Appendix A – Sudden Valley/Geneva Detailed Physical Capacity Analysis

Appendix A – Sudden Valley / Geneva Detailed Physical Capacity Analysis

This appendix provides a detailed physical capacity analysis for the Sudden Valley and Geneva area water systems (South Shore water system). It contains analyses of water demands, water rights, pump capacity, treatment capacity, storage capacity, distribution capacity, and distribution system leakage. It includes determinations of limiting factors and number of ERUs capable of being served based on existing infrastructure. Physical capacity of the existing infrastructure exceeds anticipated build-out of the Sudden Valley and Geneva areas, so this appendix also identifies what capacity is needed to meet demands for anticipated build-out.

Water Demands

Water Demands are determined separately for Geneva and Sudden Valley because the two areas have different characteristics and different water demands. Average Day Demand (ADD) and Maximum Day Demand (MDD) were determined in the 2016 LWWSD Water Use Efficiency Plan Update (Appendix B of this Water System Plan). These values were determined using source meter data, and therefore distribution system leakage is included in the values. Distribution system leakage was also quantified in the 2016 Water Use Efficiency Plan Update. The ADD and MDD values are listed below.

	Sudden Valley	**Geneva**
ADD (gpd/ERU)	150	175
MDD (gpd/ERU)	250	370

Source-Based Physical Capacity

Sources must provide MDD for the system. Equalizing storage in the reservoirs provides equalizing volume to meet peak hourly demands beyond MDD. Individual components that could limit the source production are addressed below. There is only one source for the water system, which is Lake Whatcom. There is an emergency intertie with the City of Bellingham in Geneva, but this intertie is for emergencies only and is not included in this capacity analysis.

Water Rights

Water rights for the South Shore water system are discussed in detail in the body of the Water System Plan, Section 3. After taking the periods of use of each of the water rights in to consideration, the instantaneous flow rate allowed is 3.4 cubic feet per second (cfs) at all points throughout the year. The total volume allowed from December 1 through March 31 is 540 acre-feet per year, and the total volume allowed from April 1 through November 30 is 1260 acre-feet per year. These sum to 1800 acre-feet per year.

In order to quantify the number of ERUs that could ultimately be served by the water rights, an assumption needs to be made about the proportion of ERUs designated to each Sudden Valley and Geneva. An assumption will be that the anticipated build-out numbers for each will represent that proportion. Given the anticipated build-out number (from Section 2 of the water system plan) for

Sudden Valley of 3267 ERUs and 1239 ERUs for Geneva, an assumed ratio of Sudden Valley to Geneva ERUs is 2.64.

Given the above information, the following two equations were used to solve for the maximum number of ERUs based on the instantaneous water right.

$$Instantaneous\ Water\ Right\ = \#\ SV\ ERUs * MDD_{SV} + \#\ Gen\ ERUs * MDD_{Gen}$$

$$\#\ SV\ ERUs = 2.64 * \#\ Gen\ ERUs$$

The maximum number of ERUs based on the annual total water right is calculated using the following equation and the Sudden Valley to Geneva ERU ratio.

$$Annual\ Water\ Right\ = \#\ SV\ ERUs * ADD_{SV} + \#\ Gen\ ERUs * ADD_{Gen}$$

After taking unit conversions in to account, the algebraic solutions are shown below.

	Sudden Valley	**Geneva**
Capacity based on Instantaneous water right (ERUs)	5631	2133
Capacity based on Annual water right (ERUs)	7429	2814

The above table indicates that the instantaneous water right is more limiting for the system than the annual water right, but still exceeds the anticipated build-out for the service area.

Pump Capacity

The installed pump capacity for the South Shore water system source includes the raw water pumps, the transfer pumps that pump filtered water from the clearwell to the CT reservoir, and the transmission pumps that pump from the CT reservoir to fill the Division 7 and Division 22 reservoirs.

The raw water pumping system consists of two variable speed pumps in parallel. Each pump was designed for a flow rate of 1400 gpm at a TDH of approximately 38 ft. This provided the treatment plant the full 2 MGD capacity with 100% redundancy. The VFDs on the raw water pumps are currently set such that the operational flow rate is 700 gpm, but the originally designed flow rate of 1400 gpm is still available with 100% redundancy. Flow meters in the treatment plant confirm the operational flow rate.

There are two transfer pumps in parallel that pump filtered water from the clearwell to the CT reservoir. These pumps alternate in operation and turn on and off based on the water level in the clearwell. These pumps are constant speed and run at 1400 gpm until the level in the clearwell reaches the off setpoint. The design point of each of these pumps is 1400 gpm at a TDH of approximately 39 ft. The configuration provides 100% redundancy.

The transmission pumps that pump water from the CT reservoir to the Division 7 and Division 22 reservoirs are configured with two parallel pumps to pump to each reservoir (4 pumps total). Each of the Division 7 transmission pumps is designed for a flow rate of 700 gpm at a TDH of approximately 418 ft, and each of the Division 22 transmission pumps is designed for a flow rate of 700 gpm at a TDH of approximately 606 ft. These provide 100% redundancy. Actual measured flow rates under operational conditions is 840 gpm for the Division 7 pumps and 725 gpm for the Division 22 pumps.

As the above information conveys, the smallest pumping capacity of the pumping system is 1400 gpm. This pumping capacity was used with the following two equations to determine the maximum number of ERUs that could be supported by the pumping capacity.

$$Pump\ capacity\ flow\ rate\ = \#\ SV\ ERUs * MDD_{SV} + \#\ Gen\ ERUs * MDD_{Gen}$$

$$\#\ SV\ ERUs = 2.64 * \#\ Gen\ ERUs$$

After taking unit conversions in to account, the algebraic solutions are shown below.

	Sudden Valley	Geneva
Capacity based on pumping capacity (ERUs)	5167	1957

Since these values are lower, the pumping capacity is more limiting to capacity than the water rights, but still exceeds the anticipated build-out for the service area.

Treatment Capacity

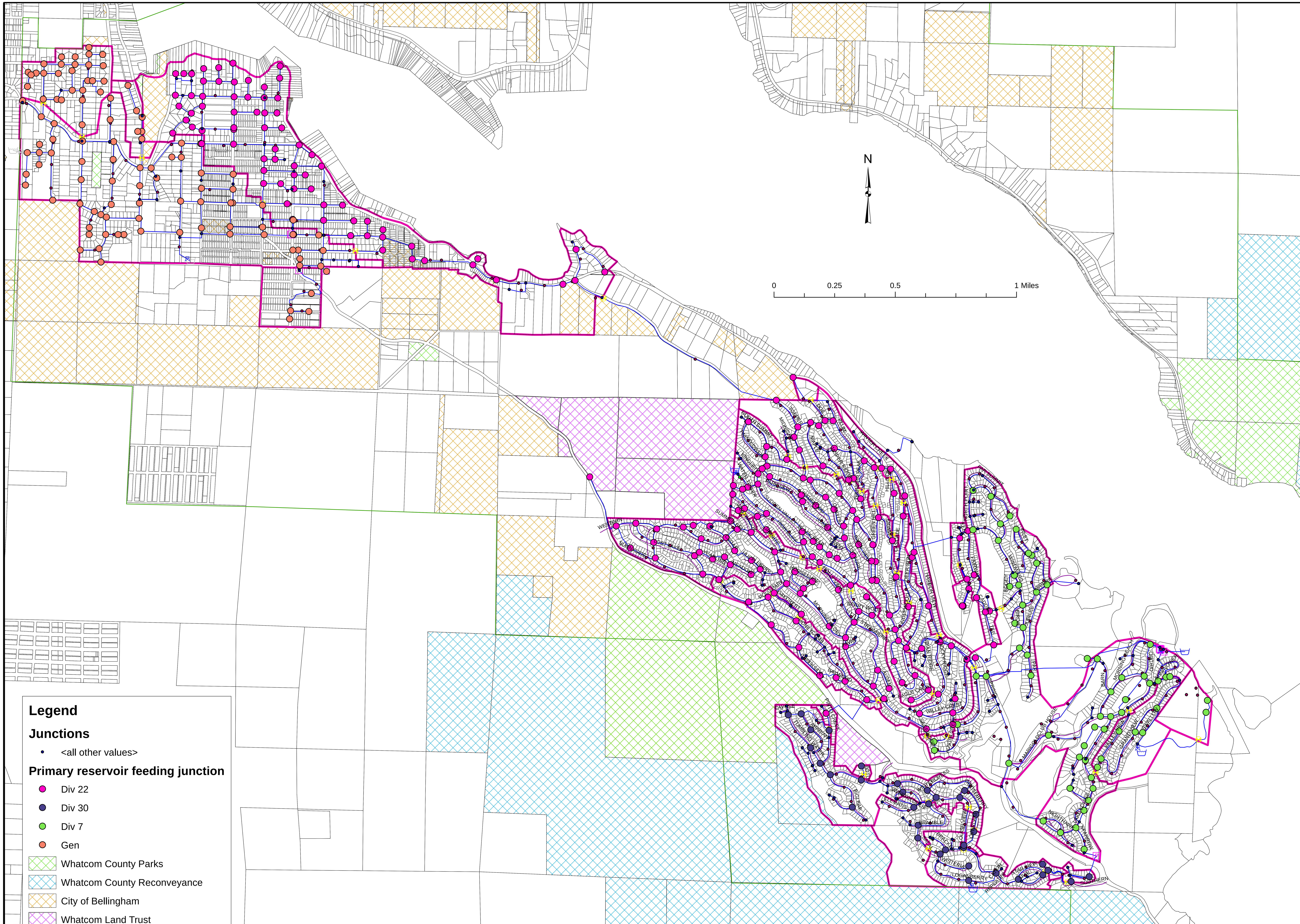
The Sudden Valley water treatment plant has a capacity of 1400 gpm. It is currently operated at 700 gpm but is capable of treating a flow of 1400 gpm, as described in Section 3.3.1 of the water system plan. There is a small amount of treatment plant down-time needed for backwash and filter-to-waste. For this analysis, it is conservatively assumed that the treatment plant can produce its capacity of water 90% of the time. The ERUs below represent this (pumping capacity ERUs x 0.9).

	Sudden Valley	Geneva
Capacity based on treatment capacity (ERUs)	4650	1761

Storage Capacity

This section will analyze the ultimate capacity for the number of ERUs that could be served by each reservoir assuming the treatment plant and pumping was operating at full capacity (1400 gpm).

Figure A-1 shows the service areas of each reservoir. This operation is different from how the system has been previously operated because prior to the construction of the new Division 22 reservoir, a portion of that service area needed to be served by the Division 30 reservoir (via the Division 7 reservoir) to provide sufficient storage. Now that the new Division 22 reservoir is online, more area can be served by the Division 22 reservoirs. This results in a more efficient operation because the Division 22 reservoirs are at a lower elevation than the Division 30 reservoir and therefore pumping costs will be lower by serving the maximum number of connections from Division 22.



LAKE WHATCOM WATER AND SEWER DISTRICT

WHATCOM COUNTY WASHINGTON

FIGURE A-1
SOUTH SHORE RESERVOIR FEED AREAS

DATE JULY 2017

SCALE As Shown

JOB NUMBER 2016-096

SHEET 1 OF 1

Coordinate System:
State Plane Washington North
North American Datum 1983

Data Source:
City of Bellingham Public Works Dept.,
Whatcom County Planning & Assessor

WILSON ENGINEERING, LLC
805 DUPONT STREET
BELLINGHAM, WA 98225
(360)733-6100 FAX(360)647-9061
www.wilsonengineering.com

Wilson
SURVEY/ENGINEERING

Table A-1 demonstrates the ultimate number of ERUs that could be served by each reservoir. There are seven items in Table A-1 that should be noted about the set-up and assumptions that went in to this table.

1. It is assumed that there is no dead storage beyond the physical raised outlet that is 0.5 ft above the base of each reservoir. No additional dead storage to provide the minimum 20 psi once all storage components have been depleted has been assumed in previous reports because of the District's Resolution 410 (and Resolutions 721, 778, Administrative Code 4.2.1) that provides a credit for a booster pump for those lots too close to distribution reservoirs to provide sufficient gravity pressure. Note that these lots were platted before the minimum required pressure at the service meter was raised from 20 psi to 30 psi under conditions where equalizing storage is depleted.
2. Table A-1 assumes that the Standby Storage for the Division 30 reservoir is allocated to the Division 7 reservoir. This has been previously justified because the pumping system to provide water to Division 30 from Division 7 is fully redundant and has an on-site backup generator to keep it pumping in case of a power outage.
3. Fire suppression storage for all the South Shore reservoirs (except Div 30) is nested within the much larger standby storage volume. This is acceptable per WAC 246-290-235(4).
4. Note that the supply capacities to the Division 7 and Division 22 reservoirs is 700 gpm. This is based on the treatment and pumping capacity of 1400 gpm.
5. Note that Division 22 serves both Sudden Valley and Geneva ERUs. The ratio of the capacities of ERUs to each was set based on the anticipated build-out ratio of ERUs served by the Division 22 reservoirs. Anticipated build-out of Sudden Valley ERUs served by Division 22 is 1978 ERUs and anticipated build-out of Geneva ERUs served by Division 22 is 515 ERUs, for a Sudden Valley to Geneva ratio of 3.84.
6. Peak hourly demand (PHD), equalizing storage, standby storage and fire suppression storage were calculated using the appropriate equations from the Washington Department of Health Water System Design Manual.
7. Operating storage shown represents current operating levels. If additional capacity were needed, operating storage could be decreased.

Table A-1: Sudden Valley and Geneva Reservoir Maximum Storage ERU Capacities

					Operating Storage		MDD (gpd/ERU)		Maximum ERUs		PHD for Reservoir (gpm)					Equalizing Storage		ADD (gpd/ERU)		Standby Storage		Fire Suppression Storage		Dead Storage	
Reservoir	Base Elevation (ft NAVD88)	Reservoir Height to Overflow (ft)	Reservoir Diameter (ft)	Reservoir storage per foot (gal/ft)	Storage Volume (gallons)	Level with Storage Depleted (ft)	Geneva	Sudden Valley	Geneva	Sudden Valley	Geneva Contribution	Sudden Valley Contribution	Flow out to other reservoirs (gpm)	Total PHD for Reservoir (gpm)	Supply Capacities (gpm)	Storage Volume (gallons)	Level with Storage Depleted (ft)	Geneva	Sudden Valley	Storage Volume (gallons)	Level with Storage Depleted (ft)	Storage Volume (gallons)	Level with Storage Depleted (ft)	Storage Volume (gallons)	Level with Storage Depleted (ft)
Division 7	670.45	35	70	28,786	230,291	27		250		1740		540	165	705	700	809	26.97		150	762,000	0.50	45,000	25.41	14,393	0.00
Division 22	804.65	35	50	14,687	117,496	27	370	250	537	2060	297	629	250	1176	700	71,380	24.84	175	150	805,950	0.50	45,000	23.49	7,343	0.00
Division 22 New	805	35	56	18,423	147,386	27											24.84				0.50		23.49	9,212	0.00
Division 30	1027.98	40	25	3,672	18,359	35		250		800		279	0	279	165	17,143	30.33		150	0	30.33	30,000	22.16	1,836	21.66
Geneva	661.12	32	52	15,885	31,771	30	370		1201		570		0	570	250	47,934	26.98	175		420,350	0.52	45,000	24.15	7,943	0.02

Summary:

		Maximum ERUs			
Reservoir	Existing capacity (gallons)	Geneva	Sudden Valley	Sum of required storage (gallons)	Surplus of storage (gallons)
Division 7	1,007,524		1740	1,007,494	31
Division 22	1,158,859	537	2060	1,158,767	92
Division 22 New					
Division 30	146,869		800	67,337	79,532
Geneva	508,333	1201		507,997	336

In analyzing Table A-1, note that the number of Division 30 ERUs shown does not appear to be the maximum, as there is still a surplus of 79,532 gallons. The reason for this is that the standby storage for the Division 30 ERUs is included in the Division 7 storage. If Division 30 ERUs were increased more, the Division 7 ERUs would need to decrease. The given ERU distribution between Division 30 and Division 7 is a reasonable distribution.

Table A-1 shows that the total ERU capacities for each Sudden Valley and Geneva based on storage capacity are shown below.

	Sudden Valley	Geneva
Capacity based on storage capacity (ERUs)	4600	1738

The distribution of these ERUs is limited to the reservoirs as shown in Table A-1. Anticipated build-out in the areas served by each reservoir is addressed below, and the maximum ERU capacity for each reservoir well exceeds anticipated build-out, as discussed in more detail below.

Distribution System Physical Capacity

The physical capacity of the South Shore water system distribution system is analyzed within the hydraulic modeling section of the water system plan. As explained in that section, the limitation on the distribution system is its ability to provide fire flow rates while maintaining adequate system pressure. The distribution system's ability to provide peak hourly flow is not a limiting factor, and therefore the distribution system does not limit the physical capacity of the water system.

Build-Out Analysis

All of the above analysis indicates that the existing physical capacity of the South Shore water system exceeds anticipated build-out within this system. The demands per ERU (ADD and MDD) have been decreasing over time and are anticipated to only continue to decrease as water conservation efforts continue to show results. The decrease over time explains why existing physical capacity exceeds anticipated build-out. Build-out analysis accounts for existing vacant lots but does not necessarily account for future schools or other institutions that may be developed because there are no current plans for development such as this.

Because existing capacity exceeds anticipated build-out, an analysis was performed to show the capacity of each component that would be required for anticipated build-out. This analysis may be useful when any of the existing facilities need to be replaced.

An analysis of anticipated build-out for each reservoir service area indicates that the physical capacity of each reservoir is not distributed proportionally to anticipated build-out ERUs in the service area of each reservoir. A comparison of this is shown below.

Reservoir Service Area	Existing Physical Capacity (ERUs)		Anticipated Build-Out (ERUs)	
	Sudden Valley	Geneva	Sudden Valley	Geneva
Division 7	1740		815	
Division 22	2060	537	1978	515
Division 30	800		474	
Geneva		1201		724

The above table shows that the existing physical capacity of the Division 7 reservoir greatly exceeds anticipated build-out of lots in its service area. It demonstrates that the Division 22 reservoirs are appropriately sized with a small amount of excess capacity beyond anticipated build-out. Division 30 capacity well exceeds anticipated build-out, but this is primarily because its standby storage is allocated from excess storage in Division 7, as discussed previously. The Geneva reservoir is somewhat oversized beyond anticipated build-out, but this allows for flexibility in operating levels and potentially having the ability to serve the lower pressure zone in Geneva instead of that area being served by the Division 22 reservoirs.

Based on anticipated build-out, Table A-2 below was developed to show how much storage volume would be needed to serve anticipated build-out. Division 30 standby storage continues to come from the Division 7 reservoir. Reservoir heights in Table A-2 were left at their existing heights and the diameters were adjusted to approximately match the required storage for the anticipated build-out ERUs. The equalizing storage is calculated based on supply capacities of 700 gpm to Division 22 and Division 7. If future flow rates from treatment and pumping are lowered (as discussed below), equalizing storage would increase slightly. This scenario is addressed in Table A-3.

Table A-2: Reservoir sizing requirements to meet anticipated build-out based on existing treatment/pumping capacity

					Operating Storage		MDD (gpd/ERU)		Build-out ERUs		PHD for Reservoir (gpm)					Equalizing Storage		ADD (gpd/ERU)		Standby Storage		Fire Suppression Storage		Dead Storage	
Reservoir	Base Elevation (ft NAVD88)	Reservoir Height to Overflow (ft)	Adjusted Reservoir Diameter (ft)	Adjusted Reservoir storage per foot (gal/ft)	Storage Volume (gallons)	Level with Storage Depleted (ft)	Geneva	Sudden Valley	Geneva	Sudden Valley	Geneva Contribution	Sudden Valley Contribution	Flow out to other reservoirs (gpm)	Total PHD for Reservoir (gpm)	Supply Capacities (gpm)	Storage Volume (gallons)	Level with Storage Depleted (ft)	Geneva	Sudden Valley	Storage Volume (gallons)	Level with Storage Depleted (ft)	Storage Volume (gallons)	Level with Storage Depleted (ft)	Storage Volume (gallons)	Level with Storage Depleted (ft)
Division 7	670.45	35	49.9	14,628	117,026	27		250		815		283	165	448	700	0	27.00		150	386,700	0.56	45,000	23.92	7,314	0.06
Division 22	804.65	35	50	14,687	117,496	27	370	250	515	1978	288	607	250	1144	700	66,606	24.90	175	150	773,650	0.54	45,000	23.49	7,343	0.04
Division 22 New	805	35	53.9	17,067	136,540	27											24.90				0.54		23.49	8,534	0.04
Division 30	1027.98	40	12.9	978	4,888	35		250		474		188	0	188	165	3,424	31.50		150	0	31.50	30,000	0.81	489	0.31
Geneva	661.12	32	39.7	9,259	18,518	30	370		724		373		0	373	250	18,519	28.00	175		253,400	0.63	45,000	23.14	4,630	0.13

Summary:

		Build-out ERUs			
Reservoir	Existing capacity (gallons)	Geneva	Sudden Valley	Sum of required storage (gallons)	Surplus of storage (gallons)
Division 7	1,007,524		815	511,040	496,484
Division 22	1,158,859	515	1978	1,110,169	48,690
Division 22 New					
Division 30	146,869		474	38,801	108,069
Geneva	508,333	724		295,066	213,266

To analyze the treatment and pumping capacity needed for anticipated build-out of the South Shore water system, the following equation was used.

$$Pump/treatment\ capacity\ flow\ rate\ = \#\ SV\ ERUs * MDD_{SV} + \#\ Gen\ ERUs * MDD_{Gen}$$

With this equation and the following anticipated build-out information, the pump/treatment capacity needed is shown below.

# Sudden Valley ERUs	3267
# Geneva ERUs	1239
MDD SV (gpd/ERU)	250
MDD Gen (gpd/ERU)	370
Pump/Treatment capacity flow rate (gpm)	886

A treatment and pumping capacity of 886 gpm would meet anticipated build-out of the South Shore system, assuming the treatment plant could produce water 100% of the time during Maximum Day Demand. Because of the need for backwashing and filter-to-waste, a conservative assumption is that the treatment plant could produce water 90% of the time. This would require a treatment and pumping capacity of 984 gpm. This is significantly less than the current capacity of 1400 gpm. If the pumping and treatment capacity was lowered to this flow rate, the transmission pumps could be designed so that they split the 984 proportionally to Division 7 and Division 22 based on anticipated MDD served by each based on multiplying the build-out ERUs by the appropriate MDD (including those reservoirs fed from Division 7 and Division 22). In this scenario, Division 7 would be ultimately serving 25% of the MDD flow, and Division 22 would be serving 75% of the MDD flow. Therefore, the transmission pumps could be sized for a flow rate of the following.

Division 22 transmission pump flow rate (gpm)	738
Division 7 transmission pump flow rate (gpm)	246

Based on these transmission pump flow rates, the reservoir sizing table was re-analyzed and is shown in Table A-3. Table A-3 was set up in the same way as Table A-2 with Division 30 standby storage allocated in Division 7, and reservoir diameters were adjusted to approximately match required storage.

Table A-3: Reservoir sizing requirements to meet anticipated build-out based on treatment/pumping capacity appropriate for anticipated build-out

					Operating Storage		MDD (gpd/ERU)		ERUs		PHD for Reservoir (gpm)					Equalizing Storage		ADD (gpd/ERU)		Standby Storage		Fire Suppression Storage		Dead Storage	
Reservoir	Base Elevation (ft NAVD88)	Reservoir Height to Overflow (ft)	Adjusted Reservoir Diameter (ft)	Adjusted Reservoir storage per foot (gal/ft)	Storage Volume (gallons)	Level with Storage Depleted (ft)	Geneva	Sudden Valley	Geneva	Sudden Valley	Geneva Contribution	Sudden Valley Contribution	Flow out to other reservoirs (gpm)	Total PHD for Reservoir (gpm)	Supply Capacities (gpm)	Storage Volume (gallons)	Level with Storage Depleted (ft)	Geneva	Sudden Valley	Storage Volume (gallons)	Level with Storage Depleted (ft)	Storage Volume (gallons)	Level with Storage Depleted (ft)	Storage Volume (gallons)	Level with Storage Depleted (ft)
Division 7	670.45	35	51.8	15,763	126,108	27		250		815		283	165	448	246	30,368	25.07		150	386,700	0.54	45,000	22.22	7,882	0.04
Division 22	804.65	35	50	14,687	117,496	27	370	250	515	1978	288	607	250	1144	738	60,906	25.07	175	150	773,650	0.51	45,000	23.64	7,343	0.01
Division 22 New	805	35	53.5	16,815	134,521	27											25.07				0.51		23.64	8,408	0.01
Division 30	1027.98	40	12.9	978	4,888	35		250		474		188	0	188	165	3,424	31.50		150	0	31.50	30,000	0.81	489	0.31
Geneva	661.12	32	39.7	9,259	18,518	30	370		724		373		0	373	250	18,519	28.00	175		253,400	0.63	45,000	23.14	4,630	0.13

Summary:

		Build-out ERUs			
Reservoir	Existing capacity (gallons)	Geneva	Sudden Valley	Sum of required storage (gallons)	Surplus of storage (gallons)
Division 7	1,007,524		815	551,057	456,468
Division 22	1,158,859	515	1978	1,102,324	56,535
Division 22 New					
Division 30	146,869		474	38,801	108,069
Geneva	508,333	724		295,066	213,266

Table A-3 shows that with the treatment/pumping capacity and transmission pump capacity appropriate for anticipated build-out, the Division 7 reservoir has slightly less surplus than what is shown in Table A-2 because the equalizing storage requirement is higher. The Division 22 reservoir has slightly more surplus than what is shown in Table A-2 because the supply capacity is slightly higher and less equalizing storage is needed. Division 30 and Geneva reservoir required storage remains unchanged from Table A-2.

Conclusions

Existing Physical Capacity Conclusion

The physical capacity analysis above shows that the limiting factor in physical capacity of the existing South Shore system when looking at the overall system is the storage capacity. This limits the overall system to the following ERUs.

	Sudden Valley	Geneva
Capacity based on most limiting factor [storage] (ERUs)	4600	1738

The distribution of these ERUs is constrained by the geographical distribution of the service areas of each reservoir, as shown in Table A-1. The physical capacity of the existing system exceeds anticipated build-out of each reservoir's service area. Anticipated build-out is addressed in more detail below.

Build-out Physical Capacity

Any proposed changes to the physical capacity of the storage or pumping/treatment capacity in the south shore water system should be designed with this information in mind and analyze the impact to the overall system physical capacity. It is anticipated that distribution system leakage and overall water demand per ERU will continue to decrease over the years. If changes to storage or pumping/treatment capacity are made many years beyond 2017, the Maximum Day and Average Day Demand should be re-assessed, as it is likely that the capacity needed to serve anticipated build-out may decrease. If projects to change these system components are undertaken in the near future, the information in Table A-3 can be used for sizing system components.

Appendix B – Water Use Efficiency Plan

LAKE WHATCOM WATER AND SEWER DISTRICT

WATER USE EFFICIENCY PLAN
2015 UPDATE

FEBRUARY 2016

LAKE WHATCOM WATER AND SEWER DISTRICT

WATER USE EFFICIENCY PLAN
2015 UPDATE

Prepared for:

Lake Whatcom Water and Sewer District

By:

Wilson Engineering, LLC

MELANIE M. MANKAMYER
STATE OF WASHINGTON
33766
REGISTERED
PROFESSIONAL ENGINEER
2-11-16

TABLE OF CONTENTS

LAKE WHATCOM WATER AND SEWER DISTRICT

WATER USE EFFICIENCY PLAN - 2015 UPDATE

The Water Use Efficiency (WUE) Program is designed to promote the goal of ensuring safe and reliable drinking water in our communities. In 2003, the Municipal Water Law was passed by Washington State Legislature. This law addresses the increasing demand on our state's water resources and directs the state Department of Health (DOH) to adopt an enforceable WUE program. This WUE program became effective January 22, 2007, and is intended to achieve a consistently high level of stewardship among all municipal water suppliers.

Lake Whatcom Water and Sewer District (LWWSD) is committed to providing safe, reliable water to their customers and work to ensure that state water resources remain reliable and adequate for future generations. LWWSD has been very active in their pursuit of conservation and system reliability measures. This WUE plan summarizes the progress to date and updates the goals and measures adopted by LWWSD to ensure that all DOH requirements are met.

A. <u>WATER USE DATA COLLECTION REQUIREMENTS</u>

Lake Whatcom Water and Sewer District currently supplies water to four distinct areas: Sudden Valley, Geneva, North Shore/Eagleridge, and North Shore Wells/Agate Heights. The total number of connections served by the District is about 3597, representing 3916 equivalent residential units (as of 12/31/2014).

The District is primarily residential. The District rate structure is based on Equivalent Residential Units (ERUs) with a water allowance for a base bi-monthly fee. Water use above the allowance is charged at a per cubic foot rate with a two tier block rate structure. Multi-family and commercial customers are assigned a number of ERUs and charged the base rate times that number of ERUs.

The District has been collecting water use data for each of the four areas separately. The best available water use data for 2010 through 2014 are included in Appendix A. The District does not sell wholesale water and therefore does not collect data on wholesale water sold.

The District collects customer meter use data by the listed customer classes and is investigating methods for reporting this data. The number of non-residential customers in the District is very small. The water use data by customer class listed in Appendix A, Exhibit 1 is based on an assumption of equal use per ERU throughout the customer classes.

Water use efficiency data will be analyzed once per year and include the following:

- Number of water services renovated/replaced
- Frequency of water conservation bill inserts
- Average Daily Demand (ADD) for each distinct area
- Maximum Daily Demand (MDD) for each distinct area
- Distribution system losses for each distinct area

B. WATER DEMAND FORECAST

The projected future populations used for the Sudden Valley and Geneva Study Areas were based on the projected growth analysis prepared by the District in conjunction with its connection fee analysis. The projected future populations for the North Shore are discussed in detail in the North Shore sections below. Water demand forecast data can be found in Appendix A, Exhibit 2. ADD and MDD were re-evaluated for each area because demand per ERU has decreased significantly in all service areas since the 2010 analysis. New ADD and MDD analysis is described below.

Sudden Valley Area

The Sudden Valley Study Area is a residential area with a golf course and a small strip mall. There are no projected agricultural or industrial water needs. The Sudden Valley Community Association has its own water source for irrigation of the golf course.

The table in Exhibit 2, Appendix A, summarizes the water demand forecasting for the Sudden Valley Study Area. We selected a low population growth projection as growth in the District is slowing. The District holds Surface water rights equivalent to 3.4 cfs maximum instantaneous withdrawal, and an average annual withdrawal of 1,800 acre-feet.

The ADD that was used in the 2010 Water Use Efficiency Plan for Sudden Valley was 207 gpd/ERU. This came from the 1994 Reduced Criteria for average day demand study. ADD since that time in Sudden Valley has decreased. Exhibit 5 shows that the annual ADD from 2012-2014 decreased each year, from 131 gpd/ERU in 2012 to 119 gpd/ERU in 2014. Therefore, an ADD value of 150 gpd/ERU is used for future projections because it is closer to recent demands but remains conservative.

Sudden Valley MDD in the 2010 Plan was 335 gpd/ERU, based on the 1994 study. Exhibit 3 shows that the MDD from 2014-2015 was 175 gpd/ERU, which is significantly lower than the previously used value. 175 gpd/ERU represents an actual MDD:ADD ratio of 1.34, which is relatively low compared to many water systems. This shows that summer demand in the Sudden Valley service area does not increase dramatically. To remain conservative, the historical MDD:ADD ratio of 1.62 was used to approximate an MDD of 250 gpd/ERU. This is used for future Sudden Valley projections. This remains conservative but is closer to recent demands than the previously used value.

Water rights for Sudden Valley are shared with Geneva, and water rights are discussed below with respect to future demand.

Geneva Area
The Geneva area is primarily residential but has two schools and a church complex. There are no projected agricultural or industrial water needs.

The table in Exhibit 2, Appendix A, summarizes the water demand forecasting for the Geneva Study Area. Again, we used the projected growth analysis prepared by the District in conjunction with its connection fee analysis.

In the 2010 Water Use Efficiency Plan, the Geneva area ADD was 245 gpd/ERU. This was based on the 1997 Reduced Criteria study. Similar to Sudden Valley, Geneva has seen decreased ADD since that time. Exhibit 5 shows that annual ADD from 2012-2014 was fairly constant and ranged from 148 to 152 gpd/ERU. To remain conservative but use a value closer to actual recent demand, an ADD of 175 gpd/ERU is used for future projections.

Geneva MDD in the 2010 plan was 500 gpd/ERU from the 1997 Reduced Criteria study. MDD in Geneva has also decreased since then, with the highest MDD from 2014-2015 being 322 gpd/ERU (Exhibit 3). This represents an actual MDD:ADD ratio of 2.12. To maintain a similar MDD:ADD ratio and remain conservative but realistic, MDD for future projections is 370 gpd/ERU.

The demand forecasting shown in the Exhibit 2 table incorporates these reduced criteria. The third table in Exhibit 2 shows the forecast for the combined Sudden Valley and Geneva systems. It can be seen that under the combined full build-out for both systems, annual and instantaneous demands can easily be met with the existing water rights.

North Shore/Eagleridge Area
The Eagleridge Water System services a residential area. There are no Urban Growth Areas in the District's North Shore area and the zoning previously ranged from RR2 to R5A. Whatcom County has imposed restrictions requiring that all new subdivided properties have a minimum of 5 acres. Therefore, any new development will be rural in nature.

The District serves the Eagleridge development and adjacent residences with the existing Eagleridge Water System. This currently consists of 68 developed residences, with a potential to increase to 71 developed residences. There are no projected non-residential water needs. There are no sources for non-revenue water.

The table in Exhibit 2, Appendix A, summarizes the water demand forecasting for the North Shore/Eagleridge Area. There are currently 68 connections, and there are only 3 potential future residences within the service area. The forecast conservatively assumes that these three lots will be developed before 2021.

ADD used in the 2010 Water Use Efficiency Plan for the Eagleridge system was 400 gpd/ERU without conservation savings and 300 gpd/ERU with conservation savings. Average demand in this system has decreased significantly over time, and ADD values for 2012-2014 ranged from 216 to 231 gpd/ERU (Exhibit 5). To remain conservative but more realistic, an ADD value of 250 gpd/ERU is used for future projections (without conservation savings). Considering that there is still room for conservation savings, a projected ADD with conservation savings is 210 gpd/ERU.

Eagleridge MDD in the 2010 Water Use Efficiency Plan was 800 gpd/ERU without conservation savings and 600 gpd/ERU with conservation savings. Typical MDD has decreased in this system, and the highest normal MDD for 2014 and 2015 was 659 GPD/ERU (see Exhibit 3). There was an anomalously high demand day on July 17, 2014, which can be seen in the MDD-July 2014 graph. Demand on this day was more than 2.5 times the demand of any other summer day in 2014 or 2015. There is no clear explanation for demand on this day, as no leaks were reported. Possibilities include problems with the meter or water being pulled from a fire hydrant. Another possibility is an inconsistency in timing of when the meter was read (perhaps it was read early in the day on July 16 and late in the day on July 17). With this in mind, the three-day average demand for July 16-July 18, 2014 was calculated to be 841.09 gpd/ERU. Overall, MDD for Eagleridge is trending toward lower values compared to historical trends, but because of this anomalous day, MDD for Eagleridge will conservatively remain at the previous value of 800 gpd/ERU for future projections without conservation. MDD with projected conservation savings remains 600 gpd/ERU.

The water usage and MDD:ADD ratio in Eagleridge is higher per connection than in other District service areas. This may be due in part to larger lot sizes and more landscaping since the highest water use is during the summer. The District has already seen a substantial reduction in MDD (MDD in 2007 was 818 GPD/ERU) and intends to target Eagleridge for further conservation savings. Eagleridge represents less than 2% of the District's connections.

The demand forecasting shown in the Exhibit 2 table incorporates the reduced criteria for the Eagleridge system. It shows the forecast for Eagleridge demand can easily be met from the existing City Connection with or without conservation savings.

Agate Heights Area

The Agate Heights (Wells) System is also rural residential in nature. The initial system was designed to supply 42 connections (with storage for 52 connections).

The table in Exhibit 2, Appendix A, summarizes the water demand forecasting for the North Shore/Agate Heights Well System Area. The Agate Heights system currently serves 45 residences. Full build-out for this system, as is, would consist of 52 residences. For the forecast, it was conservatively assumed that the additional 7 residences will be developed by 2021. This system may be expanded along Northshore Road to serve potential connections that include approximately 141 ERUs associated with the failed

1995 ULID W-6, 70 properties with pending residential surface water right applications, two small Group A water systems and four Group B water systems. Many of these ERUs represent existing residences that currently draw water directly from Lake Whatcom or private wells.

The ADD used in the 2010 Water Use Efficiency Plan for the Agate Heights system was 300 gpd/ERU without conservation savings and 250 gpd/ERU with conservation savings. Demand in this system has decreased somewhat over time, and ADD values for 2012-2014 ranged from 204 to 209 gpd/ERU (Exhibit 5). To remain conservative but more realistic, an ADD value of 230 gpd/ERU is used for future projections (without conservation savings). Considering that there is still room for conservation savings, a projected ADD with conservation savings is 200 gpd/ERU.

Agate Heights MDD in the 2010 Water Use Efficiency Plan was 800 gpd/ERU without conservation savings and 600 gpd/ERU with conservation savings. MDD has decreased in this system, and MDD for 2014 and 2015 was 446 GPD/ERU (see Exhibit 3). This represents an actual MDD:ADD ratio of 2.13. To maintain a similar MDD:ADD ratio and remain conservative but realistic, MDD for future projections without conservation savings is 500 gpd/ERU. MDD with projected conservation savings is 420 gpd/ERU.

The Agate Heights (Wells) System is supplied by a well with a 60 gpm water right permit (G1-22681P), a 360 gpm water right permit (G1-22763P), and an 18 gpm water right certificate (G1-23449C). The G1-22763P water right permit was tied to the Agate Heights Well System through a water right transfer which was completed in 2003. The G1-23449C water right certificate was tied to the Agate Heights Well System through a water right transfer in 2010 from the Lake Whatcom Residential and Treatment Center. The number of buildout connections does not necessarily represent existing zoning for the original Agate Heights Well System service area since there is the possibility that the Agate Heights system could be expanded to include: the Eagleridge system, at least 141 ERUs associated with the failed 1995 ULID W-6, 70 residential surface water right applications, two small Group A water systems and four Group B water systems in the vicinity of Agate Heights. As can be seen from the Eagleridge and Agate Heights demands, the Agate Heights Well System easily has sufficient water rights to serve Eagleridge and many additional connections. Exhibit 2 shows calculated ERUs that could be served based on the annual and instantaneous water rights and the ADD and MDD, respectively, of the Agate Heights system. Demand for new connections would need to be assessed to determine the number of additional connections that could be served from the Agate Heights Wells System.

C. WATER USE EFFICIENCY GOALS

The District developed Water Use Efficiency goals in conjunction with public input. The following goals were presented for public comment before being incorporated into the WUE Plan.

2010 Goals and Results:

1. Reduce distribution system losses in South Shore and Agate Heights service areas. The near-term (<2 years)goal is to have less than 15% apparent distribution system losses for each system; the long term (2-5 years) goal is to meet the WUE 10% distribution system loss standard.
    a. This goal was proposed after analyzing and reviewing water distribution system losses. Ideally, the losses would be less than 10% in all service areas. This goal is designed to help reduce supply side demand by reducing unaccounted for losses, which not only reduces the physical quantity of water required, but also helps to fine tune the pumping system and maximize pumping efficiency.
    b. Measured distribution system losses for the South Shore for 2012-2014 were trending down with a trend such that it was on target to meet the goal by 2015 (2015 data was not yet available). Measured distribution system losses for Agate Heights for 2012-2014 averaged 2.8%, well below the 10% loss standard.
2. Reduce residential consumption in Eagleridge service area during summer months by 10% (from 820 gpd to 738 gpd, average of three years).
    a. This goal was proposed after analyzing water use data for maximum day demand (see Exhibit 3 in Appendix A). The data shows that Eagleridge has an abnormally high consumption rate during summer months. This is most likely due to the large lot size in the area.
    b. Summer usage for Eagleridge, Sudden Valley, and Geneva was below the flow rate target set by this goal (Agate Heights was not). But average usage throughout the year for these areas also decreased, so the summer peak as a percentage did not reach the goals.

3. Maintain residential consumption levels in other service areas at 207 gpd to 250 gpd per connection.
    a. This goal was proposed after analyzing water use data from the past 3 years. It was determined that the current consumption levels were low and maintaining them is an appropriate goal.
    b. Usage decreased substantially from 2007-2009 averages to 2012-2014 averages in all areas except Agate Heights.
        i. Sudden Valley usage decreased by 25.4%
        ii. Geneva usage decreased by 21.7%
        iii. Agate Heights usage increased by 5.9%
        iv. Eagleridge usage decreased by 16.3%

2015 Goals:

1. Reduce Distribution System Losses in South Shore (Geneva and Sudden Valley) service areas. The goal is to reach and maintain less than 10% losses in all service areas.
2. Reduce high peak residential consumption in all service areas. Goal sets target summer peak usage by service area by 2020:

Summer Peak Targets	2020 Target Summer Usage per Capita (GPD)
SUDDEN VALLEY	55
GENEVA	65
AGATE HEIGHTS	75
EAGLERIDGE	100

3. Reduce the 3-year average annual per capita usage in Sudden Valley and Geneva by 2% and annual per capita usage in Eagleridge and Agate Heights by 10% by 2020, as shown below:

3-yr Average Annual Targets	Current Annual Usage per Capita (GPD)	2020 Target Annual Usage per Capita (GPD)
SUDDEN VALLEY	44.0	43.2
GENEVA	47.6	46.6
AGATE HEIGHTS	69.2	62.3
EAGLERIDGE	74.5	67.0

D. WATER USE EFFICIENCY MEASURES

1. The District is required to implement the following WUE Measures:

- Install production (source) meters – *Complete*
- Install consumption (service) meters – *Complete*
- Perform Meter Calibration – *Ongoing*
- Implement a water loss control action plan to control leakage – *Plan implemented; progress is good*
- Educate customers about water use efficiency practices – *Ongoing; bimonthly bills contain water conservation information*

2. The District has identified several (additional) supply-side WUE Measures it plans to implement:

- Improve record-keeping of non-metered authorized consumption (hydrant flushing, construction, gravity sewer flushing, Fire Department training, quantify known leaks, etc.). – *Ongoing*
- Replace service meters (age, failure); track progress. – *Ongoing*
  2010 – 20; 2011 – 22; 2012 – 60;
  2013 – 64; 2014 – 74; 2015 – 49
- Replace malfunctioning and obsolete fire hydrants. – *Ongoing*
- Control unauthorized use of water. – *Ongoing*
- Monitor overnight tank levels for unusual drops. – *Ongoing*

3. The District is required to implement a minimum of 6 consumption-side WUE Measures. Since measures are implemented for all 4 customer classes, the WUE rule counts each as 4 measures:

- Conservation Rate Structure (+4) – Each customer class (4) counts as a measure
- Water bill showing consumption history (+4)
- Customer conservation education (see Appendix B) (newsletter, bill stuffers) (+4)
- Customer leak education (See Appendix B) (+4)
- Participate in Regional water conservation programs and/or measures (+1)
  Total: 17 WUE Measures

E. DISTRIBUTION SYSTEM LEAKAGE

Distribution system losses have been reduced in all District service areas. A summary of the improvements are listed below. Detailed data is attached Exhibit 4 in Appendix A.

Sudden Valley Area

The Sudden Valley water system has a history of high levels of distribution system losses. The three-year average distribution system losses in 2005-2007 were 27.59%. The 2012-2014 three-year average is 12.86%, with 2014 being the lowest rate at 10.95%. The District also maintains a program to estimate and track system leaks in an effort to correlate events with fluctuations in unaccounted for water.

Geneva Area

The three-year average distribution system losses in Geneva for 2005-2007 were 10.97%. The 2012-2014 three-year average is 9.1%, with 2014 being the lowest rate at 8.61%. The District recently replaced about 1300 feet of AC water main and all associated service lines in Geneva. The majority of the new mains were ductile iron, with about 1,000 feet of HDPE in challenging construction locations. This may have a positive impact toward reducing distribution system losses. There are no major non-revenue water users.

The District reports on these two service areas in a single WUE report for the South Shore Water System. The combined 2012-2014 three-year average leakage from the data used in this report is 11.61%. There is a slight discrepancy between this and the 2012-2014 average leakage reported on the annual Water Use Efficiency report (12.1%). The difference is likely due to a small difference in the time that the meters were read.

North Shore/Eagleridge Area
Distribution system losses in this system remain minimal, averaging 2.87% from 2012 to 2014.

Agate Heights Area
The distribution system losses in 2005-2007 ranged from 4.4% to 46.1%. There were several data anomalies in this system that may have been due to water testing or other un-metered use. These have been corrected and/or accounted for, and the 2012-2014 three-year average is 2.83%.

F. RATE STRUCTURES
The current rate structure for Lake Whatcom Water and Sewer District is an inclining block rate, as follows:

Current Rates for 2015 – Every Two Months

Every Two Months	
Water	$52.68
Sewer	$148.03
Total Basic Rate	$200.71

Water per cubic ft. over 600 CF up to 2,500 CF	$7.48 / 100 CF
Water per cubic ft. over 2,500 CF	$9.35 / 100 CF

The basic rate of $52.68 includes a usage allocation of 600 cu ft. Any usage over 600 cu ft but less than 2,500 cu ft is billed at $7.48 per 100 cu ft. Any usage over 2,500 cu ft is billed at $9.35 per 100 cu ft. This is a stepped rate structure with two steps. The rate structure encourages water conservation and is considered a conservative rate structure. The District adopted this new two-tier rate structure in 2014 and implemented it in January 2015. The District will evaluate the effectiveness of this rate structure in encouraging more water conservation.

G. RECLAIMED WATER OPPORTUNITIES
Lake Whatcom Water and Sewer District currently sends all sewerage collected to the City of Bellingham for wastewater treatment. Since the District does not have any facilities to process wastewater, and the City's treatment plant is over 8 miles from the District's service areas, there are no immediate opportunities for implementing reclaimed water projects within the District. The City currently has no plans to implement any reclaimed water projects. It is unlikely that the District will pursue any reclaimed water projects in the next six years.

The District did include advanced wastewater treatment as one of the alternatives evaluated in the Final Environmental Impact Statement for South Shore Sewage Disposal Alternatives (August 1997) although this alternative was not ultimately selected. The advanced wastewater plant would have produced up to 1 MGD of reclaimed quality water.

The most obvious potential consumer of reclaimed water in the District service area would be the Sudden Valley Community Association (SVCA) golf course. However, SCVA holds water rights for withdrawals from Lake Louise which they use for irrigating the golf course. They do not purchase water from the District for irrigating the golf course.

H. WATER SUPPLY CHARACTERISTICS

1) **Source(s) description:**
   The two sources of water for Lake Whatcom Water and Sewer District are Lake Whatcom and the Squalicum Aquifer, both located in the Lake Whatcom Watershed. The Watershed receives 45-60 inches of rain annually, which aids the recharge of both the aquifer and the lake.

2) **Name and location of the source(s)**
   Lake Whatcom – Whatcom County, just East of Bellingham, Whatcom County
   Squalicum Aquifer – Located just North of Lake Whatcom, Whatcom County

3) **Production Capacity** Lake Whatcom holds roughly 250 Billion gallons, and is replenished by water from the Nooksack River (via diversion) and multiple streams. The Districts Agate Heights well has a production capacity of 465 gpm, and Water Rights for 438 gpm.

4) **Seasonal Variability**
   Seasonal weather changes do not impact the District's ability to provide water to their customers, and the sources have shown little change in capacity. However, the District strongly encourages limited out-door water use during dry months.

5) **Water rights**
   The District has surface water rights and reservoir rights of 1526 gpm instantaneous and 1800 afy (acre-feet per year) annual from Lake Whatcom. The District has ground water rights of 438 gpm instantaneous and 506.9 afy (acre-feet per year) annual from the Squalicum Aquifer.

6) **Legal Constraints**
   Both sources are shared with multiple parties, the most notable being the City of Bellingham. This does not limit the District's use of the water in any significant way.

For more information about Lake Whatcom, see http://www.lakewhatcom.whatcomcounty.org/about-the-lake.

APPENDIX A: WATER USE DATA TABLES

(note: the Sudden Valley Water System is on a different billing cycle than the other water systems, and as such will have unique monthly cycles)

EXHIBIT 1

2014 WATER USE PER CUSTOMER CLASS

Total Bi-Monthly Volume in Cubic Feet (CF), assuming equal use per ERU

SUDDEN VALLEY WATER SYSTEM

CUSTOMER CLASS	Volume (CF) DEC/JAN	FEB/MAR	APR/MAY	JUN/JUL	AUG/SEP	OCT/NOV
Single Family Residences	1,886,937	1,840,164	1,836,093	2,249,422	2,390,495	1,928,201
Multi-family Residences	198,412	193,494	192,983	236,324	250,930	202,317
Recreational Services (Campsites, RV Sites, Spigots)	4,859	4,739	4,726	5,788	6,145	4,955
Institutional, Commercial, or Industrial Services	63,978	62,392	62,227	76,203	80,912	65,237
Total Residential CF	2,085,349	2,033,658	2,029,076	2,485,746	2,641,426	2,130,518
Total Non-Residential CF	68,837	67,130	66,953	81,990	87,057	70,191
Total Volume (CF)	**2,154,186**	**2,100,788**	**2,096,029**	**2,567,736**	**2,728,483**	**2,200,709**

GENEVA WATER SYSTEM

CUSTOMER CLASS	Volume (CF) JAN/FEB	MAR/APR	MAY/JUN	JUL/AUG	SEP/OCT	NOV/DEC
Single Family Residences	1,043,149	915,741	1,129,403	1,528,291	1,114,990	954,076
Multi-family Residences	57,145	49,867	61,320	82,814	60,359	51,648
Recreational Services (Campsites, RV Sites, Spigots)	1,039	907	1,115	1,506	1,097	939
Outdoors	1,039	907	1,115	1,506	1,097	939
Institutional, Commercial, or Industrial Services	66,496	58,027	71,354	96,365	70,236	60,099
Total Residential CF	1,100,293	965,608	1,190,723	1,611,104	1,175,349	1,005,724
Total Non-Residential CF	68,574	59,841	73,584	99,377	72,430	61,977
Total Volume (CF)	**1,168,867**	**1,025,449**	**1,264,307**	**1,710,481**	**1,247,779**	**1,067,701**

AGATE HEIGHTS WATER SYSTEM

CUSTOMER CLASS	Volume (CF) JAN/FEB	MAR/APR	MAY/JUN	JUL/AUG	SEP/OCT	NOV/DEC
Single Family Residences	58,903	52,398	68,739	76,174	62,955	54,793
Institutional, Commercial, or Industrial Services (LWRTC)	10,851	9,652	12,663	14,032	11,597	10,093
Total Residential CF	58,903	52,398	68,739	76,174	62,955	54,793
Total Non-Residential CF	10,851	9,652	12,663	14,032	11,597	10,093
Total Volume (CF)	**69,754**	**62,050**	**81,402**	**90,206**	**74,552**	**64,886**

JOHNSON WELLS WATER SYSTEM

CUSTOMER CLASS	Volume (CF) JAN/FEB	MAR/APR	MAY/JUN	JUL/AUG	SEP/OCT	NOV/DEC
Single Family Residences	2,640	2,158	2,682	3,709	2,736	2,274

EAGLERIDGE WATER SYSTEM

CUSTOMER CLASS	Volume (CF) JAN/FEB	MAR/APR	MAY/JUN	JUL/AUG	SEP/OCT	NOV/DEC
Single Family Residences	81,351	68,586	110,181	220,421	145,832	75,747

EXHIBIT 1

2014 WATER USE PER CUSTOMER CLASS

Number of Equivalent Residential Units (ERUs)

SUDDEN VALLEY WATER SYSTEM

	ERU					
CUSTOMER CLASS	**DEC/JAN**	**FEB/MAR**	**APR/MAY**	**JUN/JUL**	**AUG/SEP**	**OCT/NOV**
Single Family Residences	2,330	2,330	2,331	2,332	2,334	2,335
Multi-family Residences	245	245	245	245	245	245
Recreational Services (Campsites, RV Sites, Spigots)	6	6	6	6	6	6
Institutional, Commercial, or Industrial Services	79	79	79	79	79	79
Total Residential ERUs	2,575	2,575	2,576	2,577	2,579	2,580
Total Non-Residential ERUs	85	85	85	85	85	85
Total ERUs	**2,660**	**2,660**	**2,661**	**2,662**	**2,664**	**2,665**

GENEVA WATER SYSTEM

	ERU					
CUSTOMER CLASS	**JAN/FEB**	**MAR/APR**	**MAY/JUN**	**JUL/AUG**	**SEP/OCT**	**NOV/DEC**
Single Family Residences	1,004	1,010	1,013	1,015	1,016	1,016
Multi-family Residences	55	55	55	55	55	55
Recreational Services (Campsites, RV Sites, Spigots)	1	1	1	1	1	1
Outdoors	1	1	1	1	1	1
Institutional, Commercial, or Industrial Services	64	64	64	64	64	64
Total Residential ERUs	1,059	1,065	1,068	1,070	1,071	1,071
Total Non-Residential ERUs	66	66	66	66	66	66
Total ERUs	**1,125**	**1,131**	**1,134**	**1,136**	**1,137**	**1,137**

AGATE HEIGHTS WATER SYSTEM

	ERU					
CUSTOMER CLASS	**JAN/FEB**	**MAR/APR**	**MAY/JUN**	**JUL/AUG**	**SEP/OCT**	**NOV/DEC**
Single Family Residences	38	38	38	38	38	38
Institutional, Commercial, or Industrial Services (LWRTC)	7	7	7	7	7	7
Total Residential ERUs	38	38	38	38	38	38
Total Non-Residential ERUs	7	7	7	7	7	7
Total ERUs	**45**	**45**	**45**	**45**	**45**	**45**

JOHNSON WELLS WATER SYSTEM

	ERU					
CUSTOMER CLASS	**JAN/FEB**	**MAR/APR**	**MAY/JUN**	**JUL/AUG**	**SEP/OCT**	**NOV/DEC**
Single Family Residences	2	2	2	2	2	2

EAGLERIDGE WATER SYSTEM

	ERU					
CUSTOMER CLASS	**JAN/FEB**	**MAR/APR**	**MAY/JUN**	**JUL/AUG**	**SEP/OCT**	**NOV/DEC**
Single Family Residences	67	67	67	67	67	67

EXHIBIT 1

2014 AVERAGE DAILY WATER USE PER SYSTEM

Gallons per day per ERU

SUDDEN VALLEY WATER SYSTEM

GPD/ERU

	DEC/JAN	FEB/MAR	APR/MAY	JUN/JUL	AUG/SEP	OCT/NOV	ANNUAL AVG
Average Usage/ERU	99	97	97	118	126	101	106

GENEVA WATER SYSTEM

GPD/ERU

	JAN/FEB	MAR/APR	MAY/JUN	JUL/AUG	SEP/OCT	NOV/DEC	ANNUAL AVG
Average Usage/ERU	134	113	139	188	139	119	139

AGATE HEIGHTS WATER SYSTEM

GPD/ERU

	JAN/FEB	MAR/APR	MAY/JUN	JUL/AUG	SEP/OCT	NOV/DEC	ANNUAL AVG
Average Usage/ERU	200	172	226	250	210	183	207

JOHNSON WELLS WATER SYSTEM

GPD/ERU

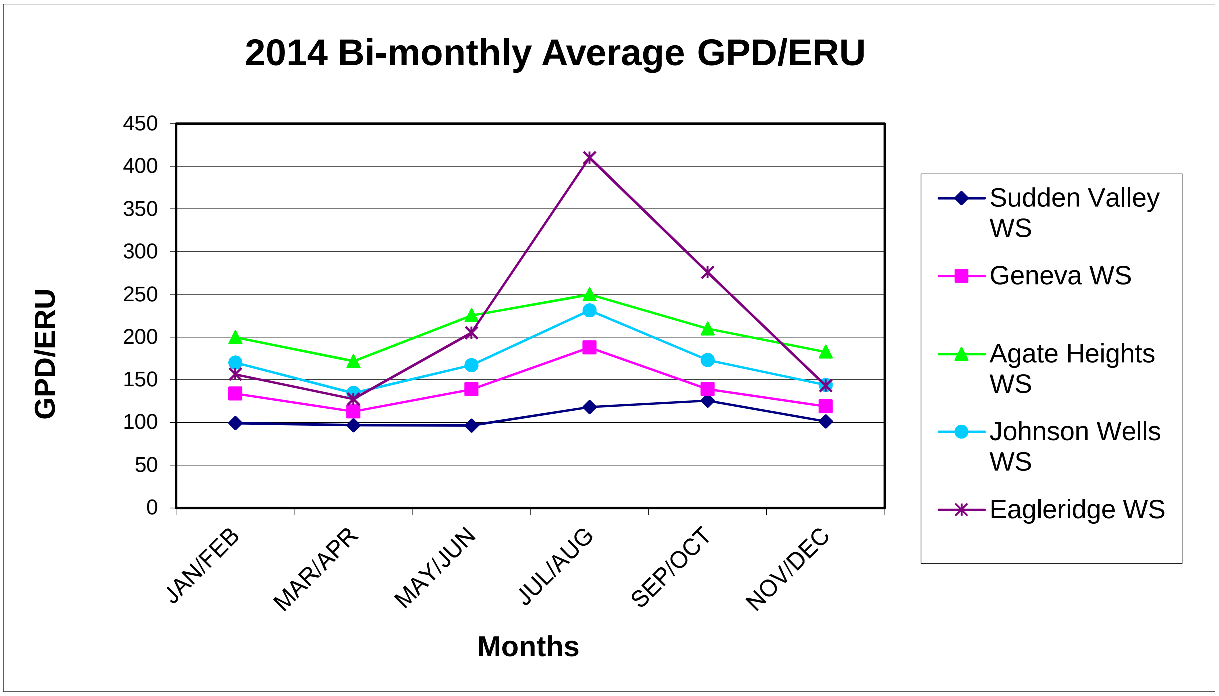
	JAN/FEB	MAR/APR	MAY/JUN	JUL/AUG	SEP/OCT	NOV/DEC	ANNUAL AVG
Average Usage/ERU	170	135	167	231	173	144	171

EAGLERIDGE WATER SYSTEM

GPD/ERU

	JAN/FEB	MAR/APR	MAY/JUN	JUL/AUG	SEP/OCT	NOV/DEC	ANNUAL AVG
Average Usage/ERU	157	128	205	410	276	143	221

EXHIBIT 1



2014 Bi-monthly Average GPD/ERU
GPD/ERU
450
400
350
300
250
200
150
100
50
0
JAN/FEB
MAR/APR
MAY/JUN
JUL/AUG
SEP/OCT
NOV/DEC
Months
Sudden Valley WS
Geneva WS
Agate Heights WS
Johnson Wells WS
Eagleridge WS

EXHIBIT 2

Water Demand Forecasting

SUDDEN VALLEY WATER SYSTEM

Water Demand Forecasting	ERUs	With Conservation Savings	
		Total Average Volume -GPD *(based on ADD= 150 gpd/ERU)*	**Maximum Daily Volume-GPD** *(based on MDD= 250 gpd/ERU)*
Current - 2015	2667	400,050	666,750
Six years - 2021	2721	408,150	680,250
20 years - 2035	2847	427,050	711,750
Full build-out	**3267**	490,050	816,750
Water Rights – Annual / Instant. (shared with Geneva)		Annual (Daily Avg) = 1,607,178 GPD Instantaneous = 2,197,472 GPD	

GENEVA WATER SYSTEM

Water Demand Forecasting	ERUs	With Conservation Savings	
		Total Average Volume -GPD *(based on ADD= 175 gpd/ERU)*	**Maximum Daily Volume-GPD** *based on MDD= 370 gpd/ERU)*
Current - 2015	1139	199,325	421,430
Six years - 2021	1181	206,675	436,970
20 years - 2035	1230	215,250	455,100
Full build-out	**1543**	270,025	570,910
Water Rights – Annual / Instant. (shared with Sudden Valley)		Annual (Daily Avg) = 1,607,178 GPD Instantaneous = 2,197,472 GPD	

COMBINED SUDDEN VALLEY/GENEVA WATER SYSTEMS

Water Demand Forecasting	ERUs	With Conservation Savings	
		Total Average Volume *(GPD)*	**Maximum Daily Volume** *(GPD)*
Current - 2015	3806	599,375	1,088,180
Six years - 2021	3902	614,825	1,117,220
20 years - 2035	4077	642,300	1,166,850
Sudden Valley full build-out	3267	490,050	816,750
Geneva full build-out	1543	270,025	570,910
Combined full build-out	**4810**	**760,075**	**1,387,660**
Water Rights – Annual / Instant.		Annual (Daily Avg) = 1,607,178 GPD Instantaneous = 2,197,472 GPD	

* ADD and MDD values are based on source data which includes distribution system leakage.

EXHIBIT 2

Water Demand Forecasting

NORTH SHORE /EAGLERIDGE WATER SYSTEM

Water Demand Forecasting	ERUs	Without Conservation Savings	
		Total Average Volume -GPD *(based on ADD= 250 gpd/ERU)*	**Maximum Daily Volume-GPD** *(based on MDD= 800 gpd/ERU)*
Current - 2015	68	17,000	54,400
Six years - 2021	71	17,750	56,800
20 years - 2035	71	17,750	56,800
Full build-out**	71	17,750	56,800
City Connection – 150 gpm	*270*	216,000 gpd	

NORTH SHORE /EAGLERIDGE WATER SYSTEM

Water Demand Forecasting	ERUs	With Conservation Savings	
		Total Average Volume -GPD *(based on ADD= 210 gpd/ERU)*	**Maximum Daily Volume-GPD** *(based on MDD= 600 gpd/ERU)*
Current - 2015	68	14,280	40,800
Six years - 2021	71	14,910	42,600
20 years - 2035	71	14,910	42,600
Full build-out **	71	14,910	42,600
City Connection – 150 gpm	*360*	216,000 gpd	

* ADD and MDD values are based on source data which includes distribution system leakage.
** Based on including all vacant lots to determine maximum potential connections. Will require ULID for construction of additional water sytem facilities.

EXHIBIT 2

Water Demand Forecasting

NORTH SHORE /AGATE HEIGHTS WELL SYSTEM

Water Demand Forecasting	ERUs	Without Conservation Savings	
		Total Average Volume -GPD *(based on ADD= 230 gpd/ERU)*	**Maximum Daily Volume-GPD** *(based on MDD= 500 gpd/ERU)*
Current - 2015	45	10,350	22,500
Six years - 2021	52	11,960	26,000
20 years - 2035	52	11,960	26,000
Full build-out**	52	11,960	26,000
Water Rights – Annual	*1968*	Annual (Daily Avg) = 452,530 GPD	
Water Rights – Instantaneous	*1261*	Instantaneous = 630,720 GPD (438 GPM)	

NORTH SHORE /AGATE HEIGHTS WELL SYSTEM

Water Demand Forecasting	ERUs	With Conservation Savings	
		Total Average Volume -GPD *(based on ADD= 200 gpd/ERU)*	**Maximum Daily Volume-GPD** *(based on MDD= 420 gpd/ERU)*
Current - 2015	45	9,000	18,900
Six years - 2021	52	10,400	21,840
20 years - 2035	52	10,400	21,840
Full build-out**	52	10,400	21,840
Water Rights – Annual	*2263*	Annual (Daily Avg) = 452,530 GPD	
Water Rights – Instantaneous	*1502*	Instantaneous = 630,720 GPD (438 GPM)	

* ADD and MDD values are based on source data which includes distribution system leakage.
** Based on including all vacant lots to determine maximum potential connections. Will require ULID for construction of additional water sytem facilities.

EXHIBIT 3

MAXIMUM DAY DEMAND DATA - JULY 2014

SUDDEN VALLEY

July 2014 Date	Plant Production (100's CF)	Days Elapsed	Geneva Volume (CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU
1-Jul	609.4	1	27,400.00	33,540.00	250,895.97	94.07
2-Jul	602.4	1	32,500.00	27,740.00	207,509.07	77.81
3-Jul	**858.2**	**1**	**30,200.00**	**55,620.00**	**416,065.41**	**156.01**
4-Jul	655.8	1	31,475.00	34,105.00	255,122.45	95.66
5-Jul	630.9	1	31,475.00	31,615.00	236,496.01	88.67
6-Jul	656.2	1	31,475.00	34,145.00	255,421.67	95.77
7-Jul	686.8	1	31,475.00	37,205.00	278,312.00	104.35
8-Jul	666.0	1	35,600.00	31,000.00	231,895.50	86.95
9-Jul	887.9	1	37,500.00	51,290.00	383,674.85	143.86
10-Jul	634.5	1	34,500.00	28,950.00	216,560.48	81.20
11-Jul	619.2	1	25,800.00	36,120.00	270,195.66	101.31
12-Jul	744.6	1	37,633.33	36,826.67	275,481.88	103.29
13-Jul	712.4	1	37,633.33	33,606.67	251,394.67	94.26
14-Jul	834.3	1	37,633.33	45,796.67	342,581.97	128.45
15-Jul	619.9	1	40,800.00	21,190.00	158,511.80	59.43
16-Jul	742.2	1	36,600.00	37,620.00	281,416.41	105.52
17-Jul	643.5	1	39,800.00	24,550.00	183,646.28	68.86
18-Jul	833.7	1	41,300.00	42,070.00	314,704.64	118.00
19-Jul	610.9	1	25,833.33	35,256.67	263,737.50	98.89
20-Jul	558.2	1	25,833.33	29,986.67	224,315.26	84.11
21-Jul	614.4	1	25,833.33	35,606.67	266,355.67	99.87
22-Jul	606.1	1	29,600.00	31,010.00	231,970.31	86.98
23-Jul	581.2	1	28,500.00	29,620.00	221,572.41	83.08
24-Jul	565.5	1	19,200.00	37,350.00	279,396.68	104.76
25-Jul	548.2	1	24,200.00	30,620.00	229,052.91	85.88
26-Jul	559.7	1	26,500.00	29,470.00	220,450.34	82.66
27-Jul	613.6	1	26,500.00	34,860.00	260,770.23	97.78
28-Jul	687.1	1	26,500.00	42,210.00	315,751.91	118.39
29-Jul	592.1	1	33,200.00	26,010.00	194,567.81	72.95
30-Jul	787.6	1	27,700.00	51,060.00	381,954.33	143.21
31-Jul	637.2	1	39,200.00	24,520.00	183,421.86	68.77
			Max Day Demand	55620.00	416065.41	156.01

EXHIBIT 3

MAXIMUM DAY DEMAND DATA - JULY 2014

GENEVA

Date	Meter Reading (100's CF)	Days Elapsed	Volume Change (100's CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU
30-Jun	991301					
1-Jul	991575	1	274	27,400.00	204,965.70	179.95
2-Jul	991900	1	325	32,500.00	243,116.25	213.45
3-Jul	992202	1	302	30,200.00	225,911.10	198.34
7-Jul	993461	4	1259	31,475.00	235,448.74	206.72
8-Jul	993817	1	356	35,600.00	266,305.80	233.81
9-Jul	994192	1	375	37,500.00	280,518.75	246.29
10-Jul	994537	1	345	34,500.00	258,077.25	226.58
11-Jul	994795	1	258	25,800.00	192,996.90	169.44
14-Jul	995924	3	1129	37,633.33	281,516.15	247.16
15-Jul	996332	1	408	40,800.00	305,204.40	267.96
16-Jul	996698	1	366	36,600.00	273,786.30	240.37
17-Jul	997096	1	398	39,800.00	297,723.90	261.39
18-Jul	**997509**	**1**	**413**	**41,300.00**	**308,944.65**	**271.24**
21-Jul	998284	3	775	25,833.33	193,246.25	169.66
22-Jul	998580	1	296	29,600.00	221,422.80	194.40
23-Jul	998865	1	285	28,500.00	213,194.25	187.18
24-Jul	999057	1	192	19,200.00	143,625.60	126.10
25-Jul	999299	1	242	24,200.00	181,028.10	158.94
28-Jul	1000094	3	795	26,500.00	198,233.25	174.04
29-Jul	1000426	1	332	33,200.00	248,352.60	218.04
30-Jul	1000703	1	277	27,700.00	207,209.85	181.92
31-Jul	1001095	1	392	39,200.00	293,235.60	257.45
			Max Day Demand	41300.00	308944.65	271.24

EAGLERIDGE

Date	Meter Reading (100's CF)	Days Elapsed	Volume Change (100's CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU	
30-Jun	53026						
1-Jul	53071	1	45	4,500.00	33,662.25	502.42	
2-Jul	53127	1	56	5,600.00	41,890.80	**625.24**	
3-Jul	53177	1	50	5,000.00	37,402.50	558.25	
7-Jul	53313	4	136	3,400.00	25,433.70	379.61	
8-Jul	53345	1	32	3,200.00	23,937.60	357.28	
9-Jul	53394	1	49	4,900.00	36,654.45	547.08	
10-Jul	53445	1	51	5,100.00	38,150.55	569.41	
11-Jul	53496	1	51	5,100.00	38,150.55	569.41	
14-Jul	53533	3	37	1,233.33	9,225.95	137.70	
15-Jul	53567	1	34	3,400.00	25,433.70	379.61	3-day avg.
16-Jul	53607	1	40	4,000.00	29,922.00	446.60	GPD/ERU
17-Jul	**53758**	**1**	**151**	**15,100.00**	**112,955.55**	**1,685.90**	**841.09**
18-Jul	53793	1	35	3,500.00	26,181.75	390.77	
21-Jul	53883	3	90	3,000.00	22,441.50	334.95	
22-Jul	53918	1	35	3,500.00	26,181.75	390.77	
23-Jul	53950	1	32	3,200.00	23,937.60	357.28	
24-Jul	53974	1	24	2,400.00	17,953.20	267.96	
25-Jul	54004	1	30	3,000.00	22,441.50	334.95	
28-Jul	54104	3	100	3,333.33	24,935.00	372.16	
29-Jul	54135	1	31	3,100.00	23,189.55	346.11	
30-Jul	54171	1	36	3,600.00	26,929.80	401.94	
31-Jul	54205	1	34	3,400.00	25,433.70	379.61	
	Max Day Demand other than July 17			5600.00	41890.80	625.24	

*17-Jul was an anomalously high reading

EXHIBIT 3

MAXIMUM DAY DEMAND DATA - JULY 2014

AGATE HEIGHTS

Date	Meter Reading (Gallons)	Days Elapsed	Volume Change (Gallons)	Average Daily Volume (Gal.)		GPD/ERU	Three Day Average
30-Jun	2306456						
2-Jul	2326229	2	19773	9,886.50		224.69	224.69
4-Jul	2346676	2	20447	10,223.50		232.35	229.80
6-Jul	2365407	2	18731	9,365.50		212.85	219.35
7-Jul	2371978	1	6571	6,571.00		149.34	191.68
8-Jul	2390838	1	18860	18,860.00		428.64	263.61
10-Jul	2413270	2	22432	11,216.00		254.91	312.82
11-Jul	2415128	1	1858	1,858.00		42.23	184.02
12-Jul	2437528	1	22400	22,400.00		509.09	268.74
14-Jul	2463951	2	26423	13,211.50		300.26	369.87
15-Jul	2471231	1	7280	7,280.00		165.45	255.33
16-Jul	**2495702**	**1**	**24471**	**24,471.00**		**556.16**	340.63
17-Jul	2501911	1	6209	6,209.00		141.11	287.58
18-Jul	2525138	1	23227	23,227.00		527.89	**408.39**
20-Jul	2544710	2	19572	9,786.00		222.41	324.23
22-Jul	2564743	2	20033	10,016.50		227.65	225.90
24-Jul	2582834	2	18091	9,045.50		205.58	212.94
26-Jul	2601981	2	19147	9,573.50		217.58	213.58
28-Jul	2625836	2	23855	11,927.50		271.08	253.25
30-Jul	2647696	2	21860	10,930.00		248.41	255.97
			Max Day Demand	24,471.00		556.16	408.39

JOHNSON WELL

Date	Meter Reading (CF)	Days Elapsed	Volume Change (CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU
1-Jul	101480					
9-Jul	**101945**	**8**	**465**	**58.13**	**434.80**	**217.40**
15-Jul	102278	6	333	55.50	415.17	207.58
23-Jul	102739	8	461	57.63	431.06	215.53
30-Jul	103060	7	321	45.86	343.03	171.52
			Max Day Demand	58.13	434.80	217.40

EXHIBIT 3

MAXIMUM DAY DEMAND DATA - JULY 2014

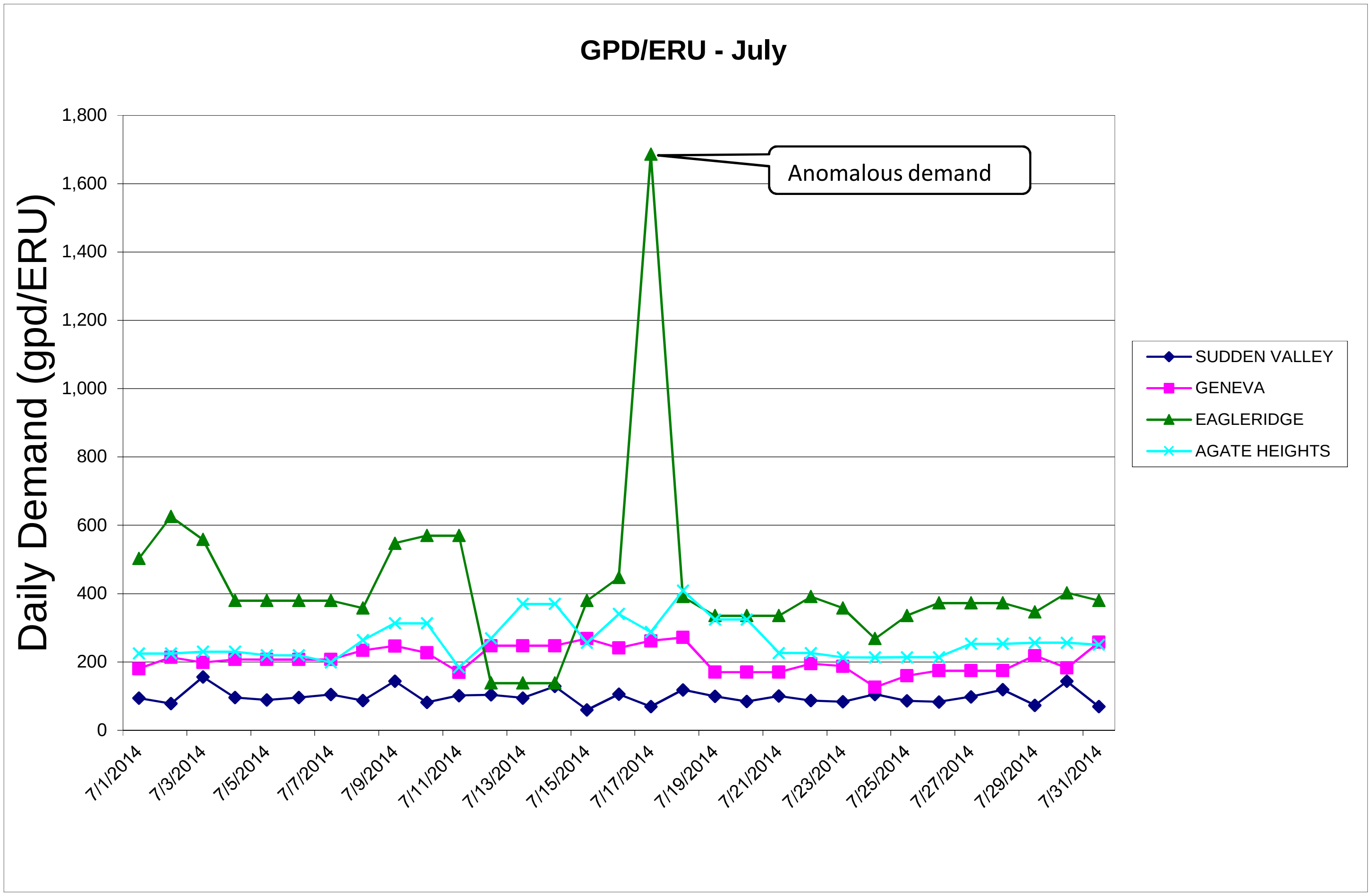


EXHIBIT 3

MAXIMUM DAY DEMAND DATA - AUGUST 2014

SUDDEN VALLEY

Aug 2015 Date	Plant Production (100's CF)	Days Elapsed	Geneva Volume (CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU
1-Aug	678.00	1	27,600.00	40,200.00	300,716.10	112.67
2-Aug	629.60	1	34,666.67	28,293.33	211,648.28	79.30
3-Aug	**902.70**	**1**	**34,666.67**	**55,603.33**	**415,940.74**	**155.84**
4-Aug	709.70	1	34,666.67	36,303.33	271,567.09	101.75
5-Aug	707.50	1	35,200.00	35,550.00	265,931.78	99.64
6-Aug	599.50	1	31,100.00	28,850.00	215,812.43	80.86
7-Aug	843.70	1	31,400.00	52,970.00	396,242.09	148.46
8-Aug	711.30	1	34,600.00	36,530.00	273,262.67	102.38
9-Aug	669.70	1	34,566.67	32,403.33	242,393.14	90.82
10-Aug	666.30	1	34,566.67	32,063.33	239,849.77	89.87
11-Aug	794.20	1	34,566.67	44,853.33	335,525.36	125.71
12-Aug	693.30	1	30,100.00	39,230.00	293,460.02	109.95
13-Aug	563.90	1	31,300.00	25,090.00	187,685.75	70.32
14-Aug	608.70	1	19,900.00	40,970.00	306,476.09	114.83
15-Aug	544.30	1	24,900.00	29,530.00	220,899.17	82.76
16-Aug	562.30	1	25,100.00	31,130.00	232,867.97	87.25
17-Aug	614.40	1	24,900.00	36,540.00	273,337.47	102.41
18-Aug	629.00	1	24,900.00	38,000.00	284,259.00	106.50
19-Aug	612.10	1	29,800.00	31,410.00	234,962.51	88.03
20-Aug	663.30	1	27,600.00	38,730.00	289,719.77	108.55
21-Aug	615.10	1	28,900.00	32,610.00	243,939.11	91.40
22-Aug	521.40	1	19,200.00	32,940.00	246,407.67	92.32
23-Aug	722.70	1	29,166.67	43,103.33	322,434.49	120.81
24-Aug	650.70	1	29,166.67	35,903.33	268,574.89	100.63
25-Aug	647.50	1	29,166.67	35,583.33	266,181.13	99.73
26-Aug	726.60	1	28,200.00	44,460.00	332,583.03	124.61
27-Aug	648.00	1	32,700.00	32,100.00	240,124.05	89.97
28-Aug	608.20	1	26,300.00	34,520.00	258,226.86	96.75
29-Aug	566.80	1	28,500.00	28,180.00	210,800.49	78.98
30-Aug	684.60	1	25,100.00	43,360.00	324,354.48	121.53
31-Aug	589.20	1	25,100.00	33,820.00	252,990.51	94.79
			Max Day Demand	55,603.33	415,940.74	155.84

EXHIBIT 3

MAXIMUM DAY DEMAND DATA - AUGUST 2014

GENEVA

Date	Meter Reading (100's CF)	Days Elapsed	Volume Change (100's CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU
31-Jul	1115					
1-Aug	1391	1	276	27,600.00	206,461.80	182.55
4-Aug	2431	3	1,040	34,666.67	259,324.00	229.29
5-Aug	**2783**	**1**	**352**	**35,200.00**	**263,313.60**	**232.81**
6-Aug	3094	1	311	31,100.00	232,643.55	205.70
7-Aug	3408	1	314	31,400.00	234,887.70	207.68
8-Aug	3754	1	346	34,600.00	258,825.30	228.85
11-Aug	4791	3	1,037	34,566.67	258,575.95	228.63
12-Aug	5092	1	301	30,100.00	225,163.05	199.08
13-Aug	5405	1	313	31,300.00	234,139.65	207.02
14-Aug	5604	1	199	19,900.00	148,861.95	131.62
15-Aug	5853	1	249	24,900.00	186,264.45	164.69
18-Aug	6606	3	753	25,100.00	187,760.55	166.01
19-Aug	6904	1	298	29,800.00	222,918.90	197.10
20-Aug	7180	1	276	27,600.00	206,461.80	182.55
21-Aug	7469	1	289	28,900.00	216,186.45	191.15
22-Aug	7661	1	192	19,200.00	143,625.60	126.99
25-Aug	8536	3	875	29,166.67	218,181.25	192.91
26-Aug	8818	1	282	28,200.00	210,950.10	186.52
27-Aug	9145	1	327	32,700.00	244,612.35	216.28
28-Aug	9408	1	263	26,300.00	196,737.15	173.95
29-Aug	9693	1	285	28,500.00	213,194.25	188.50
			Max Day Demand	35,200.00	263,313.60	232.81

EAGLERIDGE

Date	Meter Reading (100's CF)	Days Elapsed	Volume Change (100's CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU
31-Jul	54205					
1-Aug	54240	1	35	3,500.00	26,181.75	390.77
4-Aug	54350	3	110	3,666.67	27,428.50	409.38
5-Aug	54385	1	35	3,500.00	26,181.75	390.77
6-Aug	54424	1	39	3,900.00	29,173.95	435.43
7-Aug	54463	1	39	3,900.00	29,173.95	435.43
8-Aug	54499	1	36	3,600.00	26,929.80	401.94
11-Aug	54619	3	120	4,000.00	29,922.00	446.60
12-Aug	54644	1	25	2,500.00	18,701.25	279.12
13-Aug	54673	1	29	2,900.00	21,693.45	323.78
14-Aug	54697	1	24	2,400.00	17,953.20	267.96
15-Aug	54721	1	24	2,400.00	17,953.20	267.96
18-Aug	54805	3	84	2,800.00	20,945.40	312.62
19-Aug	54836	1	31	3,100.00	23,189.55	346.11
20-Aug	**54878**	**1**	**42**	**4,200.00**	**31,418.10**	**468.93**
21-Aug	54906	1	28	2,800.00	20,945.40	312.62
22-Aug	54943	1	37	3,700.00	27,677.85	413.10
25-Aug	55049	3	106	3,533.33	26,431.10	394.49
26-Aug	55085	1	36	3,600.00	26,929.80	401.94
27-Aug	55117	1	32	3,200.00	23,937.60	357.28
28-Aug	55149	1	32	3,200.00	23,937.60	357.28
29-Aug	55187	1	38	3,800.00	28,425.90	424.27
			Max Day Demand	4,200.00	31,418.10	468.93

EXHIBIT 3

MAXIMUM DAY DEMAND DATA - AUGUST 2014

AGATE HEIGHTS

Date	Meter Reading (Gallons)	Days Elapsed	Volume Change (Gallons)	Average Daily Volume (Gal.)		GPD/ERU	Three Day Average
30-Jul	2647696						
1-Aug	2670084	2	22,388	11,194.00		254.41	252.41
2-Aug	2682297	1	12,213	12,213.00		277.57	262.13
3-Aug	2701618	1	19,321	19,321.00		439.11	323.70
4-Aug	2709610	1	7,992	7,992.00		181.64	299.44
5-Aug	2729028	1	19,418	19,418.00		441.32	354.02
7-Aug	2752901	2	23,873	11,936.50		271.28	327.96
9-Aug	2778837	2	25,936	12,968.00		294.73	286.91
10-Aug	2780852	1	2,015	2,015.00		45.80	211.75
11-Aug	**2806747**	**1**	**25,895**	**25,895.00**		**588.52**	309.68
12-Aug	2809720	1	2,973	2,973.00		67.57	233.96
13-Aug	2831083	1	21,363	21,363.00		485.52	**380.54**
15-Aug	2846665	2	15,582	7,791.00		177.07	279.89
17-Aug	2864640	2	17,975	8,987.50		204.26	195.20
19-Aug	2884132	2	19,492	9,746.00		221.50	215.75
20-Aug	2889975	1	19,492	19,492.00		443.00	295.33
22-Aug	2912992	2	5,843	2,921.50		66.40	191.93
23-Aug	2917409	1	23,017	23,017.00		523.11	218.64
24-Aug	2937742	1	4,417	4,417.00		100.39	229.97
25-Aug	2938874	1	20,333	20,333.00		462.11	361.87
26-Aug	2959501	1	1,132	1,132.00		25.73	196.08
28-Aug	2981366	2	20,627	10,313.50		234.40	164.84
30-Aug	3001870	2	21,865	10,932.50		248.47	243.78
			Max Day Demand	25,895.00		588.52	380.54

