459.83 | 20 |
| | J-141 | 4.84 | 69.86 | 235.12 | 1,000.00 | 63.48 | 3,509.03 | 20 |
| | J-142 | 4.84 | 70.42 | 235.12 | 1,000.00 | 63.97 | 3,503.39 | 20 |
| | J-143 | 4.84 | 65.57 | 235.13 | 1,000.00 | 58.5 | 3,078.71 | 20 |
| | J-144 | 4.84 | 66.74 | 235.03 | 1,000.00 | 41.12 | 1,415.21 | 20 |
| | J-145 | 4.84 | 66.31 | 235.03 | 1,000.00 | 40.17 | 1,391.64 | 20 |
| | J-146 | 4.84 | 72.07 | 235.03 | 1,000.00 | 49.86 | 1,636.00 | 20 |
| | J-147 | 4.84 | 73.45 | 235.01 | 1,000.00 | -65.6 | 595.47 | 20 |
| | J-148 | 4.84 | 72.46 | 235.03 | 1,000.00 | 45.2 | 1,456.51 | 20 |
| | J-149 | 4.84 | 72.34 | 235.05 | 1,000.00 | 57.76 | 2,109.71 | 20 |
| | J-150 | 4.84 | 72.29 | 235.04 | 1,000.00 | 58.43 | 2,179.86 | 20 |
| | J-151 | 4.84 | 71.9 | 235.04 | 1,000.00 | 58.59 | 2,219.33 | 20 |
| | J-152 | 4.84 | 72.29 | 235.04 | 1,000.00 | 55.04 | 1,901.42 | 20 |
| | J-153 | 4.84 | 72.41 | 235.02 | 1,000.00 | -61.68 | 601.19 | 20 |
| | J-154 | 4.84 | 72.16 | 235.04 | 1,000.00 | 56.01 | 1,976.56 | 20 |
| | J-155 | 4.84 | 68.96 | 235.04 | 1,000.00 | 56.82 | 2,278.52 | 20 |
| | J-156 | 4.84 | 70.22 | 235.05 | 1,000.00 | 59.25 | 2,466.80 | 20 |
| | J-158 | 4.84 | 70.48 | 235.05 | 1,000.00 | 50.33 | 1,700.09 | 20 |
| | J-159 | 4.84 | 68.83 | 235.06 | 1,000.00 | 54.34 | 2,032.00 | 20 |
| | J-16 | 4.84 | 70.29 | 235.22 | 1,000.00 | 62.84 | 3,107.78 | 20 |
| | J-160 | 4.84 | 70.22 | 235.06 | 1,000.00 | 60.37 | 2,641.63 | 20 |
| | J-161 | 4.84 | 68.45 | 235.07 | 1,000.00 | 56.3 | 2,254.91 | 20 |
| | J-162 | 4.84 | 68.59 | 235.09 | 1,000.00 | 59.45 | 2,712.16 | 20 |
| | J-163 | 4.84 | 68.59 | 235.09 | 1,000.00 | 60.64 | 2,975.01 | 20 |
| | J-164 | 4.84 | 70.45 | 235.08 | 1,000.00 | 62.44 | 3,035.10 | 20 |
| | J-166 | 4.84 | 68.6 | 235.11 | 1,000.00 | 61.59 | 3,241.39 | 20 |
| | J-168 | 4.84 | 70.13 | 235.25 | 1,000.00 | 41.57 | 1,376.00 | 20 |
| | J-169 | 4.84 | 69.54 | 235.49 | 1,000.00 | 64.57 | 3,920.41 | 20 |
| | J-170 | 4.84 | 68.83 | 235.05 | 1,000.00 | 54.12 | 2,014.95 | 20 |
| | J-171 | 4.84 | 71.15 | 235.09 | 1,000.00 | 63.79 | 3,236.95 | 20 |
| | J-172 | 4.84 | 71.41 | 235.81 | 1,000.00 | 69.51 | 6,954.13 | 20 |
| | J-174 | 4.84 | 71.41 | 235.81 | 1,000.00 | 62.67 | 2,684.11 | 20 |
| | J-176 | 4.84 | 71.48 | 235.86 | 1,000.00 | 69.12 | 5,971.36 | 20 |
| | J-178 | 4.84 | 71.85 | 235.81 | 1,000.00 | 69.02 | 5,303.28 | 20 |
| | J-18 | 4.84 | 68.99 | 235.21 | 1,000.00 | 60.09 | 2,724.63 | 20 |
| | J-180 | 4.84 | 69.5 | 235.41 | 1,000.00 | 65.78 | 4,289.50 | 20 |
| | J-182 | 4.84 | 69.37 | 235.1 | 1,000.00 | 66.56 | 4,801.22 | 20 |
| | J-184 | 4.84 | 71.85 | 235.81 | 1,000.00 | 61.99 | 2,517.80 | 20 |
| | J-186 | 4.84 | 71.85 | 235.83 | 1,000.00 | 70.01 | 7,100.58 | 20 |

| | 2032 Fire Flow with Existing System | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Fire Flow | | | | | | | |
| | ID | Static Demand (gpm) | Static Pressure (psi) | Static Head (ft) | Fire-Flow Demand (gpm) | Residual Pressure (psi) | Available Flow at Hydrant (gpm) | Available Flow Pressure (psi) |
| | J-188 | 4.84 | 71.66 | 235.88 | 1,000.00 | 69.38 | 6,091.66 | 20 |
| | J-190 | 4.84 | 70.76 | 236.1 | 1,000.00 | 63.77 | 3,033.33 | 20 |
| | J-192 | 4.84 | 71.85 | 235.83 | 1,000.00 | 69.27 | 5,624.12 | 20 |
| | J-194 | 4.84 | 71.85 | 235.83 | 1,000.00 | 69.41 | 5,828.68 | 20 |
| | J-196 | 4.84 | 72.03 | 235.25 | 1,000.00 | 66.13 | 3,298.14 | 20 |
| | J-198 | 4.84 | 72.38 | 235.84 | 1,000.00 | 70.59 | 7,242.90 | 20 |
| | J-20 | 4.84 | 67.32 | 235.37 | 1,000.00 | 60.87 | 3,255.45 | 20 |
| | J-200 | 4.84 | 72.5 | 235.91 | 1,000.00 | 70.71 | 7,230.14 | 20 |
| | J-202 | 4.84 | 71.55 | 236.03 | 1,000.00 | 69.62 | 6,769.60 | 20 |
| | J-204 | 4.84 | 71.53 | 236.09 | 1,000.00 | 63.49 | 2,820.53 | 20 |
| | J-206 | 4.84 | 70.24 | 235.11 | 1,000.00 | 66.09 | 3,911.32 | 20 |
| | J-208 | 4.84 | 71.43 | 235.14 | 1,000.00 | 65.44 | 3,238.81 | 20 |
| | J-210 | 4.84 | 70.94 | 235.91 | 1,000.00 | 65.93 | 3,673.31 | 20 |
| | J-212 | 4.84 | 71.94 | 236.03 | 1,000.00 | 66.74 | 3,628.94 | 20 |
| | J-214 | 4.84 | 71.23 | 236.39 | 1,000.00 | 69.14 | 6,405.47 | 20 |
| | J-216 | 4.84 | 67.12 | 236.9 | 1,000.00 | 65.39 | 7,143.04 | 20 |
| | J-218 | 4.84 | 72.02 | 235.2 | 1,000.00 | 62.04 | 2,465.96 | 20 |
| | J-220 | 4.84 | 70.25 | 235.13 | 1,000.00 | 60.82 | 2,491.10 | 20 |
| | J-222 | 4.84 | 69.33 | 235.01 | 1,000.00 | 69.13 | 18,659.89 | 20 |
| | J-224 | 4.84 | 69.37 | 235.1 | 1,000.00 | 64.48 | 3,533.41 | 20 |
| | J-226 | 4.84 | 72.14 | 239.49 | 1,000.00 | 70.69 | 12,948.64 | 20 |
| | J-228 | 4.84 | 67.65 | 238.13 | 1,000.00 | 66.46 | 12,158.44 | 20 |
| | J-23 | 4.84 | 71.33 | 235.62 | 1,000.00 | 67.6 | 4,625.48 | 20 |
| | J-230 | 4.84 | 67.65 | 238.13 | 1,000.00 | 65.94 | 8,114.49 | 20 |
| | J-232 | 4.84 | 67.65 | 238.13 | 1,000.00 | 65.53 | 6,712.69 | 20 |
| | J-234 | 4.84 | 67.1 | 236.86 | 1,000.00 | 66.29 | 12,170.30 | 20 |
| | J-236 | 4.84 | 67.25 | 237.21 | 1,000.00 | 66.33 | 12,242.27 | 20 |
| | J-238 | 4.84 | 68.82 | 235.82 | 1,000.00 | 68.31 | 12,619.54 | 20 |
| | J-24 | 4.84 | 71.39 | 235.76 | 1,000.00 | 66.37 | 3,783.03 | 20 |
| | J-240 | 4.84 | 68.49 | 236.07 | 1,000.00 | 67.89 | 12,049.44 | 20 |
| | J-242 | 4.84 | 68.58 | 236.26 | 1,000.00 | 67.92 | 11,962.40 | 20 |
| | J-244 | 4.84 | 68.63 | 236.39 | 1,000.00 | 67.94 | 12,033.66 | 20 |
| | J-246 | 4.84 | 69.16 | 236.61 | 1,000.00 | 68.34 | 11,024.85 | 20 |
| | J-248 | 4.84 | 70.47 | 236.63 | 1,000.00 | 69.62 | 11,835.95 | 20 |
| | J-25 | 4.84 | 71.41 | 235.81 | 1,000.00 | 68.16 | 5,019.00 | 20 |
| | J-250 | 4.84 | 70.45 | 236.59 | 1,000.00 | 69.57 | 11,384.50 | 20 |
| | J-252 | 4.84 | 71.31 | 236.57 | 1,000.00 | 70.25 | 9,948.99 | 20 |
| | J-254 | 4.84 | 72.17 | 236.56 | 1,000.00 | 71.04 | 9,509.81 | 20 |
| | J-256 | 4.84 | 72.16 | 236.54 | 1,000.00 | 70.98 | 9,212.62 | 20 |
| | J-258 | 4.84 | 70.42 | 236.52 | 1,000.00 | 69.24 | 9,031.16 | 20 |
| | J-26 | 4.84 | 71.42 | 235.83 | 1,000.00 | 69.16 | 6,471.42 | 20 |
| | J-260 | 4.84 | 70.85 | 236.5 | 1,000.00 | 69.71 | 9,345.46 | 20 |
| | J-262 | 4.84 | 70.41 | 236.49 | 1,000.00 | 69.38 | 10,055.54 | 20 |
| | J-264 | 4.84 | 70.4 | 236.48 | 1,000.00 | 69.46 | 10,905.09 | 20 |
| | J-266 | 4.84 | 70.42 | 236.52 | 1,000.00 | 69.52 | 11,154.08 | 20 |
| | J-268 | 4.84 | 70.42 | 236.52 | 1,000.00 | 69.53 | 11,261.12 | 20 |
| | J-27 | 4.84 | 69.83 | 236.17 | 1,000.00 | 68.4 | 8,626.79 | 20 |
| | J-270 | 4.84 | 70.39 | 236.46 | 1,000.00 | 69.46 | 11,032.38 | 20 |
| | J-272 | 4.84 | 70.4 | 236.47 | 1,000.00 | 69.48 | 11,007.55 | 20 |
| | J-274 | 4.84 | 69.53 | 236.47 | 1,000.00 | 68.5 | 9,721.72 | 20 |
| | J-276 | 4.84 | 69.1 | 236.47 | 1,000.00 | 68.07 | 9,619.60 | 20 |
| | J-278 | 4.84 | 69.53 | 236.47 | 1,000.00 | 68.57 | 10,068.09 | 20 |
| | J-28 | 4.84 | 71.08 | 235.04 | 1,000.00 | 44.09 | 1,442.60 | 20 |
| | J-280 | 4.84 | 69.53 | 236.47 | 1,000.00 | 68.66 | 10,745.71 | 20 |
| | J-282 | 4.84 | 70.43 | 236.54 | 1,000.00 | 69.56 | 11,328.82 | 20 |
| | J-284 | 4.84 | 68.66 | 236.45 | 1,000.00 | 67.79 | 10,375.98 | 20 |
| | J-286 | 4.84 | 67.78 | 236.43 | 1,000.00 | 66.95 | 10,419.36 | 20 |
| | J-288 | 4.84 | 72.38 | 235.04 | 1,000.00 | 49.35 | 1,604.76 | 20 |
| | J-29 | 4.84 | 71.95 | 235.04 | 1,000.00 | 41.72 | 1,364.11 | 20 |
| | J-290 | 4.84 | 68.5 | 235.09 | 1,000.00 | 60.81 | 3,041.56 | 20 |
| | J-292 | 4.84 | 69.57 | 235.04 | 1,000.00 | 55.48 | 2,089.77 | 20 |

| | 2032 Fire Flow with Existing System | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Fire Flow | | | | | | | |
| | ID | Static Demand (gpm) | Static Pressure (psi) | Static Head (ft) | Fire-Flow Demand (gpm) | Residual Pressure (psi) | Available Flow at Hydrant (gpm) | Available Flow Pressure (psi) |
| | J-30 | 4.84 | 66.82 | 235.21 | 1,000.00 | 49.99 | 1,800.08 | 20 |
| | J-31 | 4.84 | 67.24 | 235.18 | 1,000.00 | 47.37 | 1,640.55 | 20 |
| | J-32 | 4.84 | 72.37 | 235.03 | 1,000.00 | 44.97 | 1,450.99 | 20 |
| | J-36 | 4.84 | 72.41 | 235.12 | 1,000.00 | 65.44 | 3,369.70 | 20 |
| | J-37 | 4.84 | 72.81 | 235.03 | 1,000.00 | 46.39 | 1,489.60 | 20 |
| | J-4 | 0 | 70.31 | 235.27 | 1,000.00 | 63.07 | 3,147.31 | 20 |
| | J-40 | 4.84 | 69.42 | 235.21 | 1,000.00 | 61.72 | 3,011.32 | 20 |
| | J-42 | 4.84 | 71.82 | 235.64 | 1,000.00 | 65.86 | 3,415.77 | 20 |
| | J-66 | 4.84 | 69.4 | 236.17 | 1,000.00 | 67.93 | 8,368.64 | 20 |
| | J-72 | 4.84 | 71.11 | 235.61 | 1,000.00 | 67.4 | 4,649.85 | 20 |
| | J-74 | 4.84 | 70.9 | 235.62 | 1,000.00 | 61.48 | 2,590.60 | 20 |
| | J-78 | 4.84 | 71.78 | 235.76 | 1,000.00 | 69.59 | 6,340.58 | 20 |
| | J-80 | 4.84 | 71.06 | 235.79 | 1,000.00 | 69.06 | 6,703.82 | 20 |
| | J-82 | 4.84 | 70.9 | 235.62 | 1,000.00 | 55.38 | 1,945.34 | 20 |
| | J-84 | 4.84 | 72.12 | 235.85 | 1,000.00 | 69.4 | 5,541.53 | 20 |
| | J-86 | 4.84 | 71.08 | 235.85 | 1,000.00 | 68.62 | 5,817.61 | 20 |
| | J-88 | 4.84 | 69.85 | 236.21 | 1,000.00 | 68.53 | 8,941.39 | 20 |
| | J-90 | 4.84 | 68.98 | 236.19 | 1,000.00 | 67.46 | 8,029.77 | 20 |
| | J-92 | 4.84 | 68.56 | 236.23 | 1,000.00 | 67.04 | 7,865.25 | 20 |
| | J-94 | 4.84 | 68.58 | 236.27 | 1,000.00 | 67.14 | 8,173.04 | 20 |
| | J-96 | 4.84 | 69.89 | 236.31 | 1,000.00 | 68.73 | 9,730.16 | 20 |
| | J-98 | 4.84 | 70.26 | 236.15 | 1,000.00 | 67 | 4,772.65 | 20 |
| | J10 | 4.84 | 71.41 | 235.81 | 1,000.00 | 68.46 | 5,141.59 | 20 |
| | J12 | 4.84 | 70.9 | 235.62 | 1,000.00 | 44.92 | 1,456.27 | 20 |
| | J16 | 4.84 | 66.74 | 235.03 | 1,000.00 | 40.84 | 1,406.55 | 20 |
| | J18 | 4.84 | 65.6 | 235.2 | 1,000.00 | 57.05 | 2,657.95 | 20 |
| | J20 | 4.84 | 69.85 | 235.2 | 1,000.00 | 59.67 | 2,525.87 | 20 |

| Fire Flow 2018 with Improved System | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fire Flow Design | | | | | | | | | | | |
| ID | Total Demand (gpm) | Critical Fire Node ID | Critical Fire Node Pressure (psi) | Critical Fire Node Head (ft) | Adjusted Fire-Flow (gpm) | Available Flow at Hydrant (gpm) | Critical Available Node ID | Critical Available Node Pressure (psi) | Critical Available Node Head (ft) | Adjusted Available Flow (gpm) | Design Flow (gpm) |
| J-10 | 1,004.24 | J-10 | 60.1 | 213.7 | 2,588.84 | 2,588.84 | J-10 | 20 | 121.16 | 2,588.84 | 2,588.84 |
| J-100 | 1,004.24 | J-100 | 65.76 | 224.97 | 3,733.16 | 3,733.15 | J-100 | 20 | 119.36 | 3,733.16 | 3,733.16 |
| J-12 | 1,004.24 | J-12 | 59.97 | 213.4 | 2,565.46 | 2,565.46 | J-12 | 20 | 121.16 | 2,565.46 | 2,565.46 |
| J-120 | 1,004.24 | J-120 | 61.56 | 226.68 | 4,106.71 | 4,106.71 | J-120 | 20 | 130.76 | 4,106.71 | 4,106.71 |
| J-121 | 1,004.24 | J-121 | 62.44 | 227.41 | 4,433.62 | 4,433.62 | J-121 | 20 | 129.46 | 4,433.63 | 4,433.62 |
| J-122 | 1,004.24 | J-122 | 60.65 | 223.77 | 3,560.14 | 3,560.14 | J-122 | 20 | 129.96 | 3,560.15 | 3,560.14 |
| J-123 | 1,004.24 | J-123 | 68.25 | 230.31 | 6,183.31 | 6,183.34 | J-123 | 20 | 118.96 | 6,183.35 | 6,183.31 |
| J-124 | 1,004.24 | J-124 | 67.4 | 229.95 | 5,711.51 | 5,711.52 | J-124 | 20 | 120.56 | 5,711.52 | 5,711.51 |
| J-125 | 1,004.24 | J-125 | 66.78 | 229.11 | 5,142.85 | 5,142.85 | J-125 | 20 | 121.16 | 5,142.85 | 5,142.85 |
| J-126 | 1,004.24 | J-126 | 65.77 | 226.79 | 4,364.46 | 4,364.47 | J-126 | 20 | 121.16 | 4,364.47 | 4,364.46 |
| J-127 | 1,004.24 | J-127 | 63.81 | 221.37 | 3,252.82 | 3,253.06 | J-127 | 20 | 120.26 | 3,253.07 | 3,252.82 |
| J-128 | 1,004.24 | J-128 | 66.69 | 227.9 | 4,912.41 | 4,912.43 | J-128 | 20 | 120.16 | 4,912.43 | 4,912.41 |
| J-129 | 1,004.24 | J-129 | 47.78 | 182.07 | 1,549.69 | 1,549.70 | J-129 | 20 | 117.96 | 1,549.70 | 1,549.69 |
| J-130 | 1,004.24 | J-130 | 45.18 | 177.66 | 1,480.67 | 1,480.73 | J-130 | 20 | 119.56 | 1,480.73 | 1,480.67 |
| J-132 | 1,004.24 | J-132 | 65.83 | 225.74 | 4,294.91 | 4,294.93 | J-132 | 20 | 119.96 | 4,294.93 | 4,294.91 |
| J-133 | 1,004.24 | J-133 | 64.79 | 223.13 | 3,747.45 | 3,747.46 | J-133 | 20 | 119.76 | 3,747.46 | 3,747.45 |
| J-135 | 1,004.24 | J-135 | 31.05 | 145.55 | 1,152.73 | 1,152.74 | J-135 | 20 | 120.06 | 1,152.74 | 1,152.73 |
| J-136 | 1,004.24 | J-137 | 64.4 | 221.93 | 3,560.26 | 3,563.72 | J-137 | 19.91 | 119.26 | 3,560.27 | 3,560.26 |
| J-137 | 1,004.24 | J-137 | 59.62 | 210.89 | 2,432.25 | 2,432.25 | J-137 | 20 | 119.46 | 2,432.25 | 2,432.25 |
| J-138 | 1,004.24 | J20 | 56.73 | 204.93 | 2,124.67 | 2,130.79 | J20 | 19.74 | 119.56 | 2,124.67 | 2,124.67 |
| J-139 | 1,004.24 | J-139 | 62.25 | 221.36 | 3,462.95 | 3,462.97 | J-139 | 20 | 123.86 | 3,462.97 | 3,462.95 |
| J-14 | 1,004.24 | J-14 | 60.85 | 213.83 | 2,615.33 | 2,615.33 | J-14 | 20 | 119.56 | 2,615.33 | 2,615.33 |
| J-140 | 1,004.24 | J-139 | 62.35 | 221.59 | 3,505.79 | 3,554.65 | J-139 | 18.81 | 121.1 | 3,505.82 | 3,505.79 |
| J-141 | 1,004.24 | J-139 | 62.51 | 221.97 | 3,569.68 | 3,623.91 | J-139 | 18.7 | 120.85 | 3,569.71 | 3,569.68 |
| J-142 | 1,004.24 | J-143 | 60.13 | 222.57 | 3,552.19 | 3,621.27 | J-143 | 18.42 | 126.32 | 3,552.22 | 3,552.19 |
| J-143 | 1,004.24 | J-143 | 59.5 | 221.11 | 3,288.33 | 3,288.34 | J-143 | 20 | 129.96 | 3,288.34 | 3,288.33 |
| J-144 | 1,004.24 | J-145 | 59.07 | 218.33 | 2,954.16 | 2,969.64 | J-145 | 19.57 | 127.16 | 2,954.16 | 2,954.16 |
| J-145 | 1,004.24 | J-145 | 58.52 | 217.06 | 2,817.72 | 2,817.72 | J-145 | 20 | 128.16 | 2,817.72 | 2,817.72 |
| J-146 | 1,004.24 | J-146 | 57.52 | 201.45 | 2,070.80 | 2,070.80 | J-146 | 20 | 114.86 | 2,070.80 | 2,070.80 |
| J-147 | 1,004.24 | J-147 | 55.89 | 194.48 | 1,883.65 | 1,883.65 | J-147 | 20 | 111.66 | 1,883.65 | 1,883.65 |
| J-148 | 1,004.24 | J-148 | 47.17 | 176.65 | 1,510.80 | 1,510.91 | J-148 | 20 | 113.96 | 1,510.91 | 1,510.80 |
| J-149 | 1,004.24 | J-149 | 59.2 | 204.73 | 2,208.82 | 2,208.82 | J-149 | 20 | 114.26 | 2,208.82 | 2,208.82 |
| J-150 | 1,004.24 | J-150 | 60.41 | 207.61 | 2,349.17 | 2,349.17 | J-150 | 20 | 114.36 | 2,349.17 | 2,349.17 |
| J-151 | 1,004.24 | J-151 | 59.83 | 207.18 | 2,315.10 | 2,315.10 | J-151 | 20 | 115.26 | 2,315.10 | 2,315.10 |
| J-152 | 1,004.24 | J-152 | 58.82 | 203.94 | 2,179.03 | 2,179.03 | J-152 | 20 | 114.36 | 2,179.03 | 2,179.03 |
| J-153 | 1,004.24 | J-153 | 56.87 | 199.16 | 2,003.20 | 2,003.20 | J-153 | 20 | 114.06 | 2,003.20 | 2,003.20 |
| J-154 | 1,004.24 | J-154 | 59.93 | 206.81 | 2,308.80 | 2,308.80 | J-154 | 20 | 114.66 | 2,308.80 | 2,308.80 |
| J-155 | 1,004.24 | J-155 | 58.8 | 211.58 | 2,498.59 | 2,498.59 | J-155 | 20 | 122.05 | 2,498.59 | 2,498.59 |
| J-156 | 1,004.24 | J-170 | 59.15 | 212.71 | 2,570.29 | 2,611.11 | J-170 | 18.61 | 119.16 | 2,570.29 | 2,570.29 |
| J-158 | 1,004.24 | J-158 | 57.93 | 206.09 | 2,230.54 | 2,230.54 | J-158 | 20 | 118.56 | 2,230.54 | 2,230.54 |
| J-159 | 1,004.24 | J-159 | 57.29 | 208.42 | 2,298.16 | 2,298.16 | J-159 | 20 | 122.36 | 2,298.17 | 2,298.16 |
| J-16 | 1,004.24 | J-18 | 60.55 | 215.74 | 2,730.11 | 2,768.31 | J-18 | 18.76 | 119.29 | 2,730.11 | 2,730.11 |
| J-160 | 1,004.24 | J-160 | 61.43 | 214.78 | 2,771.77 | 2,771.78 | J-160 | 20 | 119.16 | 2,771.78 | 2,771.77 |
| J-161 | 1,004.24 | J-161 | 57.87 | 210.65 | 2,411.02 | 2,411.02 | J-161 | 20 | 123.26 | 2,411.02 | 2,411.02 |
| J-162 | 1,004.24 | J-162 | 60.32 | 216 | 2,814.91 | 2,814.91 | J-162 | 20 | 122.96 | 2,814.92 | 2,814.91 |
| J-163 | 1,004.24 | J-163 | 61.29 | 218.25 | 3,050.30 | 3,050.31 | J-163 | 20 | 122.96 | 3,050.31 | 3,050.30 |
| J-164 | 1,004.24 | J-164 | 63.17 | 218.3 | 3,131.74 | 3,131.74 | J-164 | 20 | 118.66 | 3,131.74 | 3,131.74 |
| J-166 | 1,004.24 | J-166 | 62.2 | 220.35 | 3,320.98 | 3,320.99 | J-166 | 20 | 122.96 | 3,320.99 | 3,320.98 |
| J-168 | 1,004.24 | J-168 | 40.95 | 167.9 | 1,354.74 | 1,354.78 | J-168 | 20 | 119.56 | 1,354.78 | 1,354.74 |
| J-169 | 1,004.24 | J-20 | 62.82 | 224.99 | 3,900.45 | 3,902.57 | J-20 | 19.95 | 126.05 | 3,900.46 | 3,900.45 |
| J-170 | 1,004.24 | J-170 | 55.56 | 204.42 | 2,114.51 | 2,114.51 | J-170 | 20 | 122.36 | 2,114.51 | 2,114.51 |
| J-171 | 1,004.24 | J-170 | 62.26 | 219.89 | 3,294.43 | 3,320.21 | J-170 | 19.32 | 120.8 | 3,294.44 | 3,294.43 |
| J-172 | 1,004.24 | J-172 | 69.73 | 231.92 | 7,301.69 | 7,301.71 | J-172 | 20 | 117.16 | 7,301.72 | 7,301.69 |
| J-174 | 1,004.24 | J-174 | 61.53 | 213.01 | 2,492.84 | 2,492.74 | J-174 | 20 | 117.16 | 2,492.74 | 2,492.74 |
| J-176 | 1,004.24 | J-176 | 69.27 | 230.76 | 6,068.30 | 6,068.30 | J-176 | 20 | 117.06 | 6,068.31 | 6,068.30 |
| J-178 | 1,004.24 | J-178 | 69.22 | 229.75 | 5,440.06 | 5,440.06 | J-178 | 20 | 116.16 | 5,440.07 | 5,440.06 |
| J-18 | 1,004.24 | J-18 | 58.88 | 211.88 | 2,449.71 | 2,449.71 | J-18 | 20 | 122.16 | 2,449.71 | 2,449.71 |
| J-180 | 1,004.24 | J-180 | 66.91 | 229.41 | 5,271.96 | 5,271.96 | J-180 | 20 | 121.16 | 5,271.96 | 5,271.96 |
| J-182 | 1,004.24 | J-224 | 66.91 | 229.41 | 5,206.36 | 5,206.38 | J-224 | 20 | 121.16 | 5,206.36 | 5,206.36 |
| J-184 | 1,004.24 | J-184 | 61.67 | 212.32 | 2,462.39 | 2,462.29 | J-184 | 20 | 116.16 | 2,462.29 | 2,462.29 |
| J-186 | 1,004.24 | J-186 | 70.19 | 231.99 | 7,380.83 | 7,380.84 | J-186 | 20 | 116.16 | 7,380.85 | 7,380.83 |