JOHNSON WELL

Date	Meter Reading (CF)	Days Elapsed	Volume Change (CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU
30-Jul	103060					
4-Aug	103386	5	326	65.20	487.73	243.86
5-Aug	103439	1	53	53.00	396.47	198.23
13-Aug	**104208**	**8**	**769**	**96.13**	**719.06**	**359.53**
20-Aug	104536	7	328	46.86	350.51	175.26
27-Aug	104871	7	335	47.86	358.00	179.00
			Max Day Demand	96.13	719.06	359.53

EXHIBIT 3

MAXIMUM DAY DEMAND DATA - AUGUST 2014

GENEVA

Date	Meter Reading (100's CF)	Days Elapsed	Volume Change (100's CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU
31-Jul	1115					
1-Aug	1391	1	276	27,600.00	206,461.80	182.55
4-Aug	2431	3	1,040	34,666.67	259,324.00	229.29
5-Aug	**2783**	**1**	**352**	**35,200.00**	**263,313.60**	**232.81**
6-Aug	3094	1	311	31,100.00	232,643.55	205.70
7-Aug	3408	1	314	31,400.00	234,887.70	207.68
8-Aug	3754	1	346	34,600.00	258,825.30	228.85
11-Aug	4791	3	1,037	34,566.67	258,575.95	228.63
12-Aug	5092	1	301	30,100.00	225,163.05	199.08
13-Aug	5405	1	313	31,300.00	234,139.65	207.02
14-Aug	5604	1	199	19,900.00	148,861.95	131.62
15-Aug	5853	1	249	24,900.00	186,264.45	164.69
18-Aug	6606	3	753	25,100.00	187,760.55	166.01
19-Aug	6904	1	298	29,800.00	222,918.90	197.10
20-Aug	7180	1	276	27,600.00	206,461.80	182.55
21-Aug	7469	1	289	28,900.00	216,186.45	191.15
22-Aug	7661	1	192	19,200.00	143,625.60	126.99
25-Aug	8536	3	875	29,166.67	218,181.25	192.91
26-Aug	8818	1	282	28,200.00	210,950.10	186.52
27-Aug	9145	1	327	32,700.00	244,612.35	216.28
28-Aug	9408	1	263	26,300.00	196,737.15	173.95
29-Aug	9693	1	285	28,500.00	213,194.25	188.50
			Max Day Demand	35,200.00	263,313.60	232.81

EAGLERIDGE

Date	Meter Reading (100's CF)	Days Elapsed	Volume Change (100's CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU
31-Jul	54205					
1-Aug	54240	1	35	3,500.00	26,181.75	390.77
4-Aug	54350	3	110	3,666.67	27,428.50	409.38
5-Aug	54385	1	35	3,500.00	26,181.75	390.77
6-Aug	54424	1	39	3,900.00	29,173.95	435.43
7-Aug	54463	1	39	3,900.00	29,173.95	435.43
8-Aug	54499	1	36	3,600.00	26,929.80	401.94
11-Aug	54619	3	120	4,000.00	29,922.00	446.60
12-Aug	54644	1	25	2,500.00	18,701.25	279.12
13-Aug	54673	1	29	2,900.00	21,693.45	323.78
14-Aug	54697	1	24	2,400.00	17,953.20	267.96
15-Aug	54721	1	24	2,400.00	17,953.20	267.96
18-Aug	54805	3	84	2,800.00	20,945.40	312.62
19-Aug	54836	1	31	3,100.00	23,189.55	346.11
20-Aug	**54878**	**1**	**42**	**4,200.00**	**31,418.10**	**468.93**
21-Aug	54906	1	28	2,800.00	20,945.40	312.62
22-Aug	54943	1	37	3,700.00	27,677.85	413.10
25-Aug	55049	3	106	3,533.33	26,431.10	394.49
26-Aug	55085	1	36	3,600.00	26,929.80	401.94
27-Aug	55117	1	32	3,200.00	23,937.60	357.28
28-Aug	55149	1	32	3,200.00	23,937.60	357.28
29-Aug	55187	1	38	3,800.00	28,425.90	424.27
			Max Day Demand	4,200.00	31,418.10	468.93

EXHIBIT 3

MAXIMUM DAY DEMAND DATA - AUGUST 2014

AGATE HEIGHTS

Date	Meter Reading (Gallons)	Days Elapsed	Volume Change (Gallons)	Average Daily Volume (Gal.)		GPD/ERU	Three Day Average
30-Jul	2647696						
1-Aug	2670084	2	22,388	11,194.00		254.41	252.41
2-Aug	2682297	1	12,213	12,213.00		277.57	262.13
3-Aug	2701618	1	19,321	19,321.00		439.11	323.70
4-Aug	2709610	1	7,992	7,992.00		181.64	299.44
5-Aug	2729028	1	19,418	19,418.00		441.32	354.02
7-Aug	2752901	2	23,873	11,936.50		271.28	327.96
9-Aug	2778837	2	25,936	12,968.00		294.73	286.91
10-Aug	2780852	1	2,015	2,015.00		45.80	211.75
11-Aug	**2806747**	**1**	**25,895**	**25,895.00**		**588.52**	309.68
12-Aug	2809720	1	2,973	2,973.00		67.57	233.96
13-Aug	2831083	1	21,363	21,363.00		485.52	**380.54**
15-Aug	2846665	2	15,582	7,791.00		177.07	279.89
17-Aug	2864640	2	17,975	8,987.50		204.26	195.20
19-Aug	2884132	2	19,492	9,746.00		221.50	215.75
20-Aug	2889975	1	19,492	19,492.00		443.00	295.33
22-Aug	2912992	2	5,843	2,921.50		66.40	191.93
23-Aug	2917409	1	23,017	23,017.00		523.11	218.64
24-Aug	2937742	1	4,417	4,417.00		100.39	229.97
25-Aug	2938874	1	20,333	20,333.00		462.11	361.87
26-Aug	2959501	1	1,132	1,132.00		25.73	196.08
28-Aug	2981366	2	20,627	10,313.50		234.40	164.84
30-Aug	3001870	2	21,865	10,932.50		248.47	243.78
			Max Day Demand	25,895.00		588.52	380.54

JOHNSON WELL

Date	Meter Reading (CF)	Days Elapsed	Volume Change (CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU
30-Jul	103060					
4-Aug	103386	5	326	65.20	487.73	243.86
5-Aug	103439	1	53	53.00	396.47	198.23
13-Aug	**104208**	**8**	**769**	**96.13**	**719.06**	**359.53**
20-Aug	104536	7	328	46.86	350.51	175.26
27-Aug	104871	7	335	47.86	358.00	179.00
			Max Day Demand	96.13	719.06	359.53

EXHIBIT 3

MAXIMUM DAY DEMAND DATA - AUGUST 2014

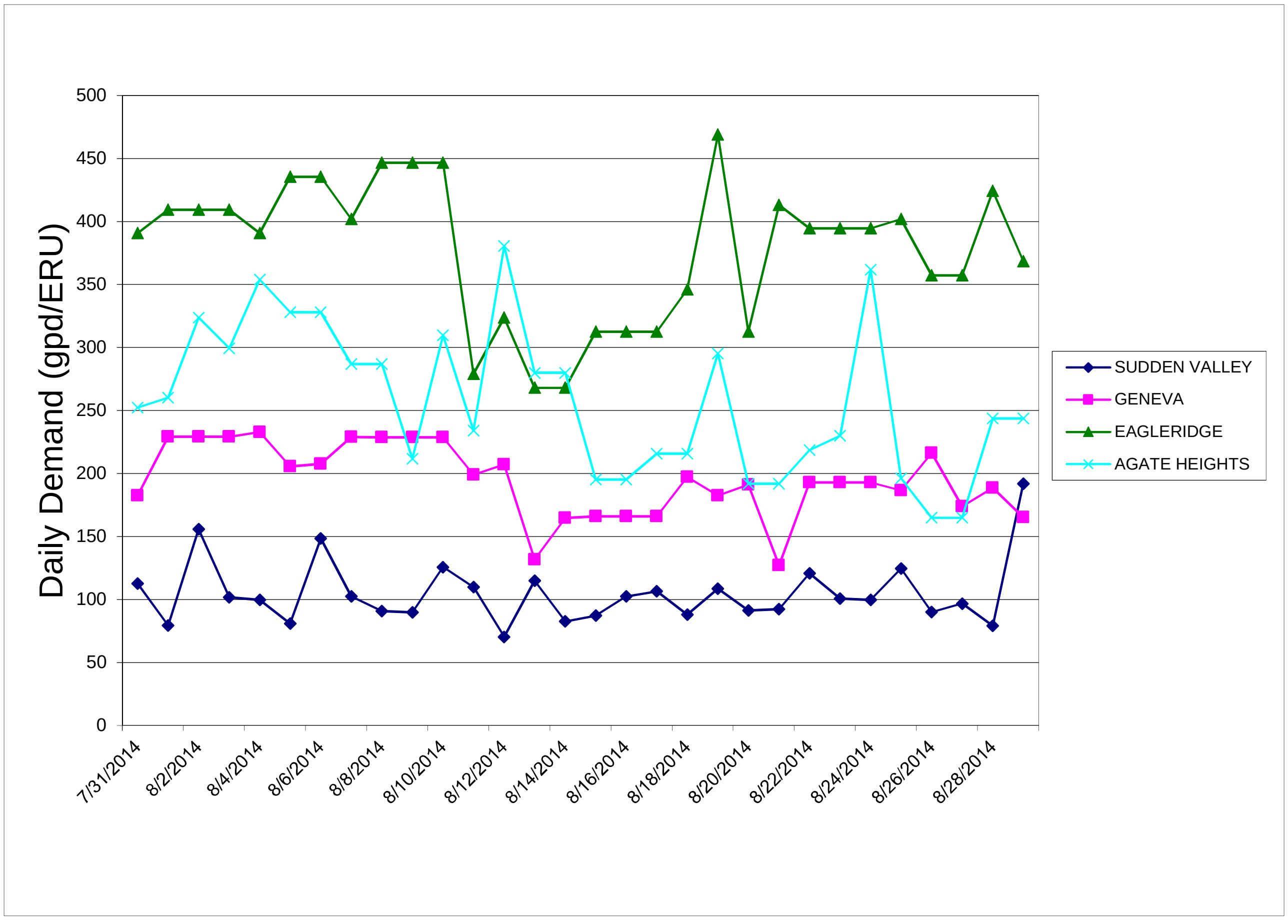


EXHIBIT 3

MAXIMUM DAY DEMAND DATA - SEPTEMBER 2014

SUDDEN VALLEY

Date	Plant Production (100's CF)	Days Elapsed	Geneva Volume (CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU
1-Sep	579.20	1	25,100.00	32,820.00	245,510.01	91.99
2-Sep	707.70	1	25,100.00	45,670.00	341,634.44	128.00
3-Sep	561.30	1	25,100.00	31,030.00	232,119.92	86.97
4-Sep	546.50	1	25,100.00	29,550.00	221,048.78	82.82
5-Sep	571.60	1	23,000.00	34,160.00	255,533.88	95.74
6-Sep	564.10	1	26,500.00	29,910.00	223,741.76	83.83
7-Sep	582.50	1	16,800.00	41,450.00	310,066.73	116.17
8-Sep	464.70	1	24,133.33	22,336.67	167,089.44	62.60
9-Sep	**704.90**	**1**	**24,133.33**	**46,356.67**	**346,771.05**	**129.93**
10-Sep	571.00	1	24,133.33	32,966.67	246,607.15	92.40
11-Sep	544.30	1	23,400.00	31,030.00	232,119.92	86.97
12-Sep	527.80	1	26,900.00	25,880.00	193,595.34	72.53
13-Sep	672.10	1	22,000.00	45,210.00	338,193.41	126.71
14-Sep	586.30	1	25,800.00	32,830.00	245,584.82	92.01
15-Sep	553.50	1	27,400.00	27,950.00	209,079.98	78.34
16-Sep	619.30	1	27,400.00	34,530.00	258,301.67	96.78
17-Sep	559.60	1	27,400.00	28,560.00	213,643.08	80.05
18-Sep	522.10	1	23,700.00	28,510.00	213,269.06	79.91
19-Sep	500.10	1	16,000.00	34,010.00	254,411.81	95.32
20-Sep	522.50	1	26,000.00	26,250.00	196,363.13	73.57
21-Sep	552.30	1	12,900.00	42,330.00	316,649.57	118.64
22-Sep	563.10	1	23,166.67	33,143.33	247,928.71	92.89
23-Sep	505.50	1	20,500.00	30,050.00	224,789.03	84.22
24-Sep	507.10	1	26,600.00	24,110.00	180,354.86	67.57
25-Sep	521.20	1	20,600.00	31,520.00	235,785.36	88.34
26-Sep	497.30	1	17,300.00	32,430.00	242,592.62	90.89
27-Sep	489.80	1	17,300.00	31,680.00	236,982.24	88.79
28-Sep	553.60	1	17,300.00	38,060.00	284,707.83	106.67
29-Sep	617.70	1	21,000.00	40,770.00	304,979.99	114.27
30-Sep	532.60	1	21,600.00	31,660.00	236,832.63	88.73
			Max Day Demand	46,356.67	346,771.05	129.93

EXHIBIT 3

MAXIMUM DAY DEMAND DATA - SEPTEMBER 2014

GENEVA

Date	Meter Reading (100's CF)	Days Elapsed	Volume Change (100's CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU
29-Aug	9693					
2-Sep	10697	4	1,004	25,100.00	187,760.55	165.14
3-Sep	10927	1	230	23,000.00	172,051.50	151.32
4-Sep	11192	1	265	26,500.00	198,233.25	174.35
5-Sep	11360	1	168	16,800.00	125,672.40	110.53
8-Sep	12084	3	724	24,133.33	180,529.40	158.78
9-Sep	12318	1	234	23,400.00	175,043.70	153.95
10-Sep	12587	1	269	26,900.00	201,225.45	176.98
11-Sep	12807	1	220	22,000.00	164,571.00	144.74
12-Sep	13065	1	258	25,800.00	192,996.90	169.74
15-Sep	**13887**	**3**	**822**	**27,400.00**	**204,965.70**	**180.27**
16-Sep	14124	1	237	23,700.00	177,287.85	155.93
17-Sep	14284	1	160	16,000.00	119,688.00	105.27
18-Sep	14544	1	260	26,000.00	194,493.00	171.06
19-Sep	14673	1	129	12,900.00	96,498.45	84.87
22-Sep	15368	3	695	23,166.67	173,298.25	152.42
23-Sep	15573	1	205	20,500.00	153,350.25	134.87
24-Sep	15839	1	266	26,600.00	198,981.30	175.01
25-Sep	16045	1	206	20,600.00	154,098.30	135.53
26-Sep	16218	1	173	17,300.00	129,412.65	113.82
29-Sep	16848	3	630	21,000.00	157,090.50	138.16
30-Sep	17064	1	216	21,600.00	161,578.80	142.11
			Max Day Demand	27,400.00	204,965.70	180.27

EAGLERIDGE

Date	Meter Reading (100's CF)	Days Elapsed	Volume Change (100's CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU
29-Aug	55187					
2-Sep	55319	4	132	3,300.00	24,685.65	368.44
3-Sep	55345	1	26	2,600.00	19,449.30	290.29
4-Sep	55374	1	29	2,900.00	21,693.45	323.78
5-Sep	55403	1	29	2,900.00	21,693.45	323.78
8-Sep	55494	3	91	3,033.33	22,690.85	338.67
9-Sep	55522	1	28	2,800.00	20,945.40	312.62
10-Sep	55549	1	27	2,700.00	20,197.35	301.45
11-Sep	55570	1	21	2,100.00	15,709.05	234.46
12-Sep	**55612**	**1**	**42**	**4,200.00**	**31,418.10**	**468.93**
15-Sep	55706	3	94	3,133.33	23,438.90	349.83
16-Sep	55737	1	31	3,100.00	23,189.55	346.11
17-Sep	55765	1	28	2,800.00	20,945.40	312.62
18-Sep	55795	1	30	3,000.00	22,441.50	334.95
19-Sep	55819	1	24	2,400.00	17,953.20	267.96
22-Sep	55887	3	68	2,266.67	16,955.80	253.07
23-Sep	55905	1	18	1,800.00	13,464.90	200.97
24-Sep	55930	1	25	2,500.00	18,701.25	279.12
25-Sep	55947	1	17	1,700.00	12,716.85	189.80
26-Sep	55961	1	14	1,400.00	10,472.70	156.31
29-Sep	56011	3	50	1,666.67	12,467.50	186.08
30-Sep	56025	1	14	1,400.00	10,472.70	156.31
			Max Day Demand	4,200.00	31,418.10	468.93

EXHIBIT 3

MAXIMUM DAY DEMAND DATA - SEPTEMBER 2014

AGATE HEIGHTS

Date	Meter Reading (Gallons)	Days Elapsed	Volume Change (Gallons)	Average Daily Volume (Gal.)		GPD/ERU	Three Day Average
30-Aug	3001870						
1-Sep	3024139	2	22,269	11,134.50		253.06	251.53
2-Sep	3025670	1	1,531	1,531.00		34.80	180.30
3-Sep	3041830	1	16,160	16,160.00		367.27	218.38
5-Sep	3062474	2	20,644	10,322.00		234.59	278.82
7-Sep	3082369	2	19,895	9,947.50		226.08	228.92
8-Sep	3082832	1	463	463.00		10.52	154.23
9-Sep	**3100073**	**1**	**17,241**	**17,241.00**		**391.84**	209.48
11-Sep	3122593	2	22,520	11,260.00		255.91	**301.22**
13-Sep	3142217	2	19,624	9,812.00		223.00	233.97
15-Sep	3166161	2	23,944	11,972.00		272.09	255.73
17-Sep	3185769	2	19,608	9,804.00		222.82	239.24
19-Sep	3201408	2	15,639	7,819.50		177.72	192.75
21-Sep	3220632	2	19,224	9,612.00		218.45	204.88
23-Sep	3238319	2	17,687	8,843.50		200.99	206.81
26-Sep	3259217	3	20,898	6,966.00		158.32	158.32
27-Sep	3268766	1	9,549	9,549.00		217.02	177.89
29-Sep	3294797	2	26,031	13,015.50		295.81	269.55
30-Sep	3297676	1	2,879	2,879.00		65.43	219.02
			Max Day Demand	17,241.00		391.84	301.22

JOHNSON WELL

Date	Meter Reading (CF)	Days Elapsed	Volume Change (CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU
27-Aug	104871					
2-Sep	105136	6	265	44.17	330.39	165.19
3-Sep	105180	1	44	44.00	329.14	164.57
10-Sep	105486	7	306	43.71	327.00	163.50
16-Sep	105827	6	341	56.83	425.14	212.57
23-Sep	**106226**	**7**	**399**	**57.00**	**426.39**	**213.19**
			Max Day Demand	57.00	426.39	213.19

EXHIBIT 3

MAXIMUM DAY DEMAND DATA - SEPTEMBER 2014

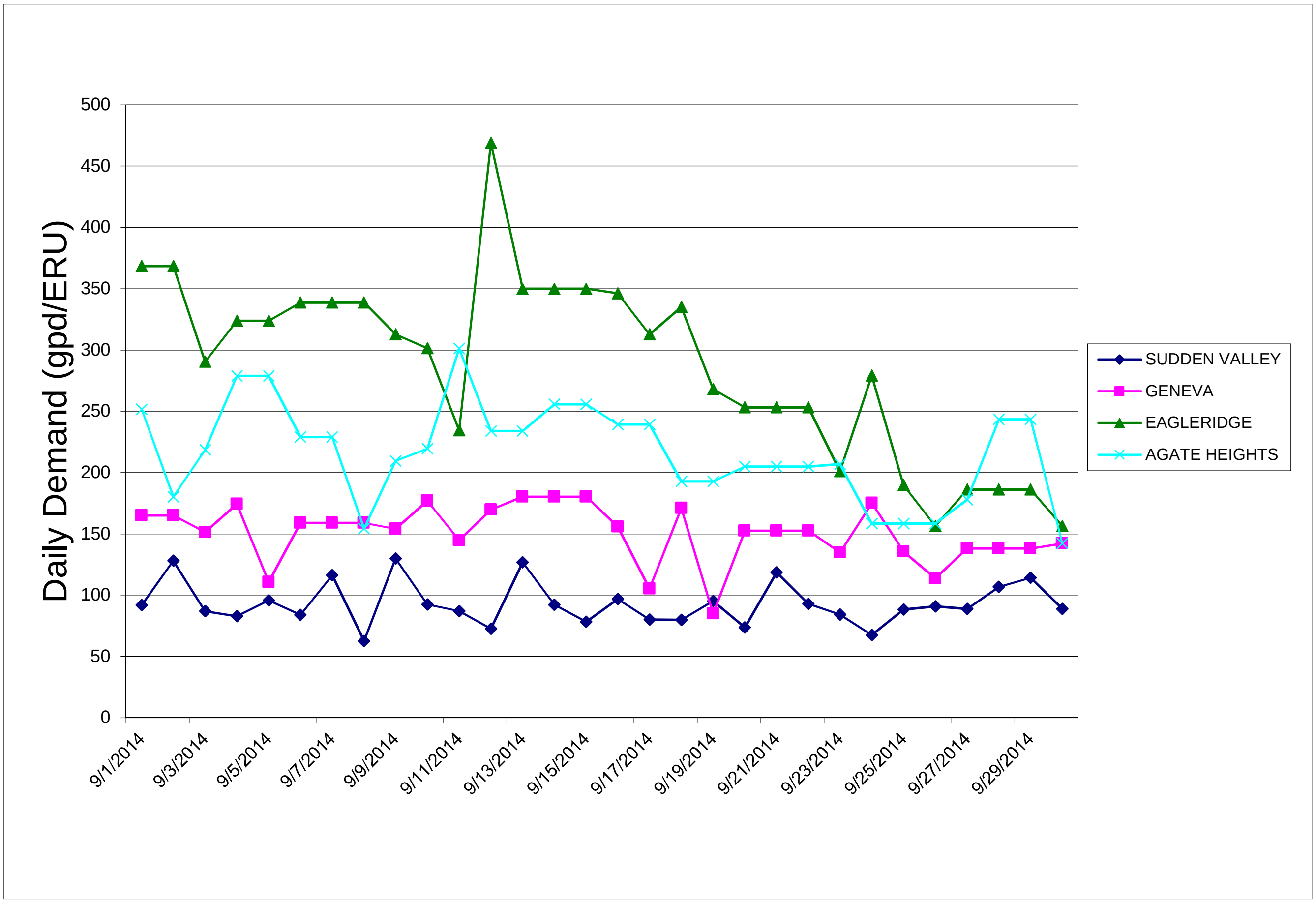


EXHIBIT 3

MAXIMUM DAY DEMAND DATA - JULY 2015

SUDDEN VALLEY

July 2015 Date	Plant Production (100's CF)	Days Elapsed	Geneva Volume (CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU
1-Jul	766.2	1	40800.00	35820.00	267951.51	100.47
2-Jul	648.2	1	33200.00	31620.00	236533.41	88.69
3-Jul	822.6	1	43000.00	39260.00	293684.43	110.12
4-Jul	**935.5**	**1**	**43000.00**	**50550.00**	**378139.28**	**141.78**
5-Jul	718.1	1	43000.00	28810.00	215513.21	80.81
6-Jul	778.4	1	39900.00	37940.00	283810.17	106.42
7-Jul	660.3	1	39900.00	26130.00	195465.47	73.29
8-Jul	733.3	1	38700.00	34630.00	259049.72	97.13
9-Jul	710.4	1	33300.00	37740.00	282314.07	105.85
10-Jul	767.3	1	41000.00	35730.00	267278.27	100.22
11-Jul	666.8	1	41000.00	25680.00	192099.24	72.03
12-Jul	692.8	1	41000.00	28280.00	211548.54	79.32
13-Jul	637.3	1	31600.00	32130.00	240348.47	90.12
14-Jul	571.1	1	25900.00	31210.00	233466.41	87.54
15-Jul	660.7	1	28400.00	37670.00	281790.44	105.66
16-Jul	658.3	1	33100.00	32730.00	244836.77	91.80
17-Jul	714.4	1	43200.00	28240.00	211249.32	79.21
18-Jul	716.8	1	43200.00	28480.00	213044.64	79.88
19-Jul	746.6	1	43200.00	31460.00	235336.53	88.24
20-Jul	736.5	1	38566.67	35083.33	262440.88	98.40
21-Jul	674.8	1	24100.00	43380.00	324504.09	121.67
22-Jul	700.6	1	34500.00	35560.00	266006.58	99.74
23-Jul	700.7	1	41500.00	28570.00	213717.89	80.13
24-Jul	596.1	1	41800.00	17810.00	133227.71	49.95
25-Jul	607.1	1	41800.00	18910.00	141456.26	53.04
26-Jul	615.2	1	41800.00	19720.00	147515.46	55.31
27-Jul	634.8	1	28733.33	34746.67	259922.44	97.46
28-Jul	625.7	1	29600.00	32970.00	246632.09	92.48
29-Jul	676.2	1	33500.00	34120.00	255234.66	95.70
30-Jul	703.5	1	28200.00	42150.00	315303.08	118.22
31-Jul	775.1	1	43500.00	34010.00	254411.81	95.39
			Max Day Demand	50550.00	378139.28	141.78

EXHIBIT 3

MAXIMUM DAY DEMAND DATA - JULY 2015

GENEVA

Date	Meter Reading (100's CF)	Days Elapsed	Volume Change (CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU
30-Jun	74851					
1-Jul	75259	1	408	40,800.00	305,204.40	267.96
2-Jul	75591	1	332	33,200.00	248,352.60	218.04
3-Jul	76021	1	430	43,000.00	321,661.50	282.41
6-Jul	77218	3	1197	39,900.00	298,471.95	262.05
7-Jul	77617	1	399	39,900.00	298,471.95	262.05
8-Jul	78004	1	387	38,700.00	289,495.35	254.17
9-Jul	78337	1	333	33,300.00	249,100.65	218.70
10-Jul	78747	1	410	41,000.00	306,700.50	269.27
13-Jul	79695	3	948	31,600.00	236,383.80	207.54
14-Jul	79954	1	259	25,900.00	193,744.95	170.10
15-Jul	80238	1	284	28,400.00	212,446.20	186.52
16-Jul	80569	1	331	33,100.00	247,604.55	217.39
17-Jul	81001	1	432	43,200.00	323,157.60	283.72
20-Jul	82158	3	1157	38,566.67	288,497.95	253.29
21-Jul	82399	1	241	24,100.00	180,280.05	158.28
22-Jul	82744	1	345	34,500.00	258,077.25	226.58
23-Jul	83159	1	415	41,500.00	310,440.75	272.56
24-Jul	83577	1	418	41,800.00	312,684.90	274.53
27-Jul	84439	3	862	28,733.33	214,939.70	188.71
28-Jul	84735	1	296	29,600.00	221,422.80	194.40
29-Jul	85070	1	335	33,500.00	250,596.75	220.01
30-Jul	85352	1	282	28,200.00	210,950.10	185.21
31-Jul	**85787**	**1**	**435**	**43,500.00**	**325,401.75**	**285.69**
			Max Day Demand	43,500.00	325,401.75	285.69

EAGLERIDGE

Date	Meter Reading (100's CF)	Days Elapsed	Volume Change (100's CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU
30-Jun	60751					
1-Jul	60797	1	46	4,600.00	34,410.30	513.59
2-Jul	60848	1	51	5,100.00	38,150.55	569.41
3-Jul	**60907**	**1**	**59**	**5,900.00**	**44,134.95**	**658.73**
6-Jul	61046	3	139	4,633.33	34,659.65	517.31
7-Jul	61082	1	36	3,600.00	26,929.80	401.94
8-Jul	61129	1	47	4,700.00	35,158.35	524.75
9-Jul	61171	1	42	4,200.00	31,418.10	468.93
10-Jul	61207	1	36	3,600.00	26,929.80	401.94
13-Jul	61326	3	119	3,966.67	29,672.65	442.88
14-Jul	61360	1	34	3,400.00	25,433.70	379.61
15-Jul	61404	1	44	4,400.00	32,914.20	491.26
16-Jul	61441	1	37	3,700.00	27,677.85	413.10
17-Jul	61486	1	45	4,500.00	33,662.25	502.42
20-Jul	61629	3	143	4,766.67	35,657.05	532.19
21-Jul	61658	1	29	2,900.00	21,693.45	323.78
22-Jul	61709	1	51	5,100.00	38,150.55	569.41
23-Jul	61734	1	25	2,500.00	18,701.25	279.12
24-Jul	61760	1	26	2,600.00	19,449.30	290.29
27-Jul	61882	3	122	4,066.67	30,420.70	454.04
28-Jul	61917	1	35	3,500.00	26,181.75	390.77
29-Jul	61950	1	33	3,300.00	24,685.65	368.44
30-Jul	61990	1	40	4,000.00	29,922.00	446.60
31-Jul	62045	1	55	5,500.00	41,142.75	614.07
			Max Day Demand	5,900.00	44,134.95	658.73

EXHIBIT 3

MAXIMUM DAY DEMAND DATA - JULY 2015

AGATE HEIGHTS

Date	Meter Reading (Gallons)	Days Elapsed	Volume Change (Gallons)	Average Daily Volume (Gal.)		GPD/ERU	Three Day Average
1-Jul	5998526						
2-Jul	6023217	1	24691	24,691.00		561.16	
3-Jul	6025934	1	2717	2,717.00		61.75	
4-Jul	6047138	1	21204	21,204.00		481.91	160.64
5-Jul	6058810	1	11672	11,672.00		265.27	269.64
6-Jul	6081437	1	22627	22,627.00		514.25	420.48
7-Jul	6089230	1	7793	7,793.00		177.11	318.88
8-Jul	6106389	1	17159	17,159.00		389.98	360.45
9-Jul	6112095	1	5706	5,706.00		129.68	232.26
10-Jul	**6147218**	**1**	**35123**	**35,123.00**		**798.25**	439.30
12-Jul	6170488	2	23270	11,635.00		264.43	442.37
13-Jul	6174001	1	3513	3,513.00		79.84	202.90
14-Jul	6197828	1	23827	23,827.00		541.52	295.27
16-Jul	6224686	2	26858	13,429.00		305.20	383.98
17-Jul	6226008	1	1322	1,322.00		30.05	213.48
18-Jul	6251717	1	25709	25,709.00		584.30	306.52
19-Jul	6252651	1	934	934.00		21.23	211.86
20-Jul	6276171	1	23520	23,520.00		534.55	380.02
21-Jul	6288181	1	12010	12,010.00		272.95	276.24
22-Jul	6311428	1	23247	23,247.00		528.34	**445.28**
23-Jul	6318107	1	6679	6,679.00		151.80	317.70
24-Jul	6339146	1	21039	21,039.00		478.16	386.10
26-Jul	6358591	2	19445	9,722.50		220.97	306.70
28-Jul	6384271	2	25680	12,840.00		291.82	268.20
30-Jul	6408787	2	24516	12,258.00		278.59	283.00
31-Jul	6411978	1	3191	3,191.00		72.52	209.90
			Max Day Demand	35,123.00		798.25	445.28

JOHNSON WELL

Date	Meter Reading (CF)	Days Elapsed	Volume Change (CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU
6-Jul	120952					
14-Jul	121670	8	718	89.75	671.37	335.69
17-Jul	**122323**	**3**	**653**	**217.67**	**1,628.26**	**814.13**
29-Jul	122440	12	117	9.75	72.93	36.47
			Max Day Demand	217.67	1,628.26	814.13

EXHIBIT 3

MAXIMUM DAY DEMAND DATA - JULY 2015

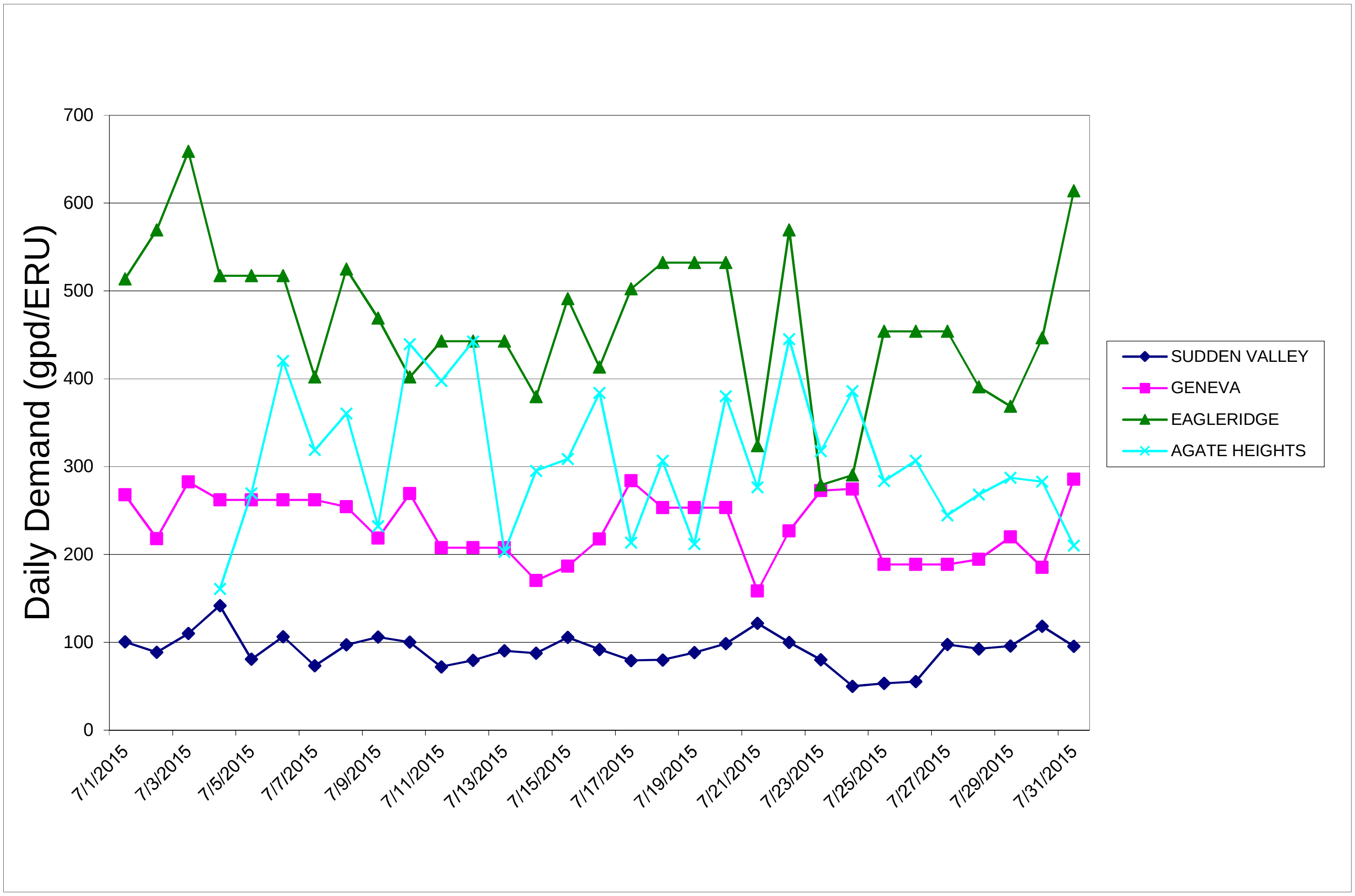


EXHIBIT 3

MAXIMUM DAY DEMAND DATA - AUGUST 2015

SUDDEN VALLEY

Aug 2015 Date	Plant Production (100's CF)	Days Elapsed	Geneva Volume (CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU
1-Aug	755.40	1	37,400.00	38,140.00	285,306.27	106.90
2-Aug	783.50	1	37,400.00	40,950.00	306,326.48	114.77
3-Aug	656.10	1	37,400.00	28,210.00	211,024.91	79.07
4-Aug	757.20	1	35,700.00	40,020.00	299,369.61	112.17
5-Aug	657.10	1	36,100.00	29,610.00	221,497.61	82.99
6-Aug	538.80	1	23,600.00	30,280.00	226,509.54	84.87
7-Aug	738.60	1	31,400.00	42,460.00	317,622.03	119.00
8-Aug	788.40	1	33,866.67	44,973.33	336,423.02	126.05
9-Aug	730.40	1	33,866.67	39,173.33	293,036.12	109.79
10-Aug	781.30	1	33,866.67	44,263.33	331,111.87	124.06
11-Aug	677.70	1	38,200.00	29,570.00	221,198.39	82.88
12-Aug	764.20	1	40,600.00	35,820.00	267,951.51	100.39
13-Aug	633.60	1	24,000.00	39,360.00	294,432.48	110.32
14-Aug	646.90	1	34,700.00	29,990.00	224,340.20	84.05
15-Aug	545.20	1	27,200.00	27,320.00	204,367.26	76.57
16-Aug	600.50	1	27,200.00	32,850.00	245,734.43	92.07
17-Aug	678.40	1	27,200.00	40,640.00	304,007.52	113.90
18-Aug	684.20	1	33,600.00	34,820.00	260,471.01	97.59
19-Aug	654.70	1	35,000.00	30,470.00	227,930.84	85.40
20-Aug	700.10	1	22,300.00	47,710.00	356,894.66	133.72
21-Aug	587.10	1	32,500.00	26,210.00	196,063.91	73.46
22-Aug	639.80	1	24,333.33	39,646.67	296,576.89	111.12
23-Aug	691.50	1	24,333.33	44,816.67	335,251.08	125.61
24-Aug	825.80	1	24,333.33	58,246.67	435,714.19	163.25
25-Aug	729.00	1	49,100.00	23,800.00	178,035.90	66.71
26-Aug	687.10	1	32,900.00	35,810.00	267,876.71	100.37
27-Aug	632.80	1	29,500.00	33,780.00	252,691.29	94.68
28-Aug	603.80	1	25,200.00	35,180.00	263,163.99	98.60
29-Aug	552.60	1	19,366.67	35,893.33	268,500.08	100.60
30-Aug	669.00	1	19,366.67	47,533.33	355,573.10	133.22
31-Aug	**780.50**	**1**	**19,366.67**	**58,683.33**	**438,980.68**	**164.47**

Max Day Demand	58,683.33	438,980.68	164.47

EXHIBIT 3

MAXIMUM DAY DEMAND DATA - AUGUST 2015

GENEVA

Date	Meter Reading (100's CF)	Days Elapsed	Volume Change (100's CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU
31-Jul	85787					
3-Aug	86909	3	1,122	37,400.00	279,770.70	245.63
4-Aug	87266	1	357	35,700.00	267,053.85	234.46
5-Aug	87627	1	361	36,100.00	270,046.05	237.09
6-Aug	87863	1	236	23,600.00	176,539.80	155.00
7-Aug	88177	1	314	31,400.00	234,887.70	206.22
10-Aug	89193	3	1,016	33,866.67	253,339.60	222.42
11-Aug	89575	1	382	38,200.00	285,755.10	250.88
12-Aug	89981	1	406	40,600.00	303,708.30	266.64
13-Aug	90221	1	240	24,000.00	179,532.00	157.62
14-Aug	90568	1	347	34,700.00	259,573.35	227.90
17-Aug	91384	3	816	27,200.00	203,469.60	178.64
18-Aug	91720	1	336	33,600.00	251,344.80	220.67
19-Aug	92070	1	350	35,000.00	261,817.50	229.87
20-Aug	92293	1	223	22,300.00	166,815.15	146.46
21-Aug	92618	1	325	32,500.00	243,116.25	213.45
24-Aug	93348	3	730	24,333.33	182,025.50	159.81
25-Aug	**93839**	**1**	**491**	**49,100.00**	**367,292.55**	**322.47**
26-Aug	94168	1	329	32,900.00	246,108.45	216.07
27-Aug	94463	1	295	29,500.00	220,674.75	193.74
28-Aug	94715	1	252	25,200.00	188,508.60	165.50
31-Aug	95296	3	581	19,366.67	144,872.35	127.19
			Max Day Demand	49,100.00	367,292.55	322.47

EAGLERIDGE

Date	Meter Reading (100's CF)	Days Elapsed	Volume Change (100's CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU
31-Jul	62045					
3-Aug	62162	3	117	3,900.00	29,173.95	435.43
4-Aug	62200	1	38	3,800.00	28,425.90	424.27
5-Aug	62244	1	44	4,400.00	32,914.20	491.26
6-Aug	62287	1	43	4,300.00	32,166.15	480.09
7-Aug	62331	1	44	4,400.00	32,914.20	491.26
10-Aug	62443	3	112	3,733.33	27,927.20	416.82
11-Aug	62474	1	31	3,100.00	23,189.55	346.11
12-Aug	**62523**	**1**	**49**	**4,900.00**	**36,654.45**	**547.08**
13-Aug	62565	1	42	4,200.00	31,418.10	468.93
14-Aug	62600	1	35	3,500.00	26,181.75	390.77
17-Aug	62697	3	97	3,233.33	24,186.95	361.00
18-Aug	62732	1	35	3,500.00	26,181.75	390.77
19-Aug	62778	1	46	4,600.00	34,410.30	513.59
20-Aug	62819	1	41	4,100.00	30,670.05	457.76
21-Aug	62852	1	33	3,300.00	24,685.65	368.44
24-Aug	62960	3	108	3,600.00	26,929.80	401.94
25-Aug	62990	1	30	3,000.00	22,441.50	334.95
26-Aug	63030	1	40	4,000.00	29,922.00	446.60
27-Aug	63065	1	35	3,500.00	26,181.75	390.77
28-Aug	63103	1	38	3,800.00	28,425.90	424.27
31-Aug	63176	3	73	2,433.33	18,202.55	271.68
			Max Day Demand	4,900.00	36,654.45	547.08

EXHIBIT 3

MAXIMUM DAY DEMAND DATA - AUGUST 2015

AGATE HEIGHTS

Date	Meter Reading (Gallons)	Days Elapsed	Volume Change (Gallons)	Average Daily Volume (Gal.)		GPD/ERU	Three Day Average
31-Jul	6411978						
1-Aug	**6444333**	**1**	**32,355**	**32,355.00**		**735.34**	362.15
2-Aug	6444632	1	299	299.00		6.80	271.55
3-Aug	6470834	1	26,202	26,202.00		595.50	**445.88**
4-Aug	6478964	1	8,130	8,130.00		184.77	262.36
5-Aug	6501168	1	22,204	22,204.00		504.64	428.30
6-Aug	6510382	1	9,214	9,214.00		209.41	299.61
8-Aug	6538455	2	28,073	14,036.50		319.01	282.48
9-Aug	6540024	1	1,569	1,569.00		35.66	224.56
10-Aug	6565201	1	25,177	25,177.00		572.20	308.96
11-Aug	6570479	1	5,278	5,278.00		119.95	242.61
12-Aug	6593449	1	22,970	22,970.00		522.05	404.73
13-Aug	6596649	1	3,200	3,200.00		72.73	238.24
14-Aug	6619494	1	22,845	22,845.00		519.20	371.33
15-Aug	6626187	1	6,693	6,693.00		152.11	248.02
16-Aug	6651066	1	24,879	24,879.00		565.43	412.25
17-Aug	6651968	1	902	902.00		20.50	246.02
18-Aug	6675417	1	23,449	23,449.00		532.93	372.95
19-Aug	6679091	1	3,674	3,674.00		83.50	212.31
20-Aug	6702336	1	23,245	23,245.00		528.30	381.58
22-Aug	6723435	2	21,099	10,549.50		239.76	335.94
23-Aug	6729713	1	6,278	6,278.00		142.68	207.40
24-Aug	6753802	1	24,089	24,089.00		547.48	309.97
25-Aug	6757484	1	3,682	3,682.00		83.68	257.95
26-Aug	6783115	1	25,631	25,631.00		582.52	404.56
27-Aug	6784285	1	1,170	1,170.00		26.59	230.93
28-Aug	6804748	1	20,463	20,463.00		465.07	358.06
30-Aug	6819249	2	14,501	7,250.50		164.78	264.88
			Max Day Demand	32,355.00		735.34	445.88

JOHNSON WELL

Date	Meter Reading (CF)	Days Elapsed	Volume Change (CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU
29-Jul	122440					
3-Aug	123008	5	568	113.60	849.78	424.89
5-Aug	**123236**	**2**	**228**	**114.00**	**852.78**	**426.39**
12-Aug	123629	7	393	56.14	419.98	209.99
19-Aug	123910	7	281	40.14	300.29	150.14
1-Sep	125114	13	1,204	92.62	692.81	346.40
			Max Day Demand	114.00	852.78	426.39

EXHIBIT 3

MAXIMUM DAY DEMAND DATA - AUGUST 2014

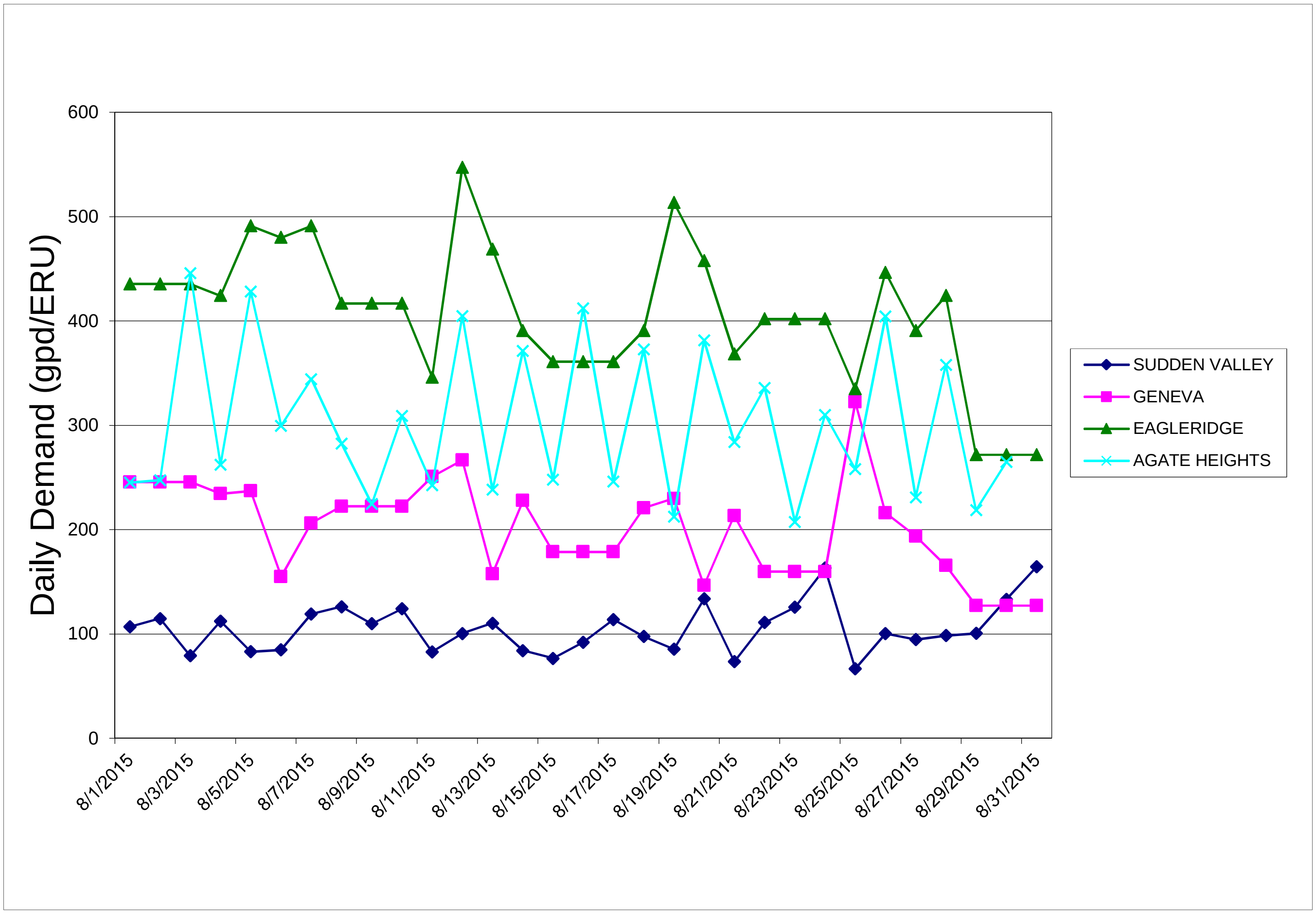


EXHIBIT 3

MAXIMUM DAY DEMAND DATA - SEPTEMBER 2015

SUDDEN VALLEY

Date	Plant Production (100's CF)	Days Elapsed	Geneva Volume (CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU
1-Sep	599.40	1	21,300.00	38,640.00	289,046.52	108.30
2-Sep	**818.50**	**1**	**19,600.00**	**62,250.00**	**465,661.13**	**174.47**
3-Sep	600.90	1	22,700.00	37,390.00	279,695.90	104.79
4-Sep	538.10	1	28,100.00	25,710.00	192,323.66	72.06
5-Sep	554.50	1	19,550.00	35,900.00	268,549.95	100.62
6-Sep	591.30	1	19,550.00	39,580.00	296,078.19	110.93
7-Sep	593.60	1	19,550.00	39,810.00	297,798.71	111.58
8-Sep	625.40	1	19,550.00	42,990.00	321,586.70	120.49
9-Sep	547.00	1	27,100.00	27,600.00	206,461.80	77.36
10-Sep	519.50	1	19,500.00	32,450.00	242,742.23	90.95
11-Sep	560.20	1	22,100.00	33,920.00	253,738.56	95.07
12-Sep	610.00	1	21,866.67	39,133.33	292,736.90	109.68
13-Sep	608.90	1	21,866.67	39,023.33	291,914.05	109.37
14-Sep	649.20	1	21,866.67	43,053.33	322,060.46	120.67
15-Sep	565.60	1	22,000.00	34,560.00	258,526.08	96.86
16-Sep	563.50	1	32,700.00	23,650.00	176,913.83	66.28
17-Sep	657.40	1	11,900.00	53,840.00	402,750.12	150.90
18-Sep	588.30	1	25,600.00	33,230.00	248,577.02	93.13
19-Sep	486.00	1	25,466.67	23,133.33	173,048.90	64.84
20-Sep	628.30	1	25,466.67	37,363.33	279,496.42	104.72
21-Sep	620.30	1	25,466.67	36,563.33	273,512.02	102.48
22-Sep	618.00	1	30,000.00	31,800.00	237,879.90	89.13
23-Sep	647.60	1	27,700.00	37,060.00	277,227.33	103.87
24-Sep	514.60	1	21,500.00	29,960.00	224,115.78	83.97
25-Sep	575.30	1	18,100.00	39,430.00	294,956.12	110.51
26-Sep	498.70	1	21,666.67	28,203.33	210,975.04	79.05
27-Sep	590.20	1	21,666.67	37,353.33	279,421.61	104.69
28-Sep	507.60	1	21,666.67	29,093.33	217,632.68	81.54
29-Sep	544.60	1	23,200.00	31,260.00	233,840.43	87.61
30-Sep	532.50	1	24,700.00	28,550.00	213,568.28	80.02
			Max Day Demand	62,250.00	465,661.13	174.47

EXHIBIT 3

MAXIMUM DAY DEMAND DATA - SEPTEMBER 2015

GENEVA

Date	Meter Reading (100's CF)	Days Elapsed	Volume Change (100's CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU
31-Aug	95296					
1-Sep	95509	1	213	21,300.00	159,334.65	140.14
2-Sep	95705	1	196	19,600.00	146,617.80	128.95
3-Sep	95932	1	227	22,700.00	169,807.35	149.35
4-Sep	96213	1	281	28,100.00	210,202.05	184.87
8-Sep	96995	4	782	19,550.00	146,243.78	128.62
9-Sep	97266	1	271	27,100.00	202,721.55	178.30
10-Sep	97461	1	195	19,500.00	145,869.75	128.29
11-Sep	97682	1	221	22,100.00	165,319.05	145.40
14-Sep	98338	3	656	21,866.67	163,573.60	143.86
15-Sep	98558	1	220	22,000.00	164,571.00	144.74
16-Sep	**98885**	**1**	**327**	**32,700.00**	**244,612.35**	**215.14**
17-Sep	99004	1	119	11,900.00	89,017.95	78.29
18-Sep	99260	1	256	25,600.00	191,500.80	168.43
21-Sep	100024	3	764	25,466.67	190,503.40	167.55
22-Sep	100324	1	300	30,000.00	224,415.00	197.37
23-Sep	100601	1	277	27,700.00	207,209.85	182.24
24-Sep	100816	1	215	21,500.00	160,830.75	141.45
25-Sep	100997	1	181	18,100.00	135,397.05	119.08
28-Sep	101647	3	650	21,666.67	162,077.50	142.55
29-Sep	101879	1	232	23,200.00	173,547.60	152.64
30-Sep	102126	1	247	24,700.00	184,768.35	162.51
			Max Day Demand	32,700.00	244,612.35	215.14

EAGLERIDGE

Date	Meter Reading (100's CF)	Days Elapsed	Volume Change (100's CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU
31-Aug	63176					
1-Sep	63196	1	20	2,000.00	14,961.00	223.30
2-Sep	63218	1	22	2,200.00	16,457.10	245.63
3-Sep	63231	1	13	1,300.00	9,724.65	145.14
4-Sep	**63254**	**1**	**23**	**2,300.00**	**17,205.15**	**256.79**
8-Sep	63318	4	64	1,600.00	11,968.80	178.64
9-Sep	63335	1	17	1,700.00	12,716.85	189.80
10-Sep	63353	1	18	1,800.00	13,464.90	200.97
11-Sep	63371	1	18	1,800.00	13,464.90	200.97
14-Sep	63431	3	60	2,000.00	14,961.00	223.30
15-Sep	63449	1	18	1,800.00	13,464.90	200.97
16-Sep	63466	1	17	1,700.00	12,716.85	189.80
17-Sep	63486	1	20	2,000.00	14,961.00	223.30
18-Sep	63501	1	15	1,500.00	11,220.75	167.47
21-Sep	63549	3	48	1,600.00	11,968.80	178.64
22-Sep	63561	1	12	1,200.00	8,976.60	133.98
23-Sep	63578	1	17	1,700.00	12,716.85	189.80
24-Sep	63592	1	14	1,400.00	10,472.70	156.31
25-Sep	63610	1	18	1,800.00	13,464.90	200.97
28-Sep	63658	3	48	1,600.00	11,968.80	178.64
29-Sep	63676	1	18	1,800.00	13,464.90	200.97
30-Sep	63690	1	14	1,400.00	10,472.70	156.31
			Max Day Demand	2,300.00	17,205.15	256.79

EXHIBIT 3

MAXIMUM DAY DEMAND DATA - SEPTEMBER 2015

AGATE HEIGHTS

Date	Meter Reading (Gallons)	Days Elapsed	Volume Change (Gallons)	Average Daily Volume (Gal.)		GPD/ERU	Three Day Average
30-Aug	6819249						
1-Sep	6833921	2	14,672	7,336.00		166.73	166.08
3-Sep	6851552	2	17,631	8,815.50		200.35	189.14
5-Sep	6868274	2	16,722	8,361.00		190.02	193.47
7-Sep	6888344	2	20,070	10,035.00		228.07	**215.39**
9-Sep	6905511	2	17,167	8,583.50		195.08	206.08
11-Sep	6920790	2	15,279	7,639.50		173.63	180.78
13-Sep	6940661	2	19,871	9,935.50		225.81	208.41
15-Sep	6958989	2	18,328	9,164.00		208.27	214.12
17-Sep	6973337	2	14,348	7,174.00		163.05	178.12
19-Sep	6990717	2	17,380	8,690.00		197.50	186.02
21-Sep	7008272	2	17,555	8,777.50		199.49	198.83
23-Sep	7025258	2	16,986	8,493.00		193.02	195.18
25-Sep	7043084	2	17,826	8,913.00		202.57	199.39
28-Sep	7064154	3	21,070	7,023.33		159.62	159.62
29-Sep	7068470	1	4,316	4,316.00		98.09	118.60
30-Sep	**7085254**	**1**	**16,784**	**16,784.00**		**381.45**	213.06
			Max Day Demand	16,784.00		381.45	215.39

JOHNSON WELL

Date	Meter Reading (CF)	Days Elapsed	Volume Change (CF)	Average Daily Volume (CF)	Gallons Per Day	GPD/ERU
1-Sep	125,114					
2-Sep	**125,172**	**1**	**58**	**58.00**	**433.87**	**216.93**
10-Sep	125,556	8	384	48.00	359.06	179.53
15-Sep	125,702	5	146	29.20	218.43	109.22
23-Sep	125,899	8	197	24.63	184.21	92.10
30-Sep	126,098	7	199	28.43	212.66	106.33
			Max Day Demand	58.00	433.87	216.93

EXHIBIT 3

MAXIMUM DAY DEMAND DATA - SEPTEMBER 2015

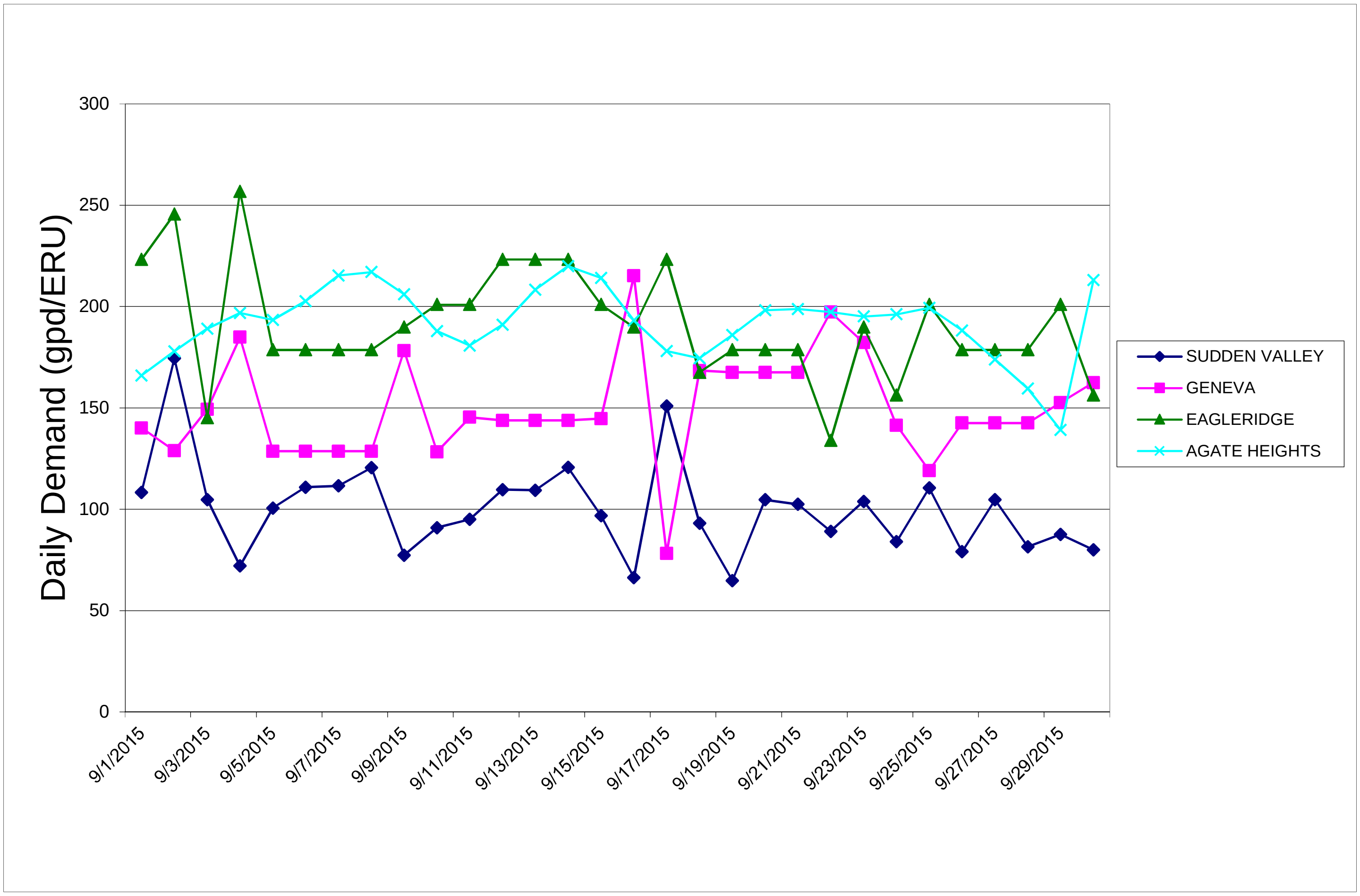
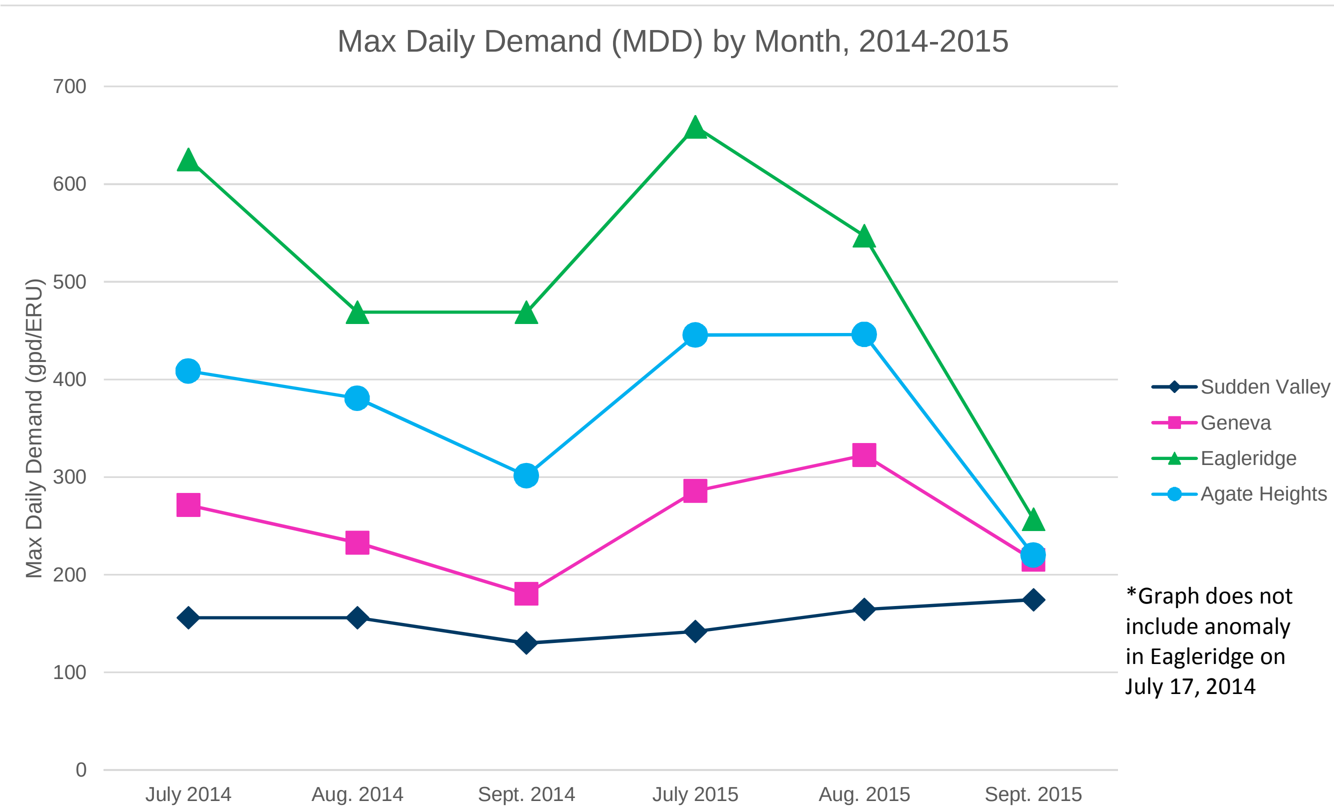


EXHIBIT 3



Max Daily Demand (MDD) by Month, 2014-2015
Max Daily Demand (gpd/ERU)
700
600
500
400
300
200
100
0
July 2014
Aug. 2014
Sept. 2014
July 2015
Aug. 2015
Sept. 2015
Sudden Valley
Geneva
Eagleridge
Agate Heights
*Graph does not include anomaly in Eagleridge on July 17, 2014

EXHIBIT 4

LWWSD DISTRIBUTION SYSTEM LOSSES
THREE-YEAR RUNNING AVERAGE

SUDDEN VALLEY WATER SYSTEM

Month	Gross Production (CU. FT.)	Metered Residential Consumption (CU. FT.)	Distribution System Leakage (CU. FT.)	% of Water Consumed	Net % of Distribution System Leakage
TOTAL 2012	17,022,912	14,347,314	2,675,598	84.28%	15.72%
TOTAL 2013	16,525,245	14,557,478	1,967,767	88.09%	11.91%
TOTAL 2014	15,549,961	13,847,931	1,702,030	89.05%	10.95%
3-YR AVG	**16,366,039**	**14,250,908**	**2,115,131**	**87.14%**	**12.86%**

GENEVA WATER SYSTEM

Month	Gross Production (CU. FT.)	Metered Residential Consumption (CU. FT.)	Distribution System Leakage (CU. FT.)	% of Water Consumed	Net % of Distribution System Leakage
TOTAL 2012	8,271,074	7,543,016	728,058	91.20%	8.80%
TOTAL 2013	8,347,682	7,522,909	824,773	90.12%	9.88%
TOTAL 2014	8,189,665	7,484,584	705,081	91.39%	8.61%
3-YR AVG	**8,269,474**	**7,516,836**	**752,637**	**90.90%**	**9.10%**

AGATE HEIGHTS WATER SYSTEM

Month	Gross Production (CU. FT.)	Metered Residential Consumption (CU. FT.)	Distribution System Leakage (CU. FT.)	% of Water Consumed	Net % of Distribution System Leakage
TOTAL 2012	440,447	424,094	16,353	96.29%	3.71%
TOTAL 2013	457,076	452,172	4,904	98.93%	1.07%
TOTAL 2014	460,315	443,280	17,035	96.30%	3.70%
3-YR AVG	**452,613**	**439,849**	**12,764**	**97.17%**	**2.83%**

EXHIBIT 4

LWWSD DISTRIBUTION SYSTEM LOSSES
THREE-YEAR RUNNING AVERAGE

JOHNSON WELLS WATER SYSTEM

Month	Gross Production (CU. FT.)	Metered Residential Consumption (CU. FT.)	Distribution System Leakage (CU. FT.)	% of Water Consumed	Net % of Distribution System Leakage
TOTAL 2012	18,154	18,397	(243)	101.34%	-1.34%
TOTAL 2013	15,844	16,775	(931)	105.88%	-5.88%
TOTAL 2014	15,309	16,199	(890)	105.81%	-5.81%
3-YR AVG	**16,436**	**17,124**	**(688)**	**104.34%**	**-4.34%**

EAGLERIDGE WATER SYSTEM

Month	Gross Production (CU. FT.)	Metered Residential Consumption (CU. FT.)	Distribution System Leakage (CU. FT.)	% of Water Consumed	Net % of Distribution System Leakage
TOTAL 2012	742,967	710,408	32,559	95.62%	4.38%
TOTAL 2013	706,345	696,358	9,987	98.59%	1.41%
TOTAL 2014	722,539	702,118	20,421	97.17%	2.83%
3-YR AVG	**723,950**	**702,961**	**20,989**	**97.13%**	**2.87%**

EXHIBIT 5

AVERAGE DAILY DEMAND - 2012

SUDDEN VALLEY WATER SYSTEM

Month	Modified Gross Production (Gal.)	Number of ERUs	% Full Time Occupancy	Billing Cycle (days)	Per ERU Average Daily Consumption	Average Occupancy Per Conn. (persons)	Per Capita Average Daily Consumption
DEC/JAN12	21,381,519	2,662	100%	61	132	2.5	53
FEB/MAR 12	16,123,083	2,662	100%	60	101	2.5	40
APR/MAY 12	21,213,757	2,662	100%	61	131	2.5	52
JUN/JUL 12	23,921,055	2,663	100%	61	147	2.5	59
AUG/SEP 12	25,235,678	2,663	100%	61	155	2.5	62
OCT/NOV 12	19,464,798	2,664	100%	61	120	2.5	48
2012 AVERAGE DAILY CONSUMPTION (gpd/ERU)					131		52

GENEVA WATER SYSTEM

Month	Modified Gross Production (Gal.)	Number of ERUs	% Full Time Occupancy	Billing Cycle (days)	Per ERU Average Daily Consumption	Average Occupancy Per Conn. (persons)	Per Capita Average Daily Consumption
JAN/FEB 12	8,302,876	1,120	100%	60	124	2.9	43
MAR/APR 12	9,629,633	1,120	100%	61	141	2.9	49
MAY/JUN 12	9,503,796	1,121	100%	61	139	2.9	48
JUL/AUG 12	12,349,849	1,121	100%	61	181	2.9	62
SEP/OCT 12	12,708,330	1,122	100%	61	186	2.9	64
NOV/DEC 12	9,377,286	1,122	100%	61	137	2.9	47
2012 AVERAGE DAILY CONSUMPTION (gpd/ERU)					151		52

AGATE HEIGHTS WATER SYSTEM

Month	Modified Gross Production (Gal.)	Number of ERUs	% Full Time Occupancy	Billing Cycle (days)	Per ERU Average Daily Consumption	Average Occupancy Per Conn. (persons)	Per Capita Average Daily Consumption
JAN/FEB 12	481,940	44	100%	60	183	2.9	63
MAR/APR 12	524,063	44	100%	61	195	2.9	67
MAY/JUN 12	543,946	44	100%	61	203	2.9	70
JUL/AUG 12	613,440	44	100%	61	229	2.9	79
SEP/OCT 12	668,841	45	100%	61	244	2.9	84
NOV/DEC 12	462,543	45	100%	61	169	2.9	58
2012 AVERAGE DAILY CONSUMPTION (gpd/ERU)					204		70

EXHIBIT 5

AVERAGE DAILY DEMAND - 2012

JOHNSON WELLS WATER SYSTEM

Month	Gross Production (Gal.)	Number of ERUs	% Full Time Occupancy	Billing Cycle (days)	Per ERU Average Daily Consumption	Average Occupancy Per Conn. (persons)	Per Capita Average Daily Consumption
JAN/FEB 12	20,734	2	100%	60	**173**	2.9	**60**
MAR/APR 12	17,420	2	100%	61	**143**	2.9	**49**
MAY/JUN 12	19,919	2	100%	61	**163**	2.9	**56**
JUL/AUG 12	21,721	2	100%	61	**178**	2.9	**61**
SEP/OCT 12	26,838	2	100%	61	**220**	2.9	**76**
NOV/DEC 12	21,198	2	100%	61	**174**	2.9	**60**
2012 AVERAGE DAILY CONSUMPTION (gpd/ERU)					**175**		**60**

EAGLERIDGE WATER SYSTEM

Month	Modified Gross Production (Gal.)	Number of ERUs	% Full Time Occupancy	Billing Cycle (days)	Per ERU Average Daily Consumption	Average Occupancy Per Conn. (persons)	Per Capita Average Daily Consumption
JAN/FEB 12	612,976	66	100%	60	**155**	2.9	**53**
MAR/APR 12	645,913	66	100%	61	**160**	2.9	**55**
MAY/JUN 12	841,918	66	100%	61	**209**	2.9	**72**
JUL/AUG 12	1,444,780	66	100%	61	**359**	2.9	**124**
SEP/OCT 12	1,453,787	66	100%	61	**361**	2.9	**125**
NOV/DEC 12	558,406	66	100%	61	**139**	2.9	**48**
2012 AVERAGE DAILY CONSUMPTION (gpd/ERU)					**231**		**79**

EXHIBIT 5

AVERAGE DAILY DEMAND - 2013

SUDDEN VALLEY WATER SYSTEM

Month	Modified Gross Production (Gal.)	Number of ERUs	% Full Time Occupancy	Billing Cycle (days)	Per ERU Average Daily Consumption	Average Occupancy Per Conn. (persons)	Per Capita Average Daily Consumption
DEC/JAN13	21,258,647	2,665	100%	62	**129**	2.5	**51**
FEB/MAR 13	19,031,194	2,666	100%	56	**127**	2.5	**51**
APR/MAY 13	19,531,289	2,666	100%	62	**118**	2.5	**47**
JUN/JUL 13	22,750,780	2,667	100%	62	**138**	2.5	**55**
AUG/SEP 13	22,194,802	2,668	100%	63	**132**	2.5	**53**
OCT/NOV 13	18,850,382	2,669	100%	63	**112**	2.5	**45**
2013 AVERAGE DAILY CONSUMPTION (gpd/ERU)					**126**		**50**

GENEVA WATER SYSTEM

Month	Modified Gross Production (Gal.)	Number of ERUs	% Full Time Occupancy	Billing Cycle (days)	Per ERU Average Daily Consumption	Average Occupancy Per Conn. (persons)	Per Capita Average Daily Consumption
JAN/FEB 13	9,907,982	1,122	100%	63	**140**	2.9	**48**
MAR/APR 13	9,423,156	1,122	100%	61	**138**	2.9	**47**
MAY/JUN 13	9,922,883	1,122	100%	58	**152**	2.9	**53**
JUL/AUG 13	14,388,996	1,121	100%	61	**210**	2.9	**73**
SEP/OCT 13	9,810,152	1,122	100%	61	**143**	2.9	**49**
NOV/DEC 13	8,991,666	1,122	100%	63	**127**	2.9	**44**
2013 AVERAGE DAILY CONSUMPTION (gpd/ERU)					**152**		**52**

AGATE HEIGHTS WATER SYSTEM

Month	Modified Gross Production (Gal.)	Number of ERUs	% Full Time Occupancy	Billing Cycle (days)	Per ERU Average Daily Consumption	Average Occupancy Per Conn. (persons)	Per Capita Average Daily Consumption
JAN/FEB 13	499,721	45	100%	63	**176**	2.9	**61**
MAR/APR 13	507,037	45	100%	61	**185**	2.9	**64**
MAY/JUN 13	576,426	45	100%	58	**221**	2.9	**76**
JUL/AUG 13	794,110	45	100%	61	**289**	2.9	**100**
SEP/OCT 13	562,700	45	100%	61	**205**	2.9	**71**
NOV/DEC 13	479,172	45	100%	63	**169**	2.9	**58**
2013 AVERAGE DAILY CONSUMPTION (gpd/ERU)					**208**		**72**

EXHIBIT 5

AVERAGE DAILY DEMAND - 2013

JOHNSON WELLS WATER SYSTEM

Month	Gross Production (Gal.)	Number of ERUs	% Full Time Occupancy	Billing Cycle (days)	Per ERU Average Daily Consumption	Average Occupancy Per Conn. (persons)	Per Capita Average Daily Consumption
JAN/FEB 13	17,316	2	100%	63	**137**	2.9	**47**
MAR/APR 13	17,772	2	100%	61	**146**	2.9	**50**
MAY/JUN 13	22,761	2	100%	58	**196**	2.9	**68**
JUL/AUG 13	23,823	2	100%	61	**195**	2.9	**67**
SEP/OCT 13	21,684	2	100%	61	**178**	2.9	**61**
NOV/DEC 13	20,929	2	100%	63	**166**	2.9	**57**
2013 AVERAGE DAILY CONSUMPTION (gpd/ERU)					**170**		**59**

EAGLERIDGE WATER SYSTEM

Month	Modified Gross Production (Gal.)	Number of ERUs	% Full Time Occupancy	Billing Cycle (days)	Per ERU Average Daily Consumption	Average Occupancy Per Conn. (persons)	Per Capita Average Daily Consumption
JAN/FEB 13	580,840	66	100%	63	**140**	2.9	**48**
MAR/APR 13	588,313	66	100%	61	**146**	2.9	**50**
MAY/JUN 13	805,981	67	100%	58	**207**	2.9	**72**
JUL/AUG 13	1,746,253	67	100%	61	**427**	2.9	**147**
SEP/OCT 13	968,316	67	100%	61	**237**	2.9	**82**
NOV/DEC 13	594,125	67	100%	63	**141**	2.9	**49**
2013 AVERAGE DAILY CONSUMPTION (gpd/ERU)					**216**		**75**

EXHIBIT 5

AVERAGE DAILY DEMAND - 2014

SUDDEN VALLEY WATER SYSTEM

Month	Modified Gross Production (Gal.)	Number of ERUs	% Full Time Occupancy	Billing Cycle (days)	Per ERU Average Daily Consumption	Average Occupancy Per Conn. (persons)	Per Capita Average Daily Consumption
DEC/JAN14	17,830,542	2,660	100%	62	**108**	2.5	**43**
FEB/MAR 14	17,865,010	2,660	100%	56	**120**	2.5	**48**
APR/MAY 14	17,262,910	2,661	100%	62	**105**	2.5	**42**
JUN/JUL 14	22,993,799	2,662	100%	62	**139**	2.5	**56**
AUG/SEP 14	22,646,380	2,664	100%	63	**135**	2.5	**54**
OCT/NOV 14	17,722,841	2,665	100%	63	**106**	2.5	**42**
2014 AVERAGE DAILY CONSUMPTION (gpd/ERU)					**119**		**47**

GENEVA WATER SYSTEM

Month	Modified Gross Production (Gal.)	Number of ERUs	% Full Time Occupancy	Billing Cycle (days)	Per ERU Average Daily Consumption	Average Occupancy Per Conn. (persons)	Per Capita Average Daily Consumption
JAN/FEB 14	9,822,667	1,127	100%	63	**138**	2.9	**48**
MAR/APR 14	8,539,477	1,131	100%	61	**124**	2.9	**43**
MAY/JUN 14	10,333,623	1,134	100%	58	**157**	2.9	**54**
JUL/AUG 14	13,564,503	1,131	100%	61	**197**	2.9	**68**
SEP/OCT 14	10,164,264	1,137	100%	61	**147**	2.9	**51**
NOV/DEC 14	8,838,256	1,137	100%	63	**123**	2.9	**43**
2014 AVERAGE DAILY CONSUMPTION (gpd/ERU)					**148**		**51**

AGATE HEIGHTS WATER SYSTEM

Month	Modified Gross Production (Gal.)	Number of ERUs	% Full Time Occupancy	Billing Cycle (days)	Per ERU Average Daily Consumption	Average Occupancy Per Conn. (persons)	Per Capita Average Daily Consumption
JAN/FEB 14	560,013	45	100%	63	**198**	2.9	**68**
MAR/APR 14	476,598	45	100%	61	**174**	2.9	**60**
MAY/JUN 14	631,983	45	100%	58	**242**	2.9	**83**
JUL/AUG 14	702,269	45	100%	61	**256**	2.9	**88**
SEP/OCT 14	580,352	45	100%	61	**211**	2.9	**73**
NOV/DEC 14	492,172	45	100%	63	**174**	2.9	**60**
2014 AVERAGE DAILY CONSUMPTION (gpd/ERU)					**209**		**72**

EXHIBIT 5

AVERAGE DAILY DEMAND - 2014

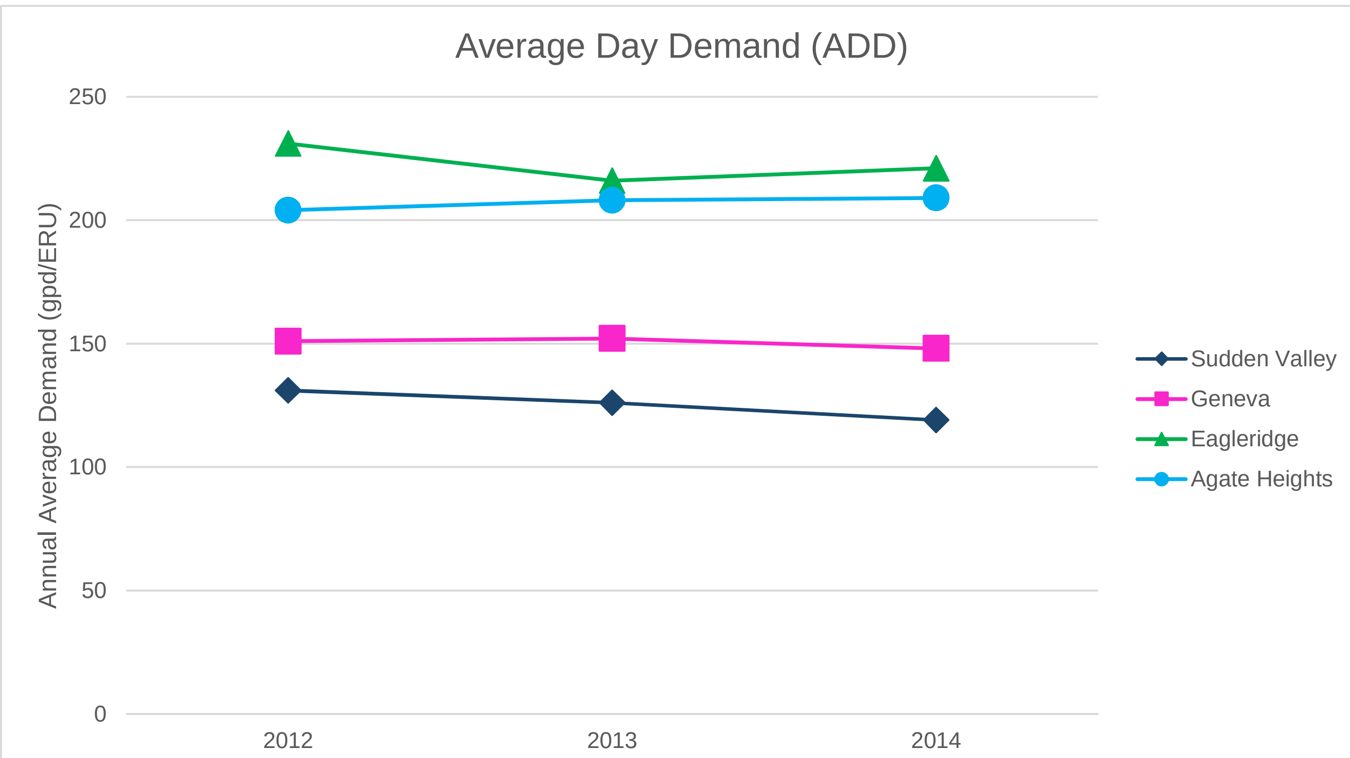
JOHNSON WELLS WATER SYSTEM

Month	Gross Production (Gal.)	Number of ERUs	% Full Time Occupancy	Billing Cycle (days)	Per ERU Average Daily Consumption	Average Occupancy Per Conn. (persons)	Per Capita Average Daily Consumption
JAN/FEB 14	19,156	2	100%	63	**152**	2.9	**52**
MAR/APR 14	17,772	2	100%	61	**146**	2.9	**50**
MAY/JUN 14	18,872	2	100%	58	**163**	2.9	**56**
JUL/AUG 14	23,823	2	100%	61	**195**	2.9	**67**
SEP/OCT 14	20,465	2	100%	61	**168**	2.9	**58**
NOV/DEC 14	17,009	2	100%	63	**135**	2.9	**47**
2014 AVERAGE DAILY CONSUMPTION (gpd/ERU)					**160**		**55**

EAGLERIDGE WATER SYSTEM

Month	Modified Gross Production (Gal.)	Number of ERUs	% Full Time Occupancy	Billing Cycle (days)	Per ERU Average Daily Consumption	Average Occupancy Per Conn. (persons)	Per Capita Average Daily Consumption
JAN/FEB 14	654,142	67	100%	63	**155**	2.9	**53**
MAR/APR 14	550,918	67	100%	61	**135**	2.9	**46**
MAY/JUN 14	875,632	67	100%	58	**225**	2.9	**78**
JUL/AUG 14	1,603,390	67	100%	61	**392**	2.9	**135**
SEP/OCT 14	1,114,620	67	100%	61	**273**	2.9	**94**
NOV/DEC 14	606,266	67	100%	63	**144**	2.9	**50**
2014 AVERAGE DAILY CONSUMPTION (gpd/ERU)					**221**		**76**

EXHIBIT 5


Average Day Demand (ADD)
Annual Average Demand (gpd/ERU)
250
200
150
100
50
0
2012
2013
2014
Sudden Valley
Geneva
Eagleridge
Agate Heights

APPENDIX B: EXAMPLES

Lake Whatcom Water & Sewer District

360-734-9224

WATER: *Are you using it wisely?*

Why is water metered in Lake Whatcom Water and Sewer District?

Lake Whatcom Water and Sewer District meters all accounts connected to its water distribution system to encourage conservation. Without water conservation, utilities have to develop a large volume of new water. Water-conserving districts do not need to pay as much to develop new water supplies or to expand or upgrade infrastructure. Most importantly, Lake Whatcom Water and Sewer District is within the watershed of our precious drinking water source. It is important to remember that as residents and employees of Lake Whatcom Water and Sewer District, we must make every effort to encourage conservation to protect our beautiful lake for many years to come.

What is Water Conservation?

- **Water conservation** is improved water management practices that reduce or enhance the beneficial use of water.
- A **water conservation measure** is an action, change, or improved process implemented to reduce water loss, waste, or use.
- **Water efficiency** is a tool of water conservation that results in more efficient water use which reduces water demand.

Lake Whatcom Water and Sewer District requests that customers irrigate on a *voluntary* watering schedule: even numbered addresses **to only water outside on** Tuesdays, Thursdays, and Saturdays, **and** odd numbered addresses **to water on** Wednesdays, Fridays, and Sundays, **with no outdoor watering on Mondays.**

Call Lake Whatcom Water & Sewer District
if you have
any questions.
(360) 734-9224
Monday—Thursday
8:00am—5:00pm

The Dos and Don'ts of Water Conservation

Bathroom

- **Do** take short showers and save 5-7 gallons a minute!
- **Do** fill the tub halfway and save 10-15 gallons.
- **Do** install water-saving toilets, showerheads and faucet aerators. Place a plastic bottle filled with water in your toilet tank if you can't switch to a low-flow toilet.
- **Don't** run the water while shaving, washing your hands or brushing your teeth. Faucets use 2-3 gallons a minute.

- **Don't** use the toilet as a wastebasket, and don't flush it unnecessarily.

Everywhere

- **Do** repair leaky faucets and turn taps off tightly. A slow drip wastes 15-20 gallons each day.
- **Don't** open fire hydrants.

Kitchen & Laundry

- **Do** run the dishwasher and washing machine only when full. Save even more by using the short cycle.
- **Do** install faucet aerators.
- **Don't** let the water run while washing dishes. Kitchen faucets use 2-3 gallons a minute. Filling a basin only takes 10 gallons to wash and rinse.

Outdoors

- **Do** use a self-closing nozzle on your hose.
- **Don't** water your sidewalk or driveway—instead, sweep them clean.

Step 6 - Finding an Interior Leak

The leak detection dial is not sensitive enough to spin with very small leaks such as a dripping faucet or fitting. If the star is spinning, look for a steady stream of water. The toilet by far is the most common culprit. The toilet ball shut-off may not be operating properly, or the flapper valve might not be sealing closed. If it is not a toilet, check the hot water tank. Check that no water is dripping or flowing from the hot water tank pressure relief valve and discharge pipe. The relief valve on the tank is typically piped to discharge outside the home or into a drain next to the hot water tank. If there is water from the relief, it may have popped off due to high pressure or valve failure. If neither the toilet nor hot water tank is the problem, check the crawl space for any signs of damp soil, pooling or streams of water. Also, check under all the sinks for a leaky fitting.

revised 02-06-2012

Step 7 - Finding an Exterior Leak

Call 811 before you dig! This is a free service to locate underground utilities. The service will coordinate and notify applicable underground utilities to come out and locate their utility lines so they are marked before digging. More information can be found at their web site www.call811.com.

Many exterior leaks are due to faulty fittings and couplings at service line end connections – either at the house or at the meter. Signs of a leak near the house might not be evident due to footing drains around the foundation that collect and direct water away from the structure. Thoroughly investigate visually and by digging near the meter and where the service line enters the house - these are the two highest probability places to check first and eliminate. Look around sprinkler system heads for wet or green spots. If a leak is not found in these locations, it may be difficult to locate. Also, look for sink holes, cracked pavement, green areas, etc.

LAKE WHATCOM WATER
& SEWER DISTRICT

1220 LAKEWAY DRIVE
BELLINGHAM, WA 98229

Phone: 360-734-9224
Fax: 360-738-8250
Email: general.inbox@lwwsd.org

LAKE WHATCOM WATER
& SEWER DISTRICT

TIPS TO FIND A WATER LEAK

General Information

All water services in Lake Whatcom Water and Sewer District are metered. The District reads meters every two months. As a courtesy while preparing bi-monthly bills, the District notifies customers who have higher than normal consumption. Notification may be in the form of a letter or door tag.

Higher than normal usage could be a result of known or unknown events such as: higher water consumption by guests and occupants, extended irrigation during dry weather, leaving a garden hose on, toilet flush valve stuck open, or possibly a service line leak.

If a leak is suspected, the information and steps described below might help find or narrow down the location of a possible leak. In many cases it is relatively simple to repair a leak once it is found. Handy people can fix leaks even if they are unfamiliar with piping and fittings. Local hardware stores will be able to assist in finding the right parts for the repair. Otherwise, the District recommends that customers obtain quotes from several reputable plumbers before hiring a plumber to find and repair a leak. Ask friends and neighbors for plumber references they have used and trust.

Lake Whatcom Water and Sewer District is here to support its customers. The District can assist with locating the meter, shutting water off at the meter, questions about billing, and general questions about how to find leaks. However the District cannot recommend specific plumbers or assist with finding or repairing leaks on the customer's side of the meter. Service lines and plumbing system on the customer's side of the meter are privately owned and maintained and are the responsibility of the property owner.

If you have questions, please contact the District at (360) 734-9224.

7 STEPS TO FINDING A LEAK

Step 1 - Locate Your Meter

Meters are generally located at one of the property corners along the public road frontage. They are installed underground inside a meter box which can be a black plastic box or concrete box with a metal cover labeled "Water Meter." If the meter cannot be located, please call the District office for assistance. In many cases the District can lookup location descriptions and relay that information over the phone for hints on where it might be. Sometimes water meters are in unusual places. For difficult locations, the District's meter reader will visit the site to assist in finding the meter.

Step 2 - Open the Meter Box

Generally, there is a smaller lid within the larger lid covering the meter box. A screwdriver may be required to pry open the small lid. After the small lid is open, it provides a hand hole to reach in and pull off the entire cover if needed to view the meter. Please put the lid back when you are done to avoid a safety hazard. Many times there are two meters in the box. To identify a meter, compare the number on top of the black cap to the meter number listed on the account bill.

Step 3 - Understanding the Dial

District meters measure water use in <u>cubic feet</u>. One cubic foot <u>equals</u> 7.48 gallons. In the adjacent photo, the meter reads 29809. All of the numbers are read for billing purposes. The register does not reset to zero after each bi-monthly read. One complete "sweep" of the sweep hand means one cubic foot of water has passed through the meter.

Step 4 – Find the Leak Detection Dial

Meters are equipped with a leak detection dial (see photo). The leak detection dial is the 6-pointed silver star in the center of the meter. The star will spin slowly even with very low flow, such as a toilet valve running. The star spins faster for higher flow rates. To test if there is leak, turn off all water fixtures in the house then visually check if the star is spinning. If the star is spinning, there is a leak either inside or outside the house.

Step 5 – Determine if the Leak is Inside or Outside the House

Find the shut-off valve for the home. Sometimes these are not easy to find. The District maintains water service line records for homes built after 2001 which might help locate the shut-off valve. Close the shut-off valve by rotating the handle clockwise and then check your faucets to confirm water is completely off. On older construction shut-off valves may not seal tightly due to corrosion or sediment in the valve body.

When the shut-off valve is closed and water is completely off, check the leak detection dial (silver star) on the meter. If it is <u>not</u> spinning, the leak is inside the home. If it is still spinning, then the leak is somewhere between the shut-off valve and the meter box.

LAKE WHATCOM WATER
& SEWER DISTRICT

1220 Lakeway Drive
Bellingham, WA 98229
Phone: 360-734-9224
Fax: 360-738-8250
Email: general.inbox@lwwsd.org

Other Problems

While some toilet repairs are easy, others may be more complicated. Know your limitations – call a reputable plumber if you have any concerns about how to make a repair. Lake Whatcom Water and Sewer District is *not* responsible for any damage to your home or toilet because of faulty repairs.

Revised 02-06-2012

Know what's **below.**
Call before you dig.

Call 811 before you dig! This is a free service to locate underground utilities. The service will coordinate and notify applicable underground utilities to come out and locate their utility lines so they are marked before digging. More information can be found at their web site www.call811.com.

LAKE WHATCOM WATER
& SEWER DISTRICT

1220 LAKEWAY DRIVE
BELLINGHAM, WA 98229

Phone: 360-734-9224
Fax: 360-738-8250
Email: general.inbox@lwwsd.org

LAKE WHATCOM WATER
& SEWER DISTRICT

LEAKY TOILET?

Yes, you can fix it!

Toilets consume approximately 26% of all water in the average home. They are also one of the likeliest places to find a leak that may waste thousands of gallons per month. In the District, leaks not only stress the drinking water system, but they also send clean water into the wastewater treatment plant. You can reduce your impact on the environment, and save money and water, by repairing some leaks yourself.

Step 1: Find the Leak

It can be easy to determine if your toilet is leaking. Maybe you hear the sound of water running, or a faint trickling or hissing. Many times, though, *water will flow through the tank silently,* and this is often why toilet leaks are overlooked. To test your toilet, lift the lid off the toilet tank and drop a Leak Detection Dye Tablet, available at local hardware stores, into the tank. If you do not have a Leak Detection Dye Tablet, several drops of food coloring dropped into the tank are just as good. Do not flush. Wait at least 10 minutes and check the bowl of the toilet. If there is dye in the bowl, the toilet has a leak.

Step 2: Gather Tools

To repair the leak, tools to have handy are

- An adjustable crescent wrench
- A hand towel
- Replacement flapper valve (flapper)

Step 3: Check the Chain

If you have to jiggle the handle to keep the toilet from running, it may be a misaligned flapper valve(2), a loose handle(9), or an incorrect length of chain(4).

To fix: Clean and adjust the chain(4). Make sure the chain isn't too long or short. Tighten the nut holding the toilet handle to the tank. If that doesn't work, the handle may have to be replaced.

Step 4: Check the Flapper

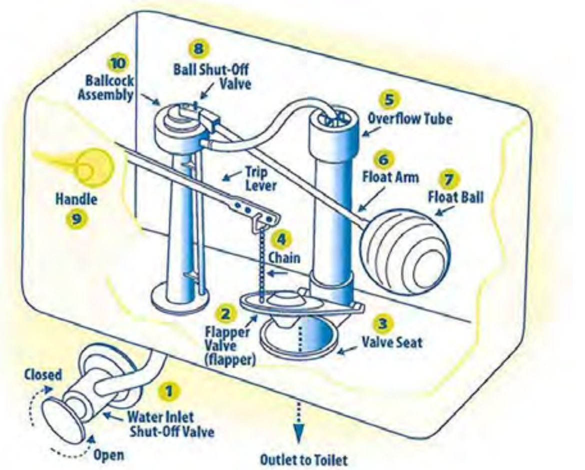
The flapper valve may not be sitting properly on the valve seat(3), or it may need to be replaced. Over time, the rubber material of the flapper deteriorates. If you gently rub the flapper and get streaks on your fingers, it should be replaced now.

To fix: Drain the toilet tank. Close the water inlet shut-off valve to turn it off(1). Flush the toilet to drain the tank. Check the valve seat(3) for corrosion and clean it if necessary. Check the flapper valve(2) to ensure it is lining up properly with the valve seat. If needed, replacement flappers can easily be purchased at hardware stores and some large grocery stores. Follow the instructions on the flapper valve packaging. After installing the new flapper valve, open the water inlet shut-off valve(1) and flush to test.

Step 5: Check the Overflow Tube

If the water level in the tank is too high, it may continuously spill into the overflow tube(5), creating a large leak. The correct water level is about one-half to one inch below the top of the overflow tube.

To fix: Bend the float arm(6) gently downward. Flush after bending the arm to test whether the water stops at the proper level. Be sure to check that the float arm is screwed in securely so that it will not rotate. *If the water level is too low, there may not be an efficient flush. If that is the case, carefully bend the float arm upward. You may need to replace the float ball(7) if it has filled with water, or replace the ball shut-off valve(8).



Images courtesy of City of Portland

LAKE WHATCOM WATER & SEWER DISTRICT

1220 Lakeway Drive
Bellingham, WA 98229
Phone: 360-734-9224
Fax: 360-738-8250
Email: general.inbox@lwwsd.org

Appendix C – North Shore Water Consolidation Feasibility Study

LAKE WHATCOM WATER AND SEWER DISTRICT
Whatcom County, Washington

NORTHSHORE CONSOLIDATION FEASIBILITY STUDY

WHATCOM COUNTY, WASHINGTON

Department of Health Contract N21980

WILSON ENGINEERING, LLC
Consulting Engineers
805 Dupont Street, Suite 7
Bellingham, Washington 98225

Project # 2016-093
August 2017

LAKE WHATCOM WATER AND SEWER DISTRICT
NORTHSHORE CONSOLIDATION FEASIBILITY STUDY
TABLE OF CONTENTS

LAKE WHATCOM WATER AND SEWER DISTRICT
NORTHSHORE CONSOLIDATION FEASIBILITY STUDY

Whatcom County, Washington

1.0 INTRODUCTION

The Washington State Department of Health (DOH) has entered into an interagency agreement with Lake Whatcom Water and Sewer District of Whatcom County (LWWSD) to prepare and submit a feasibility study evaluating consolidating three existing Group A water systems on the north shore of Lake Whatcom: Eagleridge (#08118), Agate Heights (#52957), and Agate Bay Trailer Park (#00496). In addition, two Group B water systems and numerous individual homes will be considered for consolidation. All are within the District's service area boundary as shown in Figure 1.

Development of this area has resulted in several private water systems, individual wells and individual surface water withdrawals that generally have limited or no fire flow capacity and are relatively expensive to operate due to their small size. The goal of this study is to examine the feasibility of combining the systems into one system that would result in improved water quality and quantity, and increased safety and reliability.

The study area is classified as Rural and with R5A zoning (one unit per five acres). This area is shown in Figure 2. Note that 90% of the lakefront development has already occurred, and at density levels much higher than one unit per five acres.

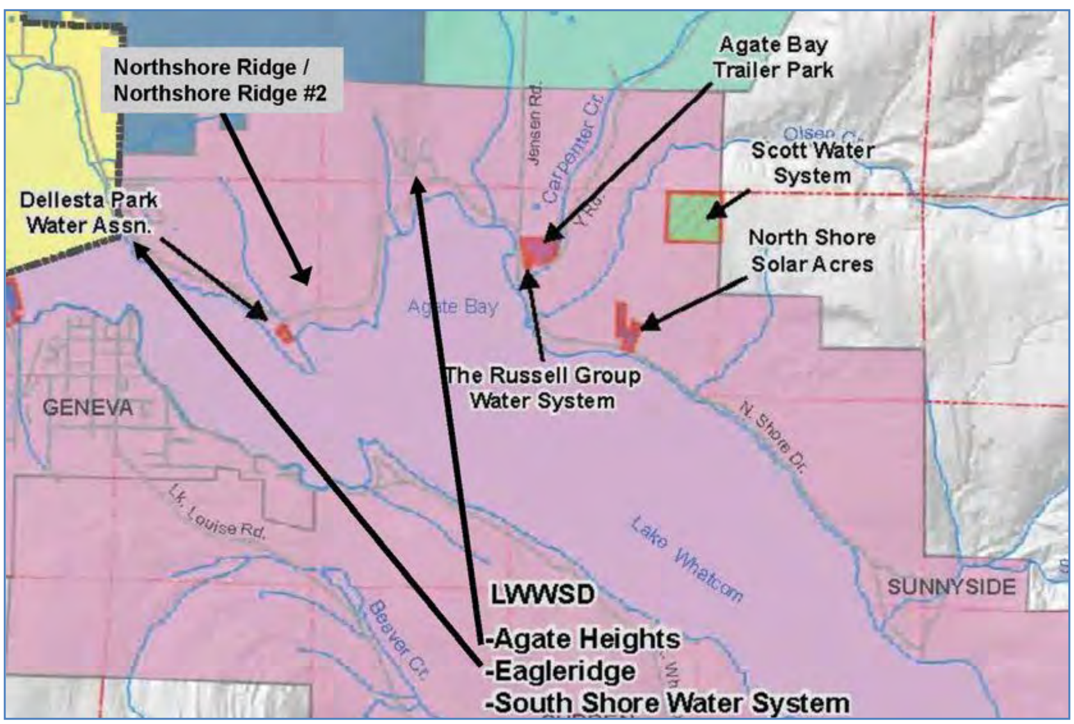


Figure 1. North Shore Area from Whatcom County Coordinated Water System Plan Map

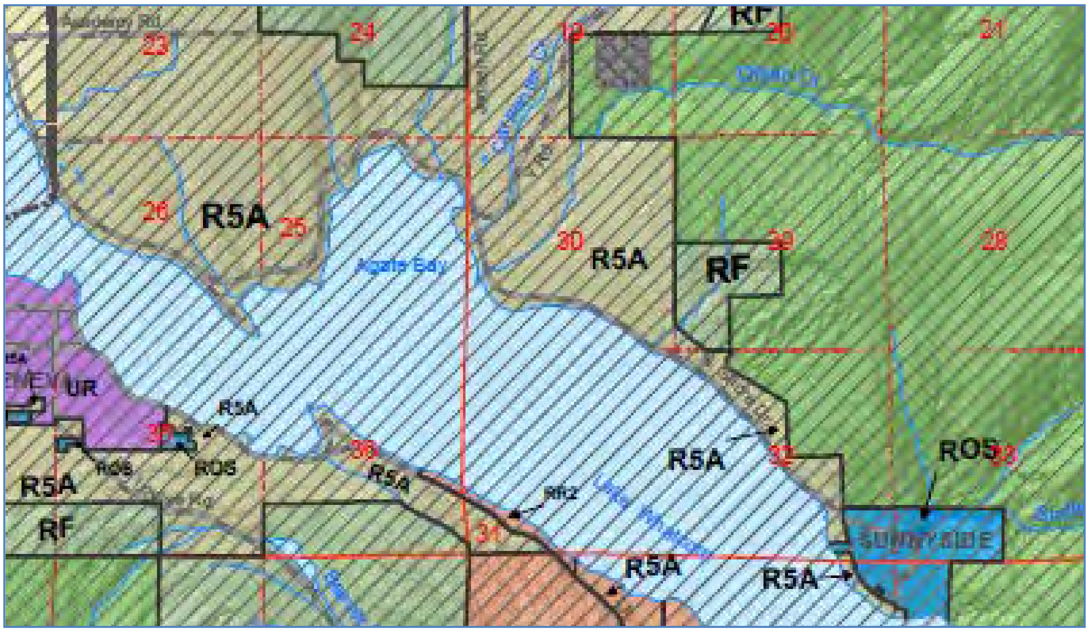


Figure 2. Whatcom County Zoning for North Shore Area

2.0 NORTHSHORE STUDY AREA EXISTING CONDITIONS

The Northshore area of Lake Whatcom Water and Sewer District is located 5 miles east of the center of Bellingham and abuts the City limits on its western edge. The study area is zoned rural - R5A (rural 1 unit per 5 acres). Water facilities inventory forms (WFI's) for several of the systems are included in the Exhibit 1. The Group A systems are (1) Eagleridge (LWWSD), (2) Agate Heights (LWWSD), (3) Agate Bay Trailer Park, and (4) Russel Group (The Fork restaurant). In addition there are several Group B water systems which include (5) North Shore Solar Acres, (6) North Shore Ridge, (7) North Shore Ridge #2, and (8) Dellesta Park. There are also 330 existing private residences within the study area that are on private wells or direct lake draws. The estimated number of existing potential water services with the study area total approximately 525. The subject individual water systems are shown on Figure 1 and the capacity of each is listed below.

- Eagleridge Water System – water source is City of Bellingham; 70 connections; capacity = 85
- Agate Heights Water System – water source is a District-owned well; 39 connections (44 ERUs); capacity = 48 connections (54 ERUs)
- Agate Bay Trailer Park Water System – Group A, well source, 25 connections
- Russell Group (restaurant) – Group A, well source, one connection
- Dellesta Park – Group B, well source, 5 connections (capacity=7)
- North Shore Solar Acres – Group B, well source, 6 connections
- Northshore Ridge – Group B, well source, 4 connections
- Northshore Ridge #2 – Group B, well source, 3 connections

2.1 Source of Supply

For the consolidated water system, the District plans to use its Agate Heights well as the Source of Supply, and maintain the connection to the City of Bellingham at Eagleridge as an emergency intertie.

Well - The District's well at Agate Heights is a 10-inch artesian well with a pumped capacity of 494 gpm (322 gpm from artesian pressure). A 100-ft radius protective zone is provided with a

Restrictive Covenant for the well.

Water Rights – The District has several water rights (Permits and Certificates) associated with this well that total 438 gpm:

1. G22681P - 60 gpm instantaneous; 32.4 acre-ft/yr annual
2. G22763P - 360 gpm instantaneous; 465.9 acre-ft/yr annual
3. G23449 - 18 gpm instantaneous; 8.6 acre-ft/yr annual

Water Quality – The water from the existing well needs to be treated to remove manganese. The Agate Heights Water Treatment Plant is currently a 30 gpm Filtronics package treatment system which is nearing capacity. The District plans to increase the capacity of the water treatment plant to accommodate localized demand even if the consolidation project is not constructed.

2.2 Storage

The Agate Heights water system has two reservoirs at two different elevations. The lower 80,000 gallon reservoir is filled at a rate of 30-gpm by the system transmission pumps, which is activated when the treatment plant is operated. The upper 105,000 gallon reservoir is filled at a rate of 21 gpm. The source is the lower reservoir. The existing reservoirs currently provide equalizing, standby, and fire storage for the Agate Heights water system.

2.3 Booster Pumps / Transmission Pumps

The Eagleridge water system currently uses booster pumps to maintain water pressure. With the consolidated water system, these booster pumps would no longer be needed. The Agate Heights water treatment plant pumps are sized to match the treatment plant capacity. The transmission pumps for the filling the upper tank are converted booster pumps, repurposed when the upper tank was installed.

2.4 Distribution System

The water distribution systems both consist entirely of 8-inch ductile iron pipe. Eagleridge currently provide 750 gpm for fire protection and Agate Heights currently provide 500-750 gpm for fire protection.

3.0 SYSTEM DEMANDS

For this feasibility study, we have developed three scenarios based on different projections for system expansion:

- Alternative 1 – Match District sewer service area
- Alternative 2 – Extend water to east end of Northshore Road
- Alternative 3 – Extend only to Group A systems at Y Road

The service areas and proposed schematic facility locations for each of these Alternatives are included in Exhibit 2.

We reviewed the Average Day Demand (ADD) and Maximum Day Demand (MDD) values for both the Eagleridge and Agate Heights water systems listed in the 2010 Water Comprehensive Plan and the 2016 Water Use Efficiency Plan Update since the customers on these systems would be similar to the new customers incorporated into the consolidated water system. The average of the four ADD values in these two reports is 243 gpd/ERU. Given that the existing data set is a small number of customers, and that the DOH Manual recommends using 350 gpd/ERU as a minimum, this analysis used 350 gpd/ERU for ADD.

The average of the four MDD values in these two reports is 680 gpm/ERU. When good metered data is not available, the DOH Manual recommends using two times the ADD for MDD. This analysis used 700 gpd/ERU for MDD.

The resulting PHD (peak hourly demand) is computed using DOH'S PHD Worksheet (See Appendix 8) for each Alternative. In addition to PHD, this water system will provide residential fire flows of 750 gpm.

4.0 SYSTEM ANALYSIS

Analysis is performed in accordance with DOH "Water System Design Manual" as described below. The amount of water supply and storage are interdependent. For instance, equalizing storage is used to supply the difference between pumping rate and demand rate. When demand rates are greater than pumping rates, water in storage is used to supply the difference. When demand rates are less than pumping rates, storage is replenished. The greater the capacity of the water supply the less equalizing storage needed. The minimum capacity of the source(s) must be equal to or greater than the maximum daily demand.

4.1 Source of Supply

The 10-inch well at Agate Heights has been performance tested at 494-gpm, however the current pump capacity is limited to 30-gpm. The District holds water rights on this well for 438 gpm. The MDD (maximum daily demand) for the system is projected to be 700 gpd/ERU. To meet MDD for any of the Alternatives, the treatment plant and pumping capacity will need to be increased.

The size of water treatment plant that each Alternative would need is calculated as follows and listed in the table below:

Build out rate = (700 gpd/parcel X Build-out ERUs) / (1,440 mins/day) = Plant Size (gpm)

Scenario:	Build-out ERUs	Minimum Plant Size (*)
Alternative #1	405	200 gpm
Alternative #2	530	260 gpm
Alternative #3	355	175 gpm

4.2 Storage

Storage required consists of the sum of operating storage, equalizing storage and the greater of standby storage or fire flow storage. Currently Agate Heights has an 80,000 gallon reservoir and a 105,000 gallon reservoir. For this analysis, we excluded the 105,000 gallon reservoir, which serves the upper pressure zone and provides fire suppression storage for the Lake Whatcom Residential and Treatment Center. Eagleridge relies on storage capacity provided by the City of Bellingham.

The total storage volume is the sum of several components. Operating storage is the volume between the “off” and “on” control levels in the reservoir. Equalizing storage is equal to the product of 150 and the difference in peak hourly demand (PHD) and supply rate. Standby storage is equal to twice the ADD of 350 gpd/ERU x N ERUs. Minimum fire suppression storage for the residential portion of this system is 45,000-gallons; however this is nested with standby storage; resulting in the larger of the two values being applicable. Dead storage is the volume in the bottom of the tank below the “silt guard” outlet plus the volume at the top of the tank above the “off” probe. The “total storage required” is the sum of each of these values and can be compared with “storage available” as reflected in the table below. The table also indicates the minimum additional storage volume required. Please note that these values are based on a DOH Design Manual ADD of 350 gpd/ERU and highly sensitive to that value because the largest component of storage (Standby Storage) is equal to two times ADD times the number of ERUs. For example, if the calculated average for ADD of 243 gpd/ERU (see Section 3) were used, the total required storage for Alternative #1 would be reduced by about 82,000 gallons to 230,000 gallons. Using the lower value for ADD will require DOH approval.

Scenario:	**Total Required Storage (gallons)**	**Storage Available (gallons)**	**Additional Storage Needed (gallons)**
Alternative #1	312,000	80,000	232,000
Alternative #2	403,000	80,000	323,000
Alternative #3	274,000	80,000	194,000

4.3 Transmission Pumps

The transmission pump system needs to deliver the treated water to the storage reservoir(s). The flow rates will be sized to match the water treatment plant capacity, and the required pumping head will be calculated based on the elevation head and the friction head.

4.3 Distribution System

The consolidated system will provide 750 gpm fire flow and ensure that a minimum pressure of 20 psi is maintained at each service meter during a fire flow event. Supplying fire flows is the driving factor in the sizing of the distribution system. The hydraulic analyses indicated that the majority of the distribution pipe will need to be 12-inch diameter in order to meet the fire flow scenarios. The remainder will be a minimum of 8-inch diameter.

The District standard practice is to install fire hydrants every 600 feet along the distribution mains.

5.0 PROJECT COST ESTIMATE AND FUNDING OPTIONS

5.1 Project Cost Estimate

We have evaluated three scenarios and developed planning level cost estimates for each. The first is Alternative1 which matches the existing District sewer service area (ending approximately at the east side of Agate Bay). Alternative 2 extends water service to the east end of Northshore Road. Alternative 3 limits the water system extension to only as far as needed to connect the existing Group A water systems and end at the Y Road. These preliminary, planning level cost estimates are included in Exhibit 3.

The preliminary project cost estimate for Alternative 1 is $6.3M to $6.9M. This includes engineering, permitting, and surveying in addition to construction costs and 10-20% contingency. It does not include the cost of metered service connections since the level of participation is unknown, and those costs are typically born directly by the property owners. The build-out number of Equivalent Residential Units (ERUs) assumed for Alternative 1 is 405 (120 from existing service areas).

The Alternative 2 scenario builds on Alternative 1, and adds about 11,750 feet of water main, nineteen fire hydrants, a larger storage reservoir, and a larger water treatment plant and transmission pumps. The build-out number of Equivalent Residential Units (ERUs) assumed for Alternative 2 is 530 (120 from existing service areas).

The preliminary project cost estimate for Alternative 2 is $9.1 to $10M. Again, this includes engineering, permitting, and surveying in addition to construction costs and 10-20% contingency. It does not include the cost of metered service connections since the level of participation is unknown, and those costs are typically born directly by the property owners.

Alternative 3 is a reduction from Alternative 1 - it has about 3,650 feet less of water main and 6 fewer fire hydrants. It also reduces the number of potential future customers by about 50 - the build-out number of Equivalent Residential Units (ERUs) assumed for Alternative 3 is 355 (120 from existing service areas).. The preliminary project cost estimate for Alternative 3 is about $5.7 to $6.2M.

5.2 Financing Options

There are several potential sources of funds for financing a drinking water project of this size. The Drinking Water State Revolving Fund (DWSRF) Loan program specifically targets projects that consolidate existing Group A water systems and will forgive up to 50% of the loan principal for these projects, subject to funding availability. These loans typically have a payback period of 24 years, so collection can also occur over time, and substantially reduce the up-front costs to participants. The Public Works Trust Fund would also fund a project like this, though funds are not reliably available. The District could issue a Revenue Bond, which would typically have a 20 year payback. The final possible funding source considered was USDA-Rural Development, which has a term of up to 40 years, but will only fund projects that have no other financing options. A summary of rates and terms for these options is listed below.

Funding Source	Interest Rate	Loan Term
Drinking Water State Revolving Fund (DWSRF) Consolidation Loan • Potential for 50% principal forgiveness (if funds are available)	1.5%	24 years
Public Works Trust Fund Loan	1-2%	20 years
Revenue Bond (as of 4/20/17; AA Bond Rating)	2.73%	20 years
USDA-Rural Development (as of 7/1/17) • Funding source of last resort	3.25%	up to 40 years

Of these options, the DWSRF Loan with the 50% principal forgiveness is the most attractive financing option because it substantially reduces the amount of capital expenditures that need to be recovered. However, there is the uncertainty that funds would be available for the principal forgiveness portion of the loan. Loan applications are typically accepted in September, and are funded based on how well the project scores on Department of Health evaluation criteria.

The Revenue Bond is a funding source that is more under the control of the District than any of the loan options. The District has an AA Bond Rating and has obtained financing for capital project using Revenue Bonds in the past. Because the District has bonding capacity, it is less likely to qualify for funding from USDA-Rural Development.

5.3 Cost Sharing Options

We have identified three potential methods the District could use to collect payments over time - a Utility Local Improvement District (ULID), a “Special Benefit Area” fee assessed upon connection, or a fixed debt-service/capital charge on the water bill. The underlying assumption for all of these options is that the costs will be borne by the new connections or assessed properties, and not by existing District customers.

The main advantage of a ULID is that it would assess all of the properties that benefit from the improvement, whether they connect or not. It also allows the assessment to be paid over time - typically 20 years with interest. It would address the inherent inequity of those who connect subsidizing fire protection for neighbors who elect not to connect. The disadvantage of a ULID is the high costs associated with creating the ULID and the hurdle that the assessment must be no more than the amount the property’s value is increased by the assessment. The area to be served is already 90% built-out, and these homes already have some source for water. We assume, therefore, that the assessment needed would exceed the amount allowed under the ULID statute.

The “Special Benefit Area” fee would be similar to a ULID, without using the formal ULID process. The project costs would be divided amongst an estimated number of likely connections. It would be possible to pay over time with a security interest recorded against the property.

It is challenging to predict the number of properties that would connect to the public water system if it is installed. Typically, a municipal purveyor cannot compel connection to a public water system, and there is a contingent of property owners who are not interested in connecting to public water. There are, however, approximately 250 residences on surface water withdrawals - some with permits, some with claims and some with applications pending. Of the 118 with permits, the Department of Ecology (DOE) estimates that about 64 include a provision “to connect to a public water supply when connection to such system is practical and discontinue use from the lake.” DOE has indicated that the 42 pending applications would be similarly provisioned, as would any new applications for surface water withdrawals. The District has also been requiring new sewer-only customers to sign a Covenant that requires them to connect to water when it is available. The number of these covenants in place is unknown, and many probably overlap with the DOE provisional water rights. Figure 3 shows the status of surface water rights based on DOE’s database. Note that the map excludes District customers but not others on wells or small water systems. These are red on the map, since they do not having a ***surface*** water right.

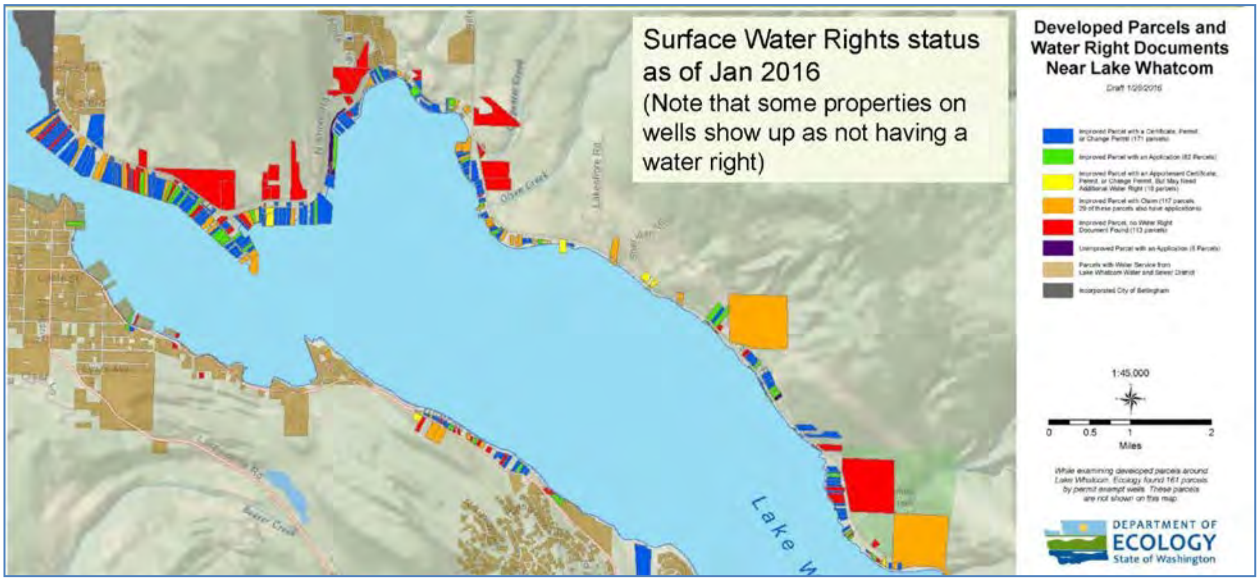


Figure 3. Department of Ecology Surface Water Right Status Map

The third option for cost recovery is adding a capital recovery charge to the water bills. This fee would not apply to existing District water customers on the North Shore. This is a simple approach, and allows the cost share to be adjusted as new connections are added. It may be interesting to investigate adding a capital recovery charge for the portion of the water system needed to provide fire protection to the sewer bills of the existing district customers. This would capture some of those who benefit from the fire protection provided by the improvements, but elected not to connect to public water.

The cost share per connection was determined using three participation levels - 50%, 75% and 90%. The cost share range shown in Table 1 below is based on the Alternative Project Costs divided by the projected number of participants for each Alternative. The lowest value represents Alternative 2 which has the highest potential number of new connections.

Table 1. Estimated Cost Share Per Connection

	Cost Share per Connection	
	Lump Sum Fee (range)	**Annualized Fee (based on 20-year Bond repayment at 2.73%)**
50% Participation	\$48,000 - \$56,500	\$3,146 - \$3,704
75% Participation	\$33,500 - \$39,200	\$2,196 - \$2,570
90% Participation	\$28,500 - \$33,300	\$1,868- \$2,183

* Lump sum fee includes an estimate for the service connection including the meter assembly

If the District pursues and secures a DWSRF Loan with up to 50% principal forgiveness for a consolidation project, then the project costs would be greatly reduced and the connection share would also be much less.

The District recently had its general facilities / connection charge for future connections reviewed. The analysis conducted did not include this potential project as a future capital investment because it was assumed that the project would be paid for by those who benefit. It also did not include the potential new customers associated with this system expansion.

Because of the size of this system expansion when compared to the existing District water utility assets, it may be beneficial to consider establishing a separate general facilities / connection charge for the North Shore. The majority of the water infrastructure is in the South Shore water system, and the majority of customers are served by the South Shore system. The general facilities / connection charge is the “buy-in” for the new customers to the existing system and the consolidation project is essentially installing a new water system for the North Shore service area. It would follow that the cost share per connection above would be the basis for a new general facilities / connection charge specifically for the North Shore, with the appropriate incorporation of the existing assets at Eagleridge and Agate Heights to the “buy-in” calculation.

5.4 Example Rates and Charges

Example Bi-monthly water charges: These numbers are very preliminary and are based on existing District water rates and average water use by Agate Heights water system customers.

- Base Rate = $62.31/two months
- Water Usage over 600 cubic feet (CF) = $8.85/100 CF
- Bi-monthly Base + average usage = $171.43 ($85.72/month)

As an example, a property with a one-inch water service and an average of 750 gallons per day water use would have a total monthly bill in the range of $213.10 to $253.10.

6.0 PUBLIC MEETING AND OUTREACH FEEDBACK

A public meeting was held on June 20, 2017, at 6:30pm at the North Whatcom Fire Hall. The meeting was well attended with 54 individuals and couples signing in. Several District Commissioners were in attendance, along with the General Manager and Assistant General Manager. The consolidation Alternatives and preliminary cost estimates were presented and the floor was open for questions and discussion. There were many comments and questions before the meeting was adjourned at 7:36 pm. There were two main themes of the discussion - comments of support for the project and comments against the project as promoting growth and development in the Lake Whatcom watershed.

A questionnaire was also available and 47 were filled out and returned that evening. Several more were returned the next day. A copy of the questionnaire and the raw results are included in Exhibit 4. The questionnaire gathered some basic information (property use, water source) in addition to interest in connecting to public water. It also polled motivations to connect and financial priorities.

The initial questionnaire responses were evenly split between those who wanted to connect to public water and those who didn’t (21 yes / 21 no). Six respondents wrote in “maybe” or “depends”. There were also recurring items that came up under “motivation” such as fire protection/safety that were added to the second generation questionnaire.

6.1 Summary of Questionnaire Responses

On July 10, 2017, the District sent a follow-up letter with the updated questionnaire to all property owners within the potential service area. The letter indicated that responses should be returned by July 31, 2017.

As of August 24, 2017, the District received 253 questionnaire responses, both from the public meeting and the subsequent mailing to the properties in the area. The mailing included existing District water customers in Eagleridge and Agate Heights, and did not exclude those who had submitted responses at the public meeting since not all of the responses received included addresses. There are known duplicates in the data set that can be identified by names or addresses, and there are probably also unknown duplicates in the responses that did not include a name or address.

The raw questionnaire data is included in Exhibit 4. In analyzing the data, we used addresses to identify 21 responses came from existing District customers. These responses are not included in the summary results listed below.

The breakdown of the questionnaire responses are listed below:

1. What is the current use of your property?
    - Single Family 200
    - Vacant 19
    - Other 12
    - No entry 1

2. What is the water source for your property?
    - Lake Draw 109
    - Well/Lake Draw 2 (checked two boxes)
    - Well 52
    - Shared Well 40
    - Water System 9
    - Rainwater 3
    - Other 6
    - None/No entry 11

3. Are you interested in connecting to a public water system? (broken down by water source)

Water Source:	Yes	No	Maybe/Depends
Lake Draw	29	53	27
Well/Lake Draw	2		
Well	14	23	15
Shared Well	15	12	13
Water System	3	1	5
Rainwater	1	1	1
Other	2	3	1
None	7		1
No entry	1	2	
TOTAL	**74**	**95**	**63**

4. If you are interested, what is your motivation to connect to a public water system?

	Yes	Maybe/Depends
• Reliability	62	36
• Water Quality	59	23
• Water Quantity	20	15
• Fire protection	23	12
• Other	6	8

5. If you are interested, what will drive your decision-making process? (Rank 1-4 with 1 being most important)

	Yes				**Maybe/Depends**			
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Overall cost to connect	38	18	4	0	36	18	0	0
Ability to pay connection fee over time	11	17	17	3	4	18	15	3
Estimated water bills	5	23	22	3	7	25	15	1
Other *	11	4	0	8	4	1	2	7

*"Other" includes: water pressure, less maintenance, timing, wants public sewer included, access to water, fire protection, monitored supply, ability to keep current water source for irrigation, will water use be limited, wants mineral-free water, resale of property, clogged intakes.

The "Comments" section of the questionnaire was well used. All of the comments are included with the raw questionnaire data in Exhibit 4. A summary of the most common comments is provided below.

The two main concerns of those who responded that they were not interested in connecting to public water were the costs associated with it and that they see public water as promoting growth in the Lake Whatcom watershed. These properties already have a water source that they are happy with. It is interesting to note that one "No" response was interested in fire protection, and another was interested in connecting to public sewer.

The primary concern of those who responded with "maybe/depends" is cost. Several also expressed concern about promoting growth and four expressed interest in a sewer connection.

The comments received by those who were interested in connecting to public water included general statements of support for the project, interest in fire protection, and interest in access to a potable water source with good quality water. There were two "yes" responders interested in connecting to public sewer. Most of the vacant properties indicated that they would connect considering the current circumstances where the Hirst decision has effectively placed a moratorium on using individual wells for new development.

It is interesting to note that three responders indicated that they are using rain water harvesting as their water source, which confirms that development has not been prevented from occurring even with the "moratorium" on individual wells. One is very interested in connecting to public water, one has just spent $18,000 for the rainwater system and is not interested in public water.

6.2 Other Concerns / Comments

Several brought up the question of whether they would be able to continue to use their existing water source for irrigation, or as a back-up supply. This is a question best answered by the Department of Ecology. We have not pursued this subject with them.

There were several questions at the public meeting about whether the District would force residences to connect. In general, the District does not have the authority to compel connection to public water. The District does have the authority to compel connection to public sewer, and has a policy that connecting to water is required with a sewer connection, where water is available. It was brought up that the District has been requiring sewer-only connections to sign a Covenant that would require connection to public water when it is available.

7.0 SUMMARY AND CONCLUSIONS

All of the water system consolidation Alternatives are technically feasible - the District has sufficient water rights on a well with sufficient production capacity, and the ability to expand the water treatment plant at the existing site. Potential challenges include obtaining a site for the new water reservoir, and underground conditions (possible rock). The financial feasibility of this project depends on the participation of enough parties to make the financial commitment acceptable. Overall costs and the ability to pay over time will be key to achieving reasonable participation levels of those in the “maybe/depends” category.

The public process for this project has raised other factors to consider which are discussed below.

7.1 Public Health

Water quality was the second highest potential motivation for connecting to public water. The District recently completed a program to test the lake waters along the east end of Northshore Road for phosphorus and fecal coliform. This area does not have public sewer, and there are about 100 homes on septic systems, many of which are older and quite close to the Lake. The test results indicate that human fecal coliform bacteria are leaching into the Lake.

These results were not widely distributed prior to the District distributing the water consolidation questionnaire. It raises the question as to whether some of the lake draw respondents would change their response from “no” to “yes” with this additional information.

7.2 Fire Protection

Several of the questionnaire responders indicated that they were also interested in the fire protection that a public water system would bring. Given that there is a significant percentage of the properties in the service area that are not interested in connecting to public water, the District should consider its options on cost recovery for providing hydrants and fire storage for those who benefit from this infrastructure but are not “paying customers”.

7.3 Protection of Lake Whatcom

Many of the questionnaire responders who were against the consolidation project expressed concern that extending public water would promote growth in the watershed and harm the lake in the process. The District is not the Land Use Authority - Whatcom County is. It should be noted that other sources of water are available - surface water for those next to the Lake, and rainwater harvesting for those not able to drill a well. At this time, the Hirst decision has halted the use of permit-exempt wells in Whatcom County, but that is not preventing development in the watershed - it is promoting the proliferation of rainwater harvesting systems. It should be noted that the proposed service area is already 90% built-out, and the availability of public water will have no impact on whether properties are able to subdivide.

There were a few responses that requested a sewer extension and indicated that they would be more interested in connecting to sewer, and that they felt extending sewer would do more to protect the lake than extending water. The District agrees there is a benefit to extending sewer and eliminating septic systems, but is constrained by the Growth Management Act (GMA) on how it proceeds since the un-sewered area is outside of an Urban Growth Area (UGA) or a Limited Area of More Intense Rural Development (LAMIRD).

7.4 Next Steps

The information the District has gathered under this study has been very informative and the District will continue to process and discuss these results. One possible future activity would be to “map” the results of those interested vs not interested, and the properties with covenants that require them to connect. Another potential follow on effort would be a sensitivity analysis on the project cost estimate to see what assumptions have a significant impact on costs (e.g. level of fire protection or standby storage). Reducing the overall costs will be critical in maximizing the number of properties that connect to public water.

EXHIBITS

1. Water Facilities Inventories (WFI)
2. Maps / Exhibits
3. Water System Consolidation Preliminary Cost Estimates
4. Questionnaire and Responses

1. Water Facilities Inventories (WFI)

WATER FACILITIES INVENTORY (WFI) FORM

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

ONE FORM PER SYSTEM

Quarter: 2
Updated: 02/14/2014
Printed: 10/19/2015
WFI Printed For: On-Demand
Submission Reason: No Change

RETURN TO: Central Services – WFI, PO BOX 47822, Olympia WA 98504-7822

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
00496 X	AGATE BAY TRAILER PARK	WHATCOM	A	Comm

6. PRIMARY CONTACT NAME & MAILING ADDRESS	7. OWNER NAME & MAILING ADDRESS	8. Owner Number 031520
DEREK & MEGAN WATT [OWNERS] PO BOX 1462 BELLINGHAM, WA 98227	DEREK & MEGAN WATT PO BOX 1462 BELLINGHAM, WA 98227	TITLE:
STREET ADDRESS IF DIFFERENT FROM ABOVE	STREET ADDRESS IF DIFFERENT FROM ABOVE	
ATTN ADDRESS 1700 NORTH SHORE DRIVE CITY BELLINGHAM STATE WA ZIP 98226	ATTN ADDRESS 1700 NORTH SHORE DRIVE CITY BELLINGHAM STATE WA ZIP 98226	

9. 24 HOUR PRIMARY CONTACT INFORMATION	10. OWNER CONTACT INFORMATION
Primary Contact Daytime Phone: (360) 715-3600	Owner Daytime Phone: (360) 715-3600
Primary Contact Mobile/Cell Phone:	Owner Mobile/Cell Phone:
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)

- [ ] Agricultural
- [ ] Commercial / Business
- [ ] Day Care
- [ ] Food Service/Food Permit
- [ ] 1,000 or more person event for 2 or more days per year
- [ ] Hospital/Clinic
- [ ] 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
- [ ] City / Town
- [ ] County
- [ ] Federal
- [ ] Investor
- [x] Private
- [ ] Special District
- [ ] State

14. STORAGE CAPACITY (gallons)

0

15 Source Number	16 SOURCE NAME: LIST UTILITY'S NAME FOR SOURCE AND WELL TAG ID NUMBER. Example: WELL #1 XYZ456. IF SOURCE IS PURCHASED OR INTERTIED, LIST SELLER'S NAME Example: SEATTLE	17 INTERTIE: INTERTIE SYSTEM ID NUMBER	18 SOURCE CATEGORY: WELL	WELL FIELD	WELL IN A WELL FIELD	SPRING	SPRING FIELD	SPRING IN SPRINGFIELD	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	Well #2 BAE194		X										X				X						183	35	SE NW	30	38N	04E

WATER FACILITIES INVENTORY (WFI) FORM - Continued

1. SYSTEM ID	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
00496 X	AGATE BAY TRAILER PARK	WHATCOM	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	25	25
A. Full Time Single Family Residences (Occupied 180 days or more per year)	25		
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	0		
B. Full Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied more than 180 days/year	0		
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	0
B. Institutional, Commercial/Business, School, Day Care, Industrial Services, etc.	0	0	0
28. TOTAL SERVICE CONNECTIONS		25	25

29. FULL-TIME RESIDENTIAL POPULATION

A. How many residents are served by this system 180 or more days per year? 40

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
	1	1	1	1	1	1	1	1	1	1	1	1

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: ____________________________

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

WATER FACILITIES INVENTORY (WFI) FORM

ONE FORM PER SYSTEM

Quarter: 0
Updated: 04/27/2005
Printed: 4/19/2017
WFI Printed For: On-Demand
Submission Reason: Name Change

RETURN TO: Central Services - WFI, PO Box 47822, Olympia, WA, 98504-7822

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
07898 X	DELLESTA PARK WATER ASSN	WHATCOM	B	

6. PRIMARY CONTACT NAME & MAILING ADDRESS

LYDIA COOPER [WS - PRIMARY CONTACT]
TOM HOUDE
2143 DELLESTA DR
BELLINGHAM, WA 98226

STREET ADDRESS IF DIFFERENT FROM ABOVE

ATTN LEONARD TAN
ADDRESS 2127 DELLESTA DR
CITY BELLINGHAM STATE WA ZIP 98226

7. OWNER NAME & MAILING ADDRESS

DELLESTA PARK WATER ASSOCIATION
NEED PRIMARY CONTACT OWNER ORG
2143 DELLESTA DR
BELLINGHAM, WA 98226

8. OWNER NUMBER: 020959

OWNER ORG - PRIMARY CO

STREET ADDRESS IF DIFFERENT FROM ABOVE

ATTN
ADDRESS
CITY STATE ZIP

9. 24 HOUR PRIMARY CONTACT INFORMATION	10. OWNER CONTACT INFORMATION
Primary Contact Daytime Phone: (360) 671-0697	Owner Daytime Phone: (360) 671-0697
Primary Contact Mobile/Cell Phone:	Owner Mobile/Cell Phone:
Primary Contact Evening Phone: (xxx)-xxx-xxxx	Owner Evening Phone:
Fax: E-mail: xxxxxxxxxxxxxxxxxxxx	Fax: E-mail: xxxxxxxxxxxxxxxxxxxx

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)

- [ ] Agricultural
- [ ] Commercial / Business
- [ ] Day Care
- [ ] Food Service/Food Permit
- [ ] 1,000 or more person event for 2 or more days per year
- [ ] Hospital/Clinic
- [ ] 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)

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

14. STORAGE CAPACITY (gallons)

2,500

15 Source Number	16 SOURCE NAME — LIST UTILITY'S NAME FOR SOURCE AND WELL TAG ID NUMBER. Example: WELL #1 XYZ456. IF SOURCE IS PURCHASED OR INTERTIED, LIST SELLER'S NAME Example: SEATTLE	17 INTERTIE — INTERTIE SYSTEM ID NUMBER	18 SOURCE CATEGORY: WELL	WELL FIELD	WELL IN A WELL FIELD	SPRING	SPRING FIELD	SPRING IN SPRINGFIELD	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
S01	WELL #1 AGF149		X										X			Y		X					215	5	NE SE	26	38N	03E

WATER FACILITIES INVENTORY (WFI) FORM - Continued

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
07898 X	DELLESTA PARK WATER ASSN	WHATCOM	B	

	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?)		5	7
A. Full Time Single Family Residences (Occupied 180 days or more per year)	5		
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	0		
B. Full Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied more than 180 days/year	0		
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	0
B. Institutional, Commercial/Business, School, Day Care, Industrial Services, etc.	0	0	0
28. TOTAL SERVICE CONNECTIONS		5	7

29. FULL-TIME RESIDENTIAL POPULATION

A. How many residents are served by this system 180 or more days per year? 20

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
* Requirement is exception from WAC 246-290												

34. NITRATE SCHEDULE	QUARTERLY	ANNUALLY	ONCE EVERY 3 YEARS
(One Sample per source by time period)			

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:** ____________

WATER FACILITIES INVENTORY (WFI) FORM

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

ONE FORM PER SYSTEM

Quarter: 0
Updated: 05/11/2005
Printed: 4/19/2017
WFI Printed For: On-Demand
Submission Reason: Non-Periodic update

RETURN TO: Central Services - WFI, PO Box 47822, Olympia, WA, 98504-7822

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
29418 J	NORTH SHORE SOLAR ACRES	WHATCOM	B	

6. PRIMARY CONTACT NAME & MAILING ADDRESS	7. OWNER NAME & MAILING ADDRESS	8. OWNER NUMBER: 011134
ELIZABETH HERDMAN [PRESIDENT] 3003 LAKESHORE RD BELLINGHAM, WA 98226	NORTH SHORE SOLAR ACRES ELIZABETH HERDMAN 3003 LAKESHORE RD BELLINGHAM, WA 98226	OWNER ORG - PRIMARY CO
STREET ADDRESS IF DIFFERENT FROM ABOVE	**STREET ADDRESS IF DIFFERENT FROM ABOVE**	
ATTN ADDRESS CITY STATE ZIP	ATTN ADDRESS CITY STATE ZIP	

9. 24 HOUR PRIMARY CONTACT INFORMATION	10. OWNER CONTACT INFORMATION
Primary Contact Daytime Phone: (360) 734-0195	Owner Daytime Phone: (360) 734-0195
Primary Contact Mobile/Cell Phone:	Owner Mobile/Cell Phone:
Primary Contact Evening Phone: (xxx)-xxx-xxxx	Owner Evening Phone: (xxx)-xxx-xxxx
Fax: E-mail: xxxxxxxxxxxxxxxxxxxx	Fax: E-mail: xxxxxxxxxxxxxxxxxxxx

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)

- [ ] Agricultural
- [ ] Commercial / Business
- [ ] Day Care
- [ ] Food Service/Food Permit
- [ ] 1,000 or more person event for 2 or more days per year
- [ ] Hospital/Clinic
- [ ] 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
- [ ] City / Town
- [ ] County
- [ ] Federal
- [x] Investor
- [ ] Private
- [ ] Special District
- [ ] State

14. STORAGE CAPACITY (gallons) 2,000

15 Source Number	16 SOURCE NAME: LIST UTILITY'S NAME FOR SOURCE AND WELL TAG ID NUMBER. Example: WELL #1 XYZ456. IF SOURCE IS PURCHASED OR INTERTIED, LIST SELLER'S NAME Example: SEATTLE	17 INTERTIE: INTERTIE SYSTEM ID NUMBER	18 SOURCE CATEGORY: WELL	WELL FIELD	WELL IN A WELL FIELD	SPRING	SPRING FIELD	SPRING IN SPRINGFIELD	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
S01	CALDWELL-WELL		X										X				X						79	3		30	38N	04E
S02	NOAH/WILLOW WELL		X										X				X						98	4		30	38N	04E

WATER FACILITIES INVENTORY (WFI) FORM - Continued

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
29418 J	NORTH SHORE SOLAR ACRES	WHATCOM	B	

	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?)		6	Undetermined
A. Full Time Single Family Residences (Occupied 180 days or more per year)	6		
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	0		
B. Full Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied more than 180 days/year	0		
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.	0	0	
28. TOTAL SERVICE CONNECTIONS		6	

29. FULL-TIME RESIDENTIAL POPULATION

A. How many residents are served by this system 180 or more days per year? 20

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
* Requirement is exception from WAC 246-290												

34. NITRATE SCHEDULE	QUARTERLY	ANNUALLY	ONCE EVERY 3 YEARS
(One Sample per source by time period)			

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:** ____________________

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

WATER FACILITIES INVENTORY (WFI) FORM

ONE FORM PER SYSTEM

Quarter: 0
Updated: 06/04/2009
Printed: 4/19/2017
WFI Printed For: On-Demand
Submission Reason: Pop/Connect Update

RETURN TO: Central Services - WFI, PO Box 47822, Olympia, WA, 98504-7822

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
AC243 K	NORTH SHORE RIDGE # 2 WATER SYSTEM	WHATCOM	B	

6. PRIMARY CONTACT NAME & MAILING ADDRESS	7. OWNER NAME & MAILING ADDRESS	8. OWNER NUMBER: 033525
PERRY ZENDER [MANAGER] 3100 E 21ST PLACE BELLINGHAM, WA 98226	NORTH SHORE RIDGE # 2 PERRY ZENDER 3100 E 21ST PLACE BELLINGHAM, WA 98226	
STREET ADDRESS IF DIFFERENT FROM ABOVE	**STREET ADDRESS IF DIFFERENT FROM ABOVE**	
ATTN	ATTN	
ADDRESS	ADDRESS	
CITY STATE ZIP	CITY STATE ZIP	

9. 24 HOUR PRIMARY CONTACT INFORMATION		10. OWNER CONTACT INFORMATION	
Primary Contact Daytime Phone: (360) 303-2211		Owner Daytime Phone: (360) 303-2211	
Primary Contact Mobile/Cell Phone:		Owner Mobile/Cell Phone:	
Primary Contact Evening Phone:		Owner Evening Phone:	
Fax:	E-mail: xxxxxxxxxxxxxxxxxxxx	Fax:	E-mail: xxxxxxxxxxxxxxxxxxxx

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

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

- ☐ Not applicable (Skip to #12)
- ☐ Owned and Managed
- ☒ Managed Only
- ☐ Owned Only

SMA NAME: NORTHWEST WATER WORKS LLC — SMA Number: 126

12. WATER SYSTEM CHARACTERISTICS (mark all that apply)

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

13. WATER SYSTEM OWNERSHIP (mark only one)

- ☒ Association
- ☐ City / Town
- ☐ County
- ☐ Federal
- ☐ Investor
- ☐ Private
- ☐ Special District
- ☐ State

14. STORAGE CAPACITY (gallons): 2,500

15 Source Number	16 SOURCE NAME: LIST UTILITY'S NAME FOR SOURCE AND WELL TAG ID NUMBER. Example: WELL #1 XYZ456. IF SOURCE IS PURCHASED OR INTERTIED, LIST SELLER'S NAME Example: SEATTLE	17 INTERTIE: INTERTIE SYSTEM ID NUMBER	18 WELL	WELL FIELD	WELL IN A WELL FIELD	SPRING	SPRING FIELD	SPRING IN SPRINGFIELD	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
S01	Well # 1 APA173		X										X			Y						X	28	3	NW SW	25	38N	03E

WATER FACILITIES INVENTORY (WFI) FORM - Continued

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
AC243 K	NORTH SHORE RIDGE # 2 WATER SYSTEM	WHATCOM	B	

	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?)		3	3
A. Full Time Single Family Residences (Occupied 180 days or more per year)	3		
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	0		
B. Full Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied more than 180 days/year	0		
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	0
B. Institutional, Commercial/Business, School, Day Care, Industrial Services, etc.	0	0	0
28. TOTAL SERVICE CONNECTIONS		3	3

29. FULL-TIME RESIDENTIAL POPULATION

A. How many residents are served by this system 180 or more days per year? 9

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
* Requirement is exception from WAC 246-290												

34. NITRATE SCHEDULE	QUARTERLY	ANNUALLY	ONCE EVERY 3 YEARS
(One Sample per source by time period)			

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:** ______

WATER FACILITIES INVENTORY (WFI) FORM

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

ONE FORM PER SYSTEM

Quarter: 0
Updated: 01/20/2009
Printed: 4/19/2017
WFI Printed For: On-Demand
Submission Reason: Contact Update

RETURN TO: Central Services - WFI, PO Box 47822, Olympia, WA, 98504-7822

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
64351 M	NORTHSHORE RIDGE ASSOC	WHATCOM	B	

6. PRIMARY CONTACT NAME & MAILING ADDRESS	7. OWNER NAME & MAILING ADDRESS	8. OWNER NUMBER: 030669
BOB OHARZEWSKI [WS - PRIMARY CONTACT] 3075 E 21ST PL BELLINGHAM, WA 98226	NORTH SHORE RIDGE ASSOCIATION BOB OHARZEWSKI 3075 21ST PL BELLINGHAM, WA 98226	 CONTACT
STREET ADDRESS IF DIFFERENT FROM ABOVE	**STREET ADDRESS IF DIFFERENT FROM ABOVE**	
ATTN ADDRESS CITY STATE ZIP	ATTN ADDRESS CITY STATE ZIP	

9. 24 HOUR PRIMARY CONTACT INFORMATION	10. OWNER CONTACT INFORMATION
Primary Contact Daytime Phone: (360) 738-3422	Owner Daytime Phone: (360) 738-3422
Primary Contact Mobile/Cell Phone: (360) 303-4544	Owner Mobile/Cell Phone:
Primary Contact Evening Phone:	Owner Evening Phone:
Fax: (360) 738-8545 E-mail: xxxxxxxxxxxxxxxxxxxx	Fax: E-mail: xxxxxxxxxxxxxxxxxxxx

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

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

- ☐ Not applicable (Skip to #12)
- ☐ Owned and Managed
- ☒ Managed Only
- ☐ Owned Only

SMA NAME: NORTHWEST WATER WORKS LLC   SMA Number: 126

12. WATER SYSTEM CHARACTERISTICS (mark all that apply)

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

13. WATER SYSTEM OWNERSHIP (mark only one)

- ☒ Association
- ☐ City / Town
- ☐ County
- ☐ Federal
- ☐ Investor
- ☐ Private
- ☐ Special District
- ☐ State

14. STORAGE CAPACITY (gallons): 500

15 Source Number	16 SOURCE NAME (LIST UTILITY'S NAME FOR SOURCE AND WELL TAG ID NUMBER. Example: WELL #1 XYZ456. IF SOURCE IS PURCHASED OR INTERTIED, LIST SELLER'S NAME Example: SEATTLE)	17 INTERTIE (INTERTIE SYSTEM ID NUMBER)	18 SOURCE CATEGORY: WELL	WELL FIELD	WELL IN A WELL FIELD	SPRING	SPRING FIELD	SPRING IN SPRINGFIELD	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
S01	WELL #1 AGO444		X										X					X				X	295	4	SW NW	25	38N	03E

WATER FACILITIES INVENTORY (WFI) FORM - Continued

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
64351 M	NORTHSHORE RIDGE ASSOC	WHATCOM	B	

	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?)		4	4
A. Full Time Single Family Residences (Occupied 180 days or more per year)	4		
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	0		
B. Full Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied more than 180 days/year	0		
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	0
B. Institutional, Commercial/Business, School, Day Care, Industrial Services, etc.	0	0	0
28. TOTAL SERVICE CONNECTIONS		4	4

29. FULL-TIME RESIDENTIAL POPULATION

A. How many residents are served by this system 180 or more days per year? 13

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?						2	2	2				
B. How many days per month are they present?						30	30	30				

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?						2	2	2				
B. How many days per month is water accessible to the public?						30	30	30				

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
* Requirement is exception from WAC 246-290												

34. NITRATE SCHEDULE	QUARTERLY	ANNUALLY	ONCE EVERY 3 YEARS
(One Sample per source by time period)			

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:** ____________________

WATER FACILITIES INVENTORY (WFI) FORM

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

ONE FORM PER SYSTEM

Quarter: 3
Updated: 07/23/2015
Printed: 10/19/2015
WFI Printed For: On-Demand
Submission Reason: Contact Update

RETURN TO: Central Services – WFI, PO BOX 47822, Olympia WA 98504-7822

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
08262 B	THE RUSSELL GROUP WATER SYSTEM	WHATCOM	A	TNC

6. PRIMARY CONTACT NAME & MAILING ADDRESS

GINA & JOHN RUSSELL [OWNERS]
2530 NORTHSHORE RD
BELLINGHAM, WA 98226

STREET ADDRESS IF DIFFERENT FROM ABOVE

ATTN
ADDRESS
CITY STATE ZIP

7. OWNER NAME & MAILING ADDRESS

GINA & JOHN RUSSELL
2530 NORTHSHORE RD
BELLINGHAM, WA 98226

8. Owner Number 033385

TITLE:

STREET ADDRESS IF DIFFERENT FROM ABOVE

ATTN
ADDRESS
CITY STATE ZIP

9. 24 HOUR PRIMARY CONTACT INFORMATION	10. OWNER CONTACT INFORMATION
Primary Contact Daytime Phone: (360) 733-1126	Owner Daytime Phone: (360) 733-1126
Primary Contact Mobile/Cell Phone: (360) 920-7140	Owner Mobile/Cell Phone: (360) 920-7140
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)

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

13. WATER SYSTEM OWNERSHIP (mark only one)

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

14. STORAGE CAPACITY (gallons)

0

15	16 SOURCE NAME	17 INTERTIE	18 SOURCE CATEGORY										19 USE			20	21 TREATMENT						22 DEPTH	23	24 SOURCE LOCATION			
Source Number	LIST UTILITY'S NAME FOR SOURCE AND WELL TAG ID NUMBER. Example: WELL #1 XYZ456 IF SOURCE IS PURCHASED OR INTERTIED, LIST SELLER'S NAME Example: SEATTLE	INTERTIE SYSTEM ID NUMBER	WELL	WELL FIELD	WELL IN A WELL FIELD	SPRING	SPRING FIELD	SPRING IN SPRINGFIELD	SEA WATER	SURFACE WATER	RANNEY / INF. GALLERY	OTHER	PERMANEANT	SEASONAL	EMERGENCY	SOURCE METERED	NONE	CHLORINATION	FILTRATION	FLUORIDATION	IRRADIATION (UV)	OTHER	DEPTH TO FIRST OPEN INTERVAL IN FEET	CAPACITY (GALLONS PER MINUTE)	1/4, 1/4 SECTION	SECTION NUMBER	TOWNSHIP	RANGE
S01	Well 1 AFG162		X										X			Y			X				49	20	SW NW	30	38N	04E

WATER FACILITIES INVENTORY (WFI) FORM - Continued

1. SYSTEM ID	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
08262 B	THE RUSSELL GROUP WATER SYSTEM	WHATCOM	A	TNC

	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	0	1
A. Full Time Single Family Residences (Occupied 180 days or more per year)	0		
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	0		
B. Full Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied more than 180 days/year	0		
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	0
B. Institutional, Commercial/Business, School, Day Care, Industrial Services, etc.	1	1	1
28. TOTAL SERVICE CONNECTIONS		1	2

29. FULL-TIME RESIDENTIAL POPULATION

A. How many residents are served by this system 180 or more days per year? 0

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?	1550	1400	1550	1500	1550	1500	1550	1550	1500	1550	1500	1550
B. How many days per month is water accessible to the public?	31	28	31	30	31	30	31	31	30	31	30	31

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?	5	5	5	5	8	8	8	8	8	5	5	5
B. How many days per month are they present?	31	28	31	30	31	30	31	31	30	31	30	31

33. ROUTINE COLIFORM SCHEDULE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	1	1	1	1	1	1	1	1	1	1	1	1

34. NITRATE SCHEDULE (One Sample per source by time period)	QUARTERLY	ANNUALLY	ONCE EVERY 3 YEARS
		S01	

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: ______________________________

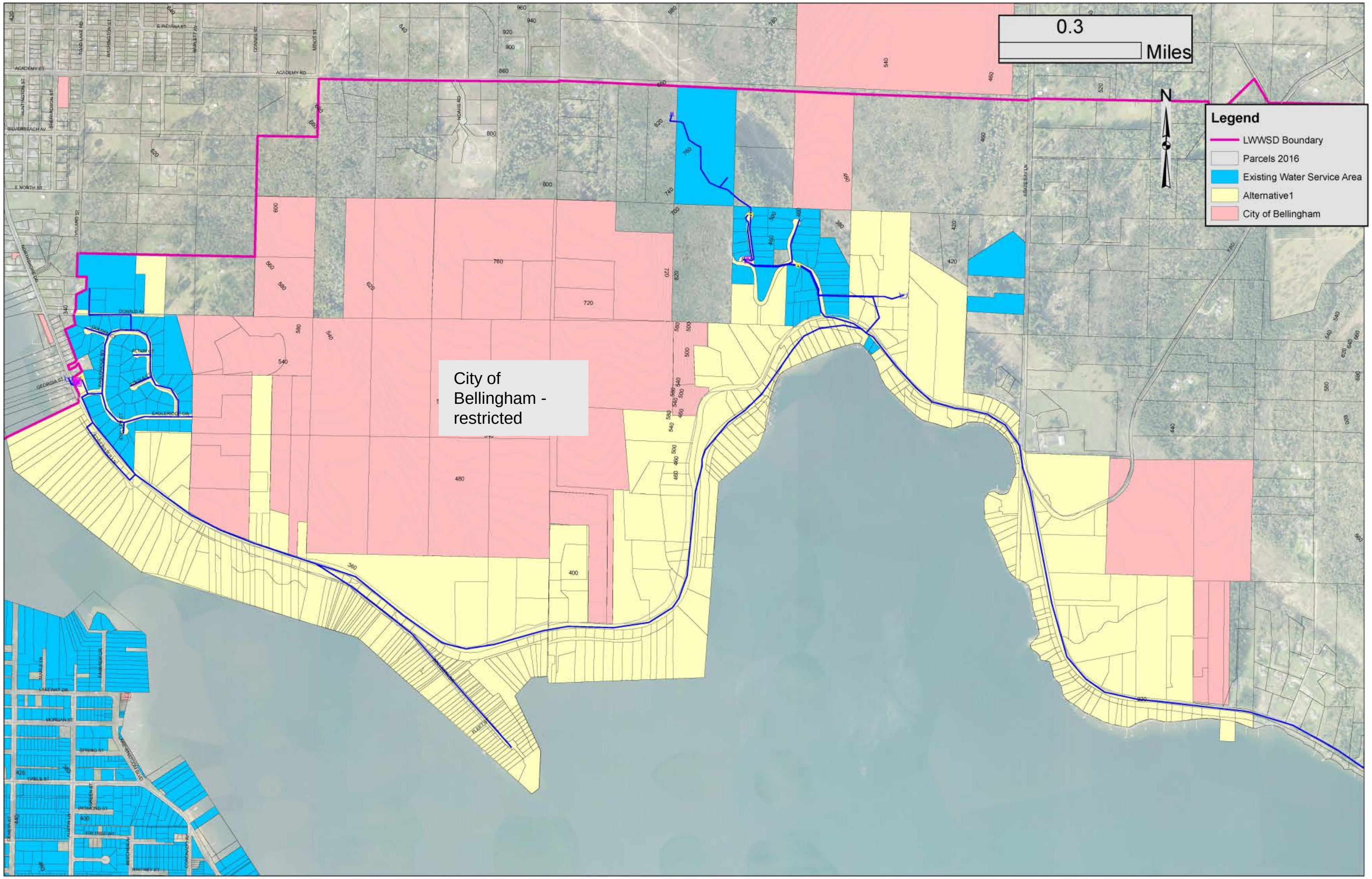
2. Exhibits

A. Alternative 1

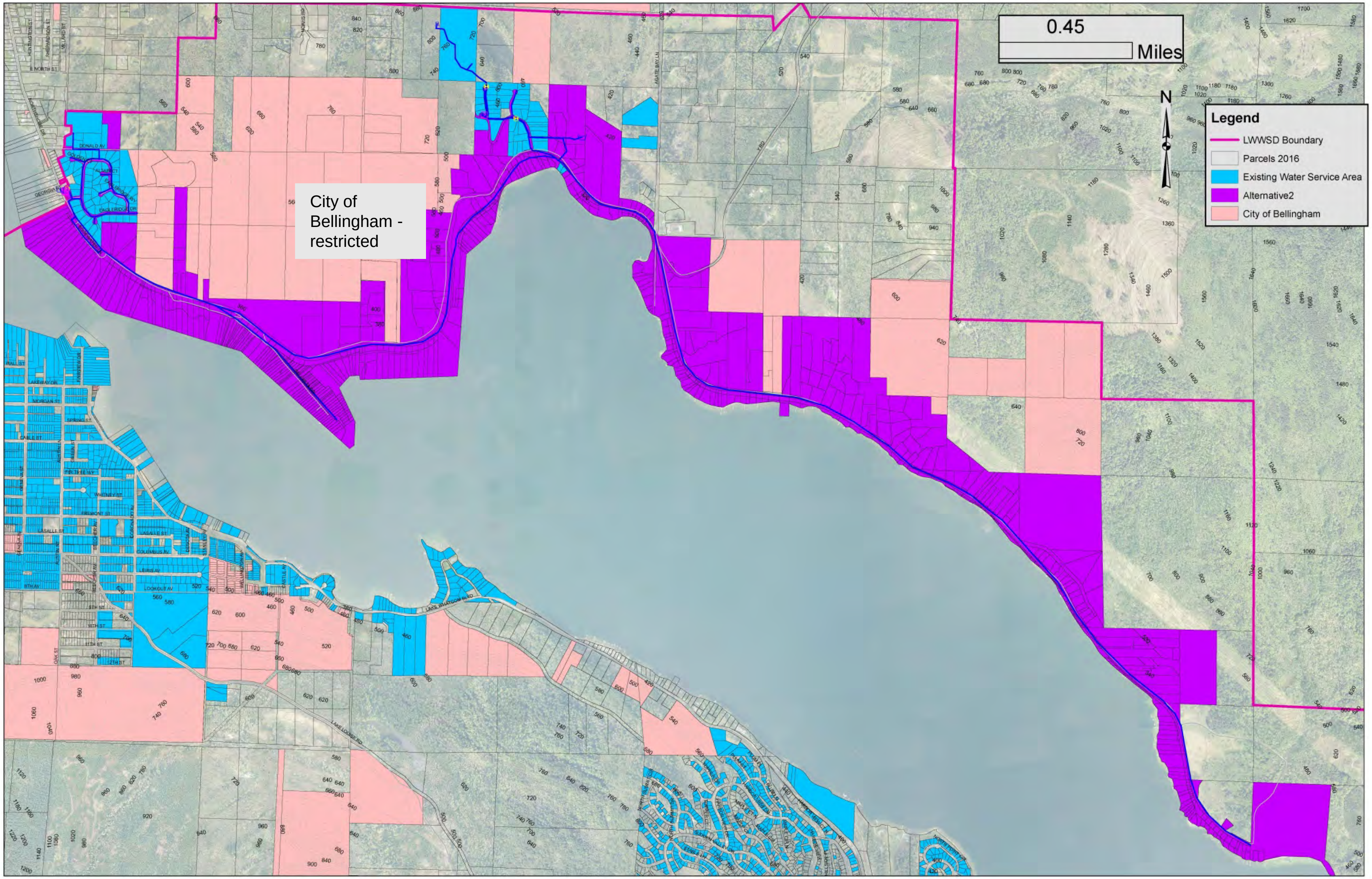
B. Alternative 2

C. Alternative 3

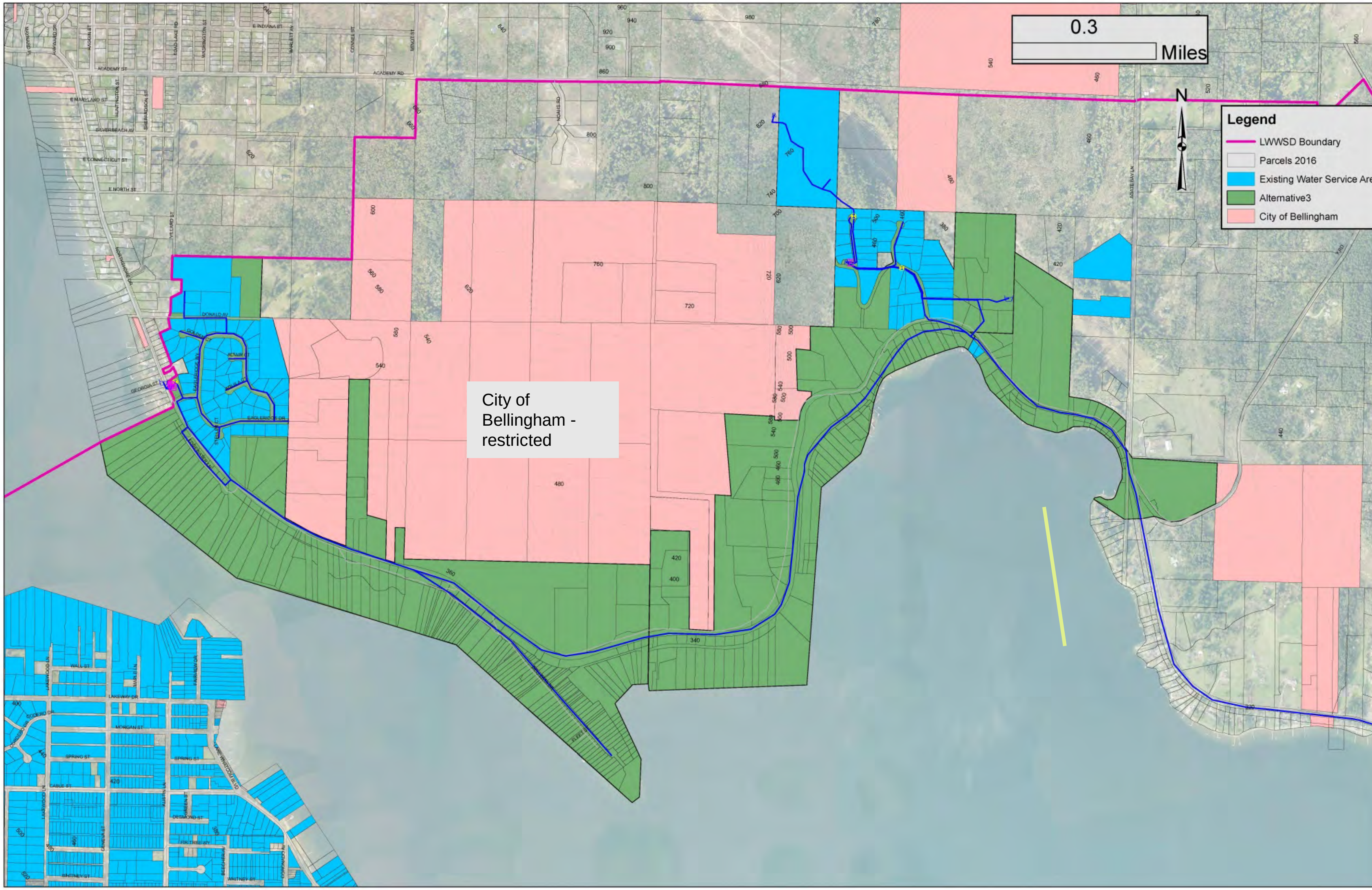
ALTERNATIVE 1 – MATCH DISTRICT SEWER SERVICE AREA



ALTERNATIVE 2 – EXTEND TO EAST END OF NORTHSHORE RD



ALTERNATIVE 3 – EXTEND FROM EAGLERIDGE TO Y ROAD



3. Water System Consolidation Preliminary Cost Estimates

A. Alternative 1

B. Alternative 2

C. Alternative 3

LAKE WHATCOM WATER AND SEWER DISTRICT **7/31/2017**
North Shore Water System Conolidation Feasibility
Preliminary Cost Estimates

Prepared by: **Curt Schoenfelder, PE and Melanie Mankamyer, PE, Wilson Engineering LLC**

Wilson Job No.: **2016-093**

Preliminary Cost Estimates - Alternative 1

Item Description	Quantity	Unit	Unit Price	Amount
CONSTRUCTION				
a. Mobilization (10%)	1	LS	$ 338,363	**$ 338,363**
b. Traffic Control (5.5%)	1	LS	$ 186,100	**$ 186,100**
c. Temporary Erosion and Sediment Control (1.2%)	1	LS	$ 40,604	**$ 40,604**
d. Distribution Improvements				
8-inch DI Pipe	11,250	LF	$ 65	$ 731,250
12-inch DI Pipe	12,000	LF	$ 75	$ 900,000
8-inch Gate Valve	14	EA	$ 1,500	$ 21,094
12-inch Gate Valve	15	EA	$ 2,500	$ 37,500
Hydrant Assembly	39	EA	$ 5,500	$ 213,125
Combination Air Release/Vacuum Valve	5	EA	$ 2,500	$ 12,500
Blow-off Assembly	2	EA	$ 2,000	$ 4,000
Connect to Existing Main	3	EA	$ 2,500	$ 7,500
~~Service Connections (all inclusive; saddles, corps, meter ass'y, box, line)~~		~~EA~~	~~$ 2,000~~	~~$ -~~
Restoration	23,250	LF	$ 24	$ 558,000
Subtotal				**$ 2,484,969**
e. Treatment and Pumping Improvements				
Building Addition (20'x20' and a bit taller)	1	LS	$ 100,000	$ 100,000
Filtronics Model FV-09 Electromedia 1 Fe/Mn Removal System (Equipment only; includes filter, reaction vessels, controls and chem feed equipment)	1	LS	$ 225,000	$ 225,000
Filtronics treatment system installation	1	LS	$ 112,500	$ 112,500
Booster pump station, duplex skid mount including Controls (Equipment only)	1	LS	$ 33,000	$ 33,000
Booster pump station installation	1	LS	$ 16,500	$ 16,500
Chlorination and other misc. upgrades	1	LS	$ 25,000	$ 25,000
Electrical upgrades	1	LS	$ 35,000	$ 35,000
Generator & Tank	1	LS	$ 55,000	$ 55,000
Subtotal				**$ 602,000**
f. Storage Improvements				
Concrete storage tank 185,000 Gallon 30x35 (installed by supplier, prevailing wages)	1	LS	$ 170,775	$ 170,775
Site Preparation and misc. under tank piping etc.	1	LS	$ 85,388	$ 85,388
Piping/valving from new tank to existing	1	LS	$ 40,500	$ 40,500
Subtotal				**$ 296,663**
SUMMARY				
Subtotal				$ 3,948,698
Contingencies	15%			$ 592,305
Sales Tax	8.5%			$ 385,985
Preliminary Estimated Construction Costs				**$ 4,926,988**
Permitting (Consulting and Permit Fees)	2.5%			$ 123,170
Topographic Survey	4%			$ 197,080
Engineering Design	15%			$ 739,050
Construction Phase Engineering/Inspection	10%			$ 492,700
Construction Phase Surveying	3%			$ 147,810
GRAND TOTAL				**$ 6,626,798**

LAKE WHATCOM WATER AND SEWER DISTRICT **7/31/2017**
North Shore Water System Conolidation Feasibility
Preliminary Cost Estimates

Prepared by: **Curt Schoenfelder, PE and Melanie Mankamyer, PE, Wilson Engineering LLC**

Wilson Job No.: **2016-093**

Preliminary Cost Estimates - Alternative 2

Item Description	Quantity	Unit	Unit Price	Amount
CONSTRUCTION				
a. Mobilization (10%)	1	LS	$ 487,827	**$ 487,827**
b. Traffic Control (5.5%)	1	LS	$ 268,305	**$ 268,305**
c. Temporary Erosion and Sediment Control (1.2%)	1	LS	$ 58,539	**$ 58,539**
d. Distribution Improvements				
8-inch DI Pipe	9,750	LF	$ 65	$ 633,750
12-inch DI Pipe	25,250	LF	$ 75	$ 1,893,750
8-inch Gate Valve	12	EA	$ 1,500	$ 18,281
12-inch Gate Valve	32	EA	$ 2,500	$ 78,906
Hydrant Assembly	58	EA	$ 5,500	$ 320,833
Combination Air Release/Vacuum Valve	5	EA	$ 2,500	$ 12,500
Blow-off Assembly	2	EA	$ 2,000	$ 4,000
Connect to Existing Main	3	EA	$ 2,500	$ 7,500
~~Service Connections (all inclusive; saddles, corps, meter ass'y, box, line)~~		~~EA~~	~~$ 2,000~~	~~$ -~~
Restoration	35,000	LF	$ 24	$ 840,000
Subtotal				**$ 3,809,521**
e. Treatment and Pumping Improvements				
Building Addition (20'x20' and a bit taller)	1	LS	$ 100,000	$ 100,000
Filtronics Model FV-09 Electromedia 1 Fe/Mn Removal System (Equipment only; includes filter, reaction vessels, controls and chem feed equipment)	1	LS	$ 225,000	$ 225,000
Filtronics treatment system installation	1	LS	$ 112,500	$ 112,500
Booster pump station, duplex skid mount including Controls (Equipment only)	1	LS	$ 33,000	$ 33,000
Booster pump station installation	1	LS	$ 16,500	$ 16,500
Chlorination and other misc. upgrades	1	LS	$ 25,000	$ 25,000
Electrical upgrades	1	LS	$ 35,000	$ 35,000
Generator & Tank	1	LS	$ 55,000	$ 55,000
Subtotal				**$ 602,000**
f. Storage Improvements				
Concrete storage tank 333,000 Gallon 30x65 (installed by supplier, prevailing wages)	1	LS	$ 341,000	$ 341,000
Site Preparation and misc. under tank piping etc.	1	LS	$ 85,250	$ 85,250
Piping/valving from new tank to existing	1	LS	$ 40,500	$ 40,500
Subtotal				**$ 466,750**
SUMMARY				
Subtotal				$ 5,692,942
Contingencies	15%			$ 853,941
Sales Tax	8.5%			$ 556,485
Preliminary Estimated Construction Costs				**$ 7,103,368**
Permitting (Consulting and Permit Fees)	2.5%			$ 177,580
Topographic Survey	4%			$ 284,130
Engineering Design	15%			$ 1,065,510
Construction Phase Engineering/Inspection	10%			$ 710,340
Construction Phase Surveying	3%			$ 213,100
GRAND TOTAL				**$ 9,554,028**

LAKE WHATCOM WATER AND SEWER DISTRICT **7/31/2017**
North Shore Water System Conolidation Feasibility
Preliminary Cost Estimates

Prepared by: **Curt Schoenfelder, PE and Melanie Mankamyer, PE, Wilson Engineering LLC**

Wilson Job No.: **2016-093**

Preliminary Cost Estimates - Alternative 3

Item Description	Quantity	Unit	Unit Price	Amount
CONSTRUCTION				
a. Mobilization (10%)	1	LS	$ 301,848	**$ 301,848**
b. Traffic Control (5.5%)	1	LS	$ 166,016	**$ 166,016**
c. Temporary Erosion and Sediment Control (1.2%)	1	LS	$ 36,222	**$ 36,222**
d. Distribution Improvements				
8-inch DI Pipe	7,600	LF	$ 65	$ 494,000
12-inch DI Pipe	12,000	LF	$ 75	$ 900,000
8-inch Gate Valve	10	EA	$ 1,500	$ 14,250
12-inch Gate Valve	15	EA	$ 2,500	$ 37,500
Hydrant Assembly	33	EA	$ 5,500	$ 179,667
Combination Air Release/Vacuum Valve	5	EA	$ 2,500	$ 12,500
Blow-off Assembly	2	EA	$ 2,000	$ 4,000
Connect to Existing Main	3	EA	$ 2,500	$ 7,500
~~Service Connections (all inclusive; saddles, corps, meter ass'y, box, line)~~		~~EA~~	~~$ 2,000~~	~~$ -~~
Restoration	19,600	LF	$ 24	$ 470,400
Subtotal				**$ 2,119,817**
e. Treatment and Pumping Improvements				
Building Addition (20'x20' and a bit taller)	1	LS	$ 100,000	$ 100,000
Filtronics Model FV-09 Electromedia 1 Fe/Mn Removal System (Equipment only; includes filter, reaction vessels, controls and chem feed equipment)	1	LS	$ 225,000	$ 225,000
Filtronics treatment system installation	1	LS	$ 112,500	$ 112,500
Booster pump station, duplex skid mount including Controls (Equipment only)	1	LS	$ 33,000	$ 33,000
Booster pump station installation	1	LS	$ 16,500	$ 16,500
Chlorination and other misc. upgrades	1	LS	$ 25,000	$ 25,000
Electrical upgrades	1	LS	$ 35,000	$ 35,000
Generator & Tank	1	LS	$ 55,000	$ 55,000
Subtotal				**$ 602,000**
f. Storage Improvements				
Concrete storage tank 185,000 Gallon 30x35 (installed by supplier, prevailing wages)	1	LS	$ 170,775	$ 170,775
Site Preparation and misc. under tank piping etc.	1	LS	$ 85,388	$ 85,388
Piping/valving from new tank to existing	1	LS	$ 40,500	$ 40,500
Subtotal				**$ 296,663**
SUMMARY				
Subtotal				$ 3,522,565
Contingencies	15%			$ 528,385
Sales Tax	8.5%			$ 344,331
Preliminary Estimated Construction Costs				**$ 4,395,281**
Permitting (Consulting and Permit Fees)	2.5%			$ 109,880
Topographic Survey	4%			$ 175,810
Engineering Design	15%			$ 659,290
Construction Phase Engineering/Inspection	10%			$ 439,530
Construction Phase Surveying	3%			$ 131,860
GRAND TOTAL				**$ 5,911,651**

4. Questionnaire and Response Summary

North Shore Water System Consolidation
Public Input Survey

Lake Whatcom Water and Sewer District is gathering information on current residential water sources and interest in connecting to a public water system in order to make an informed decision regarding extending its water distribution system along North Shore Road. This water system expansion will not financially impact current District water customers.