| Fire Flow 2018 with Improved System | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fire Flow Design | | | | | | | | | | | |
| ID | Total Demand (gpm) | Critical Fire Node ID | Critical Fire Node Pressure (psi) | Critical Fire Node Head (ft) | Adjusted Fire-Flow (gpm) | Available Flow at Hydrant (gpm) | Critical Available Node ID | Critical Available Node Pressure (psi) | Critical Available Node Head (ft) | Adjusted Available Flow (gpm) | Design Flow (gpm) |
| J-188 | 1,004.24 | J-188 | 69.53 | 230.97 | 6,214.95 | 6,214.95 | J-188 | 20 | 116.66 | 6,214.95 | 6,214.95 |
| J-190 | 1,004.24 | J-190 | 63.89 | 220.25 | 3,048.39 | 3,048.39 | J-190 | 20 | 118.96 | 3,048.39 | 3,048.39 |
| J-192 | 1,004.24 | J-192 | 69.45 | 230.27 | 5,764.08 | 5,764.08 | J-192 | 20 | 116.16 | 5,764.08 | 5,764.08 |
| J-194 | 1,004.24 | J-194 | 69.59 | 230.61 | 5,979.70 | 5,979.70 | J-194 | 20 | 116.16 | 5,979.71 | 5,979.70 |
| J-196 | 1,004.24 | J-196 | 65.79 | 220.83 | 3,198.49 | 3,198.59 | J-196 | 20 | 115.16 | 3,198.59 | 3,198.49 |
| J-198 | 1,004.24 | J-198 | 70.75 | 232.07 | 7,459.39 | 7,459.40 | J-198 | 20 | 114.96 | 7,459.41 | 7,459.39 |
| J-20 | 1,004.24 | J-20 | 60.74 | 220.18 | 3,095.95 | 3,095.96 | J-20 | 20 | 126.16 | 3,095.96 | 3,095.95 |
| J-200 | 1,004.24 | J-210 | 69.29 | 232.12 | 7,297.31 | 7,419.25 | J-210 | 18.44 | 114.76 | 7,297.33 | 7,297.31 |
| J-202 | 1,004.24 | J-202 | 69.76 | 231.89 | 6,907.14 | 6,907.15 | J-202 | 20 | 117.06 | 6,907.15 | 6,907.14 |
| J-204 | 1,004.24 | J-204 | 63.62 | 217.82 | 2,832.85 | 2,832.85 | J-204 | 20 | 117.16 | 2,832.85 | 2,832.85 |
| J-206 | 1,004.24 | J-206 | 65.65 | 224.51 | 3,699.03 | 3,699.20 | J-206 | 20 | 119.16 | 3,699.20 | 3,699.03 |
| J-208 | 1,004.24 | J-208 | 65.03 | 220.37 | 3,123.29 | 3,123.40 | J-208 | 20 | 116.46 | 3,123.40 | 3,123.29 |
| J-210 | 1,004.24 | J-210 | 66.08 | 224.7 | 3,706.19 | 3,706.19 | J-210 | 20 | 118.36 | 3,706.19 | 3,706.19 |
| J-212 | 1,004.24 | J-212 | 66.88 | 224.34 | 3,656.33 | 3,656.33 | J-212 | 20 | 116.16 | 3,656.33 | 3,656.33 |
| J-214 | 1,004.24 | J-214 | 69.25 | 231.81 | 6,485.84 | 6,485.83 | J-214 | 20 | 118.16 | 6,485.84 | 6,485.84 |
| J-216 | 1,004.24 | J-216 | 65.46 | 233.08 | 7,213.49 | 7,213.48 | J-216 | 20 | 128.16 | 7,213.49 | 7,213.49 |
| J-218 | 1,004.24 | J-218 | 61.67 | 211.33 | 2,417.40 | 2,417.45 | J-218 | 20 | 115.16 | 2,417.45 | 2,417.40 |
| J-220 | 1,004.24 | J-220 | 60.41 | 212.41 | 2,434.13 | 2,434.19 | J-220 | 20 | 119.16 | 2,434.19 | 2,434.13 |
| J-222 | 1,004.24 | J-222 | 68.36 | 232.78 | 8,336.92 | 8,336.91 | J-222 | 20 | 121.16 | 8,336.92 | 8,336.92 |
| J-224 | 1,004.24 | J-224 | 64.84 | 224.63 | 3,693.16 | 3,693.29 | J-224 | 20 | 121.16 | 3,693.28 | 3,693.16 |
| J-226 | 1,004.24 | J-226 | 70.72 | 236.22 | 13,096.57 | 13,096.16 | J-226 | 20 | 119.16 | 13,096.12 | 13,096.12 |
| J-228 | 1,004.24 | J-232 | 66.49 | 235.45 | 12,342.64 | 12,342.46 | J-232 | 20 | 128.16 | 12,342.49 | 12,342.49 |
| J-23 | 1,004.24 | J-23 | 69.09 | 230.46 | 6,133.40 | 6,133.41 | J-23 | 20 | 117.16 | 6,133.42 | 6,133.40 |
| J-230 | 1,004.24 | J-232 | 65.97 | 234.25 | 8,183.74 | 8,183.68 | J-232 | 20 | 128.16 | 8,183.69 | 8,183.69 |
| J-232 | 1,004.24 | J-232 | 65.56 | 233.3 | 6,757.15 | 6,757.12 | J-232 | 20 | 128.16 | 6,757.13 | 6,757.13 |
| J-234 | 1,004.24 | J-234 | 66.31 | 235.02 | 12,411.26 | 12,411.41 | J-234 | 20 | 128.16 | 12,411.46 | 12,411.26 |
| J-236 | 1,004.24 | J-236 | 66.35 | 235.12 | 12,467.77 | 12,467.87 | J-236 | 20 | 128.16 | 12,467.92 | 12,467.76 |
| J-238 | 1,004.24 | J-238 | 68.34 | 234.71 | 12,729.54 | 12,729.58 | J-238 | 20 | 123.16 | 12,729.54 | 12,729.54 |
| J-24 | 1,004.24 | J-24 | 68.91 | 230.04 | 5,807.10 | 5,807.11 | J-24 | 20 | 117.16 | 5,807.11 | 5,807.10 |
| J-240 | 1,004.24 | J-240 | 67.92 | 234.74 | 12,185.19 | 12,185.16 | J-240 | 20 | 124.16 | 12,185.21 | 12,185.19 |
| J-242 | 1,004.24 | J-242 | 67.95 | 234.81 | 12,127.15 | 12,127.13 | J-242 | 20 | 124.16 | 12,127.18 | 12,127.15 |
| J-244 | 1,004.24 | J-244 | 67.97 | 234.88 | 12,223.99 | 12,224.01 | J-244 | 20 | 124.16 | 12,224.05 | 12,223.99 |
| J-246 | 1,004.24 | J-246 | 68.37 | 234.79 | 11,195.22 | 11,195.24 | J-246 | 20 | 123.16 | 11,195.27 | 11,195.22 |
| J-248 | 1,004.24 | J-248 | 69.66 | 234.75 | 12,090.41 | 12,090.54 | J-248 | 20 | 120.16 | 12,090.59 | 12,090.41 |
| J-25 | 1,004.24 | J-25 | 68.94 | 230.12 | 5,811.69 | 5,811.70 | J-25 | 20 | 117.16 | 5,811.71 | 5,811.69 |
| J-250 | 1,004.24 | J-250 | 69.61 | 234.65 | 11,625.01 | 11,625.11 | J-250 | 20 | 120.16 | 11,625.14 | 11,625.01 |
| J-252 | 1,004.24 | J-252 | 70.3 | 234.23 | 10,122.19 | 10,122.21 | J-252 | 20 | 118.16 | 10,122.24 | 10,122.19 |
| J-254 | 1,004.24 | J-254 | 71.08 | 234.05 | 9,664.30 | 9,664.30 | J-254 | 20 | 116.16 | 9,664.32 | 9,664.30 |
| J-256 | 1,004.24 | J-256 | 71.03 | 233.93 | 9,357.66 | 9,357.65 | J-256 | 20 | 116.16 | 9,357.67 | 9,357.65 |
| J-258 | 1,004.24 | J-258 | 69.29 | 233.91 | 9,176.12 | 9,176.11 | J-258 | 20 | 120.16 | 9,176.13 | 9,176.12 |
| J-26 | 1,004.24 | J-26 | 69.57 | 231.55 | 7,034.80 | 7,034.83 | J-26 | 20 | 117.16 | 7,034.84 | 7,034.80 |
| J-260 | 1,004.24 | J-260 | 69.76 | 234 | 9,504.93 | 9,504.94 | J-260 | 20 | 119.16 | 9,504.96 | 9,504.93 |
| J-262 | 1,004.24 | J-262 | 69.43 | 234.23 | 10,255.98 | 10,256.00 | J-262 | 20 | 120.16 | 10,256.03 | 10,255.98 |
| J-264 | 1,004.24 | J-264 | 69.52 | 234.44 | 11,160.81 | 11,160.90 | J-264 | 20 | 120.16 | 11,160.93 | 11,160.81 |
| J-266 | 1,004.24 | J-266 | 69.57 | 234.55 | 11,400.84 | 11,400.93 | J-266 | 20 | 120.16 | 11,400.96 | 11,400.84 |
| J-268 | 1,004.24 | J-268 | 69.58 | 234.58 | 11,513.29 | 11,513.38 | J-268 | 20 | 120.16 | 11,513.42 | 11,513.29 |
| J-27 | 1,004.24 | J-27 | 68.53 | 233.16 | 8,854.63 | 8,854.71 | J-27 | 20 | 121.16 | 8,854.72 | 8,854.63 |
| J-270 | 1,004.24 | J-270 | 69.51 | 234.43 | 11,313.58 | 11,313.69 | J-270 | 20 | 120.16 | 11,313.72 | 11,313.58 |
| J-272 | 1,004.24 | J-272 | 69.53 | 234.47 | 11,263.87 | 11,263.95 | J-272 | 20 | 120.16 | 11,263.98 | 11,263.87 |
| J-274 | 1,004.24 | J-274 | 68.55 | 234.21 | 9,895.53 | 9,895.54 | J-274 | 20 | 122.16 | 9,895.56 | 9,895.53 |
| J-276 | 1,004.24 | J-276 | 68.12 | 234.21 | 9,786.78 | 9,786.79 | J-276 | 20 | 123.16 | 9,786.81 | 9,786.78 |
| J-278 | 1,004.24 | J-278 | 68.62 | 234.37 | 10,244.27 | 10,244.28 | J-278 | 20 | 122.16 | 10,244.30 | 10,244.27 |
| J-28 | 1,004.24 | J-28 | 58.57 | 206.16 | 2,250.11 | 2,250.11 | J-28 | 20 | 117.16 | 2,250.11 | 2,250.11 |
| J-280 | 1,004.24 | J-280 | 68.71 | 234.57 | 10,945.66 | 10,945.70 | J-280 | 20 | 122.16 | 10,945.73 | 10,945.66 |
| J-282 | 1,004.24 | J-282 | 69.61 | 234.64 | 11,566.85 | 11,566.93 | J-282 | 20 | 120.16 | 11,566.97 | 11,566.85 |
| J-284 | 1,004.24 | J-284 | 67.83 | 234.53 | 10,548.97 | 10,548.98 | J-284 | 20 | 124.16 | 10,549.01 | 10,548.97 |
| J-286 | 1,004.24 | J-286 | 66.98 | 234.58 | 10,582.81 | 10,582.82 | J-286 | 20 | 126.16 | 10,582.84 | 10,582.81 |
| J-288 | 1,004.24 | J-288 | 51.06 | 185.83 | 1,664.23 | 1,664.23 | J-288 | 20 | 114.16 | 1,664.23 | 1,664.23 |
| J-29 | 1,004.24 | J-29 | 59.23 | 205.68 | 2,249.05 | 2,249.05 | J-29 | 20 | 115.16 | 2,249.05 | 2,249.05 |
| J-290 | 1,004.24 | J-290 | 61.49 | 218.92 | 3,129.20 | 3,129.21 | J-290 | 20 | 123.16 | 3,129.21 | 3,129.20 |
| J-292 | 1,004.24 | J-292 | 58.62 | 209.78 | 2,402.34 | 2,402.34 | J-292 | 20 | 120.64 | 2,402.34 | 2,402.34 |

| Fire Flow 2018 with Improved System | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fire Flow Design | | | | | | | | | | | |
| ID | Total Demand (gpm) | Critical Fire Node ID | Critical Fire Node Pressure (psi) | Critical Fire Node Head (ft) | Adjusted Fire-Flow (gpm) | Available Flow at Hydrant (gpm) | Critical Available Node ID | Critical Available Node Pressure (psi) | Critical Available Node Head (ft) | Adjusted Available Flow (gpm) | Design Flow (gpm) |
| J-30 | 1,004.24 | J-30 | 47.25 | 190.04 | 1,637.11 | 1,637.23 | J-30 | 20 | 127.16 | 1,637.23 | 1,637.11 |
| J-31 | 1,004.24 | J-31 | 39.83 | 171.92 | 1,359.10 | 1,359.17 | J-31 | 20 | 126.16 | 1,359.17 | 1,359.10 |
| J-32 | 1,004.24 | J-32 | 46.86 | 176.14 | 1,501.97 | 1,502.07 | J-32 | 20 | 114.16 | 1,502.07 | 1,501.97 |
| J-36 | 1,004.24 | J-143 | 59.64 | 221.44 | 3,342.17 | 3,568.09 | J-143 | 14.39 | 117.01 | 3,342.18 | 3,342.17 |
| J-37 | 1,004.24 | J-37 | 55.89 | 195.99 | 1,905.26 | 1,905.26 | J-37 | 20 | 113.16 | 1,905.26 | 1,905.26 |
| J-4 | 1,000.00 | J-4 | 62.38 | 216.96 | 2,866.53 | 2,866.53 | J-4 | 20 | 119.16 | 2,866.53 | 2,866.53 |
| J-40 | 1,004.24 | J-18 | 60.07 | 214.63 | 2,641.10 | 2,654.01 | J-18 | 19.57 | 121.16 | 2,641.10 | 2,641.10 |
| J-42 | 1,004.24 | J-42 | 69.27 | 229.76 | 5,594.07 | 5,594.07 | J-42 | 20 | 116.06 | 5,594.08 | 5,594.07 |
| J-66 | 1,004.24 | J-66 | 67.91 | 232.73 | 7,713.90 | 7,713.91 | J-66 | 20 | 122.16 | 7,713.92 | 7,713.90 |
| J-72 | 1,004.24 | J-72 | 68.76 | 230.2 | 5,940.74 | 5,940.75 | J-72 | 20 | 117.66 | 5,940.75 | 5,940.74 |
| J-74 | 1,004.24 | J12 | 63.29 | 218.07 | 2,888.72 | 2,888.73 | J12 | 20 | 118.15 | 2,888.69 | 2,888.69 |
| J-78 | 1,004.24 | J-78 | 69.94 | 231.5 | 6,918.06 | 6,918.07 | J-78 | 20 | 116.26 | 6,918.08 | 6,918.06 |
| J-80 | 1,004.24 | J-80 | 69.32 | 231.78 | 7,141.15 | 7,141.16 | J-80 | 20 | 117.96 | 7,141.17 | 7,141.15 |
| J-82 | 1,004.24 | J12 | 57.21 | 204.04 | 2,072.10 | 2,072.11 | J12 | 20 | 118.16 | 2,072.10 | 2,072.10 |
| J-84 | 1,004.24 | J-84 | 69.61 | 230.04 | 5,653.58 | 5,653.58 | J-84 | 20 | 115.56 | 5,653.58 | 5,653.58 |
| J-86 | 1,004.24 | J-86 | 68.77 | 230.52 | 5,892.11 | 5,892.11 | J-86 | 20 | 117.96 | 5,892.11 | 5,892.11 |
| J-88 | 1,004.24 | J-88 | 68.66 | 233.45 | 9,212.31 | 9,212.38 | J-88 | 20 | 121.16 | 9,212.40 | 9,212.31 |
| J-90 | 1,004.24 | J-90 | 67.47 | 232.72 | 7,623.14 | 7,623.14 | J-90 | 20 | 123.16 | 7,623.16 | 7,623.14 |
| J-92 | 1,004.24 | J-92 | 67.09 | 232.85 | 7,710.75 | 7,710.76 | J-92 | 20 | 124.16 | 7,710.77 | 7,710.75 |
| J-94 | 1,004.24 | J-94 | 67.23 | 233.17 | 8,210.87 | 8,210.89 | J-94 | 20 | 124.16 | 8,210.90 | 8,210.87 |
| J-96 | 1,004.24 | J-94 | 67.54 | 233.86 | 9,935.80 | 10,036.62 | J-94 | 19.1 | 122.09 | 9,935.93 | 9,935.80 |
| J-98 | 1,004.24 | J-98 | 67.12 | 228.91 | 4,820.90 | 4,820.83 | J-98 | 20 | 120.16 | 4,820.83 | 4,820.83 |
| J10 | 1,004.24 | J10 | 68.66 | 229.45 | 5,269.66 | 5,269.66 | J10 | 20 | 117.16 | 5,269.66 | 5,269.66 |
| J12 | 1,004.24 | J12 | 49.54 | 186.34 | 1,617.22 | 1,617.23 | J12 | 20 | 118.16 | 1,617.23 | 1,617.22 |
| J16 | 1,004.24 | J16 | 58.02 | 214.9 | 2,640.80 | 2,640.80 | J16 | 20 | 127.16 | 2,640.80 | 2,640.80 |
| J18 | 1,004.24 | J18 | 59.38 | 220.84 | 3,164.06 | 3,164.06 | J18 | 20 | 129.96 | 3,164.07 | 3,164.06 |
| J20 | 1,004.24 | J20 | 54.64 | 200.09 | 1,949.78 | 1,949.92 | J20 | 20 | 120.16 | 1,949.92 | 1,949.78 |

| | Fire Flow 2018 with Improved System | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Fire Flow | | | | | | | |
| | ID | Static Demand (gpm) | Static Pressure (psi) | Static Head (ft) | Fire-Flow Demand (gpm) | Residual Pressure (psi) | Available Flow at Hydrant (gpm) | Available Flow Pressure (psi) |
| | J-10 | 4.24 | 69.59 | 235.6 | 1,000.00 | 60.1 | 2,588.84 | 20 |
| | J-100 | 4.24 | 70.67 | 236.31 | 1,000.00 | 65.76 | 3,733.15 | 20 |
| | J-12 | 4.24 | 69.59 | 235.61 | 1,000.00 | 59.97 | 2,565.46 | 20 |
| | J-120 | 4.24 | 65.41 | 235.55 | 1,000.00 | 61.56 | 4,106.71 | 20 |
| | J-121 | 4.24 | 65.98 | 235.57 | 1,000.00 | 62.44 | 4,433.62 | 20 |
| | J-122 | 4.24 | 65.75 | 235.53 | 1,000.00 | 60.65 | 3,560.14 | 20 |
| | J-123 | 4.24 | 70.64 | 235.83 | 1,000.00 | 68.25 | 6,183.34 | 20 |
| | J-124 | 4.24 | 69.99 | 235.92 | 1,000.00 | 67.4 | 5,711.52 | 20 |
| | J-125 | 4.24 | 69.81 | 236.12 | 1,000.00 | 66.78 | 5,142.85 | 20 |
| | J-126 | 4.24 | 69.74 | 235.95 | 1,000.00 | 65.77 | 4,364.47 | 20 |
| | J-127 | 4.24 | 70.09 | 235.86 | 1,000.00 | 63.81 | 3,253.06 | 20 |
| | J-128 | 4.24 | 70.1 | 235.78 | 1,000.00 | 66.69 | 4,912.43 | 20 |
| | J-129 | 4.24 | 71.05 | 235.78 | 1,000.00 | 47.78 | 1,549.70 | 20 |
| | J-130 | 4.24 | 70.26 | 235.54 | 1,000.00 | 45.18 | 1,480.73 | 20 |
| | J-132 | 4.24 | 70.15 | 235.69 | 1,000.00 | 65.83 | 4,294.93 | 20 |
| | J-133 | 4.24 | 70.18 | 235.57 | 1,000.00 | 64.79 | 3,747.46 | 20 |
| | J-135 | 4.24 | 70.01 | 235.48 | 1,000.00 | 31.05 | 1,152.74 | 20 |
| | J-136 | 4.24 | 70.38 | 235.53 | 1,000.00 | 64.49 | 3,563.72 | 20 |
| | J-137 | 4.24 | 70.29 | 235.52 | 1,000.00 | 59.62 | 2,432.25 | 20 |
| | J-138 | 4.24 | 70.29 | 235.61 | 1,000.00 | 56.99 | 2,130.79 | 20 |
| | J-139 | 4.24 | 68.35 | 235.43 | 1,000.00 | 62.25 | 3,462.97 | 20 |
| | J-14 | 4.24 | 70.29 | 235.62 | 1,000.00 | 60.85 | 2,615.33 | 20 |
| | J-140 | 4.24 | 69.69 | 235.43 | 1,000.00 | 63.68 | 3,554.65 | 20 |
| | J-141 | 4.24 | 69.99 | 235.43 | 1,000.00 | 64.13 | 3,623.91 | 20 |
| | J-142 | 4.24 | 70.56 | 235.43 | 1,000.00 | 64.64 | 3,621.27 | 20 |
| | J-143 | 4.24 | 65.7 | 235.44 | 1,000.00 | 59.5 | 3,288.34 | 20 |
| | J-144 | 4.24 | 66.91 | 235.43 | 1,000.00 | 59.51 | 2,969.64 | 20 |
| | J-145 | 4.24 | 66.48 | 235.43 | 1,000.00 | 58.52 | 2,817.72 | 20 |
| | J-146 | 4.24 | 72.23 | 235.39 | 1,000.00 | 57.52 | 2,070.80 | 20 |
| | J-147 | 4.24 | 73.61 | 235.38 | 1,000.00 | 55.89 | 1,883.65 | 20 |
| | J-148 | 4.24 | 72.61 | 235.38 | 1,000.00 | 47.17 | 1,510.91 | 20 |
| | J-149 | 4.24 | 72.49 | 235.39 | 1,000.00 | 59.2 | 2,208.82 | 20 |
| | J-150 | 4.24 | 72.44 | 235.39 | 1,000.00 | 60.41 | 2,349.17 | 20 |
| | J-151 | 4.24 | 72.05 | 235.39 | 1,000.00 | 59.83 | 2,315.10 | 20 |
| | J-152 | 4.24 | 72.44 | 235.38 | 1,000.00 | 58.82 | 2,179.03 | 20 |
| | J-153 | 4.24 | 72.57 | 235.38 | 1,000.00 | 56.87 | 2,003.20 | 20 |
| | J-154 | 4.24 | 72.31 | 235.38 | 1,000.00 | 59.93 | 2,308.80 | 20 |
| | J-155 | 4.24 | 69.11 | 235.38 | 1,000.00 | 58.8 | 2,498.59 | 20 |
| | J-156 | 4.24 | 70.36 | 235.38 | 1,000.00 | 60.53 | 2,611.11 | 20 |
| | J-158 | 4.24 | 70.62 | 235.38 | 1,000.00 | 57.93 | 2,230.54 | 20 |
| | J-159 | 4.24 | 68.98 | 235.39 | 1,000.00 | 57.29 | 2,298.16 | 20 |
| | J-16 | 4.24 | 70.47 | 235.63 | 1,000.00 | 61.84 | 2,768.31 | 20 |
| | J-160 | 4.24 | 70.36 | 235.39 | 1,000.00 | 61.43 | 2,771.78 | 20 |
| | J-161 | 4.24 | 68.59 | 235.4 | 1,000.00 | 57.87 | 2,411.02 | 20 |
| | J-162 | 4.24 | 68.73 | 235.41 | 1,000.00 | 60.32 | 2,814.91 | 20 |
| | J-163 | 4.24 | 68.73 | 235.41 | 1,000.00 | 61.29 | 3,050.31 | 20 |
| | J-164 | 4.24 | 70.59 | 235.41 | 1,000.00 | 63.17 | 3,131.74 | 20 |
| | J-166 | 4.24 | 68.73 | 235.43 | 1,000.00 | 62.2 | 3,320.99 | 20 |
| | J-168 | 4.24 | 70.27 | 235.57 | 1,000.00 | 40.95 | 1,354.78 | 20 |
| | J-169 | 4.24 | 69.68 | 235.81 | 1,000.00 | 64.88 | 3,902.57 | 20 |
| | J-170 | 4.24 | 68.97 | 235.38 | 1,000.00 | 55.56 | 2,114.51 | 20 |
| | J-171 | 4.24 | 71.28 | 235.41 | 1,000.00 | 64.43 | 3,320.21 | 20 |
| | J-172 | 4.24 | 71.49 | 236 | 1,000.00 | 69.73 | 7,301.71 | 20 |
| | J-174 | 4.24 | 71.49 | 236 | 1,000.00 | 61.53 | 2,492.74 | 20 |
| | J-176 | 4.24 | 71.56 | 236.05 | 1,000.00 | 69.27 | 6,068.30 | 20 |
| | J-178 | 4.24 | 71.93 | 236 | 1,000.00 | 69.22 | 5,440.06 | 20 |
| | J-18 | 4.24 | 69.17 | 235.63 | 1,000.00 | 58.88 | 2,449.71 | 20 |
| | J-180 | 4.24 | 69.55 | 235.52 | 1,000.00 | 66.91 | 5,271.96 | 20 |
| | J-182 | 4.24 | 69.48 | 235.36 | 1,000.00 | 66.91 | 5,206.38 | 20 |
| | J-184 | 4.24 | 71.93 | 236 | 1,000.00 | 61.67 | 2,462.29 | 20 |
| | J-186 | 4.24 | 71.93 | 236.01 | 1,000.00 | 70.19 | 7,380.84 | 20 |

| | Fire Flow 2018 with Improved System | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Fire Flow | | | | | | | |
| | ID | Static Demand (gpm) | Static Pressure (psi) | Static Head (ft) | Fire-Flow Demand (gpm) | Residual Pressure (psi) | Available Flow at Hydrant (gpm) | Available Flow Pressure (psi) |
| | J-188 | 4.24 | 71.74 | 236.07 | 1,000.00 | 69.53 | 6,214.95 | 20 |
| | J-190 | 4.24 | 70.84 | 236.29 | 1,000.00 | 63.89 | 3,048.39 | 20 |
| | J-192 | 4.24 | 71.93 | 236.01 | 1,000.00 | 69.45 | 5,764.08 | 20 |
| | J-194 | 4.24 | 71.93 | 236.01 | 1,000.00 | 69.59 | 5,979.70 | 20 |
| | J-196 | 4.24 | 72.11 | 235.42 | 1,000.00 | 65.79 | 3,198.59 | 20 |
| | J-198 | 4.24 | 72.46 | 236.03 | 1,000.00 | 70.75 | 7,459.40 | 20 |
| | J-20 | 4.24 | 67.48 | 235.73 | 1,000.00 | 60.74 | 3,095.96 | 20 |
| | J-200 | 4.24 | 72.58 | 236.1 | 1,000.00 | 70.85 | 7,419.25 | 20 |
| | J-202 | 4.24 | 71.63 | 236.21 | 1,000.00 | 69.76 | 6,907.15 | 20 |
| | J-204 | 4.24 | 71.62 | 236.29 | 1,000.00 | 63.62 | 2,832.85 | 20 |
| | J-206 | 4.24 | 70.31 | 235.27 | 1,000.00 | 65.65 | 3,699.20 | 20 |
| | J-208 | 4.24 | 71.5 | 235.31 | 1,000.00 | 65.03 | 3,123.40 | 20 |
| | J-210 | 4.24 | 71.02 | 236.1 | 1,000.00 | 66.08 | 3,706.19 | 20 |
| | J-212 | 4.24 | 72.02 | 236.21 | 1,000.00 | 66.88 | 3,656.33 | 20 |
| | J-214 | 4.24 | 71.31 | 236.57 | 1,000.00 | 69.25 | 6,485.83 | 20 |
| | J-216 | 4.24 | 67.19 | 237.06 | 1,000.00 | 65.46 | 7,213.48 | 20 |
| | J-218 | 4.24 | 72.09 | 235.38 | 1,000.00 | 61.67 | 2,417.45 | 20 |
| | J-220 | 4.24 | 70.32 | 235.3 | 1,000.00 | 60.41 | 2,434.19 | 20 |
| | J-222 | 4.24 | 69.4 | 235.17 | 1,000.00 | 68.36 | 8,336.91 | 20 |
| | J-224 | 4.24 | 69.48 | 235.36 | 1,000.00 | 64.84 | 3,693.29 | 20 |
| | J-226 | 4.24 | 72.19 | 239.6 | 1,000.00 | 70.72 | 13,096.16 | 20 |
| | J-228 | 4.24 | 67.71 | 238.27 | 1,000.00 | 66.49 | 12,342.46 | 20 |
| | J-23 | 4.24 | 71.45 | 235.91 | 1,000.00 | 69.09 | 6,133.41 | 20 |
| | J-230 | 4.24 | 67.71 | 238.27 | 1,000.00 | 65.97 | 8,183.68 | 20 |
| | J-232 | 4.24 | 67.71 | 238.27 | 1,000.00 | 65.56 | 6,757.12 | 20 |
| | J-234 | 4.24 | 67.17 | 237.02 | 1,000.00 | 66.31 | 12,411.41 | 20 |
| | J-236 | 4.24 | 67.32 | 237.36 | 1,000.00 | 66.35 | 12,467.87 | 20 |
| | J-238 | 4.24 | 68.86 | 235.91 | 1,000.00 | 68.34 | 12,729.58 | 20 |
| | J-24 | 4.24 | 71.46 | 235.92 | 1,000.00 | 68.91 | 5,807.11 | 20 |
| | J-240 | 4.24 | 68.54 | 236.19 | 1,000.00 | 67.92 | 12,185.16 | 20 |
| | J-242 | 4.24 | 68.63 | 236.4 | 1,000.00 | 67.95 | 12,127.13 | 20 |
| | J-244 | 4.24 | 68.7 | 236.54 | 1,000.00 | 67.97 | 12,224.01 | 20 |
| | J-246 | 4.24 | 69.22 | 236.76 | 1,000.00 | 68.37 | 11,195.24 | 20 |
| | J-248 | 4.24 | 70.54 | 236.79 | 1,000.00 | 69.66 | 12,090.54 | 20 |
| | J-25 | 4.24 | 71.49 | 235.99 | 1,000.00 | 68.94 | 5,811.70 | 20 |
| | J-250 | 4.24 | 70.53 | 236.76 | 1,000.00 | 69.61 | 11,625.11 | 20 |
| | J-252 | 4.24 | 71.38 | 236.74 | 1,000.00 | 70.3 | 10,122.21 | 20 |
| | J-254 | 4.24 | 72.24 | 236.73 | 1,000.00 | 71.08 | 9,664.30 | 20 |
| | J-256 | 4.24 | 72.24 | 236.71 | 1,000.00 | 71.03 | 9,357.65 | 20 |
| | J-258 | 4.24 | 70.5 | 236.69 | 1,000.00 | 69.29 | 9,176.11 | 20 |
| | J-26 | 4.24 | 71.5 | 236.02 | 1,000.00 | 69.57 | 7,034.83 | 20 |
| | J-260 | 4.24 | 70.92 | 236.68 | 1,000.00 | 69.76 | 9,504.94 | 20 |
| | J-262 | 4.24 | 70.48 | 236.66 | 1,000.00 | 69.43 | 10,256.00 | 20 |
| | J-264 | 4.24 | 70.48 | 236.65 | 1,000.00 | 69.52 | 11,160.90 | 20 |
| | J-266 | 4.24 | 70.49 | 236.69 | 1,000.00 | 69.57 | 11,400.93 | 20 |
| | J-268 | 4.24 | 70.49 | 236.69 | 1,000.00 | 69.58 | 11,513.38 | 20 |
| | J-27 | 4.24 | 69.92 | 236.35 | 1,000.00 | 68.53 | 8,854.71 | 20 |
| | J-270 | 4.24 | 70.47 | 236.63 | 1,000.00 | 69.51 | 11,313.69 | 20 |
| | J-272 | 4.24 | 70.47 | 236.64 | 1,000.00 | 69.53 | 11,263.95 | 20 |
| | J-274 | 4.24 | 69.61 | 236.64 | 1,000.00 | 68.55 | 9,895.54 | 20 |
| | J-276 | 4.24 | 69.17 | 236.64 | 1,000.00 | 68.12 | 9,786.79 | 20 |
| | J-278 | 4.24 | 69.61 | 236.64 | 1,000.00 | 68.62 | 10,244.28 | 20 |
| | J-28 | 4.24 | 71.23 | 235.38 | 1,000.00 | 58.57 | 2,250.11 | 20 |
| | J-280 | 4.24 | 69.61 | 236.64 | 1,000.00 | 68.71 | 10,945.70 | 20 |
| | J-282 | 4.24 | 70.5 | 236.71 | 1,000.00 | 69.61 | 11,566.93 | 20 |
| | J-284 | 4.24 | 68.73 | 236.61 | 1,000.00 | 67.83 | 10,548.98 | 20 |
| | J-286 | 4.24 | 67.85 | 236.59 | 1,000.00 | 66.98 | 10,582.82 | 20 |
| | J-288 | 4.24 | 72.53 | 235.39 | 1,000.00 | 51.06 | 1,664.23 | 20 |
| | J-29 | 4.24 | 72.09 | 235.38 | 1,000.00 | 59.23 | 2,249.05 | 20 |
| | J-290 | 4.24 | 68.64 | 235.41 | 1,000.00 | 61.49 | 3,129.21 | 20 |
| | J-292 | 4.24 | 69.72 | 235.38 | 1,000.00 | 58.62 | 2,402.34 | 20 |

| | Fire Flow 2018 with Improved System | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Fire Flow | | | | | | | |
| ID | Static Demand (gpm) | Static Pressure (psi) | Static Head (ft) | Fire-Flow Demand (gpm) | Residual Pressure (psi) | Available Flow at Hydrant (gpm) | Available Flow Pressure (psi) |
| J-30 | 4.24 | 66.96 | 235.54 | 1,000.00 | 47.25 | 1,637.23 | 20 |
| J-31 | 4.24 | 67.38 | 235.52 | 1,000.00 | 39.83 | 1,359.17 | 20 |
| J-32 | 4.24 | 72.53 | 235.38 | 1,000.00 | 46.86 | 1,502.07 | 20 |
| J-36 | 4.24 | 72.55 | 235.44 | 1,000.00 | 66.36 | 3,568.09 | 20 |
| J-37 | 4.24 | 72.97 | 235.4 | 1,000.00 | 55.89 | 1,905.26 | 20 |
| J-4 | 0 | 70.48 | 235.67 | 1,000.00 | 62.38 | 2,866.53 | 20 |
| J-40 | 4.24 | 69.6 | 235.63 | 1,000.00 | 60.5 | 2,654.01 | 20 |
| J-42 | 4.24 | 71.94 | 235.92 | 1,000.00 | 69.27 | 5,594.07 | 20 |
| J-66 | 4.24 | 69.5 | 236.4 | 1,000.00 | 67.91 | 7,713.91 | 20 |
| J-72 | 4.24 | 71.23 | 235.89 | 1,000.00 | 68.76 | 5,940.75 | 20 |
| J-74 | 4.24 | 71.02 | 235.91 | 1,000.00 | 63.29 | 2,888.73 | 20 |
| J-78 | 4.24 | 71.86 | 235.94 | 1,000.00 | 69.94 | 6,918.07 | 20 |
| J-80 | 4.24 | 71.14 | 235.98 | 1,000.00 | 69.32 | 7,141.16 | 20 |
| J-82 | 4.24 | 71.02 | 235.91 | 1,000.00 | 57.21 | 2,072.11 | 20 |
| J-84 | 4.24 | 72.2 | 236.04 | 1,000.00 | 69.61 | 5,653.58 | 20 |
| J-86 | 4.24 | 71.17 | 236.04 | 1,000.00 | 68.77 | 5,892.11 | 20 |
| J-88 | 4.24 | 69.94 | 236.4 | 1,000.00 | 68.66 | 9,212.38 | 20 |
| J-90 | 4.24 | 69.07 | 236.41 | 1,000.00 | 67.47 | 7,623.14 | 20 |
| J-92 | 4.24 | 68.65 | 236.44 | 1,000.00 | 67.09 | 7,710.76 | 20 |
| J-94 | 4.24 | 68.66 | 236.47 | 1,000.00 | 67.23 | 8,210.89 | 20 |
| J-96 | 4.24 | 69.98 | 236.5 | 1,000.00 | 68.84 | 10,036.62 | 20 |
| J-98 | 4.24 | 70.34 | 236.34 | 1,000.00 | 67.12 | 4,820.83 | 20 |
| J10 | 4.24 | 71.49 | 236 | 1,000.00 | 68.66 | 5,269.66 | 20 |
| J12 | 4.24 | 71.02 | 235.91 | 1,000.00 | 49.54 | 1,617.23 | 20 |
| J16 | 4.24 | 66.91 | 235.43 | 1,000.00 | 58.02 | 2,640.80 | 20 |
| J18 | 4.24 | 65.72 | 235.48 | 1,000.00 | 59.38 | 3,164.06 | 20 |
| J20 | 4.24 | 70.03 | 235.61 | 1,000.00 | 54.64 | 1,949.92 | 20 |

| Fire Flow 2032 with Improved System | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fire Flow Design | | | | | | | | | | | |
| ID | Total Demand (gpm) | Critical Fire Node ID | Critical Fire Node Pressure (psi) | Critical Fire Node Head (ft) | Adjusted Fire-Flow (gpm) | Available Flow at Hydrant (gpm) | Critical Available Node ID | Critical Available Node Pressure (psi) | Critical Available Node Head (ft) | Adjusted Available Flow (gpm) | Design Flow (gpm) |
| J-10 | 1,004.84 | J-10 | 59.81 | 213.02 | 2,572.09 | 2,572.09 | J-10 | 20 | 121.16 | 2,572.09 | 2,572.09 |
| J-100 | 1,004.84 | J-100 | 65.66 | 224.73 | 3,720.11 | 3,720.10 | J-100 | 20 | 119.36 | 3,720.10 | 3,720.10 |
| J-12 | 1,004.84 | J-12 | 59.68 | 212.73 | 2,549.12 | 2,549.12 | J-12 | 20 | 121.16 | 2,549.13 | 2,549.12 |
| J-120 | 1,004.84 | J-120 | 61.39 | 226.28 | 4,084.37 | 4,084.37 | J-120 | 20 | 130.76 | 4,084.37 | 4,084.37 |
| J-121 | 1,004.84 | J-121 | 62.25 | 226.97 | 4,404.39 | 4,404.40 | J-121 | 20 | 129.46 | 4,404.40 | 4,404.39 |
| J-122 | 1,004.84 | J-122 | 60.42 | 223.25 | 3,536.32 | 3,536.32 | J-122 | 20 | 129.96 | 3,536.33 | 3,536.32 |
| J-123 | 1,004.84 | J-123 | 68.08 | 229.91 | 6,137.68 | 6,137.74 | J-123 | 20 | 118.96 | 6,137.75 | 6,137.68 |
| J-124 | 1,004.84 | J-124 | 67.24 | 229.59 | 5,675.01 | 5,675.03 | J-124 | 20 | 120.56 | 5,675.03 | 5,675.01 |
| J-125 | 1,004.84 | J-125 | 66.63 | 228.77 | 5,112.66 | 5,112.67 | J-125 | 20 | 121.16 | 5,112.67 | 5,112.66 |
| J-126 | 1,004.84 | J-126 | 65.59 | 226.36 | 4,337.36 | 4,337.37 | J-126 | 20 | 121.16 | 4,337.37 | 4,337.36 |
| J-127 | 1,004.84 | J-127 | 63.63 | 220.94 | 3,238.05 | 3,238.05 | J-127 | 20 | 120.26 | 3,238.05 | 3,238.05 |
| J-128 | 1,004.84 | J-128 | 66.48 | 227.43 | 4,875.97 | 4,876.00 | J-128 | 20 | 120.16 | 4,876.00 | 4,875.97 |
| J-129 | 1,004.84 | J-129 | 47.55 | 181.54 | 1,545.36 | 1,545.37 | J-129 | 20 | 117.96 | 1,545.37 | 1,545.36 |
| J-130 | 1,004.84 | J-130 | 44.83 | 176.86 | 1,473.96 | 1,474.01 | J-130 | 20 | 119.56 | 1,474.01 | 1,473.96 |
| J-132 | 1,004.84 | J-132 | 65.59 | 225.16 | 4,259.97 | 4,259.99 | J-132 | 20 | 119.96 | 4,260.00 | 4,259.97 |
| J-133 | 1,004.84 | J-133 | 64.51 | 222.47 | 3,715.81 | 3,715.83 | J-133 | 20 | 119.76 | 3,715.83 | 3,715.81 |
| J-135 | 1,004.84 | J-135 | 30.68 | 144.7 | 1,148.33 | 1,148.34 | J-135 | 20 | 120.06 | 1,148.34 | 1,148.33 |
| J-136 | 1,004.84 | J-137 | 64.1 | 221.24 | 3,529.50 | 3,532.97 | J-137 | 19.91 | 119.26 | 3,529.52 | 3,529.50 |
| J-137 | 1,004.84 | J-137 | 59.31 | 210.18 | 2,416.91 | 2,416.91 | J-137 | 20 | 119.46 | 2,416.91 | 2,416.91 |
| J-138 | 1,004.84 | J20 | 56.44 | 204.25 | 2,113.10 | 2,119.22 | J20 | 19.74 | 119.56 | 2,113.10 | 2,113.10 |
| J-139 | 1,004.84 | J-139 | 61.9 | 220.56 | 3,427.77 | 3,427.80 | J-139 | 20 | 123.86 | 3,427.80 | 3,427.77 |
| J-14 | 1,004.84 | J-14 | 60.56 | 213.17 | 2,598.78 | 2,598.78 | J-14 | 20 | 119.56 | 2,598.78 | 2,598.78 |
| J-140 | 1,004.84 | J-139 | 62.01 | 220.8 | 3,469.75 | 3,518.80 | J-139 | 18.8 | 121.09 | 3,469.78 | 3,469.75 |
| J-141 | 1,004.84 | J-139 | 62.17 | 221.18 | 3,532.69 | 3,587.41 | J-139 | 18.69 | 120.83 | 3,532.73 | 3,532.69 |
| J-142 | 1,004.84 | J-143 | 59.8 | 221.81 | 3,514.73 | 3,585.39 | J-143 | 18.39 | 126.23 | 3,514.77 | 3,514.73 |
| J-143 | 1,004.84 | J-143 | 59.17 | 220.35 | 3,256.14 | 3,256.16 | J-143 | 20 | 129.96 | 3,256.16 | 3,256.14 |
| J-144 | 1,004.84 | J-145 | 58.74 | 217.56 | 2,927.58 | 2,943.07 | J-145 | 19.57 | 127.16 | 2,927.59 | 2,927.58 |
| J-145 | 1,004.84 | J-145 | 58.18 | 216.28 | 2,793.35 | 2,793.36 | J-145 | 20 | 128.16 | 2,793.36 | 2,793.35 |
| J-146 | 1,004.84 | J-146 | 57.13 | 200.56 | 2,056.78 | 2,056.78 | J-146 | 20 | 114.86 | 2,056.78 | 2,056.78 |
| J-147 | 1,004.84 | J-147 | 55.48 | 193.54 | 1,871.61 | 1,871.61 | J-147 | 20 | 111.66 | 1,871.61 | 1,871.61 |
| J-148 | 1,004.84 | J-148 | 46.74 | 175.67 | 1,502.46 | 1,502.57 | J-148 | 20 | 113.96 | 1,502.56 | 1,502.46 |
| J-149 | 1,004.84 | J-149 | 58.81 | 203.83 | 2,193.03 | 2,193.03 | J-149 | 20 | 114.26 | 2,193.03 | 2,193.03 |
| J-150 | 1,004.84 | J-150 | 60.02 | 206.71 | 2,331.12 | 2,331.13 | J-150 | 20 | 114.36 | 2,331.12 | 2,331.12 |
| J-151 | 1,004.84 | J-151 | 59.44 | 206.29 | 2,297.62 | 2,297.62 | J-151 | 20 | 115.26 | 2,297.62 | 2,297.62 |
| J-152 | 1,004.84 | J-152 | 58.41 | 203.01 | 2,162.98 | 2,162.98 | J-152 | 20 | 114.36 | 2,162.98 | 2,162.98 |
| J-153 | 1,004.84 | J-153 | 56.47 | 198.22 | 1,989.41 | 1,989.41 | J-153 | 20 | 114.06 | 1,989.41 | 1,989.41 |
| J-154 | 1,004.84 | J-154 | 59.53 | 205.89 | 2,290.83 | 2,290.83 | J-154 | 20 | 114.66 | 2,290.83 | 2,290.83 |
| J-155 | 1,004.84 | J-155 | 58.4 | 210.67 | 2,476.57 | 2,476.58 | J-155 | 20 | 122.05 | 2,476.58 | 2,476.57 |
| J-156 | 1,004.84 | J-170 | 58.76 | 211.8 | 2,547.33 | 2,588.14 | J-170 | 18.61 | 119.16 | 2,547.33 | 2,547.33 |
| J-158 | 1,004.84 | J-158 | 57.53 | 205.17 | 2,213.24 | 2,213.24 | J-158 | 20 | 118.56 | 2,213.24 | 2,213.24 |
| J-159 | 1,004.84 | J-159 | 56.91 | 207.54 | 2,280.07 | 2,280.07 | J-159 | 20 | 122.36 | 2,280.07 | 2,280.07 |
| J-16 | 1,004.84 | J-18 | 60.27 | 215.08 | 2,712.00 | 2,750.27 | J-18 | 18.75 | 119.28 | 2,712.01 | 2,712.00 |
| J-160 | 1,004.84 | J-160 | 61.05 | 213.9 | 2,746.82 | 2,746.83 | J-160 | 20 | 119.16 | 2,746.83 | 2,746.82 |
| J-161 | 1,004.84 | J-161 | 57.49 | 209.79 | 2,391.46 | 2,391.46 | J-161 | 20 | 123.26 | 2,391.46 | 2,391.46 |
| J-162 | 1,004.84 | J-162 | 59.95 | 215.16 | 2,789.73 | 2,789.73 | J-162 | 20 | 122.96 | 2,789.73 | 2,789.73 |
| J-163 | 1,004.84 | J-163 | 60.93 | 217.43 | 3,021.51 | 3,021.52 | J-163 | 20 | 122.96 | 3,021.53 | 3,021.51 |
| J-164 | 1,004.84 | J-164 | 62.81 | 217.46 | 3,101.96 | 3,101.97 | J-164 | 20 | 118.66 | 3,101.97 | 3,101.96 |
| J-166 | 1,004.84 | J-166 | 61.85 | 219.55 | 3,288.32 | 3,288.34 | J-166 | 20 | 122.96 | 3,288.35 | 3,288.32 |
| J-168 | 1,004.84 | J-168 | 40.61 | 167.13 | 1,349.51 | 1,349.54 | J-168 | 20 | 119.56 | 1,349.54 | 1,349.51 |
| J-169 | 1,004.84 | J-20 | 62.6 | 224.47 | 3,871.57 | 3,876.53 | J-20 | 19.89 | 125.91 | 3,871.58 | 3,871.57 |
| J-170 | 1,004.84 | J-170 | 55.16 | 203.51 | 2,098.52 | 2,098.52 | J-170 | 20 | 122.36 | 2,098.52 | 2,098.52 |
| J-171 | 1,004.84 | J-170 | 61.89 | 219.04 | 3,260.24 | 3,288.25 | J-170 | 19.26 | 120.66 | 3,260.27 | 3,260.24 |
| J-172 | 1,004.84 | J-172 | 69.6 | 231.63 | 7,258.02 | 7,258.06 | J-172 | 20 | 117.16 | 7,258.07 | 7,258.02 |
| J-174 | 1,004.84 | J-174 | 61.39 | 212.69 | 2,486.29 | 2,486.22 | J-174 | 20 | 117.16 | 2,486.22 | 2,486.22 |
| J-176 | 1,004.84 | J-176 | 69.15 | 230.48 | 6,037.68 | 6,037.68 | J-176 | 20 | 117.06 | 6,037.69 | 6,037.68 |
| J-178 | 1,004.84 | J-178 | 69.09 | 229.46 | 5,414.89 | 5,414.89 | J-178 | 20 | 116.16 | 5,414.89 | 5,414.89 |
| J-18 | 1,004.84 | J-18 | 58.59 | 211.22 | 2,434.78 | 2,434.78 | J-18 | 20 | 122.16 | 2,434.78 | 2,434.78 |
| J-180 | 1,004.84 | J-180 | 66.78 | 229.11 | 5,249.62 | 5,249.62 | J-180 | 20 | 121.16 | 5,249.62 | 5,249.62 |
| J-182 | 1,004.84 | J-224 | 66.79 | 229.15 | 5,188.58 | 5,188.60 | J-224 | 20 | 121.16 | 5,188.58 | 5,188.58 |
| J-184 | 1,004.84 | J-184 | 61.53 | 212 | 2,456.06 | 2,455.98 | J-184 | 20 | 116.16 | 2,455.98 | 2,455.98 |
| J-186 | 1,004.84 | J-186 | 70.07 | 231.7 | 7,337.61 | 7,337.64 | J-186 | 20 | 116.16 | 7,337.65 | 7,337.61 |

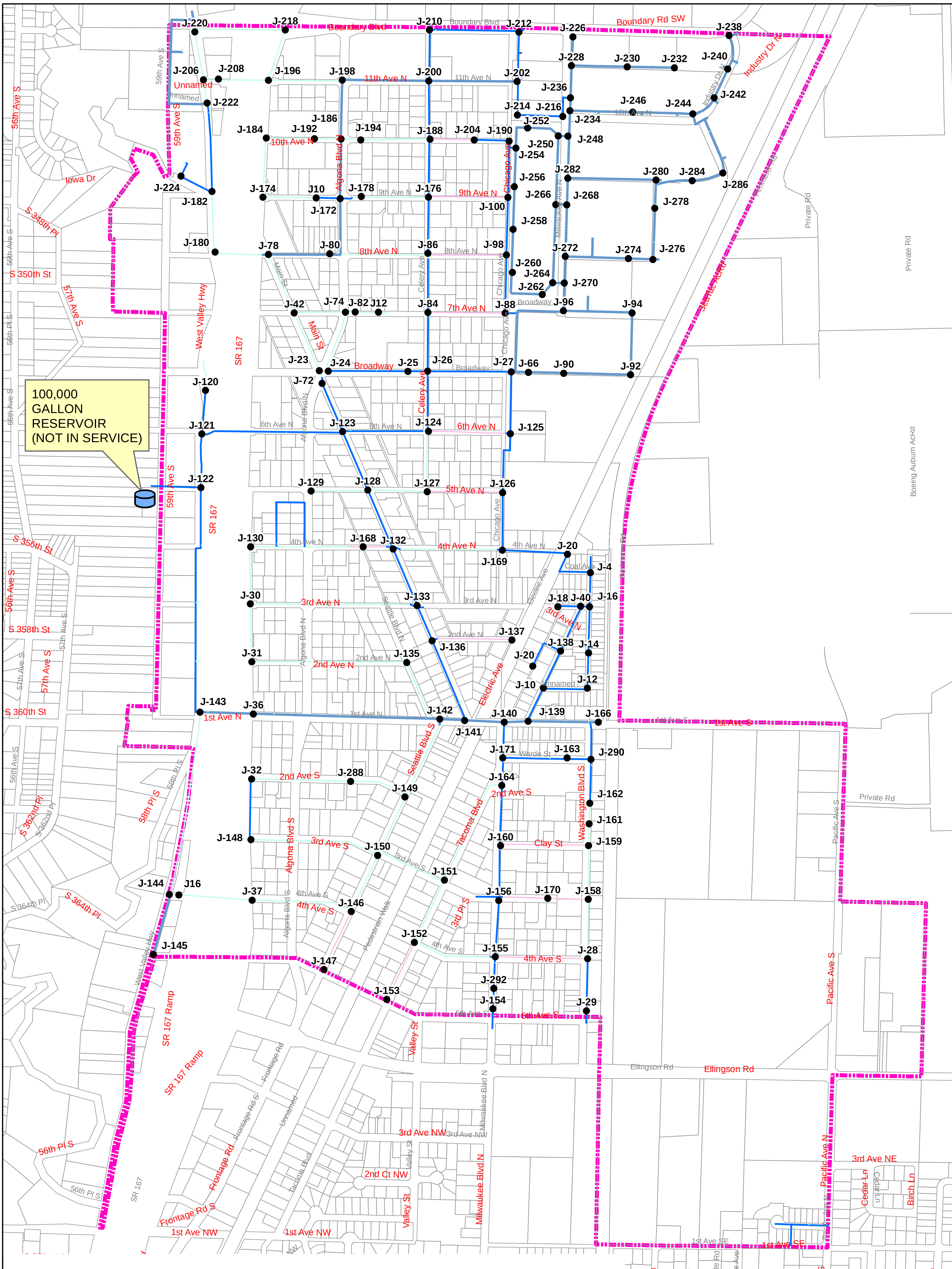
| Fire Flow 2032 with Improved System | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fire Flow Design | | | | | | | | | | | |
| ID | Total Demand (gpm) | Critical Fire Node ID | Critical Fire Node Pressure (psi) | Critical Fire Node Head (ft) | Adjusted Fire-Flow (gpm) | Available Flow at Hydrant (gpm) | Critical Available Node ID | Critical Available Node Pressure (psi) | Critical Available Node Head (ft) | Adjusted Available Flow (gpm) | Design Flow (gpm) |
| J-188 | 1,004.84 | J-188 | 69.41 | 230.69 | 6,183.80 | 6,183.80 | J-188 | 20 | 116.66 | 6,183.81 | 6,183.80 |
| J-190 | 1,004.84 | J-190 | 63.78 | 220 | 3,039.44 | 3,039.26 | J-190 | 20 | 118.96 | 3,039.26 | 3,039.26 |
| J-192 | 1,004.84 | J-192 | 69.32 | 229.98 | 5,736.15 | 5,736.16 | J-192 | 20 | 116.16 | 5,736.16 | 5,736.15 |
| J-194 | 1,004.84 | J-194 | 69.47 | 230.32 | 5,950.36 | 5,950.36 | J-194 | 20 | 116.16 | 5,950.37 | 5,950.36 |
| J-196 | 1,004.84 | J-196 | 65.68 | 220.57 | 3,191.22 | 3,191.36 | J-196 | 20 | 115.16 | 3,191.36 | 3,191.22 |
| J-198 | 1,004.84 | J-198 | 70.63 | 231.79 | 7,417.26 | 7,417.29 | J-198 | 20 | 114.96 | 7,417.30 | 7,417.26 |
| J-20 | 1,004.84 | J-20 | 60.49 | 219.61 | 3,075.38 | 3,075.38 | J-20 | 20 | 126.16 | 3,075.38 | 3,075.38 |
| J-200 | 1,004.84 | J-210 | 69.18 | 231.85 | 7,256.74 | 7,378.72 | J-210 | 18.44 | 114.76 | 7,256.77 | 7,256.74 |
| J-202 | 1,004.84 | J-202 | 69.65 | 231.64 | 6,872.66 | 6,872.67 | J-202 | 20 | 117.06 | 6,872.67 | 6,872.66 |
| J-204 | 1,004.84 | J-204 | 63.51 | 217.56 | 2,825.21 | 2,825.03 | J-204 | 20 | 117.16 | 2,825.03 | 2,825.03 |
| J-206 | 1,004.84 | J-206 | 65.55 | 224.27 | 3,690.41 | 3,690.66 | J-206 | 20 | 119.16 | 3,690.66 | 3,690.41 |
| J-208 | 1,004.84 | J-208 | 64.92 | 220.12 | 3,116.89 | 3,117.03 | J-208 | 20 | 116.46 | 3,117.03 | 3,116.89 |
| J-210 | 1,004.84 | J-210 | 65.96 | 224.43 | 3,694.27 | 3,694.16 | J-210 | 20 | 118.36 | 3,694.15 | 3,694.15 |
| J-212 | 1,004.84 | J-212 | 66.76 | 224.08 | 3,645.62 | 3,645.37 | J-212 | 20 | 116.16 | 3,645.37 | 3,645.37 |
| J-214 | 1,004.84 | J-214 | 69.16 | 231.6 | 6,458.78 | 6,458.77 | J-214 | 20 | 118.16 | 6,458.78 | 6,458.78 |
| J-216 | 1,004.84 | J-216 | 65.4 | 232.93 | 7,183.29 | 7,183.29 | J-216 | 20 | 128.16 | 7,183.30 | 7,183.29 |
| J-218 | 1,004.84 | J-218 | 61.55 | 211.06 | 2,413.23 | 2,413.29 | J-218 | 20 | 115.16 | 2,413.29 | 2,413.23 |
| J-220 | 1,004.84 | J-220 | 60.29 | 212.15 | 2,429.99 | 2,430.06 | J-220 | 20 | 119.16 | 2,430.05 | 2,429.99 |
| J-222 | 1,004.84 | J-222 | 68.3 | 232.62 | 8,316.76 | 8,316.75 | J-222 | 20 | 121.16 | 8,316.76 | 8,316.76 |
| J-224 | 1,004.84 | J-224 | 64.72 | 224.37 | 3,683.51 | 3,683.72 | J-224 | 20 | 121.16 | 3,683.72 | 3,683.51 |
| J-226 | 1,004.84 | J-226 | 70.69 | 236.15 | 13,046.06 | 13,045.86 | J-226 | 20 | 119.16 | 13,045.82 | 13,045.82 |
| J-228 | 1,004.84 | J-232 | 66.46 | 235.38 | 12,281.59 | 12,281.68 | J-232 | 20 | 128.16 | 12,281.71 | 12,281.59 |
| J-23 | 1,004.84 | J-23 | 68.94 | 230.11 | 6,094.81 | 6,094.83 | J-23 | 20 | 117.16 | 6,094.84 | 6,094.81 |
| J-230 | 1,004.84 | J-232 | 65.94 | 234.19 | 8,154.32 | 8,154.29 | J-232 | 20 | 128.16 | 8,154.30 | 8,154.30 |
| J-232 | 1,004.84 | J-232 | 65.53 | 233.23 | 6,736.18 | 6,736.16 | J-232 | 20 | 128.16 | 6,736.17 | 6,736.17 |
| J-234 | 1,004.84 | J-234 | 66.29 | 234.98 | 12,338.33 | 12,338.60 | J-234 | 20 | 128.16 | 12,338.64 | 12,338.33 |
| J-236 | 1,004.84 | J-236 | 66.33 | 235.09 | 12,397.02 | 12,397.33 | J-236 | 20 | 128.16 | 12,397.37 | 12,397.02 |
| J-238 | 1,004.84 | J-238 | 68.31 | 234.66 | 12,689.53 | 12,689.58 | J-238 | 20 | 123.16 | 12,689.53 | 12,689.53 |
| J-24 | 1,004.84 | J-24 | 68.76 | 229.7 | 5,772.41 | 5,772.42 | J-24 | 20 | 117.16 | 5,772.42 | 5,772.41 |
| J-240 | 1,004.84 | J-240 | 67.89 | 234.69 | 12,138.34 | 12,138.31 | J-240 | 20 | 124.16 | 12,138.36 | 12,138.34 |
| J-242 | 1,004.84 | J-242 | 67.92 | 234.76 | 12,073.14 | 12,073.13 | J-242 | 20 | 124.16 | 12,073.17 | 12,073.14 |
| J-244 | 1,004.84 | J-244 | 67.95 | 234.82 | 12,163.99 | 12,164.02 | J-244 | 20 | 124.16 | 12,164.06 | 12,163.99 |
| J-246 | 1,004.84 | J-246 | 68.35 | 234.73 | 11,140.03 | 11,140.07 | J-246 | 20 | 123.16 | 11,140.10 | 11,140.03 |
| J-248 | 1,004.84 | J-248 | 69.62 | 234.68 | 12,020.18 | 12,020.39 | J-248 | 20 | 120.16 | 12,020.43 | 12,020.18 |
| J-25 | 1,004.84 | J-25 | 68.8 | 229.78 | 5,778.05 | 5,778.06 | J-25 | 20 | 117.16 | 5,778.06 | 5,778.05 |
| J-250 | 1,004.84 | J-250 | 69.57 | 234.57 | 11,558.96 | 11,559.12 | J-250 | 20 | 120.16 | 11,559.15 | 11,558.96 |
| J-252 | 1,004.84 | J-252 | 70.26 | 234.15 | 10,071.06 | 10,071.10 | J-252 | 20 | 118.16 | 10,071.12 | 10,071.06 |
| J-254 | 1,004.84 | J-254 | 71.05 | 233.96 | 9,617.74 | 9,617.76 | J-254 | 20 | 116.16 | 9,617.78 | 9,617.74 |
| J-256 | 1,004.84 | J-256 | 70.99 | 233.84 | 9,313.48 | 9,313.49 | J-256 | 20 | 116.16 | 9,313.51 | 9,313.48 |
| J-258 | 1,004.84 | J-258 | 69.25 | 233.83 | 9,131.82 | 9,131.83 | J-258 | 20 | 120.16 | 9,131.85 | 9,131.82 |
| J-26 | 1,004.84 | J-26 | 69.43 | 231.23 | 6,989.14 | 6,989.19 | J-26 | 20 | 117.16 | 6,989.20 | 6,989.14 |
| J-260 | 1,004.84 | J-260 | 69.72 | 233.92 | 9,457.94 | 9,457.96 | J-260 | 20 | 119.16 | 9,457.98 | 9,457.94 |
| J-262 | 1,004.84 | J-262 | 69.39 | 234.14 | 10,201.17 | 10,201.22 | J-262 | 20 | 120.16 | 10,201.25 | 10,201.17 |
| J-264 | 1,004.84 | J-264 | 69.48 | 234.34 | 11,096.37 | 11,096.50 | J-264 | 20 | 120.16 | 11,096.54 | 11,096.37 |
| J-266 | 1,004.84 | J-266 | 69.53 | 234.47 | 11,335.85 | 11,335.99 | J-266 | 20 | 120.16 | 11,336.02 | 11,335.85 |
| J-268 | 1,004.84 | J-268 | 69.54 | 234.49 | 11,447.24 | 11,447.38 | J-268 | 20 | 120.16 | 11,447.42 | 11,447.24 |
| J-27 | 1,004.84 | J-27 | 68.44 | 232.94 | 8,796.66 | 8,796.79 | J-27 | 20 | 121.16 | 8,796.81 | 8,796.66 |
| J-270 | 1,004.84 | J-270 | 69.47 | 234.33 | 11,246.25 | 11,246.42 | J-270 | 20 | 120.16 | 11,246.46 | 11,246.25 |
| J-272 | 1,004.84 | J-272 | 69.49 | 234.38 | 11,198.96 | 11,199.09 | J-272 | 20 | 120.16 | 11,199.12 | 11,198.96 |
| J-274 | 1,004.84 | J-274 | 68.51 | 234.12 | 9,844.90 | 9,844.93 | J-274 | 20 | 122.16 | 9,844.95 | 9,844.90 |
| J-276 | 1,004.84 | J-276 | 68.08 | 234.12 | 9,737.11 | 9,737.13 | J-276 | 20 | 123.16 | 9,737.15 | 9,737.11 |
| J-278 | 1,004.84 | J-278 | 68.58 | 234.28 | 10,191.85 | 10,191.87 | J-278 | 20 | 122.16 | 10,191.90 | 10,191.85 |
| J-28 | 1,004.84 | J-28 | 58.16 | 205.24 | 2,232.62 | 2,232.62 | J-28 | 20 | 117.16 | 2,232.62 | 2,232.62 |
| J-280 | 1,004.84 | J-280 | 68.67 | 234.48 | 10,887.36 | 10,887.41 | J-280 | 20 | 122.16 | 10,887.44 | 10,887.36 |
| J-282 | 1,004.84 | J-282 | 69.57 | 234.56 | 11,501.74 | 11,501.87 | J-282 | 20 | 120.16 | 11,501.90 | 11,501.74 |
| J-284 | 1,004.84 | J-284 | 67.79 | 234.46 | 10,494.92 | 10,494.95 | J-284 | 20 | 124.16 | 10,494.98 | 10,494.92 |
| J-286 | 1,004.84 | J-286 | 66.95 | 234.51 | 10,529.99 | 10,530.00 | J-286 | 20 | 126.16 | 10,530.03 | 10,529.99 |
| J-288 | 1,004.84 | J-288 | 50.64 | 184.88 | 1,654.46 | 1,654.46 | J-288 | 20 | 114.16 | 1,654.46 | 1,654.46 |
| J-29 | 1,004.84 | J-29 | 58.82 | 204.76 | 2,231.83 | 2,231.83 | J-29 | 20 | 115.16 | 2,231.83 | 2,231.83 |
| J-290 | 1,004.84 | J-290 | 61.14 | 218.1 | 3,099.06 | 3,099.07 | J-290 | 20 | 123.16 | 3,099.07 | 3,099.06 |
| J-292 | 1,004.84 | J-292 | 58.23 | 208.86 | 2,382.03 | 2,382.03 | J-292 | 20 | 120.64 | 2,382.03 | 2,382.03 |