1. What is the current use of your property?
   - ☐ Vacant
   - ☐ Single Family
   - ☐ Other ________________________
2. What is the water source for your property?
   - ☐ Individual Well
   - ☐ Lake draw / surface water
   - ☐ Water system (name) __________________
   - ☐ Shared Well
   - ☐ Other ________________________
3. Are you interested in connecting to a public water system?
   - ☐ Yes
   - ☐ No
   - ☐ Maybe / Depends ______________________________________
4. If you are interested, what is your motivation to connect to a public water system?
   - ☐ Reliability
   - ☐ Water Quality
   - ☐ Water Quantity
   - ☐ Fire protection
   - ☐ Other ________________
5. If you are interested, what will drive your decision-making process?
   Rank 1-4, with 1 being most important
   - ____ Overall cost to connect
   - ____ Ability to pay connection fee over time
   - ____ Estimated water bills
   - ____ Other ________________________

Comments:

____

____

____

Please provide your contact information if you would like to be kept informed about this project.

Name: ____

Address: _______________________________________

Phone: ____

Email: ____

North Shore Consolidation Questionnaire-Raw Dat

ID	CurrentUse	WaterSource	Connect t	Motivation?	Overall	Pay Fe	Water	Other	Notes	Name	address	Address Street	Phone	email
1	Single Family	Lake draw	Maybe/D	Reliability, Water Quality	2	3	1			Kathy Delbecq	2135	Dellesta Dr		rkdelbecq@comcast.net
2	Single Family	Shared Well	Maybe/D		1	4	2	3	Connection to sewer with water service?	Alice and Jay Shilha	3016	Lakeshore Rd	360-647-2306	a.shilhanek@comcast.net
3	Single Family	Lake draw	Maybe/D	Reliability	1	2	3			Alan Bagley	2844	Northshore Rd	360-733-7298	bulldoglake@comcast.net
4	Single Family	Well	Maybe/D	Reliability, Water Quality	1		2			John Waldburger	2593	Northshore Rd		jwaldburger@comcast.net
5	Single Family	Lake draw	Maybe/D	Reliability, Water Quality	2	3	4	1	Want to protect water quality in Lake	Michael Picco	2106	Dellesta Dr	360-929-1831	mikepicco@yahoo.com
6	Single Family	Lake draw	Maybe/D	Reliability	1	3	2		Need more specific cost information	Ed Shannon	1745	Edgewater Ln		ed@lazy-a.com
7	Single Family	Lake draw	Yes	Water Quality	1	2	3			Will & Karen Johnso	2587	Northshore Rd	360-303-8042	gatorjhns@comcast.net
8	Single Family	Shared Well	Yes	Reliability, Water Quality,	1	3	2			Jason Sims	3100	Edgewood Ln	360-739-3353	simsjason@comcast.net
9	Single Family	Lake draw	Yes	Reliability, Water Quality	1	3	2			Evan Keating	2297	Northshore Rd	408-309-7017	evankeating@yahoo.com
10	Single Family	Shared Well	Yes	Water Quality	1	3	2			Carole & Ron Evans	2098	Northshore Rd	360-319-1769	carole77@comcast.net
11	Single Family	Lake draw	Yes	Water Quality	2	1	3							
12	Vacant	none	Yes	Other, Reliability, Water Q	1	2	3	4	Timing	Steve & Laura Ward	2840	Northshore Rd	206-595-5234	Laurelueward@gmail.com
13	Single Family	Well	Yes	Reliability	1	2	3		Currently haul water 1-5x/week (300gal)	Kevin & Diane Form	3181	Lakeshore Rd	360-733-7789	formfam@q.com
14	Single Family	Shared Well	Yes	Reliability, Water Quality	1				Cost is high; may disincentivize project					
15	Single Family	Lake draw	Yes	Reliability	2	2	2			Robert Bornstein	3152	Northshore Rd		robertandjanice@comcast
16	Single Family	Lake draw	Yes	Reliability	2	2	2			Peter Dobey	3175	Northshore Rd	360-778-2047	peterdobey@comcast.net
17	Single Family	no entry	Yes	Fire/Safety, Reliability, Wat				1	Ease of process	David C. Morse, III	2176	Dellesta Dr	360-319-1257	dmorse@blytheinc.com
18	Single Family	Lake draw	Yes	Fire/Safety, Reliability, Wat				1	fire protection	Sherri Vander Yacht	2079	Northshore Rd	360-815-4656	jeffsherri@comcast.net
19	Vacant	none	Yes	Fire/Safety, Reliability, Wat				1	fire protection	Jeff Vander Yacht	2079	Northshore Rd	360-815-4196	jvanderyacht@PSEsurvey.
20	Vacant	none	Yes	Fire/Safety, Reliability, Wat				1	fire protection	Jeff Vander Yacht	2087	Northshore Rd	360-815-4196	jvanderyacht@PSEsurvey.
21	Single Family	Shared Well	Yes	Other, Water Quality	2		2	2	Responsibility in maintaining lights in pump houses during winter (2 wells serving 4 houses)	Dr. M Attygalla	3330	Sunny Cove Ct	360-933-4625	mallika19@icloud.com
22	Single Family	Lake draw	Yes	Water Quality	1	2	2			William W. Winter	2138	Dellesta Dr	360-733-0149	winterbill1@comcast.net
23	Other	Lake draw	Yes	Reliability, Water Quality				1	Monitored supply	Peter Telfer	2152	Dellesta Dr	360-671-9872	petertelfer48@gmail.com
24	Single Family	Well	Yes	Reliability, Water Quality	1	2	3		will there be a latecomers schedule?	Darrell Visser	3099	Edgewood Ln	360-815-1602	darrellvisser@gmail.com
25	Single Family	Lake draw	Yes	Reliability	1	3	2			Steve & Rhonda Lo	1715	Edgewater Ln		lowrysteve@comcast.net
26	Single Family	Lake draw	Yes	Water Quality	2	1	3		mailing address: 2301 Stickney Island Rd, Everson	Robin Hoefer (Pears	3203	Northshore Rd	360-966-2467;	hoefermr@aol.com
27	Single Family	Lake draw	No						Water line will encourage building, more traffic on Northshore Rd, more pollution	C. La Nois	2063	Northshore Rd	360-223-1978	
28	Single Family	Other	No											
29	Single Family	Lake draw	No						Water line will cause more building, more traffice and more pollution in the Lake	Hope Lawrenson	2066	Dellesta Dr	360-733-2727	2cat10@gmail.com

ID	CurrentUse	WaterSource	Connect t	Motivation?	Overall	Pay Fe	Water	Other	Notes	Name	address	Address Street	Phone	email
30	Single Family	Lake draw	No						I'm afraid that a water line would cause more building on the lake which would pollute the lake more	Claire Banjanin	2064	Dellesta Dr	360-734-1826	cbanjanin@comcast.net
31	Single Family	Lake draw	No							Stan La Nois	2063	Northshore Rd	360-820-1313	sjlanois@comcast.net
32	Single Family	Well	No							Dave Grunhurd	2637	Northshore Rd	360-671-6568	dgrunhurd@gmail.com
33	Single Family	Shared Well	No											
34	Single Family	Lake draw	No							Steve Adelstein	1721	Edgewater Ln	360-676-9591	
35	Single Family	Lake draw	No	Fire/Safety	1	4	3	2	pay for fire protection in property tax	Karen & Tom Evich	2051	Northshore Rd	360-671-1354	karenevich@comcast.net
36	Single Family	Lake draw	No						please use website for information about this project					
37	Single Family	Well	No	Other	1		2	3	3-Construction on Northshore; 4-Who paid for this study?; 5-How much will our taxes go up?; 6-Where is the additional water going to come from?	Nate Marino	2878	Lazer Ln	360-220-7860	nate@threepalmsdesigns.
38	Single Family	Well	No						(1/2 owner)	Cecelia Thomas	2582	Northshore Rd	360-733-2663	celiethomas@operapopol
39	Single Family	Well	No						Not Interested					hyshe@yahoo.com
40	Single Family	no entry	No						No Interest	Cristi Lysne	2472	Northshore Rd	360-756-2717	garylysne@msn.com
41	Single Family	Lake draw	No						If line in Northshore there will be more sprawl and consequently more lake pollution	Milan Banjanin	2064	Dellesta Dr	360-734-1826	
42	Single Family	Lake draw	No							Paul Hovnanian	3120	Northshore Rd		paul@hovnanian.com
43	Single Family	Lake draw	No											
44	Single Family	Well	No						This is another opportunity to take state $, study something that isn't a problem to keep Wilson Engineering in business, and then force it on a small group of landowners who have already gone to the expense of putting in a private water source because there was no public water available. Now you push a project that will cost these owners another $40,000. If the County wants to take over the Lake, why not just buy everyone out at fair market value...					
45	Single Family	Well	No						This District should have brought water to us 50 years ago when many of us met with the District at the Agate Bay fire house and talked of water	Del Wolf	1854	Northshore Rd	360-734-4309	
46	Single Family	Well	No							Stan Wolf	1862	Northshore Rd		

ID	CurrentUse	WaterSource	Connect t	Motivation?	Overall	Pay Fe	Water	Other	Notes	Name	address	Address Street	Phone	email
47	Single Family	Lake draw	No						This question is misleading. A public water system under current zoning cannot state "water quality" as a benefit. Please be clear when reporting this survey that it is flawed, biased and narrowly addresses a very complex issue.	Fred Miller	3229	Northshore Rd	360-671-2365	fredmiller20@comcast.net
48	Single Family	Agate Heights	Yes	Other	1				Current system provides low pressure and high mineral content	Troy Degroot	3372	Coral Ln		iflynavy@comcast.net
49	Single Family	Lake draw	No						If a water line is put in, will we be required to hook up? Extending sewer service on the N. Shore Rd is better for Lake health.	Kris Ungren	2095	Northshore Rd	360-734-2701	suebear02@comcast.net
50	Single Family	Lake draw	No						I am very opposed to this water system expansion.	Don Boyer	2695	Northshore Rd	206-719-7446	don.boyer@comcast.net
51	Single Family	Lake draw	No		2	2	2			Charles Walter	1737	Edgewater Ln	360-201-4187	chwalter53@gmail.com
52	Single Family	Shared Well	No		2	2	2			Stew Ellison	1807	Northshore Rd		
53	Single Family	Lake draw	No		2	2	2							
54	Single Family	Lake draw	No		2	2	2		Summer place only- Property Taxes and Sewer Charges are already prohibitive	Gaylon Vander Yach	340	maberry loop lyden 982	354-3185	
55	Single Family	Well	No		2	2	2			William Cox	2661	Northshore Rd	360-778-1586	willcox@comcast.net
56	Other	Lake draw	No		2	2	2		Summer home	SIMS	23242	Bassett Rd.	360-856-6318	alwaysaproblemjan@yaho
57	Other	Other	No		2	2	2		I have just spent $18,000 to put in a rain catchment system for our new house	Gordan SullIouns	2641	Birchbay Lynden Rd 982	364-3171	
58	Single Family	Water System	No		2	2	2		Suggest new ???? Dig their own wells	Anthony & Lee Ashe	3364	Topaz Ct.		
59	Single Family	Water System	No		2	2	2		We could use a small boost of water in July and August for some of our ownwers. I am the current system manager	Lorraine A. Bierman	2722	Willow Lane	360-224-1549	
60	Single Family	Lake draw	No		2	2	2			David & Deborrah L	2653	Northshore Rd	783-9094	
61	Single Family	Lake draw	No		2	2	2		We recently spent considerable $$ in putting a UV cleansing and filteration and the water is perfect. Everyone else on N.shore has no doubt and done the same and many people have had to drill wells at considerable expense. This proposed water extension is not needed and should be a non-starter. Sorry, but we do not need the service or extra expense.	Dave Nicholes	2583	Northshore Rd	360-961-3951	davethe judge@comcast.n
62	Single Family	Well	No		2	2	2		Cost to hook up would be too much to make financial sense. We have excellent water with own well.	Ann Rushing	31846		3602205259	karlem.kuntz@comcast.co
63	Single Family	Well	No		2	2	2			Frank & Alida Bowe	2466	Northshore Rd	733-8218	

ID	CurrentUse	WaterSource	Connect t	Motivation?	Overall	Pay Fe	Water	Other	Notes	Name	address	Address Street	Phone	email
64	Single Family	Well	No		2	2	2							
65	Single Family	Well	No		2	2	2		More access to water will spur more development of houses					
66	Single Family	Lake draw	No		2	2	2			Tiller	2181	Northshore Rd		
67	Single Family	Lake draw	No		2	2	2		Not interested even if the service is available	Steve Lackey	2173	Northshore Rd	360-756-6915	stevelackey2@gmail.com
68	Single Family	Shared Well	No		2	2	2			Alicia & Jess Cantu	3362	Topaz Ct	360-223-0697	isomerz@msn.com
69	Single Family	Shared Well	No		2	2	2		No, we do not want to connect. Why should we? We have great water and low bills		2129	Dellesta Dr		
70	Single Family	Lake draw	No		2	2	2		Own Water rights to lake.. Culligam system of filter and UV treatment					
71	Single Family	Lake draw	No		2	2	2			Lorry Zeies	1449	Edgewater Ln	360-734-8766	jlziels@comcast.net
72	Single Family	Lake draw	No		2	2	2		We own water rights to lake.	John Mumma	3169	Agate Bay	733-4651	j.mumma@omast.net
73	Single Family	Well	No		2	2	2			Philip & Judy Andre	2790	Northshore Rd	360-319-0546	ladyolakew@gmail.com
74	Single Family	Lake draw	No		2	2	2							
75	Single Family	Well	No		2	2	2		If you really care about the wter quality, extend the sewer main. I have a good well and a septic system. I would pay for sewer before paying for a new water source	Chris Vazquez	2802	Northshore Rd	360-393-7272	backin1972@gmail.com
76	Single Family	Shared Well	No		2	2	2							
77	Single Family	Shared Well	No											
78	Other	Other	No											
79	Single Family	Well	No											
80	Single Family	Well	No							Michael Tario	3046	Northshore Rd	360-671-8500	
81	Single Family	Well	No							Daniel & Helen Che	1950	Northshore Rd	360-510-2720	linfenchuan3@yahoo.com
82	Single Family	Lake draw	No		1		1			Rick Lingbloom	2609	Northshore Rd		r.lingbloom@comcast.net
83	Single Family	Shared Well	No											
84	Single Family	Lake draw	No						Cost to connect is not worth the marginal benefit of provide water.	We are on your list.				
85	Single Family	Shared Well	No							Jeff Dauis	3129	Sheridian Trail		
86	Single Family	Lake draw	No						Because of the way our house is situated, hooking up to a water line that comes off of N.Shore Rd. would be extremely expensive	Canl Walton	2055	Northshore Rd	360-733-8912	canlwalton3@aol.com
87	Single Family	Well	No						Reliable water available currently. Will not pay for additional system	Steve Pratum	2619	Northshore Rd		stevepratum@smail.com
88	Single Family	Well	No											

ID	CurrentUse	WaterSource	Connect t	Motivation?	Overall	Pay Fe	Water	Other	Notes	Name	address	Address Street	Phone	email
89	Single Family	Lake draw	No						Terribly expensive dumb idea. No way. Opens the lake to more development which we do not need. Protect the watershed					
90	Single Family	Well	No							William Canhill	3049	Lakeshore Rd	360-756-7513	wcahill@aoh.com
91	Single Family	Well	No							David Babbitt	2484	Northshore Rd		david@agatebayconstruci
92	Single Family	Lake draw	No						I can't think of anything that would hurt the water shed- increasing ability to develop more houses, etc in such a fragile ecosystem. Terrible!					
93	Single Family	Lake draw	No				1			Duane H. Johnson	2577	Northshore Rd	360-303-2143	dudod@juno.com
94	Single Family	Lake draw	No							Gordon & Maude D	2359	Northshore Rd	360-734-4544	
95	Single Family	Lake draw	No							Ann & Jake Hardy	2417	Northshore Rd		havdyae@comcast.net
96	Other	Shared Well	Yes	Reliability, Water Quality,	1				Sounds good	Donald.A. Miller	3850	Washington st #1205	941-538-1655	
97	Single Family	Lake draw	Yes	Fire/Safety, Reliability, Wat	2	1	3			Jeff Frere	3295	Northshore Rd	360-920-5434	rosedawgz@gmal.com
98	Single Family	Well and share	Yes	Other, Reliability				1	We have a shared well for our house. We have another well we use for watering our garden. We want to be on public sewer system. If option to connect includes both we would sign up. If only water, I am not interested	Rory Bradt	2696	Northshore Rd	425-210-0878	rorybradt@gmail.com
99	Other	Other	Yes	Fire/Safety, Reliability, Wat	2	1	3	4	We bring in our own water. We at this point can't put in a well so would have to put in containment system.	Gail Wasilewski	1865	Vineyard PL		gailwazol@comcast.net
100	Other	Other	Yes	Fire/Safety, Reliability, Wat	2	1	3	4	We carry our water	John Wasilewski	1865	Vineyard PL		john@mantleindustries.co
101	Vacant		Yes	Water Quantity				1	Need access to public water system	Jeff Yacht	2079	Northshore Rd	360-815-4196	
102	Single Family	Lake draw	Yes	Reliability, Water Quality	2	4	3	1	How soon installation?	Tim and heslie Farri	2133	Northshore Rd	360-961-3570	LKFarris4@gmail.com
103	Single Family	Shared Well	Yes	Fire/Safety, Reliability, Wat	1					Kevin Sluys	2076	Dellesta Dr	360-510-6722	kslvys@gmail.com
104	Vacant	Well	Yes	Reliability, Water Quality,	1	3	2		I think the city of Bellingham needs more affordable, buildable lots that do not require large fees for permitting. Costs for connecting to utilties needs to be more affordable for city residents	Kimberly Barron	533	37th st	360-739-9506	northshorevet@msn.com
105	Single Family	Water System	Yes	Water Quality	1	4	3	2						
106	Vacant	Well	Yes	Reliability, Water Quality	1	2	3		I support the project. I may build on this property and availability of a reliable spource of water ould simplify matters	Christine Valentine	125	Elkenburg st unit 1 sout		christinevalentine@froutie
107	Vacant	Shared Well	Yes	Reliability, Water Quality,	1				I have two buildable lots. I think it would be good to upgrade to stand well system	Donald Miller	3850	Washington Street		
108	Other	Lake draw	Yes	Reliability, Water Quality	1	3	2		Recreation lot	Steve Kunnap	4281	James St	360-733-1943	

ID	CurrentUse	WaterSource	Connect t	Motivation?	Overall	Pay Fe	Water	Other	Notes	Name	address	Address Street	Phone	email
109	Other	Other	Yes	Fire/Safety, Reliability, Wat		2	3		Soon to build 2017-2018. My wife and I are eager to build on our land. This house is to become our primary residence and we hope to get conncted to city water as this would be an answer to the prayer	Rafael A Recto	164	Robles Way #124	707-246-4339	Lrecto@comcast.net
110	Other	Shared Well	Yes	Other	1				Recreation visit. Shared well can’t connect to.	Bruce Longstreth	1803	Northshore Rd	360-319-6881	bbngsteth@muljatgroup.c
111	Single Family	Well	Yes	Reliability, Water Quality,	3	1	2			Christy Sorenson	3191	Lakeshore Rd	360-319-8659	csorenson@vanhofthepaci
112	Single Family	Lake draw	Yes	Reliability, Water Quality	2	3	1		I am eager to connect to public water	David Engst	3108	Agate Bay lane	360-510-2842	csi247g@gmail.com
113	Single Family	Lake draw	Yes	Reliability, Water Quality	1	3	2			Robert Hannum	2643	Northshore Rd	360-671-2533	icihora@comcast.com
114	Single Family	Lake draw	Yes	Other, Reliability	2	3	1		Improved water pressure. Question: We are already on city sewer so doesn't that mean we pay for water (even though we don't receive it)?	Keith Vander Griend	1733	Edgewater Ln	360-676-0776	kvandergriend@comcast.n
115	Single Family	Water System	Yes	Fire/Safety, Reliability, Wat	1	3	2		Connected to lake whatcom water and sewer					
116	Single Family	Lake draw	Yes	Reliability, Water Quality	1	3	2			Robin Wong	2335	Northshore Rd	360-223-7297	robinthuy@comcast.net
117	Single Family	Lake draw	Yes	Fire/Safety, Reliability, Wat	2		2			Robert Olson	3362	East Badgen Everson	360-927-3292	bolson3505@gmail.com
118	Single Family	Water System	Yes	Fire/Safety, Reliability, Wat			1		Already Connected					
119	Vacant	Well	Yes	Fire/Safety, Water Quality			2			Pamp Maiers	850	PO Box 850 Moses lake	509-765-5885	
120	Single Family	Lake draw	Yes	Reliability, Water Quality	2	1	3			Mark Zarzycki	286	Briar Rd		zarzyck@hotmail.com
121	Single Family	Other	Yes	Reliability, Water Quality				2	Using rain water harvesting system. Cost won't matter, just want better water	Robert Walker	1853	Northshore Rd	360-739-8343	rwalker@mbcollision.com
122	Single Family	Shared Well	Yes	Reliability, Water Quality,	1	2	3	4		Chris Rink	2368	Northshore Rd	360-393-3586	crinkepsesurvey.com
123	Single Family	Shared Well	Yes	Reliability, Water Quality	1					Chris Knauft	3326	Sunny Cove CT	360-739-3403	chrisknauft@gmail.com
124	Single Family	Well	Yes	Reliability, Water Quality	1	2	3		Gererally in favor of this plan. Please note the name change: address for notifications	Northshore Road LL	2815	Russell Street	360-758-2111	fdfelicity@gmail.com
125	Single Family	Shared Well	Yes	Fire/Safety, Reliability, Wat	2	1	3			Paul K. Glasser	3095	Edgewood Ln	360-656-6699	pkglasser@comcast.net
126	Single Family	Water System	Yes	Fire/Safety, Other, Reliabili					water source is lake whatcom water via city of bellingham. Pay same rate as city residents. Does the city of bellingham want to bring us in direct line?	Roger Despain	1716	Golden court	360-820-9121	
127	Single Family	Lake draw	Yes	Fire/Safety, Reliability, Wat					Quality monitored water supply and fire protection are very basic services. I would like to have them.	Peter Telfer	2152	Dellesta Dr	360-671-9872	petertelfer48@gmail.com
128	Single Family	Well	Yes	Fire/Safety, Reliability, Wat	2	3	1	4	If public water becomes available it is very likely that we will connect	Stephen Hutchens	2090	Northshore Rd	360-201-0098	sphutchens@yahoo.com
129	Other	Well	Yes	Reliability, Water Quality	1	3	2			Whatcom county fo	3373	Mt. Baker highway	360-778-5850	mmcfarla@co.whatcom.w

ID	CurrentUse	WaterSource	Connect t	Motivation?	Overall	Pay Fe	Water	Other	Notes	Name	address	Address Street	Phone	email
130	Single Family	Water System	Maybe/D						Depends on cost. Current service from lake whatcom water and sewer dist is great. Not interested in having our cost go up					
131	Single Family	Lake draw	Maybe/D		2				We have a "water right" to draw out of the lake but have filter maintenance costs. We would evaluate these costs compared to purchase and hookup costs of public water system	Chris Hilleary	1857	Northshore Rd	360-319-9311	chilleary@aerotechgolfsha
132	Single Family	Water System	Maybe/D						Depends on rates	John & Dorie Micha	1720	Eagleridge Drive	360-734-9819	jmache1@comcast.net
133	Single Family	Shared Well	Maybe/D		1	2	3			Bruce & Kathy Wils	3091	E. 21ST pl		bknjrwilson@hotmail.com
134	Single Family	Shared Well	Maybe/D	Fire/Safety, Reliability, Wat	1	2	3			Vincent Williams	1010	Lonetree ct	360-933-4150	vince@hiwestfoods.com
135	Single Family	Water System	Maybe/D	Other, Water Quality	1	3	2		Current rates are too high. The burden placed on homeowners to protect, preserve and pay significantly for water is pointless when engine powered watercraft and boats are allowed in the water sources. I am sickd by the lack of ownership by those entrusted to protect our water sourcebut don't by continuing to allow oil/gas/electric into our water source.	Sullivan	3237	Eagleridgeway	360-603-4258	maureen.sullivan270@gm
136	Single Family	Lake draw	Maybe/D		1	2	3		Depends on cost					
137	Single Family	Well	Maybe/D	Reliability, Water Quality,	2	2	2			Joe Baldwin	3042	Northshore Rd	360-305-4504	jbatosc@yahoo.com
138	Single Family	Well	Maybe/D	Reliability, Water Quantity	2	2	2		Would be more interested with sewer	Bruce Kwe	3048	Lakeshore Rd		
139	Single Family	Lake draw	Maybe/D	Water Quality	2	1	3	4		Rochelle Stroup	2413	Northshore Rd	360-733-4297	
140	Single Family	Other	Maybe/D	Reliability	1	4	3	2	Rain water water source. Depends on amount of digging/land/road distribution to install					
141	Single Family	Shared Well	Maybe/D						Depends on cost. Why do I have a need or motivation? My well has a lot of water. I could stop using my water softner but I see no other advantage.	Geoff Latimer	3322	Sunny Cove Ct		geofflatimer@comcast.net
142	Single Family	Shared Well	Maybe/D	Reliability, Water Quantity	1	3	2		Depnds on cost	Mark Daniels	3011	Lakeshore Rd	360-305-0261	markdaniels1@me.com
143	Single Family	Lake draw	Maybe/D						More water means more development which will affect the lake adversly					
144	Single Family	Well	Maybe/D	Fire/Safety, Other, Reliabili					we are interested but only if we would be allowed to keep water rights to our individual well. We moved here from rural clark county and had both our own well and county water. We were very satisfied with that arrangement.	William/lois freebor	2633	Northshore Rd	360-671-0066	

ID	CurrentUse	WaterSource	Connect t	Motivation?	Overall	Pay Fe	Water	Other	Notes	Name	address	Address Street	Phone	email
145	Single Family	Lake draw	Maybe/D							James Volkmann	3239	Northshore Rd	360-392-0459	propwashsv@gmail.com
146	Single Family	Water System	Maybe/D						Already connected to lake whatcom water and very satisfied.					
147	Single Family	Shared Well	Maybe/D	Fire/Safety, Reliability, Wat	1	3	2		I am concerned that providing water services would allow for more development and potential impact on lake whatcom will have more people, houses and runoff.	Marc Fairbanks	3060	E. 21st Pl	360-927-8021	marc.fairbanks@gmail.co
148	Single Family	Well	Maybe/D		1	2	3		Not motivated. Depends on cost	Brincer Cantrell	3319	Sunny Cove Ct	206-849-2287	bcn@bridgetcantrell.com
149	Single Family	Lake draw	Maybe/D	Reliability	1				Depends on upfront cost and long term cost, comlexity of install	John Hewitt	1849	Northshore Rd	360-305-0440	jhewitte@alpha.com
150	Single Family	Water System	Maybe/D						I assume that I am connected to a 'district' water (potable) supply. That who gets my check every two	John Gardiner	3196	Steller CT	360-739-7456	gonzadoczi@hotmail.com
151	Single Family	Well	Maybe/D		1	3	3		Depends on cost. I currently have a sewer connection but was forced to sign a no contest agreement in order to receive a sewer permit. I appealed the process and was told by the board that I will not be forced to connect to a future water system. I would like to know if your position on this matter is still the same?	Kevin Bedlington	2640	Northshore Rd	360-920-1556	ktbedlington@comcast.ne
152	Single Family	Well	Maybe/D	Other	2		2		Quality/Quantity? It’s the same damn water, its just the city is doing testing and adding chemicals. You guys have a bigger well	Ellie Hughes	3325	Agate Heights Rd	360-441-7222	elliehughes@comcast.net
153	Single Family	Lake draw	Maybe/D						Want ir free. Wouldn't sewer lines makes more sense in the lake whatcom region? The purity of the lake is an issue. Also replacement of the old septic tanks is very costly. I would rather hook up to that.	Bart Smith	3277	Northshore Rd	808-351-4988	
154	Single Family	Shared Well	Maybe/D	Fire/Safety, Other, Reliabili	1	2	3	4	Cost	Brady and chep titr	3144	Edgewood Ln	805-796-0517	
155	Single Family	Lake draw	Maybe/D	Water Quality	2	3	1		Cost	Brent Belsher	1835	Northshore Rd		5belshers@comcast.net
156	Single Family	Shared Well	Maybe/D	Water Quality, Water Quan	1					Stephen Brigham	3143	Edgewater Ln	360-593-9402	brigham38@hotmail.com
157	Single Family	Well	Maybe/D	Fire/Safety, Other	1	2	3	4	Like to have house a backup. Depends. I am presently hooked to your sewer, may be the cost in the northshore rd system I could retain well for sprinkler system	Roger Bourm	2644	Northshore Rd	360-739-5624	bourm@aol.com
158	Single Family	Well	Maybe/D	Reliability	1	2	3	4	Would you run the sewer to the end	Ron Lovell	2976	Northshore Rd	360-734-6929	k8lovell@icloud.com
159	Single Family	Lake draw	Maybe/D	Fire/Safety, Reliability, Wat	2		2		Cost	Dave Lunde	2078	Dellesta Dr	360-733-3202	ds_lunde@yahoo.com
160	Single Family	Lake draw	Maybe/D	Reliability	2	3	1		cost	Seabury McGown	2084	Dellesta Dr	756-7912	
161	Single Family	Lake draw	Maybe/D	Reliability, Water Quality	1	3	2			Pete Kremen	3283	Northshore Rd	360-734-3802	pkremen@comcast.com
162	Single Family	Water System	Maybe/D						Does not apply	Kim	3227	eagleridge way	360-756-2388	

ID	CurrentUse	WaterSource	Connect t	Motivation?	Overall	Pay Fe	Water	Other	Notes	Name	address	Address Street	Phone	email
163	Single Family	Water System	Maybe/D						I have no problem on consolidating water system unless??? Money is required. I am not willing to have my water rates rise to fund this effort as LWWSD rates are already high	G new Sted	3212	eagleridge way dr	671-5113	gnewsted@comcast.net
164	Single Family	Don't know	No Idea							Maureen Osen	3224	eagleridge way	360-922-7953	m.osen@comcast.net
165	Single Family	Water System	NA						Already on system . Concerned our quality will go down or lessen out water pressure. Is this more about greed and leftlist control of our natural resources?	Dana Patrick Downs	3343	Agate heights rd	360-325-3480	
166	Single Family	Water System	NA							Rick Porter	1713	Balden Ct.		Rosannaporter@aol.com
167	Vacant	Well	Maybe/D	Other, Reliability	2	2	2		Having options.	Cathy Brooking/Pet	2600	Northshore Rd	360-733-2978	pctandem@gmail.com
168	Single Family	Well	Maybe/D	Other, Reliability	2	2	2		Will there be a LID fee? If one chooses not to connect will there still be charges? Willit be less costly to connect when line is put in?	Cathy Brooking/Pet	2600	Northshore Rd	360-733-2978	pctandem@gmail.com
169	Single Family	Lake draw	Maybe/D	Reliability	1					Keith Mayo	3926	Forest Beach Dr. NW, Gi	253-905-0547	mayok@earthlink.net
170	Single Family	Shared Well	Maybe/D	Reliability, Water Quantity	1	3	2	4	Depends on cost.	Craig Manos	3165	Lakeshore Rd	360-223-8063	craigmanos@yahoo.com
171	Single Family	Lake draw	Maybe/D		2	2	2		Depends on cost.	Calvin & Doloris Ball	2605	Northshore Rd	360-734-2473	
172	Single Family	Lake draw	Maybe/D	Fire/Safety, Reliability, Wat	1	2	3		Depends on cost to join and connect. Sufficient federal and state grants would be needed to make it financially feasible to join.	Michael T. Seilo	2309	Northshore Rd	360-733-9121	mseilos59@comcast.net
173	Single Family	Lake draw	Maybe/D	Fire/Safety, Reliability	1		2			Dan Jurgenson	1762	Northshore Rd	360-676-1019	
174	Single Family	Lake draw	Yes	Other, Reliability, Water Q	1	2	3		Occupy house two months per year. Interested w/reservations. Motivated by prospect of less maintenance.	Dan Rosser	2105	Northshore Rd	360-739-9939	
175	Single Family	Well	Yes	Reliability, Water Quality	3	1	2		Very interested.	Chris Brueske	2724	Willow Ln.		cbrueske@comcast.net
176	Single Family	Lake draw	Yes	Fire/Safety, Reliability, Wat	1	2	3	4	Able to continue lake draw for grounds/garden?	Brian Patterson	2157	Northshore Rd	360-820-5409	alberni11@gmail.com
177	Vacant	Well	Yes	Reliability, Water Quality	1									
178	Single Family	Well	Yes	Reliability, Water Quantity	1	3	2			Susan Miner	3171	Edgewood Ln	360-671-7289	susanmike76@comcast.ne
179	Single Family	Water System	Maybe/D	Reliability, Water Quantity	2	1	3		Water System: Northshore Water & Septic/Solar Acres. Interested but depends on cost.	Paul Zosel	2719	Willow Ln		pjzosel@openaccess.org
180	Single Family	Lake draw	No						Need more info. Too expensive.	Robert Benner	1741	Edgewater Ln	360-734-3452	benner1741@yahoo.com
181	Single Family	Lake draw	No						It is too expensive for us who have spent much for a water system-pump, filters, etc.	Larry Ziels	1749	Edgewater Ln	360-734-8766	jlziels@comcast.net
182	Single Family	Lake draw	No						We have water rights from DOE. We have zero interest in the public water system.	Alexander	2109	Northshore Rd	360-647-8276	

ID	CurrentUse	WaterSource	Connect t	Motivation?	Overall	Pay Fe	Water	Other	Notes	Name	address	Address Street	Phone	email
183	Single Family	Lake draw	No						We have an expensive system providing water and tested regularly.					
184	Single Family	Shared Well	No						Our shared well costs are significantly reduced compared to others on your LWWSD system.	Loran Zenovian	2588	Northshore Rd	360-255-1098	zenovianloran@gmail.com
185	Single Family	Shared Well	No						Went to public meeting-the cost to bring a public water supply down Northshore is just too high. The DOH wants to consolidate small water systems, sure, but we are not on a small water system, we are on a well.					
186	Single Family	Lake draw	No							William Knudsen	1798	Northshore Rd	360-671-8260	wgknudsen@gmail.com
187	Single Family	Lake draw	No		1					John Herds	2112	Dellesta Dr		
188	Single Family	Lake draw	No											
189	Single Family	Well	No							John N. Connell	3307	Northshore Rd	360-739-8864	johnshq@comcast.net
190	Single Family	Lake draw	No							Ron Eriksen	2171	Dellesta Dr	360-527-1542	
191	Not Indicated	Lake draw	No							Denis McGuire	2355	Northshore Rd	360-933-4297	
192	Single Family	Water System	NA	Water Quality	1				Water System: Agate Heights	Michael Cheng	3360	Opal Terrace		metcheng@yahoo.com
193	Single Family	Water System	NA						Water System: Eagleridge. Already on public water system!					
194	Single Family	Water System	Maybe/D	Water Quality	3	1	2		Water System: Eagleridge	Mark Hoffmann	1761	Aquila Ct	360-756-1367	hoffer1@gmail.com
195	Single Family	Lake draw	Yes	Water Quality		1				F&M Baily	2165	Dellesta Dr	306(?)-647-08	fmbaily@bmgm.com
196	Single Family	Water System	Maybe/D	Fire/Safety, Reliability, Wat	1	2	3		Water System: North Shore Ridge	Robert Oltarzewski	3075	E. 21st Place	360-738-3422	roco@openaccess.org
197	Single Family	Lake draw	No							Marvin Marston	1729	Edgewater Ln	360-734-8143	mmarston8143@msn.com
198	Single Family	Lake draw	Maybe/D	Reliability, Water Quality	1		2							
199	Single Family	Water System	Yes	Fire/Safety, Reliability, Wat	1	2	3		Water System: Dellesta Water Association	Craig & Lydia Coope	2141	Dellesta Dr	360-738-1786	c_e_c@comcast.net/clcoo
200	Vacant	No Response	No						Extending water systems would cause more development in the watershed, further degrading the water quality of Lake Whatcom. We are opposed to this water system plan. Please protect our lake.	Joan Van Gasken	5630	East Rd	398-0331	
201	Vacant	Other: None	Yes	Fire/Safety, Reliability, Wat	1				I am highly in favor. My property has room for a well, but currently there is a moratorium on new wells.	Ray Bowen	17729	13th NW	206-660-7546	rabo@triplebcorp.com
202	Single Family	Shared Well	Maybe/D	Reliability, Water Quality,				1	Dependent upon whether we will be granted legal access for withdrawals from our shared well if we pursue a building permit. As it stands, now following Hirst v. Whatcom County, permitted access/withdrawals are barred. Thank you for your time!	Stephanie Manzo	1811	Eldridge Ave	607-742-5698	stephanieannmanzo@gma
203	Single Family	Lake draw	Yes	Fire/Safety, Reliability	1		2		Vacation house, occupied part time.	R.A. Brocklebank	2163	Dellesta Dr	738-8030/604	brocklebank@shaw.ca

ID	CurrentUse	WaterSource	Connect t	Motivation?	Overall	Pay Fe	Water	Other	Notes	Name	address	Address Street	Phone	email
204	Single Family	Shared Well	Maybe/D	Reliability, Water Quality,	1		2		Cost is everything. I would not spend even $5,000 to then pay $100/month for water I get out of my well for $15.	Jason Sims	3100	Edgewood Ln	360-739-3353	simsjason@comcast.net
205	Single Family	Lake draw	Maybe/D	Fire/Safety, Reliability, Wat	1	3	2	4	How limited will water usage be?	Doug Bixel/Bixel Fa	2060	Dellesta Dr	360-734-0694	bixel9@comcast.net
206	Single Family	Lake draw	No						This duplicates our response submitted at the 6/20 meeting. Customers responding at both the meeting and now to this mailed survey could well distort your survey results. Beware of invalid conclusions!	Brent Walker	3141	Agate Bay Ln	360-676-5575	brentw@cbwholesale.com
207	Single Family	Lake draw	No		1	2				Jim Kaemingk	2149	Northshore Rd	360-224-5465	jim@jimk.net
208	Single Family	Water System	Maybe/D	Water Quality	1				Water System: LWWSD. Depends on if there are advantages. Current service is fine.	Walter Michelutti	2316	Agate Heights Ln		
209	Single Family	Water System	Maybe/D				1							
210	Single Family	Well/Lake draw	Yes	Reliability, Water Quantity	1		1			William & Cynthia H	3078	Northshore Rd		
211	Vacant	Other: NA	No						Three households share this lot. It is too small to build on. We each wanted to have more space.	William & Cynthia H	3078	Northshore Rd		
213	Single Family	Shared Well	Yes	Reliability, Water Quality,	1	2	3			Andress		PO Box 31715, Bellingh		
214	Single Family	Lake draw	Yes	Fire/Safety, Reliability, Wat	2	3	1	4	Ability to continue drawing water from lake for landscaping, etc.	Jack Westford	1837	Northshore Rd	360-733-5858	nwestford@gmail.com
215	Single Family	Well/Lake draw	Yes	Reliability, Water Quality	1	3	2		I think a sewer line should be put in as well if feasible. Name withheld-I don't trust the county's intentions.					
216	Vacant	Other: No sourc	Yes	Fire/Safety, Reliability		1		2	Immediacy. We support this water system expansion.	M.J. Cudmore	6651	Tideview Rd, Sooke, BC,	250-532-2921	mjc.tideview@icloud.com
217	Single Family	Well	Maybe/D							J M Stoane	2369	Northshore Rd	360-739-4793	jmstoane@gmail.com
218	Single Family	Shared Well	Maybe/D	Other	1	2			Power loss/ Well no water; better constant pressure. Do not want to be forced to hook-up if costs are too high when I have a good shared well. Power outages here make things difficult!	Chris Quinlan	2659	Northshore Rd	360-305-0986	cquinlan620@aol.com
219	Single Family	Lake draw	Yes	Reliability, Water Quality	1	2	3			Richard and Silvia H	2433	Northshore Rd	360-650-8214	rickh@briardevelopment.c
220	Single Family	Shared Well	No							Nicole Walker	2865	Lazer Lane		tom@m-i-n-t.com
221	Vacant	Shared Well	Maybe/D	Reliability	1	3	2	4	Quality of water	Nicole Walker	vacant l	Lazer Lane		tom@m-i-n-t.com
222	Single Family	Lake draw	No											
223	Single Family	Shared Well	No											
224	Single Family	Eagleridge	Maybe/D	Other, Water Quality	4	3	1	2	Cost; Water Quality	Mike Vercammen	3210	Eagleridge Way	360-647-3881	mvercammen@aol.com

ID	CurrentUse	WaterSource	Connect t	Motivation?	Overall	Pay Fe	Water	Other	Notes	Name	address	Address Street	Phone	email
225	Single Family	Well	Maybe/D	Reliability	1	4	2	3	Option to connect at future date at my discretion. My private well is clean, reliable and easy to maintain. I have a very long driveway and I am very wary of any connection costs and logistics.	Mark Mikols	15931	SE 41st Place, Bellevue,	425-786-7797	mikolsma@mac.com
226	Vacant	Other	Maybe/D	Other	2	3	1		no water / access to water					
227	Single Family	Lake draw	No						I have a perfectly adequate water system including filters and UV sterilizer. It was expensive but it works well. I certainly don't need another expensive system!!	Kenneth Kloehn, M	2151	Dellesta Dr	360-733-1048	kenklo@comcast.net
228	Vacant	Other	Maybe/D	Other	1	2			Source: to be determined when property is developed; cost	Fred & Jackies Tho	4222	78th Ave SW	360-920-5055	fredjacke@hotmail.com
229	Single Family	Lake draw	No											
230	Other	Water System	Yes	Fire/Safety, Reliability	1		2		Commercial-restaurant; Russell Group A	Gina Russell	2530	Northshore Rd	360-733-1126	info@theforkatagatebay.c
231	Single Family	Lake draw	No							Lori G. Bockwoldt	2595	Northshore Rd	360-733-7179	lbockwoldt@hotmail.com
232	Single Family	Lake draw	Maybe/D	Reliability	1	3	2							
233	Single Family	Lake draw	No							Mike and Jane Cost	3024	Northshore Rd	360-734-2687	
234	Single Family	Well	No							Mike and Jane Cost	3036	Northshore Rd	360-734-2687	
235	Single Family	Lake draw	Yes	Reliability, Water Quality	2	3	4	1	If it's really good water, free of salts, minerals.	John Bateman	2345	Northshore Rd	604-531-0753;	pentab@shaw.CA
236	Single Family	Water System	Maybe/D		2			1	Agate Bay Mobile Estates; This is a decision for the owner of the Park. As a resident of the park I can say we already have very good water in all respects. Costs to Owner of mobile park which may be passed on to residents of the park.	David Kellogg	151	Koons Ave, Medina OH	330-242-7769	tsrpq1dk@gmail.com
237	Single Family	Lake draw	Yes	Fire/Safety, Reliability, Wat	1					William P Griggs	2160	Dellesta Dr	360-305-7918	wpgriggs@comcast.net
238	Single Family	Well	Maybe/D	Reliability, Water Quality,	1	2	3		Cost	Kristi Pflueger	2036	Northshore Rd	360-671-1771	kmpflueger@hotmail.com
239	Single Family	Lake draw	No							Michael Smith	2117	Northshore Rd	360-393-8050	wasmith@hotmail.com
240	Single Family	Lake draw	No							Tiffany Smith				
241	Single Family	Well	Yes	Water Quality	2		2			Don Mason	3269	Northshore Rd	206-409-6180	don@domotomason.com
242	Single Family	Lake draw	Maybe/D	Reliability	1		2		Costs	Jay Bornstein	3149	Agate Bay Lane		jay@bornstein.com
243	Other	Water System	Maybe/D	Water Quality	2		1		25 space Manufactured Home Park. Would I be paying for 1 connection? My main distribution line to the new system? Or 25x the connection fee? Same question with the monthly fees - how do those work for my application?	Derek Watt (2516 N	PO Box	Bellingham, 98227	360-393-2671	derek@viewgreen.com
244	Single Family	Shared Well	No							Lisa Rippon	3338	Sunny Cove Ct	206-786-0334	treysmoms@gmail.com

ID	CurrentUse	WaterSource	Connect t	Motivation?	Overall	Pay Fe	Water	Other	Notes	Name	address	Address Street	Phone	email
245	Single Family	Shared Well	Yes	Other, Reliability	1	3	2	4	Usage of existing well w/o costs involved. Be able to use existing wel for irrigation and water rts and usage. Overall cost would be big decision maker.					
246	Single Family	Lake draw	Maybe/D		1	1	1		Costs - now and future	Maggie Craig	2629	Northshore Rd	505-715-1619	houraday@gmail.com
247	Single Family	Well	Maybe/D	Fire/Safety, Water Quality	1	1	2			Carl Mattson	2102	Northshore Rd	360-671-9662	Carls_construction@hotm
248	Vacant	Shared Well	Yes	Reliability				1	Resale of Property	Michael E Gerritson	CMR 46	APO, A(?) 09096		
249	Single Family	Lake draw	Maybe/D	Reliability				1	Water quality and taste	Courtney McBean	2050	Dellesta Dr		courtneymcbean@gmail.c
250	Single Family	Lake draw	Yes	Fire/Safety, Reliability, Wat	3	2	4	1	Clean, reliable water. Tired of goose shit, clogged intakes. I have a DOE permit to dra, iron-clad. I still would prefer water from a public source.	Jeff Vlasic	3197	Northshore Rd	360-201-6631	jeff@muljatgroup.com
251	Single Family	Lake draw	Maybe/D	Fire/Safety, Water Quality	2		2			John D. Daniels	3117	Agate Bay Lane	360-671-4346	jdaniels@jdcci.com
252	Single Family	Lake draw	Maybe/D	Water Quality	1	3	2			Thomas Leone	2623	Northshore Rd	360-366-8282	duffyleone@gmail.com
253	Single Family	Lake draw	No							Margaret & Paul Lo	2529 Cri	Alameda, CA 94501	360-739-4408	agatebay50@comcast.net
254	Single Family	Well	Yes	Reliability, Water Quality,	3	4	4		We really would love this service.	Cody & Tasha Repp	3162	Edgewood Ln	360-756-8129	crepp70@msn.com

Appendix D – Water Quantity / Water Quality Data

Lake Whatcom Water and Sewer District

Annual Drinking Water Quality Report
South Shore Service Area (WA State ID# 959101)
2016 Consumer Confidence Report

What is this report?

In accordance with the Federal Government's Re-authorization of the Safe Drinking Water Act of 1996, all public and private water utilities are required to prepare and provide annual drinking water quality reports to their customers. As well as being required by Federal Law, we want to keep you informed about the excellent water and sewer services delivered to you over the past year. Our goal is to provide safe, dependable, and high quality drinking water.

Where does the drinking water come from?

The drinking water supplied to your home originates from Lake Whatcom, a surface water source. Lake Whatcom Water and Sewer District draws its water from Basin #3 of Lake Whatcom near Sudden Valley. The water enters our water filtration plant where it undergoes filtration and disinfection. The water produced is very high quality, and Lake Whatcom Water and Sewer District is pleased to report the drinking water is safe and meets or exceeds all federal and state requirements.

What's in the drinking water?

Lake Whatcom Water and Sewer District routinely monitors the drinking water in accordance with Federal and State laws. Included are the results for seven constituents that are regulated by the U.S. Environmental Protection Agency (USEPA) and were detected during the period of January 1st to December 31st, 2016. To obtain a complete listing of all constituents, please contact the District. All drinking water, including bottled drinking water, may be reasonably expected to contain at least small amounts of some constituents and/or contaminants. It's important to remember that the presence of these constituents does not necessarily pose a health risk. More information about contaminants and potential health effects can be obtained by calling the Environmental Protection Agency's Safe Drinking Water Hotline at (800) 426-4791. Abbreviations and terms used in this report include:

***Parts per billion** (ppb)*

***Parts per million** (ppm)*

***Nephelometric Turbidity Unit** (NTU)* – Nephelometric turbidity unit is a measure of the clarity of water. Turbidity in excess of 5 NTU is just noticeable to the average person.

***Action Level** (AL)* – The concentration of a contaminant, if exceeded, triggers treatment or other requirements that a water system must follow.

Maximum Contaminant Level – The "Maximum Allowed" (MCL) is the highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs (see below) as feasible using the best available treatment technology. MCL's are set at very stringent levels. To understand the possible health effects described for many regulated constituents, a person would have to drink 2 liters of water everyday at the MCL level for a lifetime to have a one-in-a-million chance of having the described health effect.

Maximum Disinfection Residual Level – (MRDL) the highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.

Maximum Contaminant Level Goal – The "Goal" (MCLG) is 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.

N/D- Non Detectable

Information for persons with compromised immune systems

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-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. United States Environmental Protection Agency and Centers for Disease Control (USEPA/CDC) guidelines on appropriate means to lessen the risk of infection by cryptosporidium and other microbiological contaminants are available from the toll free Safe Drinking Water Hotline at (800) 426-4791.

Testing completed by Lake Whatcom Water and Sewer District and State certified laboratories.

Detected substance	Violation Yes/No	2016 (or most recent) Level	MCL, AL or MRLD	MCLG	Likely Source of substance
Barium	No	.006 ppm	2 ppm	2 ppm	Erosion from natural deposits, discharge from metal refiners, discharge of drilling waste
Chlorine	No	Of the free chlorine residual samples that were collected with our required bacterial samples in the distribution system the average chlorine residual was .57 ppm with a range of .10 ppm 1.00 ppm	4 ppm (MRLD) maximum in distribution system	2 ppm minimum to first customer in distribution system	Added at Water Treatment Plant for disinfection
Nitrate	No	.48 ppm	10 ppm	10ppm	Erosion from natural deposits, runoff from fertilizer, sewage, leaching from septic tanks
Copper	No	The 90th percentile value of 24 homes sampled showed copper at a level of 278 ppb with a range of 17 ppb to 572 ppb	1300 ppb	1300 ppb	Corrosion of household plumbing, erosion of natural deposits, leaching from wood preservatives
Lead	No	The 90th percentile value of 24 homes sampled showed lead at a level of 5ppb with a range of N/D to 8 ppb	15 ppb	0 ppm	Corrosion of household plumbing, erosion of natural deposits
TTHM Total Trihalomethanes	No	35.9 ppb	80 ppb	N/A	By-product of drinking water chlorination
HAAs Halo-acetic Acid	No	16.8 ppb	60 ppb	N/A	By-product of drinking water chlorination
Turbidity	No	0.04 NTU*	1.0 NTU	N/A	Soil runoff

Facts about detected substances

Barium – Some people who drink water containing barium in excess of the MCL for many years could experience an increase in their blood pressure. Barium is a lustrous, machinable metal which exists in nature only in ores containing mixtures of elements. Barium is used in electronic components, metal alloys, bleaches, dyes, ceramics, glass, and fireworks, as well as well drilling operations where it is released directly in to the ground.

Chlorine – Chlorine is used as a water disinfectant. Disinfection is the most important step in the water treatment process to destroy pathogenic bacteria and other harmful agents. Chlorination is a very common and effective method for the disinfection of your drinking water. Your water provider is required to maintain a free-chlorine residual throughout their water distribution system.

Nitrate – Infants below the age of six months who drink water containing nitrates in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue baby syndrome.

Copper – Copper is an essential nutrient, but some people who drink water containing copper in excess of the action level over a relatively short amount of time could experience gastrointestinal distress. Some people who drink water containing copper in excess of the action level over many years could suffer liver or kidney damage. People with Wilson's disease should consult their personal doctor.

Lead – Infants and children who drink water containing lead in excess of the action level could experience delays in their physical or mental development, including slight deficits in attention span and learning abilities. Adults who drink this water over many years could develop kidney problems or high blood pressure. Elevated levels of lead can cause serious health problems, especially for pregnant women and young children. In Sudden Valley and Geneva, lead is not found in the treated water, but lead in drinking water can come from pipes and faucets in our homes. Lake Whatcom Water & Sewer District is responsible for providing high quality drinking water but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for at least 30 seconds before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline at (800) 426-4791, or online at *http://www.epa.gov/safewater/lead*

TTHMs (Total Trihalomethanes) & HAAs (Halo-Acetic Acids) – Some people who drink water containing trihalomethanes or Halo-Acetic Acids in excess of the MCL over many years may experience problems with their liver, kidneys, or central nervous systems, and may have an increased risk of getting cancer.

Turbidity – Turbidity has no health effects. However, turbidity can interfere with disinfection and provide a medium for microbial growth. Turbidity may indicate the presence of disease-causing organisms. These organisms include bacteria, viruses, and parasites that can cause symptoms such as nausea, cramps, diarrhea, and associated headaches.

*0.07 NTU was the maximum instantaneous operational level recorded, 0.07 NTU was the maximum hourly average recorded, 0.07 NTU was the maximum daily average recorded. The annual daily average was 0.04 NTU.

Questions or Concerns about your water?

For questions regarding this report or concerning your water utility, please contact Lake Whatcom Water and Sewer District Water Treatment Plant Operator Kevin Cook at (360) 734-9224. To learn more, please attend any of our regularly scheduled Board of Commissioner meetings.

- Second Wednesday of each month at 6:30 pm
- Last Wednesday of each month at 8:00 am

Meetings are held at the District office at 1220 Lakeway Drive at the beginning and end of each Regular meeting, there is a public comment period where you may express any questions or concerns to the Board.

Cross Connections may be hazardous to your health

What is a Cross Connection? A cross connection is any actual or potential physical connection between a potable (i.e., drinkable) water line and any pipe, vessel, or machine containing a non-potable fluid, solid, or gas where the non-potable substance can enter the potable water system by backflow. Garden hoses left connected and turned on when not in use can easily contaminate your home plumbing system. For questions or concerns about potential Cross Connections, please contact Lake Whatcom Water and Sewer District employee Rich Munson at (360) 734-9224.

Do I have any obligations regarding cross connections? Yes, if your residence has an in-ground irrigation system, heat pump, boiler or any other type of identified cross connection that requires a backflow prevention device, you are required to have the device inspected annually by a State Certified Backflow Assembly Tester.

REMEMBER: a cross connection not only threatens your health and safety, but that of your neighbors and the community as whole, so **PLEASE** do your part to prevent them.

Conservation

Inefficient and or leaking faucets, toilets, and excessive outdoor watering account for a significant amount of water that is treated at water treatment plants. Lake Whatcom Water and Sewer District would like to encourage voluntary water conservation, and there are many simple ways to help in this effort. By installing water saving shower heads, kitchen and bathroom faucets and low flow toilets, an average residence will save 25% or more water in a day then a residence without. **We request voluntary even numbered addresses to only water outside on Tuesdays, Thursdays and Saturdays, and odd numbered addresses to water on Wednesdays, Fridays and Sundays, with no outdoor watering on Mondays**. Lake Whatcom Water and Sewer District is a metered system, so saving water means saving money. Water may seem like an unlimited resource in the Pacific Northwest, but there is a limit, and it can only be plentiful for all future generations if we all do our part in conserving this precious resource.

Our commitment to our customers

Lake Whatcom Water and Sewer District staff is on duty around the clock to provide the safest and best quality water service to every home. We ask that all of our customers help us protect our precious water sources which are the heart of our community, our way of life, and our children's future.

Lake Whatcom Water and Sewer District

Annual Drinking Water Quality Report
Eagleridge Service Area (WA State ID# 081181)
2016 Consumer Confidence Report

What is this report?

In accordance with the Federal Government's Re-authorization of the Safe Drinking Water Act of 1996, all public and private water utilities are required to prepare and provide annual drinking water quality reports to their customers. As well as being required by Federal Law, we want to keep you informed about the excellent water and sewer services delivered to you over the past year. Our goal is to provide safe, dependable, and high quality drinking water.

Where does the drinking water come from?

Lake Whatcom Water and Sewer District purchases the water supplied to your home from the City of Bellingham and distributes the water in its own water distribution system to your tap. The City of Bellingham draws its water from Basin #2 of Lake Whatcom and pumps the water to its Water Filtration Plant where it undergoes filtration and disinfection. The water produced is a very high quality drinking water supply, and Lake Whatcom Water and Sewer District is pleased to report that the drinking water is safe and meets or exceeds all federal and state requirements.

What's in the drinking water?

Lake Whatcom Water and Sewer District and the City of Bellingham routinely monitor the drinking water in accordance with federal and state laws. Included are the results for five constituents that are regulated by the U.S. Environmental Protection Agency (USEPA) and were detected during the period of January 1st to December 31st, 2016 to obtain a complete listing of all constituents, please contact the District. All drinking water, including bottled drinking water, may be reasonably expected to contain at least small amounts of some constituents and/or contaminants. It's important to remember that the presence of these constituents does not necessarily pose a health risk. More information about contaminants and potential health effects can be obtained by calling the Environmental Protection Agency's Safe Drinking Water Hotline at (800) 426-4791. In the following table you will find many terms and abbreviations you may not be familiar with. Abbreviations and terms used in this report include:

Parts per billion *(ppb)*
Parts per million *(ppm)*
Nephelometric Turbidity Unit *(NTU)* – Nephelometric turbidity unit is a measure of the clarity of water. Turbidity in excess of 5 NTU is just noticeable to the average person.
Action Level – The concentration of a contaminant, if exceeded, triggers treatment or other requirements that a water systems must follow.
Maximum Contaminant Level *(MCL)* – The "Maximum Allowed" is the highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs (see below) as feasible using the best available treatment technology. MCL's are set at very stringent levels. To understand the possible health effects described for many regulated constituents, a person would have to drink 2 liters of water every day at the MCL level for a lifetime to have a one-in-a-million chance of having the described health effect.
Maximum Disinfection Residual Level *(MRDL)* – The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.
Maximum Contaminant Level Goal *(MCLG)* – The "Goal" is 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.
N/D- Non Detectable

Information for persons with compromised immune systems

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as those with cancer undergoing chemotherapy, those 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. The United States Environmental Protection Agency and Centers for Disease Control (USEPA/CDC) guidelines on appropriate means to lessen the risk of infection by cryptosporidium and other microbiological contaminants are available from the toll free Safe Drinking Water Hotline at (800) 426-4791.

Testing completed by Lake Whatcom Water and Sewer District, the City of Bellingham and State certified laboratories.

Detected Substance	Violation Yes/No	2016 (or most recent) Level	MCL, MRDL or AL	MCLG	Likely Source of Substance
Copper	No	The 90th percentile value of 8 homes sampled showed copper at a level of 71 ppb with a range of 11 ppb to 71 ppb	1300 ppb	1300ppb	Corrosion of household plumbing, erosion of natural deposits, leaching from wood preservatives
Lead	No	The 90th percentile value of 8 homes sampled showed lead at N/D ppb Range ND to N/D ppb Zero homes sampled above the AL	15 ppb	0	Corrosion of household plumbing, erosion of natural deposits
TTHM Total Trihalomethanes	No	44.6 ppb	80 ppb	0	By-product of drinking water chlorination
HAAs Halo-acetic-Acid	No	14.7 ppb	60 ppb	0	By-product of drinking water chlorination
Turbidity	No	0.09 NTU was the highest recorded at the city's plant	1.0 NTU	0	Soil run-off
Chlorine	No	Of the free chlorine residuals samples collected with our required bacterial samples in the distribution system the average free chlorine residual average was approximately .34 ppm with a range of .20 ppm to .50 ppm.	4 ppm MRDL	.2 ppm minimum at first customer in distribution system.	Added for disinfection at the City of Bellingham's water treatment plant

Facts about detected substances

Copper – Copper is an essential nutrient, but some people who drink water containing copper in excess of the action level over a relatively short amount of time could experience gastrointestinal distress. Some people who drink water containing copper in excess of the action level over many years could suffer liver or kidney damage. People with Wilson's disease should consult their personal doctor.

Lead – Infants and children who drink water containing lead in excess of the action level could experience delays in their physical or mental development. Children could show slight deficits in attention span and learning abilities. Adults who drink this water over many years could develop kidney problems or high blood pressure. Elevated levels of lead in drinking water can cause serious health problems, especially for pregnant women and young children. In Bellingham, lead is not found in the treated water, but lead in drinking water can come from pipes and faucets in our customers' homes. Lake Whatcom Water and Sewer is responsible for providing high quality drinking water but cannot control the variety of materials used in customer's plumbing. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for at least 30 seconds before using the water for drinking or cooking. You can capture this water to use on plants. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline at (800) 426-4791, or online at *http://www.epa.gov/safewater/lead*

TTHMs & Halo-Acetic Acids – Some people who drink water containing trihalomethanes or Halo-Acetic Acids in excess of the MCL over many years may experience problems with their liver, kidneys, or central nervous systems and may have an increased risk of getting cancer.

Turbidity – Turbidity has no health effects. However, turbidity can interfere with disinfection and provide a medium for microbial growth. Turbidity may indicate the presence of disease-causing organisms. These organisms include bacteria, viruses, and parasites that can cause symptoms such as nausea, cramps, diarrhea, and associated headache.

Chlorine – Chlorine is used as a water disinfectant. Disinfection is the most important step in the water treatment process to destroy pathogenic bacteria and other harmful agents. Chlorination is a very common and effective method for the disinfection of your drinking water. Your water provider is required to maintain a free-chlorine residual throughout their water distribution system.

Questions or Concerns about your water?

For questions regarding this report or concerning your water, please contact Lake Whatcom Water and Sewer District Water Treatment Plant Operator Kevin Cook at (360) 734-9224. To learn more, please attend any of our regular, bi-monthly Board of Commissioner meetings.

- Second Wednesday of each month at 6:30 pm
- Last Wednesday of each month at 8:00 am

Meetings are held at the District office at 1220 Lakeway Drive. At the beginning and end of each Regular meeting, there is a public comment period where you may address any questions or concerns to the Board.

Cross Connections may be hazardous to your health

What is a Cross Connection? A cross connection is any actual or potential physical connection between a potable (i.e., drinkable) water line and any pipe, vessel, or machine containing a non-potable fluid, solid, or gas where the non-potable substance can enter the potable water system by backflow. Garden hoses left connected and turned on when not in use can easily contaminate your home plumbing system. For questions or concerns about potential Cross Connections, please contact Lake Whatcom Water and Sewer District employee Rich Munson at (360) 734-9224.
Do I have any obligations regarding cross connections? Yes, if your residence has an in-ground irrigation system, heat pump, boiler or any other type of identified cross connection that requires a backflow prevention device, you are required to have the device inspected annually by a State Certified Backflow Assembly Tester.
REMEMBER: a cross connection not only threatens your health and safety, but that of your neighbors and the community as whole, so **PLEASE** do your part to prevent them.

Conservation

Inefficient and/or leaking faucets, toilets, and excessive outdoor watering account for a significant amount of water that is treated at water treatment plants. Lake Whatcom Water and Sewer District would like to encourage voluntary water conservation. By installing water saving shower heads, kitchen and bathroom faucets and low flow toilets, an average residence could save 25% or more water a day then a residence without. **We request voluntary even numbered addresses to only water outside on Tuesdays, Thursdays and Saturdays, and odd numbered addresses to water on Wednesdays, Fridays and Sundays, with no outdoor watering on Mondays**. Lake Whatcom Water and Sewer District is a metered system, so saving water means saving money. Water may seem like an unlimited resource in the Pacific Northwest, but there is a limit, and it can only be plentiful for all future generations if we all do our part in conserving this precious resource.

Our commitment to our customers

Lake Whatcom Water and Sewer District staff is on duty around the clock to provide the safest and best quality water service to every home. We ask that all of our customers help us protect our precious water sources which are the heart of our community, our way of life, and our children's future.

Lake Whatcom Water and Sewer District

Annual Drinking Water Quality Report

Agate Heights Service Area (Washington state I.D. #52957B)

2016 Consumer Confidence Report

What is this report?

In accordance with the Federal Government's Re-authorization of the Safe Drinking Water Act of 1996, all public and private water utilities are required to prepare and provide annual drinking water quality reports to their customers. As well as being required by Federal Law, we want to keep you informed about the excellent water and sewer services delivered to you over the past year. Our goal is to provide safe, dependable, and high quality drinking water.

Where does the drinking water come from?

The Agate Heights water system is served by the Giesbrecht 10-inch artesian well, which is located within the Squalicum aquifer system. This well produces a high quality drinking water supply that contains naturally occurring iron and manganese and other minerals. The water is drawn from the well and undergoes a chlorination and filtration process to reduce the level of iron and manganese, and to provide chlorine residual to protect the water distribution system. Lake Whatcom Water and Sewer District is pleased to report that your drinking water is safe and meets or exceeds all federal and state requirements.

What's in the drinking water?

Lake Whatcom Water and Sewer District routinely monitors the drinking water in accordance with Federal and State laws. Included are the results for six constituents that are regulated by the U.S. Environmental Protection Agency (USEPA) and were detected during the period of January 1st to December 31st, 2016. To obtain a complete listing of all constituents, please contact the District. All drinking water, including bottled drinking water, may be reasonably expected to contain at least small amounts of some constituents and/or contaminants. It's important to remember that the presence of these constituents does not necessarily pose a health risk. More information about contaminants and potential health effects can be obtained by calling the Environmental Protection Agency's Safe Drinking Water Hotline at (800) 426-4791. Abbreviations and terms used in this report include:

***Parts per billion** (ppb)*
***Parts per million** (ppm)*
***Nephelometric Turbidity Unit** (NTU)* – Nephelometric turbidity unit is a measure of the clarity of water. Turbidity in excess of 5 NTU is just noticeable to the average person.
Action Level – The concentration of a contaminant, if exceeded, triggers treatment or other requirements that a water system must follow.
Maximum Contaminant Level – The "Maximum Allowed" (MCL) is the highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs (see below) as feasible using the best available treatment technology. MCL's are set at very stringent levels. To understand the possible health effects described for many regulated constituents, a person would have to drink 2 liters of water every day at the MCL level for a lifetime to have a one-in-a-million chance of having the described health effect.
Maximum Disinfection Residual Level – (MRDL) The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.
Maximum Contaminant Level Goal – The "Goal" (MCLG) is 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.
N/D- Non Detectable

Information for persons with compromised immune systems Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-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. United States Environmental Protection Agency and Centers for Disease Control (USEPA/CDC) guidelines on appropriate means to lessen the risk of infection by cryptosporidium and other microbiological contaminants are available from the toll free Safe Drinking Water Hotline at (800) 426-4791.

Testing is completed by Lake Whatcom Water and Sewer District and State certified laboratories.

Detected Substance	Violation Yes/No	2016(or most recent) Level	MCL, Al or MDRL	MCLG	Likely Source of Substance
Arsenic	No	.004 ppm	.010 ppm	0 ppm	Erosion of natural deposits, runoff from orchards, runoff from glass, and electronics production wastes
Barium	No	.039 ppm	2 ppm	2 ppm	Erosion from natural deposits, discharge from metal refiners, discharge of drilling waste
Copper	No	The 90th percentile value of 7 homes sampled showed copper at a level of 144 ppb with a range of 13 ppb to 144 ppb	1,300 ppb	1,300 ppb	Corrosion of household plumbing, erosion of natural deposits, leaching from wood preservatives
Fluoride	N0	.10 ppm	4.0 ppm	4.0 ppm	Water additive which promotes strong teeth; erosion of natural deposits; discharge from fertilizer and aluminum factories
Lead	No	The 90th percentile value of 7 homes sampled showed lead N/D levels	15 ppb	0 ppb	Corrosion of household plumbing, erosion of natural deposits
HAAs Halo- acetic acids	No	6.5 ppb	60 ppb	0 ppb	By-product of drinking water chlorination
TTHM Total Trihalomethanes	No	12.9 ppb	80 ppb	0 ppb	By-product of drinking water chlorination
Chlorine	No	Of the free chlorine residual samples that were collected with our required bacterial samples in the distribution system the average chlorine residual was approximately .47 ppm with a range of .18 ppm to .60 ppm.	4 ppm MRDL	.2 ppm minimum at first customer in distribution system	Added at water treatment plant for disinfection.

Facts about detected substances

Arsenic – While your drinking water meets EPA's standard for arsenic, it does contain low levels of arsenic. EPA's standard balances the current understanding of arsenic's possible health effects against the costs of removing arsenic from drinking water. EPA continues to research the health effects of low levels of arsenic, which is a mineral known to cause cancer in humans at high concentrations and is linked to other health effects such as skin damage and circulatory problems.

Barium – Some people who drink water containing barium in excess of the MCL for many years could experience an increase in their blood pressure. Barium is a lustrous, machinable metal which exists in nature only in ores containing mixtures of elements. Barium is used in electronic components, metal alloys, bleaches, dyes, ceramics, glass, and fireworks, as well as well drilling operations where it is released directly in to the ground

Copper – Copper is an essential nutrient, but some people who drink water containing copper in excess of the action level over a relatively short amount of time could experience gastrointestinal distress. Some people who drink water containing copper in excess of the action level over many years could suffer liver or kidney damage. People with Wilson's Disease should consult their personal doctor.

Fluoride -- Bone disease (pain and tenderness of the bones); Children may get mottled teeth.

Lead – Elevated levels of lead in drinking water can cause serious health problems, especially for pregnant women and young children. In our Agate Heights system, lead is not found in the treated water, but lead in drinking water can come from pipes and faucets in our homes. Lake Whatcom Water and Sewer District is responsible for providing high quality drinking water but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for at least 30 seconds before using the water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline at (800) 426-4791, or online at *http://www.epa.gov/safewater/lead*

TTHMs (Total Trihalomethanes) & HAAs (Halo-Acetic Acids) – Some people who drink water containing Trihalomethanes or Halo-Acetic Acids in excess of the MCL over many years may experience problems with their liver, kidneys, or central nervous systems, and may have an increased risk of getting cancer.

Chlorine – Chlorine is used as a water disinfectant. Disinfection is the most important step in the water treatment process to destroy pathogenic bacteria and other harmful agents. Chlorination is a very common and effective method for the disinfection of your drinking water. Your water provider is required to maintain a free-chlorine residual throughout their water distribution system.

Questions or Concerns about your water?

For questions regarding this report or concerning your water, please contact Lake Whatcom Water and Sewer District, Water Treatment Plant Operator Kevin Cook at (360) 734-9224. To learn more, please attend any of our regular, bi-monthly Board of Commissioner meetings.

- Second Wednesday of each month at 6:30 pm
- Last Wednesday of each month at 8:00 am

Meetings are held at the District office at 1220 Lakeway Drive. At the beginning and end of each Regular meeting, there is a public comment period where you may address any questions or concerns to the Board.

Cross Connections may be hazardous to your health

What is a Cross Connection? A cross connection is any actual or potential physical connection between a potable (i.e., drinkable) water line and any pipe, vessel, or machine containing a non-potable fluid, solid, or gas where the non-potable substance can enter the potable water system by backflow. Garden hoses left connected and turned on when not in use can easily contaminate your home plumbing system. For questions or concerns about potential Cross Connections, please contact Lake Whatcom Water and Sewer District employee Rich Munson at (360) 734-9224.
Do I have any obligations regarding cross connections? Yes, if your residence has an in-ground irrigation system, heat pump, boiler or any other type of identified cross connection that requires a backflow prevention device, you are required to have the device inspected annually by a State Certified Backflow Assembly Tester.
REMEMBER: a cross connection not only threatens your health and safety, but that of your neighbors and the community as whole, so **PLEASE** do your part to prevent them.

Conservation

Inefficient and or leaking faucets, toilets, and excessive outdoor watering account for a significant amount of water that is treated at water treatment plants. Lake Whatcom Water and Sewer District would like to encourage voluntary water conservation and there are many simple ways to help in this effort. By installing water saving shower heads, kitchen and bathroom faucets and low flow toilets, an average residence could save 25% or more water a day then a residence without. **We request voluntary even numbered addresses to only water outside on Tuesdays, Thursdays and Saturdays, and odd numbered addresses to water on Wednesdays, Fridays and Sundays, with no outdoor watering on Mondays.** Lake Whatcom Water and Sewer District is a metered system, so saving water means saving money. Water may seem like an unlimited resource in the Pacific Northwest, but there is a limit, and it can only be plentiful for all future generations if we all do our part in conserving this precious resource.

Our commitment to our customers

Lake Whatcom Water and Sewer District staff is on duty around the clock to provide the safest and best quality water service to every home. We ask that all of our customers help us protect our precious water sources which are the heart of our community, our way of life, and our children's future.

Appendix E – Hydraulic Analyses

Appendix E - Hydraulic Models and Analysis Results

The program used to perform the hydraulic analysis was InfoWater Version 12.3, the Innovyze water distribution modeling program that is fully integrated with ArcGIS for its graphical interface.

A. Sudden Valley: and

B. Geneva:

Model Set-Up

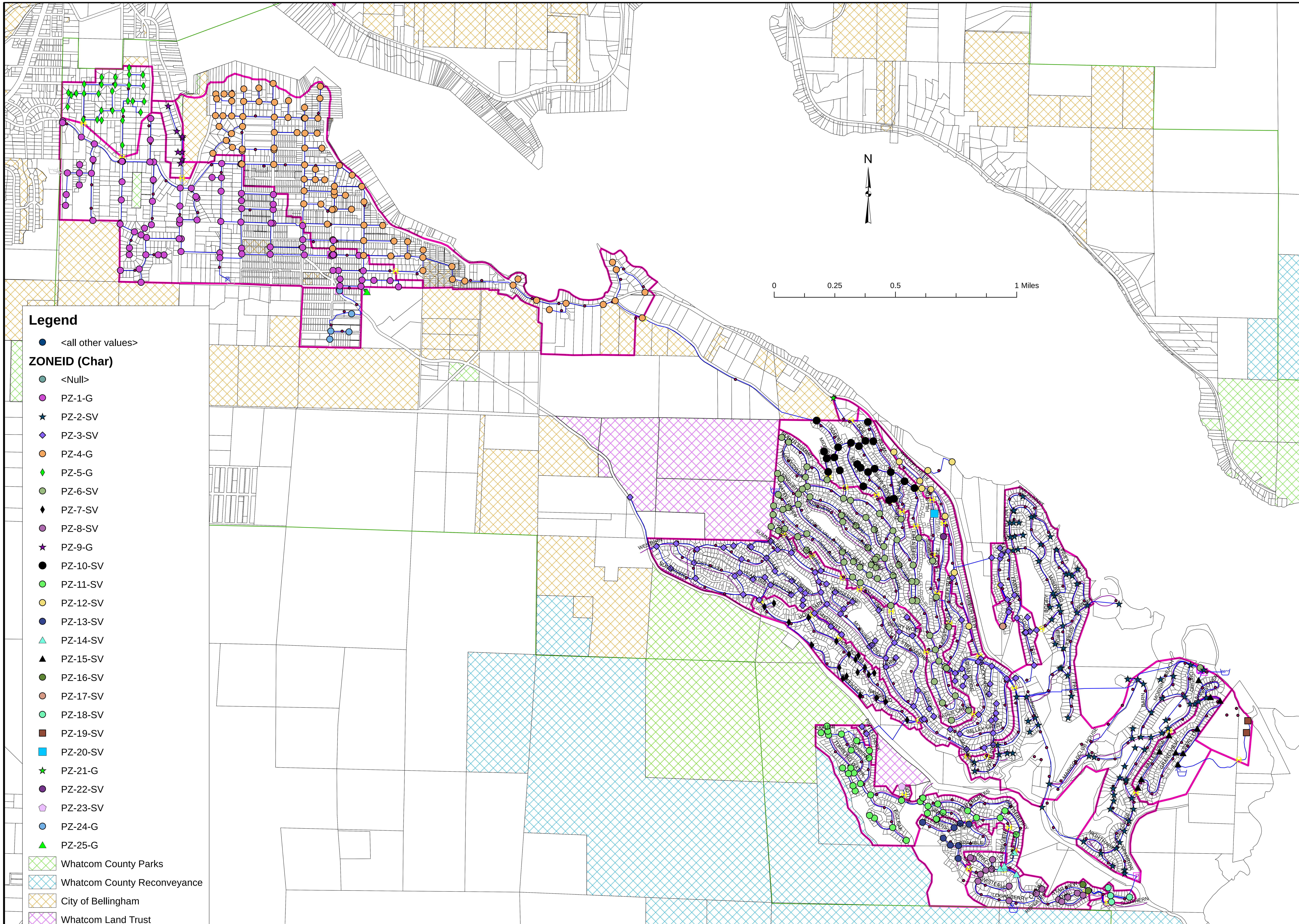
The hydraulic model for Sudden Valley and Geneva was updated since the previous water system plan update. Updates included infrastructure for all Developer Extension Agreements that have been constructed, updates to Maximum Day Demand (MDD) and Peak Hour Demand (PHD), and updates to PRV settings so that the model represents current settings and conditions. Pump curves were updated so that flow rates accurately represented measured flow rates. Fire flow demands were updated to include junctions with new hydrants. The new Division 22 reservoir that has recently been constructed was added to the model. Elevations were updated to be based on NAVD88 (which is now the vertical datum used by the City of Bellingham).

MDD was updated to be 250 gpd/ERU for Sudden Valley ERUs and 370 gpd/ERU for Geneva ERUs (Appendix B). Distribution of MDD was based on the previous model but was updated as appropriate. PHD was updated using Equation 5-1 from the DOH Water System Design Manual calculating a total peak hour demand for each hydraulically distinct pressure zone. The total zone PHD was then distributed to the junctions within that pressure zone with the same distribution as the MDD demand.

There are 25 hydraulically distinct pressure zones within the south shore water system. Many of these are within similar bands of elevation, but due to the topography and distribution do not have connecting pipes. See Figure E-1 for a map of the 25 pressure zones.

All pipes 6" and larger ***or*** part of a loop were included in the Sudden Valley system analysis. All pipes in the Geneva system were included in the analysis. The minimum system pressures used were 30 psi for peak hourly demand conditions with equalizing storage depleted and 20 psi for fireflow plus Maximum Daily Demand (MDD) conditions with equalizing and fire suppression storage depleted. These are the State required minimum system pressures.

The modeling performed was for the full anticipated build-out population of Geneva and Sudden Valley based on existing infrastructure (infill of vacant lots). Build-out for Geneva is estimated at 1239 ERUs and build-out for Sudden Valley is estimated at about 3267 ERUs. Scenarios for less than full build-out were not assessed because the system currently has capacity for full build-out.



SHEET 1 OF 1

DATE JULY 2017

SCALE As Shown

JOB NUMBER 2016-096

LAKE WHATCOM WATER AND SEWER DISTRICT

WHATCOM COUNTY WASHINGTON

FIGURE E-1
SOUTH SHORE PRESSURE ZONES

Coordinate System:
State Plane Washington North
North American Datum 1983

Data Source:
City of Bellingham Public Works Dept.,
Whatcom County Planning & Assessor

WILSON ENGINEERING, LLC
805 DUPONT STREET
BELLINGHAM, WA 98225
(360)733-6100 FAX(360)647-9061
www.wilsonengineering.com

Wilson
SURVEY / ENGINEERING

In order to evaluate the system under conditions that deplete all equalizing and/or fire suppression storage volume (per DOH Water System Design Manual, Section 8.2.3.5, a and b), all reservoir storage was evaluated to determine operating, equalizing, and fire suppression storage volumes. Results are summarized in Table A-1 of Appendix A. Peak Hour Demand per reservoir was calculated using DOH Equation 5-1 using the number of ERUs for each reservoir. Fire Suppression Storage is 750 gpm x 60 minutes for each reservoir except Division 30 because Division 30 only serves residential connections in Sudden Valley (need 500 gpm x 60 minutes). Other reservoirs could serve Commercial/Condos in Sudden Valley or Geneva connections, which have a fire flow requirement of 750 gpm. Storage for the two Division 22 reservoirs is shared proportionally between the two. Fire Suppression Storage is nested within Standby Storage.