| Fire Flow 2032 with Improved System | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fire Flow Design | | | | | | | | | | | |
| ID | Total Demand (gpm) | Critical Fire Node ID | Critical Fire Node Pressure (psi) | Critical Fire Node Head (ft) | Adjusted Fire-Flow (gpm) | Available Flow at Hydrant (gpm) | Critical Available Node ID | Critical Available Node Pressure (psi) | Critical Available Node Head (ft) | Adjusted Available Flow (gpm) | Design Flow (gpm) |
| J-30 | 1,004.84 | J-30 | 46.9 | 189.23 | 1,628.20 | 1,628.32 | J-30 | 20 | 127.16 | 1,628.32 | 1,628.20 |
| J-31 | 1,004.84 | J-31 | 39.47 | 171.08 | 1,352.85 | 1,352.89 | J-31 | 20 | 126.16 | 1,352.89 | 1,352.85 |
| J-32 | 1,004.84 | J-32 | 46.43 | 175.16 | 1,493.70 | 1,493.80 | J-32 | 20 | 114.16 | 1,493.80 | 1,493.70 |
| J-36 | 1,004.84 | J-143 | 59.31 | 220.68 | 3,308.97 | 3,535.48 | J-143 | 14.37 | 116.97 | 3,308.99 | 3,308.96 |
| J-37 | 1,004.84 | J-37 | 55.52 | 195.14 | 1,894.09 | 1,894.09 | J-37 | 20 | 113.16 | 1,894.09 | 1,894.09 |
| J-4 | 1,000.00 | J-4 | 62.1 | 216.33 | 2,847.42 | 2,847.42 | J-4 | 20 | 119.16 | 2,847.42 | 2,847.42 |
| J-40 | 1,004.84 | J-18 | 59.78 | 213.97 | 2,623.95 | 2,636.87 | J-18 | 19.57 | 121.16 | 2,623.95 | 2,623.95 |
| J-42 | 1,004.84 | J-42 | 69.12 | 229.43 | 5,563.72 | 5,563.72 | J-42 | 20 | 116.06 | 5,563.73 | 5,563.72 |
| J-66 | 1,004.84 | J-66 | 67.82 | 232.53 | 7,671.20 | 7,671.22 | J-66 | 20 | 122.16 | 7,671.23 | 7,671.20 |
| J-72 | 1,004.84 | J-72 | 68.61 | 229.84 | 5,903.57 | 5,903.59 | J-72 | 20 | 117.66 | 5,903.59 | 5,903.57 |
| J-74 | 1,004.84 | J12 | 63.12 | 217.68 | 2,877.90 | 2,878.06 | J12 | 20 | 118.15 | 2,878.01 | 2,877.90 |
| J-78 | 1,004.84 | J-78 | 69.81 | 231.2 | 6,877.40 | 6,877.43 | J-78 | 20 | 116.26 | 6,877.44 | 6,877.40 |
| J-80 | 1,004.84 | J-80 | 69.19 | 231.49 | 7,098.24 | 7,098.28 | J-80 | 20 | 117.96 | 7,098.28 | 7,098.24 |
| J-82 | 1,004.84 | J12 | 57.03 | 203.62 | 2,066.07 | 2,066.09 | J12 | 20 | 118.16 | 2,066.08 | 2,066.07 |
| J-84 | 1,004.84 | J-84 | 69.48 | 229.75 | 5,625.63 | 5,625.63 | J-84 | 20 | 115.56 | 5,625.63 | 5,625.62 |
| J-86 | 1,004.84 | J-86 | 68.65 | 230.23 | 5,861.99 | 5,862.00 | J-86 | 20 | 117.96 | 5,862.00 | 5,861.99 |
| J-88 | 1,004.84 | J-88 | 68.57 | 233.25 | 9,154.53 | 9,154.65 | J-88 | 20 | 121.16 | 9,154.66 | 9,154.53 |
| J-90 | 1,004.84 | J-90 | 67.39 | 232.53 | 7,581.52 | 7,581.54 | J-90 | 20 | 123.16 | 7,581.55 | 7,581.52 |
| J-92 | 1,004.84 | J-92 | 67.01 | 232.66 | 7,668.77 | 7,668.79 | J-92 | 20 | 124.16 | 7,668.80 | 7,668.77 |
| J-94 | 1,004.84 | J-94 | 67.16 | 232.99 | 8,164.73 | 8,164.77 | J-94 | 20 | 124.16 | 8,164.78 | 8,164.73 |
| J-96 | 1,004.84 | J-94 | 67.46 | 233.7 | 9,871.49 | 9,973.95 | J-94 | 19.09 | 122.06 | 9,871.68 | 9,871.49 |
| J-98 | 1,004.84 | J-98 | 67.02 | 228.68 | 4,800.98 | 4,800.98 | J-98 | 20 | 120.16 | 4,800.98 | 4,800.98 |
| J10 | 1,004.84 | J10 | 68.53 | 229.15 | 5,245.22 | 5,245.22 | J10 | 20 | 117.16 | 5,245.22 | 5,245.22 |
| J12 | 1,004.84 | J12 | 49.35 | 185.9 | 1,613.50 | 1,613.50 | J12 | 20 | 118.16 | 1,613.50 | 1,613.50 |
| J16 | 1,004.84 | J16 | 57.68 | 214.11 | 2,619.08 | 2,619.09 | J16 | 20 | 127.16 | 2,619.09 | 2,619.08 |
| J18 | 1,004.84 | J18 | 59.1 | 220.2 | 3,139.66 | 3,139.67 | J18 | 20 | 129.96 | 3,139.67 | 3,139.66 |
| J20 | 1,004.84 | J20 | 54.34 | 199.4 | 1,940.02 | 1,940.02 | J20 | 20 | 120.16 | 1,940.02 | 1,940.02 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Fire Flow 2032 with Improved System | | | | | | | |
| | Fire Flow | | | | | | | |
| | ID | Static Demand (gpm) | Static Pressure (psi) | Static Head (ft) | Fire-Flow Demand (gpm) | Residual Pressure (psi) | Available Flow at Hydrant (gpm) | Available Flow Pressure (psi) |
| | J-10 | 4.84 | 69.44 | 235.27 | 1,000.00 | 59.81 | 2,572.09 | 20 |
| | J-100 | 4.84 | 70.58 | 236.08 | 1,000.00 | 65.66 | 3,720.10 | 20 |
| | J-12 | 4.84 | 69.45 | 235.28 | 1,000.00 | 59.68 | 2,549.12 | 20 |
| | J-120 | 4.84 | 65.31 | 235.32 | 1,000.00 | 61.39 | 4,084.37 | 20 |
| | J-121 | 4.84 | 65.87 | 235.33 | 1,000.00 | 62.25 | 4,404.40 | 20 |
| | J-122 | 4.84 | 65.63 | 235.27 | 1,000.00 | 60.42 | 3,536.32 | 20 |
| | J-123 | 4.84 | 70.53 | 235.56 | 1,000.00 | 68.08 | 6,137.74 | 20 |
| | J-124 | 4.84 | 69.87 | 235.66 | 1,000.00 | 67.24 | 5,675.03 | 20 |
| | J-125 | 4.84 | 69.7 | 235.87 | 1,000.00 | 66.63 | 5,112.67 | 20 |
| | J-126 | 4.84 | 69.62 | 235.68 | 1,000.00 | 65.59 | 4,337.37 | 20 |
| | J-127 | 4.84 | 69.97 | 235.59 | 1,000.00 | 63.63 | 3,238.05 | 20 |
| | J-128 | 4.84 | 69.98 | 235.5 | 1,000.00 | 66.48 | 4,876.00 | 20 |
| | J-129 | 4.84 | 70.93 | 235.5 | 1,000.00 | 47.55 | 1,545.37 | 20 |
| | J-130 | 4.84 | 70.11 | 235.22 | 1,000.00 | 44.83 | 1,474.01 | 20 |
| | J-132 | 4.84 | 70.02 | 235.39 | 1,000.00 | 65.59 | 4,259.99 | 20 |
| | J-133 | 4.84 | 70.04 | 235.25 | 1,000.00 | 64.51 | 3,715.83 | 20 |
| | J-135 | 4.84 | 69.87 | 235.14 | 1,000.00 | 30.68 | 1,148.34 | 20 |
| | J-136 | 4.84 | 70.24 | 235.2 | 1,000.00 | 64.19 | 3,532.97 | 20 |
| | J-137 | 4.84 | 70.15 | 235.2 | 1,000.00 | 59.31 | 2,416.91 | 20 |
| | J-138 | 4.84 | 70.15 | 235.29 | 1,000.00 | 56.7 | 2,119.22 | 20 |
| | J-139 | 4.84 | 68.2 | 235.09 | 1,000.00 | 61.9 | 3,427.80 | 20 |
| | J-14 | 4.84 | 70.15 | 235.29 | 1,000.00 | 60.56 | 2,598.78 | 20 |
| | J-140 | 4.84 | 69.54 | 235.09 | 1,000.00 | 63.34 | 3,518.80 | 20 |
| | J-141 | 4.84 | 69.85 | 235.09 | 1,000.00 | 63.79 | 3,587.41 | 20 |
| | J-142 | 4.84 | 70.41 | 235.09 | 1,000.00 | 64.3 | 3,585.39 | 20 |
| | J-143 | 4.84 | 65.56 | 235.1 | 1,000.00 | 59.17 | 3,256.16 | 20 |
| | J-144 | 4.84 | 66.77 | 235.09 | 1,000.00 | 59.17 | 2,943.07 | 20 |
| | J-145 | 4.84 | 66.33 | 235.09 | 1,000.00 | 58.18 | 2,793.36 | 20 |
| | J-146 | 4.84 | 72.07 | 235.03 | 1,000.00 | 57.13 | 2,056.78 | 20 |
| | J-147 | 4.84 | 73.45 | 235.02 | 1,000.00 | 55.48 | 1,871.61 | 20 |
| | J-148 | 4.84 | 72.46 | 235.03 | 1,000.00 | 46.74 | 1,502.57 | 20 |
| | J-149 | 4.84 | 72.33 | 235.04 | 1,000.00 | 58.81 | 2,193.03 | 20 |
| | J-150 | 4.84 | 72.29 | 235.03 | 1,000.00 | 60.02 | 2,331.13 | 20 |
| | J-151 | 4.84 | 71.9 | 235.03 | 1,000.00 | 59.44 | 2,297.62 | 20 |
| | J-152 | 4.84 | 72.28 | 235.02 | 1,000.00 | 58.41 | 2,162.98 | 20 |
| | J-153 | 4.84 | 72.41 | 235.02 | 1,000.00 | 56.47 | 1,989.41 | 20 |
| | J-154 | 4.84 | 72.15 | 235.02 | 1,000.00 | 59.53 | 2,290.83 | 20 |
| | J-155 | 4.84 | 68.95 | 235.02 | 1,000.00 | 58.4 | 2,476.58 | 20 |
| | J-156 | 4.84 | 70.21 | 235.03 | 1,000.00 | 60.14 | 2,588.14 | 20 |
| | J-158 | 4.84 | 70.47 | 235.02 | 1,000.00 | 57.53 | 2,213.24 | 20 |
| | J-159 | 4.84 | 68.82 | 235.04 | 1,000.00 | 56.91 | 2,280.07 | 20 |
| | J-16 | 4.84 | 70.33 | 235.31 | 1,000.00 | 61.56 | 2,750.27 | 20 |
| | J-160 | 4.84 | 70.21 | 235.04 | 1,000.00 | 61.05 | 2,746.83 | 20 |
| | J-161 | 4.84 | 68.44 | 235.05 | 1,000.00 | 57.49 | 2,391.46 | 20 |
| | J-162 | 4.84 | 68.57 | 235.06 | 1,000.00 | 59.95 | 2,789.73 | 20 |
| | J-163 | 4.84 | 68.58 | 235.07 | 1,000.00 | 60.93 | 3,021.52 | 20 |
| | J-164 | 4.84 | 70.44 | 235.06 | 1,000.00 | 62.81 | 3,101.97 | 20 |
| | J-166 | 4.84 | 68.58 | 235.08 | 1,000.00 | 61.85 | 3,288.34 | 20 |
| | J-168 | 4.84 | 70.13 | 235.25 | 1,000.00 | 40.61 | 1,349.54 | 20 |
| | J-169 | 4.84 | 69.55 | 235.52 | 1,000.00 | 64.66 | 3,876.53 | 20 |
| | J-170 | 4.84 | 68.82 | 235.03 | 1,000.00 | 55.16 | 2,098.52 | 20 |
| | J-171 | 4.84 | 71.13 | 235.07 | 1,000.00 | 64.07 | 3,288.25 | 20 |
| | J-172 | 4.84 | 71.39 | 235.76 | 1,000.00 | 69.6 | 7,258.06 | 20 |
| | J-174 | 4.84 | 71.39 | 235.76 | 1,000.00 | 61.39 | 2,486.22 | 20 |
| | J-176 | 4.84 | 71.46 | 235.81 | 1,000.00 | 69.15 | 6,037.68 | 20 |
| | J-178 | 4.84 | 71.82 | 235.76 | 1,000.00 | 69.09 | 5,414.89 | 20 |
| | J-18 | 4.84 | 69.03 | 235.31 | 1,000.00 | 58.59 | 2,434.78 | 20 |
| | J-180 | 4.84 | 69.46 | 235.32 | 1,000.00 | 66.78 | 5,249.62 | 20 |
| | J-182 | 4.84 | 69.42 | 235.22 | 1,000.00 | 66.79 | 5,188.60 | 20 |
| | J-184 | 4.84 | 71.82 | 235.76 | 1,000.00 | 61.53 | 2,455.98 | 20 |
| | J-186 | 4.84 | 71.83 | 235.77 | 1,000.00 | 70.07 | 7,337.64 | 20 |

| | Fire Flow 2032 with Improved System | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Fire Flow | | | | | | | |
| | ID | Static Demand (gpm) | Static Pressure (psi) | Static Head (ft) | Fire-Flow Demand (gpm) | Residual Pressure (psi) | Available Flow at Hydrant (gpm) | Available Flow Pressure (psi) |
| | J-188 | 4.84 | 71.64 | 235.83 | 1,000.00 | 69.41 | 6,183.80 | 20 |
| | J-190 | 4.84 | 70.74 | 236.07 | 1,000.00 | 63.78 | 3,039.26 | 20 |
| | J-192 | 4.84 | 71.83 | 235.77 | 1,000.00 | 69.32 | 5,736.16 | 20 |
| | J-194 | 4.84 | 71.83 | 235.78 | 1,000.00 | 69.47 | 5,950.36 | 20 |
| | J-196 | 4.84 | 72.05 | 235.29 | 1,000.00 | 65.68 | 3,191.36 | 20 |
| | J-198 | 4.84 | 72.36 | 235.79 | 1,000.00 | 70.63 | 7,417.29 | 20 |
| | J-20 | 4.84 | 67.35 | 235.43 | 1,000.00 | 60.49 | 3,075.38 | 20 |
| | J-200 | 4.84 | 72.48 | 235.87 | 1,000.00 | 70.74 | 7,378.72 | 20 |
| | J-202 | 4.84 | 71.53 | 235.98 | 1,000.00 | 69.65 | 6,872.67 | 20 |
| | J-204 | 4.84 | 71.52 | 236.06 | 1,000.00 | 63.51 | 2,825.03 | 20 |
| | J-206 | 4.84 | 70.27 | 235.18 | 1,000.00 | 65.55 | 3,690.66 | 20 |
| | J-208 | 4.84 | 71.45 | 235.2 | 1,000.00 | 64.92 | 3,117.03 | 20 |
| | J-210 | 4.84 | 70.92 | 235.87 | 1,000.00 | 65.96 | 3,694.16 | 20 |
| | J-212 | 4.84 | 71.92 | 235.98 | 1,000.00 | 66.76 | 3,645.37 | 20 |
| | J-214 | 4.84 | 71.21 | 236.35 | 1,000.00 | 69.16 | 6,458.77 | 20 |
| | J-216 | 4.84 | 67.11 | 236.87 | 1,000.00 | 65.4 | 7,183.29 | 20 |
| | J-218 | 4.84 | 72.04 | 235.25 | 1,000.00 | 61.55 | 2,413.29 | 20 |
| | J-220 | 4.84 | 70.28 | 235.19 | 1,000.00 | 60.29 | 2,430.06 | 20 |
| | J-222 | 4.84 | 69.37 | 235.1 | 1,000.00 | 68.3 | 8,316.75 | 20 |
| | J-224 | 4.84 | 69.42 | 235.22 | 1,000.00 | 64.72 | 3,683.72 | 20 |
| | J-226 | 4.84 | 72.13 | 239.48 | 1,000.00 | 70.69 | 13,045.86 | 20 |
| | J-228 | 4.84 | 67.64 | 238.11 | 1,000.00 | 66.46 | 12,281.68 | 20 |
| | J-23 | 4.84 | 71.34 | 235.65 | 1,000.00 | 68.94 | 6,094.83 | 20 |
| | J-230 | 4.84 | 67.64 | 238.11 | 1,000.00 | 65.94 | 8,154.29 | 20 |
| | J-232 | 4.84 | 67.64 | 238.11 | 1,000.00 | 65.53 | 6,736.16 | 20 |
| | J-234 | 4.84 | 67.09 | 236.84 | 1,000.00 | 66.29 | 12,338.60 | 20 |
| | J-236 | 4.84 | 67.24 | 237.19 | 1,000.00 | 66.33 | 12,397.33 | 20 |
| | J-238 | 4.84 | 68.81 | 235.81 | 1,000.00 | 68.31 | 12,689.58 | 20 |
| | J-24 | 4.84 | 71.35 | 235.66 | 1,000.00 | 68.76 | 5,772.42 | 20 |
| | J-240 | 4.84 | 68.49 | 236.06 | 1,000.00 | 67.89 | 12,138.31 | 20 |
| | J-242 | 4.84 | 68.57 | 236.25 | 1,000.00 | 67.92 | 12,073.13 | 20 |
| | J-244 | 4.84 | 68.63 | 236.38 | 1,000.00 | 67.95 | 12,164.02 | 20 |
| | J-246 | 4.84 | 69.15 | 236.59 | 1,000.00 | 68.35 | 11,140.07 | 20 |
| | J-248 | 4.84 | 70.46 | 236.61 | 1,000.00 | 69.62 | 12,020.39 | 20 |
| | J-25 | 4.84 | 71.38 | 235.74 | 1,000.00 | 68.8 | 5,778.06 | 20 |
| | J-250 | 4.84 | 70.44 | 236.58 | 1,000.00 | 69.57 | 11,559.12 | 20 |
| | J-252 | 4.84 | 71.3 | 236.56 | 1,000.00 | 70.26 | 10,071.10 | 20 |
| | J-254 | 4.84 | 72.16 | 236.54 | 1,000.00 | 71.05 | 9,617.76 | 20 |
| | J-256 | 4.84 | 72.15 | 236.52 | 1,000.00 | 70.99 | 9,313.49 | 20 |
| | J-258 | 4.84 | 70.41 | 236.5 | 1,000.00 | 69.25 | 9,131.83 | 20 |
| | J-26 | 4.84 | 71.4 | 235.77 | 1,000.00 | 69.43 | 6,989.19 | 20 |
| | J-260 | 4.84 | 70.84 | 236.49 | 1,000.00 | 69.72 | 9,457.96 | 20 |
| | J-262 | 4.84 | 70.4 | 236.47 | 1,000.00 | 69.39 | 10,201.22 | 20 |
| | J-264 | 4.84 | 70.4 | 236.46 | 1,000.00 | 69.48 | 11,096.50 | 20 |
| | J-266 | 4.84 | 70.41 | 236.5 | 1,000.00 | 69.53 | 11,335.99 | 20 |
| | J-268 | 4.84 | 70.41 | 236.5 | 1,000.00 | 69.54 | 11,447.38 | 20 |
| | J-27 | 4.84 | 69.82 | 236.13 | 1,000.00 | 68.44 | 8,796.79 | 20 |
| | J-270 | 4.84 | 70.39 | 236.44 | 1,000.00 | 69.47 | 11,246.42 | 20 |
| | J-272 | 4.84 | 70.39 | 236.46 | 1,000.00 | 69.49 | 11,199.09 | 20 |
| | J-274 | 4.84 | 69.53 | 236.46 | 1,000.00 | 68.51 | 9,844.93 | 20 |
| | J-276 | 4.84 | 69.09 | 236.46 | 1,000.00 | 68.08 | 9,737.13 | 20 |
| | J-278 | 4.84 | 69.53 | 236.46 | 1,000.00 | 68.58 | 10,191.87 | 20 |
| | J-28 | 4.84 | 71.07 | 235.02 | 1,000.00 | 58.16 | 2,232.62 | 20 |
| | J-280 | 4.84 | 69.53 | 236.46 | 1,000.00 | 68.67 | 10,887.41 | 20 |
| | J-282 | 4.84 | 70.42 | 236.52 | 1,000.00 | 69.57 | 11,501.87 | 20 |
| | J-284 | 4.84 | 68.65 | 236.44 | 1,000.00 | 67.79 | 10,494.95 | 20 |
| | J-286 | 4.84 | 67.77 | 236.41 | 1,000.00 | 66.95 | 10,530.00 | 20 |
| | J-288 | 4.84 | 72.37 | 235.03 | 1,000.00 | 50.64 | 1,654.46 | 20 |
| | J-29 | 4.84 | 71.94 | 235.02 | 1,000.00 | 58.82 | 2,231.83 | 20 |
| | J-290 | 4.84 | 68.49 | 235.07 | 1,000.00 | 61.14 | 3,099.07 | 20 |
| | J-292 | 4.84 | 69.56 | 235.02 | 1,000.00 | 58.23 | 2,382.03 | 20 |

| | Fire Flow 2032 with Improved System | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Fire Flow | | | | | | | |
| | ID | Static Demand (gpm) | Static Pressure (psi) | Static Head (ft) | Fire-Flow Demand (gpm) | Residual Pressure (psi) | Available Flow at Hydrant (gpm) | Available Flow Pressure (psi) |
| | J-30 | 4.84 | 66.82 | 235.21 | 1,000.00 | 46.9 | 1,628.32 | 20 |
| | J-31 | 4.84 | 67.24 | 235.18 | 1,000.00 | 39.47 | 1,352.89 | 20 |
| | J-32 | 4.84 | 72.37 | 235.03 | 1,000.00 | 46.43 | 1,493.80 | 20 |
| | J-36 | 4.84 | 72.4 | 235.1 | 1,000.00 | 66.03 | 3,535.48 | 20 |
| | J-37 | 4.84 | 72.82 | 235.05 | 1,000.00 | 55.52 | 1,894.09 | 20 |
| | J-4 | 0 | 70.34 | 235.35 | 1,000.00 | 62.1 | 2,847.42 | 20 |
| | J-40 | 4.84 | 69.46 | 235.31 | 1,000.00 | 60.22 | 2,636.87 | 20 |
| | J-42 | 4.84 | 71.83 | 235.67 | 1,000.00 | 69.12 | 5,563.72 | 20 |
| | J-66 | 4.84 | 69.41 | 236.18 | 1,000.00 | 67.82 | 7,671.22 | 20 |
| | J-72 | 4.84 | 71.12 | 235.64 | 1,000.00 | 68.61 | 5,903.59 | 20 |
| | J-74 | 4.84 | 70.91 | 235.65 | 1,000.00 | 63.13 | 2,878.06 | 20 |
| | J-78 | 4.84 | 71.75 | 235.7 | 1,000.00 | 69.81 | 6,877.43 | 20 |
| | J-80 | 4.84 | 71.03 | 235.74 | 1,000.00 | 69.19 | 7,098.28 | 20 |
| | J-82 | 4.84 | 70.91 | 235.65 | 1,000.00 | 57.03 | 2,066.09 | 20 |
| | J-84 | 4.84 | 72.1 | 235.79 | 1,000.00 | 69.48 | 5,625.63 | 20 |
| | J-86 | 4.84 | 71.06 | 235.8 | 1,000.00 | 68.65 | 5,862.00 | 20 |
| | J-88 | 4.84 | 69.84 | 236.19 | 1,000.00 | 68.57 | 9,154.65 | 20 |
| | J-90 | 4.84 | 68.98 | 236.2 | 1,000.00 | 67.39 | 7,581.54 | 20 |
| | J-92 | 4.84 | 68.56 | 236.23 | 1,000.00 | 67.01 | 7,668.79 | 20 |
| | J-94 | 4.84 | 68.57 | 236.26 | 1,000.00 | 67.16 | 8,164.77 | 20 |
| | J-96 | 4.84 | 69.89 | 236.29 | 1,000.00 | 68.76 | 9,973.95 | 20 |
| | J-98 | 4.84 | 70.24 | 236.12 | 1,000.00 | 67.02 | 4,800.98 | 20 |
| | J10 | 4.84 | 71.39 | 235.76 | 1,000.00 | 68.53 | 5,245.22 | 20 |
| | J12 | 4.84 | 70.91 | 235.65 | 1,000.00 | 49.35 | 1,613.50 | 20 |
| | J16 | 4.84 | 66.77 | 235.09 | 1,000.00 | 57.68 | 2,619.09 | 20 |
| | J18 | 4.84 | 65.59 | 235.17 | 1,000.00 | 59.1 | 3,139.67 | 20 |
| | J20 | 4.84 | 69.89 | 235.29 | 1,000.00 | 54.34 | 1,940.02 | 20 |




N

0 700 1,400 Feet

**LEGEND:**

- MODEL NODE

WATERLINES:

- 4-INCH
- 6-INCH
- 8-INCH
- 12-INCH
- ALGONA CITY LIMITS

CITY OF ALGONA

WATER SYSTEM PLAN
NODE MAP

Gray & Osborne, Inc.

Document Path: L:\ALGONA\12503 WSP 2012\GIS\FIGURE NODE MAP.mxd

# APPENDIX G

# SAMPLE MAINTENANCE REPORTING FORMS

# VALVE MAINTENANCE / INSPECTION REPORT

Valve #________, Valve Size ________, Section _____/_____/4, Map #________

Location:

Principle St:____________________ ________ ft. ________________ of center line

Intersecting St:____________________ ________ ft. ________________ of center line

Specific Location: Checked OK ________ or measured as follows:

________ ft. ________________ of ________________________________

________ ft. ________________ of ________________________________

________ ft. ________________ of ________________________________

Found: ________________, # of turns: ____________, Left: ____________

Packing: OK ________, Leaking: ________________________

Stem: OK ________, Bent / Broken: ________________________

Nut: OK ________, Missing / Damaged: ________________________

Gears: OK ________, Faulty: ________________________

Lid: OK ________, Missing / Broken: ____________, Replaced ____________

Box: OK ________, Cold mixed *Yes / No* needed? *Yes / No*

Buried *Yes / No* ____________, Protruding *Yes / No* ____________"

Too Close to Operating Nut *Yes / No*

Other Problems / Work Needed: ________________________________

________________________________________________________________

________________________________________________________________

Work / Repairs Completed:

________________________________ By: ____________ Date ___/___/___

________________________________ By: ____________ Date ___/___/___

________________________________ By: ____________ Date ___/___/___

Inspection/Maintenance Completed by: ____________________ Date ___/___/___

Remarks on back of page _____ Yes _____ No

# VALVE REPAIR REPORT

Valve #__________ Valve Size ____________ Section _____ _____/4 Map #__________

Connecting Pipe #______________ to Pipe/Node #_______________, Installed_____/_____

Type ______________, Connecting ends ________ x ________, Make ______________________

Opens ________________, # of turns _____________, Depth to operate nut ________________

Normally ________________, Valve box cold-mixed? ___________ needed? _____________

General Location:

Principle St:________________________ _________ ft. ___________________ of center line

Intersecting St:______________________ _________ ft. ___________________ of center line

Specific Location:

___________ ft. ___________________ of _______________________________________

___________ ft. ___________________ of _______________________________________

___________ ft. ___________________ of _______________________________________

Valve/Site Map:

Last corrected ____/____/____ dBase enter ____/____/____ CAD Map ____/____/____

Remarks on back of page _____ Yes _____ No

# HYDRANTS MAINTENANCE / INSPECTION REPORT

Hydrant #________, Valve Size ________, Section _____/_____/4, Map #________

Location:

Principle St:____________________ ________ ft. ____________________ of center line

Intersecting St:____________________ ________ ft. ____________________ of center line

Specific Location: Checked OK ________ or measured as follows:

__________ ft. ________________ of ________________________________

__________ ft. ________________ of ________________________________

__________ ft. ________________ of ________________________________

Caps Missing: ____________, Replaced: ____________, Greased: ____________

Chains Missing: ____________, Replaced: ____________, Freed: ____________

Paint: OK __________, Repaint: ________________________________

Oper. Nut: OK __________, Greased: __________ Replaced: __________

Nozzles: OK __________, Caulked: __________ Replaced: __________

Valve & Seat: OK __________, Replaced: ________________________________

Packing: OK __________, Tightened: __________ Replaced: __________

Drainage: OK __________, Corrected: ________________________________

Flushed: __________ Minutes __________ Nozzle Open

Pressure: Static: __________ Residual: __________ Flow __________ gpm

Branch Valve: Condition: ________________________________

Other Problems / Work Needed: ________________________________

________________________________________________________________

________________________________________________________________

Work / Repairs Completed:

________________________________ By: __________ Date ____/____/____

________________________________ By: __________ Date ____/____/____

________________________________ By: __________ Date ____/____/____

Inspection/Maintenance Completed by: ____________________ Date ____/____/____

Remarks on back of page _____ Yes _____ No

# MAIN REPAIR REPORT

Main #____________ Main Size ______________ Section _____ _____/4 Map #_______

Node #__________ (Valve/Main #________) to Node #_______ (Valve/Main #________)

Date Installed _____/_____ Type ____________ Manufacturer ________________

Length of Main __________ ft. Number of Connections on Main ______________

Valves to Isolate ________, ________, ________, ________, ________, ________,________

Location:

______________ side of ____________________________________________________

From _______________________________ St. to _______________________________

Other Location Information:

_________________________________________________________________________

_________________________________________________________________________

Specific Location:

_________ ft. ______________ of _______________________________________________

_________ ft. ______________ of _______________________________________________

Site Map:

Last corrected _____/_____/_____ dBase enter _____/_____/_____ Map _____/_____/_____

Remarks on back of page _____ Yes _____ No

**City of Algona Administrative Policy**

**RE: Response to customer complaint regarding potable water**

The City occasionally receives complaints regarding water quality. These complaints include but are not limited to:

1. Taste
2. Oder
3. Sand or other particles in the water.

The following procedure is adopted for responding to these complaints:

<u>Step 1</u>
A complaint is referred to the Public Works Director and the Public Works Supervisor.

<u>Step 2</u>
The customer is contacted either by phone, e-mail or in person. The complaint is discussed to determine if there is a reasonable explanation for the problem, possible solutions are suggested and a follow up is made to determine if the problem persists.

Depending on the severity of the concern, the City may recommend:
1. That the water be tested at the City's expense.
2. That the customer discontinue drinking and/or bathing with the water.
3. Notification to the City of Auburn, (who provides the water) and the Department of Health.
4. A record of the complaint and the resolution is maintained.
5. Periodically flush hot water tank. (most frequent problem)

# APPENDIX H

# CROSS-CONNECTION CONTROL PROGRAM

# City of Algona
# Premises Isolation and In-Premises Protection
# Cross-Connection Control Program

Purpose:

The purpose of the City of Algona cross-connection program shall be to protect the public water system, as defined in WAC 246-290-010, form contamination via cross-connections.

General:

Except where specifically designated herein, all words used in this procedure shall carry their customary meanings. Words used in the present tense include the future, and plural includes the singular: The word "shall" is always mandatory; the word "may" denotes a use of discretion in making a decision.

Definitions:

"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 nonpressurized receiving vessel. To be an air gap approved by the department of health, 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 one and one-half inches.

"Approved atmospheric vacuum breaker" means an AVB of make, model, and size that is approved by the department of health. AVBs that appear on the current approved backflow prevention assemblies list developed by the University of Southern California Foundation for Cross-Connection and Hydraulic Research or that are listed or approved by other nationally recognized testing agencies (such as IAPMO, ANSI, of UL) acceptable to the local administrative authority 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 preventer," "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.

"Assessment of risk" means the results of an evaluation of a health, system, or plumbing hazard. The evaluation required in making a determination of the type of backflow preventer needed to isolate a specific cross connection (e.g., a plumbing fixture), or a group of cross connections contained within a facility or complex of facilities (e.g., a shopping mall) is comprised of the following steps:

- Determine the degree of potential health hazard risk to the public water system. (In assessing the purveyor's risk of contamination of the public water system, if knowledge of the degree of hazard posed by a substance is not known, the purveyor must assume that it is high.
- Determine the probability (high or low) that a cross-connection may occur.
    1. The probability increases that an existing cross-connection will go undetected as the complexity of a piping system increases.
    2. Piping changes will create new cross-connections, or change the operating conditions from backsiphonage to backpressure conditions.
    3. A backflow preventer could be bypassed or removed from service.
    4. A substance could be changed or increased in strength.
    5. A substance may deteriorate, and thus become a health hazard.
    6. A substance, when combined with the chemicals in the potable water supply, or when exposed to certain piping material, may react and form a compound that poses a health hazard, such as CO2 mixing with water to form carbolic acid that leaches copper form a copper service pipe.
    7. A substance, if it contains a bacteriological contaminant, could become a health hazard long after it enters the potable water supply, through bacteria regrowth.
- Determine the risk level acceptable to the purveyor, and
- Determine the reliability required of the backflow preventer.
- Determine the appropriate backflow prevention commensurate with the assessed risk using WAC 246-290-490 Table 8.

"Authorized agent" means any person who:

- Makes decisions regarding the operation and management of a public water system whether or not he or she is engaged in the physical operation of the system;
- Makes decisions whether to improve, expand, purchase, or sell the system; or
- Has discretion over the finances of the system.

"Backflow" means the undesirable reversal of flow of water of 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 such as thermal expansion) 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 service both the fire sprinkler system and the consumer's potable water system.

"Consumer" 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, "consumer" means the owner or operator of a water system connected to a public water system through a service connection.

"Consumer's water system" means any potable and/or industrial water system that begins at the public water system point of delivery; that is, at the immediate downstream side of the water meter, 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.

"Contaminant" means a substance present in drinking water that may adversely affect the health of the consumer or the aesthetic qualities of the water.

"Cross-connection" means any actual or potential physical connection between a public water system or the consumer's water system and any source of nonpotable 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" (CCS) means a person holding a valid Washington State Cross-Connection Control Specialist certificate issued in accordance with Chapter 246-292 WAC.

"Cross-connection control summary report" means the annual report required by the department that describes the status of the purveyor's cross-connection control program.

"Department" means the Washington State Department of Health or health officer as identified in a joint plan of operation in accordance with WAC 246-290-030(1).

"Direct service connection" means a service hookup to a property that is contiguous to a water distribution main and where additional mains or extensions are not needed to provide service.

"Distribution system" means all piping components of a public water system that service to convey water from transmission mains linked to source, storage and treatment facilities to the consumer excluding individual services.

"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.

"Health hazard" means any condition, device, or practice in a water supply system and/or it operation that creates or may create, a danger to the health and well being of a customer.

"Health officer" means the health officer of the city, county, city-county health department or district, or an authorized representative.

"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 wastes.

"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.

"Local administrative authority" 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 (WAC 51-46-0603.3.3).

"Low health cross-connection hazard" means a 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 quantities of such potable waters for domestic use.

"Potable" means water suitable for drinking by the public.

"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 (at the point where the water purveyor no longer has legal jurisdiction and/or authority to control the water) to isolate the consumer's water system from the purveyor's distribution system.

"Plumbing hazard" shall mean a cross-connection in a consumer's potable water system that may permit backsiphonage in the event of a negative pressure in the supply line.

"Public water system" is defined and referenced under WAC 246-290-020.

"Public Works Director" shall mean the Public Works Director of the City of Algona. Any act in the cross-connection control program required or authorized by the Public Works Director may be done on his or her behalf by a certified cross-connection control specialists (CCS) who is an authorized representative of the City of Algona.

"Purveyor" means an 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 the authorized agents of such entities.

"Resident" means an individual living in a dwelling unit served by a public water system.

"Service connection" means a connection to a public water system designed to provide potable water to a single-family residence, or other residential or nonresidential population.

"System hazard" shall mean a threat to the physical properties of the public or the consumer's potable water system by a material not dangerous to health but aesthetically objectionable that would have a degrading effect on the quality of the potable water in the system.

"Unapproved auxiliary water supply" means a water supply (other than the purveyor's water supply) on or available to the consumer's premise that is either not approved for human consumption by the health agency having jurisdiction or is not otherwise acceptable to the purveyor.

"Used water" means water which has left the control of the purveyor.

Code Authority and Enforcement:

The enforcement of this cross-connection control program in the area served by the City of Algona, will be in accordance with WAC 246-290-490, cross-connection control, effective April 27, 2003, City of Algona Ordinance 13.02.160 and the City of Algona Cross-Connection Control Program.

General Policy:

It is the intention of this policy to provide for the permanent abatement or control of all cross-connections under the control of the water purveyor of the City of Algona. Where it is officially, actually and/or economically unfeasible to find, eliminate or to permanently control all cross-connections of the consumer's water system, and when it is mandated by WAC 246-290-490 and/or deemed necessary by the City of Algona cross-connection specialist, there shall be installed at the water service connection an approved backflow prevention assembly commensurate with the assessed degree of hazard posed by the consumer's water system upon the public water supply.

The following methods of cross-connection control are considered minimum protection at the water service connection at the property line:

1. The public water supply to any premise listed under WAC 246-290-490(4)(b)(i)(ii)(iii)(Table 9) or deemed a "Table 9 Type Facility" by the City of Algona CCS shall require an approved air gap separation or an approved reduced pressure backflow assembly installed immediately downstream of the domestic water service connection, prior to any branch connections.

2. The public water supply to any premise on which material dangerous to health or toxic substances are stored or handled, and which, in the assessment of the City of Algona CCS poses a potential high health cross-connection hazard to the public water system, shall require an approved air gap separation or an approved reduced pressure backflow assembly installed immediately downstream of the domestic water service connection, prior to any branch connections.

3. The public water supply to any premise where entry is restricted so that inspection for cross-connections cannot be made with sufficient frequency or at sufficient short notice to assure that cross-connections do not exist shall require an approved air gap separation or an approved reduced pressure backflow assembly installed immediately downstream of the domestic water service connection, prior to any branch connections.

4. The public water supply to any premise having a repeated history of cross-connections being established or re-established, shall require an approved air gap separation or an approved reduced pressure backflow assembly installed immediately downstream of the domestic water service connection, prior to any branch connections.

5. The public water supply to any premise which has an unapproved auxiliary water supply on or available to the consumer's premise that is either not approved for human consumption by the health agency having jurisdiction or is not otherwise acceptable to the purveyor, and with no known cross-connections, shall require an approved air gap separation or an approved reduced pressure backflow assembly installed immediately downstream of the domestic water service connection, prior to any branch connections.

6. The public water supply to any premise which has internal cross-connections that are not correctable or which has complex plumbing arrangements that make it impractical to ascertain whether or not cross-connections exist, shall require an approved air gap separation or an approved reduced pressure backflow assembly installed immediately downstream of the domestic water service connection, prior to any branch connections.

7. The public water supply to any premise which poses a high probability of changes in the use of water by tenants, such as, but not limited to, strip malls or shopping malls, shall require an approved air gap separation or an approved reduced pressure backflow assembly installed immediately downstream of the domestic water service connection, prior to any branch connections.

8. The public water supply to any premise with a fire system with any chemical additives, including food-grade additives or chemicals that would be injected into the fire system by a responding fire department shall require an approved reduced pressure backflow assembly (or reduced pressure detector assembly) installed immediately downstream of the public water service connection, prior to any branch connections.

9. The public water supply to any premise with a fire system with no chemical additives and that shall never be injected with chemicals by a responding fire department shall require an approved double check valve assembly (or double check detector assembly) installed immediately downstream of the public water service connection, prior to any branch connections.

10. The public water supply to any premise where cross-connections are unavoidable or not correctable, such as, but not limited to, tall buildings (over 30 feet), or water booster pump systems, shall require an approved double check valve assembly installed immediately downstream of the water service connection, prior to any branch connections.

<u>Coordination and delineation of responsibilities with local administrative authorities</u>

The control of cross-connections requires cooperation between the water purveyor, the local administrative authority, the health officer and the consumer.

- WAC 246-290-490(1)(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.

- WAC 246-290-490(1)(e): Under the provisions of 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-connections within the consumer's water system, i.e., within the property lines of the consumer's premise, falls under the jurisdiction of the local administrative authority.

- WAC 246-290-490(2)(d): The purveyor shall coordinate with the local administrative authority in all matters concerning cross-connection control. The purveyor shall document and describe such coordination, including delineation of responsibilities, in the written cross-connection control program required in (e) of this subsection.

The City of Algona CCS shall make available to all local administrative agencies the information maintained in the cross-connection control program files, which may include, but is not limited to: (1) a master list of all premises that have been isolated from the public water system in accordance with the cross-connection control program; (2) information concerning any internal cross-connections that come to the attention of the CCS during risk assessment evaluations or premises; and (3) notification of any termination of water service for failure to comply with the requirements of WAC 246-290-490, or the City of Algona Ordinance 13.02.160, or the City of Algona Cross-Connection Control Program.

<u>Risk Assessment Survey:</u>

A risk assessment survey for cross-connections and sanitary hazards requires a water use evaluation of new and existing buildings, structures, and ground. The systematic evaluation shall be prioritized by risk to public health and shall be conducted as outlined below:

1. Upon application for a water service connection, the property owner (applicant) shall complete an application for City of Algona water service and a water usage questionnaire, which shall be reviewed by the City of Algona CCS. The CCS shall make a determination of the risk posed to the public water system by the property owner's water system. The CCS shall classify the water service connection as either a high health hazard or a low health hazard cross-connection, and shall specify the need and identify the type of backflow protection required (if applicable) for premises isolation backflow protection. When deemed necessary, the CCS shall request the City of Algona engineering division to require a detailed plan and specification for the plumbing installation in order to facilitate risk-assessment review of the water use at the property.

2. The CCS shall review all purveyor and consumer water system related plans and specifications to assess the following:
   - The actual or potential health hazard or contamination risk to the public water system.
   - The complexity of any existing and/or proposed water piping system.
   - The probability of occurrence of cross-connections within a purveyor or consumer water system.

- The determination of what cross-connections might constitute acceptable risks.
- The determination of the reliability required of any backflow prevention assembly utilized within a facility or mandated for premises isolation.
- The actual or potential use and/or availability of any unapproved auxiliary water supply system.
- The storage and handling of material dangerous to health or toxic substances which, if introduced into the water system, would constitute a system, plumbing, or health hazard.

If, upon review, it is determined that any of these conditions will exist, the CCS will advise the purveyor or property owner in writing that such cross-connections exist, and will offer technical guidance in eliminating or controlling such cross-connections. If the CCS determines that the property owner's water system represents a potential health hazard risk to the district water system, such as, but not limited to, WAC 246-290-490(4)(b)(Table 9) type facilities or systems, an approved backflow prevention assembly commensurate with the assessed degree of hazard shall be required for premises isolation at the water service connection, notwithstanding any point of hazard, point of use, or fixture protection existing within the property lines of the premises.

3. During the construction phase of any new building, structure, or ground installation, the City of Algona CCS shall perform the require premises isolation cross-connection control survey inspection. Upon completion of the inspection, but prior to the establishment of a water service connection, the CCS shall advise the property owner/authorized agent, that subject cross-connection control inspection has been made and advise if any additional backflow protection is required. The CCS shall advise the property owner/authorized agent that it is the property owner's responsibility to have a Washington State certified backflow assembly tester (BAT) test the backflow assembly prior to use of the water service, and that annual testing is required thereafter. The CCS shall attend and witness the initial test of all backflow assemblies installed as premises isolation under the City of Algona's jurisdiction. It is the responsibility of the property owner/authorized agent to contract the CCS and coordinate an appointment time for the CCS to attend and witness the required test of a backflow assembly (minimum 24 hour advance notice required).

<u>Existing Buildings, Structures, and Grounds:</u>

The CCS will evaluate the high health hazard premises, all commercial and/or industrial premises, all premises with fire systems, all premises with water system using booster pumps, all premises with buildings 30 feet of more in height, and all residential properties to insure premises isolation protection has been provided at the water service connection, if applicable. Premises not on the established survey priority list that come to the attention of the CCS, and upon evaluation are determined deficient in required premises isolation of other backflow protection, shall be brought into current compliance without regard to any established priority list. Inspections of residential properties will normally follow completion of premises isolation of high health hazard facilities unless those residential properties appear to pose a high health hazard risk to the public water supply, and for any reason, come to the attention of the CCS.

The initial evaluation shall proceed according to the following steps:

1. A priority list shall be established using existing water service records, telephone directory yellow pages listings, and other available resources.

2. Beginning with the highest rates health hazard on the program's survey priority list, the CCS will make a risk assessment evaluation of each property for actual or potential cross-connections and/or any conditions that might tend to contaminate the public water system.

3. Upon completion of the risk assessment evaluation, the CCS will determine whether or not premises isolation backflow protection will be required, whether internal backflow protection is required, and will determine the level of protection required commensurate with the assessed degree of hazard.

4. The CCS will prepare a written report to the file system that may include, but is not limited to, the following:

   a. A list of all cross-connections found, their location, and any optional methods of elimination or control.
   b. Any applicable drawings, sketches, blueprints, or photos.
   c. A summary of the findings, recommendations and requirements for corrective actions, and a time frame (normally a maximum of 90 days for high health hazards) in which the corrective action must be completed.

5. The CCS shall notify the property owner/authorized agent, in writing, of the City of Algona requirement for premises isolation backflow protection. The code enforcement letter shall include the requirements for corrective actions and a corrective action completion date. One copy of the completed letter shall reside in the cross-connection control program jacket file for the facility.

6. On the corrective action completion date, the CCS shall contact the property owner/authorized agent and ask if the corrective actions have been completed. If the corrective actions have been completed, the CSC shall inspect each required premises isolation backflow assembly located at the water service connection to the property. If the corrective actions are in progress but more time is required for completion, a new completion date may be set by the CCS. If corrective actions have been disregarded, the

City of Algona shall take appropriate corrective action within its authority, per WAC 246-290-490(23)(j)(i)(ii)(iii), City of Algona Ordinance 13.02.160 and the City of Algona Cross-Connection Control Program, which may include, but is not limited to, denying or discontinuing water service to a consumer's premises until the cross-connection hazard is eliminated or controlled to the satisfaction of the City of Algona CCS.

7. When all required actions have been completed, a copy of the completed required actions letter shall be placed in the cross-connection control file for the property, together with all copies of correspondence, notes, related documents and any completed backflow assembly test report forms.

8. Reinspection of premises isolation for each premises found to be subject to this procedure shall be accomplished annually, if possible, or more often if a risk assessment so indicates, or whenever there is a change in the use of water within the premises or whenever there is a change of tenant.

<u>Records and Reports:</u>

Cross-Connection Control Program File System:

1. A separate jacket file shall be established by the CCS, for each individual customer that requires the installation of a premises isolation backflow prevention assembly. Jacket files shall be filed in alphabetical sequence by premise name or customer name (last name first, first name last). A computer software database will be utilized for compiling as well as Department of Health annual summary reporting.

2. The following information shall be maintained in each individual jacket file:
   (a) Copies of all correspondence with customer relative to cross-connection control.
   (b) Copies of evaluation reports, complete with field drawings (if applicable).
   (c) Copies of all completed backflow assembly test report forms.
   (d) Copies of all reports or correspondence pertaining to enforcement action, cross-connections, or backflow incidents.

<u>Backflow Incident Response</u>

A backflow incident occurs when an undesirable reversal of flow of water or other substances into the public water system from a customer's water system occurs. Water purveyors are required, as a part of the CCCP, to plan for emergency response procedures for backflow incidents resulting in contamination or potential contamination of the water system. The following procedures will be taken in response to a backflow incident:

1. The City shall notify DOH, the authority having jurisdiction, and the 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:

    (a) Contaminated the public water system; or

    (b) Occurred within the premises of a consumer served by the purveyor.

2. The City shall take corrective actions, if needed.

Corrective actions taken by the City may include:
- Flushing and cleaning water pmains or customer plumbing,
- Disinfecting water mains or customer plumbing,
- Replacing water mains or customer plumbing,
- Other actions.

Corrective actions ordered by the City may include:
- Elimination of cross-connections,
- Remove by-pass,
- Install new cross-connection control device,
- Change existing cross-connection control device,
- Other actions.

In addition the City may also need to:
- Notify customers,
- Issue a boil water notice,
- Issue other notification as required by DOH.

3. The City shall document details of backflow incidents contaminating the public water system:

    (a) The following information shall be gathered on a backflow incident report form and provided to DOH:

- Time, data and location of incident,
- Premise type, hazard category and date of most current hazard evaluation,
- Type of backflow preventer if premise isolation was required,
- Method of discovery of the backflow incident,
- Contaminant information, laboratory test results, extent of contamination,
- Water quality complaints received, number of illnesses reported,
- Source of contamination,
- Type of backflow, water main pressure, cause of backflow,
- Backflow preventer information,
- Corrective actions taken, Notifications,

(b) Include all backflow incident report(s) in the annual cross-connection program summary report, unless otherwise requested by the department.

replacement or repair cost of the meter in the event it is destroyed or damaged beyond normal wear and tear by any cause other than the fault of the city. The city shall bill the original charge and the cost of any such repair or replacement to the property owner and, if it is not paid, the unpaid charge or cost shall be certified and filed as a lien in the manner provided by law, or otherwise collected as other water charges in the manner provided by law and ordinance.

C. The installation of the meter shall be done under the supervision of the director or his representative at a location approved by him.

D. The director or his representative shall have access at all reasonable hours to the meters so installed for the purpose of inspecting, maintaining, repairing, replacing and reading them.

E. No building or structure shall be furnished water service unless each such building or structure has a meter installed pursuant to this section. (Ord. 947-04 § 2 (part)).

**13.02.110 Water rate charges.**
The rates for water service charges, hookup charges, meter and new installation are designated by Chapter 2.50 of this code. (Ord. 947-04 § 2 (part)).

**13.02.120 Meter testing.**
When any consumer whose water service is metered makes a complaint that the bill for any past time has been excessive, the water department will, upon request, have such meter reread and the service inspected for leaks. Should the consumer thereafter desire that the meter be tested a meter testing fee may be required. (Ord. 947-04 § 2 (part)).

**13.02.130 Supplying water to additional families.**
It is unlawful for any person whose premises are supplied with water to furnish water to additional families or premises. (Ord. 947-04 § 2 (part)).

**13.02.140 Fishing or swimming in reservoir.**
It is unlawful for any person to bathe in, fish in or throw any substance into any reservoir, or place any foreign substance upon any grounds belonging to, connected with or under the control of the water department of the city. (Ord. 947-04 § 2 (part)).

**13.02.150 Interfering with or damage to water department property.**
A. It is unlawful for any person, firm or corporation to open, close or interfere with, or attempt to, or connect with any fire hydrant, stop valve or stop cock, belonging to the city water department unless authorized by the director, but this section shall not apply to members of the city's authorized fire department while acting in such capacity.

B. It is unlawful for any person unless duly authorized by the director to disturb, interfere with, or damage any water main, water pipe, machinery, tool, meter or any other appliances, buildings, improvements, lawns, grass plots, flowers, vines, bushes or trees belonging to, connected with, or under the control of the water department of the city. (Ord. 947-04 § 2 (part)).

**13.02.160 Illegal connections.**
The installation or maintenance of any cross-connection which would endanger the public water supply of the city of Algona is prohibited. Any such cross-connection now existing or hereafter installed is hereby declared subject to immediate termination of water service and any such cross-connection shall be abated immediately.

A. The control or elimination of cross-connections shall be in accordance with the provisions of the Washington Administrative Code (WAC 246-290-490). The policies, procedures, and criteria for determining appropriate levels of protection shall be in accordance with the Accepted Procedure and Practice in Cross-Connection Control Manual, Pacific Northwest Section, American Waterworks Association, Fifth Edition, or any superseding edition.

B. The city of Algona may deny or discontinue water service to any customer failing to cooperate in the installation, maintenance, testing, or inspection of backflow prevention assemblies required and stated in WAC 246-290-490.

C. As a condition of new or continued water service, approved backflow prevention assemblies shall be installed and maintained by all customers who:

1. Are industrial or commercial customers not entitled to an exemption under subsection E of this section;

2. Operate commercial or residential fire sprinkler systems connected to their plumbing;

3. Operate irrigation systems connected to their plumbing and the city's system;

4. Maintain cross-connections of their water system with air-conditioning systems, medical apparatuses, or other devices or processes where chemicals or other objectionable substances may be siphoned into the water system.

D. An "approved backflow prevention assembly" means a backflow prevention assembly model approved by the state of Washington, Department of Health, and the city of Algona. Unless an exemption is granted, the minimum requirement for a backflow prevention assembly shall be that it consists of a double-check valve assembly. A reduced pressure backflow assembly is required whenever toxic materials are present, whenever the city finds the cross-connection poses a health hazard, or whenever the city finds intricate plumbing arrangements which make it impractical to ascertain whether or not cross-connections exist. The reduced pressure backflow assembly shall be installed at the service connection immediately downstream from the water meter prior to any branch connections.

E. Pressure vacuum breakers may be substituted for other backflow prevention assemblies required under this regulation where the public works director or his designee determines that the circumstances and good engineering practices allow such substitution without compromising protection of water quality and public health. Where an industrial or commercial customer can demonstrate to the satisfaction of the public works director that there are no cross-connections with the water supply system on his premises and that no health hazard is posed by reason of the presence of toxic materials in the environment, the public works director or his staff may grant the customer an exemption from the cross-connection requirements herein, so long as cross-connections are not installed. Decisions made under this section shall be made at the sole discretion of the public works department or such staff member as he designates to carry out the cross-connection control programs of the city. Exemptions are subject to periodic review and may be revoked whenever a cross-connection is made or a risk to public health or water quality is present.

F. The public works director and such staff members as he may designate are delegated the authority to inspect, approve, and disapprove backflow prevention assemblies; to require correction, modifications, repairs, or maintenance on backflow prevention assemblies and to inspect all premises of customers where backflow prevention assemblies may be required. A minimum standard for the maintenance and installation of backflow prevention assemblies shall be those set forth in the "Accepted Procedures and Practice in the Cross-Connection Control Manual," May 1990, Fifth Edition, as published by the Pacific Northwest Section of the American Waterworks Committee and any subsequent edition or amendment of said manual. The public works director is authorized to establish higher standards for the installation and maintenance of backflow prevention assemblies where he finds that good engineering practice, industry standards or the protection of public health requires such higher standards.

G. As a condition of a continued water service, customers shall make their premises, including buildings and structures, to which water is supplied, accessible to city personnel periodically to determine whether backflow prevention assemblies are required or are properly installed and maintained. Testing and inspections will be made annually.

H. As a condition of continued water service, it shall further be the responsibility of each customer to maintain and repair backflow prevention assemblies and to upgrade any backflow prevention assembly which does not comply with the requirements of this chapter or the standards established by the city.

I. Prior to the installation of irrigation systems (fire sprinkler systems) and backflow prevention assemblies, the customer shall obtain a permit from the city for such installation.

J. Should a customer fail to install, maintain or repair a backflow prevention assembly as directed by the public works director, water service to the customer shall be terminated upon order of the public works director or city council, as directed by WAC 246-290-490.

K. The requirements herein for backflow prevention assembly installation shall apply even though local building and/or plumbing codes may not require backflow prevention assemblies.

L. The city of Algona strictly prohibits interconnection of other water supplies with the city's distribution system. Auxiliary water supplies (private wells, piped irrigation sources, etc.) are a major cross-connection control hazard and, therefore, must be effectively isolated from the domestic water supply. City of Algona cross-connection control policies and requirements for customers with private wells are as follows:

1. No backflow protection is required if the source is verified to be permanently inactivated. In such cases, formal abandonment in accordance with the requirements of the department of health should be pursued by the owner.

2. If the well remains active and the piping system is verified to be physically separated and permanently disconnected from the city's distribution main, an approved double-check valve assembly is required at the service connection to provide a measure of protection against inadvertent interconnection of the supplies.

New services will be locked off until compliance is verified by the city of Algona. Visual inspection of piping is required for premises retaining active well systems.

All backflow prevention assemblies are subject to annual inspection and testing. The cost of annual performance testing and any required maintenance is the responsibility of the backflow prevention assembly owner.

M. The city of Algona strictly prohibits the connection to any fire hydrant, standpipe, or blow-off. All connections to the above shall be considered a cross-connection and will be terminated immediately. The following are exceptions:

1. The fire department for fire protection and training;

2. The water department for service and maintenance of system;

3. The cross-connection control specialist may make exceptions with the use of an approved backflow assembly. (Ord. 947-04 § 2 (part)).

**13.02.170 Right of entry to read meters.**
Officers and employees of the city water department shall be entitled at proper hours of the day (8:00 a.m. through 5:00 p.m.) to enter upon property to which water is supplied under this chapter, for the purpose of reading the meter, and it is unlawful for any owner or any occupant of any premises supplied with city water to fail, neglect or refuse to give free access to such premises for such purposes. (Ord. 947-04 § 2 (part)).

**13.02.180 Discontinuance of water service.**
Should the owner of any premises desire to discontinue the use of water, the owner shall give the city notice in writing and pay in full all outstanding charges on the account at the office of the city clerk. The water shall then be shut off. Availability charges will then commence as established in Chapter 2.50 of this code. Upon application and payment of a reconnect fee in the amount set forth in Chapter 2.50 of this

## BACKFLOW INCIDENT REPORT FORM

There are many backflow incidents which occur that are not reported. This is usually because they are of short duration and are not detected, the customer is not aware they should be reported, or it may not be known to whom they should be reported.

The PNWS/AWWA Cross Connection Control Committee is making an effort to bring these incidents to the attention of water purveyors and the public. If you have any knowledge regarding backflow incidents, please fill out a copy of this form and return it to any member of the committee, or to the individual named on the reverse side. In addition, the state health agency must be notified.

Reporting Agency: ______________________ Report Date: ______________

Reported By: ______________________ Title: ______________

Mail Address: ______________________ City: ______________

State: __________ Zip Code: __________ Telephone: ______________

Date of Incident: ______________________ Time of Occurrence: ______________

General Location (Street, Block, etc.): ______________________

Backflow Originated From:

Name of Premise: ______________________

Street Address: ______________________ City: ______________

Contact Person: ______________________ Telephone: ______________

Type of Business: ______________________

Description of Contaminants:
(Attach chemical analysis or MSDS if available)

______________________

______________________

Distribution of Contaminant:

Contained within customer's premise: Yes: ______ No: ______

Number of persons affected: ______________

Effect of Contamination:

Illness reported: ______________________

Physical irritation reported: ______________________

(over)

Cross Connection Source of Contaminant:
(boiler, chemical pump, irrigation system, etc.)

______________________________________________

______________________________________________

Cause of Backflow:
(main break, fire flow, etc.)

______________________________________________

______________________________________________

Corrective Action Taken to Restore Water Quality:
(main flushing, disinfection, etc.)

______________________________________________

______________________________________________

Corrective Action Ordered to Eliminate or Protect Cross Connection:
(type of backflow preventer, location, etc.)

______________________________________________

______________________________________________

Previous Cross Connection Survey of Premise:

Date: ______________________ By: ______________________

Type of Backflow Preventer Isolating Premise:

RPBA: _____ RPDA: _____ DCVA: _____ DCDA: _____ None: _____

Type of Backflow Preventer Isolating Source of Contaminant:

RPBA: _____ RPDA: _____ DCVA: _____ DCDA: _____ PVBA: _____ AVB: _____

Air Gap: _____ None: _____

Date of latest Test of Assembly: ______________________

Notification of State Health Department:

Date: ____________ Time: ____________ Person Notified: ______________________

Notified By: ______________________________________________

Attach sheets with additional remarks, sketches, and/or media information.

Mail to:

# CROSS CONNECTION CONTROL SURVEY REPORT

| DATE | FILE NO. | TIME |
|---|---|---|
| | | |

Firm Name: ______________________ Type Of Business: ______________________

Address: ______________________ Zip: __________ Phone No.: ______________

Party Contacted: ______________________ Address: ______________________

Letter To:

Firm Name: ______________________ Address: ______________________

City: ______________ State: __________ Zip: ________ Phone No.: ______________

| City Water Service | Size | Pressure | Meter No. |
|---|---|---|---|
| Domestic | | | |
| Fire | | | |
| Irrigation | | | |
| Other Water Supply | | | |

Source __________ Use __________

| No. | Type Of Cross-Connection And Location | Recommended Remedy |
|---|---|---|
| | | |

*(Sketch)*

| No. | Type Of Cross-Connection And Location | Recommended Remedy |
|---|---|---|
| | | |

*(Sketch)*

Copy to:

- [ ] P. W. Bldg Dept.
- [ ] Architect
- [ ] Engineer
- [ ] Contractor
- [ ] Fire Prevention Bureau

# WATER SYSTEM PLAN CHECK

PROJECT

PROJECT LOCATION

NAME Plans Submitted By | DATE

ADDRESS Street City Zip

PHONE

## WATER DISTRIBUTION SECTION

Requirements: ______________________________

DISTRIBUTION ENGINEER

## WATER QUALITY SECTION

Requirements: ______________________________

WATER QUALITY ENGINEER

## BACKFLOW PREVENTION ASSEMBLY TEST REPORT

Return No Later Than: ____________

Name of Premises: ____________ File No.: ____________

Service Address: ____________

Location of Assembly: ____________

Assembly: ____________ ____________ ____________ ____________
Manufacturer | Model | Size | Serial No.

Line Pressure at Time of Test: ________ LBS. Type of Assembly: ____________

| | Reduced Pressure Assemblies | | | Pressure Vacuum Breaker | |
|---|---|---|---|---|---|
| | Double Check Assemblies | | Relief Valve | Air Inlet | Check Valve |
| | 1st Check | 2nd Check | | Opened at ____ psid | ____ psid |
| Initial Test | DC-closed tight ....... ☐<br>RP- ____ psid<br>Leaked ................ ☐ | Closed tight ........ ☐<br>Leaked ............... ☐ | Opened at<br>____ psid | Did not open ...... ☐ | Leaked ......... ☐ |
| Repairs and Materials Used | | | | | |
| Test After Repair | DC-closed tight ....... ☐<br>RP- ____ psid | Closed tight ........ ☐ | Opened at<br>____ psid | Opened at<br>____ psid | ____ psid |

Air Gap Inspection: Required minimum air gap separation provided ..........Yes ☐ No ☐

Remarks: ____________

____________

The Above Report Is Certified To Be True:

Initial Test Performed By: ____________ Cert. No.: ________ Date: ________

Repaired By: ____________ Date: ________

Final Test Performed By: ____________ Cert. No.: ________ Date: ________

Water Service Restored Yes ☐ No ☐

____________
*Customer's Signature*

**NO. 000000**

# BACKFLOW PREVENTION ASSEMBLY TEST REPORT

☐ New
☐ Replacement

Firm Name: ______________________________

Device Address: ______________________________
Street

______________________________
City Zip

Device Size: ☐☐•☐☐ Device Make: ☐☐☐☐☐☐☐ Model: ☐☐☐☐☐☐☐☐☐☐

Water System: ____________________ Serial Number: ☐☐☐☐☐☐☐☐☐☐☐

Device Location: ______________________________

| | REDUCED PRESSURE ASSEMBLY | | | PRESSURE VACUUM BREAKER | | INITIAL TEST |
|---|---|---|---|---|---|---|
| | DOUBLE CHECK VALVE | | Check #1 | Air Inlet | Check | Passed ☐ Failed ☐ |
| | Check #1 | Check #2 | | | | |
| **INITIAL TEST** | Tight ☐ Leaked ☐ Press Drop ☐☐•☐ psid | Tight ☐ Leaked ☐ | Relief Opened At ☐☐•☐ psid<br>**Relief Valve** Passed ☐ Failed ☐ | Opened At ☐☐•☐ psid Did Not Open ☐ | Press Drop ☐☐•☐ psid Leaked ☐ | Date: ☐☐☐☐☐☐ |
| **REPAIRS AND/OR PARTS** | | | | | | |
| **TEST AFTER REPAIR** | Tight ☐ | Tight ☐ | #1 Press Drop ☐☐•☐ psid<br>Relief Open ☐☐•☐ psid | Opened At ☐☐•☐ psid | Press Drop ☐☐•☐ psid | **After Repair** Date: ☐☐☐☐☐☐ |

Detector Meter Reading: ______________

IN COMPLETING AND SUBMITTING THIS TEST REPORT, THE TESTER CERTIFIES THAT THE DEVICE HAS BEEN TESTED AND MAINTAINED IN ACCORDANCE WITH ALL APPLICABLE RULES AND REGULATIONS OF THE WATER SYSTEM OWNER AND THE STATE.