In looking at Division 7 and Division 30, Division 7 has excess storage and Division 30 has a storage shortfall unless it were operated to be continuously full (no operating storage). Previous reports (2009 Reservoir Capacity Analysis, 2015 Division 22 Reservoir Predesign Report) have addressed this issue and it has been concluded that Division 30 can share the standby storage provided by Division 7 because Division 30 is fed by a booster station from Division 7 and the booster station is fully redundant and can be powered by an on-site generator. This level of reliability is adequate to transfer standby storage from Division 7 to Division 30 in the majority of standby situations, including a prolonged power outage.

Operating Storage levels shown in Table A-1 match current operating records except for Division 22. Currently, Division 22 is serving fewer ERUs and Division 30 is serving more ERUs than shown in the table because the new Division 22 reservoir is not yet in service. Once it is complete, operation will be adjusted to approximately match the ERU distribution shown in Table A-1 and the bottom of the operational level of the Division 22 reservoirs will be raised to the levels shown in Table A-1.

ERU allocations per reservoir are based on the operational PRV settings such that Division 30 does not feed connections on the northeast side of Lake Louise Road. A map of where the reservoirs are feeding under this ERU allocation scenario is shown in Figure A-1 of Appendix A.

For Peak Hour Demand (PHD), the model was evaluated with tank levels such that all equalizing storage was depleted, as shown in Table A-1. For fire suppression flows during Maximum Day Demand (MDD), the model was evaluated with tank levels such that all equalizing storage and fire suppression storage was depleted, as shown in Table A-1.

<u>Model Calibration</u>

An effort was made to calibrate the model as described below. Limitations in resources (availability of field crews to perform flushing) did not allow for data collection in enough areas of the system to perform a full system calibration. Data that was collected and calibration conclusions from that data are described below. We recommend that LWWSD continue to collect pressure and flow data during routine flushing so that data is available from throughout the system to assess model calibration more comprehensively in the future. Calibration was performed using the guidance provided by the AWWA Manual M32: Computer Modeling of Water Distribution Systems. Pressures were monitored by two hydrant pressure loggers manufactured by Global Water, installed at appropriate locations in the distribution system. This typically included installing one logger at a hydrant adjacent to the hydrant being flushed to monitor the local pressure drop and the second logger at the hydrant that the model indicated was the limiting junction (location where pressure dropped to 20 psi during fire flow and therefore limited the fire flow rate). The loggers were factory calibrated from 0-200 psi and were field adjusted with a one point calibration to 0 psi under the guidance of a Global Water technician. The reported accuracy of the loggers is +/- 1% of full scale. Loggers were programmed to collect one pressure reading every 30 seconds. Flow rates were measured using a water meter and a stopwatch.

Calibration data was collected during the summer months and during the day. Residential demand during this time was assumed to be approximately equal to MDD for comparison to the MDD model demands. Absolute pressures were assessed to determine if there were any major discrepancies in system connectivity or PRV settings. Relative pressure drop during flushing was compared to model pressure drop at the field-measured flow rate and flushing location.

Flow and pressure data was collected over 4 days of flushing in pressure zones PZ-3-SV, PZ-6-SV, and PZ-7-SV. This limited calibration effort revealed that the model in those areas did not contain major errors in connectivity or PRV settings. It also demonstrated that, in general, the field-measured pressure drops during flushing were higher than predicted by the model. In order to reconcile these differences, adjustments to the model were made. The Hazen-Williams friction coefficient was adjusted from a previously assumed value of 100 to a value of 70 for the Sudden Valley portion of the system. This is justified because some or perhaps much of the distribution pipe is cast iron, and coefficients this low may be appropriate for cast iron pipe that is more than 40 years old. Minor losses due to bends and valves were added to the model (minor loss coefficient of 1 for every pipe segment). These changes brought the model in to agreement with the measured data within approximately 1 psi for the areas for which data was collected. Because the Sudden Valley water system was all constructed in the early 1970s in the time span of a couple years, and because the adjustments needed were very similar for all the areas in which data was collected, we assumed that this calibration could reasonably be applied throughout the Sudden Valley water system. As more data is collected in the future, this can be reassessed.

No data was collected in the Geneva area of the south shore water system. In general, most of the water mains in the Geneva area are newer than those in Sudden Valley and are cement mortar lined ductile iron. For this reason, we left the Hazen-Williams friction coefficient unchanged from the previous water system plan at a value of 100. Estimated minor losses from pipe bends were added to the Geneva area of the model.

<u>Model and Analysis Results</u>

A first item to note when assessing the model results is the impact of the limited number of services and fire hydrants near the storage reservoirs. The original system was designed to previous State standards (20 psi) and certain lots close to the reservoirs only have 20 psi of static pressure. These lots have been identified and qualify for reimbursement by the District for the purchase of a residential booster in accordance with District Resolution 410 (and Resolutions 721, 778, Administrative Code 4.2.1). This complicates the analysis somewhat because these areas will not necessarily maintain 20 psi under MDD + fire flow conditions or 30 psi under PHD.

Peak Hour Demand

Peak Hour Demand pressure results can be seen in Table E-1. This table is ordered by pressure at each junction from low to high.

Table E-1 indicates that there are 18 junctions with less than 30 psi. Each of these is addressed individually below. All of the junctions are either near a reservoir or are in Sudden Valley on the ridge that runs from the Division 22 reservoirs to the southeast. For those not near a reservoir, the street name is given.

The junctions with less than 30 psi under PHD that are not near a reservoir were not identified in the previous analysis. These may be a result of the calibration effort. Calibration data was not collected for the specific location along the ridge SE of Division 22, and it is possible that the modifications may not be applicable for this area. Further data could be collected to further calibrate the model in this area.

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)	Description
J1288	0	799	815.69	7.23	Near Div 22
J203	0	800	825.07	10.86	Near Div 22
J1540	0	668	697.17	12.64	Near Div 7
J1822FH	0	778	815.69	16.33	Near Div 22
J1428	2.3	748.96	793.79	19.43	Basin View Cir
J276	5.86	747.08	793.28	20.02	Sudden Valley Dr
J592	3.56	745.84	793.45	20.63	Basin View Cir
J768	1.03	771.38	820.48	21.27	Near Div 22
J1847	0	780	829.43	21.42	Near Div 22
J602	0.51	770.35	820.47	21.72	Near Div 22
J590	2.02	742.98	793.42	21.85	Sudden Valley Dr
J482	3.16	643.63	696.6	22.95	Near Div 7
J1072	10.97	1,003.00	1,056.83	23.32	Near Div 30
J54	2.8	763.82	820.71	24.65	Near Div 22
J502	4.82	736.59	794.14	24.94	Sudden Valley Dr
J1914	1.79	749.04	811.35	27	Highwood Cir
J1494	2.3	730.96	793.31	27.01	Sandalwood Cir
J1896	0	621	687.43	28.79	Near Geneva Res

Table E-1 shows that there are still quite a few services that receive water in excess of 100 psi. Further investigation in to PRV adjustments or addition of PRVs (and subsequently pressure zones) may be investigated.

MDD + Fire Flow

There are a couple of low-pressure junctions that limit fire flows to insufficient quantities in order to maintain 20 psi throughout the system. Again, this is primarily due to the junctions/services near the reservoirs. Specifically, junctions at the northwest end of Water Tower Ct and Kinglet Ct near the Division 22 reservoirs and one junction near the Division 30 reservoir were responsible for the limitation. When these junctions were artificially lowered in elevation (to account for the fact that services in these areas are eligible for reimbursement of individual booster pumps), most of the available fire flow results showed that greater than 500 gpm was available. The amount of artificial elevation decrease for these areas was a maximum of 28 ft (12 psi).

There are three exceptions to the above description. There is one fire hydrant at the northwest end of Kinglet Ct that cannot achieve 500 gpm while maintaining 20 psi

(J1822FH). This is because the static pressure at this hydrant is approximately 20 psi. Even with a residual pressure at the hydrant of 10 psi, less than 500 gpm is available.

A second area with less than 500 gpm fire flow available is at Fire Hydrant 10-057 (J1428) on Basin View Circle. This hydrant has too low of a static pressure to provide 500 gpm while maintaining 20 psi, and it limits a number of hydrants around it to slightly less than 500 gpm (but all more than 400 gpm). The third hydrant that is an issue is Fire Hydrant 6-038 on Highwood Circle (J1914). This hydrant provides 382 gpm while maintaining 20 psi. These two areas were not a problem when the model was last analyzed and is probably a result of the calibration of the model. Data for the calibration effort was not collected for this specific area, so it is possible that the C factor of 70 and minor losses may not be appropriate for this area. Further data could be collected to assess this in the future.

There are also some areas where available fire flow is greater than 500 gpm but less than the fire flow standard of 750 gpm for specific areas. Some of these are in the Sudden Valley commercial or multi-family areas and are again likely the result of the calibration effort. Calibration data for these areas was not collected and could be investigated in further detail.

Full fire flow model results as described above can be seen in Table E-2.

In the “Critical Node Pressure” column of Table E-2, it can be seen that there are quite a few scenarios in which portions of the system could be depressurized if a hydrant was opened all the way and the pressure at the hydrant was allowed to drop to 20 psi. The results indicate that this generally is only a risk if more than 1000 gpm is drawn out of specific hydrants. In order to attempt to prevent this, LWWSD may consider labeling hydrants with capacities.

The National Fire Protection Association (NFPA) Code 291 sets forth guidelines for marking hydrants that could be implemented by LWWSD in coordination with the local fire districts. It recommends that hydrant tops and nozzle caps be painted according to the following based on rated capacity:

Rated capacity of 1500 gpm or greater: Light blue

Rated capacity of 1000 – 1499 gpm: Green

Rated capacity of 500-999 gpm: Orange

Rated capacity of less than 500 gpm: Red

NFPA 291 also recommends that hydrants having a static pressure of less than 40 psi should be rated at one-half of the static pressure (instead of at 20 psi) and that any pressure rating less than 20 psi should be stenciled on to the top of the hydrant in black.

C. North Shore - Eagleridge:

Model Set-Up

The Eagleridge water system model includes all pipes and pumps. The model demands were updated to reflect a MDD of 800 gpd/ERU and a system PHD of 130.5 gpm (based on MDD, build-out of 85 ERUs). Demands were distributed throughout the system. Pump curves were updated based on available information. Elevations were updated to all be based on NAVD88. For existing information, this was done by converting elevation information from Old City of Bellingham Datum to NAVD88 (Old City of Bellingham Datum is 1.71 ft lower than NAVD88). Junction elevations were updated to NAVD88 using LIDAR from the 2013 City of Bellingham project that produced detailed (3 ft by 3 ft resolution) DTM (Digital Terrain Model) data. This data was downloaded from the Washington State Department of Natural Resources LIDAR portal (http://lidarportal.dnr.wa.gov/).

The source from the City of Bellingham was updated to reflect current operating conditions. The connection from the City is at a hydraulic grade of approximately 519 ft. Based on information from the City of Bellingham CityIQ database, the connection is fed by approximately 2500 feet of unlooped 8-inch diameter water main. This information was input in to the model.

Model Verification

SCADA data of pump station discharge pressure and pump on/off status was analyzed to confirm that operation was consistent with model set-up. Suction and discharge pressures as well as the PRV setting were measured manually to confirm parameters. Field crew resources were not available to perform flushing and pressure measurement, so model calibration was not performed. The previously assumed Hazen Williams friction coefficient of 100 continues to be used. We recommend re-assessing this when flow and pressure data can be measured.

Model and Analysis Results

The model was analyzed based on the existing configuration with domestic and fire flow pumps. Results indicate that the existing system can provide sufficient pressure and flow to meet Peak Hour Demand for the projected build-out while maintaining a minimum system pressure of well above 30 psi (Table E-3). Results also indicate that the existing system can provide 750 gpm at all fire hydrants while maintaining a minimum system pressure of 20 psi (Table E-4).

Because of the change in source pressure from the previous analysis, the possibility of bypassing or eliminating the pump station was investigated. The hydraulic grade line of the Eagleridge system with the PRV setting of 105 psi is approximately 572 ft whereas the City source hydraulic grade line is approximately 519 ft. The model indicates that with the three residential flow pumps bypassed and served by the pressure of the City source with 20 ft of pipe as small as 2.5 inches in diameter (which is currently installed), 30 psi can be provided to all connections under peak hour demand. It is understood that the District receives low pressure complaints when this existing bypass is in operation, but the model indicates that the minimum pressure is provided to all customers. These results are shown in Table E-3A.

MDD plus fire flow was also investigated under pump bypass scenarios. With bypassing the pumps with 8-inch diameter pipe, it was found that most available fire flows were approximately 500-600 gpm. However, the pressure from the City source requires further investigation because in order to do a full assessment, the City source pressure needs to be modeled under conditions where equalizing and fire suppression storage in the reservoir are depleted and MDD in the City distribution system is accounted for. These items require coordination with the City to quantify and require a more detailed analysis.

D. North Shore - Agate Heights:

The Johnson Well Group B system with two connections was not modeled. The Agate Heights system was modeled and is described below.

Model Set-Up

The Agate Heights water system model includes all pipes, pumps, tanks and pressure reducing valve stations. MDD was updated to 500 gpd/ERU, and PHD was calculated for each pressure zone. Demands were appropriately distributed. PRV settings were updated to reflect current operational settings. Elevations were updated to all be based on NAVD88. For existing information, this was done by converting elevation information from Old City of Bellingham Datum to NAVD88 (Old City of Bellingham Datum is 1.71 ft lower than NAVD88). Junction and PRV elevations were updated to NAVD88 using LIDAR from the 2013 City of Bellingham project that produced detailed (3 ft by 3 ft resolution) DTM (Digital Terrain Model) data. This data was downloaded from the Washington State Department of Natural Resources LIDAR portal (http://lidarportal.dnr.wa.gov/).

Model Verification

System operating parameters were confirmed from the system's SCADA data. Tank levels were set such that equalizing storage was depleted for the PHD analysis and both equalizing and fire suppression storage volumes were depleted for the MDD + fire suppression flow rate analysis. These were set based on Table 3.3-6.

Field crew resources were not available to perform flushing and pressure measurement, so model calibration was not performed. The previously assumed Hazen Williams friction coefficient of 100 continues to be used. We recommend re-assessing this when flow and pressure data can be measured.

Model and Analysis Results

The results indicate that the system is capable of maintaining the minimum 30 psi pressure during peak hour demands (See Table E-5). Table E-5 indicates three junctions with less than 30 psi, but these are junctions on the transmission pipes and are not points in the distribution system. The results also indicate that the system can provide in excess of 750 gpm fire flows at the Lake Whatcom Residential and Treatment Center (LWRTC) and throughout the residential subdivisions while maintaining the minimum 20 psi system pressure (See Table E-6).

With the addition of a second, higher tank to serve the LWRTC, the Opal Terrace pressure zone was converted from being pressurized by a booster pump station to gravity service. While the analysis indicates the pumps should have sufficient capacity to keep up with refilling the tank under maximum day demand (MDD) conditions, staff have indicated that larger pumps would aid in overall system operations. This upgrade will be coordinated with the proposed project to increase the capacity of the Agate Heights Water Treatment Plant.

Table E-1: PHD Pressure Model Results

		ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
1	☐	J1288	0.00	799.00	815.69	7.23
2	☐	J203	0.00	800.00	825.07	10.86
3	☐	J1540	0.00	668.00	697.17	12.64
4	☐	J1822FH	0.00	778.00	815.69	16.33
5	☐	J1428	2.30	748.96	793.79	19.43
6	☐	J276	5.86	747.08	793.28	20.02
7	☐	J592	3.56	745.84	793.45	20.63
8	☐	J768	1.03	771.38	820.48	21.27
9	☐	J1847	0.00	780.00	829.43	21.42
10	☐	J602	0.51	770.35	820.47	21.72
11	☐	J590	2.02	742.98	793.42	21.85
12	☐	J482	3.16	643.63	696.60	22.95
13	☐	J1072	10.97	1,003.00	1,056.83	23.32
14	☐	J54	2.80	763.82	820.71	24.65
15	☐	J502	4.82	736.59	794.14	24.94
16	☐	J1914	1.79	749.04	811.35	27.00
17	☐	J1494	2.30	730.96	793.31	27.01
18	☐	J1896	0.00	621.00	687.43	28.79
19	☐	J1394	5.10	726.45	797.22	30.67
20	☐	J356	15.70	624.96	696.27	30.90
21	☐	J566	12.22	613.00	687.37	32.23
22	☐	J912	5.10	740.34	816.23	32.88
23	☐	J1620	0.00	824.81	903.24	33.99
24	☐	J1900	11.72	470.00	556.80	37.61
25	☐	J1845	0.00	600.00	687.15	37.76
26	☐	J1924	3.81	712.03	799.23	37.78
27	☐	J1054	11.66	605.35	693.27	38.10
28	☐	J1438	2.55	722.99	811.41	38.31
29	☐	J1464	9.87	597.00	687.03	39.01
30	☐	J104	0.00	811.31	903.24	39.84
31	☐	J704	6.61	723.58	815.69	39.91
32	☐	J56	2.55	726.07	818.61	40.10
33	☐	J882	3.34	625.79	720.07	40.85
34	☐	J1482	0.00	625.06	720.08	41.17
35	☐	J1384	2.55	707.63	804.74	42.08
36	☐	J1386	3.05	707.43	804.56	42.09
37	☐	J1920	15.79	804.37	903.10	42.78
38	☐	J1272	0.00	797.55	898.21	43.62
39	☐	J102	19.06	801.05	903.24	44.28
40	☐	J798	1.03	711.04	813.87	44.56
41	☐	J1843	2.81	584.00	687.12	44.68
42	☐	J1086	0.00	477.58	580.95	44.79
43	☐	J1004	0.00	611.15	715.37	45.16
44	☐	J580	3.75	482.57	586.87	45.19
45	☐	J604	1.03	710.12	814.66	45.30
46	☐	J448	0.00	480.78	585.33	45.30
47	☐	J1334	7.12	706.64	811.31	45.35
48	☐	J201	1.07	580.00	685.16	45.57
49	☐	J1882	1.41	580.00	685.48	45.71
50	☐	J1442	4.32	684.18	789.75	45.74

Table E-1: PHD Pressure Model Results

		ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
51	☐	J274	9.42	685.47	791.35	45.88
52	☐	J1618	8.01	472.94	580.96	46.80
53	☐	J1410	5.35	700.54	808.90	46.95
54	☐	J1672	0.00	677.35	787.67	47.81
55	☐	J1472	16.61	446.29	556.82	47.89
56	☐	J776	4.24	470.34	581.08	47.99
57	☐	J796	3.31	701.48	812.77	48.22
58	☐	J784	6.36	688.79	801.38	48.78
59	☐	J38	12.01	472.32	585.27	48.94
60	☐	J1434	5.58	699.30	812.59	49.09
61	☐	J1322	4.15	605.47	719.38	49.36
62	☐	J185	0.00	572.00	686.24	49.50
63	☐	J652	2.42	470.00	584.45	49.59
64	☐	J1480	2.86	604.86	719.55	49.69
65	☐	J1346	0.00	615.26	729.96	49.70
66	☐	J210	0.00	441.46	556.26	49.74
67	☐	J894	4.07	697.71	812.54	49.76
68	☐	J1796	4.32	675.66	790.53	49.77
69	☐	J1052	0.94	571.00	686.25	49.94
70	☐	J736	0.00	472.00	587.90	50.22
71	☐	J80	14.10	775.82	892.11	50.39
72	☐	J422	10.71	439.69	556.26	50.51
73	☐	J1448	0.00	471.54	588.30	50.59
74	☐	J152	0.00	695.32	812.55	50.79
75	☐	J1136	6.61	695.00	812.55	50.93
76	☐	J212	0.00	438.46	556.26	51.04
77	☐	J1718	0.00	689.91	807.82	51.09
78	☐	J1534	6.00	462.78	580.94	51.20
79	☐	J1042	3.50	467.70	586.39	51.43
80	☐	J442	0.00	461.91	580.94	51.57
81	☐	J1092	17.45	778.92	898.21	51.69
82	☐	J1348	0.00	461.34	580.94	51.82
83	☐	J1640	2.26	461.21	580.94	51.88
84	☐	J498	4.15	575.81	695.98	52.07
85	☐	J1112	2.75	465.06	585.23	52.07
86	☐	J840	6.85	931.84	1,052.30	52.20
87	☐	J1108	3.56	685.37	807.15	52.76
88	☐	J630	6.87	671.49	793.68	52.94
89	☐	J1274	0.00	775.75	898.21	53.06
90	☐	J1232	3.76	563.00	685.48	53.07
91	☐	J1668	3.05	682.66	805.42	53.19
92	☐	J922	5.20	428.00	550.79	53.21
93	☐	J1262	2.09	596.45	719.46	53.30
94	☐	J342	8.99	457.90	581.13	53.40
95	☐	J1720	0.00	684.57	807.82	53.40
96	☐	J1990	9.72	774.55	898.42	53.67
97	☐	J1536	4.00	456.92	580.91	53.72
98	☐	J416	0.00	635.70	760.04	53.88
99	☐	J1656	6.24	590.61	714.98	53.89
100	☐	J686	2.89	460.00	584.46	53.93

Table E-1: PHD Pressure Model Results

		ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
101	☐	J408	0.00	431.56	556.26	54.03
102	☐	J1702	6.53	463.00	588.02	54.17
103	☐	J728	2.80	690.30	815.55	54.27
104	☐	J1460	2.86	602.91	728.46	54.40
105	☐	J782	21.27	465.35	592.17	54.95
106	☐	J486	7.54	560.00	687.01	55.03
107	☐	J742	2.26	456.35	583.59	55.13
108	☐	J1788	2.81	558.00	685.48	55.24
109	☐	J584	6.36	679.47	808.03	55.71
110	☐	J1134	6.36	683.80	812.69	55.85
111	☐	J1484	5.06	659.91	789.17	56.01
112	☐	J1928	3.76	556.00	685.42	56.08
113	☐	J1050	3.81	590.32	720.11	56.24
114	☐	J858	0.00	458.43	588.30	56.27
115	☐	J828	0.00	457.63	587.60	56.31
116	☐	J1244	3.30	555.00	685.40	56.50
117	☐	J884	1.68	589.92	720.34	56.51
118	☐	J376	6.11	555.00	686.22	56.86
119	☐	J52	3.30	554.00	685.27	56.88
120	☐	J582	0.00	455.51	586.87	56.92
121	☐	J988	1.94	453.00	584.45	56.96
122	☐	J1826	7.05	760.52	891.98	56.96
123	☐	J1030	3.25	453.11	585.49	57.36
124	☐	J86	11.72	423.50	556.37	57.57
125	☐	J1694	0.76	674.68	808.08	57.80
126	☐	J1502	0.00	674.39	807.82	57.81
127	☐	J542	1.76	451.96	585.75	57.97
128	☐	J1828	6.10	453.70	587.91	58.16
129	☐	J1224	7.80	421.87	556.27	58.24
130	☐	J522	3.56	656.48	790.90	58.24
131	☐	J1504	0.00	673.13	807.82	58.36
132	☐	J1590	0.00	594.90	729.96	58.52
133	☐	J199	0.55	550.00	685.16	58.57
134	☐	J444	0.00	445.77	580.94	58.57
135	☐	J1790	18.76	624.76	760.05	58.62
136	☐	J836	2.35	550.00	685.40	58.67
137	☐	J1522	9.41	551.00	686.97	58.92
138	☐	J1910	0.00	650.01	787.56	59.60
139	☐	J1380	0.00	443.38	580.95	59.61
140	☐	J1984	0.00	589.80	727.55	59.69
141	☐	J1558	0.00	450.00	587.90	59.75
142	☐	J1930	0.00	592.70	730.79	59.83
143	☐	J1956	4.43	412.00	550.74	60.12
144	☐	J312	0.00	451.00	589.90	60.19
145	☐	J1402	2.89	445.00	584.45	60.42
146	☐	J990	1.45	445.00	584.45	60.42
147	☐	J1376	0.00	590.28	730.18	60.62
148	☐	J205	0.00	546.00	686.23	60.76
149	☐	J1942	5.73	594.20	734.45	60.77
150	☐	J1952	3.81	675.46	815.83	60.82

Table E-1: PHD Pressure Model Results

		ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
151	☐	J272	2.98	410.00	550.76	60.99
152	☐	J1998	0.00	439.73	580.94	61.18
153	☐	J794	3.30	544.00	685.48	61.31
154	☐	J1710	2.98	409.00	550.75	61.42
155	☐	J1284	3.05	647.79	789.73	61.50
156	☐	J870	3.81	576.00	718.02	61.54
157	☐	J730	3.05	672.47	814.61	61.59
158	☐	J1670	0.00	644.82	787.67	61.90
159	☐	J306	12.19	444.54	587.76	62.05
160	☐	J982	2.81	543.00	686.25	62.07
161	☐	J1330	6.11	543.00	686.26	62.07
162	☐	J1256	0.00	577.40	720.74	62.11
163	☐	J1884	0.00	444.25	587.68	62.15
164	☐	J1696	0.00	441.00	584.45	62.16
165	☐	J1982	4.05	583.99	727.55	62.21
166	☐	J280	3.56	666.90	810.77	62.34
167	☐	J106	5.66	443.66	587.69	62.41
168	☐	J1644	1.79	672.47	816.53	62.42
169	☐	J1252	5.86	672.23	816.59	62.55
170	☐	J188	2.98	406.00	550.75	62.72
171	☐	J1204	1.76	438.67	583.53	62.77
172	☐	J1554	1.79	670.22	816.29	63.30
173	☐	J1234	3.56	659.39	805.70	63.39
174	☐	J620	4.51	434.50	580.94	63.45
175	☐	J1222	0.00	640.83	787.56	63.58
176	☐	J1908	0.00	639.90	787.56	63.98
177	☐	J1248	0.00	579.65	727.41	64.02
178	☐	J1954	0.76	403.00	550.75	64.02
179	☐	J1726	2.55	666.45	814.25	64.04
180	☐	J330	0.00	433.10	580.92	64.05
181	☐	J738	5.31	440.00	587.90	64.09
182	☐	J1200	0.00	433.17	581.12	64.11
183	☐	J788	5.10	640.10	788.55	64.32
184	☐	J1906	4.74	432.57	581.10	64.36
185	☐	J1818	14.81	611.32	760.03	64.44
186	☐	J172	4.43	402.00	550.73	64.44
187	☐	J164	0.00	581.37	730.18	64.48
188	☐	J1246	0.00	578.40	727.41	64.56
189	☐	J532	5.58	640.43	789.52	64.60
190	☐	J524	0.00	431.45	580.92	64.76
191	☐	J1404	0.00	438.09	587.68	64.82
192	☐	J586	2.98	401.00	550.80	64.91
193	☐	J1996	2.51	431.04	580.97	64.97
194	☐	J460	0.00	437.42	587.71	65.12
195	☐	J1750	2.81	535.00	685.48	65.20
196	☐	J72	8.20	434.00	584.49	65.21
197	☐	J1728	0.00	436.99	587.63	65.27
198	☐	J752	5.73	577.07	727.75	65.29
199	☐	J1310	0.00	636.55	787.56	65.43
200	☐	J1946	0.00	539.08	690.22	65.49

Table E-1: PHD Pressure Model Results

		ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
201	☐	J1026	7.77	637.62	788.77	65.50
202	☐	J526	4.80	436.36	587.64	65.55
203	☐	J195	4.09	780.00	931.53	65.66
204	☐	J328	0.00	429.16	580.92	65.76
205	☐	J1748	1.41	533.00	685.48	66.07
206	☐	J1712	2.22	398.00	550.76	66.19
207	☐	J1852	5.96	575.69	728.47	66.20
208	☐	J1364	0.00	900.05	1,053.24	66.38
209	☐	J418	0.00	606.58	760.04	66.49
210	☐	J826	0.00	433.85	587.60	66.62
211	☐	J252	5.49	565.56	719.51	66.71
212	☐	J1338	0.00	402.00	556.13	66.79
213	☐	J1912	1.54	654.00	808.25	66.83
214	☐	J256	7.39	566.12	720.71	66.98
215	☐	J1854	2.15	573.84	728.47	67.00
216	☐	J1184	1.49	396.00	550.76	67.06
217	☐	J1598	8.94	532.00	686.98	67.15
218	☐	J1548	0.00	563.51	718.94	67.35
219	☐	J404	3.30	530.00	685.44	67.35
220	☐	J690	0.00	431.33	587.67	67.74
221	☐	J1422	5.17	529.00	685.49	67.81
222	☐	J626	2.98	394.00	550.80	67.94
223	☐	J1138	4.43	394.00	550.91	67.99
224	☐	J278	1.01	428.02	585.04	68.04
225	☐	J1630	5.94	896.48	1,053.57	68.06
226	☐	J570	4.24	423.54	580.94	68.20
227	☐	J1508	0.00	570.13	727.72	68.29
228	☐	J1708	1.68	562.32	720.37	68.48
229	☐	J406	2.35	527.00	685.41	68.64
230	☐	J510	3.39	426.00	584.45	68.65
231	☐	J1936	21.09	423.33	581.82	68.68
232	☐	J1060	4.43	392.00	550.72	68.78
233	☐	J1214	3.86	427.00	585.73	68.78
234	☐	J1810	0.76	392.00	550.77	68.79
235	☐	J1736	0.00	428.45	587.63	68.97
236	☐	J1266	0.00	421.38	580.95	69.14
237	☐	J1550	0.00	559.36	718.94	69.14
238	☐	J692	0.00	428.00	587.67	69.18
239	☐	J774	3.71	391.00	550.74	69.22
240	☐	J108	6.53	427.94	587.69	69.22
241	☐	J1202	0.00	421.32	581.12	69.24
242	☐	J1236	5.58	646.59	806.85	69.44
243	☐	J1146	5.31	425.00	585.27	69.44
244	☐	J1841	0.00	525.00	685.44	69.52
245	☐	J1318	0.00	554.63	715.12	69.54
246	☐	J1168	2.22	390.00	550.76	69.66
247	☐	J1950	5.26	419.81	581.32	69.98
248	☐	J264	20.68	525.00	686.93	70.17
249	☐	J1784	0.00	524.00	686.27	70.31
250	☐	J1230	15.66	424.80	587.56	70.53

Table E-1: PHD Pressure Model Results

		ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
251	☐	J1808	14.22	380.00	542.84	70.56
252	☐	J1002	2.63	559.05	722.07	70.64
253	☐	J204	5.73	566.81	729.96	70.70
254	☐	J512	3.39	421.00	584.45	70.82
255	☐	J1862	3.71	387.00	550.87	71.01
256	☐	J1802	0.00	563.74	727.64	71.02
257	☐	J908	0.00	624.00	788.27	71.18
258	☐	J924	5.10	625.13	789.74	71.33
259	☐	J1556	2.55	647.12	812.00	71.44
260	☐	J1058	2.22	385.00	550.74	71.81
261	☐	J528	3.93	421.27	587.57	72.06
262	☐	J804	8.26	421.17	587.56	72.10
263	☐	J1520	0.00	414.65	581.12	72.13
264	☐	J58	2.15	553.64	720.11	72.13
265	☐	J426	4.78	552.86	719.67	72.28
266	☐	J1144	1.94	418.00	585.27	72.48
267	☐	J402	4.94	528.85	696.14	72.49
268	☐	J186	2.98	383.00	550.74	72.68
269	☐	J1874	0.00	518.00	686.27	72.91
270	☐	J1844	6.09	621.02	789.33	72.93
271	☐	J304	3.34	559.07	727.64	73.04
272	☐	J1994	4.07	621.23	790.58	73.38
273	☐	J168	2.42	415.00	584.49	73.44
274	☐	J70	3.86	415.00	584.49	73.44
275	☐	J1020	1.54	644.04	814.06	73.67
276	☐	J1972	0.00	882.89	1,053.24	73.81
277	☐	J1916	2.22	380.00	550.87	74.04
278	☐	J710	6.28	417.00	587.91	74.05
279	☐	J1624	0.00	515.00	686.27	74.21
280	☐	J832	0.00	880.25	1,051.54	74.22
281	☐	J766	2.02	644.26	815.55	74.22
282	☐	J191	10.26	760.00	931.53	74.32
283	☐	J1450	10.10	384.00	555.64	74.37
284	☐	J1336	1.47	384.00	556.13	74.59
285	☐	J1196	11.59	413.00	585.15	74.59
286	☐	J558	5.86	618.39	790.89	74.75
287	☐	J1812	14.65	880.58	1,053.28	74.83
288	☐	J1804	4.83	418.00	590.79	74.87
289	☐	J1476	16.25	411.59	585.01	75.15
290	☐	J410	0.00	382.74	556.26	75.18
291	☐	J1849	0.00	513.00	686.55	75.20
292	☐	J1282	7.41	377.00	550.77	75.29
293	☐	J1832	0.00	512.00	685.79	75.30
294	☐	J538	2.51	410.58	584.41	75.32
295	☐	J1576	0.00	553.23	727.41	75.47
296	☐	J1632	0.00	879.10	1,053.57	75.60
297	☐	J1724	1.79	614.41	789.00	75.65
298	☐	J1574	4.78	552.79	727.41	75.66
299	☐	J1320	0.00	540.30	715.12	75.75
300	☐	J374	0.00	511.00	685.91	75.79

Table E-1: PHD Pressure Model Results

		ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
301	☐	J952	8.78	613.69	788.67	75.82
302	☐	J1966	6.57	511.00	686.25	75.93
303	☐	J1622	0.00	511.00	686.27	75.94
304	☐	J1834	3.30	510.00	685.44	76.02
305	☐	J1368	5.58	633.63	809.22	76.08
306	☐	J606	2.75	407.39	584.06	76.55
307	☐	J414	8.01	404.11	580.91	76.61
308	☐	J756	8.25	874.60	1,051.67	76.72
309	☐	J1212	8.57	543.63	720.74	76.74
310	☐	J1382	0.00	406.76	584.11	76.84
311	☐	J946	2.51	403.32	580.96	76.97
312	☐	J1658	13.48	537.15	714.98	77.05
313	☐	J830	0.00	635.85	814.06	77.22
314	☐	J980	1.41	508.00	686.25	77.23
315	☐	J876	0.00	609.22	787.59	77.29
316	☐	J724	3.76	507.00	685.84	77.49
317	☐	J1308	14.51	608.47	787.56	77.60
318	☐	J30	2.51	404.87	584.15	77.68
319	☐	J1616	0.00	401.50	580.91	77.74
320	☐	J1664	0.00	541.15	720.76	77.83
321	☐	J32	0.00	403.94	584.15	78.08
322	☐	J286	4.00	400.99	581.37	78.16
323	☐	J36	3.50	403.79	585.03	78.53
324	☐	J1120	0.00	544.08	725.44	78.58
325	☐	J48	0.00	543.43	725.44	78.86
326	☐	J1198	0.00	402.09	584.15	78.88
327	☐	J1298	8.01	398.78	580.90	78.91
328	☐	J1118	7.39	543.06	725.44	79.02
329	☐	J1278	1.94	402.00	584.44	79.05
330	☐	J1654	12.56	402.00	584.45	79.05
331	☐	J838	0.00	869.70	1,052.32	79.13
332	☐	J1636	5.52	532.23	714.97	79.18
333	☐	J1839	0.00	368.00	550.84	79.23
334	☐	J1860	6.09	605.53	789.18	79.58
335	☐	J138	5.92	367.00	550.82	79.65
336	☐	J160	5.76	400.32	584.24	79.69
337	☐	J640	6.11	503.00	686.94	79.70
338	☐	J244	4.70	503.00	686.98	79.72
339	☐	J1690	13.25	867.49	1,051.54	79.75
340	☐	J1088	1.94	400.00	585.08	80.20
341	☐	J158	5.76	399.17	584.27	80.21
342	☐	J384	3.78	371.00	556.12	80.21
343	☐	J446	4.70	500.00	685.34	80.31
344	☐	J62	3.10	536.54	722.07	80.39
345	☐	J1584	13.17	601.60	787.67	80.63
346	☐	J902	10.44	370.00	556.11	80.64
347	☐	J972	0.94	500.00	686.26	80.71
348	☐	J1530	0.97	398.00	584.45	80.79
349	☐	J193	6.17	745.00	931.52	80.82
350	☐	J400	21.05	509.57	696.15	80.85

Table E-1: PHD Pressure Model Results

		ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
351	☐	J154	9.06	540.75	727.64	80.98
352	☐	J660	0.94	498.00	685.16	81.10
353	☐	J1324	0.00	531.62	718.94	81.16
354	☐	J726	0.00	393.18	580.90	81.34
355	☐	J956	1.89	499.00	686.96	81.44
356	☐	J372	0.00	394.58	582.61	81.47
357	☐	J1824	23.73	424.05	612.08	81.48
358	☐	J197	0.55	497.00	685.16	81.53
359	☐	J1514	0.00	393.32	581.67	81.61
360	☐	J464	2.71	507.19	696.15	81.88
361	☐	J1286	2.80	600.75	789.73	81.88
362	☐	J1926	1.89	496.00	685.41	82.07
363	☐	J1542	0.00	395.00	584.44	82.09
364	☐	J842	4.24	497.00	686.96	82.31
365	☐	J1342	6.76	598.14	788.27	82.38
366	☐	J454	0.00	597.44	787.67	82.43
367	☐	J60	2.86	529.99	720.24	82.44
368	☐	J338	0.00	600.05	790.39	82.47
369	☐	J834	0.00	861.14	1,051.54	82.50
370	☐	J550	2.75	394.73	585.27	82.56
371	☐	J1526	0.00	390.48	581.78	82.89
372	☐	J236	3.39	400.00	591.38	82.92
373	☐	J1258	0.00	392.06	583.46	82.93
374	☐	J1944	2.42	393.00	584.45	82.95
375	☐	J180	3.39	393.00	584.48	82.97
376	☐	J556	9.42	597.80	789.74	83.17
377	☐	J1068	1.94	393.00	585.08	83.23
378	☐	J1366	0.00	861.08	1,053.24	83.26
379	☐	J688	0.00	494.00	686.22	83.29
380	☐	J1918	0.00	393.00	585.27	83.31
381	☐	J1122	2.98	358.00	550.74	83.51
382	☐	J1124	1.49	358.00	550.74	83.52
383	☐	J1646	4.36	392.00	585.14	83.69
384	☐	J958	1.18	532.73	726.08	83.78
385	☐	J1978	0.00	389.94	583.34	83.80
386	☐	J1078	0.00	389.33	583.12	83.97
387	☐	J1062	1.51	389.30	583.46	84.13
388	☐	J1280	5.92	355.00	550.75	84.82
389	☐	J140	5.92	355.00	550.81	84.85
390	☐	J1172	14.57	490.00	686.29	85.05
391	☐	J746	1.76	384.63	581.04	85.11
392	☐	J1662	0.00	524.27	720.76	85.14
393	☐	J268	0.75	384.10	580.98	85.31
394	☐	J1176	5.08	359.00	556.11	85.41
395	☐	J974	6.11	489.00	686.28	85.48
396	☐	J762	3.72	590.27	787.64	85.52
397	☐	J662	9.06	530.54	728.48	85.77
398	☐	J488	0.00	852.85	1,051.48	86.06
399	☐	J466	0.00	497.47	696.14	86.09
400	☐	J818	4.36	387.00	586.14	86.29

Table E-1: PHD Pressure Model Results

		ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
401	☐	J1010	0.00	587.56	787.50	86.63
402	☐	J284	0.00	380.81	581.04	86.76
403	☐	J1156	8.99	518.61	718.84	86.76
404	☐	J1506	0.00	527.42	727.72	86.79
405	☐	J996	16.90	697.48	897.83	86.81
406	☐	J1836	8.09	488.49	689.30	87.01
407	☐	J1606	3.10	526.45	727.29	87.02
408	☐	J1560	0.00	486.00	686.94	87.07
409	☐	J904	7.56	355.00	556.11	87.14
410	☐	J1254	0.00	355.00	556.11	87.14
411	☐	J234	5.80	390.00	591.48	87.30
412	☐	J874	5.40	585.66	787.52	87.47
413	☐	J680	0.00	383.00	585.01	87.53
414	☐	J1756	6.91	524.77	727.32	87.77
415	☐	J1104	3.25	380.78	583.34	87.77
416	☐	J1486	0.00	380.26	582.99	87.84
417	☐	J1240	7.54	483.00	686.22	88.06
418	☐	J250	4.05	514.75	719.22	88.60
419	☐	J610	1.44	517.19	722.07	88.77
420	☐	J890	7.77	581.94	787.50	89.07
421	☐	J1192	7.05	480.00	685.80	89.17
422	☐	J642	6.93	511.06	717.48	89.44
423	☐	J1754	3.25	374.23	580.91	89.55
424	☐	J1182	1.49	344.00	550.75	89.58
425	☐	J1932	0.00	480.00	686.90	89.65
426	☐	J1454	0.00	374.05	581.03	89.69
427	☐	J928	0.00	580.21	787.50	89.82
428	☐	J598	2.39	511.32	719.11	90.03
429	☐	J648	2.42	377.00	585.14	90.19
430	☐	J430	7.75	383.00	591.48	90.34
431	☐	J814	4.31	511.76	720.26	90.34
432	☐	J16	3.30	477.00	686.23	90.66
433	☐	J1780	0.00	516.72	726.25	90.79
434	☐	J1510	4.05	577.84	787.49	90.84
435	☐	J1878	0.00	517.81	727.78	90.98
436	☐	J744	0.00	375.00	585.14	91.05
437	☐	J846	5.17	475.00	685.34	91.14
438	☐	J1070	0.97	374.00	584.63	91.27
439	☐	J1800	2.98	340.00	550.74	91.32
440	☐	J844	4.70	476.00	686.96	91.41
441	☐	J1414	0.00	372.33	583.37	91.45
442	☐	J1782	0.00	374.00	585.08	91.46
443	☐	J1512	0.00	370.41	581.67	91.54
444	☐	J930	0.00	576.02	787.50	91.63
445	☐	J116	8.94	473.00	685.16	91.93
446	☐	J822	0.97	509.32	722.07	92.18
447	☐	J722	9.41	473.00	685.80	92.21
448	☐	J636	3.57	507.51	720.78	92.41
449	☐	J1758	0.00	513.76	727.32	92.54
450	☐	J806	3.10	505.52	719.14	92.56

Table E-1: PHD Pressure Model Results

		ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
451	☐	J1592	5.01	367.42	581.03	92.56
452	☐	J1564	11.59	379.00	593.33	92.87
453	☐	J1876	4.78	513.33	727.78	92.92
454	☐	J812	3.39	369.00	584.47	93.36
455	☐	J1314	0.00	470.00	685.80	93.51
456	☐	J1032	2.89	375.00	591.37	93.75
457	☐	J1602	7.77	571.14	787.69	93.83
458	☐	J1716	0.00	511.40	728.19	93.94
459	☐	J262	2.81	470.00	686.90	93.98
460	☐	J1328	1.41	470.00	686.90	93.98
461	☐	J324	5.23	501.25	719.10	94.39
462	☐	J1524	0.00	363.02	581.78	94.79
463	☐	J1934	0.00	467.00	686.22	94.99
464	☐	J1588	3.12	497.93	717.34	95.07
465	☐	J682	1.76	363.86	583.40	95.13
466	☐	J1960	0.00	380.00	599.64	95.17
467	☐	J1048	6.91	499.36	719.14	95.23
468	☐	J1830	0.00	466.00	685.79	95.24
469	☐	J868	8.99	496.18	716.61	95.51
470	☐	J490	0.00	831.04	1,051.48	95.52
471	☐	J1578	0.00	364.00	584.45	95.52
472	☐	J1532	2.42	371.00	591.48	95.53
473	☐	J872	28.14	498.00	718.54	95.56
474	☐	J1870	3.39	363.00	584.80	96.10
475	☐	J1760	4.36	366.00	587.90	96.15
476	☐	J1270	5.23	681.02	903.10	96.23
477	☐	J1938	7.74	360.10	582.56	96.39
478	☐	J1518	14.22	320.00	542.82	96.55
479	☐	J646	2.42	362.00	585.05	96.65
480	☐	J350	2.42	362.00	585.13	96.68
481	☐	J712	10.71	494.20	717.63	96.81
482	☐	J412	0.00	357.46	580.90	96.82
483	☐	J224	0.00	674.35	897.85	96.84
484	☐	J238	0.00	501.77	726.23	97.26
485	☐	J178	2.42	360.00	584.48	97.27
486	☐	J638	1.68	495.97	720.96	97.49
487	☐	J954	5.96	501.08	726.25	97.57
488	☐	J22	5.17	461.00	686.23	97.59
489	☐	J1488	0.00	357.64	582.99	97.64
490	☐	J84	10.49	493.63	719.02	97.66
491	☐	J1698	4.36	360.00	585.39	97.66
492	☐	J96	2.42	359.00	584.45	97.69
493	☐	J944	7.74	355.09	580.95	97.86
494	☐	J1544	6.25	357.18	583.12	97.90
495	☐	J392	5.96	499.71	725.85	97.99
496	☐	J114	0.94	459.00	685.16	98.00
497	☐	J800	0.00	493.72	720.40	98.22
498	☐	J424	2.39	492.39	719.12	98.24
499	☐	J1430	6.75	367.00	593.95	98.34
500	☐	J142	2.75	353.67	580.93	98.47

Table E-1: PHD Pressure Model Results

		ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
501	☐	J368	3.86	357.00	584.48	98.57
502	☐	J436	7.25	375.00	602.54	98.59
503	☐	J1064	1.51	355.83	583.46	98.63
504	☐	J258	0.00	492.63	720.40	98.69
505	☐	J144	0.00	352.88	580.93	98.81
506	☐	J222	10.28	669.78	897.85	98.83
507	☐	J470	5.17	457.00	685.34	98.94
508	☐	J1580	0.00	356.00	584.45	98.99
509	☐	J1400	19.26	354.17	582.99	99.14
510	☐	J34	0.00	354.04	582.99	99.20
511	☐	J600	3.57	489.78	719.11	99.36
512	☐	J1470	0.00	558.75	788.10	99.38
513	☐	J182	0.00	489.44	719.50	99.69
514	☐	J1452	5.49	350.86	581.03	99.73
515	☐	J998	0.00	667.65	897.83	99.73
516	☐	J854	4.24	352.90	583.34	99.85
517	☐	J156	5.73	496.89	727.62	99.98
518	☐	J1704	3.34	488.39	719.34	100.07
519	☐	J260	0.00	489.11	720.40	100.22
520	☐	J1732	0.00	496.85	728.23	100.26
521	☐	J1922	5.65	455.00	686.74	100.41
522	☐	J1174	2.63	487.24	719.11	100.47
523	☐	J128	2.42	352.00	584.45	100.72
524	☐	J548	7.54	454.00	686.94	100.93
525	☐	J496	6.25	347.95	580.93	100.95
526	☐	J82	5.02	485.84	719.09	101.07
527	☐	J322	31.77	501.01	734.44	101.14
528	☐	J240	3.57	492.79	726.25	101.16
529	☐	J916	0.00	451.00	685.36	101.55
530	☐	J148	6.11	451.00	685.40	101.57
531	☐	J232	2.42	350.00	584.45	101.59
532	☐	J670	7.15	492.81	727.41	101.65
533	☐	J1238	4.70	451.00	686.22	101.92
534	☐	J1082	1.94	349.00	584.45	102.02
535	☐	J1970	3.50	346.93	583.06	102.31
536	☐	J74	2.75	344.35	580.93	102.51
537	☐	J544	4.52	482.09	719.09	102.69
538	☐	J50	2.81	448.00	685.17	102.76
539	☐	J1340	8.11	550.98	788.18	102.78
540	☐	J926	2.89	347.00	584.65	102.97
541	☐	J462	7.75	355.00	592.74	103.01
542	☐	J1678	5.94	814.59	1,053.02	103.31
543	☐	J428	4.24	341.74	580.94	103.64
544	☐	J978	5.02	488.73	728.13	103.73
545	☐	J1276	3.39	345.00	584.44	103.75
546	☐	J1894	0.00	344.54	585.30	104.32
547	☐	J1080	0.97	343.00	584.11	104.47
548	☐	J1730	0.00	315.06	556.26	104.51
549	☐	J189	8.25	690.00	931.55	104.66
550	☐	J122	2.89	344.00	586.14	104.92

Table E-1: PHD Pressure Model Results

		ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
551	☐	J302	4.52	476.31	719.10	105.20
552	☐	J1848	8.64	476.73	719.82	105.33
553	☐	J346	3.30	442.00	685.76	105.62
554	☐	J634	0.00	342.00	585.76	105.62
555	☐	J1892	0.00	341.26	585.30	105.74
556	☐	J1822	0.00	481.64	725.77	105.78
557	☐	J1474	5.02	481.63	725.76	105.78
558	☐	J1456	2.89	340.00	584.64	106.00
559	☐	J1814	0.00	481.06	725.76	106.02
560	☐	J246	0.00	480.78	725.75	106.15
561	☐	J676	7.86	482.48	727.63	106.22
562	☐	J920	0.00	439.00	685.33	106.74
563	☐	J146	6.11	439.00	685.34	106.74
564	☐	J702	0.00	334.53	580.93	106.76
565	☐	J94	2.89	338.00	584.45	106.78
566	☐	J1634	4.70	440.00	686.91	106.98
567	☐	J318	0.00	473.70	720.96	107.14
568	☐	J1816	2.15	478.42	725.82	107.20
569	☐	J500	0.00	357.00	604.78	107.36
570	☐	J1194	2.35	438.00	685.81	107.37
571	☐	J1742	3.39	336.00	584.52	107.68
572	☐	J1792	0.00	336.00	584.52	107.69
573	☐	J1868	2.89	336.00	584.79	107.80
574	☐	J666	0.00	478.04	727.65	108.15
575	☐	J1046	5.02	476.01	725.75	108.21
576	☐	J976	0.00	477.40	728.13	108.64
577	☐	J100	3.10	470.00	720.96	108.74
578	☐	J1378	0.00	474.93	726.25	108.90
579	☐	J820	4.05	468.98	720.94	109.17
580	☐	J1358	6.91	473.36	725.90	109.42
581	☐	J986	3.10	474.12	727.48	109.78
582	☐	J300	6.68	465.62	719.01	109.79
583	☐	J910	4.36	330.00	584.52	110.28
584	☐	J382	3.30	431.00	685.72	110.37
585	☐	J248	0.00	470.83	725.75	110.46
586	☐	J1496	0.00	472.35	727.44	110.53
587	☐	J1858	7.75	342.00	597.95	110.90
588	☐	J896	6.11	429.00	684.99	110.92
589	☐	J628	3.57	462.25	718.95	111.23
590	☐	J758	3.00	324.09	580.95	111.30
591	☐	J126	2.42	327.00	584.45	111.55
592	☐	J866	4.36	327.00	584.46	111.56
593	☐	J1126	3.32	467.77	725.82	111.81
594	☐	J1566	0.00	326.20	584.58	111.96
595	☐	J1096	2.35	426.00	685.15	112.29
596	☐	J700	0.00	325.49	585.32	112.59
597	☐	J898	0.00	425.00	684.99	112.65
598	☐	J914	3.30	425.00	685.36	112.81
599	☐	J1398	3.75	323.80	584.17	112.82
600	☐	J1568	1.01	323.64	584.17	112.89

Table E-1: PHD Pressure Model Results

		ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
601	☐	J68	3.39	324.00	585.49	113.31
602	☐	J1864	7.25	341.00	602.54	113.33
603	☐	J364	2.86	465.63	727.42	113.43
604	☐	J698	3.50	322.67	585.32	113.81
605	☐	J1468	0.00	525.11	788.10	113.95
606	☐	J966	3.86	320.00	584.52	114.62
607	☐	J1744	2.42	320.00	584.52	114.62
608	☐	J760	0.00	315.98	580.95	114.81
609	☐	J440	5.80	320.00	585.10	114.87
610	☐	J816	16.23	454.81	720.33	115.05
611	☐	J1128	0.00	460.06	725.82	115.15
612	☐	J1890	0.97	318.00	584.41	115.43
613	☐	J1902	0.00	519.69	787.47	116.03
614	☐	J1958	0.00	331.00	599.64	116.40
615	☐	J1686	2.42	311.00	579.71	116.43
616	☐	J964	4.36	315.00	584.52	116.78
617	☐	J1178	6.28	333.00	602.55	116.80
618	☐	J1866	0.00	332.00	602.54	117.23
619	☐	J948	0.00	445.52	717.51	117.86
620	☐	J900	0.00	625.00	897.83	118.22
621	☐	J1000	2.81	412.00	684.99	118.28
622	☐	J1500	3.39	322.00	596.43	118.91
623	☐	J1660	8.20	326.00	601.76	119.49
624	☐	J1498	3.39	320.00	596.43	119.78
625	☐	J514	0.71	447.69	726.62	120.86
626	☐	J292	5.49	447.98	727.72	121.21
627	☐	J694	2.81	403.00	685.13	122.25
628	☐	J1360	0.00	436.55	725.78	125.32
629	☐	J1106	3.30	395.00	685.36	125.81
630	☐	J398	2.86	436.67	727.16	125.87
631	☐	J1842	0.00	435.01	727.16	126.59
632	☐	J1806	0.00	494.42	787.48	126.98
633	☐	J1838	0.00	490.60	788.02	128.88
634	☐	J1600	1.24	427.93	725.82	129.07
635	☐	J1840	0.00	489.78	788.02	129.23
636	☐	J207	13.99	546.00	846.30	130.12
637	☐	J1904	2.04	486.56	787.44	130.37
638	☐	J1166	2.04	485.96	787.86	130.82
639	☐	J1390	0.00	376.37	689.30	135.59
640	☐	J516	1.44	408.55	727.02	137.99
641	☐	J187	0.00	597.00	931.60	144.98
642	☐	JDIV22P	0.00	0.00	790.39	342.47

Table E-2: South Shore Fire Flow Model Results

	ID	Total Demand (gpm)	Available Flow at Hydrant (gpm)	Critical Node ID	Critical Node Pressure (psi)	Critical Node Head (ft)	Design Flow (gpm)	Design Pressure (psi)	Design Fire Node Pressure (psi)
1	J1822FH	500.00	325.29	J1288	13.07	801.16	172.82	20.00	26.96
2	J1428	501.09	323.16	J1428	20.00	795.12	323.17	20.00	20.07
3	J1914	500.85	381.64	J1914	20.00	795.20	381.64	20.00	20.01
4	J592	751.69	430.42	J1428	19.03	792.88	405.73	20.00	21.00
5	J276	752.78	441.06	J1428	19.66	794.33	431.50	20.00	20.35
6	J1286	751.33	1,057.55	J1428	0.94	751.14	431.69	20.00	57.84
7	J1284	751.45	524.63	J1428	16.99	788.18	431.81	20.00	27.73
8	J522	751.69	1,156.42	J1428	-7.49	731.67	432.05	20.00	56.81
9	J1994	751.93	1,399.31	J1428	-16.12	711.77	432.30	20.00	71.45
10	J1796	752.05	617.25	J1428	12.74	778.36	432.41	20.00	38.69
11	J1442	752.05	469.42	J1428	18.66	792.02	432.43	20.00	24.81
12	J558	752.78	738.44	J1428	7.26	765.71	433.14	20.00	59.81
13	J274	754.47	884.51	J1428	-0.07	748.80	434.83	20.00	45.07
14	J1724	750.85	640.52	J1428	11.97	776.59	436.12	20.00	50.52
15	J532	752.65	869.16	J1428	0.85	750.93	436.54	20.00	49.18
16	J872	753.38	705.87	J1428	9.00	769.74	437.26	20.00	68.18
17	J322	754.59	652.72	J1428	11.59	775.70	439.87	20.00	76.42
18	J408	750.00	900.91	J1428	-0.28	748.32	440.86	20.00	45.15
19	J1730	750.00	1,065.41	J1428	-4.81	737.85	440.86	20.00	89.56
20	J210	750.00	727.92	J1428	8.21	767.91	440.87	20.00	37.45
21	J410	750.00	1,019.76	J1428	-3.42	741.06	440.87	20.00	64.69
22	J1224	751.93	1,220.72	J1428	-9.78	726.39	442.80	20.00	54.97
23	J86	752.90	10,620.26	J1428	-321.28	7.49	444.11	20.00	54.91
24	J788	752.42	806.94	J1428	6.59	764.18	449.28	20.00	49.27
25	J502	752.29	587.28	J1428	14.98	783.54	450.24	20.00	25.12
26	J164	500.00	1,291.87	J1428	-7.27	732.18	488.07	20.00	60.75
27	J1716	500.00	1,059.57	J1428	1.09	751.49	488.96	20.00	78.47
28	J840	501.81	497.22	J840	20.00	978.00	497.22	20.00	19.99
29	J998	500.00	498.44	J998	20.00	713.81	498.44	20.00	20.00
30	J1590	500.00	936.51	J1428	5.31	761.23	498.58	20.00	47.50
31	J1472	754.11	1,782.47	J1428	-25.92	689.15	498.78	20.00	45.58
32	J704	753.14	1,854.41	J1288	-0.55	769.74	499.72	20.00	40.59
33	J1272	500.00	503.93	J1272	20.00	843.70	503.95	20.00	20.01
34	J1556	751.21	762.29	J1288	17.29	810.89	504.23	20.00	50.09
35	J796	751.57	1,908.46	J1288	-1.30	768.00	504.60	20.00	48.80
36	J894	751.93	1,095.62	J1288	12.97	800.93	504.96	20.00	45.50
37	J1136	753.14	1,081.63	J1288	13.18	801.43	506.16	20.00	46.20
38	J1318	750.00	2,051.24	J1288	-2.44	765.36	508.30	20.00	66.13
39	J1394	752.42	800.93	J1428	9.94	771.90	510.67	20.00	30.16
40	J1636	751.93	2,714.02	J1288	-11.83	743.69	511.43	20.00	76.31
41	J630	753.26	677.57	J1428	14.44	782.29	511.50	20.00	34.00
42	J1656	752.18	2,288.48	J1288	-6.24	756.60	512.57	20.00	51.03
43	J1588	751.09	2,661.43	J1288	-13.26	740.39	513.50	20.00	92.96
44	J1322	751.45	1,560.01	J1428	-9.36	727.35	513.53	20.00	48.39
45	J1236	752.65	2,233.01	J1288	-5.03	759.38	514.36	20.00	69.56
46	J1658	754.71	2,685.12	J1288	-13.99	738.71	514.48	20.00	74.38
47	J1234	751.69	2,020.98	J1288	-1.04	768.61	514.76	20.00	63.50
48	J868	753.14	2,889.68	J1288	-15.27	735.76	514.80	20.00	93.25
49	J1548	750.00	1,172.86	J1288	12.07	798.86	515.00	20.00	57.76
50	J1324	750.00	1,887.23	J1288	1.46	774.37	515.00	20.00	77.31

Table E-2: South Shore Fire Flow Model Results

		ID	Total Demand (gpm)	Available Flow at Hydrant (gpm)	Critical Node ID	Critical Node Pressure (psi)	Critical Node Head (ft)	Design Flow (gpm)	Design Pressure (psi)	Design Fire Node Pressure (psi)
51	☐	J642	752.42	2,053.87	J1288	-1.43	767.69	515.44	20.00	85.29
52	☐	J1434	752.65	1,204.90	J1288	11.61	797.78	515.47	20.00	45.75
53	☐	J870	751.33	1,346.19	J1288	9.44	792.79	515.89	20.00	56.62
54	☐	J182	750.00	2,704.41	J1288	-13.50	739.84	516.10	20.00	98.26
55	☐	J1358	503.50	1,076.13	J1428	1.46	752.33	516.39	20.00	88.75
56	☐	J712	753.74	2,014.30	J1288	-0.72	769.34	517.03	20.00	91.98
57	☐	J1156	753.14	2,398.69	J1288	-7.66	753.33	517.44	20.00	84.91
58	☐	J1438	751.21	784.55	J1288	17.24	810.78	517.78	20.00	32.01
59	☐	J816	755.67	2,826.21	J1428	-57.66	615.90	517.96	20.00	112.68
60	☐	J1924	751.81	1,023.10	J1288	14.30	804.01	518.38	20.00	37.44
61	☐	J784	753.02	1,332.95	J1288	9.79	793.60	518.39	20.00	48.58
62	☐	J1334	753.38	952.48	J1288	15.25	806.19	520.63	20.00	39.70
63	☐	J1384	751.21	774.21	J1288	17.44	811.26	522.52	20.00	34.43
64	☐	J1386	751.45	1,059.61	J1288	14.05	803.42	526.01	20.00	39.88
65	☐	J1410	752.54	943.53	J1288	15.55	806.90	527.98	20.00	40.73
66	☐	J1720	750.00	1,003.42	J1288	14.89	805.37	529.88	20.00	46.39
67	☐	J1554	750.85	530.03	J1554	20.00	716.37	530.01	20.00	19.31
68	☐	J900	500.00	594.87	J996	5.56	710.30	534.84	20.00	37.60
69	☐	J1108	751.69	1,254.64	J1288	11.66	797.91	534.91	20.00	49.53
70	☐	J996	503.98	538.82	J996	20.00	743.64	538.82	20.00	20.04
71	☐	J584	753.02	1,045.50	J1288	15.05	805.74	558.61	20.00	47.48
72	☐	J1694	750.36	762.20	J1288	18.14	812.87	558.80	20.00	38.67
73	☐	J1732	500.00	1,466.81	J1428	-9.50	727.04	561.55	20.00	90.38
74	☐	J222	502.42	625.83	J996	8.00	715.93	572.25	20.00	32.14
75	☐	J1368	752.65	1,158.30	J1288	14.35	804.11	585.12	20.00	62.69
76	☐	J1460	751.45	592.32	J1460	20.00	649.06	592.32	20.00	20.00
77	☐	J1482	500.00	595.60	J1482	20.00	671.22	595.60	20.00	20.00
78	☐	J730	751.45	766.59	J604	4.12	719.63	605.30	20.00	35.64
79	☐	J768	750.49	613.70	J768	20.00	817.54	613.69	20.00	20.01
80	☐	J1670	500.00	774.60	J1672	5.91	690.98	614.42	20.00	34.09
81	☐	J280	751.69	1,319.42	J1288	13.67	802.55	615.66	20.00	51.47
82	☐	J1984	500.00	657.97	J1428	18.99	792.79	620.83	20.00	24.07
83	☐	J1982	502.05	815.44	J1428	14.61	782.69	622.88	20.00	36.63
84	☐	J1484	501.81	623.05	J1484	20.00	706.06	623.05	20.00	20.00
85	☐	J1726	751.21	2,783.99	J996	-172.37	299.67	630.69	20.00	57.01
86	☐	J442	750.00	1,004.47	J1428	8.79	769.25	633.11	20.00	37.64
87	☐	J402	751.33	634.20	J402	20.00	575.00	634.19	20.00	19.83
88	☐	J1086	750.00	1,330.71	J1428	-0.02	748.92	636.61	20.00	41.33
89	☐	J1644	750.85	1,011.31	J1288	16.80	809.77	637.91	20.00	45.50
90	☐	J328	750.00	1,098.58	J1428	5.81	762.37	639.54	20.00	48.35
91	☐	J1952	751.81	1,925.07	J1288	6.50	786.00	642.95	20.00	56.39
92	☐	J1616	750.00	1,269.01	J1428	1.44	752.29	646.04	20.00	62.78
93	☐	J56	751.21	2,283.41	J1288	0.31	771.71	646.16	20.00	39.71
94	☐	J412	750.00	1,267.98	J1428	1.46	752.34	647.32	20.00	76.26
95	☐	J726	750.00	1,306.88	J1428	0.58	750.31	647.63	20.00	66.62
96	☐	J414	753.87	1,273.98	J1428	1.42	752.23	649.54	20.00	62.02
97	☐	J1754	751.57	1,304.71	J1428	0.67	750.50	649.77	20.00	72.36
98	☐	J1536	751.93	1,130.29	J1428	5.10	760.74	650.46	20.00	41.05
99	☐	J1298	753.87	1,299.69	J1428	0.82	750.87	651.49	20.00	64.47
100	☐	J1246	500.00	691.83	J1428	19.03	792.89	652.21	20.00	24.81

Table E-2: South Shore Fire Flow Model Results

		ID	Total Demand (gpm)	Available Flow at Hydrant (gpm)	Critical Node ID	Critical Node Pressure (psi)	Critical Node Head (ft)	Design Flow (gpm)	Design Pressure (psi)	Design Fire Node Pressure (psi)
101	☐	J1534	752.90	1,429.13	J1428	-1.43	745.66	655.44	20.00	46.57
102	☐	J670	503.62	1,374.97	J1428	-0.36	748.14	655.84	20.00	82.76
103	☐	J1998	750.00	1,667.65	J1428	-5.43	736.44	666.22	20.00	56.42
104	☐	J1266	750.00	1,856.61	J1428	-8.56	729.21	667.95	20.00	64.90
105	☐	J620	752.18	1,708.08	J1428	-6.02	735.07	669.61	20.00	58.66
106	☐	J1480	501.45	674.51	J1480	20.00	651.02	674.51	20.00	20.02
107	☐	J1854	751.09	1,141.23	J1288	16.16	808.30	675.77	20.00	48.38
108	☐	J144	750.00	1,666.27	J1428	-5.05	737.31	678.17	20.00	85.92
109	☐	J142	751.33	1,596.49	J1428	-3.90	739.96	679.69	20.00	83.99
110	☐	J702	750.00	1,347.01	J1428	0.56	750.26	679.91	20.00	81.71
111	☐	J496	753.02	1,693.41	J1428	-5.44	736.42	681.92	20.00	88.12
112	☐	J760	500.00	1,031.11	J1428	9.77	771.52	686.51	20.00	68.83
113	☐	J946	751.21	1,947.06	J1428	-9.68	726.62	687.82	20.00	71.60
114	☐	J758	751.45	2,008.86	J1428	-10.61	724.47	687.94	20.00	101.88
115	☐	J944	753.74	2,031.87	J1428	-10.85	723.92	690.58	20.00	90.52
116	☐	J1996	751.21	1,499.01	J1428	-1.71	745.01	690.97	20.00	54.55
117	☐	J268	750.36	2,007.25	J1428	-10.26	725.28	692.53	20.00	78.90
118	☐	J454	500.00	790.22	J1672	12.84	706.99	693.98	20.00	33.02
119	☐	J1584	504.71	1,057.22	J1672	-12.82	647.76	698.69	20.00	52.81
120	☐	J1942	502.90	1,339.93	J1288	14.60	804.69	701.86	20.00	48.39
121	☐	J766	750.96	989.63	J768	17.65	812.12	702.78	20.00	33.66
122	☐	J728	751.33	875.02	J768	18.55	814.18	703.15	20.00	32.43
123	☐	J912	752.42	711.40	J1288	19.95	817.04	704.19	20.00	20.30
124	☐	J1592	752.42	1,990.24	J1428	-9.33	727.44	705.30	20.00	84.07
125	☐	J1452	752.65	1,710.39	J1428	-4.68	738.16	705.53	20.00	85.18
126	☐	J746	750.85	2,064.68	J1428	-10.53	724.66	706.62	20.00	78.41
127	☐	J1950	752.54	2,092.64	J1428	-9.77	726.41	710.04	20.00	65.07
128	☐	J1946	750.00	907.93	J482	18.77	686.96	712.97	20.00	35.06
129	☐	J464	750.73	1,099.23	J482	17.37	683.71	713.69	20.00	53.13
130	☐	J482	750.85	713.83	J482	20.00	689.79	713.81	20.00	19.97
131	☐	J580	751.81	1,870.13	J482	12.16	671.70	714.78	20.00	44.25
132	☐	J1054	753.14	760.87	J482	19.74	689.19	716.11	20.00	21.59
133	☐	J356	754.23	1,154.76	J482	16.95	682.75	717.19	20.00	25.78
134	☐	J400	755.67	1,160.83	J482	16.91	682.66	718.64	20.00	54.97
135	☐	J1496	500.00	1,406.38	J1428	2.75	755.31	721.72	20.00	85.13
136	☐	J1050	501.93	917.97	J882	4.99	637.31	732.69	20.00	35.18
137	☐	J742	751.09	1,965.94	J482	11.92	671.15	734.37	20.00	53.60
138	☐	J252	502.78	928.30	J882	4.15	635.36	735.22	20.00	39.33
139	☐	J1708	500.85	1,055.68	J1288	17.77	812.02	739.22	20.00	49.05
140	☐	J1042	751.69	2,014.54	J482	11.10	669.26	740.07	20.00	49.13
141	☐	J58	501.09	910.86	J1288	18.90	814.61	740.11	20.00	39.19
142	☐	J250	502.05	1,054.96	J1288	17.79	812.05	740.19	20.00	57.93
143	☐	J598	501.21	926.63	J1288	18.78	814.33	740.26	20.00	46.60
144	☐	J1174	501.33	973.54	J1288	18.41	813.48	740.36	20.00	55.54
145	☐	J806	501.57	1,014.72	J1288	18.10	812.77	740.47	20.00	56.28
146	☐	J628	501.81	1,133.30	J1288	17.16	810.60	740.84	20.00	75.37
147	☐	J1704	501.69	987.09	J1288	18.32	813.27	740.87	20.00	57.06
148	☐	J600	501.81	1,041.53	J1288	17.89	812.29	740.88	20.00	61.56
149	☐	J256	503.74	1,099.02	J1288	17.45	811.27	740.94	20.00	50.99
150	☐	J544	502.29	992.25	J882	-2.02	621.13	741.31	20.00	58.06

Table E-2: South Shore Fire Flow Model Results

		ID	Total Demand (gpm)	Available Flow at Hydrant (gpm)	Critical Node ID	Critical Node Pressure (psi)	Critical Node Head (ft)	Design Flow (gpm)	Design Pressure (psi)	Design Fire Node Pressure (psi)
151	☐	J302	502.29	1,135.19	J1288	17.15	810.58	741.32	20.00	72.41
152	☐	J426	502.42	995.51	J882	-3.29	618.20	741.36	20.00	46.30
153	☐	J82	502.54	982.22	J882	-1.26	622.88	741.55	20.00	56.78
154	☐	J324	502.65	1,044.60	J1288	17.87	812.25	741.68	20.00	59.47
155	☐	J1256	500.00	989.69	J1288	18.28	813.19	741.81	20.00	41.49
156	☐	J60	501.45	961.89	J1288	18.51	813.71	741.96	20.00	47.39
157	☐	J300	503.38	1,147.81	J1288	17.05	810.36	742.41	20.00	75.70
158	☐	J1048	503.50	1,090.76	J1288	17.52	811.42	743.05	20.00	63.76
159	☐	J1662	500.00	1,237.69	J1288	16.35	808.73	743.55	20.00	66.35
160	☐	J1448	500.00	1,059.94	J1288	17.86	812.22	746.22	20.00	35.19
161	☐	J858	500.00	1,679.19	J1288	13.42	801.98	746.22	20.00	54.90
162	☐	J662	504.59	2,407.32	J1288	4.37	781.10	747.07	20.00	79.07
163	☐	J606	751.33	1,886.79	J482	12.65	672.83	749.22	20.00	67.07
164	☐	J318	500.00	947.05	J1288	18.61	813.95	749.41	20.00	53.26
165	☐	J638	500.85	1,336.06	J1288	15.53	806.83	750.25	20.00	77.55
166	☐	J822	500.49	1,269.13	J1288	16.09	808.14	753.95	20.00	67.96
167	☐	J1002	751.33	832.14	J1288	19.47	815.92	754.68	20.00	28.35
168	☐	J62	501.57	1,006.17	J1288	18.20	813.00	755.04	20.00	44.89
169	☐	J1120	500.00	1,205.29	J1288	16.76	809.67	758.26	20.00	53.74
170	☐	J32	750.00	1,647.92	J482	14.21	676.43	762.77	20.00	64.28
171	☐	J203	500.00	764.13	J203	20.00	823.16	764.04	20.00	20.02
172	☐	J54	751.33	1,244.39	J203	18.18	818.96	765.45	20.00	23.61
173	☐	J1606	501.57	1,979.86	J1288	9.64	793.24	767.70	20.00	75.11
174	☐	J160	752.78	1,658.09	J482	14.09	676.16	771.65	20.00	65.33
175	☐	J158	752.78	1,689.46	J482	13.89	675.69	772.64	20.00	66.21
176	☐	J448	750.00	1,780.59	J482	13.17	674.02	773.74	20.00	41.35
177	☐	J1758	500.00	1,095.33	J1288	17.83	812.14	776.58	20.00	53.87
178	☐	J286	751.93	2,315.21	J1428	-10.80	724.05	778.31	20.00	71.86
179	☐	J538	751.21	1,914.99	J482	12.43	672.33	779.88	20.00	65.29
180	☐	J1756	503.50	1,718.74	J1288	12.54	799.93	779.89	20.00	71.86
181	☐	J1828	501.69	1,982.89	J1288	10.97	796.33	781.73	20.00	56.90
182	☐	J1112	751.33	1,957.51	J482	11.84	670.95	784.97	20.00	47.90
183	☐	J1204	750.85	1,906.91	J482	12.75	673.06	785.57	20.00	58.20
184	☐	J1052	750.45	792.76	J185	19.57	617.16	786.24	20.00	20.50
185	☐	J986	501.57	1,433.03	J1288	15.33	806.38	793.45	20.00	80.11
186	☐	J278	750.49	2,257.76	J482	10.01	666.73	795.35	20.00	63.45
187	☐	J980	750.67	1,127.11	J185	-5.35	559.66	795.93	20.00	46.58
188	☐	J38	755.80	1,304.71	J482	16.79	682.37	797.19	20.00	37.03
189	☐	J1030	751.57	2,079.17	J482	11.07	669.19	798.61	20.00	53.07
190	☐	J700	750.00	1,880.84	J482	12.67	672.86	806.30	20.00	94.83
191	☐	J698	751.69	2,173.98	J482	10.55	667.99	807.99	20.00	101.27
192	☐	J1892	750.00	2,265.30	J482	9.95	666.59	809.42	20.00	95.66
193	☐	J1894	750.00	1,379.19	J482	16.31	681.28	809.43	20.00	72.89
194	☐	J36	751.69	2,334.35	J482	9.56	665.70	809.62	20.00	72.90
195	☐	J1330	752.91	987.72	J185	7.85	590.13	813.77	20.00	32.38
196	☐	J306	503.38	1,952.68	J1288	11.47	797.46	814.24	20.00	57.99
197	☐	J1062	750.73	2,059.27	J482	11.86	671.01	814.65	20.00	76.23
198	☐	J1064	750.73	1,142.99	J482	18.12	685.45	814.66	20.00	56.62
199	☐	J1990	502.29	985.94	J1272	10.03	820.69	815.56	20.00	30.24
200	☐	J550	751.33	2,392.19	J482	9.11	664.67	816.45	20.00	76.91

Table E-2: South Shore Fire Flow Model Results

		ID	Total Demand (gpm)	Available Flow at Hydrant (gpm)	Critical Node ID	Critical Node Pressure (psi)	Critical Node Head (ft)	Design Flow (gpm)	Design Pressure (psi)	Design Fire Node Pressure (psi)
201	☐	J832	500.00	821.68	J832	20.00	926.41	821.68	20.00	20.01
202	☐	J460	500.00	1,997.67	J1288	11.20	796.85	829.82	20.00	58.67
203	☐	J304	501.69	848.90	J1802	17.98	605.23	831.09	20.00	22.01
204	☐	J682	750.85	2,077.03	J482	11.99	671.31	833.15	20.00	84.56
205	☐	J106	501.57	1,310.88	J1288	16.75	809.66	839.62	20.00	42.83
206	☐	J108	501.81	1,515.10	J1288	15.23	806.14	840.71	20.00	52.00
207	☐	J1414	750.00	1,966.09	J482	13.02	673.67	842.17	20.00	79.28
208	☐	J1476	757.85	2,336.42	J482	9.90	666.48	842.95	20.00	69.12
209	☐	J690	500.00	1,178.21	J1288	17.80	812.08	846.38	20.00	41.15
210	☐	J1172	756.94	1,314.29	J185	-15.53	536.15	846.51	20.00	55.66
211	☐	J1104	751.57	1,491.11	J482	16.39	681.45	852.68	20.00	64.24
212	☐	J854	752.05	2,009.50	J482	12.84	673.26	853.16	20.00	86.15
213	☐	J199	750.26	1,079.64	J201	7.00	596.16	856.20	20.00	33.26
214	☐	J526	501.33	915.35	J1288	19.64	816.34	857.32	20.00	25.46
215	☐	J1512	750.00	2,381.60	J1428	-8.31	729.79	861.49	20.00	81.26
216	☐	J1728	500.00	1,690.56	J1288	14.24	803.86	869.39	20.00	51.40
217	☐	J1310	500.00	890.77	J1222	18.15	682.71	871.58	20.00	21.84
218	☐	J154	504.59	1,800.96	J1288	13.52	802.20	872.56	20.00	64.74
219	☐	J1364	500.00	879.03	J1364	20.00	946.21	879.03	20.00	20.01
220	☐	J156	502.90	2,195.71	J1288	9.97	794.01	881.03	20.00	85.07
221	☐	J1524	750.00	2,396.80	J1428	-7.25	732.24	894.15	20.00	83.06
222	☐	J528	501.09	1,504.09	J1288	16.07	808.09	896.39	20.00	51.52
223	☐	J838	500.00	1,280.45	J840	-6.93	915.85	903.71	20.00	46.94
224	☐	J1230	504.34	2,377.69	J1288	8.61	790.86	914.29	20.00	61.68
225	☐	J1566	750.00	2,454.07	J482	10.26	667.32	920.27	20.00	98.45
226	☐	J1308	505.19	1,119.11	J1910	2.00	654.62	930.68	20.00	37.36
227	☐	J1078	750.00	952.25	J482	19.94	689.65	937.92	20.00	21.74
228	☐	J1544	753.02	1,676.98	J482	16.09	680.76	940.94	20.00	71.26
229	☐	J197	750.26	1,576.34	J201	-15.96	543.16	961.33	20.00	55.97
230	☐	J804	502.29	2,628.71	J1288	6.29	785.51	969.96	20.00	67.73
231	☐	J1806	500.00	1,356.97	J1672	-7.97	658.95	971.15	20.00	71.64
232	☐	J928	500.00	1,010.64	J1672	17.53	717.81	971.15	20.00	25.29
233	☐	J1902	500.00	1,256.88	J1672	0.10	677.58	971.15	20.00	58.26
234	☐	J756	502.18	1,252.84	J840	2.09	936.66	971.25	20.00	40.47
235	☐	J1904	500.73	1,354.80	J1672	-7.73	659.51	971.88	20.00	72.96
236	☐	J762	501.33	1,405.47	J1672	-11.97	649.73	972.48	20.00	54.81
237	☐	J874	501.93	1,088.94	J1672	12.50	706.20	973.09	20.00	33.55
238	☐	J1970	751.69	1,660.87	J482	16.45	681.60	973.26	20.00	71.48
239	☐	J1602	502.78	1,561.45	J1672	-26.02	617.30	973.93	20.00	66.02
240	☐	J272	750.90	986.46	J272	20.00	456.16	986.46	20.00	20.17
241	☐	J1568	750.49	1,527.57	J482	17.34	683.65	992.53	20.00	70.41
242	☐	J1398	751.81	2,291.45	J482	12.29	672.01	993.86	20.00	93.17
243	☐	J1178	752.91	2,133.59	J1288	16.43	808.92	999.43	20.00	97.67
244	☐	J436	753.36	1,389.15	J1288	19.04	814.94	999.86	20.00	58.15
245	☐	J1864	753.36	1,771.81	J1288	17.81	812.11	999.88	20.00	84.74
246	☐	J676	503.98	2,305.79	J1288	10.79	795.91	1,016.36	20.00	89.13
247	☐	J1232	751.79	1,201.73	J1882	12.63	609.16	1,041.74	20.00	27.37
248	☐	J116	754.26	1,865.12	J201	-26.36	519.16	1,042.65	20.00	66.37
249	☐	J1660	753.80	2,192.65	J1288	16.46	808.98	1,043.96	20.00	99.07
250	☐	J908	500.00	1,045.32	J908	20.00	670.16	1,045.31	20.00	19.58

Table E-2: South Shore Fire Flow Model Results

		ID	Total Demand (gpm)	Available Flow at Hydrant (gpm)	Critical Node ID	Critical Node Pressure (psi)	Critical Node Head (ft)	Design Flow (gpm)	Design Pressure (psi)	Design Fire Node Pressure (psi)
251	☐	J1166	500.73	1,940.98	J1672	-62.93	532.10	1,086.57	20.00	102.94
252	☐	J490	500.00	1,164.52	J840	17.58	972.41	1,116.10	20.00	25.64
253	☐	J1238	752.24	1,173.24	J1934	13.07	497.16	1,117.72	20.00	27.46
254	☐	J416	500.00	1,456.43	J1364	-6.27	885.58	1,128.28	20.00	46.15
255	☐	J80	500.70	1,344.43	J1364	3.38	907.84	1,128.98	20.00	46.92
256	☐	J1678	501.57	1,268.84	J1364	9.55	922.09	1,129.86	20.00	35.60
257	☐	J1818	502.29	1,407.99	J1364	-1.85	895.79	1,130.58	20.00	43.02
258	☐	J50	751.34	2,227.90	J201	-37.20	494.16	1,145.46	20.00	77.21
259	☐	J1958	750.00	2,261.42	J1288	16.95	810.13	1,172.43	20.00	92.32
260	☐	J1960	750.00	1,723.12	J1288	18.66	814.07	1,172.43	20.00	61.34
261	☐	J1840	500.00	1,950.56	J1672	-51.79	557.81	1,177.14	20.00	97.59
262	☐	J1096	751.12	2,386.64	J201	-42.35	482.27	1,185.20	20.00	85.53
263	☐	J1750	751.34	1,471.93	J1882	8.19	598.89	1,187.02	20.00	34.36
264	☐	J794	751.57	1,554.26	J1882	4.40	590.16	1,187.24	20.00	35.61
265	☐	J1468	500.00	1,953.09	J840	-22.50	879.92	1,189.17	20.00	88.12
266	☐	J1342	502.42	1,688.14	J840	-5.87	918.28	1,191.28	20.00	53.38
267	☐	J952	503.14	1,933.86	J840	-20.93	883.55	1,193.22	20.00	63.75
268	☐	J1860	502.18	1,845.19	J840	-14.70	897.92	1,194.44	20.00	59.23
269	☐	J1938	753.74	2,408.93	J1428	2.06	753.72	1,194.48	20.00	74.48
270	☐	J34	750.00	1,879.10	J482	17.18	683.28	1,207.93	20.00	63.41
271	☐	J1486	750.00	1,530.59	J482	18.76	686.93	1,207.94	20.00	43.62
272	☐	J1400	759.30	2,038.95	J482	16.42	681.52	1,217.23	20.00	67.88
273	☐	J694	751.34	2,591.59	J201	-48.43	468.23	1,238.24	20.00	94.56
274	☐	J1138	751.34	2,398.58	J201	-28.62	513.94	1,244.56	20.00	66.81
275	☐	J1928	751.79	1,265.13	J1928	20.00	602.16	1,265.14	20.00	20.01
276	☐	J1282	752.24	1,833.24	J201	-1.41	576.75	1,266.82	20.00	51.96
277	☐	J372	750.00	1,794.70	J1428	13.11	779.21	1,272.24	20.00	48.33
278	☐	J52	751.57	1,469.84	J201	12.76	609.44	1,273.65	20.00	28.23
279	☐	J1862	751.12	2,346.89	J201	-25.38	521.43	1,275.42	20.00	66.13
280	☐	J1182	750.45	1,841.50	J201	-1.60	576.30	1,275.45	20.00	58.51
281	☐	J1124	750.45	1,792.72	J201	0.50	581.15	1,280.29	20.00	52.48
282	☐	J1058	750.67	1,322.10	J1060	16.97	431.16	1,285.55	20.00	22.66
283	☐	J774	751.12	1,702.70	J201	4.19	589.66	1,286.00	20.00	40.95
284	☐	J1712	750.67	1,595.77	J201	8.70	600.08	1,292.37	20.00	34.91
285	☐	J1106	751.57	1,295.55	J1106	20.00	441.16	1,295.54	20.00	21.52
286	☐	J140	751.79	2,205.97	J201	-17.27	540.13	1,296.22	20.00	68.60
287	☐	J138	751.79	2,393.57	J201	-27.13	517.38	1,296.22	20.00	71.35
288	☐	J1858	753.59	2,309.53	J1288	17.43	811.22	1,300.80	20.00	83.90
289	☐	J1270	500.96	1,664.19	J840	4.87	943.09	1,328.86	20.00	39.96
290	☐	J586	750.90	2,137.79	J201	-12.39	551.41	1,329.07	20.00	50.13
291	☐	J1920	502.90	1,765.14	J840	-0.11	931.58	1,330.83	20.00	37.97
292	☐	J102	503.50	1,833.95	J840	-3.69	923.34	1,331.43	20.00	41.99
293	☐	J1876	502.42	1,868.99	J1288	17.35	811.04	1,351.58	20.00	57.81
294	☐	J1760	752.02	1,354.56	J1760	20.00	412.16	1,354.56	20.00	19.98
295	☐	J922	751.57	2,102.07	J201	-8.58	560.20	1,368.87	20.00	38.97
296	☐	J738	752.46	1,710.96	J736	6.13	486.16	1,370.65	20.00	33.84
297	☐	J446	752.24	2,125.08	J201	-8.93	559.38	1,379.85	20.00	52.20
298	☐	J920	750.00	2,679.51	J201	-35.34	498.45	1,393.42	20.00	79.50
299	☐	J430	753.59	3,269.12	J185	-41.75	475.64	1,398.14	20.00	82.45
300	☐	J846	752.46	1,824.49	J201	5.11	591.79	1,402.88	20.00	46.78