______________________ ______________ ______________
*Tester's Signature* *Gauge #* *Cert. #*

Report Received By: ______________________________ (Representative or Firm)

White - Water System Pink - Customer Yellow - Tester

# BACKFLOW PREVENTION ASSEMBLY TEST RECORD CARD

| FIRM NAME | | FILE NO. | ASSEMBLY NO. |
|---|---|---|---|
| ADDRESS | | ZIP | PHONE NO. |
| PARTY CONTACTED | | TITLE | |
| TYPE OF ASSEMBLY | | | |

☐ Reduced Pressure Backflow Assembly ☐ Double Check Valve Assembly ☐ Pressure Vacuum Breaker Assembly

| MAKE OF ASSEMBLY | MODEL | SERIAL NO. | SIZE |
|---|---|---|---|
| DATE INSTALLED | | METER NO. | |
| CROSS-CONNECTION CONTROLLED | | | |
| LOCATION OF ASSEMBLY | | | |

*(Reverse Side of Card)*

| DATE TESTED | CHECK VALVE #1 | CHECK VALVE #2 | RELIEF VALVE | POPPET (PVBA) | DATE REPAIRS MADE | REMARKS |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

# TEST EQUIPMENT CALIBRATION FORM

Name: ______________________________

Address: ______________________________
Street

______________________________
City Zip

Gauge I.D. #: ☐☐☐☐☐☐ Type: Duplex ☐ Diff. Press. ☐

Make: ______________________ Model #: ☐☐☐☐☐

## Calibration Adjustment Required

| | | | | |
|---|---|---|---|---|
| Duplex: | Green (Low Needle): | Low ☐ | High ☐ | None ☐ |
| | Red (High Needle): | Low ☐ | High ☐ | None ☐ |
| Differential Pressure: | | Low ☐ | High ☐ | None ☐ |

Repairs And/ Or Parts ______________________________

______________________________

Comments: ______________________________

______________________________

______________________________

______________________________

______________________________

| | Yes | No |
|---|---|---|
| All necessary adjustments have been made: | ☐ | ☐ |

This gauge has been calibrated in compliance with ______________________ Administrative Rules.

Date Of Calibration: ☐☐☐

Next Calibration Date: ☐☐☐

Calibrator's Name: ______________________

Calibrator's #: ☐☐☐☐☐

*American Water Works Association*
*Pacific Northwest Section*
*Cross Connection Control Committee*

**Summary Of Annual Test Reports - Year: ____________**

Reduced Pressure Backflow Assemblies

Make & Model Of Assembly: ______________________________

| | | NUMBER OF FAILURES | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **SIZE OF ASSEMBLY (Inches)** | **TOTAL NUMBER OF TESTS** | *(a) No. 1 Check* | *(b) No. 2 Check* | *(c) Both Checks* | *(d) Relief Valve* | *(e) Relief & Either Check* | *(f) Relief & Both Checks* | *(g) No. 1 CV - Relief < 3 PSI* |
| 0.375 | | | | | | | | |
| 0.50 | | | | | | | | |
| 0.75 | | | | | | | | |
| 1.00 | | | | | | | | |
| 1.25 | | | | | | | | |
| 1.50 | | | | | | | | |
| 2.00 | | | | | | | | |
| 2.50 | | | | | | | | |
| 3.00 | | | | | | | | |
| 4.00 | | | | | | | | |
| 6.00 | | | | | | | | |
| 8.00 | | | | | | | | |
| 10.00 | | | | | | | | |

Name Of Water Utility: ______________________________

Report By: ______________________ Telephone No.: ______________

*American Water Works Association*
*Pacific Northwest Section*
*Cross Connection Control Committee*

## Summary Of Annual Test Reports - Year: ____________

Double Check Valve Assemblies

Make & Model Of Assembly: ______________________________

| SIZE OF ASSEMBLY (Inches) | TOTAL NUMBER OF TESTS | NUMBER OF FAILURES | | |
|---|---|---|---|---|
| | | *(a)* *No. 1 Check* | *(b)* *No. 2 Check* | *(c)* *Both Checks* |
| 0.375 | | | | |
| 0.50 | | | | |
| 0.75 | | | | |
| 1.00 | | | | |
| 1.25 | | | | |
| 1.50 | | | | |
| 2.00 | | | | |
| 2.50 | | | | |
| 3.00 | | | | |
| 4.00 | | | | |
| 6.00 | | | | |
| 8.00 | | | | |
| 10.00 | | | | |

Name Of Water Utility: ______________________________

Report By: ____________________ Telephone No.: ______________

*American Water Works Association*
*Pacific Northwest Section*
*Cross Connection Control Committee*

**Summary Of Annual Test Reports - Year: ___________**

Pressure Vacuum Breaker Assemblies

Make & Model Of Assembly: ______________________________

| SIZE OF ASSEMBLY (Inches) | TOTAL NUMBER OF TESTS | NUMBER OF FAILURES | | |
|---|---|---|---|---|
| | | *(a)* *Air Inlet* | *(b)* *Check Valve* | *(c)* *Both CV & Inlet* |
| 0.50 | | | | |
| 0.75 | | | | |
| 1.00 | | | | |
| 1.25 | | | | |
| 1.50 | | | | |
| 2.00 | | | | |
| | | | | |

Name Of Water Utility: ______________________________

Report By: ____________________ Telephone No.: ____________________

## Other Publications Available From The Pacific Northwest Section American Water Works Association:

**Summary Of Backflow Incidents**

A 3-ring binder containing reports of backflow incidents. Updated reports are provided periodically to holders of this binder. It is a very useful educational tool.

**Home Irrigation Safety**

A 3 1/2 X 8 1/2, 4-fold pamphlet illustrating backflow protection for home irrigation systems. The pamphlet illustrates installation standards and describes the AVB, PVBA, DCVA, and RPBA. Up to 25 copies are available with no charge. Camera-ready copy is available to permit printing your utility or company name and phone number.

**Cross Connection Control For Residential Fire Sprinkler Systems**

A 3 1/2 X 8 1/2, 4-fold pamphlet illustrating the difference between direct and indirect systems, and their backflow protection requirements. Up to 25 copies are available with no charge. Camera-ready copy is available to permit printing your utility or company name and phone number.

**Cross Connections Can Create Health Hazards**

A 3 1/2 X 8 1/2, tri-fold pamphlet explaining in simple terms what constitutes a cross connection, and danger associated with cross connections. Up to 25 copies are available with no charge. Camera-ready copy is available to permit printing your utility or company name and phone number.

**Solar Domestic Hot Water Systems And The Water Purveyor**

A 5 1/2 X 8 1/2, 12-page manual that describes solar domestic hot water systems and gives precautions that should be taken to protect the consumers' hot water system. It also provides recommendations to protect the public water supply.

**Computer Data Base Program**

Backflow Prevention Assemblies computer data base software which will allow water purveyors to manage a cross connection program to insure that all backflow prevention assemblies are tested annually while developing statistics on problems encountered by particular makes, models, or sizes of assemblies.

## These publications may be ordered from:

Pacific Northwest Section-AWWA
P. O. Box 19581
Portland, OR 97280
503/246-5845

BACKFLOW LIST

| | |
|---|---|
| 701 1st Ave | 238 Bldg – E of door #14, in vault |
| BOEING | Bldg. 17-62, 1st floor, Location C-3, top of block |
| | Bldg. 17-62, 1st floor, Location D-14, 10' E |
| | Bldg 17-62, 2nd floor, Location B-15, mezzanine |
| | Bldg. 17-62, 2nd floor, Location B-14, 50'E, 30'S |
| | Bldg. 17-62, 1st floor, Location D-5, 30'E Dr14D5 |
| | Bldg. 17-62, 1st floor, Location F-2, 20", Bir Rm |
| | Bldg 17-62, 1st floor, Location E-5, 10'W |
| | Bldg 17-62, Pit, Location F-8, Pit |
| | Bldg 17-62, boiler room |
| | Bldg 17-62, inside door 14d5. janitor closet |
| | Bldg 17-62, South Wall/North penetrant booth |
| | Bldg 17-62, South side penetrant booth |
| 138 5TH Ave S. | Meter box by Water Meter |
| 501 10th Ave N | SE corner beside meter |
| | SW wall next to riser |
| | Fire main by-pass |
| | S wall warehouse directly N of pumper connection |
| 502 10th Ave N. | SW corner 10th Ave N/Industry Dr. N in turf |
| | North property in vault |
| | (four device numbers in file) |
| 901 Algona Blvd | Riser room, W side of bldg, 60' N of SW corner |
| 400 Boundary Blvd | NW corner of warehouse at fire system risers |
| | Fire system main |
| | Fire system bypass |
| | Left side of drive thru |
| 501 Boundary Blvd | East riser |
| | By shipping office |
| | Refidgeration mechanical room |
| | Main line in vault by street |
| | NE corner production area |
| | North property |
| | West perimeter |
| | Boiler room |

| | |
|---|---|
| 512 Boundary Blvd | By hydrant along street<br>Main fire riser<br>East of E entrance by hydrant<br>N side of warehouse |
| 306 Ellingson Rd | By street in irrigation box by meter<br>Riser room<br>By riser near loading docks<br>NW corner of warehouse<br>3' W of deduct meter @ driveway entrance<br>Inside E wall |
| 840 Industry Dr. N | Fire pump room |
| 1002 Industry Dr. | SE corner $10^{th}$ N/Industry Dr in turf |
| 1150 Industry Dr | SE of fry room<br>Above clean potato line<br>Outside W wall of fry room S of chemical tanks<br>Fire sprinkler room W wall<br>Opposite time clocks N end of plant |
| 1196 Industry Dr N | Riser in warehouse<br>S wall @ fire system risers |
| 500 Milwaukee | Fire pum room, W side of bldg. |
| 650 Milwaukee | AC cell/South<br>AC cell/North<br>Ground, vault by FDC connection<br>NE corner of bldg.<br>233 bld – E of guard gate, in vault |
| 652-654 Milwaukee | Vault by entry |
| 700 Milwaukee | S wall of warehouse by sprinkler riser<br>Outside vault W side of bldg. |
| 800 Milwaukee | West of building<br>Generator room |
| 851 Milwaukee | Ground vault by FDC<br>Fire vault W side of property<br>Ground vault by yard Piv & FDC across from Door #11<br>Pit middle of building by Milwaukee |

SERIAL TYPE

| | |
|---|---|
| 2400 Perimeter Rd<br>BOEING | Bldg 17-62, NE corner (landscape irrigation)<br>Bldg 17-04, 1st floor, Location C-15 216472 RP 1/2<br>Bldg 17-06, 1st floor, Location A-32 38'E 134985 1/2" WATTS 009<br>Bldg 17-62 Top of xray lab blockhouse<br>Bldg 17-62, 2nd floor, Location B-15. mezzanine<br>Bldg 17-62, 1st floor, Location D-5, 30'EDr14D5<br>Bldg 17-62, pit, F-8, pit<br>Bldg 17-62, 1st floor, LocationF-2, 20'E, Blr Rm<br>Bldg 17-62, 1st floor, Location E-5, 10'W |
| 34721 West Valley Hwy | Along drive entrance by meter |
| 35315 West Valley Hwy | Pit<br>In vault between transfer station facility and cashier shack |

117 5TH AVE S FRONT BATHROOM IN SINK CABINET

# APPENDIX I

# CAPITAL IMPROVEMENT PROJECT COST ESTIMATES

**CITY OF ALGONA**
**CAPITAL IMPROVEMENT PROJECTS**
**PRELIMINARY COST ESTIMATE-PROJECT D-1**
**Water main along Seattle Boulevard S, 5th Avenue S and Tacoma Boulevard S**

| NO. | ITEM | QUANTITY | | UNIT PRICE | | AMOUNT |
|---|---|---|---|---|---|---|
| 1 | Mobilization, Cleanup, and Demobilization | LUMP SUM | $ | 20,000.00 | $ | 20,000.00 |
| 2 | 8-inch D.I. Water Pipe, Including Fittings | 1,600 LF | $ | 60.00 | $ | 96,000.00 |
| 3 | Locate Existing Utilities | LUMP SUM | $ | 1,000.00 | $ | 1,000.00 |
| 4 | Erosion Control | LUMP SUM | $ | 1,000.00 | $ | 1,000.00 |
| 5 | Additional Pipe Fittings | 250 LB | $ | 3.00 | $ | 750.00 |
| 6 | Trench Safety Systems | LUMP SUM | $ | 1,600.00 | $ | 1,600.00 |
| 7 | 8-inch Gate Valves | 2 EA | $ | 1,800.00 | $ | 3,600.00 |
| 8 | Fire Hydrants | 4 EA | $ | 4,500.00 | $ | 18,000.00 |
| 9 | Service Connections | 7 EA | $ | 1,250.00 | $ | 8,750.00 |
| 10 | Abandon Existing A/C Watermain | 1,040 LF | $ | 5.00 | $ | 5,200 |
| 11 | Sawcutting | 3,200 LF | $ | 3.00 | $ | 9,600 |
| 12 | Gravel Backfill | 700 TN | $ | 15.00 | $ | 10,500.00 |
| 13 | Connections to Existing | 2 EA | $ | 3,000.00 | $ | 6,000.00 |
| 14 | Crushed Surfacing Top Course | 200 TN | $ | 20.00 | $ | 4,000.00 |
| 15 | HMA Cl. 1/2" PG 58-22 | 160 TN | $ | 150.00 | $ | 24,000.00 |
| 16 | Foundation Gravel | 90 TN | $ | 20.00 | $ | 1,800.00 |
| 17 | Cold Mix Asphalt | 40 TN | $ | 110.00 | $ | 4,400.00 |
| 18 | Traffic Control | 48 HRS | $ | 95.00 | $ | 4,600.00 |
| | Subtotal: | | | | $ | 220,800.00 |
| | Sales Tax (9.5%): | | | | $ | 20,976.00 |
| | Subtotal: | | | | $ | 241,776.00 |
| | Contingency (20%): | | | | $ | 48,355.20 |
| | TOTAL ESTIMATED CONSTRUCTION COST: | | | | $ | 290,131.00 |
| | Engineering and Administrative Costs (25%): | | | | $ | 72,532.75 |
| | TOTAL ESTIMATED PROJECT COST: | | | | $ | 363,000.00 |

**CITY OF ALGONA**
**CAPITAL IMPROVEMENT PROJECTS**
**PRELIMINARY COST ESTIMATE-PROJECT D-2**
**Main St, between 8th Avenue N and Broadway Street**

| NO. | ITEM | QUANTITY | | UNIT PRICE | | AMOUNT |
|---|---|---|---|---|---|---|
| 1 | Mobilization, Cleanup, and Demobilization | LUMP SUM | $ | 17,000.00 | $ | 17,000.00 |
| 2 | 8-inch D.I. Water Pipe, Including Fittings | 1,200 LF | $ | 60.00 | $ | 72,000.00 |
| 3 | Locate Existing Utilities | LUMP SUM | $ | 500.00 | $ | 500.00 |
| 4 | Erosion Control | LUMP SUM | $ | 500.00 | $ | 500.00 |
| 5 | Additional Pipe Fittings | 200 LB | $ | 3.00 | $ | 600.00 |
| 6 | Trench Safety Systems | LUMP SUM | $ | 1,200.00 | $ | 1,200.00 |
| 7 | 8-inch Gate Valves | 7 EA | $ | 1,800.00 | $ | 12,600.00 |
| 8 | Fire Hydrants | 3 EA | $ | 4,500.00 | $ | 13,500.00 |
| 9 | Service Connections | 7 EA | $ | 1,250.00 | $ | 8,750.00 |
| 10 | Abandon Existing A/C Watermain | 1,200 LF | $ | 5.00 | $ | 6,000 |
| 11 | Sawcutting | 2,400 LF | $ | 3.00 | $ | 7,200 |
| 10 | Gravel Backfill | 530 TN | $ | 15.00 | $ | 7,950.00 |
| 11 | Connections to Existing | 4 EA | $ | 3,000.00 | $ | 12,000.00 |
| 12 | Crushed Surfacing Top Course | 150 TN | $ | 20.00 | $ | 3,000.00 |
| 13 | HMA Cl. 1/2" PG 58-22 | 120 TN | $ | 150.00 | $ | 18,000.00 |
| 14 | Foundation Gravel | 70 TN | $ | 20.00 | $ | 1,400.00 |
| 15 | Cold Mix Asphalt | 30 TN | $ | 110.00 | $ | 3,300.00 |
| 16 | Traffic Control | 32 HRS | $ | 95.00 | $ | 3,000.00 |
| | Subtotal:.......... | | | | $ | 188,500.00 |
| | Sales Tax (9.5%):.......... | | | | $ | 17,907.50 |
| | Subtotal:.......... | | | | $ | 206,407.50 |
| | Contingency (20%):.......... | | | | $ | 41,281.50 |
| | TOTAL ESTIMATED CONSTRUCTION COST:.......... | | | | $ | 247,689.00 |
| | Engineering and Administrative Costs (25%):.......... | | | | $ | 61,922.25 |
| | TOTAL ESTIMATED PROJECT COST:.......... | | | | $ | 310,000.00 |

**CITY OF ALGONA**
**CAPITAL IMPROVEMENT PROJECTS**
**PRELIMINARY COST ESTIMATE-PROJECT D-3**
**West Valley Highway, between 9th Avenue N and Broadway Street**

| NO. | ITEM | QUANTITY | UNIT PRICE | AMOUNT |
|---|---|---|---|---|
| 1 | Mobilization, Cleanup, and Demobilization | LUMP SUM | $ 25,000.00 | $ 25,000.00 |
| 2 | 8-inch D.I. Water Pipe, Including Fittings | 1,460 LF | $ 60.00 | $ 87,600.00 |
| 3 | Locate Existing Utilities | LUMP SUM | $ 800.00 | $ 800.00 |
| 4 | Erosion Control | LUMP SUM | $ 800.00 | $ 800.00 |
| 5 | Additional Pipe Fittings | 250 LB | $ 3.00 | $ 750.00 |
| 6 | Trench Safety Systems | LUMP SUM | $ 1,500.00 | $ 1,500.00 |
| 7 | 8-inch Gate Valves | 2 EA | $ 1,800.00 | $ 3,600.00 |
| 8 | Fire Hydrants | 3 EA | $ 4,500.00 | $ 13,500.00 |
| 9 | Service Connections | 17 EA | $ 1,250.00 | $ 21,250.00 |
| 10 | Abandon Existing A/C Watermain | 1,460 LF | $ 5.00 | $ 7,300 |
| 11 | Sawcutting | 2,920 LF | $ 3.00 | $ 8,760 |
| 12 | Connections to Existing | 2 EA | $ 3,000.00 | $ 6,000.00 |
| 13 | Crushed Surfacing Top Course | 820 TN | $ 20.00 | $ 16,400.00 |
| 14 | HMA Cl. 1/2" PG 58-22 | 450 TN | $ 150.00 | $ 67,500.00 |
| 15 | Foundation Gravel | 80 TN | $ 20.00 | $ 1,600.00 |
| 16 | Cold Mix Asphalt | 40 TN | $ 110.00 | $ 4,400.00 |
| 17 | Traffic Control | 80 HRS | $ 95.00 | $ 7,600.00 |
| | Subtotal: | | | $ 274,360.00 |
| | Sales Tax (9.5%): | | | $ 26,064.20 |
| | Subtotal: | | | $ 300,424.20 |
| | Contingency (20%): | | | $ 60,084.84 |
| | TOTAL ESTIMATED CONSTRUCTION COST: | | | $ 360,509.00 |
| | Engineering and Administrative Costs (25%): | | | $ 90,127.25 |
| | TOTAL ESTIMATED PROJECT COST: | | | $ 451,000.00 |

**CITY OF ALGONA**
**CAPITAL IMPROVEMENT PROJECTS**
**PRELIMINARY COST ESTIMATE-PROJECT D-4**
**5th Avenue S, between Washington Blvd and Milwaukee Blvd**

| NO. | ITEM | QUANTITY | | UNIT PRICE | AMOUNT |
|---|---|---|---|---|---|
| 1 | Mobilization, Cleanup, and Demobilization | LUMP SUM | | $ 10,000.00 | $ 10,000.00 |
| 2 | 8-inch D.I. Water Pipe, Including Fittings | 700 | LF | $ 60.00 | $ 42,000.00 |
| 3 | Locate Existing Utilities | LUMP SUM | | $ 750.00 | $ 750.00 |
| 4 | Erosion Control | LUMP SUM | | $ 750.00 | $ 750.00 |
| 5 | Additional Pipe Fittings | 150 | LB | $ 3.00 | $ 450.00 |
| 6 | Trench Safety Systems | LUMP SUM | | $ 700.00 | $ 700.00 |
| 7 | 8-inch Gate Valves | 1 | EA | $ 1,800.00 | $ 1,800.00 |
| 8 | Fire Hydrants | 1 | EA | $ 4,500.00 | $ 4,500.00 |
| 9 | Service Connections | 17 | EA | $ 1,250.00 | $ 21,250.00 |
| 10 | Sawcutting | 1,400 | LF | $ 3.00 | $ 4,200 |
| 11 | Gravel Backfill | 310 | TN | $ 15.00 | $ 4,650.00 |
| 12 | Connections to Existing | 2 | EA | $ 3,000.00 | $ 6,000.00 |
| 13 | Crushed Surfacing Top Course | 90 | TN | $ 20.00 | $ 1,800.00 |
| 14 | HMA Cl. 1/2" PG 58-22 | 70 | TN | $ 150.00 | $ 10,500.00 |
| 15 | Foundation Gravel | 40 | TN | $ 20.00 | $ 800.00 |
| 16 | Cold Mix Asphalt | 20 | TN | $ 110.00 | $ 2,200.00 |
| 17 | Traffic Control | 24 | HRS | $ 95.00 | $ 2,300.00 |
| | Subtotal:........................................ | | | | $ 114,650.00 |
| | Sales Tax (9.5%):........................................ | | | | $ 10,891.75 |
| | Subtotal:........................................ | | | | $ 125,541.75 |
| | Contingency (20%):........................................ | | | | $ 25,108.35 |
| | TOTAL ESTIMATED CONSTRUCTION COST:........................................ | | | | $ 150,650.00 |
| | Engineering and Administrative Costs (25%):........................................ | | | | $ 37,662.50 |
| | TOTAL ESTIMATED PROJECT COST:........................................ | | | | $ 189,000.00 |

**CITY OF ALGONA**
**CAPITAL IMPROVEMENT PROJECTS**
**PRELIMINARY COST ESTIMATE-PROJECT D-5**
**West Valley Highway, between 1st Avenue and 4th Avenue S**

| NO. | ITEM | QUANTITY | UNIT PRICE | AMOUNT |
|---|---|---|---|---|
| 1 | Mobilization, Cleanup, and Demobilization | LUMP SUM | $ 27,000.00 | $ 27,000.00 |
| 2 | 12-inch D.I. Water Pipe, Including Fittings | 1,400 LF | $ 80.00 | $ 112,000.00 |
| 3 | Locate Existing Utilities | LUMP SUM | $ 2,000.00 | $ 2,000.00 |
| 4 | Erosion Control | LUMP SUM | $ 2,000.00 | $ 2,000.00 |
| 5 | Additional Pipe Fittings | 300 LB | $ 3.00 | $ 900.00 |
| 6 | Trench Safety Systems | LUMP SUM | $ 1,400.00 | $ 1,400.00 |
| 7 | 12-inch Gate Valves | 2 EA | $ 2,500.00 | $ 5,000.00 |
| 8 | Fire Hydrants | 3 EA | $ 4,500.00 | $ 13,500.00 |
| 9 | Service Connections | 7 EA | $ 1,250.00 | $ 8,750.00 |
| 10 | Abandon Existing A/C Watermain | 1,400 LF | $ 5.00 | $ 7,000 |
| 11 | Sawcutting | 2,800 LF | $ 3.00 | $ 8,400 |
| 10 | Connections to Existing | 2 EA | $ 3,000.00 | $ 6,000.00 |
| 11 | Crushed Surfacing Top Course | 910 TN | $ 20.00 | $ 18,200.00 |
| 12 | HMA Cl. 1/2" PG 58-22 | 470 TN | $ 150.00 | $ 70,500.00 |
| 13 | Foundation Gravel | 90 TN | $ 20.00 | $ 1,800.00 |
| 14 | Cold Mix Asphalt | 40 TN | $ 110.00 | $ 4,400.00 |
| 15 | Traffic Control | 80 HRS | $ 95.00 | $ 7,600.00 |
| | Subtotal: | | | $ 296,450.00 |
| | Sales Tax (9.5%): | | | $ 28,162.75 |
| | Subtotal: | | | $ 324,612.75 |
| | Contingency (20%): | | | $ 64,922.55 |
| | TOTAL ESTIMATED CONSTRUCTION COST: | | | $ 389,535.00 |
| | Engineering and Administrative Costs (25%): | | | $ 97,383.75 |
| | TOTAL ESTIMATED PROJECT COST: | | | $ 487,000.00 |

**CITY OF ALGONA**
**CAPITAL IMPROVEMENT PROJECTS**
**PRELIMINARY COST ESTIMATE-PROJECT D-6**
**2nd Avenue N, west of Main Street**

| NO. | ITEM | QUANTITY | | UNIT PRICE | | AMOUNT |
|---|---|---|---|---|---|---|
| 1 | Mobilization, Cleanup, and Demobilization | LUMP SUM | $ | 8,000.00 | $ | 8,000.00 |
| 2 | 8-inch D.I. Water Pipe, Including Fittings | 560 LF | $ | 60.00 | $ | 33,600.00 |
| 3 | Locate Existing Utilities | LUMP SUM | $ | 2,000.00 | $ | 2,000.00 |
| 4 | Erosion Control | LUMP SUM | $ | 2,000.00 | $ | 2,000.00 |
| 5 | Additional Pipe Fittings | 100 LB | $ | 3.00 | $ | 300.00 |
| 6 | Trench Safety Systems | LUMP SUM | $ | 600.00 | $ | 600.00 |
| 7 | 8-inch Gate Valves | 1 EA | $ | 1,800.00 | $ | 1,800.00 |
| 8 | Fire Hydrants | 1 EA | $ | 4,500.00 | $ | 4,500.00 |
| 9 | Service Connections | 7 EA | $ | 1,250.00 | $ | 8,750.00 |
| 10 | Abandon Existing A/C Watermain | 560 LF | $ | 5.00 | $ | 2,800 |
| 11 | Sawcutting | 1,120 LF | $ | 3.00 | $ | 3,360 |
| 10 | Gravel Backfill | 250 TN | $ | 15.00 | $ | 3,750.00 |
| 11 | Connections to Existing | 1 EA | $ | 3,000.00 | $ | 3,000.00 |
| 12 | Crushed Surfacing Top Course | 70 TN | $ | 20.00 | $ | 1,400.00 |
| 13 | HMA Cl. 1/2" PG 58-22 | 60 TN | $ | 150.00 | $ | 9,000.00 |
| 14 | Foundation Gravel | 30 TN | $ | 20.00 | $ | 600.00 |
| 15 | Cold Mix Asphalt | 20 TN | $ | 110.00 | $ | 2,200.00 |
| 16 | Traffic Control | 16 HRS | $ | 95.00 | $ | 1,500.00 |
| | Subtotal: | | | | $ | 89,160.00 |
| | Sales Tax (9.5%): | | | | $ | 8,470.20 |
| | Subtotal: | | | | $ | 97,630.20 |
| | Contingency (20%): | | | | $ | 19,526.04 |
| | TOTAL ESTIMATED CONSTRUCTION COST: | | | | $ | 117,156.00 |
| | Engineering and Administrative Costs (25%): | | | | $ | 29,289.00 |
| | TOTAL ESTIMATED PROJECT COST: | | | | $ | 147,000.00 |

**CITY OF ALGONA**
**CAPITAL IMPROVEMENT PROJECTS**
**PRELIMINARY COST ESTIMATE-PROJECT D-7**
**Replacement of AC Water Mains**

| NO. | ITEM | QUANTITY | | UNIT PRICE | | AMOUNT |
|---|---|---|---|---|---|---|
| 1 | Mobilization, Cleanup, and Demobilization | LUMP SUM | $ | 10,000.00 | $ | 10,000.00 |
| 2 | 8-inch D.I. Water Pipe, Including Fittings | 700 LF | $ | 60.00 | $ | 42,000.00 |
| 3 | Locate Existing Utilities | LUMP SUM | $ | 800.00 | $ | 800.00 |
| 4 | Erosion Control | LUMP SUM | $ | 800.00 | $ | 800.00 |
| 5 | Additional Pipe Fittings | 150 LB | $ | 3.00 | $ | 450.00 |
| 6 | Trench Safety Systems | LUMP SUM | $ | 700.00 | $ | 700.00 |
| 7 | 8-inch Gate Valves | 1 EA | $ | 1,800.00 | $ | 1,800.00 |
| 8 | Fire Hydrants | 1 EA | $ | 4,500.00 | $ | 4,500.00 |
| 9 | Service Connections | 12 EA | $ | 1,250.00 | $ | 15,000.00 |
| 10 | Abandon Existing A/C Watermain | 700 LF | $ | 5.00 | $ | 3,500 |
| 11 | Sawcutting | 1,400 LF | $ | 3.00 | $ | 4,200 |
| 12 | Gravel Backfill | 310 TN | $ | 15.00 | $ | 4,650.00 |
| 13 | Connections to Existing | 2 EA | $ | 3,000.00 | $ | 6,000.00 |
| 14 | Crushed Surfacing Top Course | 90 TN | $ | 20.00 | $ | 1,800.00 |
| 15 | HMA Cl. 1/2" PG 58-22 | 70 TN | $ | 150.00 | $ | 10,500.00 |
| 16 | Foundation Gravel | 40 TN | $ | 20.00 | $ | 800.00 |
| 17 | Cold Mix Asphalt | 20 TN | $ | 110.00 | $ | 2,200.00 |
| 16 | Traffic Control | 24 HRS | $ | 95.00 | $ | 2,300.00 |
| | Subtotal: | | | | $ | 112,000.00 |
| | Sales Tax (9.5%): | | | | $ | 10,640.00 |
| | Subtotal: | | | | $ | 122,640.00 |
| | Contingency (20%): | | | | $ | 24,528.00 |
| | TOTAL ESTIMATED CONSTRUCTION COST: | | | | $ | 147,168.00 |
| | Engineering and Administrative Costs (25%): | | | | $ | 36,792.00 |
| | TOTAL ESTIMATED PROJECT COST: | | | | $ | 184,000.00 |

# APPENDIX J

# SEPA CHECKLIST

CITY OF ALGONA
402 Warde Street
Algona, Washington 98001

Administration (253) 833-2897
Public Works (253) 833-2741
Police (253) 833-2743
Fax (253) 939-3366

*** MEMORANDUM ***

TO: Interested Parties

FROM: Elizabeth Chamberlain, Algona Contract Planner

DATE: August 5, 2013

RE: **Notice of Determination of Non-Significance for the City of Algona's Water Comprehensive Plan Update**

---

Please find enclosed a copy of the determination of non-significance in accordance with 197-11-340(2) for the above referenced project. Also included are the following:

1. Environmental Checklist
2. Draft Water Comprehensive Plan

If you have any questions regarding this process or would like to received additional documentation on the proposed amendments, please contact Elizabeth Chamberlain, Algona Contract Planner, at planner@algonwa.gov

CITY OF ALGONA
402 Warde Street
Algona, Washington 98001

Administration (253) 833-2897
Public Works (253) 833-2741
Police (253) 833-2743
Fax (253) 939-3366

## *Determination of Non-Significance*
## *City of Algona's Water Comprehensive Plan Update*

**Description of Proposal:** City of Algona - Water Comprehensive Plan Update

**Proponent:** City of Algona

**Location:** City's water service area – includes the city limits

**Lead Agency:** City of Algona

The lead agency for this proposal has determined that it does not have probable significant adverse impact on the environment. An environmental impact statement (EIS) is not required under RCW 43.21C.030(2)(c). This decision was made after review of a completed environmental checklist and other information on file with the lead agency. This information is available to the public on request.