Table E-2: South Shore Fire Flow Model Results

		ID	Total Demand (gpm)	Available Flow at Hydrant (gpm)	Critical Node ID	Critical Node Pressure (psi)	Critical Node Head (ft)	Design Flow (gpm)	Design Pressure (psi)	Design Fire Node Pressure (psi)
301	☐	J836	751.12	1,451.45	J1244	17.83	596.16	1,404.94	20.00	22.19
302	☐	J146	752.91	2,711.39	J201	-35.74	497.53	1,406.96	20.00	79.62
303	☐	J470	752.46	1,969.60	J201	-0.46	578.93	1,408.35	20.00	55.73
304	☐	J916	750.00	2,649.20	J201	-30.73	509.08	1,422.49	20.00	74.38
305	☐	J914	751.57	1,574.67	J201	15.13	614.92	1,424.06	20.00	35.60
306	☐	J1422	752.46	2,049.20	J1882	-2.10	575.16	1,438.38	20.00	42.13
307	☐	J1922	752.69	2,521.68	J185	-30.71	501.12	1,445.07	20.00	70.72
308	☐	J1500	751.57	2,540.41	J1288	17.35	811.03	1,447.81	20.00	88.90
309	☐	J148	752.91	2,709.27	J201	-30.73	509.08	1,455.53	20.00	74.40
310	☐	J1926	750.90	1,785.10	J201	10.04	603.18	1,477.70	20.00	37.87
311	☐	J1834	751.57	1,965.32	J1882	3.91	589.02	1,487.51	20.00	41.90
312	☐	J234	752.69	3,429.08	J185	-39.37	481.14	1,553.01	20.00	78.62
313	☐	J652	751.12	1,575.69	J652	20.00	516.16	1,575.69	20.00	19.99
314	☐	J1630	501.57	1,732.23	J1072	18.53	1,022.76	1,607.56	20.00	25.91
315	☐	J1072	502.90	1,608.88	J1072	20.00	1,026.16	1,608.88	20.00	20.03
316	☐	J462	753.59	3,049.17	J185	-19.67	526.61	1,694.35	20.00	82.49
317	☐	J1240	753.59	1,789.71	J688	15.23	529.16	1,719.36	20.00	24.77
318	☐	J1336	750.26	2,601.39	J201	-6.41	565.21	1,733.52	20.00	59.05
319	☐	J904	751.34	1,788.96	J201	18.60	622.93	1,734.60	20.00	23.94
320	☐	J382	751.57	3,384.66	J201	-37.37	493.75	1,734.83	20.00	82.76
321	☐	J902	751.85	2,117.19	J201	9.43	601.76	1,735.11	20.00	38.90
322	☐	J1430	753.13	2,643.96	J185	-5.93	558.32	1,742.36	20.00	67.16
323	☐	J346	751.57	3,153.73	J201	-24.88	522.57	1,772.76	20.00	74.93
324	☐	J724	751.79	2,772.59	J1882	-10.32	556.19	1,778.37	20.00	51.20
325	☐	J1194	751.12	3,380.84	J201	-30.50	509.62	1,817.47	20.00	78.38
326	☐	J1278	750.90	1,873.10	J1278	20.00	448.16	1,873.10	20.00	19.94
327	☐	J648	751.12	2,079.54	J1646	13.50	423.16	1,970.65	20.00	26.44
328	☐	J964	752.02	1,981.11	J964	20.00	361.16	1,981.11	20.00	19.96
329	☐	J1402	751.34	2,552.13	J652	9.17	491.16	2,207.96	20.00	30.85
330	☐	J710	752.91	3,069.12	J736	-3.83	463.16	2,210.48	20.00	43.72
331	☐	J16	751.57	3,187.96	J201	-1.20	577.24	2,251.46	20.00	52.90
332	☐	J640	752.91	3,639.53	J1464	-3.94	587.90	2,279.78	20.00	53.68
333	☐	J1634	752.24	3,732.81	J1464	-5.59	584.09	2,288.56	20.00	70.91
334	☐	J974	752.91	3,094.71	J201	2.76	586.37	2,298.36	20.00	47.21
335	☐	J510	751.57	2,762.36	J652	4.80	481.08	2,342.42	20.00	36.20
336	☐	J744	750.00	2,512.69	J1646	12.63	421.16	2,364.54	20.00	27.38
337	☐	J988	750.90	2,503.74	J652	15.27	505.24	2,368.50	20.00	25.12
338	☐	J1918	750.00	2,402.41	J1918	20.00	439.16	2,402.41	20.00	19.90
339	☐	J512	751.57	2,596.96	J652	13.52	501.21	2,409.85	20.00	28.42
340	☐	J910	752.02	2,432.38	J910	20.00	376.16	2,432.38	20.00	19.95
341	☐	J1654	755.82	2,950.43	J652	0.65	471.49	2,445.35	20.00	41.84
342	☐	J548	753.59	4,062.11	J1464	-6.60	581.77	2,457.89	20.00	68.11
343	☐	J1082	750.90	2,501.72	J1082	20.00	395.16	2,499.70	20.00	19.27
344	☐	J1530	750.45	2,824.97	J652	7.99	488.44	2,500.29	20.00	36.25
345	☐	J1696	750.00	2,691.10	J652	14.45	503.34	2,533.03	20.00	26.31
346	☐	J1944	751.12	3,040.83	J652	1.07	472.47	2,539.82	20.00	43.59
347	☐	J926	751.34	2,576.79	J926	20.00	393.16	2,576.79	20.00	19.97
348	☐	J96	751.12	3,042.91	J652	3.82	478.82	2,601.48	20.00	43.86
349	☐	J1849	750.00	3,098.93	J201	11.32	606.13	2,615.07	20.00	34.78
350	☐	J68	751.57	2,700.54	J1698	18.57	402.86	2,673.42	20.00	21.89

		ID	Total Demand (gpm)	Available Flow at Hydrant (gpm)	Critical Node ID	Critical Node Pressure (psi)	Critical Node Head (ft)	Design Flow (gpm)	Design Pressure (psi)	Design Fire Node Pressure (psi)
351	☐	J1896	750.00	2,725.65	J1896	20.00	667.16	2,725.62	20.00	20.05
352	☐	J956	750.90	3,695.33	J1896	14.47	654.39	2,726.52	20.00	45.99
353	☐	J1843	751.34	2,799.72	J1896	19.63	666.31	2,726.97	20.00	21.25
354	☐	J844	752.24	2,762.25	J1896	19.83	666.76	2,727.87	20.00	22.06
355	☐	J244	752.24	3,442.06	J1896	16.05	658.05	2,727.87	20.00	40.71
356	☐	J1522	754.48	3,705.61	J1896	14.42	654.29	2,730.10	20.00	36.24
357	☐	J566	755.82	3,046.66	J1896	18.35	663.35	2,731.45	20.00	22.03
358	☐	J1214	751.79	3,819.51	J1464	5.92	610.67	2,759.41	20.00	44.49
359	☐	J818	752.02	3,940.00	J1464	4.91	608.33	2,767.59	20.00	53.98
360	☐	J812	751.57	3,475.08	J652	-2.69	463.80	2,825.94	20.00	48.76
361	☐	J686	751.34	3,130.57	J201	16.48	618.03	2,852.15	20.00	28.58
362	☐	J180	751.57	3,267.55	J652	6.65	485.34	2,869.34	20.00	37.19
363	☐	J1146	752.46	4,113.37	J1896	13.08	651.18	2,892.02	20.00	46.52
364	☐	J70	751.79	3,291.19	J1896	17.92	662.36	2,893.75	20.00	34.13
365	☐	J72	753.80	3,098.83	J1896	18.97	664.77	2,895.54	20.00	27.34
366	☐	J1196	755.37	4,012.16	J1896	13.76	652.76	2,899.47	20.00	45.83
367	☐	J680	750.00	4,241.67	J1896	12.19	649.12	2,907.40	20.00	56.69
368	☐	J440	752.69	3,630.05	J1896	16.15	658.28	2,931.77	20.00	49.84

Table E-3: Existing Eagleridge PHD Model Results

		ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
1	☐	J10	0.00	426.00	571.43	63.01
2	☐	J-NE-19	1.98	409.00	571.43	70.38
3	☐	J-NE-14	7.90	391.00	571.41	78.17
4	☐	J-NE-18	5.94	387.00	571.43	79.91
5	☐	J-NE-11	9.88	382.00	571.41	82.07
6	☐	J-NE-10	1.98	381.14	571.42	82.45
7	☐	J-NE-15	9.88	379.00	571.41	83.37
8	☐	J-NE-17	15.82	376.00	571.45	84.69
9	☐	J-NE-16	9.88	376.00	571.45	84.69
10	☐	J-NE-12	5.94	374.00	571.41	85.54
11	☐	J-NE-21	5.94	372.00	571.42	86.41
12	☐	J-NE-20	1.98	372.00	571.42	86.41
13	☐	J-NE-9	9.88	370.00	571.42	87.27
14	☐	J-NE-1	0.00	324.00	527.29	88.09
15	☐	J-NE-13	11.86	356.00	571.41	93.34
16	☐	J-NE-6	9.88	339.00	571.58	100.78
17	☐	J-NE-7	13.84	337.00	571.53	101.62
18	☐	J-NE-3	0.00	335.00	571.83	102.62
19	☐	J-NE-4	1.98	333.00	571.69	103.42
20	☐	J-NE-8	5.94	331.00	571.52	104.22
21	☐	J-PMP-NE-D	0.00	329.50	606.06	119.83

Table E-3A: Eagleridge PHD Model Results with pump station bypassed by 2.5 inch pipe

		ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
1	☐	J10	0.00	426.00	512.94	37.67
2	☐	J-NE-19	1.98	409.00	512.94	45.04
3	☐	J-NE-14	7.90	391.00	512.93	52.83
4	☐	J-NE-18	5.94	387.00	512.94	54.57
5	☐	J-NE-11	9.88	382.00	512.93	56.73
6	☐	J-NE-10	1.98	381.14	512.93	57.11
7	☐	J-NE-15	9.88	379.00	512.93	58.03
8	☐	J-NE-17	15.82	376.00	512.96	59.35
9	☐	J-NE-16	9.88	376.00	512.97	59.35
10	☐	J-NE-12	5.94	374.00	512.93	60.20
11	☐	J-NE-21	5.94	372.00	512.94	61.07
12	☐	J-NE-20	1.98	372.00	512.94	61.07
13	☐	J-NE-9	9.88	370.00	512.93	61.93
14	☐	J-NE-13	11.86	356.00	512.93	68.00
15	☐	J-NE-6	9.88	339.00	513.10	75.44
16	☐	J-NE-7	13.84	337.00	513.05	76.28
17	☐	J-NE-3	0.00	335.00	513.34	77.28
18	☐	J-NE-4	1.98	333.00	513.21	78.08
19	☐	J-NE-8	5.94	331.00	513.04	78.88
20	☐	J-NE-1	0.00	324.00	517.29	83.75

Table E-4: Existing Eagleridge MDD + Fire Flow Model Results

		ID	Total Demand (gpm)	Available Flow at Hydrant (gpm)	Critical Node ID	Critical Node Pressure (psi)	Critical Node Head (ft)	Design Flow (gpm)	Design Pressure (psi)	Design Fire Node Pressure (psi)
1	☐	J-NE-8	751.80	1,189.06	J-NE-8	20.00	377.16	1,189.06	20.00	19.99
2	☐	J-NE-19	750.00	1,363.31	J10	12.63	455.15	1,304.39	20.00	27.36
3	☐	J-NE-20	750.60	1,401.17	J10	7.85	444.11	1,304.99	20.00	33.53
4	☐	J-NE-21	751.80	1,356.69	J10	13.70	457.61	1,306.19	20.00	27.46
5	☐	J-NE-18	751.80	1,472.76	J10	3.10	433.15	1,336.76	20.00	36.90
6	☐	J-NE-14	752.39	1,437.36	J10	9.44	447.79	1,350.35	20.00	31.06
7	☐	J-NE-15	752.99	1,441.33	J10	9.02	446.82	1,350.95	20.00	32.03
8	☐	J-NE-12	751.80	1,483.17	J10	4.52	436.43	1,356.18	20.00	36.55
9	☐	J-NE-13	753.59	1,491.58	J10	3.68	434.50	1,357.97	20.00	38.54
10	☐	J-NE-16	752.99	1,532.12	J10	-1.06	423.55	1,360.80	20.00	41.18
11	☐	J-NE-17	754.78	1,477.24	J10	6.11	440.09	1,362.59	20.00	34.97
12	☐	J-NE-11	752.99	1,447.75	J10	10.44	450.08	1,367.65	20.00	30.51
13	☐	J-NE-10	750.60	1,416.77	J10	14.40	459.22	1,369.28	20.00	26.45
14	☐	J-NE-9	752.99	1,483.60	J10	6.57	441.17	1,371.67	20.00	34.89
15	☐	J-NE-7	754.18	1,679.64	J10	-11.13	400.31	1,423.86	20.00	53.10
16	☐	J-NE-6	752.99	1,743.74	J10	-17.71	385.13	1,436.62	20.00	57.71
17	☐	J-NE-4	750.60	1,807.10	J10	-20.31	379.12	1,473.23	20.00	60.30

Table E-5: Agate Heights PHD Model Results

		ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
1	☐	J-AG-19	0.00	550.29	568.36	7.83
2	☐	J-AG-06	0.00	528.29	568.35	17.36
3	☐	J-AG-05	0.00	528.29	569.54	17.87
4	☐	J-AG-26	8.53	467.00	568.29	43.89
5	☐	J-AG-08	6.14	393.00	524.93	57.16
6	☐	J-AG-27	10.68	428.29	568.29	60.66
7	☐	J-AG-15	19.79	698.29	842.00	62.27
8	☐	J-AG-14	0.00	690.00	842.01	65.87
9	☐	J14	6.52	596.00	748.01	65.87
10	☐	J-AG-10	3.05	372.00	524.92	66.26
11	☐	J-AG-09	4.59	364.00	524.92	69.73
12	☐	J-AG-07	2.15	403.00	568.29	71.62
13	☐	J-AG-18	0.00	676.00	842.00	71.93
14	☐	J-AG-04	0.00	395.29	569.60	75.53
15	☐	J-AG-11	7.68	346.29	524.92	77.40
16	☐	J-AG-03	0.00	381.29	569.64	81.61
17	☐	J-AG-12	6.14	334.00	524.92	82.72
18	☐	J-AG-01	0.00	368.29	569.76	87.29
19	☐	J12	14.68	538.00	748.01	91.00
20	☐	J-AG-02	0.00	358.29	569.67	91.59
21	☐	J-AG-16	0.00	599.00	842.00	105.29
22	☐	J-AG-17	0.00	599.00	842.02	105.30
23	☐	J-AG-25	0.00	539.00	842.35	131.44
24	☐	J-AG-20	0.00	536.00	842.35	132.74

Table E-6: Agate Heights Fire Flow Model Results

		ID	Total Demand (gpm)	Available Flow at Hydrant (gpm)	Critical Node ID	Critical Node Pressure (psi)	Critical Node Head (ft)	Design Flow (gpm)	Design Pressure (psi)	Design Fire Node Pressure (psi)
1	☐	J-AG-07	750.35	2,647.92	J-AG-26	-7.73	449.16	1,604.33	20.00	47.73
2	☐	J-AG-08	751.39	2,265.57	J-AG-26	3.80	475.76	1,605.37	20.00	43.67
3	☐	J-AG-09	751.04	2,264.25	J-AG-26	3.82	475.83	1,605.02	20.00	49.56
4	☐	J-AG-10	750.69	1,704.98	J-AG-26	17.84	508.18	1,604.67	20.00	26.29
5	☐	J-AG-11	751.74	2,236.23	J-AG-26	4.63	477.68	1,605.72	20.00	52.29
6	☐	J-AG-12	751.39	1,729.72	J-AG-26	17.31	506.95	1,605.37	20.00	29.78
7	☐	J-AG-14	750.00	2,010.83	J-AG-15	16.41	736.17	1,906.18	20.00	23.59
8	☐	J-AG-15	753.82	1,519.27	J-AG-15	20.00	744.45	1,519.27	20.00	20.00
9	☐	J-AG-16	750.00	2,071.27	J-AG-15	0.37	699.14	1,622.27	20.00	48.13
10	☐	J-AG-17	750.00	1,761.41	J-AG-15	14.64	732.08	1,628.47	20.00	30.44
11	☐	J-AG-18	750.00	1,847.78	J-AG-15	10.34	722.16	1,617.05	20.00	29.66
12	☐	J-AG-26	751.39	1,145.48	J-AG-26	20.00	513.16	1,145.48	20.00	20.00
13	☐	J-AG-27	751.74	1,899.42	J-AG-26	3.23	474.45	1,334.26	20.00	36.77

Appendix F – Financial Data

6-year Operating Income and Expenses
2016-2017 Operating Budget Summaries
Master Fees and Charges Schedule

Lake Whatcom Water and Sewer District
Fund Resources and Uses Arising from Cash Transactions
For the Year Ended December 31, 2016

Beginning Cash and Investments		
30810	Reserved	576,111
30880	Unreserved	2,561,577
388 / 588	Prior Period Adjustments, Net	-
Revenues		
310	Taxes	-
320	Licenses and Permits	-
330	Intergovernmental Revenues	1,064,741
340	Charges for Goods and Services	6,045,677
350	Fines and Penalties	84,137
360	Miscellaneous Revenues	78,698
Total Revenues:		7,273,252
Expenditures		
530	Utilities	4,103,639
Total Expenditures:		4,103,639
Excess (Deficiency) Revenues over Expenditures:		3,169,614
Other Increases in Fund Resources		
391-393, 596	Debt Proceeds	7,338,843
397	Transfers-In	-
385	Special or Extraordinary Items	-
386 / 389	Custodial Activities	-
381, 395, 398	Other Resources	-
Total Other Increases in Fund Resources:		7,338,843
Other Decreases in Fund Resources		
594-595	Capital Expenditures	1,770,174
591-593, 599	Debt Service	6,968,016
597	Transfers-Out	-
585	Special or Extraordinary Items	-
586 / 589	Custodial Activities	62,890
Total Other Decreases in Fund Resources:		8,801,080
Increase (Decrease) in Cash and Investments:		**1,707,377**
Ending Cash and Investments		
5081000	Reserved	861,673
5088000	Unreserved	3,983,391
Total Ending Cash and Investments		**4,845,064**

The accompanying notes are an integral part of this statement.

Lake Whatcom Water and Sewer District
Fund Resources and Uses Arising from Cash Transactions
For the Year Ended December 31, 2015

Beginning Cash and Investments		
30810	Reserved	524,448
30880	Unreserved	2,127,214
388 & 588	Prior Period Adjustments, Net	-
Operating Revenues		
310	Taxes	-
320	Licenses and Permits	-
330	Intergovernmental Revenues	1,889,661
340	Charges for Goods and Services	5,701,207
350	Fines and Penalties	59,921
360	Miscellaneous Revenues	85,031
Total Operating Revenues:		7,735,820
Operating Expenditures		
530	Utilities	3,859,569
598	Miscellaneous Expenses	-
Total Operating Expenditures:		3,859,569
Net Operating Increase (Decrease):		3,876,251
Nonoperating Revenues		
370-380, 395 & 398	Other Financing Sources	100,849
391-393	Debt Proceeds	-
397	Transfers-In	-
Total Nonoperating Revenues:		100,849
Nonoperating Expenditures		
580, 596 & 599	Other Financing Uses	-
591-593	Debt Service	758,573
594-595	Capital Expenditures	2,732,501
597	Transfers-Out	-
Total Nonoperating Expenditures:		3,491,074
Net Increase (Decrease) in Cash and Investments:		**486,026**
Ending Cash and Investments		
5081000	Reserved	576,111
5088000	Unreserved	2,561,577
Total Ending Cash and Investments		**3,137,688**

The accompanying notes are an integral part of this statement.

Lake Whatcom Water and Sewer District
Fund Resources and Uses Arising from Cash Transactions
For the Year Ended December 31, 2014

Beginning Cash and Investments		
30810	Reserved	563,840
30880	Unreserved	2,006,925
388 & 588	Prior Period Adjustments, Net	-
Operating Revenues		
310	Taxes	-
320	Licenses and Permits	-
330	Intergovernmental Revenues	175,649
340	Charges for Goods and Services	5,270,575
350	Fines and Penalties	64,178
360	Miscellaneous Revenues	139,098
Total Operating Revenues:		5,649,500
Operating Expenditures		
530	Utilities	3,891,029
Total Operating Expenditures:		3,891,029
Net Operating Increase (Decrease):		1,758,471
Nonoperating Revenues		
370-380, 395 & 398	Other Financing Sources	103,654
391-393	Debt Proceeds	-
397	Transfers-In	-
Total Nonoperating Revenues:		103,654
Nonoperating Expenditures		
580, 596 & 599	Other Financing Uses	-
591-593	Debt Service	512,858
594-595	Capital Expenditures	1,268,369
597	Transfers-Out	-
Total Nonoperating Expenditures:		1,781,227
Net Increase (Decrease) in Cash and Investments:		**80,898**
Ending Cash and Investments		
5081000	Reserved	566,495
5088000	Unreserved	2,085,167
Total Ending Cash and Investments		**2,651,662**

The accompanying notes are an integral part of this statement.

MCAG NO. 2330

Lake Whatcom Water and Sewer District

STATEMENT C-4

FUND RESOURCES AND USES ARISING FROM CASH TRANSACTIONS

For the Year Ended December 31, 2013

BARS Code		401 Enterprise
Beginning Cash and Investments		
30810	Beg Fund Bal-Reserved	4,539,666
30880	Beg Fund Bal-Unreserved	474,708
38800/58800	Prior Period Adjustments, net	0
Operating Revenues		
310	Taxes	0
320	Licenses & Permits	0
330	Intergovernmental Revenues	0
340	Charges for Goods and Services	5,030,581
350	Fines & Penalties	79,026
360	Miscellaneous Revenues	97,718
Total Operating Revenues:		5,207,325
Operating Expenditures		
530	Utilities	3,716,959
598	Intergovernmental Payments	0
Total Operating Expenditures:		3,716,959
Net Operating Increase (Decrease):		1,490,366
Nonoperating Revenues		
370, 380, 395, 398	Other Financing Sources	95,824
391-393	Debt Proceeds	0
397	Transfers-In	0
Total Nonoperating Revenues:		95,824
Nonoperating Expenditures		
580, 596, 599	Other Financing Uses	0
591-593	Debt Service	3,324,893
594-595	Capital Expenditures	704,906
597	Transfers-Out	0
Total Nonoperating Expenditures:		4,029,799
Increase (Decrease) in Cash and Investments		-2,443,609
Ending Cash and Investments		
50810	End Fund Bal-Reserved	563,840
50880	End Fund Balance-Unreserved	2,006,925

The accompanying notes are an integral part of this Statement.

MCAG NO. 2330

Lake Whatcom Water and Sewer District

STATEMENT C-4

FUND RESOURCES AND USES ARISING FROM CASH TRANSACTIONS

For the Year Ended December 31, 2012

BARS Code		401 Enterprise
Beginning Cash and Investments		
30810	Beg Fund Bal-Reserved	4,964,558
30880	Beg Fund Bal-Unreserved	227,342
38800/58800	Prior Period Adjustments, net	0
Operating Revenues		
310	Taxes	0
320	Licenses & Permits	0
330	Intergovernmental Revenues	0
340	Charges for Goods and Services	4,640,410
350	Fines & Penalties	0
360	Miscellaneous Revenues	252,808
Total Operating Revenues:		4,893,218
Operating Expenditures		
530	Utilities And Environment	3,524,225
598	Intergovernmental Payments	0
Total Operating Expenditures:		3,524,225
Net Operating Increase (Decrease):		1,368,993
Nonoperating Revenues		
370, 380, 395, 398	Other Financing Sources	93,199
391-393	Debt Proceeds	0
397	Transfers-In	0
Total Nonoperating Revenues:		93,199
Nonoperating Expenditures		
580, 596, 599	Other Financing Uses	0
591-593	Debt Service	848,917
594-595	Capital Expenditures	791,977
597	Transfers-Out	0
Total Nonoperating Expenditures:		1,640,894
Increase (Decrease) in Cash and Investments		-178,702
Ending Cash and Investments		
50810	End Fund Bal-Reserved	4,539,661
50880	End Fund Balance-Unreserved	473,537

The accompanying notes are an integral part of this Statement.

MCAG NO. 2330

LAKE WHATCOM WATER AND SEWER DISTRICT

STATEMENT OF ACTIVITIES ARISING FROM CASH TRANSACTIONS
For the Year Ended December 31, 2011

OPERATING RECEIPTS		
Combined Water/Sewer Sales		$ 4,378,245
Miscellaneous		108,818
	Total Operating Receipts	4,487,063
OPERATING DISBURSEMENTS		
Combined Water/Sewer - Salaries		1,210,935
Combined Water/Sewer - Benefits		442,896
Combined Water/Sewer - Supplies		198,488
Combined Water/Sewer - Services		1,720,824
Other Operating Expenditures		30,855
	Total Operating Expenses	3,603,998
	Operating Income	883,065
NON-OPERATING RECEIPTS		
Investment Income		88,714
Capital Contributions		62,741
Interest on Assessments		43,617
Special Assessments		66,417
	Total Nonoperating Receipts	261,489
NON-OPERATING DISBURSEMENTS		
Purchase of Capital Assets		2,383,892
Long-term Debt Payments - Principal		526,224
Long-term Debt Payments - Interest		326,636
	Total Nonoperating Disbursements	3,236,752
Net decrease in net cash and investments		(2,092,198)
Beginning balance of cash and investments		7,284,098
Unreserved ending		227,342
Reserved ending		4,964,558
Ending balance of cash and investments		$ 5,191,900

See accountants' compilation report and notes to financial statements.

LAKE WHATCOM WATER AND SEWER FUND SUMMARY 2016

	401 OPERATING	420 SYSTEM REINVESTMENT	425 SEWER/ STORM WATER	430 2009 BOND PROJECTS	440 DWSRF PROJECTS	450 2009 BOND DEBT SERVICE	460 2009 BOND RESERVE (RESTRICTED)	470 WATER LOAN DEBT SERVICE	480 ULID 18	TOTAL
2016 REVENUES AND TRANSFERS IN	6,049,026	877,000	5,020	-	1,962,700	443,050	10,000	53,870	60,000	9,460,666
2016 EXPENDITURES AND TRANSFERS OUT	(6,456,153)	(877,000)	(200)	(62,683)	(1,962,700)	(443,050)	(200)	(53,867)	(60,000)	(9,915,853)
CASH/INVESTMENTS 2015 CARRYOVER	1,900,000	-	926,910	62,683	-	-	513,400	-	-	3,402,993
PROPOSED 2016 YEAR END BALANCE	$1,492,873	$0	$931,730	$0	$0	$0	$523,200	$3	$0	$2,947,806
ALLOCATED TO OPERATING RESERVES	-$800,000									
AVAILABLE 2016 YEAR END BALANCE	$692,873									

LAKE WHATCOM WATER AND SEWER FUND SUMMARY 2017

	401 OPERATING	420 SYSTEM REINVESTMENT	425 SEWER/ STORM WATER CONTINGENCY	426 WATER CONTINGENCY	431 2016 BOND FUND	440 DWSRF PROJECTS	450 DEBT SERVICE	460 BOND RESERVE (RESTRICTED)	TOTAL
2017 REVENUES AND TRANSFERS IN	6,298,017	1,668,000	103,750	2,500	-	229,950	890,172	3,850	9,196,239
2017EXPENDITURES AND TRANSFERS OUT	(6,928,728)	(1,688,000)	(210,200)	-	(156,923)	(1,058,100)	(913,162)	(200)	(10,935,313)
CASH/INVESTMENTS 2016 CARRYOVER	1,750,000	-	887,000	440,000	156,923	828,150	22,990	773,200	4,856,263
PROPOSED 2017 YEAR END BALANCE	**$1,119,289**	**$0**	**$780,550**	**$442,500**	**$0**	**$0**	**$0**	**$776,850**	**$3,119,189**
ALLOCATED TO OPERATING RESERVES	**-$800,000**								
AVAILABLE 2017 YEAR END BALANCE	**$319,289**								

MASTER FEES AND CHARGES
SCHEDULE #24
Effective date July 12, 2017 (Resolution 835)

Item	Administrative Fees	Fee/Charge	Reference
1.	**Equipment Charge, Hourly**		
	Air Compressor–Ingersol/Rand 185 CFM Diesel	$20.00	Resolution 798
	Backhoe – John Deere 580D	$45.00	
	Boom Truck – 6,000 Pound	$30.00	
	Combination Vacuum/Flush Truck	$100.00	
	Sewer Camera Van	$75.00	
	Dump Truck – 2-Yard	$25.00	
	Dump Truck – 5-Yard	$45.00	
	Equipment Trailer – 14,000 Pound	$15.00	
	Flush Truck	$65.00	
	Portable Engine Pump – 600 gpm @130-Feet	$40.00	
	Portable Generator – 75 kw	$45.00	
	Portable Generator – 250 kw	$85.00	
	Tanker Truck – 3,000 Gallon	$75.00	
	Tool Truck	$20.00	
2.	**Information Reproduction**		
	Digital Recording - Board Meeting	$35.00	Resolution 680
	Document – standard size – less than 10 pages	No charge	Resolution 680
	Document – standard size –more than 10 pages	.15 per page	Resolution 717
	Document – non-standard size – deposit	$50.00	Resolution 680
	Document – non standard size – reproduction	Cost	Resolution 680
3.	**Labor, Hourly**		Resolution 798 Direct Labor Costs
	Accounting Clerk	$34.00	
	Accounts Payable/Payroll	$38.00	
	Accounts Receivable	$38.00	
	Administrative Assistant	$46.00	
	Construction Engineer	$53.00	
	District Engineer	$71.00	
	Engineering Technician	$42.00	
	Finance Manager	$62.00	
	General Manager	$80.00	
	Maintenance Electrician	$53.00	
	Maintenance Supervisor	$57.00	
	Maintenance Worker	$42.00	
	Utility Systems Support Specialist	$42.00	
	Water Treatment Plant Operator	$46.00	
	Wilson Engineering Consultation - Current hourly rate + 10%		Resolution 798
4.	**Document Recording Fees**		
	Document Recording	$105.00	Resolution 753
	Lien Record/Release	$150.00	Resolution 756
	Transfer, real estate closing	$30.00	Resolution 806
	Segregation of assessment, equivalent residential units and water/sewer permits	$100.00	Resolution 819
	Assessment transfer	$250.00	Resolution 680
5.	**Payment return item**	$25.00	Resolution 820

Item	**Billing – SEWER SERVICE**		Fee/Charge	Reference
	Regular Customer Charge Per Billing Cycle - Sewer			
6.	**Effective January 1, 2015**			
	Billing Cycle Charge		$148.03	Resolution 806
	Account Charge	$7.03		
	Volume Charge per dwelling unit	$141.00		
	Low Income Senior/Disabled Rate 40% Discount	$88.82		
7.	**Effective January 1, 2016**			
	Billing Cycle Charge		$151.74	Resolution 806
	Account Charge	$7.21		
	Volume Charge per dwelling unit	$144.53		
	Low Income Senior/Disabled Rate 40% Discount	$91.04		
8.	**Effective January 1, 2017**			
	Billing Cycle Charge		$155.53	Resolution 806
	Account Charge	$7.39		
	Volume Charge per dwelling unit	$148.14		
	Low Income Senior/Disabled Rate 40% Discount	$93.32		
9.	**Effective January 1, 2018**			
	Billing Cycle Charge		$159.42	Resolution 806
	Account Charge	$7.57		
	Volume Charge per dwelling unit	$151.85		
	Low Income Senior/Disabled Rate 40% Discount	$95.65		
10.	**Effective January 1, 2019**			
	Billing Cycle Charge		$163.40	Resolution 806
	Account Charge	$7.76		
	Volume Charge per dwelling unit	$155.64		
	Low Income Senior/Disabled Rate 40% Discount	$98.04		
11.	**Late Fee** – One late fee per account per year refundable with General Manager's approval.		10% of past due utility services balance	RCW 57.08.081(3)
12.	**Bulk sewage disposal**		$100.00 + 0.0018/gallon	Latest actual bill from COB

Item	**Billing – WATER SALES**	Fee/Charge	Reference
	Regular Customer Charge Per billing cycle – up to 600 cubic feet of water		
13.	**5/8 x 3/4 Inch Meter**		
	Effective January 1, 2015	$52.68	Resolution 806
	Low Income Senior/Disabled Rate	$31.61	
	Effective January 1, 2016	$57.29	
	Low Income Senior/Disabled Rate	$34.37	
	Effective January 1, 2017	$62.31	
	Low Income Senior/Disabled Rate	$37.39	
	Effective January 1, 2018	$67.60	
	Low Income Senior/Disabled Rate	$40.56	
	Effective January 1, 2019	$70.31	
	Low Income Senior/Disabled Rate	$42.19	
14.	**1 Inch Meter**		
	Effective January 1, 2015	$69.88	Resolution 806
	Effective January 1, 2016	$75.99	
	Effective January 1, 2017	$82.64	
	Effective January 1, 2018	$89.67	
	Effective January 1, 2019	$93.25	
15.	**1½ Inch Meter**		
	Effective January 1, 2015	$96.40	Resolution 806
	Effective January 1, 2016	$104.83	
	Effective January 1, 2017	$114.00	
	Effective January 1, 2018	$123.69	
	Effective January 1, 2019	$128.64	
16.	**2 Inch Meter**		
	Effective January 1, 2015	$133.19	Resolution 806
	Effective January 1, 2016	$144.84	
	Effective January 1, 2017	$157.52	
	Effective January 1, 2018	$170.91	
	Effective January 1, 2019	$177.74	
17.	**3 Inch Meter**		
	Effective January 1, 2015	$263.40	Resolution 806
	Effective January 1, 2016	$286.45	
	Effective January 1, 2017	$311.51	
	Effective January 1, 2018	$337.99	
	Effective January 1, 2019	$351.51	
18.	**Usage Over 600 Cubic Feet**		
	Effective January 1, 2015	$7.48	Resolution 806
	Effective January 1, 2016	$8.13	
	Effective January 1, 2017	$8.85	
	Effective January 1, 2018	$9.60	
	Effective January 1, 2019	$9.98	
	Low Income Senior/Disabled Rate	40% Discount	
19.	**Usage Over 2,500 Cubic Feet**		Resolution 806
	Effective January 1, 2015	$9.35	
	Effective January 1, 2016	$10.17	

	Effective January 1, 2017	$11.06	
	Effective January 1, 2018	$12.00	
	Effective January 1, 2019	$12.48	
20.	**Late Fee** – One late fee per account per year reversable with General Manager's approval.	10% of past due utility services balance	Resolution 766 RCW 57.08.081(3)

Item	Miscellaneous Water Charges	Fee/Charge	Reference
21.	**Water Interruption - Voluntary**		
	With Billing Suspension Lock curb stop valve		Resolution 661
	During normal business hours	$150.00	
	Outside normal business hours	$175.00	
	With billing suspension Unlock curb stop valve		Resolution 661
	During normal business hours	No charge	
	Outside normal business hours	$150.00	
22.	Without Billing Suspension		Resolution 661
	Lock curb stop valve	$50.00	Resolution 661
	Unlock curb stop valve		
	During normal business hours	No charge	
	Outside normal business hours	$150.00	
23.	**Water interruption - Involuntary**		
	Delinquent Account - Lock curb stop valve	$50.00	Resolution 661
	Unlock curb stop valve		
	During normal business hours	No charge	
	Outside normal business hours	$150.00	
24.	**Water interruption - Other**		
	Failure to comply with emergency order	Same as above	
	Failure to eliminate cross connection	Same as above	
	Failure to repair leak	Same as above	
	Request of agency/higher authority	No charge	
	Visible leak in vacant building or Disaster	No charge	
25.	**Unauthorized Lock Removal Fee** When customer cuts or removes lock from meter without District authorization.	$150.00	Resolution 726
26.	**Damaged Meter** If meter damaged by the customer	Material & labor to repair meter + $150.00	Resolution 726
27.	**Clear obstructed water meter** after request to customer to remove is refused	$50.00	Board meeting 11/10/99
28.	**Hydrant meter, fire hose, fittings**		
	Equipment rental – single continuous use	$35.00	Board meeting 11/10/99
	Bulk water purchase with hydrant meter	$0.0357/cf	Resolution 696

Item	**Developer Extension Agreements**	Fee/Charge	Reference
29.	**Initial Fees**		
	Application – Good for 60 days	$300.00	Resolution 680
	Conformance Deposit	$1,000.00	Resolution 680
	General Administration	$750.00	Resolution 680
30.	**Final Design Review**		
	District Engineer	Cost + 2%	Resolution 680
31.	**Design Review and Inspection***		
	Initial Deposit	$5,000.00	Resolution 680
	Supplemental Deposit	$2,000.00	Resolution 680
32.	**Contract noncompliance**	Cost + 2%	Board Meeting 5/14/97
33.	**Latecomers Reimbursement Agreements, Reimbursement processing**	$185.00 per connection	Board Meeting 6/10/09 + Resolution 753
34.	**Special Agreements**	Cost + 2%	Board Meeting 5/14/97
35.	**Third Party Claims**	Cost + 2%	
36.	**Time Extension**		
	Before expiration date	$250.00	
	After expiration date	$750.00	

*The name of this fee was changed from Facilities Inspection to Design Review and Inspection deposit. Reference April 11, 2007 Minutes

Item	**Permitting**				Fee/Charge	Reference
37.	**Water Permit**					
Water General Facilities & Installation	Meter Size	Continuous Flow Rating (GPM)	Meter Capacity Ratio	Connection Fee	Installation	Resolution 747 Effective 1/1/2009
	5/8 x 3/4	15	1	$4,110.00	$700.00	
	1"	30	2	$8,220.00		
	1.5"	75	5	$20,550.00		
	2"	120	8	$32,880.00	$4,200.00	
	3" Compound	330	22	$90,420.00		
	4" Compound	440	29.33	$120,546.30		
Water General Facilities & Installation	Meter Size	Continuous Flow Rating (GPM)	Meter Capacity Ratio	Connection Fee	Installation	Resolution 835 Effective 1/1/2018
	5/8 x 3/4	15	1	$5,742.00	$700.00	
	1"	30	2	$11,484.00		
	1.5"	75	5	$28,710.00		
	2"	120	8	$45,935.00	$4,200.00	
	3" Compound	330	22	$126,322.00		
	4" Compound	440	29.33	$168,411.00		
Water General Facilities & Installation	Meter Size	Continuous Flow Rating (GPM)	Meter Capacity Ratio	Connection Fee	Installation	Resolution 835 Effective 1/1/2019
	5/8 x 3/4	15	1	$5,885.00	$700.00	
	1"	30	2	$11,771.00		
	1.5"	75	5	$29,427.00		
	2"	120	8	$47,084.00	$4,200.00	
	3" Compound	330	22	$129,480.00		
	4" Compound	440	29.33	$172,621.00		
Water General Facilities & Installation	Meter Size	Continuous Flow Rating (GPM)	Meter Capacity Ratio	Connection Fee	Installation	Resolution 835 Effective 1/1/2020
	5/8 x 3/4	15	1	$6,033.00	$700.00	
	1"	30	2	$12,065.00		
	1.5"	75	5	$30,163.00		
	2"	120	8	$48,261.00	$4,200.00	
	3" Compound	330	22	$132,717.00		
	4" Compound	440	29.33	$176,936.00		
Water General Facilities & Installation	Meter Size	Continuous Flow Rating (GPM)	Meter Capacity Ratio	Connection Fee	Installation	Resolution 835 Effective 1/1/2021
	5/8 x 3/4	15	1	$6,183.00	$700.00	
	1"	30	2	$12,367.00		
	1.5"	75	5	$30,917.00		
	2"	120	8	$49,467.00	$4,200.00	
	3" Compound	330	22	$136,035.00		
	4" Compound	440	29.33	$181,360.00		
38.	Permit administration and processing				$40.00	Board Meeting 1/30/03

	Initial Water Inspection			$25.00	Resolution 667
	Subsequent Water Inspection			$75.00	Board Meeting 8/16/96
39.	**Water Permit – Special Charges**				
	Blaine Water Main Extension Latecomer's (North Shore)			$10,910.00	Expires 8/25/2024
	Columbus Street Water Latecomer's Fee (Geneva)			$528.50	Expires 3/24/2018
	Coronado Heights Phase 2 Water			$1,627.58	Expires 3/24/2018
	North Shore and Eagleridge/COB Reimbursement			$300.00	6/10/88 Agreement
	South Geneva Class A Water			$17,088.97	Expires 7/22/2026
	South Geneva Class B Water			$5,981.14	Expires 7/22/2026
40.	**Sewer Permit**				
Sewer General Facilities	Meter Size	Meter Capacity Ratio	Connection	Installation	Resolution 747 Effective 1/1/2009
	5/8 x 3/4	1	$5,201.00	Done by Owner's Bonded Side Sewer Contractor	
	1"	2	$10,402.00		
	1.5"	5	$26,005.00		
	2"	8	$41,608.00		
	3" Compound	22	$114,422.00		
	4" Compound	29.33	$152,545.33		
Sewer General Facilities	Meter Size	Meter Capacity Ratio	Connection	Installation	Resolution 835 Effective 1/1/2018
	5/8 x 3/4	1	$7,726.00	Done by Owner's Bonded Side Sewer Contractor	
	1"	2	$15,452.00		
	1.5"	5	$38,631.00		
	2"	8	$61,809.00		
	3" Compound	22	$169,975.00		
	4" Compound	29.33	$226,607.00		
Sewer General Facilities	Meter Size	Meter Capacity Ratio	Connection	Installation	Resolution 835 Effective 1/1/2019
	5/8 x 3/4	1	$7,919.00	Done by Owner's Bonded Side Sewer Contractor	
	1"	2	$15,839.00		
	1.5"	5	$39,596.00		
	2"	8	$63,354.00		
	3" Compound	22	$174,224.00		
	4" Compound	29.33	$232,273.00		
Sewer General Facilities	Meter Size	Meter Capacity Ratio	Connection	Installation	Resolution 835 Effective 1/1/2020
	5/8 x 3/4	1	$8,117.00	Done by Owner's Bonded Side Sewer Contractor	
	1"	2	$16,235.00		
	1.5"	5	$40,586.00		
	2"	8	$64,938.00		
	3" Compound	22	$178,580.00		
	4" Compound	29.33	$238,079.00		
Sewer General Facilities	Meter Size	Meter Capacity Ratio	Connection	Installation	Resolution 835 Effective 1/1/2021
	5/8 x 3/4	1	$8,320.00	Done by Owner's Bonded Side Sewer Contractor	
	1"	2	$16,640.00		
	1.5"	5	$41,601.00		
	2"	8	$66,562.00		
	3" Compound	22	$183,044.00		
	4" Compound	29.33	$244,031.00		
41.	Service Installation – If District installed stub exists			$755.00	

	Permit Processing	$40.00	
	Initial Sewer Inspection	$75.00	
	Subsequent Sewer Inspection	$100.00	
42.	**Sewer Permit – Special Charges**		
	Bergen Sewer Latecomer's Fee	$4,195.67	Expires 7/24/2018
	Edgewood Long Plat Sewer	$4,102.00	Expires 2/24/2019
	Lakewood/Grand Blvd Special Benefit Fee	$6,000.00	District Funded
	La Salle Sewer Extension	$4,761.73	Expires 7/13/2021
	South Geneva Class A Sewer	$22,406.50	Expires 7/22/2026
	South Geneva Class A Sewer Vault	$1,704.55	Expires 7/22/2026
	ULID #18 Latecomers Fee – see table, below	See table	Resolution 672
43.	**Other Sewer Charges**		
	Grinder Pump Installation – Customer own/maintain	$150.00	Resolution 645
	Review waiver of claim agreements for customer owned side sewers with less than 2% slope	$50.00	Resolution 645
	Unauthorized Connection to Sewer		
	Investigation, testing, inspection	$500.00	Resolution 645
	Repair and correction	Cost + 2%	Resolution 645
	Disconnect monitoring/enforcement after 90 days	$25.00/day	Board Meeting 8/29/03
	Voluntary sewer service interruption		
	Permit to install two-way clean out	Permit processing & inspection fee	
	Suspend billing – insert plug into side sewer	$250.00	Resolution 709
	Resume billing/remove plug /business hours	No charge	
	Resume billing/remove plug/after business hrs	$150.00	

44. **ULID #18 LATECOMER FEE**

Year	Equivalent to Assessment	Latecomer Penalty	Total	Reference
2016	$2,792.78	$3,714.40	$6,507.18	Resolution 672
2017	$2,792.78	$3,979.71	$6,772.49	
2018	$2,792.78	$4,245.03	$7,037.81	
2019	$2,792.78	$4,510.34	$7,303.12	
2020	$2,792.78	$4,775.65	$7,568.43	
2021	$2,792.78	$5,040.97	$7,833.75	
2022	$2,792.78	$5,306.28	$8,099.06	

NOTE: As described in Resolution 672, ULID #18 Latecomer Charges were created to put parcels not assessed on the same footing as those that were assessed for the ULID. Assessed parcels could, and many did, prepay their assessments. To provide the same opportunity for non-assessed parcels, prepayment of ULID 18 Latecomer Charges will also be accepted. Therefore, paid in full ULID Latecomer Charges satisfy the ULID Latecomer Charges permanently.

45. **VIOLATIONS of Administrative Code**		
Labor	Staff hourly rates – See page 2	Resolution No. 798
Equipment use	Hourly rate – See page 2	
Materials	Cost of materials used	
Attorney's Fees and Expenses	Reimburse District's Costs	
Administrative Fee	10% of total expenses	
Any person who violates any provision of the Administrative Code shall be liable to the District for any expense, loss, damage, cost of inspection or cost of correction incurred by the District by reason of such violation, including any expenses and attorney fees incurred by the District in collecting from such person of such loss, damage, expense, cost of inspection or cost of correction, plus an administrative fee equal to 10% of the total expenses. (Reference: Administrative Code Section 3.3.1 Liability to District)		

Appendix G – District Standard Document Templates

Water and/or Sewer Permit Application
Developer Extension Agreement Application
Developer Extension Agreement

2016 New Customer

Revised 7/26/2016

Water & Sewer Permit Application Packet

Table of Contents

CONNECTION FEE COMPONENTS & CHARGES

Last Updated 12/21/2015

Item	Water	Sewer
General Facilities (5/8" x 3/4" Water Meter)	$4,110.00	$5,201.00
Service Installation	$700.00	See footnote (1)
Permit Processing	$40.00	$40.00
Initial Inspection	$25.00	$75.00
Subtotal	$4,875.00	$5,316.00
Total (Water and Sewer)	**$10,191.00**	

OTHER FEES OR CHARGES

Item	Water	Sewer	Expires
Agate Heights Water Latecomer's Class A Giesbrecht	$9,860.38(4)		3/15/2017
Agate Heights Water Latecomer's Class B Evergreen View Ventures	$2,129.12(5)		3/15/2017
Bergen Sewer		$4,195.67	7/24/2018
Blaine Water Main Extension	$10,910.00		8/25/2024
COB Reservoir Reimbursement Fee	$300.00(2)		
Columbus St. Water Latecomer's Fee	$528.50(3)		3/24/2018
Coronado Heights Phase 2 Water	$1,627.58		3/14/2018
Edgewood Long Plat Sewer		$4,102.00	2/24/2019
Lakewood/Grand Blvd Special Benefit Fee		$6,000.00	
La Salle Sewer Extension		$4,761.73	7/13/2021
Sewer Collection Special Benefit		$6,000.00(8)	
South Geneva Class A Sewer		$22,406.50	
South Geneva Class A Sewer Vault		$1,704.55	7/22/2026
South Geneva Class A Water	$17,088.97		7/22/2026
South Geneva Class B Water	$5,981.14		7/22/2026
Sunny Cove Court Sewer		$1,077.46	3/13/2016
ULID #18 Latecomer's Fee		See footnote(9)	See footnote

(1) An additional $755.00 is charged for some lots in Sudden Valley where the District installed a sewer lateral from the sewer main to the property line.

(2) Eagleridge Phase 1 water permits.

(3) Geneva Columbus St. (Pennington) benefit area, see benefit area map (expires 2018).

(4) Agate Heights Water System Class A within 200' of Agate Heights Waterline see latecomer's file for parcel number list (expires 2017).

(5) Agate Heights Water System Class B within 200' of Agate Heights Waterline see latecomer's file for parcel number list – applies only if EVV develops (expires 2017).

(8) $6,000.00 in Special Benefit fees will be added to connection fees where the collector system has been extended to provide sewer service.

(9) Latecomer Charge for Trunk Sewer Capacity. Sewer service for properties which are not subject to assessment as part of ULID No. 18 but which are within the south shore service area benefitting from the Lake Louise Road interceptor shall pay a latecomer charge in lieu of the ULID assessment, calculated in accordance with the ULID #18 Latecomer Fee table.

44. ULID #18 LATECOMER FEE

Year	Equivalent to Assessment	Latecomer Penalty	Total	Reference
2003	$2,792.78	$265.31	$3,058.09	Resolution 672
2004	$2,792.78	$530.63	$3,323.41	
2005	$2,792.78	$795.94	$3,588.72	
2006	$2,792.78	$1,061.26	$3,854.04	
2007	$2,792.78	$1,326.57	$4,119.35	
2008	$2,792.78	$1,591.88	$4,384.66	
2009	$2,792.78	$1,857.20	$4,649.98	
2010	$2,792.78	$2,122.51	$4,915.29	
2011	$2,792.78	$2,387.83	$5,180.61	
2012	$2,792.78	$2,653.14	$5,445.92	
2013	$2,792.78	$2,918.46	$5,711.24	
2014	$2,792.78	$3,183.77	$5,976.55	
2015	$2,792.78	$3,449.08	$6,241.86	
2016	$2,792.78	$3,714.40	$6,507.18	
2017	$2,792.78	$3,979.71	$6,772.49	
2018	$2,792.78	$4,245.03	$7,037.81	
2019	$2,792.78	$4,510.34	$7,303.12	
2020	$2,792.78	$4,775.65	$7,568.43	
2021	$2,792.78	$5,040.97	$7,833.75	
2022	$2,792.78	$5,306.28	$8,099.06	

NOTE: As described in Resolution 672, ULID #18 Latecomer Charges were created to put parcels not assessed on the same footing as those that were assessed for the ULID. Assessed parcels could, and many did, prepay their assessments. To provide the same opportunity for non-assed parcels, prepayment of ULID 18 Latecomer Charges will also be accepted. Therefore, paid in full ULID Latecomer Charges satisfy the ULID Latecomer Charges permanently.

ABOUT LAKE WHATCOM WATER & SEWER DISTRICT

Lake Whatcom Water and Sewer District (Formerly Water District No. 10) was formed in 1968 and provides water and sewer services to approximately 4,000 residential customers in the area encompassing Lake Whatcom. Residents of the City of Bellingham, Lake Whatcom Water and Sewer District, and many lakeside homeowners use Lake Whatcom for drinking water.

Lake Whatcom Water and Sewer District operates a water treatment plant that provides water to Sudden Valley and Geneva residents. The District also distributes water purchased from the City of Bellingham to its Eagleridge customers. All water distributed by Lake Whatcom Water and Sewer District meets or surpasses EPA Safe Drinking Water standards.

Sewage from the District is collected and pumped to the Bellingham secondary wastewater treatment plant at Post Point for treatment. The District does not treat its own sewage.

Lake Whatcom Water and Sewer is operated by 18 staff persons and a five member Board of Commissioners.

DON'T FLUSH IT!

Some things should not be flushed down toilets or dumped down sink drains because they can clog or damage your pipes and the District's sewer system. Kitchen grease and oil, clay cat litter, feminine hygiene products, contraceptives, dental floss, candle wax and ground eggshells can all clog your pipes and cause problems further down the line.

When clogs occur, District field crews have to manually clean the sewer lines and/or pump stations, so razors and needles that end up in the sewer system can become a health hazard to them.

Petroleum products, solvents, oil based paint, and paint thinners can cause serious damage to pump station mechanics and should never be flushed or poured into the sewer.

BOARD OF COMMISSIONERS MEETINGS

Lake Whatcom Water and Sewer District has three service areas: Geneva, Sudden Valley and the North Shore of Lake Whatcom. The service areas are divided into five commissioner districts, each represented by a resident elected from that district to serve on the Board of Commissioners. Currently serving as Commissioners are:

Commissioner District	Commissioner
Position 1 Sudden Valley Home Phone 733-6525	Laura Weide laura.weide@lwwsd.org
Position 2 Geneva Home Phone 734-3453	Todd Citron todd.citron@lwwsd.org
Position 3 North Shore Home Phone	Bruce R. Ford bruce.ford@lwwsd.org
Position 4 Sudden Valley Home Phone (408)316-3025	Curtis J. Casey curtis.casey@lwwsd.org
Position 5 Geneva Home Phone 933-4249	John Millar ian.millar@lwwsd.org

The Board of Commissioners meets regularly on the second and last Wednesdays of each month. The first regular meeting of the month usually begins at 6:30 p.m. and the second regular meeting of the month begins at 8:00 a.m. Meetings are held in the conference room at the District's office located at 1220 Lakeway Drive. All regular meetings are open to the public. You are encouraged to attend the meetings and share your views with the District's Commissioners. Please call ahead to confirm specific meeting dates and times.

LAKE WHATCOM WATER & SEWER DISTRICT

Customer Information

Lake Whatcom Water & Sewer District
1220 Lakeway Drive
Bellingham, WA 98229

Phone (360) 734-9224
24 Hour Emergency (360) 734-9224
FAX (360) 738-8250
general.inbox@lwwsd.org
www.lwwsd.org

Office Hours: Monday – Thursday
8:00 a.m. – 5:00 p.m.

SERVICE RATES

Utility bills are for services received in the previous two months and are mailed out bi-monthly. All water service in the District is metered. Water use from 0-600 cubic feet per billing period is covered by the basic rate. The basic rate applies at all times, even when the home is vacant. Sewer is billed at a flat rate. The rates below are for single family residences:

Every **Two** Months	
Water Base Charge	$57.29
Sewer Base Charge	$151.74
Total Basic Rate	$209.03

Water per 100 cubic feet over 600 (up to 2,500)	$8.13

Water per 100 cubic feet over 2,500	$10.17

Average water use over the duration of two months for one person is about 600 cubic feet. Water usage usually increases during the summer months.

$$$$$$$$$$$$$$

Low Income Senior/Disabled Reduced Rate
Qualifying rate payers will receive a 40% rate reduction. For more information regarding this option, contact the District's office. This reduced rate will be available until 12/31/2019.

HELP CONSERVE WATER!
The sewer portion of your bill accounts for the majority of the basic rate. Sewer costs to the District are based on the volume of sewage sent to the City of Bellingham. While sewage charges are not directly under District control, you can help control sewer costs by conserving water and thus sewer flows.

PAYMENTS

ACCEPTED PAYMENT METHODS ARE:

On the web: Visa, Discover, MasterCard or personal check; www.lwwsd.org
By mail: Personal check or money order
In office: Cash, Visa, Discover, MasterCard, personal check or money order
By phone: Visa, Discover or MasterCard

All payments are required to be made in **US Funds only**

Post-dated checks will not be accepted.

Fees apply to all types of returned payments.

For property owners: Direct debit autopay will be processed on the 20th of the month due (or next business day)

Rental properties: Utility bills will be mailed to the property owner. When requested, a copy of the bill can also be mailed to the property addressed to "Current Resident". Property managers may also be billed by request.

The total balance is due with each billing cycle. A late charge of 10% is applied onto any remaining portion not paid by the due date.

OTHER CHARGES

Delinquent Account Fees
For those accounts delinquent by 60 days after the due date:

• Meter lock/Water service interruption	$50.00
• After 4:00 p.m./week-end unlock	$150.00
• Unauthorized meter unlock	$150.00
• Lien Recording Fee	$150.00
• Obstructed/Covered Meter	$50.00

Temporary Billing Suspension
Residents who are away from their homes for more than 3 months can save money by temporarily suspending water service to their homes. Upon receipt of a written request ***accompanied by a fee of $150 and any outstanding account balance,*** the District will lock the meter and discontinue billing. Contact the office 48 hours prior to your return, and the meter will be unlocked during regular business hours.
Please note:
Shutting the water off on the customer side of the water meter ***without following the above procedure*** will not discontinue the billing.

TYPICAL WATER USE

If you are not accustomed to being on metered water you may be surprised by how much water you use. Dripping faucets and leaking toilets can add to your water bill. Watering lawns and gardens should be done sparingly if you are conserving costs. The examples below give an idea of the average water consumption by certain fixtures and appliances.

Toilet (new)	.25 cubic ft/flush
Toilet (old)	.80 cubic ft/flush
Shower (new)	.25 cubic ft/minute
Shower (old)	.68 cubic ft/minute
Dishwasher	3.05 cubic ft/load
Washing Machine	5.35 cubic ft/load
Bathtub	5.00 cubic feet
Sink Faucet	.40 cubic ft/minute

COVERED METERS

Please help us to provide you with accurate bills by clearing or trimming away bushes and removing garbage cans, firewood, landscaping materials, vehicles or other obstructions from your meter.

LAKE WHATCOM WATER AND SEWER DISTRICT
Application for Water/Sewer Permit

PART 1 - Customer Billing / Lot Owner Information

Name: ______________________ Phone Number: ________________

Mailing Address: ____

City: ________________ State: ______ Zip: ____________

PART 2 - Project Site Information

Tax Parcel Number: ______________________ Sudden Valley Division: ______ Lot(s): ______

Street Address: ____

City: ________________ State: ______ Zip: ____________

PART 3 - Type of Permit (check all that apply)

☐ **Water Service**

- ☐ Single Family Residence
- ☐ Commercial or Other Type of Building. Describe: ____________________
  - Water Supply Fixture Units (WSFU) per Uniform Plumbing Code: __________

☐ Customer Pressure Reducing Valve will be Installed. (show location of PRV on site plan)

Special plumbing or activities that will be present on this site: ☐ None

- ☐ Underground sprinkler system
- ☐ Water treatment system (e.g. water softener)
- ☐ Solar heating system
- ☐ Residential fire sprinkler system
- ☐ Sewage pumping facility or grey water system
- ☐ Boat moorage with water supply
- ☐ Home-based business. Description: ____________________ (e.g. beauty salon, machine shop, etc...)
- ☐ Radiant In-floor Heat
- ☐ Boiler
- ☐ Swimming pool or spa
- ☐ Other water supply

☐ **Sewer Service**

List Bonded Side Sewer Contractor Installing Sewer: ____________________

- ☐ Gravity Side Sewer
- ☐ Private Grinder Pump to Gravity Sewer Main (Submit Grinder Pump Service Checklist)
- ☐ Private Grinder Pump to Sewer Force Main (Submit Grinder Pump Service Checklist)

PART 4 – County Permits & Water/Sewer Service Site Plan

☐ **Copy of Whatcom County Building Permit** (new construction only)

☐ **Copy of Whatcom County Revocable Encroachment Permit** (required if work is in County Right-of-Way)

☐ **Site Plan**. Plan must be to scale, neat, legible, and include the following information as applicable:

Existing Features. Property lines, buildings, driveways, ditches, culverts, sewer mains, manholes, sewer cleanouts, fire hydrants, water main valves, sewer cleanouts.

Proposed Features. Buildings, driveways, sewer service alignment, cleanouts, connection to sewer main, grinder pump, location of customer pressure reducing valve, easements, backflow preventer.

Note: Tree removal for sewer and water service lines must be coordinated with Sudden Valley Community Association.

Application Submitted By: ______________________ Date: ____________ Phone: ____________
(print name)

LAKE WHATCOM WATER AND SEWER DISTRICT
Grinder Pump Service Checklist

DESIGN/PUMP SELECTION

Grinder Pump System Tax Parcel Number: ____________________

- [ ] E-One 2000 Series Package Grinder Pump System
- [ ] Hydromatic Package Grinder Pump System
- [ ] Liberty Pumps 2448LSG, 2472LSG, or 2484LSG Simplex Grinder Package System
- [ ] Myers Package Grinder Pump System
- [ ] Other (System must be reviewed and approved by District. Submit drawings, specifications, & calculations)

Static Head (feet):____________(Vertical distance, or height, effluent is pumped)

Dynamic Head (feet):____________ (Friction losses due to pipe, bends, valves, fittings)

Total Dynamic Head (feet):____________ (Static Head + Dynamic Head)

Pump Operating Point (gpm):____________ (Flow rate of pump at Total Dynamic Head)

MINIMUM SPECIFICATIONS

Grinder pump systems shall be in accordance with Section C1-10.1 and C1-10.2 of the current edition of the Criteria for Sewage Works Design published by Washington State Department of Ecology. Specific section references from the design manual are noted in parentheses below.

Installed grinder pump system shall meet the criteria for the maximum hydraulic gradeline and be able to meet the pumping requirements of the structure where it is installed. (C1-10.1.5)

- [ ] **Connection to Gravity Sewer Main**
  - [ ] Pressure service line shall be 1-1/4" HDPE SDR11 between grinder pump and gravity sewer stub.
  - [ ] Minimum pipeline velocity of 2 feet per second. (C1-10.1.4)
  - [ ] Maintenance shut-off ball valve on discharge line at grinder pump. (C1-10.2.1A)
  - [ ] One check valve required. Can be installed on grinder pump. (C1-10-2.1A)

- [ ] **Connection to Force Main**
  - [ ] Pressure service line shall be 1-1/4" HDPE SDR11 between grinder pump and check valve vault.
  - [ ] Minimum pipeline velocity of 2 feet per second. (C1-10.1.4)
  - [ ] Maintenance shut-off ball valve on discharge line at grinder pump.
  - **Two check valves required. (C1-10.2.1A)**
    - [ ] Check valve #1: Installed at Grinder Pump. Can be installed on grinder pump.
    - [ ] Check valve #2: Installed at property line. Check valve in vault per Standard Detail S12.
  - [ ] Tapping saddle, 2" corp stop, resilient seat gate valve, and valve box at force main. (C1-10.2.1A)
  - [ ] 2" HDPE SDR11 service line between forcemain and check valve vault.

- [ ] **Control Panel / Electrical Requirements**
  - [ ] Grinder pump UL Listed for use in raw sewage. (C1-10.2.2A)
  - [ ] Pump control panel and level-sensing mechanism UL Listed for use in raw sewage (C1-10.2.2C)
  - [ ] High level visual and audio alarm with battery backup. (C1-10.2.2C)
  - [ ] Audio alarm capable of being silienced until repair can be made. (C1-10.2.2C)

  - [ ] Power transfer switch with an emergency generator plug for vessels with less than 24 hours of storage (1000 gallons for single family residence). (C1-10.1.6D&E)

  - [ ] Electrical components in compliance with National Electrical Code and state Labor and Industries Electrical Inspection Division. (C1-10.2.2D)

- [ ] **Ventilation**
  - [ ] Grinder pump storage tank shall have a separate vent system from structure plumbing. (C1-10.2.2E)

DESIGNER/SUPPLIER CONTACT INFORMATION

Designer:______________________________ Phone:____________________ Date:______________
(print name)

Supplier:______________________________ Phone: ____________________ Date:______________
(print name)

Rev. 10/11/2007

Assessor Parcel Number:____________________________

Address (if known):________________________________

Water/Sewer Permit and Construction Checklist

➢ Additional fees and credits associated with property

ULID #18 – is property located within the south shore sewer service area?

- ☐ **NO**, then ULID 18 does do not apply.
- ☐ **YES**, then check if property has Restrictive Covenant?
  - ☐ **YES**, then property cannot be served by sewer. *Owner might be able to trade restriction for assessment from another property.*
  - ☐ **NO**, then property can be served by sewer.

    Has ULID 18 assessment?
    - ☐ **YES**, then can be served with no additional fees.
    - ☐ **NO**, then Charges-in-Lieu of Assessment apply.

      Charges-in Lieu of Assessment: **$**______________

      for Year __________.

Is property located in a Latecomer Area?

- ☐ **NO**, then no additional fees apply
- ☐ **YES**, then following Latecomer Fees apply:

  ____________________________ **$**______________

  ____________________________ **$**______________

  ____________________________ **$**______________

District installed Sewer Stub?

- ☐ **NO**, then no additional fees apply
- ☐ **YES**, then an additional charge applies. **$**______________

Applicable credits?

- ☐ Pre-Paid Connection Certificate Credit: **$**______________
- ☐ Expired Permit(s) Credit: **$**______________

- Water Availability Form, Water/Sewer Availability Form, or Sewer-Only Will-Serve Letter

Property is located within Urban Growth Area (UGA) or Local Area of More Intense Rural Development (LAMIRD)?

- ☐ **NO**, then City of Bellingham must confirm lot existed prior to May 1, 2005 in accordance with the Interlocal Agreement for Sewage Services between the City and District prior to District issuing an availability for sewer.

  Process for confirmation with City of Bellingham.

  - ☐ Property owner provides District with copy of deed or Whatcom County Lot of Record determination that proves lot existed prior to May 1, 2005.
  - ☐ District will send information to City for confirmation
  - ☐ When District receives confirmation from City that lot can be served, District can continue with sewer availability checklist.
- ☐ **YES**, then continue to next checklist item.

Conditions for water and/or sewer availability.

Property is adjacent to water and sewer?

- ☐ **YES**, then prepare Water and Sewer Availability Form
- ☐ **NO**, then check next condition

Property is adjacent to Sewer only?

- ☐ **YES**, then Covenant Regarding Future Water Service is required prior to Sewer-Only Will-Serve Letter, or if within 200-Feet of Water System, Developer Extension may be required.
- ☐ **NO**, then check next condition

Property is adjacent to Water only?

- ☐ **YES,** then Covenant Regarding Future Sewer Services is required prior to Water Availability Form, or if within 200-Feet of Sewer Main, Developer Extension may be required (if located within LAMIRD or UGA).

- Submit Application for Water/Sewer Permit forms to District. Include the following:

- ☐ Copy of Whatcom County Building Permit
- ☐ Copy of Whatcom County Revocable Encroachment Permit (Required if work is in County Right-of-Way)
- ☐ Site Plan to include Existing and Proposed Features
- ☐ Pressure Reducing Valve(PRV) shown on Site Plan
- ☐ Special Plumbing or Activities to be listed
- ☐ Submit Grinder Pump Checklist if required
- ☐ Designate Bonded Side Sewer Contractor performing side sewer installation

- Pay Connection Fees, Sign Water/Sewer Permit

- ☐ District will prepare Water/Sewer Permit and call to schedule time for payment and pickup (typically 1 business day after submittal of Application for Water/Sewer Permit).

- Connection to Water
  - ☐ District will install water meter adjacent to property. Typically takes 2 to 14 days depending on whether a service line exists from the public water main to the property.
  - ☐ Customers can install their own water service lines from the water meter to the house per District standards.
  - ☐ Customer requests inspection of private pressure reducing valve required (PRV) on the service line at the entry of the house. The PRV protects internal plumbing from pressure spikes in public water system. The District's distribution system has over 50 large PRV's located throughout the system. These large PRV's have the potential to stick open and cause high water pressure with no warning. Customers may elect not to install a private pressure reducing valve after recording a Hold Harmless Agreement Concerning Owner's Desire Not to Install a Pressure Reducing Valve.
  - ☐ Billing for both water and sewer (if also served by sewer) begins the date the water meter is unlocked by the District at customer's request.

- Connection to Sewer
  - ☐ Installation of the side sewer from the public sewer main to the house must be performed by a contractor on the District's Bonded Side Sewer Contractor List.
  - ☐ Contractor requests a pre-construction meeting with District prior to any work.
  - ☐ Contractor requests sewer pipe bedding and backfill inspection prior to covering any pipe.
  - ☐ Contractor requests sewer leak test Inspection
  - ☐ Billing for sewer-only customers begins the date the side sewer is connected to the public sewer main.

WATER AVAILABILITY FORM
PUBLIC WATER SYSTEM

WHATCOM COUNTY
HEALTH DEPARTMENT
509 Girard Street
Bellingham, WA 98225
Telephone: 360-778-6000
Fax: 360-778-6001

Complete and submit this form with original signatures to WCHD
(copies are not accepted)

Applicant Information:

Property Owner(s): ______________________________ Phone: ______________
Address: ______________________ City: ____________ State: ____ Zip: ________
Contact Person: ______________________________ Phone: ______________
Email and/or Alternate Contact: ______________________________

I certify that I am the owner or authorized representative of the below noted property. I have examined this form and know the same to be true and correct. I understand that this approval expires one year after the PWS Authorized Representative signature date and that application for final plat approval and/or building permit must be made before the expiration date. I understand that information submitted is subject to the Public Records Act 42.56.

Sign: ____________________ Print: ____________________ Date: __________

Property Information:

Tax Parcel Number (12 digit number): __ __ __ __ __ __ __ __ __ __ __ __
Project Type (check one): ☐ Single ☐ Multi-Family ☐ADU ☐ Commercial ☐ Plat
Address of Project: ______________________________
Building Permit Number: ______________ Plat Name: ______________ Lot: ________
- Briefly describe project (attach site plan and additional pages as needed)________________

Certification of Public Water Availability:

This Section to be Completed by the Public Water System Authorized Representative

Public Water System Name: ______________________________ DOH ID#: __________
The above Public Water System (PWS) is approved by the WA State Department of Health or the WCHD for ________ service connections and currently serves ________ service connections. The PWS has the necessary water system infrastructure in place to adequately provide service to the above property per WAC 246-290 or WAC 246-291. The PWS is capable of and willing to supply water to the above property, residence, project or plat for ________ ☐ **New** service(s) and/or ________ ☐ **Existing** service(s).

I certify that I am an authorized representative of the above PWS. I understand this certification expires one year after the PWS signature date. I understand that information submitted is subject to the Public Records Act 42.56.

Sign: ____________________ Print: ____________________ Date: __________
Title: ______________ Address: ____________________ Phone: ______________

For Health Department Use Only:

☐ Approved Date: ____________ Notify Via: ☐ Email ☐ Phone ☐ Mail
☐ Denied ______________________
By: ______________________ Approval Expires: ____________
Comments or Conditions: ______________________________

LAKE WHATCOM WATER & SEWER DISTRICT
1220 Lakeway Drive
Bellingham, WA, 98229

(360) 734-9224
Fax 738-8250

Sample

{Date}

Re: Sewer "Will Serve" Letter for
{Address}
{Assessor Parcel Number}

To Whom It May Concern:

The District can currently provide sewer service to the above parcel. Currently water is not available to this parcel. Prior to issuance of a sewer permit, a Covenant Binding Property Regarding Future Water Service must be recorded at the Whatcom County Auditor's Office. See attached covenant form.

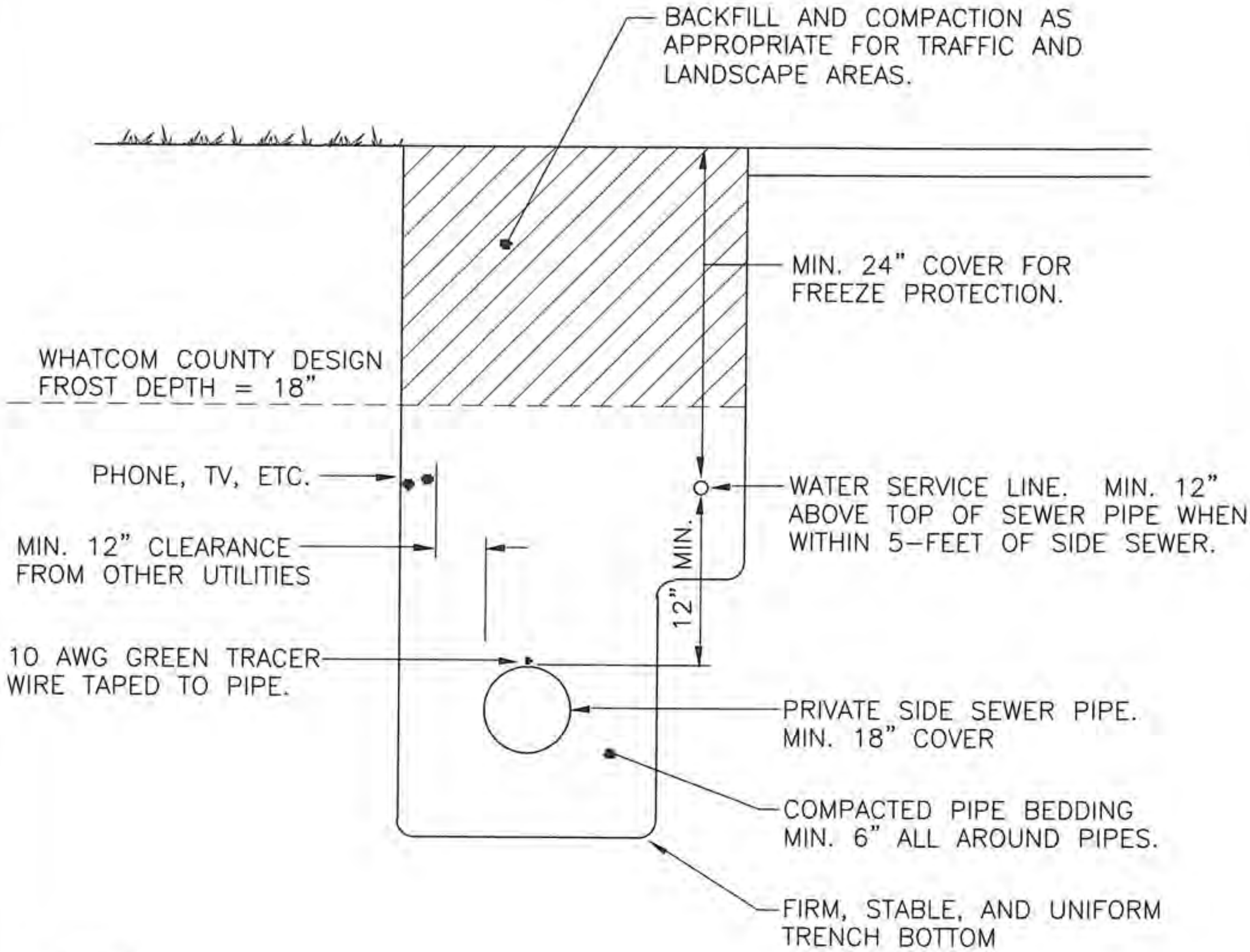
This determination, however, is not indefinite, nor irrevocable. Nothing stated herein constitutes a commitment to provide water and sewer service to you in the future. The information used to arrive at this determination of availability is believed to be accurate at this time, but future demands are not always predictable. Similarly, new laws, regulations, or ordinances could also limit the ability to provide water and sewer service in the future. Accordingly, any expenditure which you make in anticipation of future sewer service is strictly at your own risk. Any statements in paragraph(s) above which are inconsistent with this paragraph should be disregarded.

Please call if you have any questions.

Sincerely,

LAKE WHATCOM WATER & SEWER DISTRICT

{District Representative}
{Title}



NOTES:

1. District side sewer pipe material standards (PVC ASTM D3034 SDR 35) comply with 2012 International Plumbing Code (IPC) Table 702.3 Building Sewer Pipe. Separation of water service and side sewer as detailed above complies with IPC 603.2 requirements.

2. Water service lines and side sewers shall be bedded in material meeting WSDOT 9-03.12(3) Gravel Backfill for Pipe Zone Bedding as shown in following table:

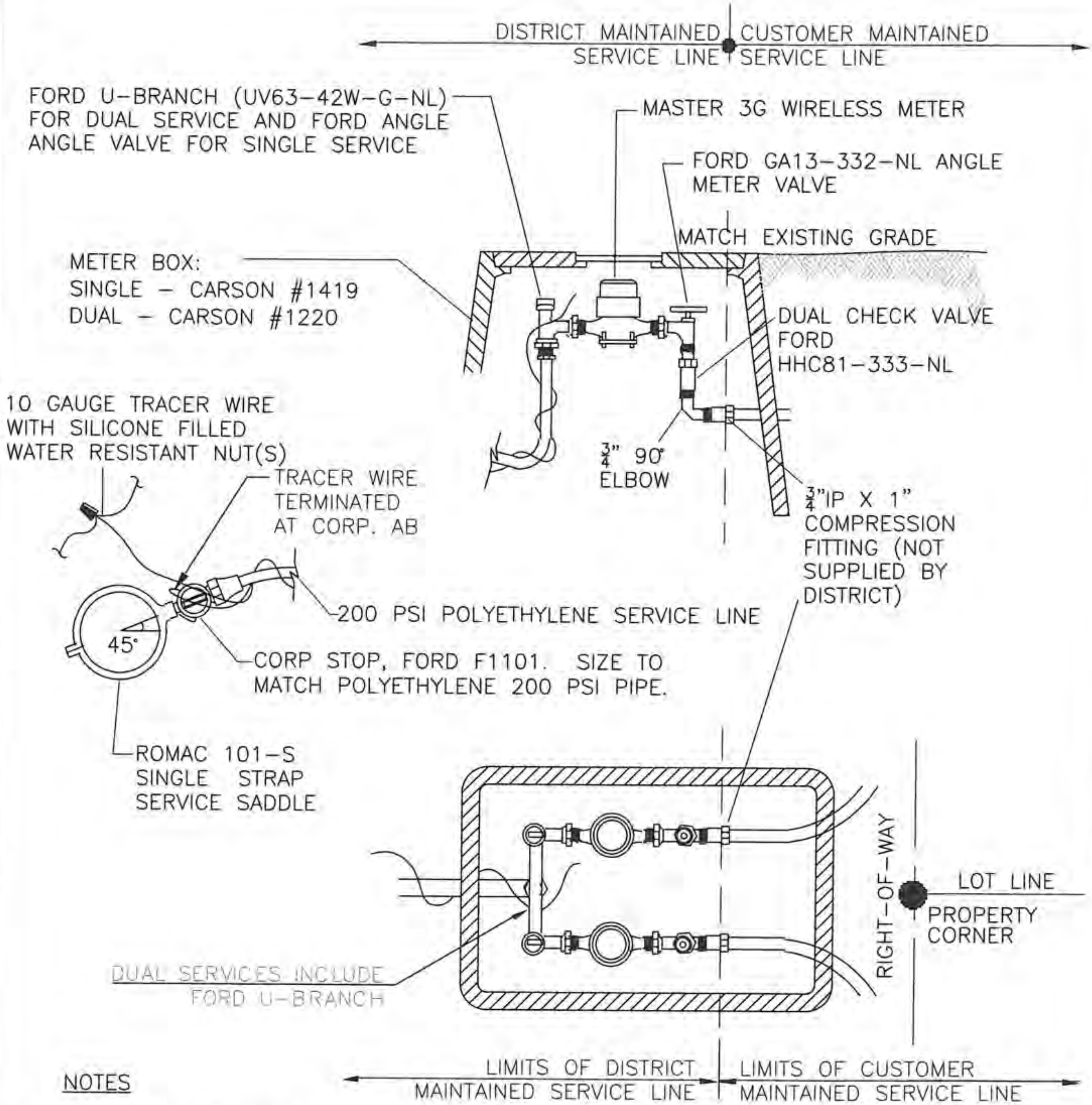
Sieve Size	Percent Passing by Weight
1.5"	99-100
1"	75-100
5/8"	50-100
U.S. No. 4	20-80
U.S. No. 40	3-24
U.S. No 200	10.0 max
Sand Equivalent	35 min.

PRIVATE WATER SERVICE LINE AND SIDE SEWER TRENCH DETAIL

STANDARD DETAIL

G7

5/1/2014



NOTES

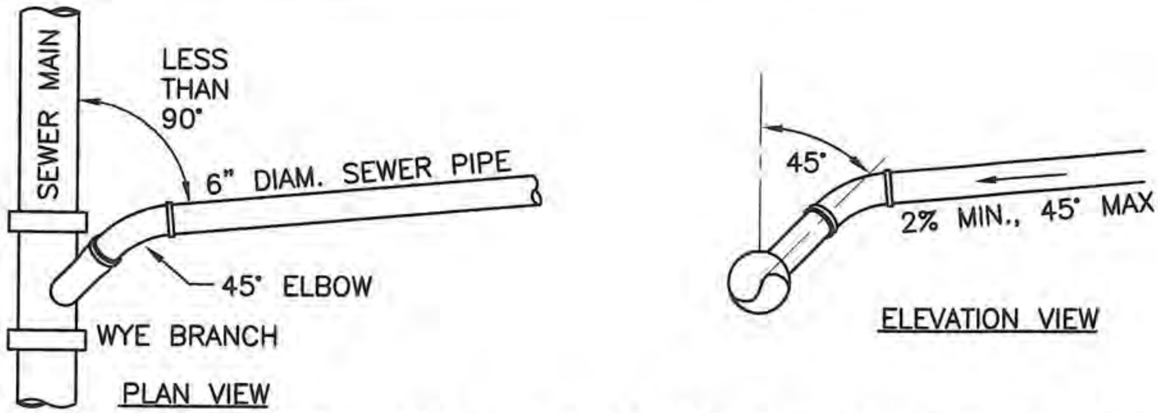
1. Service fittings shall be in accordance with WSDOT 9-30.6 except that only compression (grip joint) fittings on service lines are allowed.

2. All fittings shall be Ford brass.

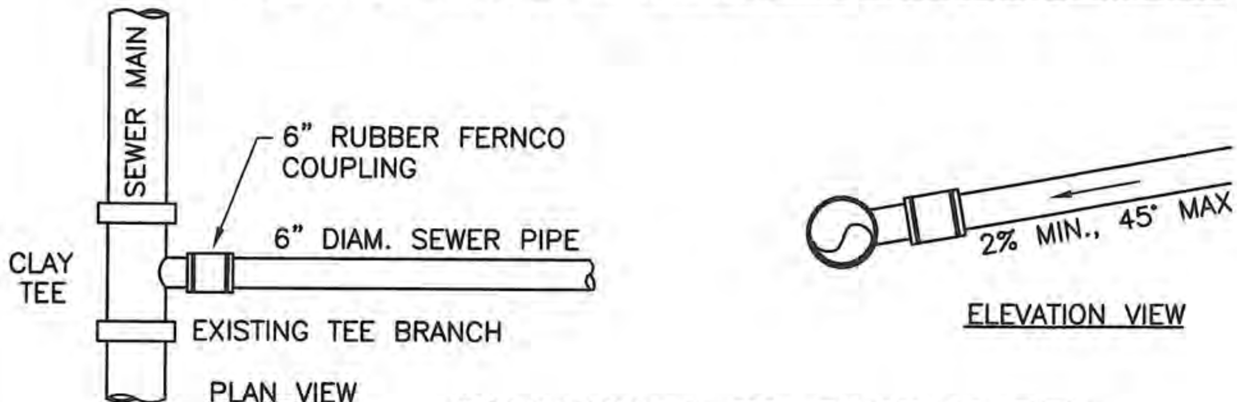
3. The water service pipe shall have a minimum of 30 inches depth and a maximum of 36 inches depth, including under ditch sections.

4. Meter boxes in traffic areas shall be concrete with a reader lid.

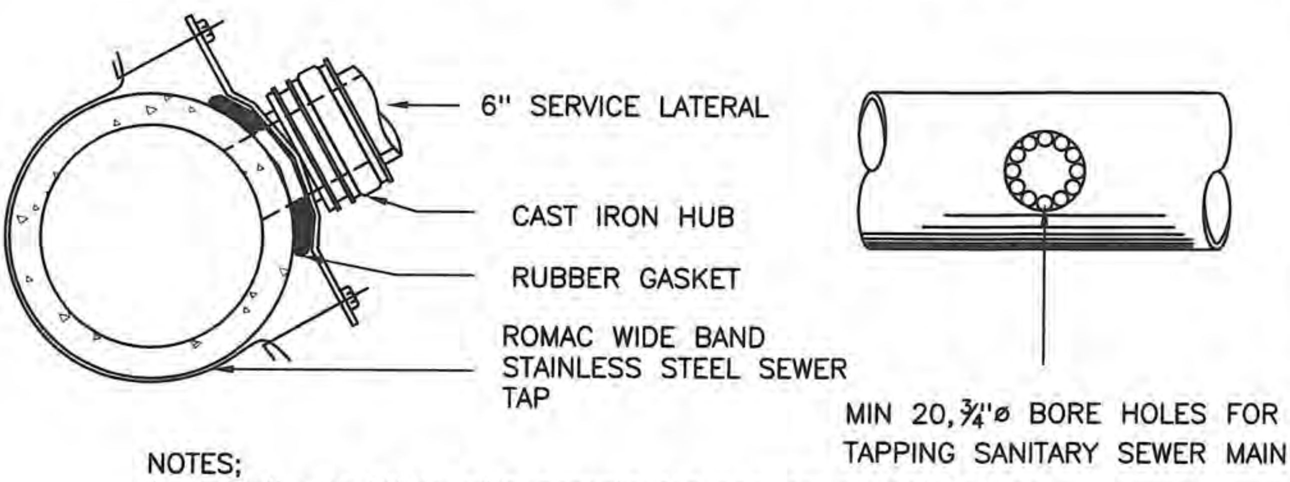
LAKE WHATCOM WATER & SEWER DISTRICT	WATER METER ASSEMBLY	STANDARD DETAIL W8 01/04/2016



SERVICE LATERAL INSTALLED WITH NEW MAINS



CONNECTION TO EXISTING TEE



NOTES;
1. Install wye fitting with gaskets for new sewer installations
2. Pipe bedding shall be sand or pea gravel 6" all around.
3. Minimum cover to finish grade is 30".
4. Drill multiple 3/4' holes (20 min for 6") then break out

CONNECTION TO EXISTING SEWER (TAP)

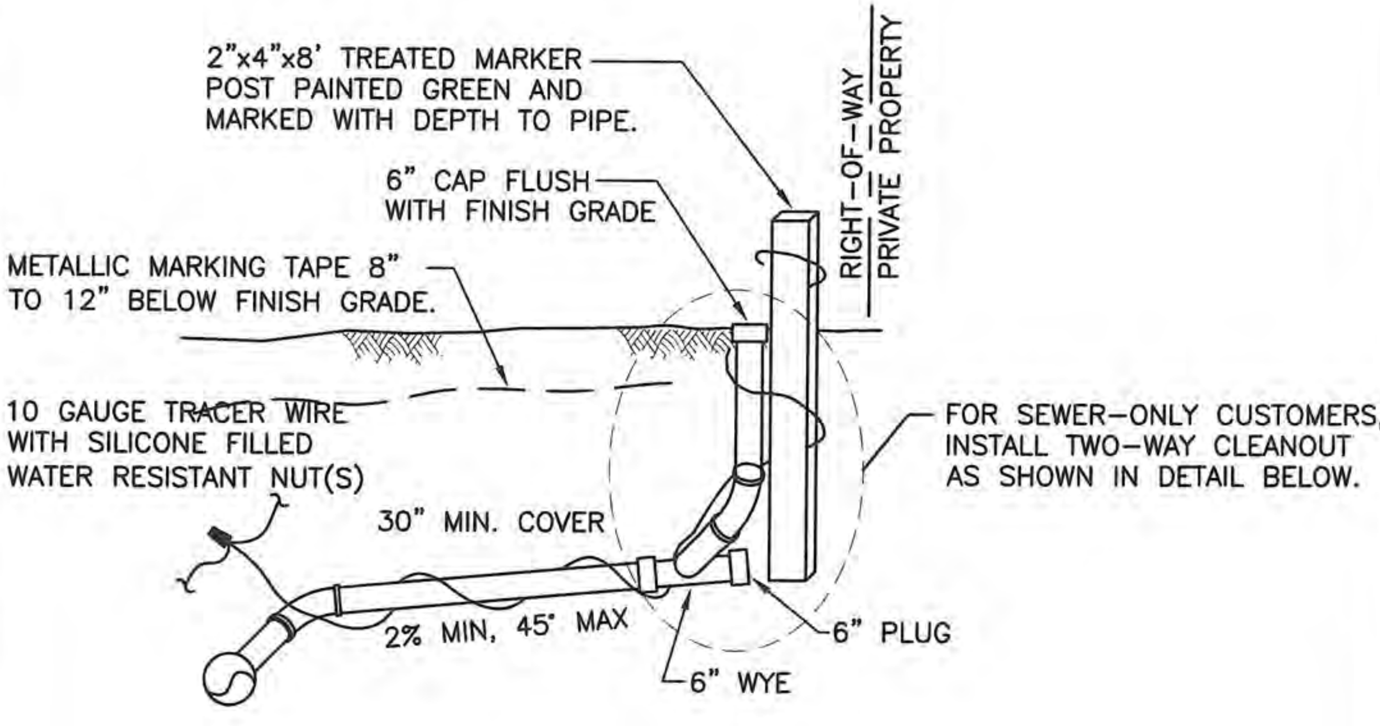
LAKE WHATCOM WATER & SEWER DISTRICT

SEWER LATERAL CONNECTION TO MAIN

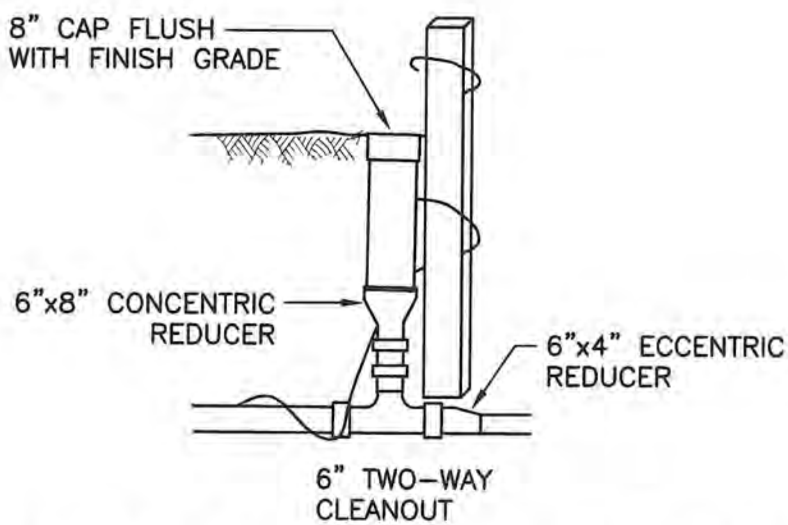
STANDARD DETAIL

S6

3/13/2014

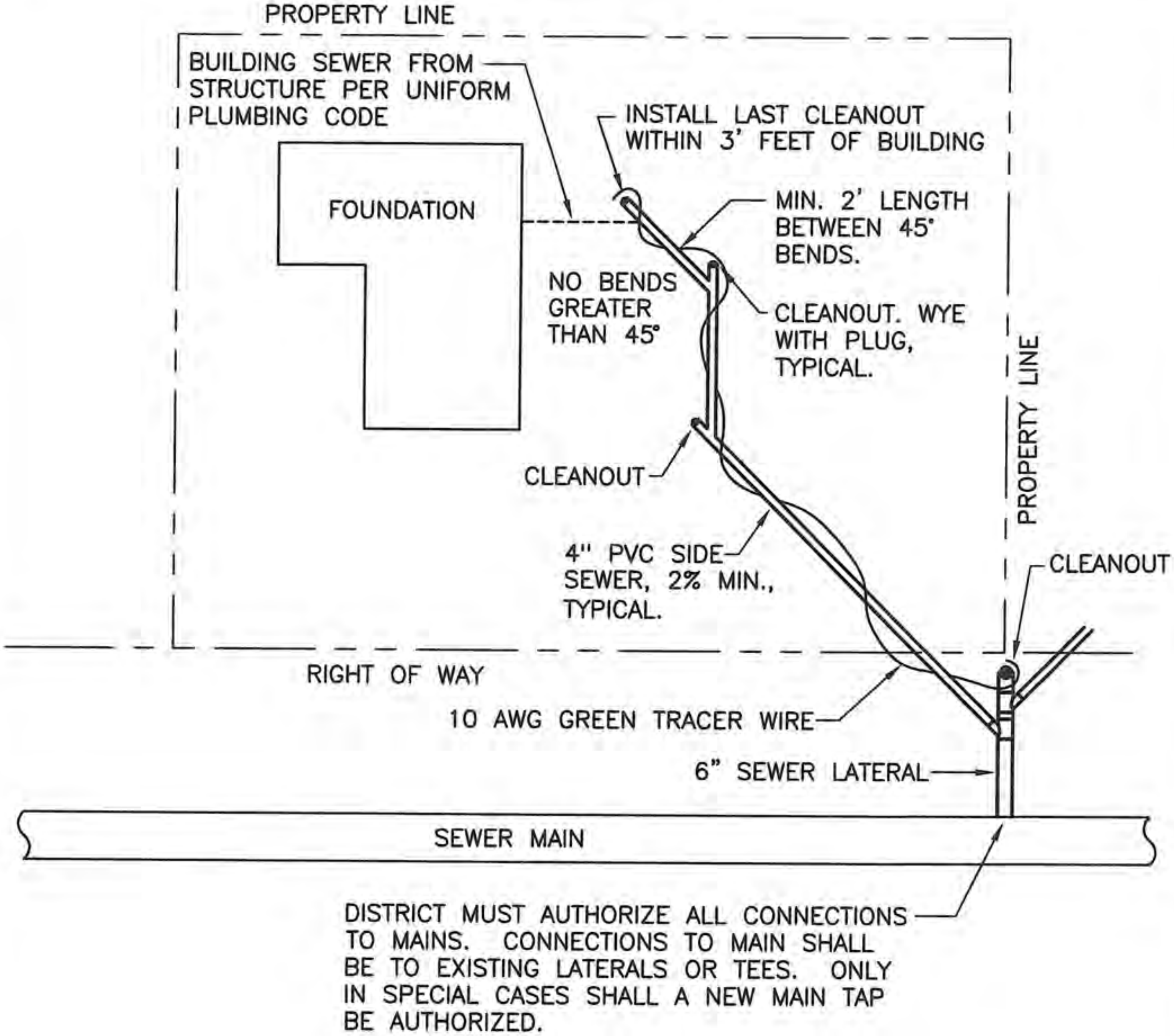


TYPICAL SEWER LATERAL & CLEANOUT



CLEANOUT FOR SEWER-ONLY CUSTOMERS.

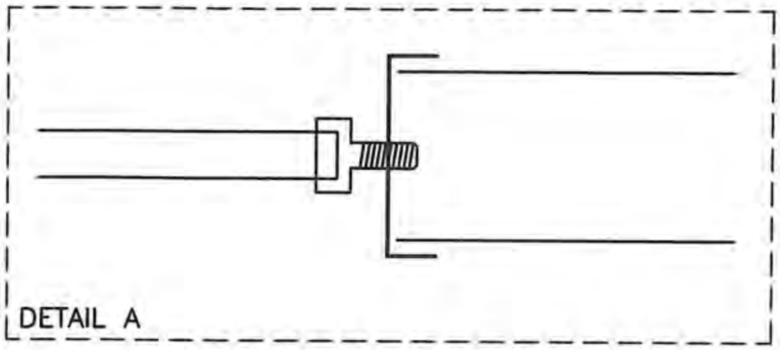
LAKE WHATCOM WATER & SEWER DISTRICT	SEWER LATERAL AND CLEANOUT	STANDARD DETAIL S7 3/13/2014

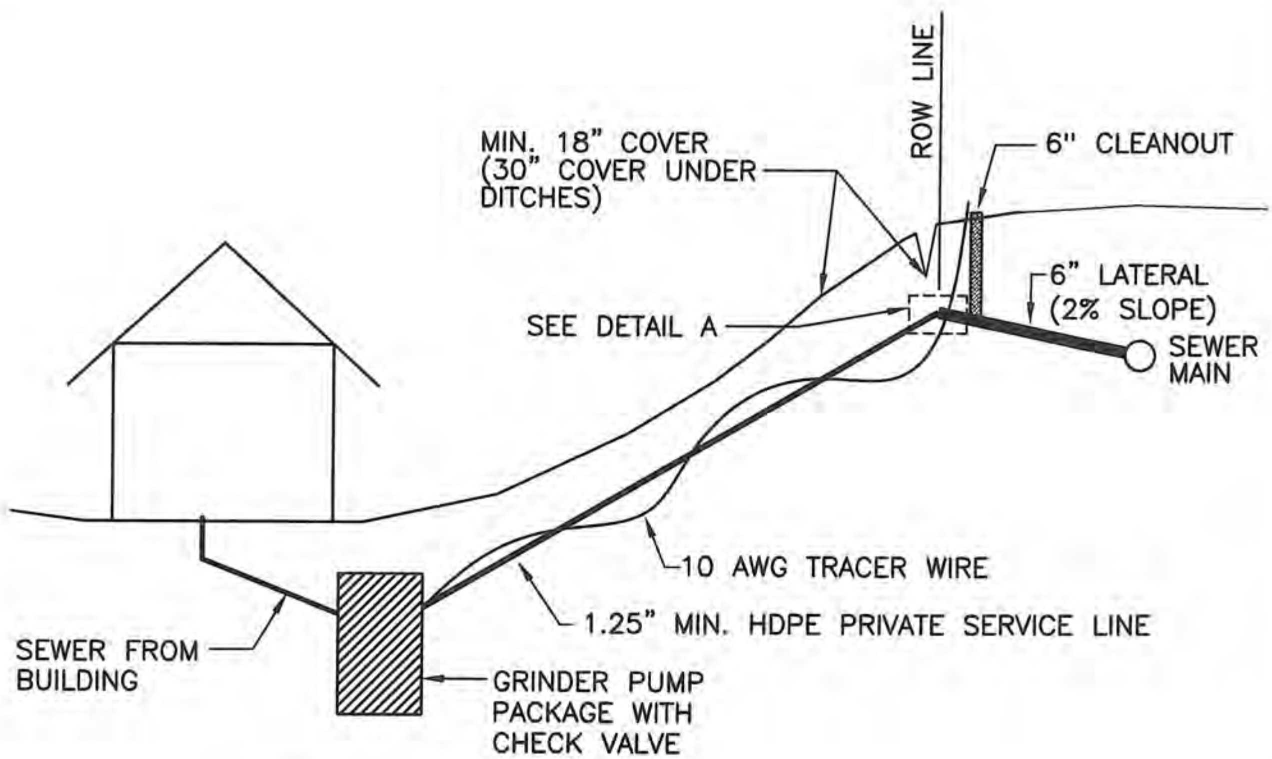


Notes:

1. All pipe from main to cleanout at foundation shall be PVC ASTM D3034 SDR 35, joints shall conform to ASTM D3212 using elastomeric gaskets conforming to ASTM F477. Fittings shall be injection molded, factory welded, or factory solvent cemented.
2. Minimum 18" of cover from property line to building.
3. Down spouts, sump pumps, and outside drains shall not be connected to the sewer line.
4. Bends greater than 45° will not be accepted.
5. Minimum size for sewer lines will be 4" for single family residence and 6" for multi-family residence up to a 4 plex.
6. Cleanouts on service lines shall be installed at every change in alignment or grade in excess of 22 1/2 degrees.
7. Cleanouts shall be spaced no greater than 100' apart.
8. A cleanout shall be installed within 3' of the building.

LAKE WHATCOM WATER & SEWER DISTRICT	GRAVITY SIDE SEWER INSTALLATION	STANDARD DETAIL S8 3/13/2014





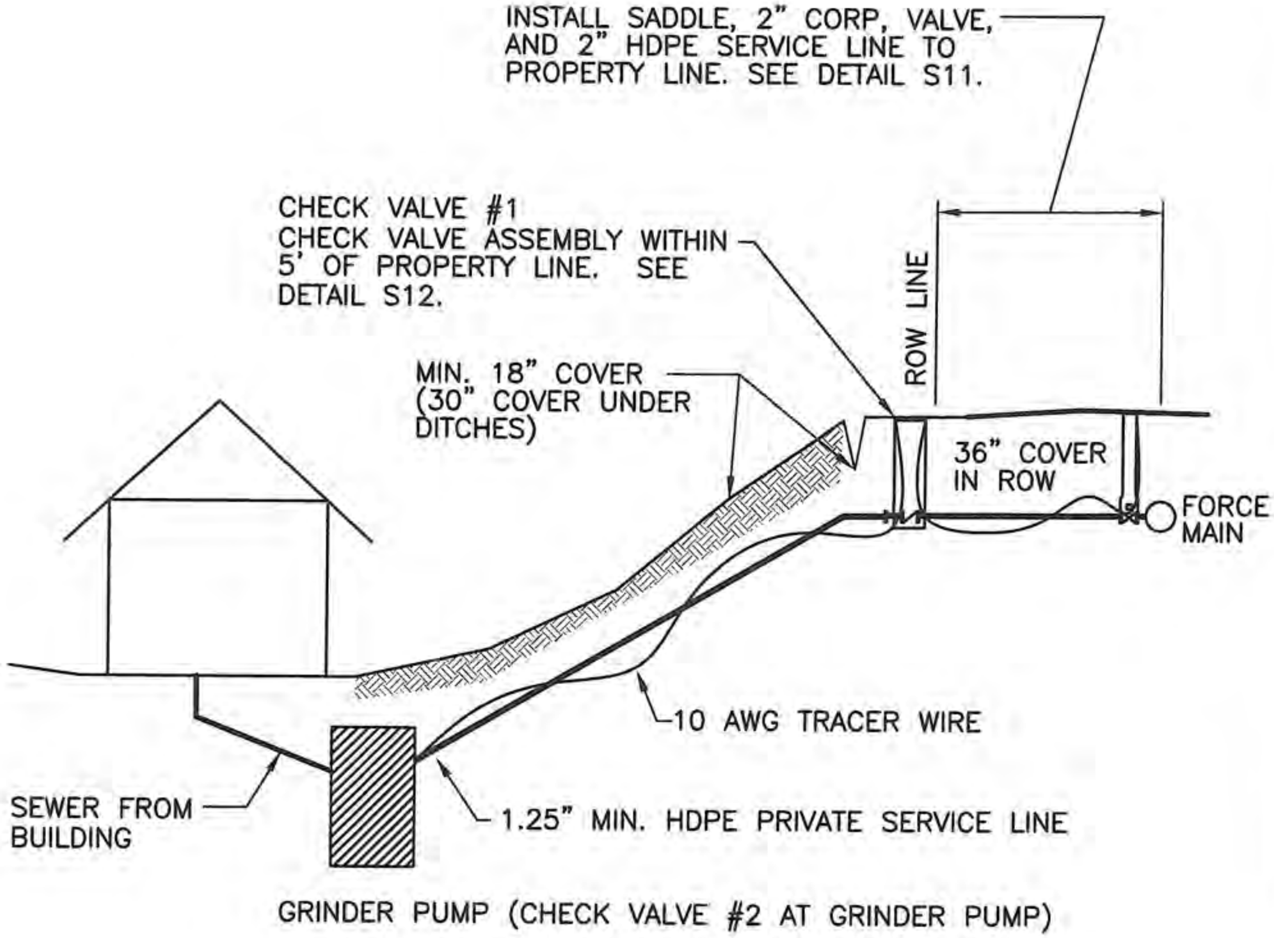
SEE DOE'S CRITERIA FOR SEWAGE WORKS DESIGN, SECTIONS C1–10.1 & C1–10.2 FOR GRINDER PUMP DESIGN & COMPONENT INFORMATION

NOTES:

1. Pressure sewer service pipe shall be PE 3408 HDPE conforming to the requirements of ASTM D–3350. Piping shall be SDR11, IPS (OD), pressure rated at 160 PSI, conforming to the requirements of AWWA C901 and ASTM F714.

2. Brass compression fittings only – no hose clamps.

LAKE WHATCOM WATER & SEWER DISTRICT	GRINDER PUMP SERVICE TO GRAVITY MAIN INSTALLATION	STANDARD DETAIL S9 3/13/2014



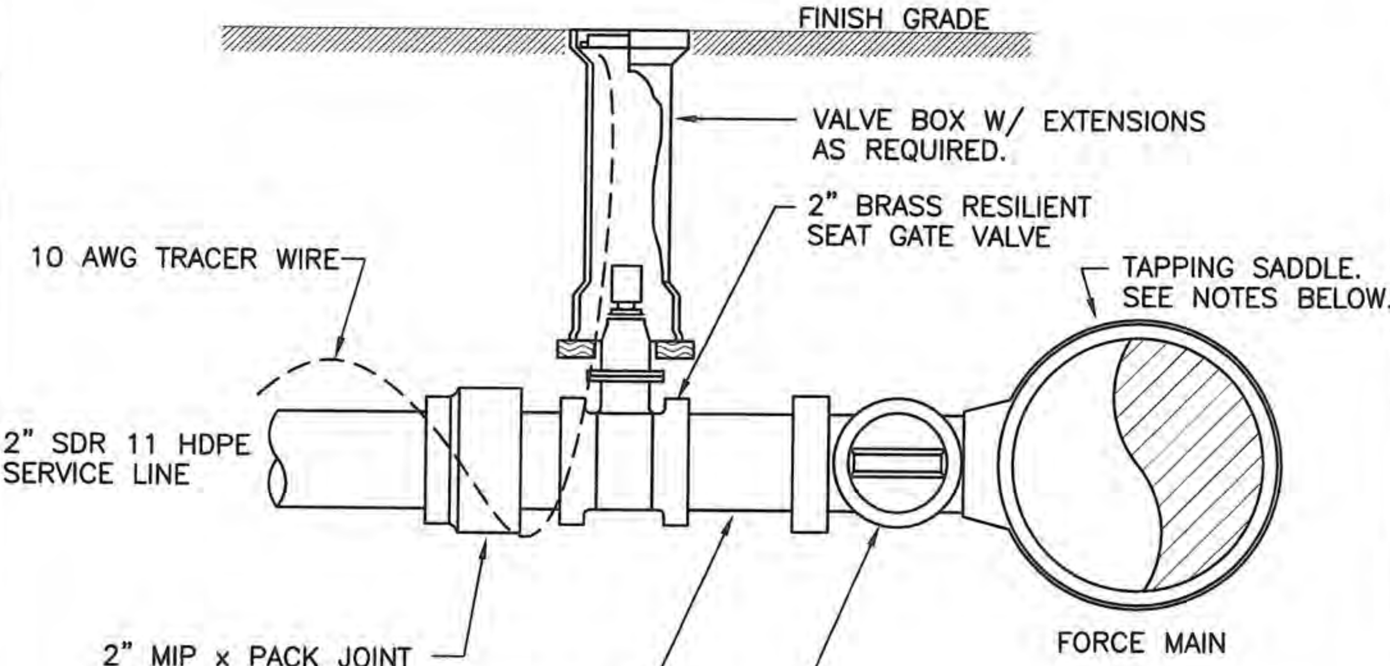
SEE DOE'S CRITERIA FOR SEWAGE WORKS DESIGN, SECTIONS C1–10.1 & C1–10.2 FOR GRINDER PUMP DESIGN & COMPONENT INFORMATION

NOTES:

1. Pressure sewer service pipe shall be PE 3408 HDPE conforming to the requirements of ASTM D–3350. Piping shall be SDR11, IPS (OD), pressure rated at 160 PSI, conforming to the requirements of AWWA C901 and ASTM F714.

2. Two check valves are required between the pump station and the force main. One check valve shall be installed within 5' of the right-of-way in the check valve vault. The second valve shall be installed at the grinder pump.

LAKE WHATCOM WATER & SEWER DISTRICT	GRINDER PUMP SERVICE TO FORCE MAIN INSTALLATION	STANDARD DETAIL S10 3/13/2014



** NOTE! FUSED HDPE TEES SHALL BE INSTALLED WITH NEW HDPE FORCE MAINS. (NO TAPPING SADDLE OR CORP STOP.)

NOTES:

1. HDPE Service Saddles. Saddles for use on SDR 17 HDPE mains shall be epoxy or nylon coated ductile iron tapping saddles with a double stainless steel strapping mechanism specifically recommended by the manufacturer for use on HDPE piping. Saddles shall be Romac style 202N-H or approved equal.

2. PVC Service Saddles. Saddles for use on AWWA C900 PVC mains shall have epoxy or nylon coated ductile iron tapping saddles with a double strap stainless steel strapping mechanism. Service saddles shall be Romac style 202N or approved equal.

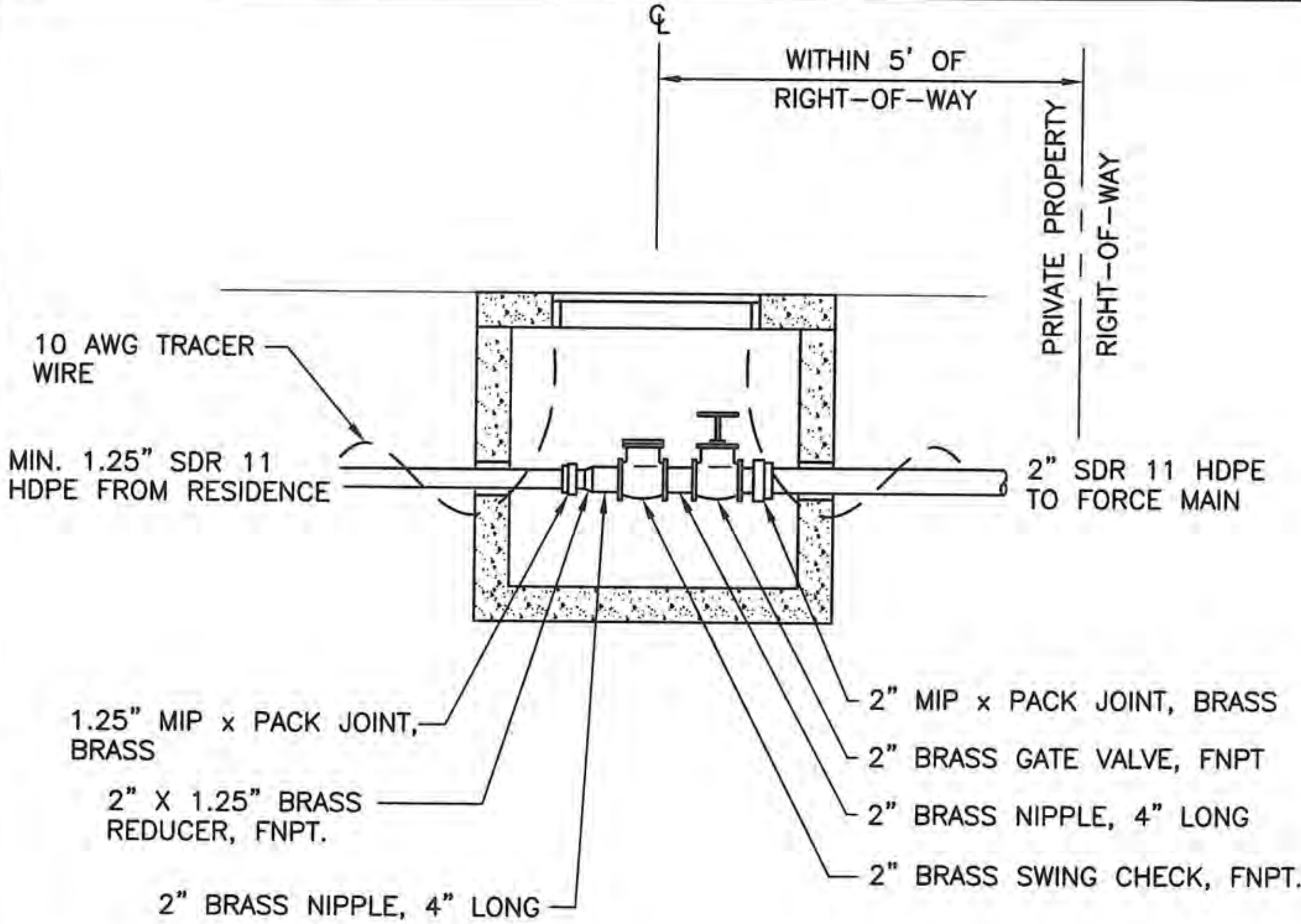
3. Ductile Iron Service Saddles. Saddles for use on ductile iron mains shall have epoxy or nylon coated ductile iron tapping saddles with stainless steel tapping mechanism. Service saddles shall be Romac style 101NS or approved equal.

4. Customer Service Shutoff Valves. Shutoff valves shall be resilient wedge type gate valves in conformance with AWWA C509. Valves shall be suitable for sewage service and be equipped with transition gaskets where needed. Gate valves shall have a non-rising stem and be fusion-bonded epoxy coated inside and out meeting AWWA C550. Gate valves shall be Clow resilient wedge gate valves or approved equal.

5. Valve boxes shall have the word "SEWER" cast into the cover.

6. Fittings. All fittings shall be brass.

LAKE WHATCOM WATER & SEWER DISTRICT	CONNECTION TO FORCE MAIN	STANDARD DETAIL S11 3/13/2014



Notes

1. Check Valve. Check valve shall be horizontal swing type manufactured out of brass and be pressure rated to 125 psi. Valve shall have metal to metal seal and threaded NPT end connections. Valve shall be a Watts Regulator Company Series WCV or equal.

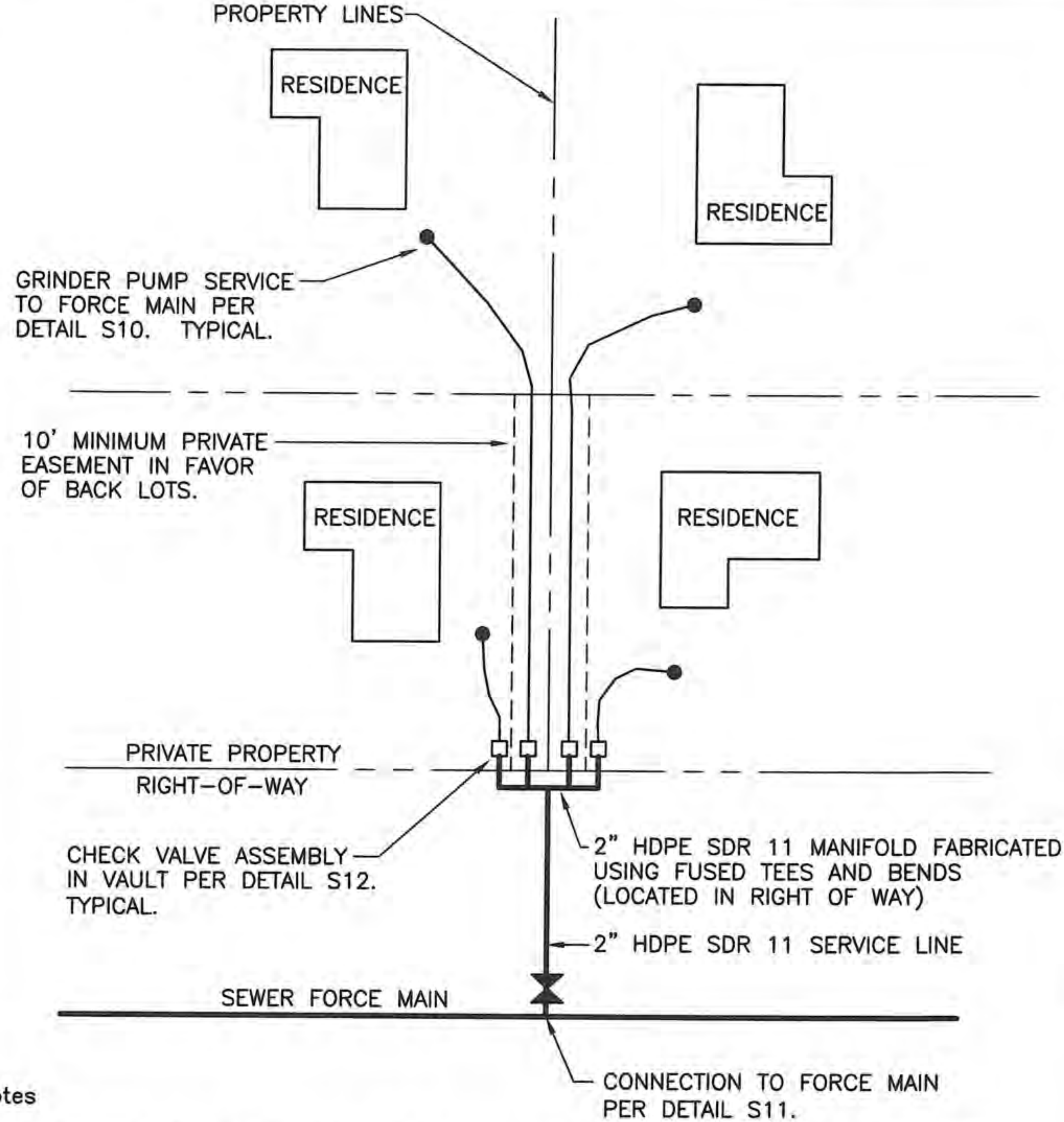
2. Gate Valve. Gate valve shall be manufactured out of brass and be pressure rated to 200 psi. Valve shall have threaded bonnet and non-rising stem. Valve shall be a Watts Regulator Company Series WGV or equal.

3. Vault. Vault shall be a pre-cast concrete hand hole with a 2'-0" by 3'-0" inside diameter and a maximum 4'-0" inside depth. Hand hole and access hatch shall be traffic rated. Access hatch shall be galvanized steel checker plate with pick holes and bolt down holes in plate. Check valve vaults shall be Utility Vault Model 2436 hand hole or approved equal.

4. Air/Vacuum Valve. Where required, air relief and combination air relief/ vacuum relief valves shall be as manufactured by Orenco, Apco, Crispin or equivalent for sewer service. All valves shall be fully accessible to enable customer's operation, maintenance and repair.

5. Fittings and Adapters. All fittings and adapters shall be brass.

LAKE WHATCOM WATER & SEWER DISTRICT	FORCE MAIN SERVICE CHECK VALVE	STANDARD DETAIL S12 3/13/2014



Notes

1. If approved by the District Engineer, a single 2" service tap may be shared with multiple residences. District will review requests for shared taps on a case by case basis. Property owners desiring to install a shared tap, shall individually but at the same time, submit a sewer permit application with the grinder pump check list for review by the District.

2. Manifold must be fabricated using fused HDPE tees and bends by a contractor certified by a HDPE pipe or fusion machine manufacturer.

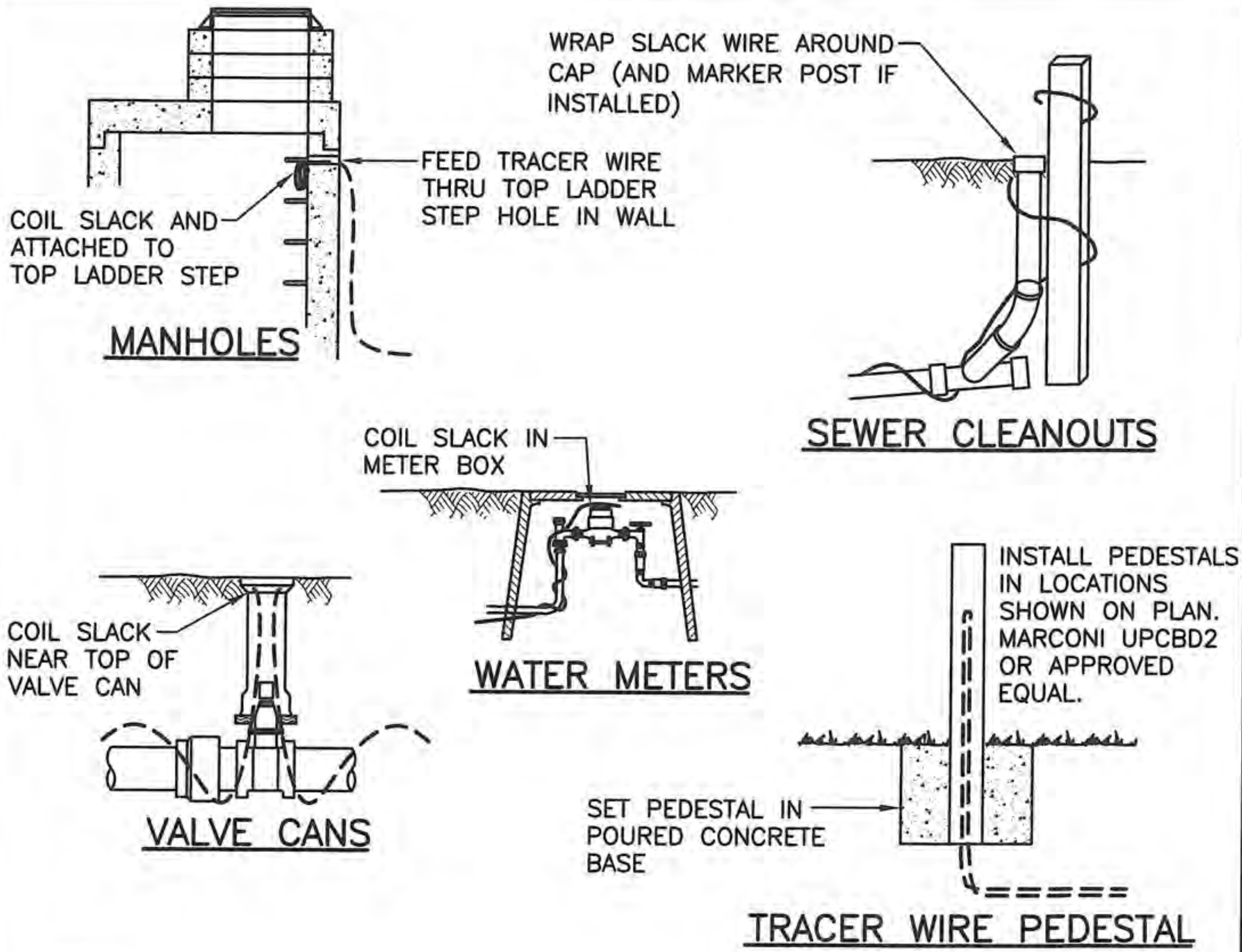
LAKE WHATCOM WATER & SEWER DISTRICT — lake whatcom

SHARED FORCE MAIN SERVICE TAP

STANDARD DETAIL

S13

3/13/2014



NOTES:

1. Tracer wire installation is required on all District owned pipe and communication lines. Tracer wire is also required on private side sewers.

2. Tracer wire shall be 10 AWG insulated copper wire rated for direct burial in wet locations. Use green insulation for sewer, blue insulation for water, and orange insulation for fiber/communication related utilities.

3. Install tracer wire in continuous lengths (no splices) between surface access points. Any direct bury splices shall be approved and inspected by the District Engineer prior to cover. Splices shall be made with silicone filled wire nuts rated for direct burial in wet locations such as "Ideal Underground Wire Connectors", "Ideal Mudbug Connectors," "Copperhead Snakebite Connectors," or "3M DBR Direct Bury Splice Kit."

4. Tape tracer wire to pipe at 10-foot intervals.

5. Provide at least 2-feet of coiled tracer wire slack at surface access points.

LAKE WHATCOM WATER & SEWER DISTRICT	TRACER WIRE	STANDARD DETAIL E5 3/13/2014

LAKE WHATCOM WATER & SEWER DISTRICT

1220 Lakeway Drive
Bellingham, WA, 98229

(360) 734-9224
Fax 738-8250

BONDED SIDE SEWER CONTRACTOR LIST

Blythe Plumbing & Heating 2201 Humboldt Street Bellingham, WA 98225 Phone (360)733-7810 FAX (360)671-3787 lorrieg@blytheinc.com	Bode's Electric/Plumbing Wolfgang Sellinger 7666 Woodland Rd Ferndale, WA 98248 Phone (360)384-4087 FAX (360)384-0524	Boss Construction Contact: Gary Christie 4945 Guide Meridian Bellingham, WA 98226 Phone (360)398-2300 Cell (360)507-1621	Coast Construction Contact: Chuck Westfall 6188 Portal Way Ferndale, WA 98248 Phone (360)306-1391 FAX (360)384-3417
Dahlgren Excavating Contact: Rick Dahlgren P.O. Box 573 Everson, WA 98247 Phone (360)380-5533	Faber Construction Corp 131 E Grover Street Lynden, WA 98264 Phone (360)354-3500 Cell (360)815-4713	Favinger Plumbing Inc. Contact: Arthur Favinger 1700 Kentucky Street Bellingham, WA 98226 Phone (360)676-1774	Fountain Construction Contact: Lee Breakey 4185 Chance Rd Bellingham, WA 98226 Phone (360)734-9167
Harkness Contracting Contact: Rick Harkness P.O. Box 233 Acme, WA 98220 Phone (360)595-1128	Iverson Earth Works, LLC 2330 Birch Bay Lynden Custer, WA 98240 (360)366-3476	Kramer Construction 1442 Sunset Ave Ferndale, WA 98248 Phone (360)312-9739 Cell (360)303-0515	Len Honcoop Gravel Inc Contact: Jodi Tjoelker 8911 Guide Meridian Rd Lynden, WA 98264 Phone (360)354-4763
Mc Farlane Construction P.O. Box 29047 Bellingham, WA 98228 Phone (360)733-1555 FAX (360)724-6602 Cell (360)303-6993	Moceri Construction Inc. 1013 Donovan Ave Bellingham, WA 98225 Contact: Levi Nyberg Phone: (360)671-3381 Cell (360)319-9737	Olsson Construction Contact: Duane Olson 5750 Silverstar Rd Bellingham, WA 98226 Phone (360)961-7388	On The Level Const Contact: Joe Denhartog P.O. Box 1072 Bellingham, WA 98227 Phone (360)671-1957 Cell(360)223-7673
P & P Excavating Contact: Tom Pullar 2499 E. Smith Rd Bellingham, WA 98226 Phone (360)592-5374 Cel (360)815-4473	Plumb-Rite Contact: Bill Zaiss 1706 Front St #668 Lynden, WA 98264 Cell (360)815-2576	Premium Septic Service Inc. 3212 Mt. Baker Hwy Bellingham, WA 98226 (360)410-1764 Cell (360)393-7272 FAX (360)392-6119	Presco Construction 4921 Lewis Ave Bellingham, WA 98229 (360)671-9837
R & R Excavating 6595 Northwest Rd Ferndale, WA 98248 (360)815-5914 Ron5326@gmail.com	Ram Construction Contact: Mike Hammes 4290 Pacific Hwy Bellingham, WA 98225 Phone (360)715-8643	Samish Environmental, LLC 6777 La Bello Drive Lynden, WA 98264 Phone: (360)510-7403 Cell: (360)510-7403 FAX (360)398-1703	Skeers Construction Inc. Contact Dave Monks 1249 Birch Falls Drive Bellingham, WA 98225 (360)671-0911 Cell (360)305-7660
SML Construction Contact: Sean Logan 855 40th Street Bellingham, WA 98229 Phone (360)305-5190 FAX (360)933-4546	Sorenson Construction Lyle or Dennis Sorenson P.O. Box 388 Everson, WA 98247 Phone (360)966-2628 Cell (425)508-1490	Twilight Excavation, Inc. Contact: Ray Henken 6900 Northwest Drive Ferndale, WA 98248 Phone (360)380-1769 Cell (360)201-9351	Upland Developers Inc. Contact Phil Perkins P.O. Box 2706 Ferndale, WA 98248 (360)319-6981
Matt Weeks' Excavating 2318 Birch Bay Lynden Custer, WA 98240 Phone (360)366-314 Cell (360)410-6939 mwkjweeks@yahoo.com	Winterburn Construction Chris Winterburn 4590 Sand Road Bellingham, WA 98226 Phone (360)592-1305 Cell(360)815-0269		

Last Updated: July 13, 2016

LAKE WHATCOM WATER & SEWER DISTRICT

APPLICATION TO ESTABLISH DEVELOPER EXTENSION AGREEMENT (DEA)

1. Printed Name	2. Signature	3. Date Signed

4. Address	5. Phone	
	Home	
	Work	
	Fax	

6. Attach Following Maps (11 x 17 or smaller):

- ☐ Assessor map with parcels highlighted (black and white copies only, please)
- ☐ Proposed plat or lot layout with proposed water and/or sewer improvements. Show existing and proposed utility easements and public right-of-ways

7. Project Name

8. Site and Project Information

List of Parcel Numbers:	Proposed Number of Water Services:	
	Proposed Number of Sewer Services:	
Current Zoning:	Total Acres:	
Anticipated Start of Construction:	Anticipated Construction Duration:	

Provide a brief narrative description of the proposed development and requested water and/or sewer services. (If you require more space, please attach a separate sheet of paper):

To be completed by District

9. Application Complete	10. Application Fee Received	11. Receipt #	12. Received by
Yes ☐ No ☐	Yes ☐ No ☐		

13. General Manager Signature	14. Date Signed

*****SPECIAL NOTICES TO APPLICANT*****

- When you request to establish a DEA with the District, we will provide you with an Application and a sample of a Developer Extension Agreement. The sample is provided to you for information and planning purposes only.
- Once the District approves your application, you will be asked to complete and submit the DEA.
- Application processing steps are printed on the reverse of this form.
- This Application, once accepted and approved by the District, does not constitute, nor does it imply, a guarantee by the District to provide water or sewer service.
- This is NOT a “Will Serve” document.

OVERVIEW OF DEVELOPER EXTENSION PROCESS

Application Process:

A. Developer identifies basic facilities needed for the project.
B. Developer completes a Developer Extension Agreement (DEA) Application Form.
C. Board of Commissioners evaluates whether or not to allow extension.

After Board of Commissioners decides to allow extension:

D. District and Developer sign a Developer Extension Agreement.
E. Developer designs facilities using District Design Standards.
F. Developer constructs facilities using District's Construction Standards.
G. District accepts inprovements.
H. If applicable, District creates a Latecomer's Agreement with Developer per RCW's 56 & 57.

APPLICATION PROCEDURES

1. Applicant furnishes information required on reverse and pays application processing fee.

2. District performs preliminary Application completeness evaluation. If evaluation proves unsatisfactory, the District will return the application package to applicant citing deficiencies, and advise that application revision and resubmission is necessary.

3. Using information provided on the reverse, District ascertains proposed project conformance to the latest approved version of the District's Comprehensive Plan and other relevant District planning requirements. If found that:

   3.1. The information provided is insufficient to allow a determination, the District General Manager notifies the Applicant accordingly, citing discrepancies, and advises that Application revision/resubmission is necessary.

   3.2. In full conformance, the District General Manager advises the Applicant accordingly, and automatically petitions the District's Board of Commissioners to authorize the creation of a Developer Extension Agreement (DEA).

   3.3. In non or partial conformance, the District General Manager notifies Applicant accordingly, citing discrepancies, and advises that Application revision/resubmission is necessary.

   If a Comprehensive Plan Amendment is required, the Applicant petitions the District's Board of Commissioners to have the District attempt a formal amendment to the latest approved version of the District's Comprehensive Plan. Applicant is hereby cautioned that:

   - The Commissioners are not obligated to grant Applicant's request to attempt to amend the Comprehensive Plan.
   - Applicant shall fund all expenses associated with said amendment attempt, (current minimum estimate $1,000.)
   - Amendment approval is not guaranteed since amendments require approval by multiple State and County agencies.

LAKE WHATCOM WATER AND SEWER DISTRICT

DEVELOPER EXTENSION AGREEMENT

(DEA)

Contract #	#D08??

Project Information			
Title	**?????Project Name??????**		
	Developer	Developer's Engineer	Developer's Contractor
Name			
Address			
Phone #s			

Table of Contents

1. DEFINITIONS

- Construction - *Activities that execute or implement the* design.
- Design - *Plans, specifications, drawings, and other related documents, plus any other helpful visual or technical aids, such as graphics and mock ups, that communicate the details of the proposed* facilities.
- Developer - *Person/entity making application to construct water, sewer, and/or stormwater* facilities.
- Developer Extension Agreement (DEA) - *the contract between the District and the Developer to construct water and/or sewer facilities on property owned by the Developer, and in roads, easements, or other rights of way described in the approved application.*
- Developer's Contractor - *The entity selected by the* Developer *to perform* construction.
- Developer's Engineer - *The engineering entity preparing the design for the proposed* facilities. *The* Developer's Engineer *shall be qualified under Section 4.3 below, but shall NOT be the* District's Engineer.
- District - *Lake Whatcom Water and Sewer District.*
- District Engineer - *The professional engineer employed by the District that administers the Developer Extension Agreement.*
- Facility - *Water, sanitary sewer, and/or stormwater infrastructure and hardware; including but not limited to pipes and fittings, valves, pump stations, hydrants, associated electrical-mechanical devices, telemetry, buildings, and shelters.*
- Notice to Proceed with Construction - *A* District *generated document to the* Developer *that specifically authorizes the* Developer *to execute the* District's Engineer's *approved design at the site. Conversely, the* Developer *shall not install water and sewer utilities at the site without prior receipt of a* Notice to Proceed with Construction.
- Pre-paid Connection Certificate – *The certificate that the District issues when a Developer makes the required payment to reserve capacity in District-owned water and/or sewer facilities as part of a Developer Extension Agreement.*
- Connection Charge – *The current total monetary charge for general facilities charges, ULID or latecomer fees, as well as an administrative charge, which is paid to the District for system capacity. The connection charge is applicable for the calendar year issued, and thereafter shall be subject to such additional or higher fees as may thereafter be adopted by the District.*

2. LOCATION OF PROPOSED FACILITIES

Developer shall install the proposed water and sewer facilities on property owned by the Developer, and in roads and/or easements and/or other approved rights of way as described in an approved application for water and sewer. The water system shall……… The Application was approved for ?? water and sewer connections on ????DATE?????.

The properties owned by the Developer to be used for these facility extensions have the following Whatcom County Tax Parcel number(s) (as of the date of this agreement):

Tax Parcel Number	Owner
###### ##### ####	Name Address

3. COMPREHENSIVE PLAN

Developer represents that the proposed facilities are consistent with the District's most current approved Comprehensive Plan.

4. FACILITIES DESIGN

4.1. Design Standards

The facilities shall comply with the District's Design & Construction Standards in effect on the date the Notice to Proceed with Construction (NTPC) is issued by the District.. The District reserves the right to update the Design and Construction Standards at any time. The facilities shall also comply with Washington State Department of Health and Washington State Department of Ecology design standards and requirements. The Developer shall prepare all plans submitted in AutoCad Release 2002 or later format.

4.2. Design Standards Compliance Determination

The District Engineer retains exclusive and sole authority to determine when the Developer's Engineer's design complies with the Design and Construction Standards. The District Engineer is the Final Design approval authority. The Developer shall reimburse the District for costs incurred to review project Final Design. The Developer shall not commence construction until the District Engineer approves the design. It is the responsibility of the Developer to ensure that the plans prepared by the Developer's Engineer conform in all respects to District specifications. Failure by the District to discover errors, omissions, or discrepancies in the plans shall not relieve the Developer of this responsibility.

4.3. Developer's Engineer

4.3.1. Qualifications

Licensed Professional Engineer per RCW 18.43.

4.3.2. Authority

The Developer's Engineer shall design the facilities that are the subject of this Agreement, prepare and submit for approval any construction-phase revisions, and prepare record drawings of the completed facilities.

4.4. Changes

Failure of the District to require changes in the plans prior to approval of them shall not be deemed a waiver of the District's right to require such changes in the plans as the District may deem necessary during the course of work.

4.5. Ownership

The originals of all plans, including all electronic file media, prepared by the Developer's Engineer shall be delivered to the District upon completion of the project and shall become the property of the District. Neither Developer nor Developer's Engineer shall have any rights of ownership, copyright, trademark or patent in the plans.

4.6. Information Provided by District to Developer

The District shall make available to the Developer information it may have regarding existing utilities and obstructions. Such information is not guaranteed. Incompleteness or errors in this information shall not be the cause of a claim against the District or its consultants, nor shall it relieve the Developer of responsibility for repairing any damage its activities may cause to such utilities.

5. FACILITIES CONSTRUCTION

5.1. Prerequisites to Commencing Construction

- ❑ District Engineer approves the design (see Section 4.2).
- ❑ Developer reimburses District for design review costs (see Section 4.2 and Section 6.3).
- ❑ Developer delivers copy of insurance policy (see Section 7) to District.
- ❑ Developer delivers copies of easements (see Section 9) to District.
- ❑ Developer delivers copies of permits (see Section 10) to District.
- ❑ Developer pays developer conformance deposit (see Section 13) to District.
- ❑ Developer delivers performance bond (see Section 14) to District.
- ❑ Developer pays 25% of total amount of general facilities connection fees due (see Schedule A1) to District.
- ❑ Developer pays initial facilities inspection deposit (see Schedule A1) to District
- ❑ District issues **Notice to Proceed with Construction** (NTPC) to Developer.

5.2. Construction Standards

The construction of the proposed facilities shall comply with the design approved by the District Engineer and shall incorporate the District's Design and Construction Standards in effect on the date the Notice to Proceed with Construction (NTPC) is issued by the District. The District reserves the right to update the Design and Construction Standards at any time. The District retains exclusive and sole authority to determine Developer compliance with this requirement. A District designated inspector shall be present on the project site at all times wherever project construction activities occur that involves underground utility work or other work that is to be buried or covered. The Developer shall reimburse the District for costs incurred to perform site inspections. The Developer shall collect accurate field information and provide record drawings to the District. The District inspector's notes will also be made available, but should not be relied on as the only source of "as-built" information. Before final acceptance, the Developer shall provide the District with record drawings on mylar, together with their digital files (both Adobe PDF and AutoCAD DWG files). The District shall issue a "Final District Acceptance of Facilities" notification to the Developer when the facilities are accepted. The Developer's professional land surveyor shall perform construction staking.

6. FEES AND CHARGES PAYABLE TO DISTRICT

6.1. General Provision

The Developer shall bear all costs, including those incurred by the District, associated with the administration, planning, design, construction, and required governmental agency approvals of the proposed facilities project.

6.2. General Fee Schedule

See separate attached DEA Fees and Charges Schedule.

7. INSURANCE AND HOLD HARMLESS

The Developer shall take out and maintain during the life of this contract Public Liability Insurance for bodily injury and property damage liability, including without limitation, coverage for explosion, blasting, collapse and destruction of underground utilities and contingent liability, including products and completed operations and blanket contractual liability, as shall protect Developer, the District and its consultants. The Developer shall provide the District a signed certificate of insurance and CG2026 additional insured endorsement naming the District and its consultants specifically as additional named insured in said policies, all at no cost to the District. The Developer shall also require their Contractor and Subcontractors provide the same certificate and endorsement. The insurance shall cover the District and its consultants for all claims or damages for bodily injury, including wrongful death, as well as other claims for property damage which may arise from operations under this Agreement whether such operations be by the Developer, its contractor, or by any subcontractor or anyone directly or indirectly employed by them. The Developer agrees, in addition, to indemnify and save harmless the District, and the District's officers, agents, consultants, and employees, from all suits, claims, demands, judgments and attorneys fees, expenses or losses occasioned by the performance of this Agreement by Developer, any contractor, subcontractor, or persons working directly or indirectly for Developer, or on account of or in consequence of any act or omission of any such person, including but not limited to neglect in safeguarding the work or failure to conform to the safety standards for construction work adopted by the Safety Division of the Department of Labor and Industries of the State of Washington.

The amount of such insurance shall be as follows:

Commercial general liability insurance in an amount not less than one million dollars ($1,000,000.00) per occurrence and one million dollars ($1,000,000.00) in the aggregate in any one year.

The Developer shall not cause any policy to be canceled or permit it to lapse, and all policies shall include a clause to the effect that the policy or certificate shall not be subject to cancellation or to a reduction in the required limits of liability or amounts of insurance or any other material change until notice has been mailed to the District stating when, not less than thirty (30) days thereafter, such cancellation or reduction or change shall be effective. In the event the District or Developer receives notice of cancellation, the Developer shall immediately obtain other comparable insurance acceptable to the District and provide proof thereof to the District. In the event the Developer is unable to obtain and provide such insurance, he shall immediately cease all work on the project, save and except that which is necessary to secure the site and prevent injury.

All certificates of insurance, authenticated by the proper officer of the insurer, shall state in particular those insured, the extent of the insurance, the location and operations to which the insurance applies, the expiration date, and the above mentioned notice of cancellation clause. The Developer shall provide a copy of insurance policy as well as the signed certificate of insurance and CG 2026 additional insured endorsement to the District prior to commencing construction.

8. SPECIAL CONDITIONS

This agreement is conditioned upon Whatcom County's determination that the provision of water and/or sewer service to the proposed development complies with the Washington State Growth Management Act, RCW 36.70A. The Developer agrees to indemnify, defend, and hold harmless from any and all claims, suits, actions, or administrative proceedings, and any liability, loss or damage of any kind or nature, based upon any such actual or alleged violation.

9. EASEMENTS AND RIGHTS-OF-WAY

The Developer shall provide all necessary easements at its sole cost regardless of changes in the design, together with evidence of title. A licensed land surveyor shall prepare legal descriptions for easements across the property of others. Developer shall deliver to District on the standard District form these recorded easement(s) prior to the time Developer commences construction hereunder.

In accordance with the District's Standards, the Developer shall include in any preliminary plat documents the easements for all water and sewer facilities not located in public rights-of-way. A licensed land surveyor shall prepare legal descriptions for easements that cannot be clearly delineated on the plat map.

Prior to acceptance of facilities, Developer shall deliver to the District all original recorded easements, and copies of the recorded plat (if there is a new plat) or other proof of dedication to Whatcom County of any newly designated or existing but unopened rights-of-way.

Developer shall provide a title insurance policy establishing clear title in grantor to District in sum not less than $1000.00 per 500 lineal feet of easement.

10. PERMITS AND COMPLIANCE

Developer shall obtain all necessary permits and approvals. Developer shall provide the District with a copy of all such permits and approvals before construction begins. Construction shall proceed in accordance with all permits, approvals, and other governmental requirements, including the Whatcom County Development Standards and other District requirements. The District reserves the right to cancel, suspend, or not renew or extend this agreement in the event that the Developer, or its agents, are not in compliance with this Agreement, the Plans and Specifications, the terms of any permits and approvals, the Whatcom County Development Standards, or other governmental requirements.

11. USE OF EXISTING FACILITIES

Until execution and acceptance of the Bill of Sale there shall be no water and/or wastewater flow through any on-site or off-site mains or facilities, unless otherwise authorized in writing by the District.

12. LATECOMER REIMBURSEMENT AGREEMENT

At the request of the Developer prior to District final acceptance of facilities, the District will create a Latecomers Reimbursement Agreement with Developer per Title 57 RCW. Developer shall submit to the District all contracts and costs related to the facilities. The District's Engineer will determine the benefit area of the new facilities and verify those costs that are eligible for reimbursement. If the District determines that no benefit area per Title 57 RCW exists, then no Latecomers Reimbursement Agreement will result. The Latecomers Reimbursement Agreement shall be signed and notarized by the Developer prior to final acceptance of facilities. Requests by the Developer to establish a Latecomer Reimbursement Agreement after District's final acceptance of facilities will not be considered.

13. DEVELOPER CONFORMANCE DEPOSIT

The Developer Conformance Deposit shall be held until the Developer has filed with the District a copy of the recorded plat and any adjustments, amendments, or additions to the easement documents or as-built records of the District that are required due to changes in the development, including but not limited to the following: lot lines, greenbelt area legal description, easement descriptions, right-of-way dedication.

The District will retain the Deposit until all items requiring adjustment, amendment, or addition have been completed. All costs of such changes for engineering, legal and administration shall be deducted from the Deposit and any balance remaining shall be returned to the Developer. The Deposit shall not constitute a limit on the amount to be paid to the District for any such adjustments, and connections to the system will not be allowed until the District has been reimbursed for the full amount thereof if in excess of the amount of the Deposit.

14. PERFORMANCE AND PAYMENT BOND

Prior to commencement of the work, the Developer shall furnish to the District a performance and payment bond between Developer and the District upon a Developer-provided form with sureties approved by the District and in an amount equal to 150% of the estimated cost of the project as determined by the District Engineer. The performance and payment bond shall require the Developer to faithfully perform all the provisions of this Agreement, including the execution of the approved Plans and District Construction Standards, and pay all laborers, mechanics, and subcontractors and materialmen, and all persons who supply such person or persons, or subcontractors, with provisions and supplies for the carrying on of the work. The performance and payment bond shall also hold the District harmless from any claims thereof, whether any such claims would arise under the public works lien statutes, or the mechanic lien statutes of the State of Washington or any other source, and compliance with the formal requirements of any such statutes shall not be a condition to recovery upon said bond. In lieu of a performance and payment bond the Developer may provide a letter of credit in the amount of 150% of the estimated cost of the project to be held by the District until completion of construction. The letter of credit shall be issued by a Bellingham bank and payable to the District upon demand.

Should the work not be completed within the time allowed under this agreement, the District may complete the project and charge the bond for its costs.

15. MAINTENANCE BOND

The Developer shall provide a maintenance bond in the amount of ten percent (10%) of the construction costs as documented by the Developer. Said bond shall guarantee maintenance for two (2) years after acceptance of the facilities by the District and shall be in a form acceptable to the District.

16. GRADING OF ROADS

Developer shall grade all roads to the design subgrade elevation prior to the start of construction and shall advise the District, in writing, of any changes, which may be contemplated during construction. If the Developer changes the subgrade elevation of the road after completion of the facilities, or any part thereof, the Developer shall be responsible for all costs incurred for the facilities as a result of said change in subgrade elevation. This obligation shall remain in full force until Whatcom County or other municipality releases the road construction maintenance bond or bond of other description in connection with the Developer's obligation for completion of roads within the area.

17. CONNECTION TO THE DISTRICT'S SYSTEM

Written application for permission to make the actual connection to the District's system at a specified time shall be made by Developer or its contractor not less than 48 hours prior to the time that connection to the District's system is desired. All connections to the existing system and all testing of the new facilities shall require authorization of the District or its authorized representatives.

Openings of valves and use of water from the District's system will be done by the District or its authorized representative. The District reserves the right to require that connections be made by live tap where disturbance of water service would in the opinion of the District, be unduly detrimental. The District may elect to make connections to the existing system and the Developer shall pay all costs for the connection.

Not less than 48 hours prior to the time that the extension is partially or fully completed and connection to the District's system is desired, written application for permission to make the actual connection to the District's system at a specified time shall be made by Developer or its Contractor. All new connections to the existing system and all testing of new lines shall require authorization of the District and shall be conducted in the presence of the District's representatives. All inspections, connections and testing shall be made during normal working hours, unless prior arrangements have been made with the District.

18. PRE-PAID CONNECTION CERTIFICATION

The District will issue a Pre-paid Connection Certificate for each approved connection after the Developer makes the required payment of all General Facilities Connection Fees. The Pre-paid Connection Certificate reserves capacity in District-owned water and/or sewer facilities. The connection charge paid is applicable for the calendar year issued, and thereafter shall be subject to such additional or higher fees as may thereafter be adopted by the District.

19. BILL OF SALE

Developer agrees to execute a Bill of Sale prepared by the District prior to acceptance of system and furnish it to the District. The Developer shall deliver a copy of the recorded plat, short plat, or legal description of the property. A legal description, prepared by the Developer's professional land surveyor, is required for inclusion into the Bill of Sale. Said Bill of Sale will provide for transfer of title of the extension facilities from the Developer to the District and will further include the following statements:

A. Developer is the lawful Owner of said facilities and the facilities are free from any encumbrances.
B. Developer has the right to transfer said title and will warrant and defend the same against all claims and demands of all persons.
C. Developer grants the facilities to the District in consideration of incorporating same into the overall system of the District.
D. A statement of the costs, separating the costs of the water facilities from the cost of the sewer facilities, including administration, legal and engineering fees.
E. All bills for labor and material have been paid and the Developer has provided a certificate from the contractor installing the facilities, and the Developer's Engineer, acknowledging that the contractor and engineer have been paid in full and/or do fully release, transfer, assign and set over to the District all of their rights, title, claims and interest therein.
F. Developer further warrants that for a period of two (2) years from the date of the Bill of Sale that the facilities will remain in good working order and condition except where abused or neglected by the District. The Developer will repair or replace at its own expense any unsatisfactory work or material during the two (2) year period of warranty. The District will inspect the facilities at the end of the 2-year period.

20. FINAL ACCEPTANCE

Formal Final Acceptance of the Facilities shall occur when all of the following conditions occur.

- ❑ District inspects and approves facilities as 100% complete.
- ❑ District receives water meters (Master Meter Dialog 3G Wireless RF) for each service. (see District Design and Construction Standards)
- ❑ District receives and accepts record drawings (see Section 5).
- ❑ District receives and accepts easements and title insurance (see Section 9).
- ❑ District receives Maintenance Bond (see Section 15).

- ❑ District receives and approves Bill of Sale (see Section 19).
- ❑ District receives a copy of recorded plat, short plat, or legal description (see Section 19).
- ❑ District receives legal description of property (see Section 19).
- ❑ District receives Latecomers Reimbursement fees due to other Developers, if Latecomers Reimbursement Agreement(s) apply to Developer's property.
- ❑ Developer pays to District any Supplemental DEA Processing/General Administrative Fees, if due.
- ❑ District receives signed and notarized Latecomers Reimbursement Agreement prepared by the District, if applicable.

21. CONDITION PRECEDENT

Compliance with the terms and conditions of this DEA and all applicable resolutions of the District shall be a condition precedent to the District's obligation to accept a bill of sale and a condition precedent to the District's agreement to maintain and operate the facilities and to provide utility service to the real property described herein. Without limiting the generality of the preceding sentence, the District shall be under no obligation to allow connections to the water or wastewater system of any portion of the real property described in this DEA if there are any fees or costs due and owing to the District arising from this DEA or from regulations, resolutions or ordinances of any government agency.

The District shall not be obligated to provide utility service to the property described in this DEA if construction by third parties of facilities to be deeded to the District have not been completed and title accepted by the District if said third party facilities are necessary to provide utility service to the said property.

22. BREACH OF CONTRACT - ATTORNEY'S FEES

A breach of any provision of this DEA shall constitute a total breach hereof, and shall subject the Developer to cancellation of the DEA, forfeiture of deposits, and claim for costs and damages, as allowed by law. The parties agree that in the event of litigation regarding the terms or performance of this DEA, the substantially prevailing party shall be entitled to an award of reasonable attorney fees and costs, in addition to any other appropriate remedy.

23. LIMITATION OF PERIOD FOR ACCEPTANCE

The facilities shall be completed and accepted by the District within three (3) years of this Agreement. If the facilities are not completed and accepted within three (3) years from the date below, then the Developer's rights under this DEA shall cease. The Developer may submit a written request along with the DEA Renewal Fee to request a DEA renewal from the Board of Commissioners. The Board of Commissioners has the right to reject or accept the renewal request. If the Board of Commissioners accepts the renewal request, the Developer shall pay all administrative, legal, engineering, and other costs incurred to renew the DEA, all as determined by the Board of Commissioners. A DEA renewal requires both the Developer and Board of Commissioners signing a new DEA The District is not responsible for notifying the Developer of pending Contract expiration.

24. NO THIRD PARTY RIGHTS CREATED

This agreement is made entirely for the benefit of the District and the Developer and successors in interest. No third party shall have any rights hereunder, whether by agency or as a third party beneficiary or otherwise.

25. BINDING OF PROPERTIES

Parcels listed in this agreement are bound by the terms of the agreement until the agreement expires or the defined improvements are completed per the agreement. While the agreement is in force, requests for Denial of Service from parcels which will be served by the defined water and/or sewer improvements will not be considered by the District.

26. AGREEMENT

We, ________________________________, the Owners / Developer of the herein described property, have read and accept the terms and conditions set forth in this application.

____
Name, Owner / Developer
(Owner of Parcels …..[LIST OF PARCELS])

____
Name, Owner
(Owner of Parcels …..[LIST OF PARCELS])

____
Name, Owner
(Owner of Parcels …..[LIST OF PARCELS])

APPROVED this ____ day of ________________, _________

LAKE WHATCOM WATER AND SEWER DISTRICT
Whatcom County, Washington

By: ___________________________________
President, Board of Commissioners

A1. DEA FEES AND CHARGES SCHEDULE

(per current Master Fees and Charges Schedule)

Purpose	Amount	Due	Refundable
Initial DEA Processing/General Administration	$750.00	With submission of Contract	No
Supplemental DEA Processing/General Administration	If District's actual costs are greater than above amount, District will bill Developer for balance due	Prior to Final District Acceptance of Facilities	No
DEA Renewal District Commissioners approve renewal.	$750.00	With written request for renewal	Yes, if Commissioners deny renewal request.
Final Design Review (Performed by District's Engineer)	District Engineer's direct costs as invoiced to District plus 2% administration fee	With submission of final Drawings and Specifications for review	No
Design Review and Inspection Deposit	District's costs as invoiced to District plus 2% administration fee -------------------------------- $5,000.00 initial deposit -------------------------------- $2,000.00 supplemental deposit	See below. -------------------------------- Prior to Design Review -------------------------------- Whenever account balance is less than $2,400.00. If account balance is ever less than $800.00, District will issue an immediate stop work order and will suspend the DEA until the account balance is more than $2,400.00	Yes, to extent balance exists on Final District Acceptance of Facilities date
General Facilities Connection	*Total*: Per separate schedule in effect on day of <u>Final District Acceptance of Facilities</u> -------------------------------- *Initial Deposit*: 25% of total amount per separate schedule in effect on day <u>DEA approved/signed</u> -------------------------------- *Balance* = (*Total - Initial Deposit)*	See below for *Initial Deposit* and *Balance* -------------------------------- Prior to Notice to Proceed with Construction -------------------------------- Prior to Final District Acceptance of Facilities	No <u>NOTE</u>: Payment of fees does not guarantee utility service priority if DEA expires or if Developer abandons DEA.
Conformance Deposit (See Section 13)	$1,000.00	Prior to Notice to Proceed with Construction	No
Performance Bond (See Section 14)	150% of estimated project cost	Prior to Notice to Proceed with Construction	No
Maintenance Bond (See Section 15)	10% of constructed facilities cost	Prior to Final District Acceptance of Facilities	No
Latecomers Fees owed to other Developers or District ULID Fees owed	Depends on existence of any Latecomers Reimbursement Agreements or District ULIDs applicable to	Prior to Final District Acceptance of Facilities	Yes, if paid and District does not accept facilities, or if paid and Developer cancels project.

Purpose	Amount	Due	Refundable
	developed property		
Special Agreements (For costs to prepare any special agreement(s) between District and Developer)	Actual cost plus 2% administration fee	Payable in full on demand	No
Third Party Claims (For all costs, damages, and expenses, including reasonable attorneys fees, incurred by District responding to, and/or defending claims made by third parties for acts of Developer, Developer's Engineer, or Contractor)	Actual cost plus 2% administration fee	Payable in full on demand	No
Contract Noncompliance (For all costs, charges, expenses, and damages attributable to failure of Developer to comply with this Contract and/or the requirements of any governing agency)	Actual cost plus 2% administration fee	Payable in full on demand	No

Appendix H – Water and Sewer Design Standards and Construction Standards and Details

TABLE OF CONTENTS

CHAPTER 1 DRAWING STANDARDS

1.1 Construction Drawings

1.1.1 Format and Content

Construction drawings for proposed public water and/or sewer facilities shall be prepared in accordance with the following drawing standards.

Format

- Drawings submitted for review: 50% reduced scale 11”x17” sheets
- Final drawings submitted for approval: full scale 24”x36” sheets
- Minimum text size 0.08” when plotted at full scale size.

Basic Drawing Elements

- North Arrow
- Scale Bar
- Legend (Clearly differentiate between existing and proposed features)
- Vicinity Map
- Overall Project Map
- Vertical Datum and Project Benchmark Information

  All projects in the District must be on either NAVD88 or the “Old” City of Bellingham Vertical Datum (1909 to 2009).
- Horizontal Survey Reference Point Information

  All projects in the District must be based on NAD83 (1998) City of Bellingham monument-derived coordinates. Show bearing and distance information between survey reference points.
- Lake Whatcom Water and Sewer District General Notes. Water System Notes and/or Sewer System Notes as appropriate.
- Lake Whatcom Water and Sewer District Standard Details as applicable for type of improvements

Scale for Plan and Profile Drawings

- 1" = 20' horizontal in areas with existing utilities or improvements
- 1”=50’ horizontal in areas with little or no existing utilities or improvements.
- 1”=2’or 1"= 5' or 1"=10' for vertical as appropriate

Topographic and Survey Information

- Right-of-way
- Easements (with Auditor File Numbers)
- Existing features and improvements
- Contour intervals of 1 or 2 feet as appropriate site and design

- Existing features and improvements such as pavement, concrete, gravel, sidewalks, curbs, utility poles, transformers, telephone pedestals, overhead and underground utilities.

<u>Plans</u>
- Proposed improvements clearly shown and noted
- Design alignment and stake out information. (Stationing, bearings, distances, and offsets)
- For water mains, lineal footage from water main fitting to fitting.
- For sewer mains, lineal footage between exterior faces of manholes.
- Pipe material type called out on each segment

<u>Profiles</u>
- All utility crossings with clearances noted.
- Distances from centerline of manhole to manhole
- Distances from exterior face of manhole to manhole
- Calculated slope between exterior face of manhole to manhole (actual pipe slope)
- Rim and invert elevations for existing and proposed manholes
- Trench dams shown

1.1.2 Plan Review Sets
Submit two sets of 50% reduced scale 11"x17"drawings. If there are review comments, the District will return one redlined original set. For subsequent re-submittals, submit two sets of 50% reduced scale drawings.

1.1.3 Final Approval Sets
Once all District review comments have been addressed, the District will request three full scale sets to stamp "Approved for Construction." The District will retain two sets and return one approved set.

1.2 Record Drawings

1.2.1 Content
Record drawings shall include the exact location of all water and sewer mains and services and the approximate location of all other underground and above ground utilities and shall include information listed below.

<u>Basic Information</u>
- Each drawing shall include "Record Drawing" boldly noted on each sheet.
- Line-out design text that has changed and note record information.
- Circle plan design elements that changed and show record information.

Water Mains and Services

- Location of all vertical and horizontal bends in the water system. Stationing shall be along the length of the extension.
- Location of all water valves, hydrants, hydrant valves, and blow-offs with distance along centerline and distance from the centerline.
- Location of all utilities within easements. This includes distances to the utilities from the easement lines.
- Stationing of service taps on the main. Stationing shall be cumulative along the length of the extension.
- Distance from main to meter.
- Distance from tap to a point opposite (at 90 degrees) the meter along main, and station this point.
- Distance from this point on the main to the meter (distance 90 degrees).
- Depth of all services.

Sewer Mains and Service Stubs

- Location of all sanitary manholes, inverts, valves and cleanouts on the sewer main.
- Location of all vertical and horizontal bends in the force main system.
- Location of all side sewer saddles on the sewer main from the back-station manhole.
- Stationing of all sewer wyes into the main, located from the back station manhole.
- Length of side service stub, lineal feet, and size of pipe.
- Distance along mainline from side sewer wye to where end equals 90 degrees from mainline.
- Distance from this point on the main to the end of stub. (distance 90 degrees).
- Depth of services at end of stub.
- Location of cleanouts on the sewer stub.

1.2.2 Construction Record Keeping

All District projects must have full time inspection. A District Inspector will document and maintain construction asbuilt information. It is the Contractor's responsibility to ensure that the Inspector has all asbuilt information and measurements recorded prior to backfill of facilities.

1.2.3 Preparation

A copy of the District inspector's notes and sketches will be given to the Engineer of Record for preparing the record drawings. For developer constructed facilities, the developer's engineer prepares and stamps the record drawings. For district constructed facilities, the District's consulting engineer prepares and stamps the record drawings.

1.2.4 Review and Submittal Format

Submit one 50% reduced scale 11"x17" set to the District for review. Upon acceptance, the District will request final record drawings. Final records drawings include one set on Mylar, one set on paper, AutoCAD .dwg files, and an electronic PDF set.

1.2.5 Condition of Final Acceptance

Final record drawings must be received and accepted by the District before final acceptance of the project by the Board of Commissioners.

CHAPTER 2 DESIGN STANDARDS

2.1 Water Projects

2.1.1 Minimum Design Requirements

Minimum design criteria, unless the District criteria is more stringent, shall be in accordance with the current "Water System Design Manual", Washington State Department of Health and Washington Administrative Code Chapter 246-290 Public Water Supplies.

2.1.2 Minimum Pipe Size

Minimum pipe size for new or replaced water lines is eight (8) inches in diameter. Dead-end lines are only permitted where there is a cul-de-sac and where it is not possible to make a loop. Blow-offs or fire hydrants shall be installed at the end of a dead-end line.

2.1.3 Comprehensive Plan Requirements

Water system construction and reconstruction shall be done pursuant to a design that, when fully implemented, will provide the flow requirements of the District's Comprehensive Plan. Minimum pipe size shall be as identified by the District's Water Comprehensive Plan. A Latecomers agreement can be created if the sizing was in excess of that required by the Developer or Utility Local Improvement District.

2.1.4 Minimum Allowable Pressure

The minimum pressures allowed by the District at any time are 30 psi under peak hourly demand, or 20 psi under maximum day demand and fire flow combined.

2.1.5 Increases in Flow Requirements

When any new development increases the flow requirements, the Developer shall upgrade the existing water system to support the changes.

2.1.6 Providing for Future Extensions

Utilities shall be extended through the property to allow for future extension, expansion and continuation of the District's distribution system or for conformance with the Water Comprehensive Plan.

2.1.7 Easements

A minimum ten (10) feet of recorded easement must be provided on each side of the pipe, for a total width of twenty (20) feet.

2.1.8 Valves
Valves shall be installed along the water main at intervals not to exceed 500 feet per NFPA 1142 G.7. Gate valves shall be placed at all junction points, such that there are valves on each leg of a tee (3 valves), or cross (4 valves).

2.1.9 Fire Hydrants
Fire hydrants shall be installed every 600 feet.

2.1.10 Sampling Stations
One sample station per zone is required for each new pressure zone. The District may require sample stations for new developments in existing pressure zones.

2.1.11 Separation from Sanitary Sewer
Minimum separation of water mains and sanitary sewer lines shall be ten (10) feet horizontally for parallel pipe, and eighteen (18) inches vertically with water on top for perpendicular or oblique crossings, measured from the bottom of the water pipe to the crown of the sewer pipe. Situations occurring with less than the minimum separation as required shall be in accordance with Section C1-9.1 Required Separation Between Water Lines and Sanitary Sewers of the current edition of the "Criteria For Sewage Works Design" published by the Washington State Department of Ecology.

2.1.12 Pipe Slope and Air/Vacuum Release Valves
Water mains shall be installed at an upward slope to a high point where a combination air/vacuum release valve shall be installed.

2.1.13 Water Booster Stations
All public/District-owned water booster stations shall have at least two pumps.

2.2 Sewer Projects

2.2.1 Minimum Design Requirements
Minimum design criteria, unless the District criteria is more stringent, shall be in accordance with the current "Criteria for Sewage Works Design", State of Washington Department of Ecology.

2.2.2 Minimum Pipe Size
Minimum pipe size for sewer gravity mains is eight (8) inches except that, in special cases, 6-inch diameter sewer lines may be approved by the District if they meet the Department of Ecology Guidelines for 6-inch sewer lines. Minimum size for side sewers shall be six (6) inches from main to property line. Minimum size pipe for force mains shall be four (4) inches.

2.2.3 Providing for Future Extensions

Utilities shall be extended through the property to be developed to allow for future extension, expansion and continuation of the District's collection system or for conformance with Sewer Comprehensive Plan.

2.2.4 Easements

A minimum ten (10) feet of recorded easement must be provided on each side of the pipe, for a total width of twenty (20) feet.

2.2.5 Separation from Water Mains

Minimum separation of water mains and sanitary sewer lines shall be ten (10) feet horizontally for parallel pipe, and eighteen (18) inches vertically with water on top for perpendicular or oblique crossings, measured from the bottom of the water pipe to the crown of the sewer pipe. Situations occurring with less than the minimum separation as required shall be in accordance with Section C1-9.1 Required Separation Between Water Lines and Sanitary Sewers of the current edition of the "Criteria For Sewage Works Design" published by the Washington State Department of Ecology.

2.2.6 Manholes

Manholes shall be installed in accordance with Standard Details and DOE Guidelines. Manholes shall be placed at each grade and direction change. Distances between manholes shall not exceed 350 feet. Manholes shall be a minimum of five feet deep to the invert of pipe. Manholes shall be installed at the end of each line of 8-inch diameter or greater. Cleanouts shall only be used on 8-inch or smaller lines and shall be located not more than 150 feet from a manhole.

2.2.7 Manhole Drop Connections

An outside drop connection shall be provided for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert. Inside drops may be used only at the discretion of the District on existing manholes.

CHAPTER 3 CONSTRUCTION STANDARDS – GENERAL NOTES

3.1 Construction Plan Notes

The General Notes apply for all new public facility construction within the District and shall be included in every construction plan set. Water System Notes and Sewer System Notes shall be included in the plan set as relevant for the type of construction project.

3.1.1 General Notes

See District Standard Detail G1 for General Notes to be included in the construction plans.

3.1.2 Water System Notes

See District Standard Detail W1 for Water System Notes to be included in the construction plans.

3.1.3 Sewer System Notes

See District Standard Detail S1 for Sewer System Notes to be included in the construction plans.

CHAPTER 4 CONSTRUCTION STANDARDS - WATER SERVICES

4.1 General Requirements

4.1.1 District Water Permit

A District water permit is required prior to installation of a water service.

4.1.2 Uniform Plumbing Code

All improvements shall be installed per the most current edition of the Uniform Plumbing Code (UPC).

4.1.3 Easements

Water services shall be installed on only the property being served and in appropriate recorded easements and rights-of-ways.

4.1.4 Developer Extension Agreement Projects

The Developer is responsible for installing the water service from the water main to property line for new main construction. The Property Owner is responsible for installing water service from property line to building. The Developer will provide the District with the meter assemblies. The District will install meter assemblies when the Property Owner requests service.

4.1.5 Installation, Maintenance, & Repair

The Property Owner is responsible for service line installation, maintenance and repair from the meter to the building. For new services, the District taps the water main, installs a service saddle, corp stop, service, meter assembly and meter box.

4.1.6 Separation from Side Sewer Services

Per 2012 UPC 603.2, water service lines located within five (5) feet of side sewer lines shall be installed above the side sewer pipe with a minimum vertical clearance of twelve (12) inches. Maintain a minimum horizontal clearance of twelve (12) inches at all locations except when crossing.

4.1.7 Pressure Reducing Valves

It is the responsibility of the Property Owner to supply and install a pressure reducing valve (PRV) for their service. Pressure reducing valves shall be installed downstream of the meter and dual check valve. Property Owners that elect not to install a PRV must record a hold harmless agreement with the Whatcom County Auditor. Hold harmless agreements are available at the District office.