This DNS is issued under 197-11-340(2); the lead agency will not act on this proposal for 14 days from the date issued below. Comments must be submitted by 5:00 p.m. on **August 19, 2013.**

Any person aggrieved of the City's determination may file an appeal with the City of Algona within 14 days of the close of the comment period, or by 5:00 p.m. on **September 3, 2013.**

Responsible Official: David E. Hill
Position/Title: Mayor of Algona
Address: 402 Warde Street
Algona, Washington 98001
253833-2897

Date Issued: **August 5, 2013**     Signature: ____________

**Note: This determination does not constitute approval of the proposal. Approval of the proposal can only be made by the legislative or administrative body vested with that authority. The proposal will be required to meet all applicable regulations.**

# PART ELEVEN – FORMS

**WAC 197-11-960 Environmental Checklist.**

## ENVIRONMENTAL CHECKLIST

## A. BACKGROUND

1. Name of proposed project, if applicable.

   *Water System Comprehensive Plan*

2. Name of Applicant:

   *City of Algona*

3. Address and Phone Number of Applicant and Contact Person:

   *Diana Quinn, City Clerk*
   *402 Warde Street*
   *Algona, WA 98001*
   *(253) 833-2897*

4. Date Checklist Prepared:

   *June 2013*

5. Agency Requesting Checklist

   *City of Algona*

6. Proposed Timing or Schedule (including phasing, if applicable)

   *The development of the Water System Comprehensive Plan (Plan) occurred in 2012 and 2013.*

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

   *This Plan provides a 6-year capital improvement plan (CIP). These projects will be implemented based on need and available financing.*

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

   *None.*

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal. If yes, explain.

   *This Plan will required approval by the Washington Department of Health prior to adoption by the City.*

10. List any government approvals or permits that will be needed for your proposal, if known.

    *Government approval and permits will be obtained for each project implemented in the CIP.*

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description.)

    *The scope of work for the Water System Comprehensive Plan is organized into the following chapters:*

    - *Chapter 1, Introduction, provides background information including system history, inventory of existing facilities, service area agreements, interlocal agreements, future service area, service area policies and conditions of service, and related planning documents.*

    - *Chapter 2, Basic Planning Data, includes existing and future population projections; number of service area connections; and water use data including production, consumption, lost and unaccounted for water, peaking factors, and equivalent residential units. Service area characteristics, existing and projected land use, and water demand forecasts are also included.*

    - *Chapter 3, Basic System Analysis, consists of system design standards, general facility standards, and an analysis of Granite Falls' source of supply, and storage capacity. Water Quality Regulations, includes existing drinking water quality standards, anticipated future drinking water quality standards, water quality monitoring schedule, and water quality analysis. Hydraulic Analysis, discusses the hydraulic modeling program, model development, system demands, model calibration, and distribution system analysis that includes peak hour and available fire flow simulations.*

    - *Chapter 4, Water Conservation Plan, includes water use data collection, program development and implementation, recommended measures and level of implementation, regional conservation programs, Granite Falls' conservation program, water right evaluation, and water system reliability analysis.*

    - *Chapter 5, Source Water Protection Program - References PUD program. PUD Supplies all water to Granite Falls*

    - *Chapter 6, Operations and Maintenance Program, reviews water system management and personnel, operator certification, routine operating procedures, preventative maintenance, record keeping, water quality sampling procedures, and discusses the*

*Water Company's coliform monitoring plan, emergency response program, safety procedures, cross-connection control program, and service reliability.*

- *Chapter 7, Construction Standards.*

- *Chapter 8, Capital Improvement Plan (CIP), provides an implementation schedule for six and 20 years.*

- *Chapter 9, Financial Program, analyzes past income and expenses, balanced one-year operating budget, revenue and cash flow to fund CIP and emergency improvements, and assesses the rate structure to consider affordability of rates and water conservation.*

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including the street address, if any, and section, township, and range, if known. If a proposal would occur over a range of areas, provide the range or boundaries of the site(s). While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

    *The study area for this Plan is located in the corporate limits of Algona and unincorporated King County.*

## B. ENVIRONMENTAL ELEMENTS

This is a nonproject action, therefore a number of the environmental elements will not apply. A general answer will be provided where appropriate. The answers will apply generally to Granite Falls' service area.

### 1. Earth

a. General description of the site (check one): ☒ flat, ☐ rolling, ☐ hilly, ☒ steep slope, ☐ other:

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

*Algona is situated between the Green River valley and the White River valley. Elevation slopes both to the north and to the south in the direction of the two rivers at less than 5% with a steep hill on the west margin of the City.*

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

*The Soil Survey of King County, Washingotn classifies the majority of the soil as Seattle Muck.*

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

**2. Air**

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

**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.

*To be determined on a project specific basis.*

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.

*To be determined on a project specific basis.*

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.

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

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.

*To be determined on a project specific basis.*

b. Ground:

1) Will ground water be withdrawn, or will water be discharged to ground water? Give general description, purpose, and approximate quantities if known.

*To be determined on a project specific basis.*

2) 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.

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

c. Water runoff (including stormwater):

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.

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

**4. Plants**

a. Check types of vegetation found on the site:

- ☐ Deciduous tree: Hemlock, yew, alder, apple, cherry, and maple.
- ☐ Evergreen tree: Douglas fir, cedar, pine, spruce
- ☐ Shrubs
- ☐ Grass
- ☐ Pasture
- ☐ Crop or grain
- ☐ Wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
- ☐ Water plants: water lily, eelgrass, milfoil, other
- ☐ Other types of vegetation: Foxglove, lupine, paintbrush, berries, ferns, moss and lichens
- ☒ To be determined on a project specific basis.

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

**5. Animals**

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

- ☐ Birds: ducks, geese, osprey, great blue heron, turkey vulture, bald eagle.
- ☐ Mammals:
- ☐ Fish:
- ☒ *To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

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

*The entire Puget Sound basin is a part of the Pacific Flyway.*

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

*None required.*

**6. Energy and Natural Resources**

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

**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.

*To be determined on a project specific basis.*

1) Describe special emergency services that might be required.

*To be determined on a project specific basis.*

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

None required.

**8. Noise**

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

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

None required.

**9. Land and Shoreline Use**

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

*Existing land use in Granite Falls is primarily residential with a small number of commercial establishments.*

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

*No.*

c. Describe any structures on the site.

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

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

*To be determined based upon growth within Algona.*

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

*None.*

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

*None required.*

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

*To be determined on a project specific basis.*

**10. Housing**

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

*None.*

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

*None.*

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

None required.

**11. Aesthetics**

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

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

*None required.*

**12. Light and Glare**

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

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

*None required.*

**13. Recreation**

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

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

*None required.*

**14. 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.

*None.*

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

*None.*

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

*None required.*

**15. 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.

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

**16. Public Services**

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

*To be determined on a project specific basis.*

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

*To be determined on a project specific basis.*

**17. Utilities**

a. Check utilities currently available at the site:

☐ Electricity
☐ Natural gas
☐ Water
☐ Refuse service
☐ Sanitary service
☐ Septic system
☐ Other:
☒ Not applicable

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

*To be determined on a project specific basis.*

## C. 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: Warren W. Perkins

Date Submitted: 6/24/13

## D. SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS

(Do not use this sheet for project actions.)

Because these question are very general, it may be helpful to read them in conjunction with the list of the elements of the environment.

When answering these questions, be aware of the extent of the proposal, or the types of activities likely to result from the proposal, would affect the item in a greater intensity or at a faster rate than if the proposal were not implemented. Respond briefly and in general terms.

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?

   *To be determined on a project specific basis.*

   Proposed measures to avoid or reduce such increases are:

   *To be determined on a project specific basis.*

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

   *Unknown at this time.*

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

   *If threatened or endangered plant, animal, fish or marine species are discovered during construction, all work will cease until the Department of Fish and Wildlife or the Department of Natural Resources can be contacted and an expert brought on to the site.*

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

   *To be determined on a project specific basis.*

   Proposed measures to protect or conserve energy and natural resources area:

   *To be determined on a project specific basis.*

4. How would the proposal be likely to use or affect environmentally sensitive areas or area 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?

   *To be determined on a project specific basis.*

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

   *To be determined on a project specific basis.*

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

   *To be determined on a project specific basis.*

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

   *To be determined on a project specific basis.*

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

   *To be determined on a project specific basis.*

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

   *To be determined on a project specific basis.*

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

   *To be determined on a project specific basis.*

**WAC 197-11-970 Determination of Nonsignificance (DNS).**

**DETERMINATION OF NONSIGNIFICANCE**

Description of proposal:

| **Adoption of Water System Comprehensive Plan Update** |
|---|

Proponent: **City of Algona** ____________________

Location of proposal, including street address, if any:

________________________________________

Lead Agency: ______________________________

The lead agency for this proposal has determined that it does not have a probable significant adverse impact on the environment. An environmental impact statement (EIS) is not required under RCW 43.21C.030 (2)(c). This decision was made after review of a completed environmental checklist and other information on file with the lead agency. This information is available to the public on request.

☐ There is no comment period for this DNS.

☐ This DNS is issued after using the optional DNS process in WAC 197-11-355. There is no further comment period on the DNS.

☐ This DNS is issued under WAC 197-11-340(2); the lead agency will not act on this proposal for 14 days from the date below.

Comments must be submitted by: (not applicable)

Responsible official: ______________________________

Position/Title: ____________________ Phone: ____________

Address: __________________________________

Date: ________ Signature: ______________________________

# APPENDIX K

# COUNCIL MEETING MINUTES

# CORRESPONDENCE

# CONSISTENCY STATEMENTS

**Algona City Council**
**Council Workshop**
**March 12, 2013**

Mayor Pro Tem Thomas called the meeting to order at 6:00 PM in the Council Chambers of City Hall. Roll call was taken with Council members Tim Fairley, Ed Britz, Lynda Osborn and Paul Mallary was present. Staff members present were Diana Quinn – City Administrator, Lee Gaskill – Police Lieutenant, James Schrimpsher – Police Detective and Laurie Ulrich – Deputy City Clerk.

**APPROVAL OF AGENDA**
The agenda was unanimously approved upon motion by Fairley; seconded by Britz.

**PRESENTATIONS** –
**A.** Warren Perkins – Gray & Osborne, Inc. – Utility Rates – Warren, City Engineer, went through a PowerPoint presentation talking about our 2013 water system plan. He said we currently have about 3,075 residents and by the year 2018 that number will be closer to 3,300 residents. Our consumer confidence annual report shows our water quality as good. He said the concerns are that Algona will need to purchase a 100,000 gallon storage tank from Auburn and we need replacement of asbestos concrete mains. He showed a couple different ways to increase the % of the water rates and the Council members have asked for him to break down some of those scenarios with more detail for their review.

**COUNCIL DISCUSSION ITEMS**

**A.** Discussion Items
- Utility rates – The Council members requested more information of different ways to increase the water rates. Warren will provide that information for them.

**AUDIENCE PARTICIPATION** – None

**ADJOURNMENT**

There being no further business the meeting adjourned at 6:46 PM.

**ATTEST:**

Laurie Ulrich
Laurie Ulrich – Deputy City Clerk

Bill Thomas
Bill Thomas, Mayor Pro Tem

**Algona City Council**
**Council Workshop**
**April 9, 2013**

Mayor Pro Tem Thomas called the meeting to order at 6:00 PM in the Council Chambers of City Hall. Roll call was taken with Council members Tim Fairley, Ed Britz, Lynda Osborn and Paul Mallary was present. Staff members present were Diana Quinn – City Administrator, and Laurie Ulrich – Deputy City Clerk.

**APPROVAL OF AGENDA**
The agenda was unanimously approved upon motion by Fairley; seconded by Britz.

**PRESENTATIONS** –

**COUNCIL DISCUSSION ITEMS**

**A.** Ordinances & Resolutions – None

**B.** Discussion Items

- Water Rates – Warren, Gary & Osborne, said that Boeing is our highest commercial billing and that they are charged a lower base rate than what we bill for Algona residents. It is currently hooked up to the City of Auburn's infrastructure directly but we are billing for their usage. Council wants to see about what we are charging all of the commercial businesses and their rates.
- Draft Water System Plan – the councilmembers were given a draft copy of the plan to review and will talk about at the next meeting. The recommendation is to have a new rate detection system and new rate study for 2014.

**AUDIENCE PARTICIPATION** – None

**ADJOURNMENT**

There being no further business the meeting adjourned at 6:23 PM.

**ATTEST:**

Laurie Ulrich – Deputy City Clerk

Bill Thomas, Mayor Pro Tem

**Algona City Council**
**Council Workshop**
**April 23, 2013**

Mayor Pro Tem Thomas called the meeting to order at 6:00 PM in the Council Chambers of City Hall. Roll call was taken with Council members Tim Fairley, Ed Britz, Lynda Osborn and Paul Mallary was present. Staff members present were Diana Quinn – City Administrator, and Laurie Ulrich – Deputy City Clerk.

**APPROVAL OF AGENDA**
The agenda was unanimously approved upon motion by Fairley; seconded by Osborn.

**PRESENTATIONS** – None

**COUNCIL DISCUSSION ITEMS**

**A.** Ordinances & Resolutions – None

**B.** Discussion Items

- Water Rates – Warren, Gary & Osborne, said that the City of Algona has lost about $11,000 over the years for their water. He said the City of Auburn has raised their water rates every year since 2008 and we need to look at raising our rates so that our funds do not lose any more revenue. Councilmember Fairley has asked Warren to do a comparison and show a base rate with no water charge and to figure out the cost for actual water use.
- Draft Water System Plan – Warren suggested that they should figure out the water rates prior to discussing the water system plan. Mayor Pro Tem gave Diana his copy of the water system plan and had some administration questions.

**AUDIENCE PARTICIPATION** – Robert Rumph – 313 8th Avenue N – He asked Dave Hill 209 9th Avenue N – he mentioned that having an administrative fee includes maintenance, repairs, testing, and billing for the water.

**ADJOURNMENT**

There being no further business the meeting adjourned at 6:37 PM.

**ATTEST:**

Laurie Ulrich – Deputy City Clerk

Bill Thomas, Mayor Pro Tem

**Algona City Council**
**Council Workshop**
**May 14, 2013**

Mayor Pro Tem Thomas called the meeting to order at 6:00 PM in the Council Chambers of City Hall. Roll call was taken with Council members Tim Fairley, Ed Britz, Lynda Osborn and Paul Mallary was present. Staff members present were Diana Quinn – City Administrator, and Laurie Ulrich – Deputy City Clerk.

**APPROVAL OF AGENDA**

The agenda was unanimously approved upon motion by Fairley; seconded by Britz.

**PRESENTATIONS** – None

**COUNCIL DISCUSSION ITEMS**

**A.** Ordinances & Resolutions – None

**B.** Discussion Items

- Water Rates – Diana talked about the memorandum from Warren with Gray & Osborne. The memorandum breaks down two scenarios for the water rates. The Council has asked to have a base rate of $18.00 and charge the same amount per unit that the City of Auburn charges. They would like it written in to the Ordinance to pass on the City of Auburn rate increases over the next years as a pass through to the Algona residents.

**AUDIENCE PARTICIPATION** – None

**ADJOURNMENT**

There being no further business the meeting adjourned at 6:24 PM.

**ATTEST:**

Laurie Ulrich

Laurie Ulrich – Deputy City Clerk

William Thomas

William Thomas, Mayor Pro Tem

**Algona City Council**
**Council Workshop**
**May 28, 2013**

Mayor Pro Tem Thomas called the meeting to order at 6:17 PM in the Council Chambers of City Hall. Roll call was taken with Council members Tim Fairley, Ed Britz, and Paul Mallary was present. Motion to excuse Lynda Osborn by Fairley; seconded by Britz. Unanimously approved. Staff member present was and Laurie Ulrich – Deputy City Clerk-Treasurer.

## APPROVAL OF AGENDA

The agenda was unanimously approved upon motion by Fairley; seconded by Britz.

**PRESENTATIONS** – None

## COUNCIL DISCUSSION ITEMS

**A.** Ordinances & Resolutions – None

**B.** Discussion Items

- Water Rates – Warren - Gray & Osborne gave a presentation on some scenarios for the water rate increase. The Council members have decided to go with the scenario 6 base rate of $22.54, Volume Rate between $2.61 & $2.65 with 4.0 CCF through 2014.

**AUDIENCE PARTICIPATION** – None

## ADJOURNMENT

There being no further business the meeting adjourned at 6:38 PM.

**ATTEST:**

Laurie Ulrich

Laurie Ulrich – Deputy City Clerk-Treasurer

William Thomas

William Thomas, Mayor Pro Tem

# Algona City Council
# Council Meeting
# June 11, 2013

Mayor David E. Hill called the meeting to order at 7:00 PM in the Council Chambers of Algona City Hall. He initiated the flag salute. Roll call was taken with Council members Tim Fairley, Lynda Osborn and Paul Mallary was present. Motion to excuse Bill Thomas and Ed Britz by Fairley; seconded by Osborn. Unanimously approved. Staff members present were Buster McGehee – Police Chief, Diana Quinn – City Administrator Kari Sand – City Attorney and Laurie Ulrich – Deputy City Clerk-Treasurer.

**PUBLIC HEARING** –
Water Rate Increase – opened hearing at 7:01. No questions. Closed hearing at 7:02.

**APPROVAL OF AGENDA** -
The agenda was unanimously approved upon motion by Fairley; seconded by Osborn.

**CONSENT AGENDA** -
The consent agenda was unanimously approved upon motion by Fairley; seconded by Osborn.

**A.** Minutes – Council Workshop – May 28, 2013
Minutes – Council Meeting – May 28, 2013
Minutes – Special Council Meeting – May 31, 2013

**B.** Audit of Reports

| | | | |
|---|---|---|---|
| *1. Claims June 11, 2013* | *#103628 - #103665* | = | *$ 120,936.36* |
| *2. Payroll May 31, 2013* | *#60683 - #60689* | = | *$ 86,385.78* |

*VOID #*

**REPORTS** -
**Councilmember Fairley**: He mentioned that he will not be attending the next Council meeting on June 25th.
**Councilmember Thomas:** Absent; excused
**Councilmember Britz:** Absent; excused
**Councilmember Osborn:** None
**Councilmember Mallary:** None
**Buster McGehee:** He introduced Reserve Officer Terbinos Gebremariam, who started with the Algona Police Department in the Explorer Program as the Police Explorer Advisor. He went through the Reserve academy in 2008 and recently just completed the Police Academy on May 30, 2013. He paid his own way financially to go through the Police Academy and Chief McGehee wanted him to be recognized for his dedication to the City of Algona. Chief McGehee will be placing another storage unit next to the current evidence trailer so that they can start inventory and a bar coding system for the evidence. They received the AWC RMSA 2013

Spring Loss Prevention Grant for $1,000.
**Mayor Hill:** He said there will be an open house at the Filipino Hall on Thursday, June 13, 2013 from 6:00 p.m. – 9:00 p.m. with the Department of Ecology, Department of Health, Boeing and the City of Algona. There will be a Q & A session for about an hour.

**AUDIENCE PARTICIPATION** – Discussion with residents took place and questions were answered regarding the Boeing Plume.

**COUNCIL DISCUSSION ITEMS** –

A. Budget Amendment for new Police vehicles – Buster asked the Council to waive the 3 touch rule so that he can begin to order 2 new police vehicles by July so that we can still receive good pricing on them. Diana said she would have to look at the budget. Consensus from the Council is to waive the 3 touch rule and have it ready for the next Council meeting.

**UNFINISHED BUSINESS** – None

**NEW BUSINESS** – None

**ORDINANCES & RESOLUTIONS** –

A. Resolution 1080-13, A Resolution of the City of Algona, Washington, awarding the West Valley Highway Improvements Project (TIB 6-P-119(003)-1). Motion to approve Resolution 1080-13 by Fairley; seconded by Osborn. Unanimously approved.
B. Ordinance 1076-13, An Ordinance of the City of Algona, Washington, amending section 2.50.030 of the Algona Municipal Code entitled Water Service Charges, increasing water rates due to an increase in wholesale water rates from the City of Auburn. Motion to approve Ordinance 1076-13 by Fairley; seconded by Osborn. Kari Sand, City Attorney said she had some changes to make to the Ordinance. Motion to approve Ordinance 1076-13 as amended for the City Attorney changes by Fairley; seconded by Osborn. Unanimously approved.
C. Resolution 1075-13, A Resolution of the City Council of the City of Algona, King County, Washington, authorizing the disposal of surplus property. Motion to approve Resolution 1075-13 by Fairley; seconded by Mallary. Unanimously approved.
D. Resolution 1076-13, A Resolution of the City Council of the City of Algona, Washington, authorizing the Mayor to execute an engineering supplement No. 1 with Gray and Osborne, Inc. for the West Valley Highway Improvement Project (TIB 6-P-119(003)-1). Motion to approve Resolution 1076-13 by Fairley; seconded by Osborn. Unanimously approved
E. Resolution 1077-13, A Resolution of the City Council of the City of Algona, Washington, Authorizing the Mayor to execute and agreement with Gray and Osborne, Inc. for construction management services for the West Valley Waterline Replacement Project. Motion to approve Resolution 1077-13 by Fairley; seconded by Mallary. Unanimously approved.
F. Resolution 1078-13, A Resolution of the City Council of the City of Algona, Washington, authorizing the Mayor to execute a modification to the professional services contract with ICF International for consulting services relating to the Boeing Company's chemical contamination in the City of Algona. Motion to approve Resolution 1078-13 by Fairley; seconded by Osborn. Unanimously approved.

G. Resolution 1079-13, A Resolution of the City of Algona, Washington, authorizing the Mayor to execute an Interlocal Agreement between the City of Auburn and the City of Algona for information technology services. Motion to approve Resolution 1079-13 by Fairley; seconded by Osborn. Unanimously approved.

**ADJOURNMENT -**
There being no further business the meeting adjourned at 8:22 P.M.

**ATTEST:**

Laurie Ulrich

Laurie Ulrich, Deputy City Clerk - Treasurer

David E. Hill, Mayor

# Algona City Council
# Council Meeting
# July 9, 2013

Mayor David E. Hill called the meeting to order at 7:00 PM in the Council Chambers of Algona City Hall. He initiated the flag salute. Roll call was taken with Council members Tim Fairley, Bill Thomas, Ed Britz, Lynda Osborn and Paul Mallary was present. Staff members present were Diana Quinn – City Administrator, Kevin Caviezel – Event Planner, James Schrimpsher – Police Detective and Laurie Ulrich – Deputy City Clerk-Treasurer.

**APPROVAL OF AGENDA** -
The agenda was unanimously approved upon motion by Fairley; seconded by Britz.

**CONSENT AGENDA** -
The consent agenda was unanimously approved upon motion by Fairley; seconded by Britz.

**A.** Minutes – Council Meeting – June 25, 2013

**B.** Audit of Reports

| | | | |
|---|---|---|---|
| *1. Claims July 9, 2013* | *#103698 - #103739* | = | *$ 133,586.67* |
| *2. Payroll June 30, 2013* | *#60692 - #60698* | = | *$ 85,538.58* |

*VOID #*

**REPORTS** -
**Councilmember Fairley**: None
**Councilmember Thomas:** He said both of the committees he is on have not had meetings.
**Councilmember Britz:** None
**Councilmember Osborn:** None
**Councilmember Mallary:** None
**Diana Quinn:** She went over the monthly statistics for June.
**Kevin Caviezel:** He talked about Algona Days and the events. There will be the movie in the park on the 19th, dance groups, Elvis, classic pop rock group for music, 29 vendors, and 3 food vendors. The parade will be on Saturday at 11:00.
**Mayor Hill:** He said he is meeting tomorrow with the Department of Ecology to talk about the grant for public information. He has been unable to get a response from Department of Ecology as to why they are delaying the vapor intrusion testing. They have about 10-11 homes already surveyed. He will continue to monitor them trying to move ahead. Mayor Hill answered questions from the residents regarding the Department of Ecology and the Boeing plume.

**AUDIENCE PARTICIPATION** – Ronica Hopkins – 201 Main Street – She brought in fireworks that were left on her property. She asked the council why we allow fireworks in the City. Diana suggested that she come in to City Hall and fill out a complaint form so that we have a record on file.

**COUNCIL DISCUSSION ITEMS** –
A. Water System Plan – Council needs to review the water plan. It will need to be reviewed by the state, county, City of Auburn and we have to do a SEPA. At the next meeting we will motion to ask to authorize us to send the draft out to the other agencies and we will accept the final draft Ordinance once we receive the final document from the state.

**UNFINISHED BUSINESS** – None

**NEW BUSINESS** – None

**ORDINANCES & RESOLUTIONS** - None

**ADJOURNMENT** -
There being no further business the meeting adjourned at 7:52 P.M.

ATTEST: Laurie Ulrich

Laurie Ulrich, Deputy City Clerk/Treasurer

David E. Hill, Mayor

# Algona City Council
# Council Meeting
# July 23, 2013

Mayor David E. Hill called the meeting to order at 7:00 PM in the Council Chambers of Algona City Hall. He initiated the flag salute. Roll call was taken with Council members Tim Fairley, Bill Thomas, Ed Britz, Lynda Osborn and Paul Mallary was present. Staff members present were Diana Quinn – City Administrator, Elizabeth Chamberlain – City Planner, Kari Sand – City Attorney via phone and Laurie Ulrich – Deputy City Clerk-Treasurer.

**APPROVAL OF AGENDA -**
The agenda was unanimously approved upon motion by Fairley; seconded by Britz.

**CONSENT AGENDA -**
The consent agenda was unanimously approved upon motion by Fairley; seconded by Britz.

**A.** Minutes – Council Meeting – July 9, 2013

**B.** Audit of Reports

| | | | |
|---|---|---|---|
| *1. Claims July 23, 2013* | *#103740 - #103775* | = | *$ 42,070.03* |
| *2. Payroll July 15, 2013* | *#60699 - #60701* | = | *$ 55,530.61* |

*VOID #*

**C.** June 2013 Treasurer Report

**REPORTS -**
**Councilmember Fairley**: None
**Councilmember Thomas:** The King County Flood Control and the Emergency Management Advisory Committee will reconvene in August.
**Councilmember Britz:** None
**Councilmember Osborn:** She said the pancake breakfast went well for Algona Days. They talked to a lot of people about the Hometown Community Services.
**Councilmember Mallary:** None
**Diana Quinn:** None
**Mayor Hill:** He said the Department of Ecology is moving about the same pace. He said they are getting ready to do the vapor intrusion testing soon. He had a meeting with the Department of Ecology and Diana and they discussed putting together a better communication process. They are proposing a non-technical weekly meeting. They also talked about the City of Algona possibly qualifying for some available grants.

**AUDIENCE PARTICIPATION** – Discussion took place with residents and council regarding the Boeing plume. Mayor Hill answered questions and updated residents with the current information.

**COUNCIL DISCUSSION ITEMS** –
A. Motion to forward the Water System Plan onto the Washington State Department of Health, King County and Auburn for approval and any SEPA comments. Revisions, if any, will be incorporated into the final version of the plan for adoption by Ordinance by City Council at a later date by Fairley; seconded by Thomas. Unanimously approved.

**UNFINISHED BUSINESS** – None

**NEW BUSINESS** –
**A.** Motion to approve Coco Joe's Cabaret License by Fairley; seconded by Britz. Unanimously approved.

**ORDINANCES & RESOLUTIONS** –
**A.** Resolution 1074-13, A Resolution of the City of Algona, Washington, authorizing the Mayor to execute an Interlocal Agreement between the City of Algona and the City of Pacific for Municipal Court Services and facilities. Motion to approve Resolution 1074-13 by Fairley; seconded by Osborn. Unanimously approved.
**B.** Ordinance 1078-13, An Ordinance of the City of Algona, Washington; adopting a permitting process for water use from fire hydrants, clarifying the penalty provision for unauthorized use; authorizing administrative procedures; providing for severability; and establishing an effective date. Motion to approve Ordinance 1078-13 by Fairley; seconded by Britz. Unanimously approved.
**C.** Ordinance 1079-13, An Ordinance of the City of Algona, Washington, approving a Conditional Use Permit to allow a propane tank business at 16 11$^{th}$ Avenue North, Algona, Washington; providing for severability; and establishing an effective date. Elizabeth said the Planning Commission recommended approval on July 11$^{th}$. She said the business must meet 6 recommendations and specifically mentioned #6 stating – retail sales at the project site are a requirement of the proposal. Any discontinuation of retail sales may cause for the conditional use permit to be revoked. Motion to approve Ordinance 1079-13 by Fairley; seconded by Thomas. Unanimously approved.

**ADJOURNMENT** -
There being no further business the meeting adjourned at 8:20 P.M.

**ATTEST:**
Laurie Ulrich

Laurie Ulrich, Deputy City Clerk/Treasurer

David E. Hill

David E. Hill, Mayor

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



October 16, 2013

JAMES GRIESS
ALGONA WATER DEPT
402 WARDE ST
ALGONA WA 98001

Subject: Algona, City of – Water System ID# 01450
King County
2013 WSP- Review
Submittal #13-0803

Dear Mr. Griess:

Thank you for submitting the Water System Plan (WSP) for the City of Algona (the City) received in this office on August 13, 2013. We have reviewed the plan and offer the following comments. These comments must be adequately addressed prior to approval of the WSP.

1. Has the Auburn Water Department reviewed the plan, and concurred with projected ADD water demands?

2. City of Auburn supply portfolio; The City of Auburn executed a wholesale water agreement with Tacoma public Utilities on July 6, 2012 which provides supply up to 1.0 mgd for ADD, up to 1.8 mgd for MDD and up to 1.62 mgd for 4 day peak use.

3. The Table 3-1 General Facility Requirements for 'Minimum System Pressure' just has minimum DOH requirements listed (minimum service pressures will be greater than 30 psi under peak hour flows). Is this really the City's desired level of service? Many utilities have a pressure range that they consider optimum – nearly always well above 30 psi. Maximum pressures are also usually considered. Re-evaluate City's desired service / performance standards along with minimum requirements set by the DOH.

4. The 'Reliability Recommendations' section in Table 3-1 doesn't actually have any reliability goals / standards listed, just a statement that DOH recommendations don't apply! The City needs to revisit this topic and develop specific goals and standards.

5. Table 3-1 valve and hydrant spacing standards should be explicitly stated here – don't make the reader have to search somewhere else.

6. Also regarding Table 3-1 – many utilities include specific water quality service / performance standards for their water systems. Does the City want to have specific WQ standards for its citizens?

7. The water quality section in Chapter 3 should include acknowledgement and explanation of surface water treatment rule (SWTR) requirements that apply to Algona because part of Auburn's water supply comes from the City of Tacoma's Green River supply.

8. The Chapter 3 storage analysis does not meet minimum requirements under WAC 246-290. Table 3-1 Algona 'standard' does not meet minimum DOH requirements listed in the table. You must identify explicit volumes for all required storage components including the 300,000-gallon fire flow volume represented by 2,500 gpm for 2-hours. If Auburn facilities are providing all of Algona's required storage (total volume stated) then the water system plan must contain written acknowledgement from Auburn concurring. (Auburn's water system plan must state the same thing and be included in Auburn's storage analysis).

9. The distribution system hydraulic modeling runs in the plan show flow results (gpm) from limiting the analysis to minimum pressures. What are the resultant pressures in the distribution modeling when actual fire flows desired are inputted?

10. Please include the City's water main break / leak repair rates for the last three years.

11. Table 6-1 – How will Algona 'check distribution system' daily? Will operators drive around, measure pressures, measure chlorine residuals, read the master meters? List actual activities.

12. Regarding the City's cross connection control program – please submit 1) a current list of all devices installed and 2) the date of their last inspection certification.

13. The following items should be included in the City's individual CMP:

    i. Need updated – current plan with date included (2006 date on submitted plan). Must explicitly address Groundwater Rule Requirements for having Auburn collect source samples from all wells operating.
    ii. Need schematic showing repeat sample sites.
    iii. Need sample collection SOP.

iv. A stand-alone document is preferred – updated CMP does not have to be in WSP document.

14. Please submit copies of the City's Construction Completion Report forms for all water mains installed under the construction document submittal exception provision per WAC 246-290-125(2) for the last six years.

    a. The objective paragraph at the beginning of Chapter 7 is not accurate and must be changed to reflect the limits of section WAC 246-290-125(2). The City of Algona may only seek authority to not submit project reports and construction documents for distribution water main projects to the department. Standard Specifications and Details – please address the following:
    b. New lead free requirements are coming into effect for all Group A water systems. Do these specifications reflect this Federal requirement?
    c. The specifications and detail sheets should all have current revision dates consistent with this WSP effort. Please submit a separate bound copy of the standards / specifications.
    d. Please include Algona's procedures for the distribution main construction document submittal exception process in the body of the water system plan. This exception process is only for distribution mains. The water main projects still must be designed by a P.E., installed under the oversight of the design engineer, and a construction completion formally certified with report forms kept on file. Please clarify who specifically provides water main installation oversight and inspections required under the distribution main construction document submittal exception process.

15. Provide a determination of local government consistency from the City's Planning and Land Use Department.

16. Prior to DOH approval, the City's governing body must approve and adopt the WSP. This is a requirement resulting from the Municipal Water Legislation.

17. Please provide copies of any comments made by adjacent purveyors, along with your response to those comments.

We hope that you have found these comments to be clear, constructive and helpful in the development of your final draft WSP. We ask that you submit the revised WSP on or before **January 16, 2014**. In order to expedite the review of your revised submittal, please include a cover letter summarizing how each of the above comments was addressed in the revised WSP and where each response is located (i.e., page numbers, Appendices, etc.)

Regulations establishing a schedule for fees for review of planning, engineering and construction documents have been adopted (WAC 246-290-990). Please note that we have included an invoice in the amount of **$3705.00** for the review of the Water System Plan. This fee covers our cost for review of the initial submittal, plus the review of one revised document. 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, and P.O. Box 1099, Olympia, WA 98507-1099.**

Thank you again for submitting your revised Water System Plan for our review. If you have any comments or questions concerning our review, please contact me at (253) 395-6771.

Sincerely,

Richard Rodriguez

Richard Rodriguez
WSDOH Regional Planner

Cc: Steve Deem, DOH
Seattle/King County Health
Steve Hirschey, King County UTRC
Warren Perkins, P.E., Gray& Osborne, Inc.

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

*Northwest Regional Office • 3190 160th Ave SE • Bellevue, WA 98008-5452 • 425-649-7000*
*711 for Washington Relay Service • Persons with a speech disability can call 877-833-6341*



August 20, 2013

Richard Rodriguez
Regional Planner
Department of Health
20435 72nd Avenue South, Suite 200
Kent, WA 98032

**RE: Algona Water Department Water System, ID #01450; Review of 2013 Water System Plan, Submittal 13-0803**

Dear Mr. Rodriguez:

Thank you for the opportunity to review the City of Algona 2013 Water System Plan. Consistent with the Memorandum of Understanding between the Departments of Ecology and Health, I have reviewed the relevant portions of the Water System Plan (WSP) and offer the following comments.

**Water Right Analysis**

The City of Algona has depended solely upon the City Auburn for its water supply since 1996. The single water right that Algona holds according to Ecology records is groundwater certificate G1-22769C which was issued for 500 gpm and 175 ac-ft/yr. This right is listed in Table 1-3 as G1-22769P, which indicates a permit, rather than a developed municipal right, which is what this certificate for municipal purposes represents.

Although G1-22769C is recognized in Ecology records as being an active file and was issued for municipal purposes, abandonment of the right can still be an issue if the well is not maintained or used for a prolonged period. There is no evidence that this well is being maintained and records indicate the well was last used in 1996, seventeen years ago.

Ecology's records indicate that the water rights for Auburn should resemble what is presented below as Table 1 (where QaA=Additive Qa and QaN= Non-Additive Qa, both in ac-ft/yr).

| Table 1: City of Auburn Water Rights Portfolio | | | | | |
|---|---|---|---|---|---|
| **Water Right** | **Source** | **Priority** | **Qi (gpm)** | **$Qa_A$** | **$Qa_N$** |
| SWC 857 | Coal Creek Springs | 4/22/1925 | 6,730 | 9,410 | |
| GWC 3560 | Wells 1, 6, & 7 | 11/12/1957 | 2,200 | 2,480 | 2,480 |
| G1-00277C | Wells 2, 6, & 7 | 2/26/1968 | 2,400 | | |
| G1-20391C | Wells 4, 6, & 7 | 12/29/1972 | 2,800 | 3,600 | |
| G1-23629C | Wells 3A, 3B, 6, & 7 | 7/8/1980 | 2,800 | 3,600 | |
| G1-23633C | Well 5 | 6/23/1980 | 1,000 | 720 | |
| G1-25518C | Well 5A | 10/10/1989 | 167 | | 187 |
| G1-22769C | Algona Well | 12/10/1976 | 500 | 175 | |
| S1-049354CL | West Hill Springs | 1907 | 625 | 1,010 | |
| ***Totals*** | | | ***19,222*** | ***20,995*** | ***2,667*** |

The water rights in Table 3-1 of the Algona WSP (also Appendix C) are from Auburn's 2001 WSP. As you may be aware Ecology and Auburn had differing totals for some of their rights and reached an agreement in 2010. That agreement concluded that Auburn's total primary (additive) Qa from all sources, including the Algona right (G1-22769C), is 20,995 ac-ft/yr (18.7 mgd).

The description of water rights in Appendix C would be better served by inclusion of Chapter 6 of the Auburn WSP rather than Chapter 5, since Chapter 6 has full descriptions of those rights, with minor errors as noted above.

Thank you again for the opportunity to review the Algona WSP. Please contact me at (425) 649-7077 or at Doug.Wood@ecy.wa.gov if you have questions regarding this review or need additional information.

Sincerely,

Douglas H. Wood, MS, LHG
Water Resource Program

dw/mc

cc: James Griess
Warren Perkins, P.E.

King County

**Utilities Technical Review Committee**
Department of Natural Resources and Parks
King Street Center
210 South Jackson Street, Suite 512
Seattle, WA 98104-3855
www.kingcounty.gov

November 8, 2013

James Griess
Public Works Supervisor
City of Algona
402 Warde Street
Algona, WA, 98001

Dear Mr. Griess:

Thank you for submitting the City of Algona Water System Plan (Plan) for King County approval. The Plan was received on August 13, 2013. In accordance with King County Code (KCC) 13.24, the King County's Utilities Technical Review Committee (UTRC) has reviewed the Plan for consistency with the King County Comprehensive Plan and KCC.
In reviewing the Plan, the UTRC found that the Plan is largely consistent with the County's comprehensive plan and code. We have identified five points of clarification or additions that are necessary before we can make a recommendation to the King County Council for approval of the City's Plan. We request you include the following information:

1. Clarify the zoning and land use for the future service area that is currently unincorporated King County, west of the City. The County's zoning and land use information can be found on the world wide web at: http://www.kingcounty.gov/operations/GIS/Maps/iMAP.aspx.
2. Clarify the demarcation of and map legend for the green area on Figure 1-4 that is currently unincorporated King County, west of the City, and called UGA. Please note that the area west of the City and north of 1st Avenue North on Figure 1-4 is within the City of Federal Way Potential Annexation Area;
3. Clarify the reasoning behind the City's adopted service area policy for a surcharge of fifty percent for water service to customers outside of the City and aspects of reasonable service considered by the City for service to unincorporated King County;
4. Clarify the distribution system leakage (DSL), the various three-year average DSLs used in the plan and why the annual water use efficiency reports filed by the City for the years 2009, 2010, and 2011 are not consistent with the information presented in the Plan for the DSL; and
5. Provide a completed Reclaimed Water Checklist which can be found online at: http://www.kingcounty.gov/environment/dnrp/utilities-technical-review-committee.aspx.

Often times the construction and/or maintenance of utility lines requires work within the road right-of-way 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, Traffic, and 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 right-of-way once an overlay of the road section has been completed. Although each utility has a set of construction standards and specifications for its projects, when construction and/or maintenance of utilities require work within the road right-of-way for roads in unincorporated King County, please be aware that the current edition of the King County Road and Construction standards apply to any installation or work in these rights-of-way. 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 at: http://www.kingcounty.gov/transportation/kcdot/Roads/EngineeringServices/RoadStandards2007.aspx.

Finally and somewhat related to the water plan, our understanding is the City does not have a franchise with the County. It appears the abandoned reservoir is in the unincorporated area. King County Code 6.27.020 relates to franchises and states that municipal corporations are required, in accordance with RCW 36.55.010, to obtain a right-of-way franchise approved by the King County council in order to use the right-of-way of county roads for the construction and maintenance of waterworks and any other such public and private utilities. UTRC member Mr. Doug Williams will work directly with you to determine the need for a franchise and the development of a franchise if one is required.

We look forward to seeing the final Plan and working with you to secure the King County Council's approval. The Council's action represents King County's final action on the Plan and is the statement of consistency under Revised Code of Washington 43.20.260.

If you have any questions or concerns about any of the information in the letter, please do not hesitate to call me at 206-477-5387. Thank you.

Sincerely,

Stephen Hirschey

Stephen Hirschey
Chair, Utilities Technical Review Committee

cc: Richard Rodriguez, Regional Planner, Washington State Department of Health

CITY OF AUBURN WASHINGTON

Peter B. Lewis, Mayor

25 West Main Street * Auburn WA 98001-4998 * www.auburnwa.gov * 253-931-3000

November 4, 2013

Steve Deem, P.E.
Washington State Department of Health
Office of Drinking Water
20425 72nd Avenue S., Suite 310
Kent, WA 98032-2388

Subject: City of Algona Water Storage

Dear Mr. Deem,

In response to comments made to the City of Algona's Water System Plan, the City of Auburn is confirming that we are providing Algona with water storage capacity in our water system. The current volume allocated to Algona is 180,000 gallons and is physically located in Auburn's recently completed Reservoir 6. Please refer to the City of Auburn Lakeland Hills Reservoir 6 Project Report (March 2010) for detailed storage analysis information concerning Algona's allocation.

Auburn and Algona operate cooperatively according to the terms contained in the Algona/Auburn Intertie Agreement No. 3A (IA#3a) a copy of which can be found in both Algona's and Auburn's Water System Plans. The IA#3a gives Algona the option to purchase an additional 100,000 gallons of storage; however, Algona has not yet exercised this option.

Please give me a call at (253) 804-5062 if you require further information regarding this issue.

Sincerely,

Dan Repp, P.E.
Utilities Engineer
Department of Public Works

DR/mh

cc: Susan Fenhaus, P.E., Water Utility Engineer
File

CITY OF PACIFIC
100 3RD AVENUE SOUTHEAST
PACIFIC, WASHINGTON 98047
CITY HALL (253) 929-1100
FAX (253) 939-6026

August 13, 2013

GRAY & OSBORNE, INC.
REC'D - SEATTLE
AUG 15 2013
JOB #

Gray & Osborne, Inc.
Attn: Mr. Warren Perkins, .P.E.
701 Dexter Avenue North, Suite 200
Seattle, WA. 98109

Re: City of Algona Water System Plan

Dear Mr. Perkins:

The City of Pacific has reviewed the City of Algona Water System Plan. Enclosed please find a signed Local Government Consistency Review Checklist. Please note that we believe most items on the checklist are not applicable.

We recommend a revision to Figures 3-1 and 8-1 to identify the areas served by agencies other than the City of Algona. This will make it clear to the reader why some areas do not appear to be contiguous with the system. Additionally, it will clarify to the reader that some areas are not being served by Algona without the need to refer to other graphics in the report.

If you have any questions or concerns, please feel free to call Jim Schunke or me at (253)929-1110.

Respectfully,

CITY OF PACIFIC

James J. Morgan, P.E.

Cc: Project File

Enclosure: Local Government Consistency Review Checklist

Washington State Department of Health

## Local Government Consistency Review Checklist

A consistency review between DOH planning and engineering documents and adopted comprehensive plans and development regulations is required in certain situations. This checklist may be used to document the consistency review as required in WAC 246-290-108. A consistency review is required for each local government with jurisdiction over the applicable service area.

Water System Name: City of Algona PWS ID: 01450 V

Planning Document Title: City of Algona - Water System Plan Plan Date: July 2013

Local Government with Jurisdiction: City of Algona

| Consistency Statement | Page(s) in Planning Document | Yes – No – Not Applicable |
|---|---|---|
| The applicable service area is consistent with the land use and zoning in the adopted comprehensive plan and adopted development regulations. | | N/A |
| **For Water System Plans***:* The six-year growth projection used to forecast water demand is consistent with the adopted city/county's population growth projections. If a different growth projection was used, the alternative growth projection and methodology proposed is acceptable based on explanation given. | | N/A |
| **For Water System Plans***:* Provisions of water service for new service connections are consistent with the adopted comprehensive plan and adopted development regulations. | | Yes |
| **For city-owned systems only***:* All utility service extension ordinances regarding water service are included in the plan. These policies are consistent with the adopted comprehensive plan and adopted development regulations. | | N/A |
| Other relevant elements related to water supply (as determined by DOH) is consistent with the adopted comprehensive plan and adopted development regulations. | | N/A |
| **Where the local government with jurisdiction did not provide a Consistency Review**: Provide documentation of efforts taken and amount of time provided. Include: name of contact, date, type of effort attempted, and response from local agency. | | N/A |

I certify that the above statements are true to the best of my knowledge and that these statements support the conclusion that the subject-planning document is consistent with adopted comprehensive plans, development regulations, and other policies.

Signature ________________ Date 8/13/2013

James J Morgan City Engineer Pacific

Printed Name, Title, & Jurisdiction

****For any issues of inconsistency, please document the inconsistency, including the citation from the comprehensive plan or development regulation. Provide direction on how this inconsistency can be resolved.****

Washington State Department of Health

## Local Government Consistency Review Checklist

A consistency review between DOH planning and engineering documents and adopted comprehensive plans and development regulations is required in certain situations. This checklist may be used to document the consistency review as required in WAC 246-290-108. A consistency review is required for each local government with jurisdiction over the applicable service area.

Water System Name: City of Algona PWS ID: 01450 V

Planning Document Title: City of Algona - Water System Plan Plan Date: July 2013

Local Government with Jurisdiction: City of Algona

| Consistency Statement | Page(s) in Planning Document | Yes – No – Not Applicable |
|---|---|---|
| The applicable service area is consistent with the land use and zoning in the adopted comprehensive plan and adopted development regulations. | Figure 1-2 | Yes |
| **For Water System Plans***:* The six-year growth projection used to forecast water demand is consistent with the adopted city/county's population growth projections. If a different growth projection was used, the alternative growth projection and methodology proposed is acceptable based on explanation given. | Table 2-9 | Yes |
| **For Water System Plans***:* Provisions of water service for new service connections are consistent with the adopted comprehensive plan and adopted development regulations. | Pages 7-1 & 7-2 | Yes |
| **For city-owned systems only***:* All utility service extension ordinances regarding water service are included in the plan. These policies are consistent with the adopted comprehensive plan and adopted development regulations. | Appendix D | Yes |
| Other relevant elements related to water supply (as determined by DOH) is consistent with the adopted comprehensive plan and adopted development regulations. | | |
| **Where the local government with jurisdiction did not provide a Consistency Review**: Provide documentation of efforts taken and amount of time provided. Include: name of contact, date, type of effort attempted, and response from local agency. | | |

I certify that the above statements are true to the best of my knowledge and that these statements support the conclusion that the subject-planning document is consistent with adopted comprehensive plans, development regulations, and other policies.

Elizabeth F Chamberlain 10-30-13

Signature Date

Elizabeth F. Chamberlain, Algona Contract Planner City of Auburn

Printed Name, Title, & Jurisdiction

****For any issues of inconsistency, please document the inconsistency, including the citation from the comprehensive plan or development regulation. Provide direction on how this inconsistency can be resolved.****

## Consistency Review Guidance

This checklist may be used to meet the requirements of WAC 246-290-108.

For water system plans, a consistency review is required for the retail service area and any additional areas where a municipal water supplier wants to expand their water right's place of use.

For small water system management programs, a consistency review is only required for areas where a municipal water supplier wants to expand its water right's place of use. If no water right place of use expansion is requested, a consistency review is not required.

For engineering documents, a consistency review is only required for areas where a municipal water supplier wants to expand its water right's place of use. This is only allowed for non-community water systems.

**Documenting consistency:**

- Provide a copy of the adopted land use/zoning map that corresponds to the service area. The uses provided in the WSP should be consistent with the adopted land use/zoning map.
- Include a copy of service area policies on how new water service will be provided to new customers. Cities and towns must include all service extension ordinances.
- Include a copy of the growth projections that corresponds to the service area. If the local population growth rate projections are not used, provide a detailed explanation on why the projections chosen more accurately describe the expected growth rate. Explain how it is consistent with the adopted land use.
- Include any other portions of comprehensive plans or development regulations which are related to water supply.

*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

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.

*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.*

**Water System Name:** City of Algona
**Date:** December 2, 2013
**PWS ID#** 01450
**Contact:** Jimmy Griess - City of Algona

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), <u>non single-family residential,</u> 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
     - ☑ The information requested is unknown or not available.
       Additional Comments: There are no large self-supplied water users in the service area
   - **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: ____________________

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 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: All water is supplied to Algona by Auburn. Algona has no water rights.

**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: All water is supplied to Algona by Auburn. Algona has no water rights

**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:
   ______________________________________________________________________
   ______________________________________________________________________

   ☑ 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? |
|---|---|---|---|---|
| | | | | |
| | | | | |
| See attached Table 2-5 | from the Water System Plan | | Unknown all customers | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

[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

Gray & Osborne, Inc.
CONSULTING ENGINEERS

December 20, 2013

Mr. Richard Rodriguez
Washington State Department of Health
Northwest Drinking Water Regional Operations
20425 72nd Avenue South, Suite 310
Kent, Washington 98032-2388

SUBJECT: RESPONSES TO WDOH LETTER – JULY 2013 DRAFT WATER SYSTEM PLAN
CITY OF ALGONA, KING COUNTY, WASHINGTON
G&O #12503.00

Dear Mr. Rodriguez:

We are writing in response to your letter of October 16, 2013d regarding the Algona Water System Plan. Below are your comments in *italics*. Our responses follow each of your comments.

1. *Has the Auburn Water Department reviewed the Plan, and concurred with projected ADD water demands.*

   Yes. The draft Water System Plan was transmitted to the City of Auburn on July 3, 2013. Verbal comments were received from Auburn (Dan Repp) on August 29, 2013. The comments were related to water supply, generally to the Tacoma wholesale agreement (see Item 2 below). Mr. Repp indicated that the water demand projections were in agreement with their assumptions.

2. *City of Auburn supply portfolio: The City of Auburn executed a wholesale water agreement with Tacoma Public Utilities on July 6, 2012 which provides supply up to 1.0 mgd for ADD, up to 1.8 mgd for MDD and up to 1.62 mgd for 4 day peak use.*

   Table 1-2 has been revised to reflect this agreement.

3. *The Table 3-1 General Facility Requirements for Minimum System Pressure just has minimum DOH requirements listed (minimum service pressures will be greater than 30 psi under peak hour flows). Is this really*

*the City's desired level of service? Many utilities have a pressure range that they consider optimum – nearly always well above 30 psi. Maximum pressures are also usually considered. Re-evaluate the City's desired service/performance standards along with minimum requirements set by WDOH.*

Table 3-1 has been revised to reflect the preferred pressure in Algona. Algona's supply is from Auburn through master meters with no pressure reduction. Thus, Algona cannot control pressure within its system.

4. *The 'Reliability Recommendations' section in Table 3-1 doesn't actually have any reliability goals /standards listed, just a statement that DOH recommendations don't apply! The City needs to revisit this topic and develop specific goals and standards.*

   Table 3-1 has been revised.

5. *Table 3-1 valve and hydrant spacing standards should be explicitly stated here – don't make the reader have to search somewhere else.*

   Table 3-1 has been revised.

6. *Also regarding Table 3-1 – many utilities include specific water quality service performance standards for their water systems. Does the City want to have specific WQ standards for its citizens?*

   Algona does not provide water quality treatment. There are no specific water quality goals, except that the water should meet all state and federal regulations for water quality.

7. *The water quality section in Chapter 3 should include acknowledgement and explanation of surface water treatment rule (SWTR) requirements that apply to Algona because part of Auburn's water supply comes from the City of Tacoma's Green River supply.*

   Table 3-2 has been revised and a section regarding surface water has been added to the report text (page 3-8).

8. *The Chapter 3 storage analysis does not meet minimum requirements under WAC 246-290. Table 3-1 Algona standard does not meet minimum DOH requirements listed in the table. You must identify explicit volumes*

*for all required storage components including the 300,000 gallon fire flow volume represented by 2,500 gpm for 2-hours. If Auburn facilities are providing all of Algona's required storage (total volume stated) then the water system plan must contain written acknowledgment for Auburn concurring. (Auburn's water system plan must state the same thing and be included in Auburn's storage analysis).*

The City of Auburn has completed the Lakeland Hills Reservoir since its 2009 Water System Plan. Therefore, the storage analysis has changed since that plan was completed. The City of Auburn submitted a letter, dated November 4, 2013, stating that Auburn supplies 180,000 gallons of storage to the City of Algona and that an additional 100,000 gallons for storage is available for Algona to purchase, should it exercise that option. Algona is a consecutive water system; fire storage and standby storage are supplied by Auburn. Tables 3-1 and 3-15 have been revised to clarify the storage requirements. Additional text has been added in the STORAGE section in Chapter 3.

9. *The distribution system hydraulic modeling runs in the plan show flow results (gpm) from limiting the analysis to minimum pressures. What are the resultant pressures in the distribution modeling when the actual fire flows desired are inputted?*

   Table 3-19 summarizes the hydraulic analysis. Generally, due to the flat topography in Algona, the critical node is the fire flow node – the nodes are self-limiting. The modeling results in Appendix F have been revised to more fully reflect the results.

10. *Please include the City's water main break/leak repair rates for the last three years.*

    For the past 3 years, the City has averaged about two water main breaks and five service line breaks per year. Text has been added in the Distribution System Leakage section.

11. *Table 6-1 – How will Algona 'check distribution system' daily? Will operator's drive around, measure pressures, measure chlorine residuals, read the master meters? List usual activities.*

The City crew performs maintenance and repair throughout the City. As part of their daily rounds, the crew generally will drive every street in the City at least once per week. They read the master meters twice per week.

12. *Regarding the City's cross connection control program – please submit 1) A current list of all devices installed and 2) the date of their last inspection.*

A current list of backflow prevention devices is included in Appendix H. The City is upgrading its Cross Connection Control Program to ensure annual inspection and tracking of inspection reports for each backflow prevention device. Letters are sent out to those with backflow prevention devices on a rolling basis, based upon the date of device installation. Salvador Marez, on the City's public works staff, earned a Cross-Connection Control Specialist certification in August 2012 and is updating the City's program.

13. *The following items should be included in the City's individual CMP (Coliform Monitoring Plan):*

a. *Need updated - current Plan with date included (2006 date on submitted Plan).*

*Must explicitly address Groundwater Rule Requirements for having Auburn collect source samples from all wells operating.*

The 2006 Coliform Monitoring Plan is the one currently used by the City. The form was revised in December 2013 to address notification requirements and sampling procedures.

b. *Need schematic showing repeat sample sites.*

A map is added to Appendix E. The map shows routine sample sites. Repeat sites are adjacent to the routine sites.

c. *Need sample Collection SOP.*

The City Crew has indicated the following, and is added to the Coliform Monitoring Plan:

- Water samples for bacteriological analysis are collected the first Tuesday of every month from three designated sites. All samples are collected a water sampling stations. Prior to sampling, the hose bib is sprayed down with a 50/50 mix of water and 5 percent chlorine solution. The hose bib is turned on for about a minute while washing it.

- The chlorine residual concentration is recorded and then the water sample is collected into bottle prepared at the laboratory. When finished the samples are put in the refrigerator at City Hall for same day pickup by Water Management Laboratory.

d. *A stand-alone document is preferred – updated CMP does not have to be in the WSP document.*

The Coliform Monitoring Plan is included as Appendix E.

14. *Please submit copies of the City's Construction Completion Report Forms for all water mains installed under the construction document submittal exception provision per WAC 246-290-125(2) for the last six years.*

Construction Completion Reports are attached for the three projects completed.

a. *The objective paragraph at the beginning of Chapter 7 is not accurate and must be changed to reflect the limits of section WAC 246-290-125(2). The City of Algona may only seek authority to <u>not</u> submit project reports and construction documents for distribution water main projects to the department. Standard Specifications and Details – please address the following*

The paragraph has been revised.

b. *New lead free requirements are coming into effect for all Group A water systems. Do these specifications reflect this Federal requirement?*

The City's Water System Construction Standards have been updated (Appendix D) and include requirements that all materials comply with NSF/ANSI and EPA standards. Those standards include lead-free requirements. The City's new standards will be adopted when the Water System Plan is adopted.

c. *The specifications and detail sheets should all have current revision dates consistent with this WSP effort. Please submit a separate bound copy of the Standards/Specifications.*

The detail sheets (Appendix D) have been signed and dated. A separate bound copy is enclosed.

d. *Please include Algona's procedures for the distribution main submittal exception process in the body of the water system plan. This exception process is only for distribution water mains. The water main projects still must be designed by a P.E. installed under the oversight of the design engineer, and a construction completion formally certified with report forms kept on file. Please clarify who specifically provides water main installation oversight and inspections required under the distribution main construction document submittal exception process.*

If the City recieves approval to not submit project reports under the submittal exception process, it will keep on file a copy of the Construction Completion Report for water main distribution projects. The submittal exception will only apply for projects that are using methods and materials specified in the Construction Standards.

All projects are designed and reviewed by licensed engineers for compliance with City standards prior to finalizing the design.

For the three projects completed in the past 6 years, the City Engineer has provided full-time inspection of the water main installation. Satisfactory pressure testing and bacteriological testing results are required before the new water main may be connected to the system. The water main installation in 2012 received WDOH approval prior to installation as it was, in part, constructed by directional drilling with HDPE water main, not a City standard.

15. *Provide a determination of local government consistency from the City's Planning and Land Use Department.*

    The Consistency Statement is included (Appendix K).

16. *Prior to DOH approval the City's governing body must approve and adopt the Water System Plan. This is a requirement resulting from the Municipal Water Law.*

    Per email from Richard Rodriguez, when WDOH has completed its review and the WSP is ready for approval, the City will be notified and the WSP will be adopted. After the City takes that action, WDOH will approve the Plan. A copy of the adopting resolution will be forwarded to WDOH.

    The City approved the draft WSP and requested that it be sent to the WDOH for review and comment (Appendix K).

17. *Please provide comments from adjacent purveyors, along with your response to those comments.*

    The Department of Ecology commented on Water Rights (Appendix K). Table 1-3 has been revised per their comments and two pages have been added to Appendix C from Chapter 6 of the 2009 Auburn Water System Plan.

    Verbal comments were received from Auburn related to source capacity, specifically the Tacoma Intertie and Tables 1-2 and 1-3. Those tables have been revised.

    King County provided comments regarding zoning and service outside the City. See Appendix K for comments received and the responses.

    Pacific recommended revisions to Figure 3-1 and 8-1. Figures 1-3, 3-1, and 8-1 have been revised. Note that the figures show Algona's the area within Algona but south of Ellingson Road and east of Pacific Avenue, as outside of the City retail service area. A Consistency Statement from Pacific is in Appendix K.

Please contact the undersigned at your convenience if you have any questions regarding the Water System Plan.

Very truly yours,

GRAY & OSBORNE, INC.

Warren W. Perkins

Warren Perkins, P.E.

WWP/hhj
Encl.

cc: Ms. Diana Quinn, City Administrator/Clerk Treasurer, City of Algona
Mr. Jimmy Griess, Public Works Supervisor, City of Algona

Gray & Osborne, Inc.
CONSULTING ENGINEERS

December 20, 2013

Mr. Steve Hirschey
Utilities Technical Review Committee
King County Department of Natural Resources
King Street Center
210 South Jackson Street, Suite 512
Seattle, Washington 98104-3055

SUBJECT: RESPONSES TO KING COUNTY LETTER – JULY 2013 DRAFT WATER SYSTEM PLAN
CITY OF ALGONA, KING COUNTY, WASHINGTON
G&O #12503.00

Dear Mr. Hirschey:

We are writing in response to your letter of November 8, 2013, regarding the Algona Water System Plan. Below are your comments in *italics*. Our responses follow each of your comments.

1. *Clarify the zoning and land use for the future service area that is currently in King County, west of the City.*

   The Urban Growth Area west of the City, is zoned by King County as R-1. If the area is annexed, the City will bring it in as critical areas or commercial, depending upon the zoning identified by the City. The area generally consists of steep slopes and has limited development potential.

2. *Clarify the demarcation of and map legend for the green area on Figure 1-4 that is currently unincorporated King County, west of the City, and called UGA. Please note that the area west of the City and north of 1st Avenue North on Figure 1-4 is within the City of Federal Way Potential Annexation Area.*

   Figure 1-4 has been revised. If annexations in this area are proposed, the cities will need to resolve the potentially overlapping jurisdiction.

3. *Clarify the reasoning behind the City's adopted service area policy for a surcharge of fifty percent for water service to customers outside the City and aspects of reasonable service considered by the City for service to unincorporated King County.*

Table 1-6 has been revised. There is not a 50 percent surcharge; the rates are the same. Currently, the City does not serve customers outside the city boundaries.

4. *Clarify the distribution system leakage (DSL), the various three-year average DSLs used in the plan and why the annual water use efficiency reports filed by the City for the years 2009, 2010 and 2011 are not consistent with the information presented in the Plan for DSL.*

The difference is the Boeing Facility on 1st Avenue and east of the railroad tracks. The City's reports include water sold to and consumed by the Boeing Facility; the calculations in the Water System Plan do not. The Boeing Facility is connected directly to the Auburn system; none of the water used by Boeing goes through the City's master meters. The facility is in Algona and thus an Algona customer. Boeing is billed by Algona and is Algona's largest customer. The Water System Plan calculated DSL as the difference between water passing through the master meters and the amount sold, as determined by water bills, excluding Boeing.

5. *Provide a completed Reclaimed Water Checklist.*

A checklist is attached.

Please contact the undersigned at your convenience if you have any questions regarding the Water System Plan.

Very truly yours,

GRAY & OSBORNE, INC.

Warren W. Perkins

Warren Perkins, P.E.

WWP/hhj
Encl.

cc: Ms. Diana Quinn, City Administrator/Clerk Treasurer, City of Algona
Mr. Jimmy Griess, Public Works Supervisor, City of Algona
Mr. Richard Rodriguez, Washington State Department of Health

Gray & Osborne, Inc.
CONSULTING ENGINEERS

December 20, 2013

Mr. Doug Wood
Washington State Department of Ecology
Northwest Regional Office
3190 160th Avenue SE
Bellevue, Washington 98008-5452

SUBJECT: RESPONSE TO ECOLOGY LETTER – JULY 2013 DRAFT WATER SYSTEM PLAN
CITY OF ALGONA, KING COUNTY, WASHINGTON
G&O #12503.00

Dear Mr. Wood:

We are writing in response to your letter of August 20, 2013, regarding the Algona Water System Plan.

In summary, you commented on the City of Auburn's water rights. We have revised Table 1-3 to show the water rights as given in your letter.

Please contact the undersigned at your convenience if you have any questions regarding the Water System Plan.

Very truly yours,

GRAY & OSBORNE, INC.

Warren W. Perkins

Warren Perkins, P.E.

WWP/hhj
Encl.

cc: Ms. Diana Quinn, City Administrator/Clerk Treasurer, City of Algona
Mr. Jimmy Griess, Public Works Supervisor, City of Algona
Mr. Richard Rodriguez, Washington State Department of Health