4.1.8 Privately Owned Water Booster Systems

Privately owned water booster systems are not allowed as a means of obtaining water service where the pressure at the service's meter would be below 30 psi. The only exceptions are certain existing Sudden Valley lots covered by Resolution 410. Each application is subject to cross-connection control analysis by the District. Typical residential applications will require District standard dual check valves at the service meter. Higher risk applications will be required to install backflow prevention devices as determined by the cross-connection control analysis.

4.1.9 Inspections

The District must inspect and approve the pressure reducing valve prior to covering.

CHAPTER 5 CONSTRUCTION STANDARDS - SEWER SERVICES

5.1 General Requirements

5.1.1 Contractor Requirements

Contractors installing side sewer services shall have a current Sewer Services Contractor's Certification Agreement and surety bond on file at the District.

5.1.2 Uniform Plumbing Code

All improvements shall be installed per the most current edition of the Uniform Plumbing Code.

5.1.3 District Sewer Permit

A District sewer permit is required prior to installation of any side sewer service.

5.1.4 Easements

Side sewer services shall be installed on only the property being served and in appropriate recorded easements and rights-of-ways.

5.1.5 Authorization to Connect to Sewer Main

Contractor shall connect the side sewer service to the sewer main at the location identified and authorized by the District. The Contractor shall schedule an onsite pre-construction meeting with the District to obtain authorization to connect prior side sewer installation.

5.1.6 Other Permits

Contractor shall obtain and abide by encroachment permits or other permissions which may be required from the County, State Highway Department, Sudden Valley Community Association, or other entity having jurisdiction over roads and streets, prior to commencing sewer service work. Restoration shall be done in a manner approved by the appropriate jurisdiction.

5.1.7 Surveying and Staking

Lots and/or property lines shall be surveyed and staked to assure sewer service is installed within the property, recorded easements, and/or right-of-ways. Surveying and staking are the responsibility of the Contractor and Property Owner.

5.1.8 Surface Water Drain Connections Prohibited

Downspouts, foundation/crawl space sump pumps, yard drains, or any outside drains shall not be connected to the sanitary sewer service.

5.2 Side Sewer Services into Gravity Mains

5.2.1 Installation, Maintenance, & Repair

The Property Owner is responsible to contract with a Contractor on the District's Bonded Side Sewer Contractor List. The Contractor installs the side sewer service from the sewer main to the residence, which includes installing a service tee on District sewer main, cleanout at property line, the private service line to the building, and restoration per the Standard Drawings.

The Property Owner is responsible for maintenance and repair of the side sewer service from the cleanout at the property line to the residence.

5.2.2 Grinder Pumps

Grinder pumps may be installed in such special circumstances where installation of a gravity system is not possible. The District must authorize the use of a grinder pump system prior to installation. Grinder pump design shall be in accordance with Section C1-10.1 and C1-10.2 of the current edition of the "Criteria For Sewage Works Design" published by the Washington State Department of Ecology.

5.2.3 Pre-Construction Meeting

The Contractor shall schedule a preconstruction meeting with the District prior to beginning construction. At the preconstruction meeting, the District will identify and authorize the location of connection to the sewer main.

5.2.4 Inspections

The District must inspect all side sewer services prior to backfill. Services backfilled without an inspection must be re-exposed and the full length tested at Contractor's expense.

Bedding & Backfill Inspection. The entire sewer service pipe from the main to the cleanout adjacent to building must be inspected and approved by the District prior to backfill. Pipe backfilled before inspection will be rejected.

Leak Test. Contractor fills service line with water from a plug inserted in the cleanout at the property line up to the cleanout at the building. The line must hold water with no visible drop in elevation to pass. The test is observed by the District after all lines have been backfilled.

Grinder Pump Inspection (if applicable). The private grinder pump station may be located inside the residence or outside the residence. If located inside the residence, the installation shall be subject to inspection by the Whatcom County Building Official (or his or her designee). If located outside of the residence, the grinder pump station shall be subject to inspection by the District.

5.3 Pressure Side Sewer Services into Force Mains

5.3.1 Design

The Property Owner is responsible for the design of the pressure side sewer service installation including the grinder pump station at the residence. The Property Owner shall engage a civil engineer licensed in the State of Washington to prepare hydraulic calculations, determine pipe size, determine air release and air vacuum valve requirements, and select the appropriate model of grinder pump for the specific residential installation. Grinder pump design shall be in accordance with Section C1-10.1 and C1-10.2 of the current edition of the "Criteria For Sewage Works Design" published by the Washington State Department of Ecology.

The private grinder pump package shall consist of at least a grinder pump, basin, cover, check valve, controls, and interior and exterior visual and audible alarms (with battery backup for high level alarm), provided by a single supplier/manufacturer. Approved grinder pump package manufacturers include Environment-One (E-One Model 2010-IDU Package Grinder Pump System); Myers Residential Grinder Pump System Package; Hydromatic Grinder Pump System Package, and Liberty Pumps simplex grinder package (Models 2448LSG, 2472LSG, & 2484LSG).

Where required, air relief and combination air relief/ vacuum relief valves shall be as manufactured by Orenco, APCO, Crispin or equivalent for sewer service. All valves shall be fully accessible to enable Customer's operation, maintenance and repair.

5.3.2 Developer Extension Agreement Projects

The Developer is responsible for installing the customer service shutoff valve, check valve, check valve vault and service line from the main to check valve for new main construction.

5.3.3 Installation, Maintenance and Repair

The Property Owner is responsible for installation, maintenance and repair of the side sewer service from the property line to the residence including the grinder pump station, check valve, and check valve vault.

For individual permits, the District taps the force main, installs the saddle, customer service shutoff valve, and service line to the property line. (Note for Developer Extension Agreements, the developer installs these items during construction of the new main.)

5.3.4 Pre-Construction Meeting

The Contractor shall schedule a preconstruction meeting with the District prior to beginning construction. At the preconstruction meeting, the District will identify and authorize a connection to the customer service line at the property line.

5.3.5 Inspections

The District must inspect all side sewer services prior to backfill. Services backfilled without an inspection must be re-exposed and the full length tested at Contractor's expense.

Bedding & Backfill Inspection. Sewer service pipe from the main to the cleanout adjacent to building must be inspected and approved by the District prior to backfill.

Pressure Test. With all joints exposed, the District must witness a successful hydrostatic pressure test in accordance with WSDOT Section 7-09.3(23) at 150 psi for all pipe and fittings between the grinder pump and the customer service shut-off valve.

Grinder Pump Inspection. The private grinder pump station may be located inside the residence or outside the residence. If located inside the residence, the installation shall be subject to inspection by the Whatcom County Building Official (or his or her designee). If located outside of the residence, the grinder pump station shall be subject to inspection by the District.

CHAPTER 6 CONSTRUCTION STANDARDS - DETAILS

General Details

G1 General Notes
G2 Typical Trench and Backfill Detail
G3 Water Project Record Drawing Documentation
G4 Sewer Project Record Drawing Documentation
G5 Maintenance Vehicle Turnaround
G6 Water Main / Sewer Non-Standard Crossing
G7 Private Water Service Line and Side Sewer Trench Detail
G8 Trench Dam with Drain

Water Details

W1 Water System Notes
W2 Concrete Thrust Block
W3 Concrete Thrust Block for Convex Vertical Bends
W4 Fire Hydrant Assembly
W5 2-inch Blowoff Assembly
W6 Combination Air Release / Air Vacuum Valve Assembly
W7 Water Sampling Station
W8 Water Meter Assembly
W9 Reverse Thrust Block

Sewer Details

S1 Sewer System Notes
S2 Sanitary Sewer Manhole Type 3
S3 Inside Drop Sewer Manhole Connection
S4 Outside Drop Sewer Manhole Connection
S5 Sewer Main Cleanout
S6 Sewer Lateral Connection to Main
S7 Sewer Lateral and Cleanout
S8 Gravity Side Sewer Installation
S9 Grinder Pump Service to Gravity Main Installation
S10 Grinder Pump Service to Force Main Installation
S11 Connection to Force Main
S12 Force Main Service Check Valve
S13 Shared Force Main Service Tap
S14 Manhole Rim & Valve Box Re-adjustment
S15 Manhole Pipe Penetration Details

Electrical/Telemetry Details

E1 Telemetry Panel
E2 Utility Equipment Rack
E3 Schedule 80 PVC Trench
E4 Handhole
E5 Tracer Wire

GENERAL NOTES

1. All work and materials shall conform to the most current edition of the Standard Specifications for Road, Bridge and Municipal Construction (WSDOT) as prepared by Washington State Department of Transportation and the Washington State Chapter of the American Public Works Association, Lake Whatcom Water and Sewer District Design and Construction Standards, and the instructions and recommendations of the Manufacturer of the material concerned. In case of a conflict between the above standards, the more stringent shall apply. All work and materials shall be subject to the approval of the District Engineer.

2. Contractor shall obtain encroachment permits or other permissions which may be required from the County, State Highway Department, Sudden Valley Community Association, or other entity having jurisdiction over roads and streets, prior to commencing work.

3. All pipe shall be bedded in bedding material meeting WSDOT 9–03.12(3). The bedding cross–section shall be blocked with Control Density Fill (CDF) per WSDOT 2–09.3(1)E a minimum of every 800 feet and the trench drained to daylight or to a storm drain.

4. Backfill under pavement, under the roadway section, and at driveway crossings within County ROW shall consist of crushed surfacing top course material conforming to WSDOT 9–03.9(3). Backfill within private roadways shall consist of material conforming to WSDOT 9–03.19. Backfill in other areas shall consist of material conforming to WSDOT 9–03.15, except as shown on the plans or details. Backfilling of trenches shall be in accordance with WSDOT 7.08.3(3). Backfill shall be compacted to 95% modified Proctor within traffic areas, 90% modified Proctor in landscape and open areas.

5. Tracer wire installation is required on all District owned pipe and communication lines. Tracer wire is also required on private side sewers. Install tracer wire per District Standard Detail E5. In addition to tracer wire, install 2–inch wide detectable marking tape 8 to 12 inches below the finish surface. Detectable marking tape shall meet WSDOT 9–15.18 and be color coded blue for water and green for sewer.

6. Water mains crossing over sewers stub service line with less than 18–inches of vertical clearance shall be stabilized with Control Density Fill (CDF) per WSDOT 2–09.3(1)E.

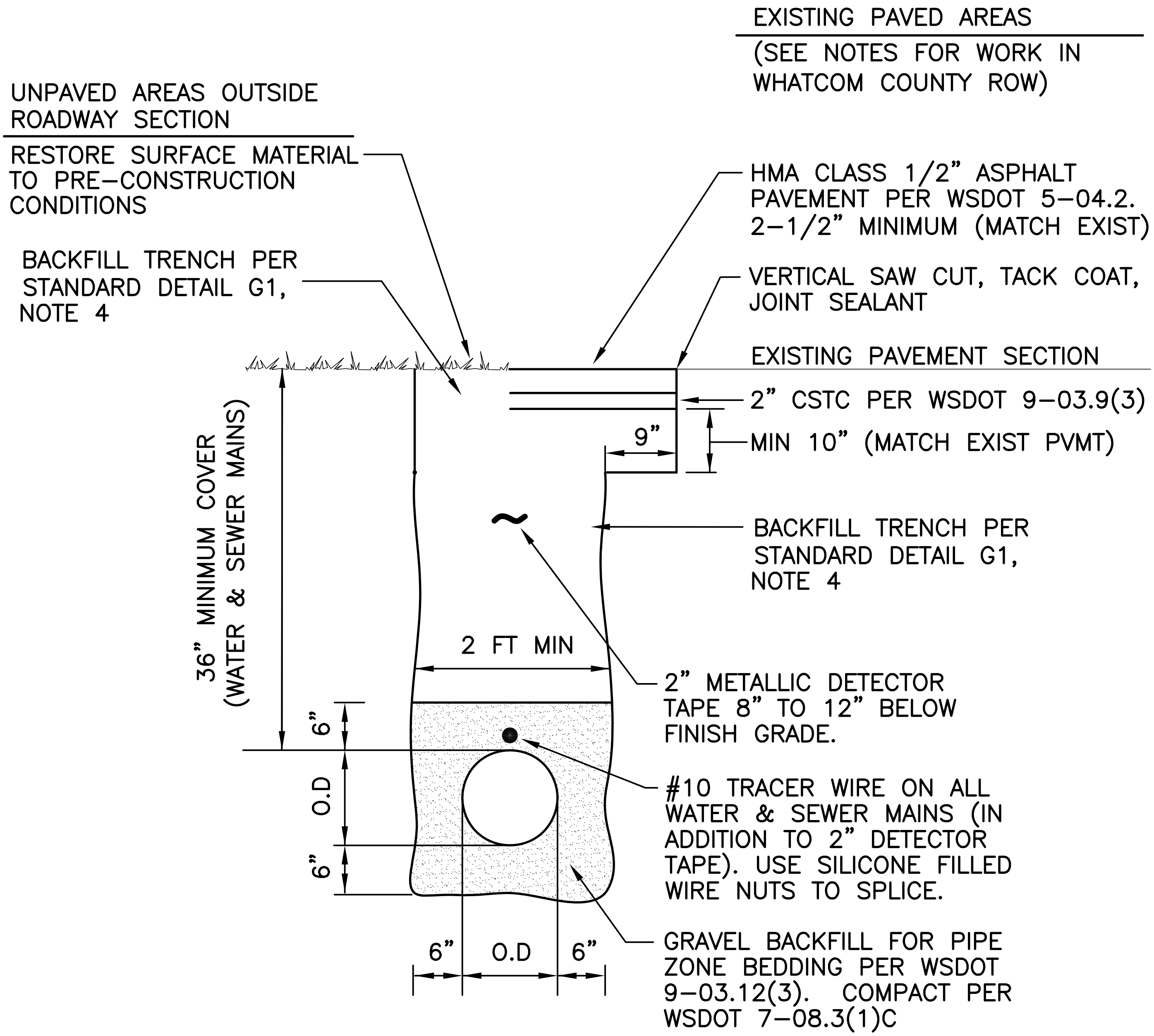
7. From the main to the property line, sewer laterals and water service lines shall maintain a minimum horizontal separation of 5–feet. Separation may be reduced to 1–foot if water service line is a minimum of 12–inches above the top of the sewer lateral.

8. Contractor shall remove all debris and excess excavation; repair all damage, and restore the site, public or private, to pre–construction conditions.

9. Where mains or service lines are placed within a ditch area, the buried depth shall be at least 30–inches below the bottom of the ditch.

10. All work within Whatcom County Right Of Way (ROW) shall comply with Whatcom County Development Standards, Section 512, updated 9/23/2015 or more recent.

GENERAL NOTES	STANDARD DETAIL G1 9/20/2017



NOTES:

1. With respect to trench repairs and pavement overlays, in the event of conflict between this detail and Whatcom County Standard Drawing Numbers 512.F-1 and 512.F-2, the more stringent standard shall apply.

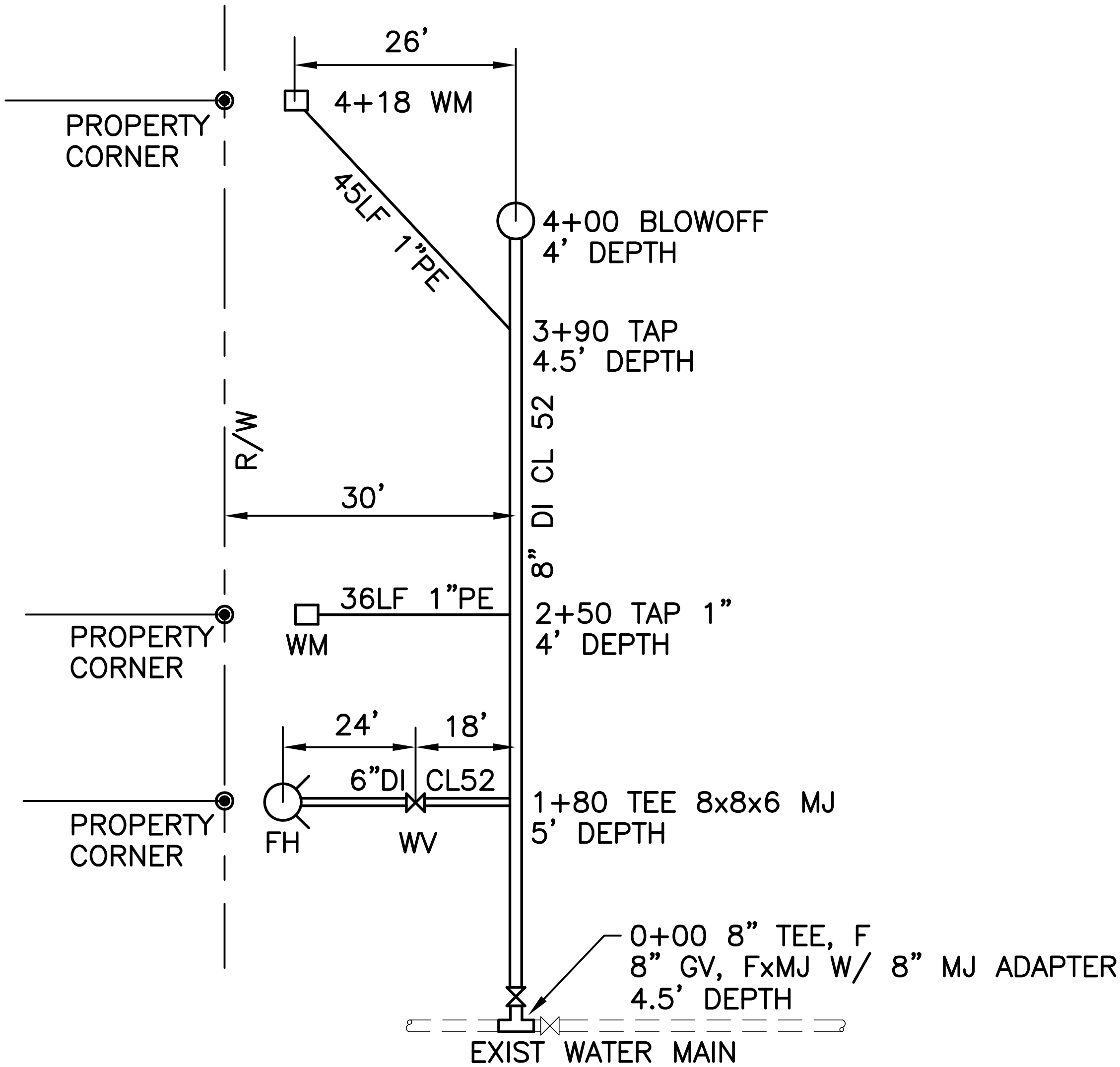
2. Standard utility locations within county-maintained public road prisms as shown in the 2012.09.25 version of Whatcom County Standard Drawing No. 512.D-1 shall apply.

TYPICAL TRENCH AND BACKFILL DETAIL

STANDARD DETAIL

G2

9/20/2017



EXAMPLE RECORD DRAWING

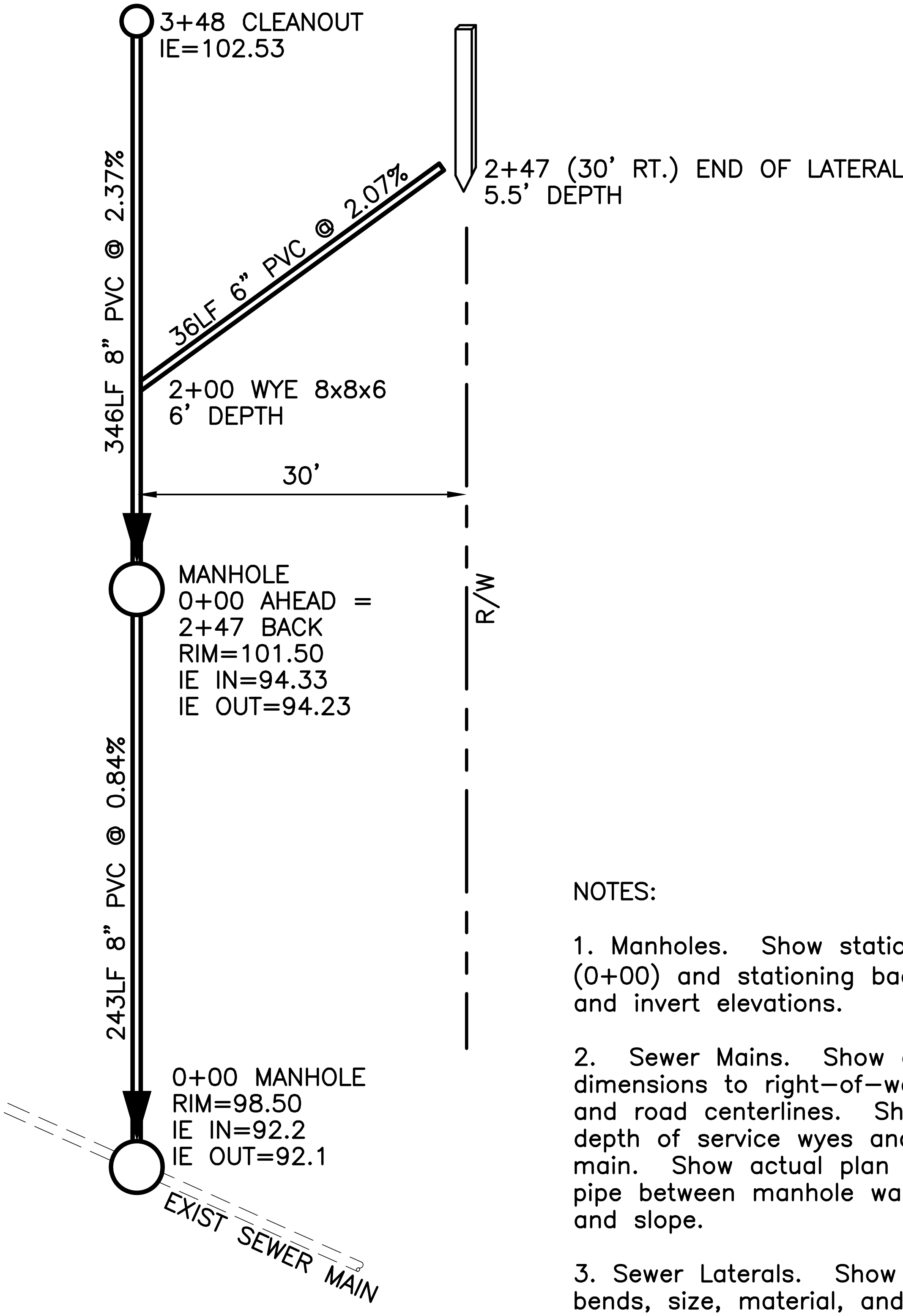
NOTES:

1. Water Mains. Show alignment dimensions to right–of–way, easements, and road centerlines. Show stationing and depth of fittings, valves, and service taps along the main.

2. Fire Hydrants, Blowoffs, and other Appurtenances. Show length & material between tees, valves, hydrants, blowoffs, etc. Show station/offset of appurtenance if skewed from 90–degrees from main.

3. Water Services & Sampling Stations. Show tap station along main and size of tap. Show length & material of service line from main to meter box or sampling station.

WATER PROJECT RECORD DRAWING DOCUMENTATION	STANDARD DETAIL G3 5/1/2014



EXAMPLE RECORD DRAWING

NOTES:

1. Manholes. Show stationing ahead (0+00) and stationing back, rim elevation, and invert elevations.

2. Sewer Mains. Show alignment dimensions to right-of-way, easements, and road centerlines. Show station and depth of service wyes and tees along the main. Show actual plan view length of pipe between manhole walls with material and slope.

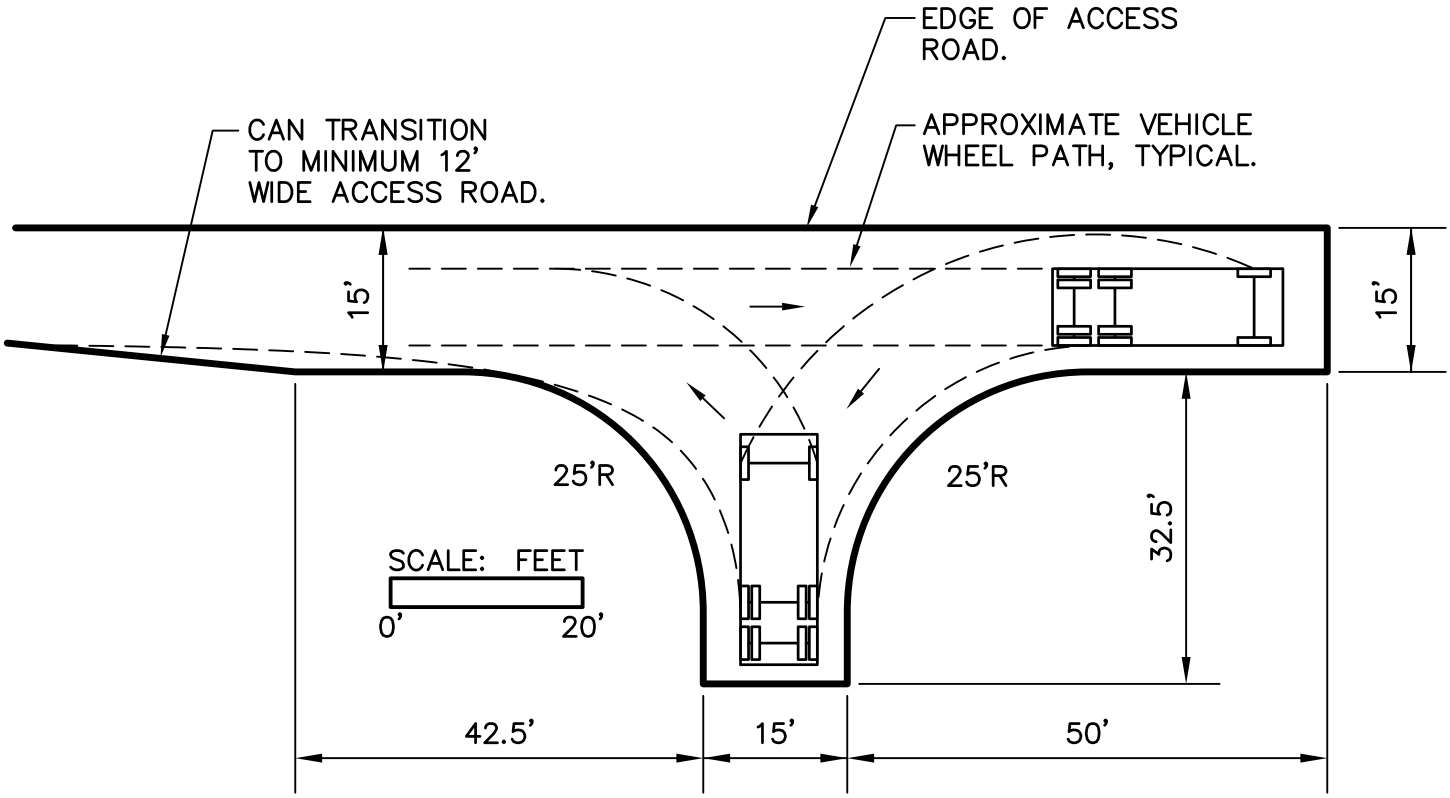
3. Sewer Laterals. Show distances between bends, size, material, and length of pipe. Show station, offset, and depth at end of stub or cleanout.

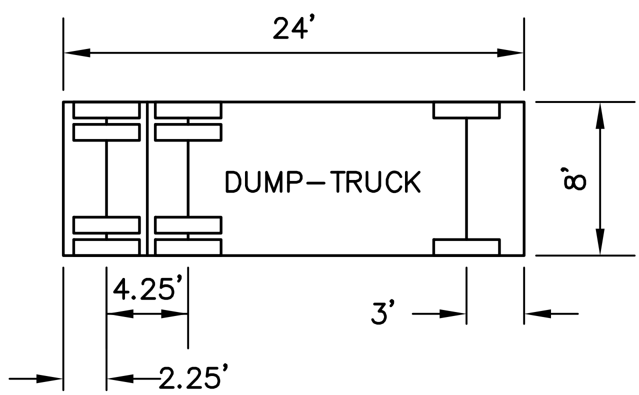
SEWER PROJECT RECORD DRAWING DOCUMENTATION

STANDARD DETAIL

G4

5/1/2014





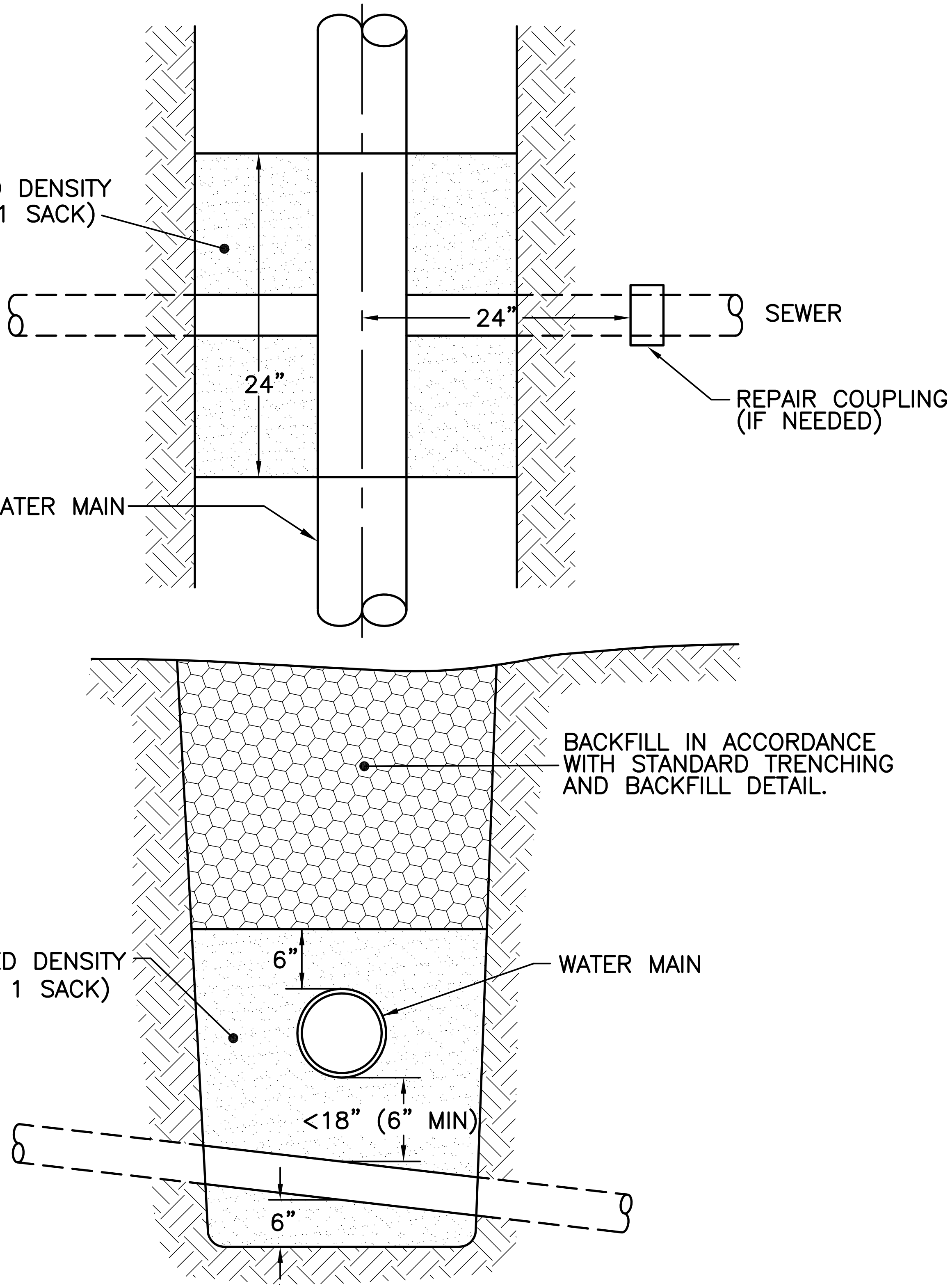
DESIGN VEHICLE

MAINTENANCE VEHICLE TURNAROUND

STANDARD DETAIL

G5

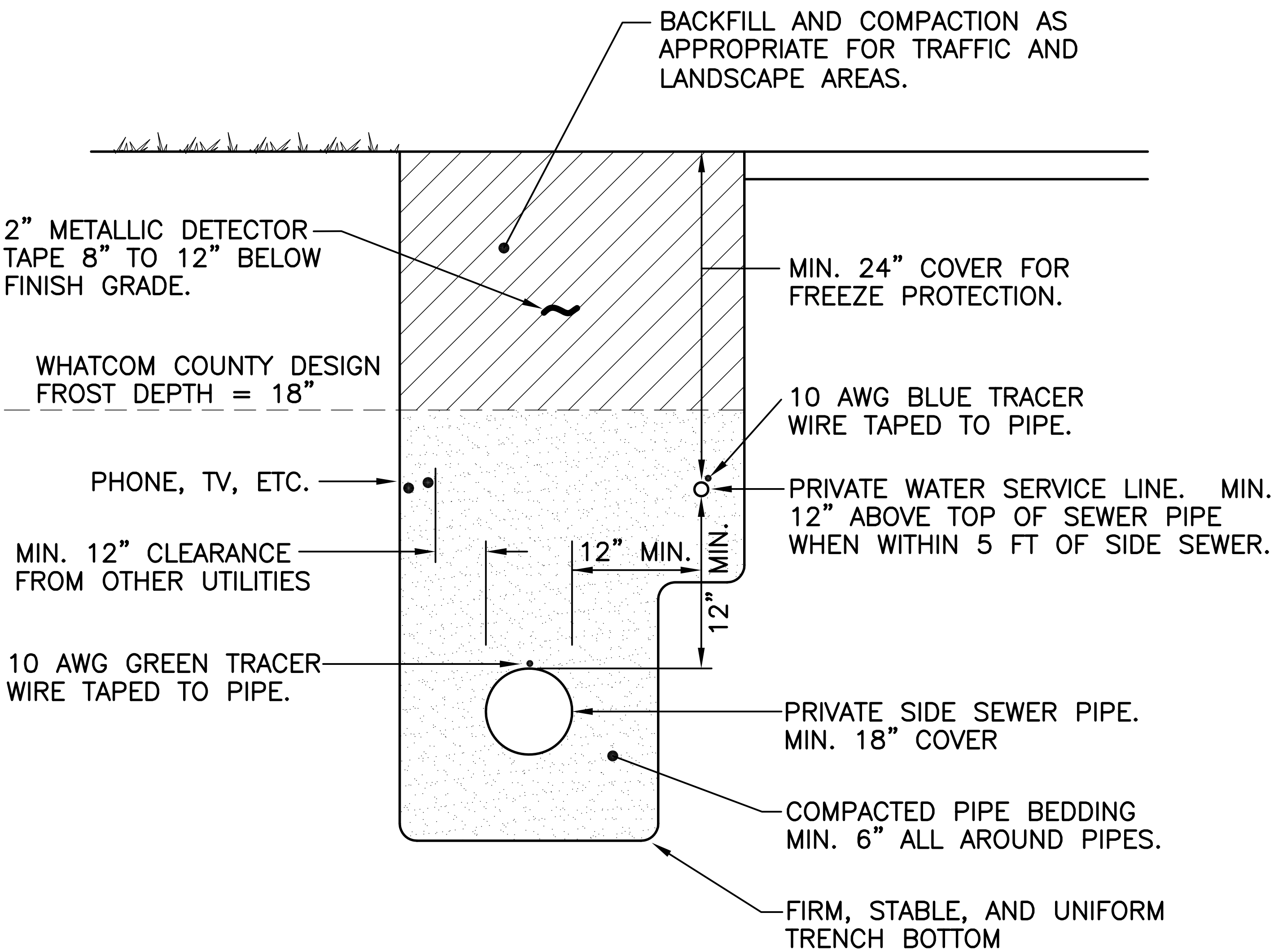
5/1/2014



NOTES:

1. Minimum required distance from center of sewer to water main joint is 5'.
2. Minimum required distance from center of water main to sewer joint is 2'.
3. Controlled Density Fill shall surround both pipes with minimum 6" thick.

WATER MAIN / SEWER NON-STANDARD CROSSING	STANDARD DETAIL G6 01/04/2016



NOTES:

1. Side sewer pipe material (PVC ASTM D3034 SDR 35) shall comply with most current International Plumbing Code (IPC) Table 702.3 Building Sewer Pipe. Separation of water service and side sewer shall comply with IPC 603.2 requirements.

2. Water service lines and side sewers shall be bedded in material meeting WSDOT 9-03.12(3) Gravel Backfill for Pipe Zone Bedding as shown in following table:

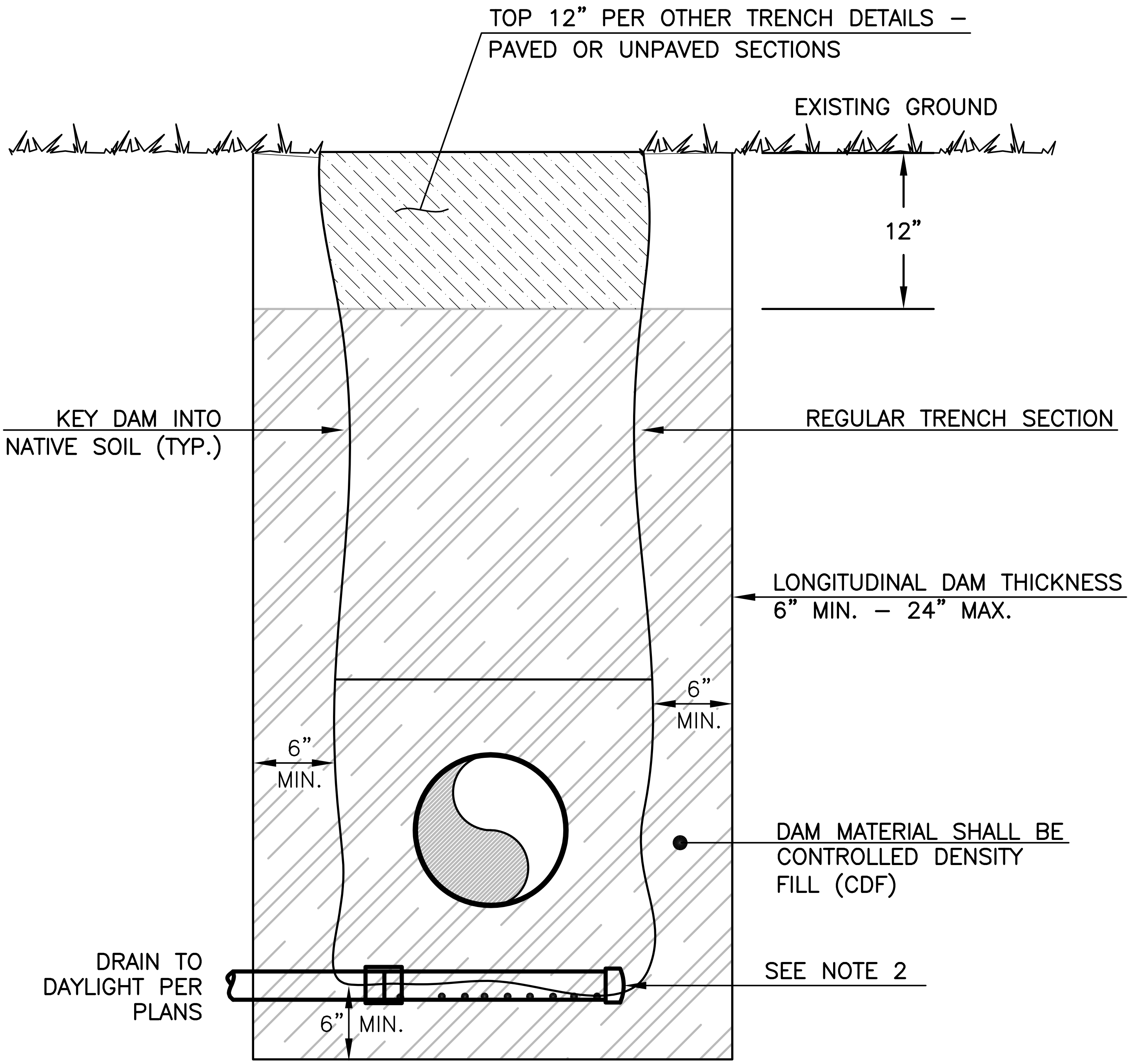
Sieve Size	Percent Passing by Weight
1.5"	99-100
1"	75-100
5/8"	50-100
U.S. No. 4	20-80
U.S. No. 40	3-24
U.S. No 200	10.0 max
Sand Equivalent	35 min.

PRIVATE WATER SERVICE LINE AND SIDE SEWER TRENCH DETAIL

STANDARD DETAIL

G7

9/20/2017



NOTES:

1. SEE PLAN AND PROFILE SHEETS FOR LOCATIONS OF DAMS.
2. INSTALL 4 INCH PVC CAP, PERFORATED DRAIN PIPE WITH HOLES FACING DOWN, COUPLER, AND SOLID PVC PIPE 1 TO 2 FEET OUTSIDE THE LIMITS OF THE CDF ON THE UPHILL SIDE OF THE TRENCH DAM. INSTALL DRAIN ROCK (WSDOT 9–03.12(4)) 6 INCHES ON ALL SIDES OF PERFORATED PIPE. SEPARATE DRAIN ROCK FROM OTHER MATERIAL USING GEOTEXTILE FOR UNDERGROUND DRAINAGE PER WSDOT 9–33.2, TABLES 1&2, MODERATE SURVIVABILITY, CLASS C.

TRENCH DAM WITH DRAIN	STANDARD DETAIL G8 9/20/2017

WATER SYSTEM NOTES

1. Water distribution system materials, trenching, bedding, installation, backfilling, disinfection, and testing shall conform to WSDOT 7–09.

2. Water main pipe shall be class 52 ductile iron per WSDOT 9–30.1(1) and encased in polyethylene encasement per WSDOT 9–30.1(2). Fittings for ductile iron pipe shall conform to WSDOT 9–30.2 (1). HDPE pipe may be substituted for ductile iron pipe with the approval of the District Engineer subject to pipe rating based on the specific design/installation conditions and materials conforming to WSDOT 9.30.1(6) and 9.30.2(10).

3. Valves shall have a minimum pressure rating of 200 psi. Gate valve installation shall conform to WSDOT 7–12. Gate valves shall be resilient–seated gate valves conforming to WSDOT 9–30.3(1) and AWWA C515 Standard for Resilient Seated Gate Valves. A cast iron valve box with a commercial concrete collar (18" x 18" x 6") shall be installed with each valve. An approved marking post shall be installed with each valve in accordance with WSDOT 7–12.3(1) for all valves not installed in pavement. Valves not in pavement shall have a 24" x 24" x 6" concrete collar cast around the valve box. Where a valve operating nut is more than 4–feet lower than grade, an American Flow Control Trench Adapter valve box and stem extension combination (or approved equal) must be installed.

4. Pressure reducing valves (2" and larger) shall be manufactured by Cla–Val, Watts, or approved alternate.

5. Service connections shall be installed per WSDOT 7–15. Lot corners shall be staked prior to service connection installations to assure services are installed in correct locations as shown on the approved plans.

6. District Engineer or their appointed representative shall witness pressure testing and bacteriological test sampling. Contractor shall provide the District Engineer 48 hours notice prior to conducting tests or sampling.

7. Water lines and appurtenances shall be pressure tested in accordance with WSDOT 7–09.3(23).

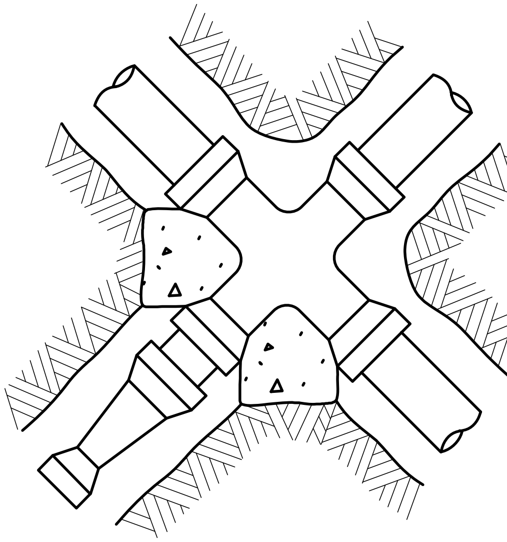
8. District Engineer must receive a satisfactory bacteriological report before new water mains are connected to existing mains and placed in service. Contractor shall disinfect, flush and provide a satisfactory bacteriological report to the District Engineer in accordance with WSDOT 7–09.3(24). Contractor shall provide two chlorine concentration test reports to show the initial chlorine concentration is at least 50 mg/L, and to show the 24–hour residual chlorine concentration is at least 25 mg/L. All tests must be performed by a DOH–certified testing laboratory and sample–taking shall be witnessed by the District Engineer or their appointed representative. Chlorinated flush water must be disposed of into the sanitary sewer. Contractor shall coordinate with District staff to ensure the rate of disposal does not overload the sewer.

9. New services shall be pressure tested along with the new main. No use of water through a newly installed service shall be allowed until water main and service installation has been inspected, pressure tested, chlorinated and a satisfactory bacteria test received. After installation, the service connection shall be flushed prior to connecting the meter. No service is to be covered until the District's Inspector has inspected the initial installation. All corporations must be in an ON position and all angle valves must be in the OFF position.

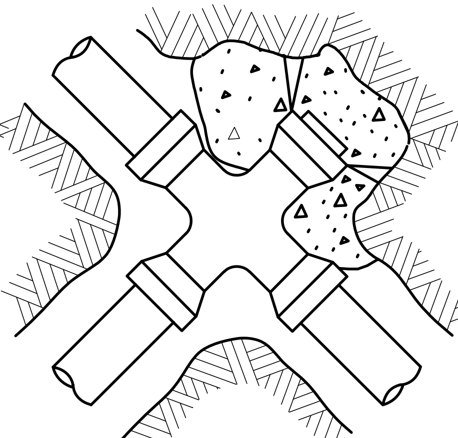
10. Service flow testing shall be done after water main pressure testing. During the inspection, every service shall be turned on to its full capacity to check flow and guarantee that each service line has been flushed.

11. No water main tie–ins to existing mains shall be schedule for Fridays, weekends, or holidays.

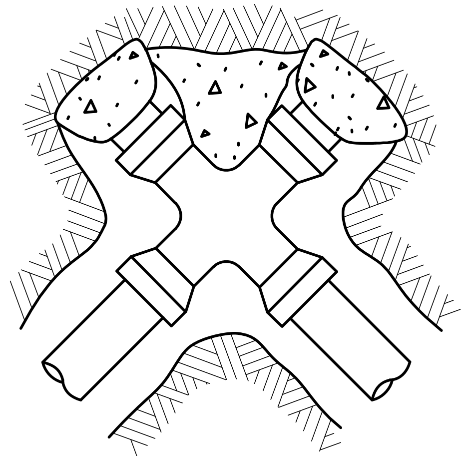
WATER SYSTEM NOTES	STANDARD DETAIL W1 9/20/2017



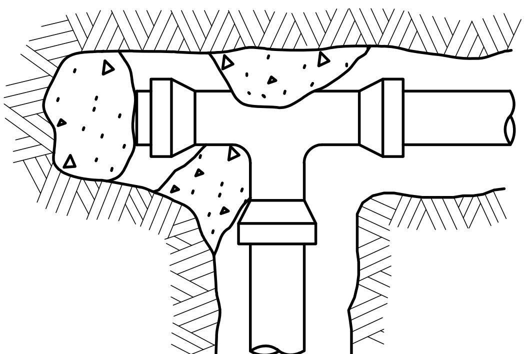
UNBALANCED CROSS
(Use column A)



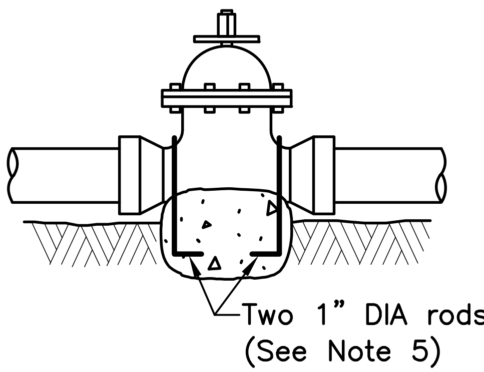
PLUGGED CROSS
(Use column A)



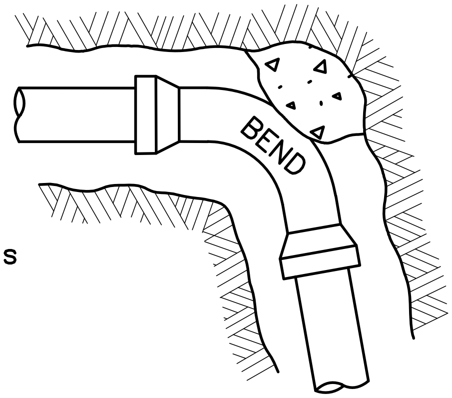
PLUGGED CROSS
(Use column B)

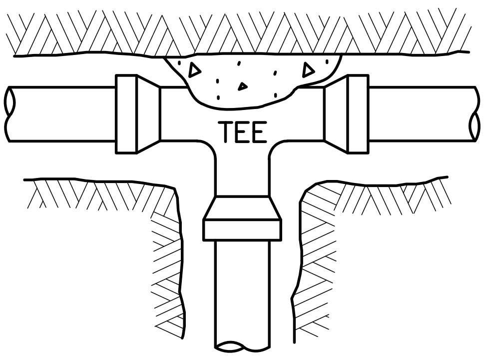


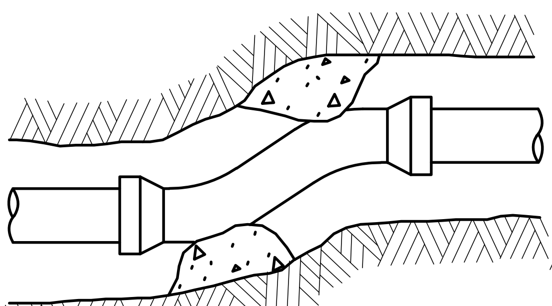
PLUGGED TEE
(Use column B)



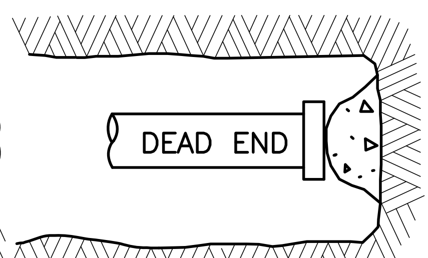
VALVE
(Use column A)







OFFSET
(Use columns B – E)



BASED ON WSDOT STANDARD PLAN
B–90.40–00 DATED 6/8/06.

CONCRETE THRUST BLOCK
Sheet 1 of 2

STANDARD DETAIL

W2

9/20/2017

NOTES:

1. Contractor may substitute restrained joints & fittings with the approval of the district engineer. Calculation of the restrained pipe required length on each side of fittings for max pressure and soil type are required. Calculations shall be sealed by a professional engineer and submitted for review and approval.

2. Contractor to provide blocking adequate to withstand full test pressure.

3. Divide thrust by safe bearing load to determine required area (in square feet) of concrete to distribute load.

4. Areas to be adjusted for other pressure conditions.

5. Provide two 1" minimum diameter rods on valves up through 10" diameter. Valves larger than 10" require special tie rod design.

Size	Test Pressure PSI	Thrust at Fittings in Pounds				
		A	B	C	D	E
		Tee and Dead Ends	90° Bend	45° Bend	22.5° Bend	11.25° Bend
4"	250	3,140	4,440	2,405	1,225	615
6"	250	7,070	9,995	5,410	2,760	1,385
8"	250	12,565	17,770	9,620	4,905	2,465
10"	250	19,635	27,770	15,030	7,660	3,850
12"	250	28,275	39,985	21,640	11,030	5,545
14"	250	38,485	54,425	29,455	15,015	7,545
16"	250	50,265	71,085	38,470	19,615	9,855

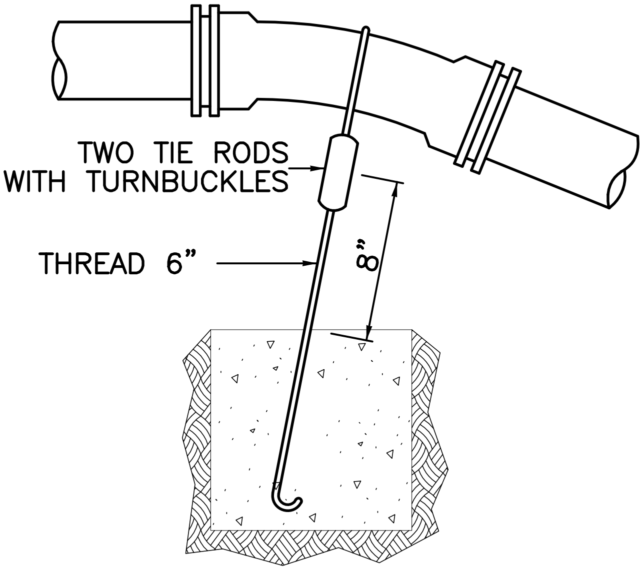
Soil Type	Safe Bearing Load PSF
Muck, peat, etc.*	0
Soft clay	1,000
Sand	2,000
Sand and gravel	3,000
Sand and gravel cemented with clay	4,000
Hard shale	10,000

*Restrained joints required in all cases.

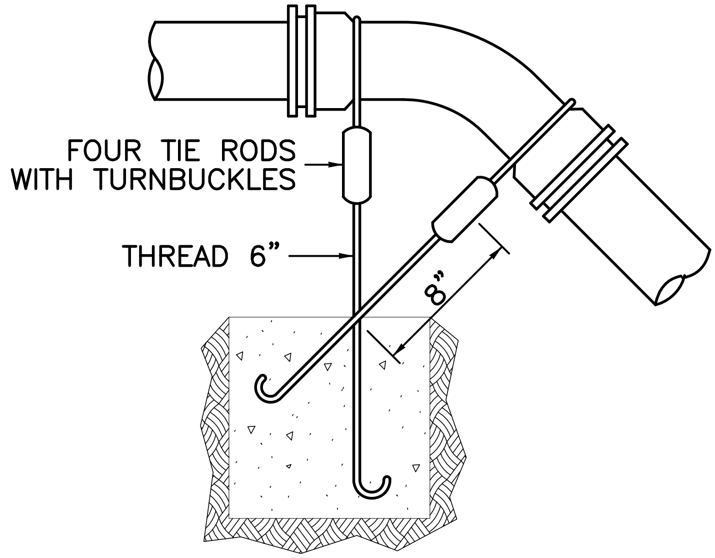
BASED ON WSDOT STANDARD PLAN B-90.40-00 DATED 6/8/06.

CONCRETE THRUST BLOCK
Sheet 2 of 2

STANDARD DETAIL
W2
5/1/2014



BLOCKING FOR 11.25° OR 22.5°
VERTICAL BENDS



BLOCKING FOR 45°
VERTICAL BENDS

NOTE: STEEL TIE RODS SHALL BE HEAVILY COATED
WITH ASPHALT AFTER INSTALLATION.

DIMENSION TABLE

PIPE DIAM.	TEST PRESSURE (PSI)	BEND ANGLE	CONCRETE VOLUME (Cubic–Ft)	CUBE SIZE (Ft)	TIE ROD DIAM.	TIE ROD EMBEDMENT
4"	250	11.25°	6	1.8	5/8"	17"
		22.5°	12	2.3		
		45°	22	2.8		
6"	250	11.25°	14	2.4	5/8"	17"
		22.5°	27	3.0		
		45°	50	3.7		
8"	250	11.25°	25	2.9	5/8"	17"
		22.5°	48	3.6		
		45°	89	4.5		
10"	250	11.25°	38	3.4	5/8"	17"
		22.5°	75	4.2		
		45°	139	5.2		
12"	250	11.25°	55	3.8	5/8"	17"
		22.5°	108	4.8		
		45°	200	5.8	7/8"	24"
14"	250	11.25°	75	4.2	5/8"	17"
		22.5°	147	5.3	3/4"	20"
		45°	272	6.5	1"	27"
16"	250	11.25°	98	4.6	5/8"	17"
		22.5°	192	5.8	7/8"	24"
		45°	355	7.1	1 1/8"	30"

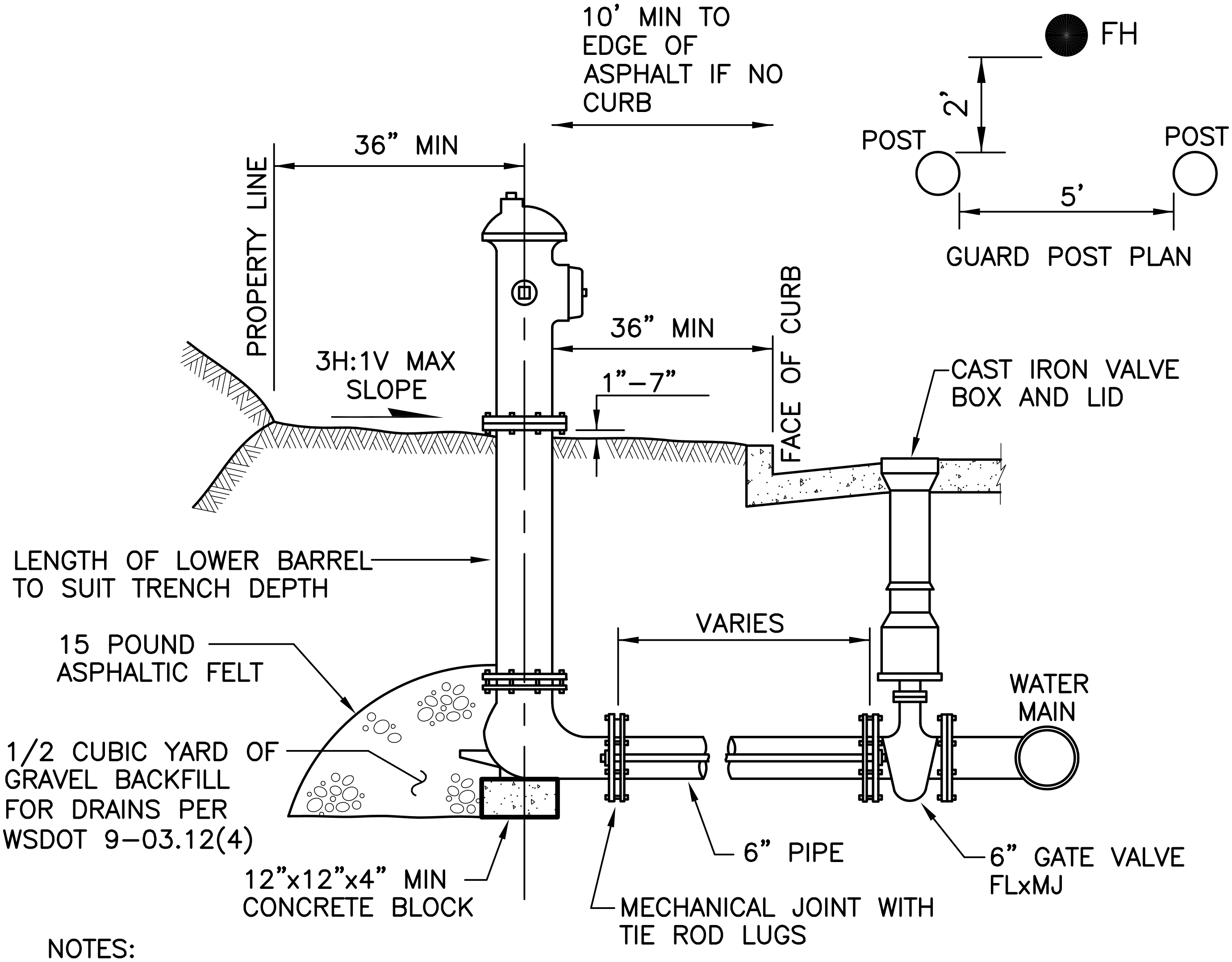
BASED ON WSDOT STANDARD PLAN
B–90.50–00 DATED 6/8/06.

CONCRETE THRUST BLOCK
FOR CONVEX VERTICAL BENDS

STANDARD DETAIL

W3

5/1/2014



NOTES:

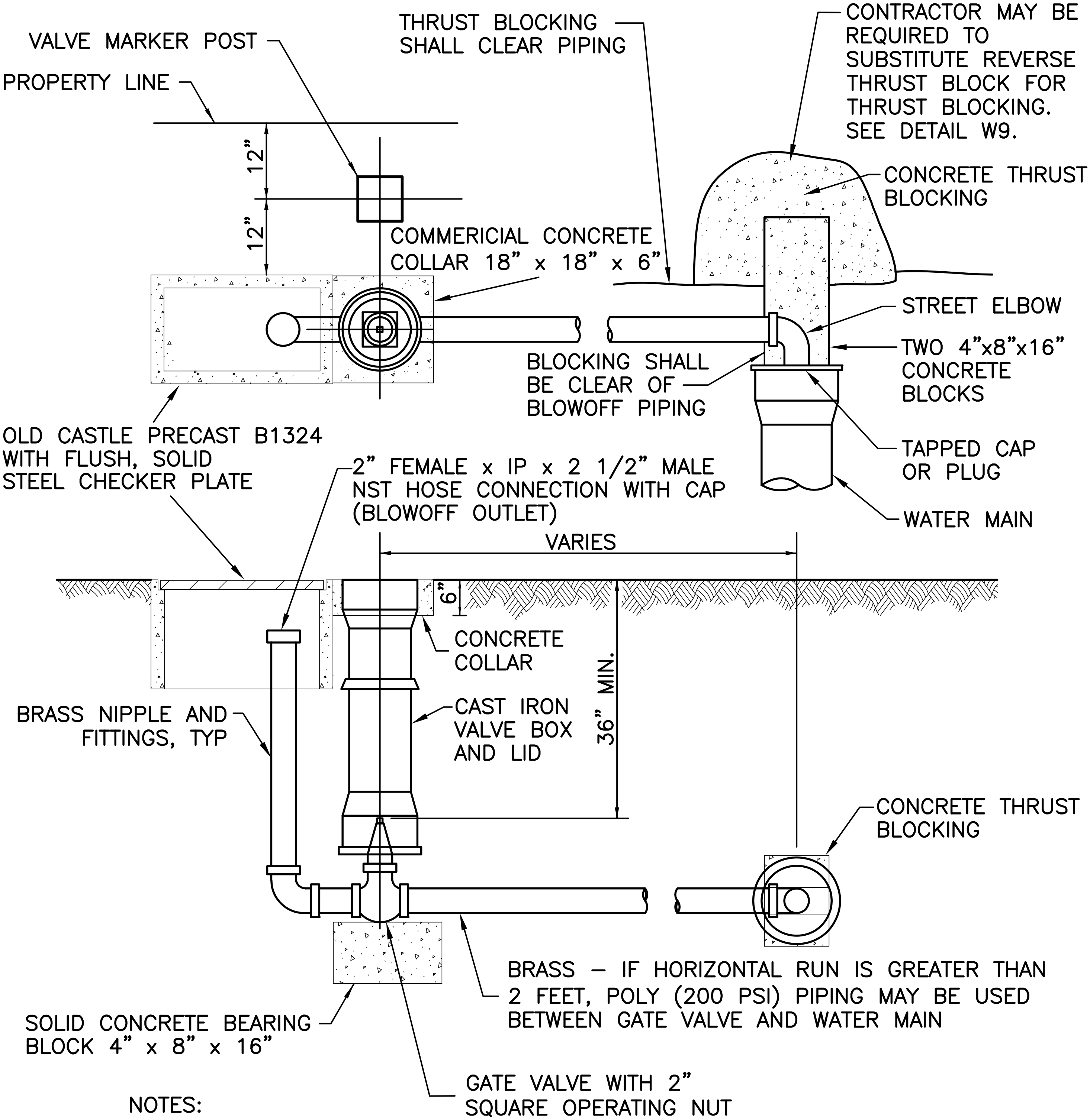
1. Fire hydrants shall be 5–1/4" compression type MJ foot with National Standard Thread on 2–1/2" side ports, and 5" Stortz connection fitting on the steamer port. District standard fire hydrant manufacturers/models are: American Flow Control – Waterous Pacer 250, M&H – Style 929 Reliant, Clow – Medallion, and EJ 5CD250 3 nozzle with standard operating nut. Hydrant caps & bells shall be painted bright industrial yellow in accordance with Whatcom County Fire District #2 and #4 requirements. Hydrant barrel extensions shall be provided and installed as required.

2. Shackle rods shall be installed with Romac ductile lugs. Tie rods shall be $\frac{3}{4}$" diameter stainless steel (for up to 12" diameter main) with stainless steel hardware. Restrained joints may be substituted for tie rods with approval of District Engineer.

3. Ground surface within 36" of hydrant shall be smooth and clear of obstructions on all sides.

4. A minimum of two guard posts shall be provided. Guard posts shall be reinforced concrete having a compressive strength of 3,500 psi and shall be 6–feet in length by 9–inches in diameter. Reinforcing shall consist of a minimum of five No. 3 deformed steel bars. Guard posts shall be buried 3–feet deep and painted bright white.

FIRE HYDRANT ASSEMBLY	STANDARD DETAIL W4 9/20/2017



NOTES:

1. Paint pipe threads with asphalt paint after assembly.
2. Valve and piping to valve shall be 2" unless otherwise noted on plans.
3. Locate blowoff outlet near property corner if possible.

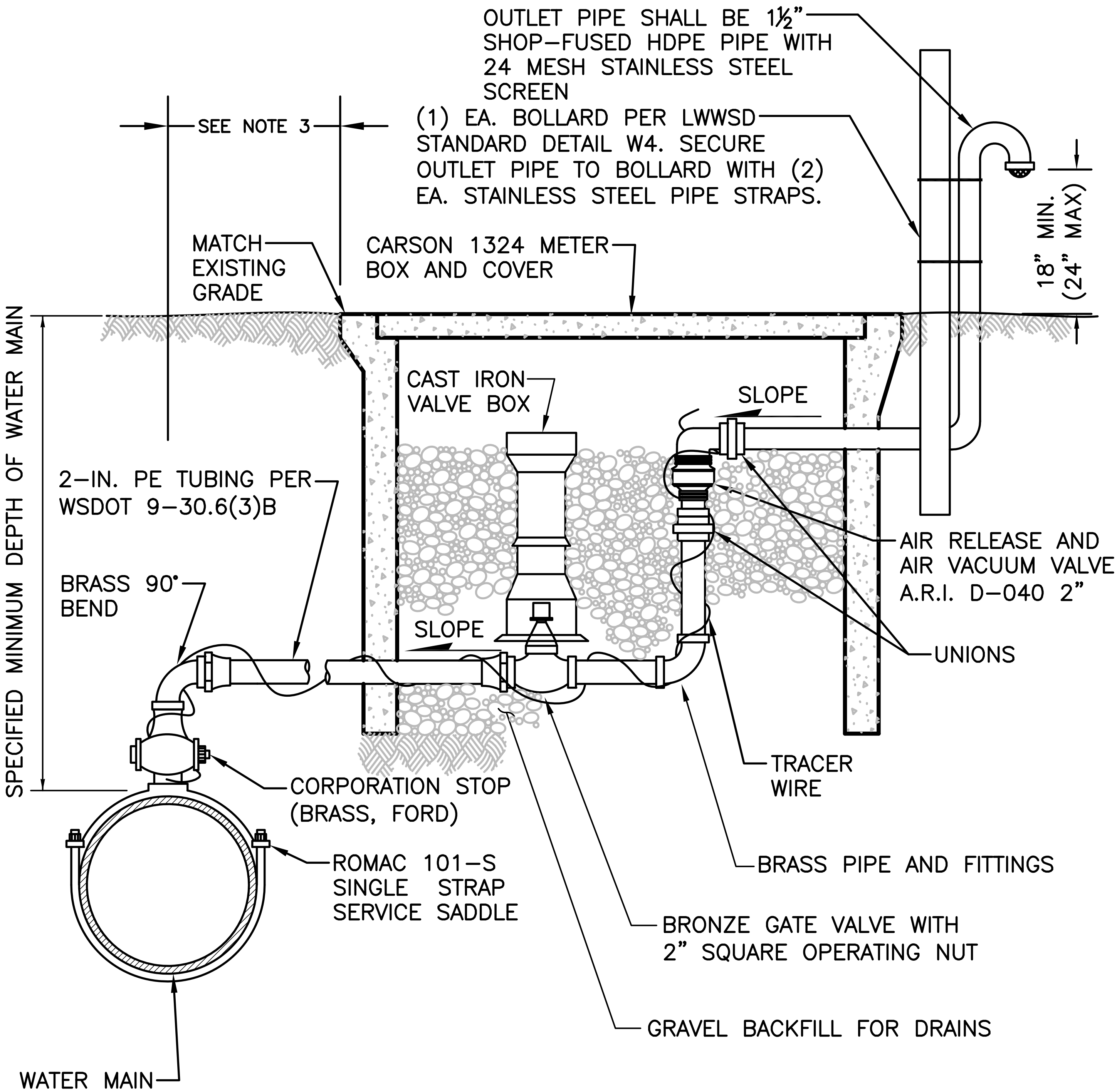
BASED ON WSDOT STANDARD PLAN B-90.20-00 DATED 6/8/06.

2 INCH BLOWOFF ASSEMBLY

STANDARD DETAIL

W5

9/20/2017

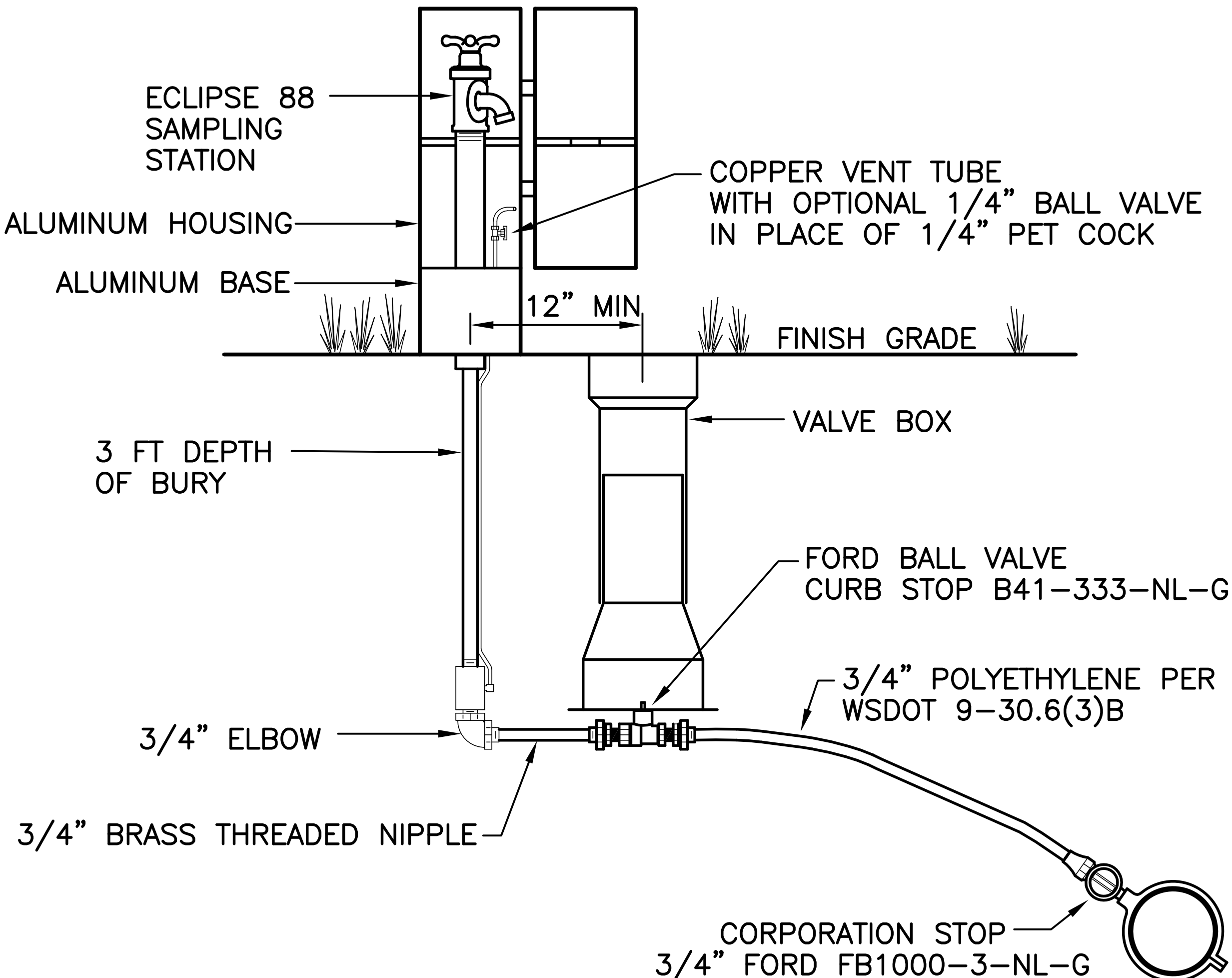


NOTES:

1. The Air/Vacuum Release Valves shall be 2" A.R.I. Model D-040.
2. Locate at the high point of the main, tap top of main.
3. Air/Vacuum Release assembly shall be installed along the right-of-way at location staked by engineer.

BASED ON WSDOT STANDARD PLAN B-90.30-00 DATED 6/8/06.

COMBINATION AIR RELEASE / AIR VACUUM VALVE ASSEMBLY	STANDARD DETAIL W6 9/20/2017



NOTES:

1. Sampling stations shall be buried 3' bury, with a 3/4-inch FIP inlet, and a (3/4-inch hose or unthreaded) nozzle.

2. All stations shall be in a lockable, nonremovable, aluminum cast housing. Housing shall be painted green.

3. When opened, the station shall require no key for operation, and the water will flow in an all brass waterway.

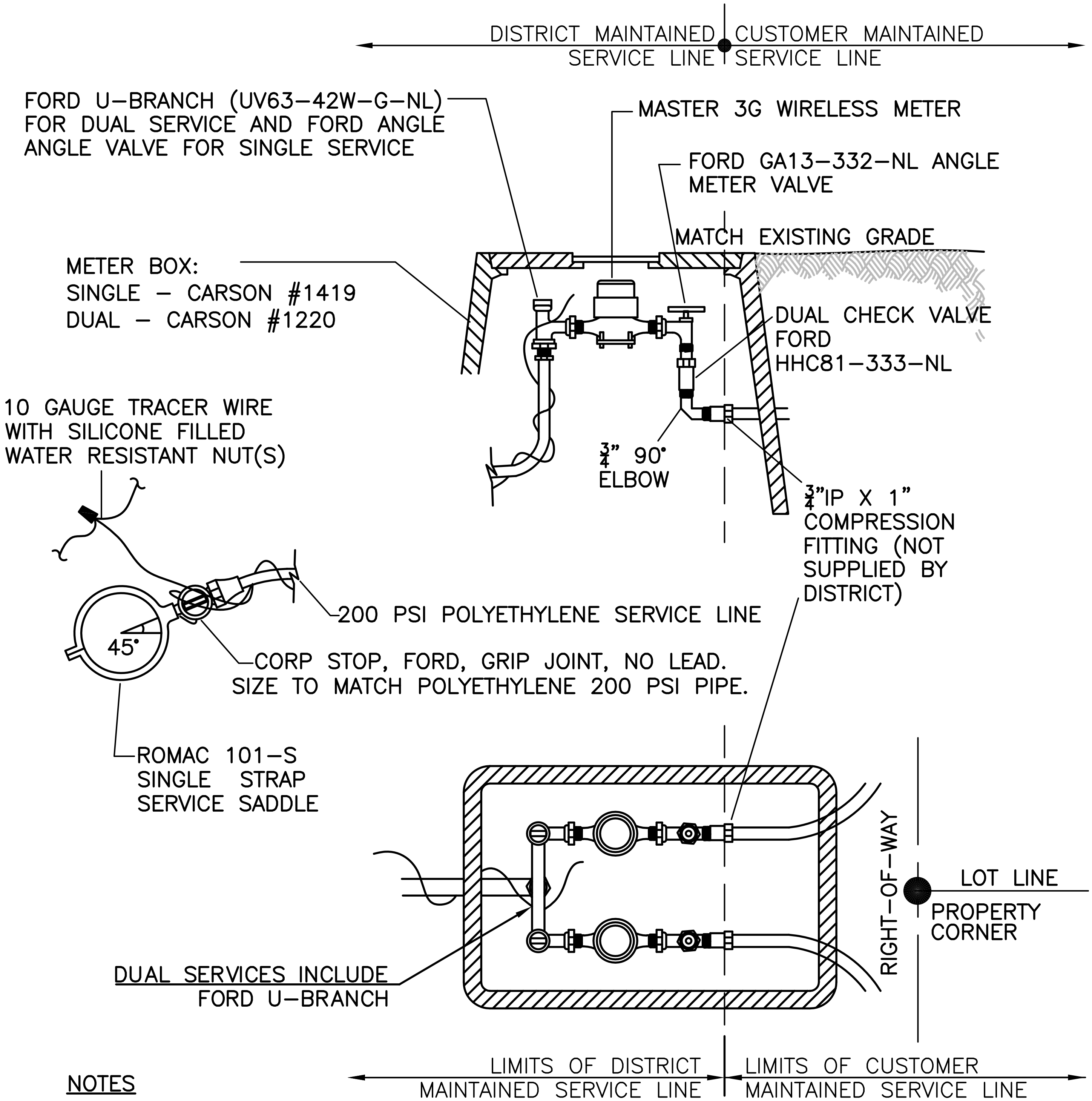
4. All working parts will be of brass and be removable from above ground with no digging.

5. Exterior piping shall be brass pipe.

6. A copper vent tube will enable each station to be pumped free of standing water to prevent freezing and to minimize bacteria growth.

7. Sampling station shall be Eclipse No. 88, manufactured by Kupferle Foundry, St. Louis, MO 63102.

WATER SAMPLING STATION	STANDARD DETAIL W7 9/20/2017



NOTES

1. Service fittings shall be in accordance with WSDOT 9–30.6 except that only compression (grip joint) fittings on service lines are allowed.

2. All fittings shall be Ford brass.

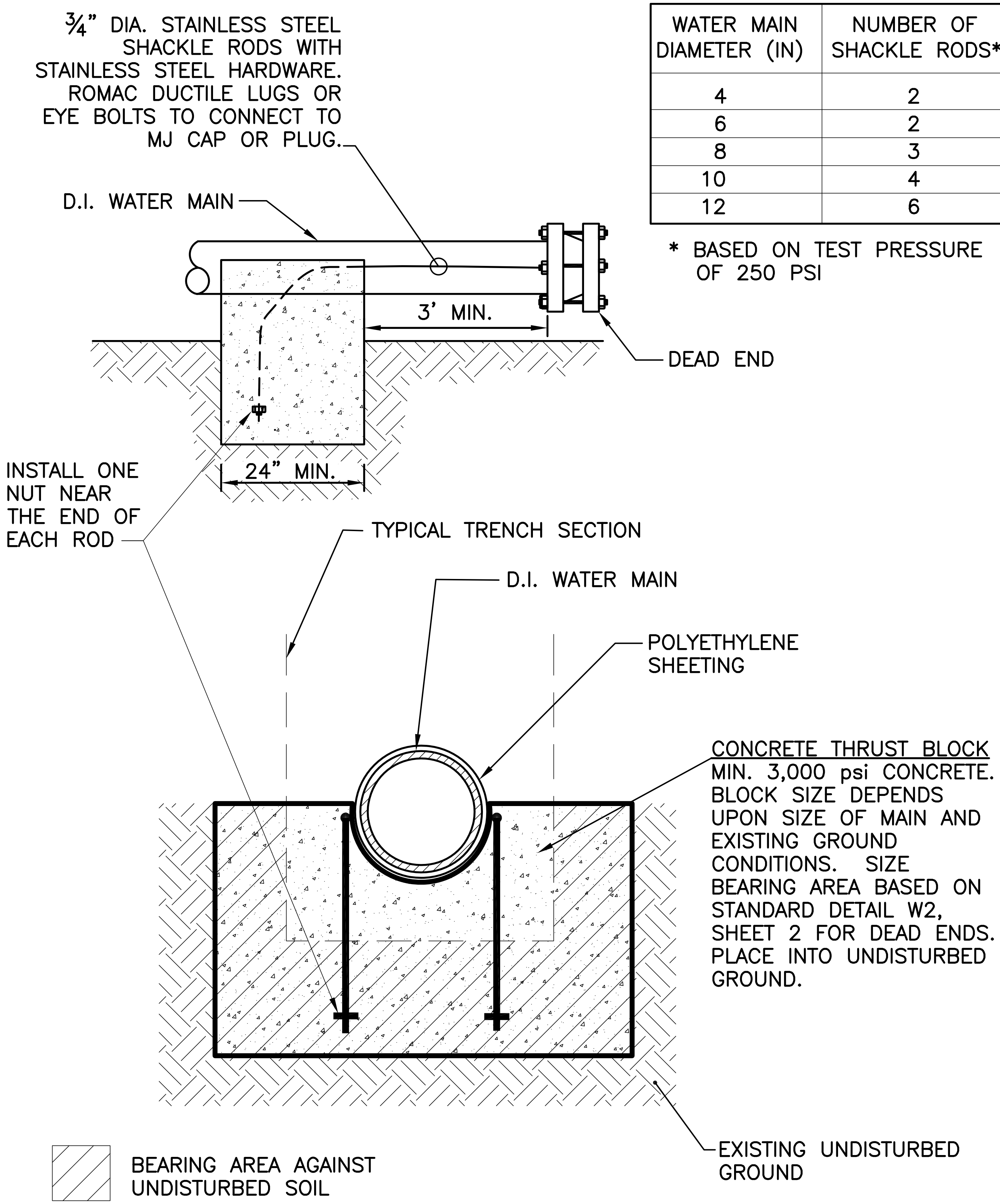
3. The water service pipe shall have a minimum of 30 inches depth and a maximum of 36 inches depth, including under ditch sections.

4. Meter boxes in traffic areas shall be concrete with a reader lid.

WATER METER ASSEMBLY	STANDARD DETAIL W8 9/20/2017

WATER MAIN DIAMETER (IN)	NUMBER OF SHACKLE RODS*
4	2
6	2
8	3
10	4
12	6

* BASED ON TEST PRESSURE OF 250 PSI



REVERSE THRUST BLOCK

NOT TO SCALE

STANDARD DETAIL

W9

9/20/2017

SEWER SYSTEM NOTES

1. Sewer system materials, trenching, bedding, installation, backfilling, and testing shall conform to WSDOT 7–05 and 7–17.

2. Gravity sewer pipe shall be ASTM D3034–SDR 35 PVC per WSDOT 9–05.12(1). In certain applications, the District may require class 52 ductile iron pipe, per WSDOT 9–30.1(1) encased in polyethylene encasement per WSDOT 9–30.1(2).

3. Pressure sewer pipe shall be class 52 ductile iron pipe per WSDOT 9–30.1(1) encased in polyethylene encasement per WSDOT 9–30.1(2) or PVC C900 class 150 per WSDOT 9–30.1(5). HDPE may be substituted with the approval of the District Engineer and the pipe rating shall be based on the specific design conditions.

4. Side sewers, from main to private property line, shall be installed per WSDOT 7–18. Side sewers shall have a minimum slope of 2%. Side sewer shall maintain a minimum cover of 30 inches under ditches. Side sewers and cleanout/test tee at property line shall be minimum 6–inches in diameter. Inspection prior to backfill.

5. Sewer cleanouts shall be installed per WSDOT 7–19.

6. Grout for manholes shall be a non–shrinking cementitious grout, containing no gypsum or calcium sulfate Di–hydrate ($CaSO_4 2H_2O$), conforming to WSDOT 9–20.3(2), such as Rapid Set Cement All or approved equivalent. Grout shall be installed according to manufacturer's instructions. JET SET, BLUELINE, AND QUICKCRETE ARE NOT ALLOWED!

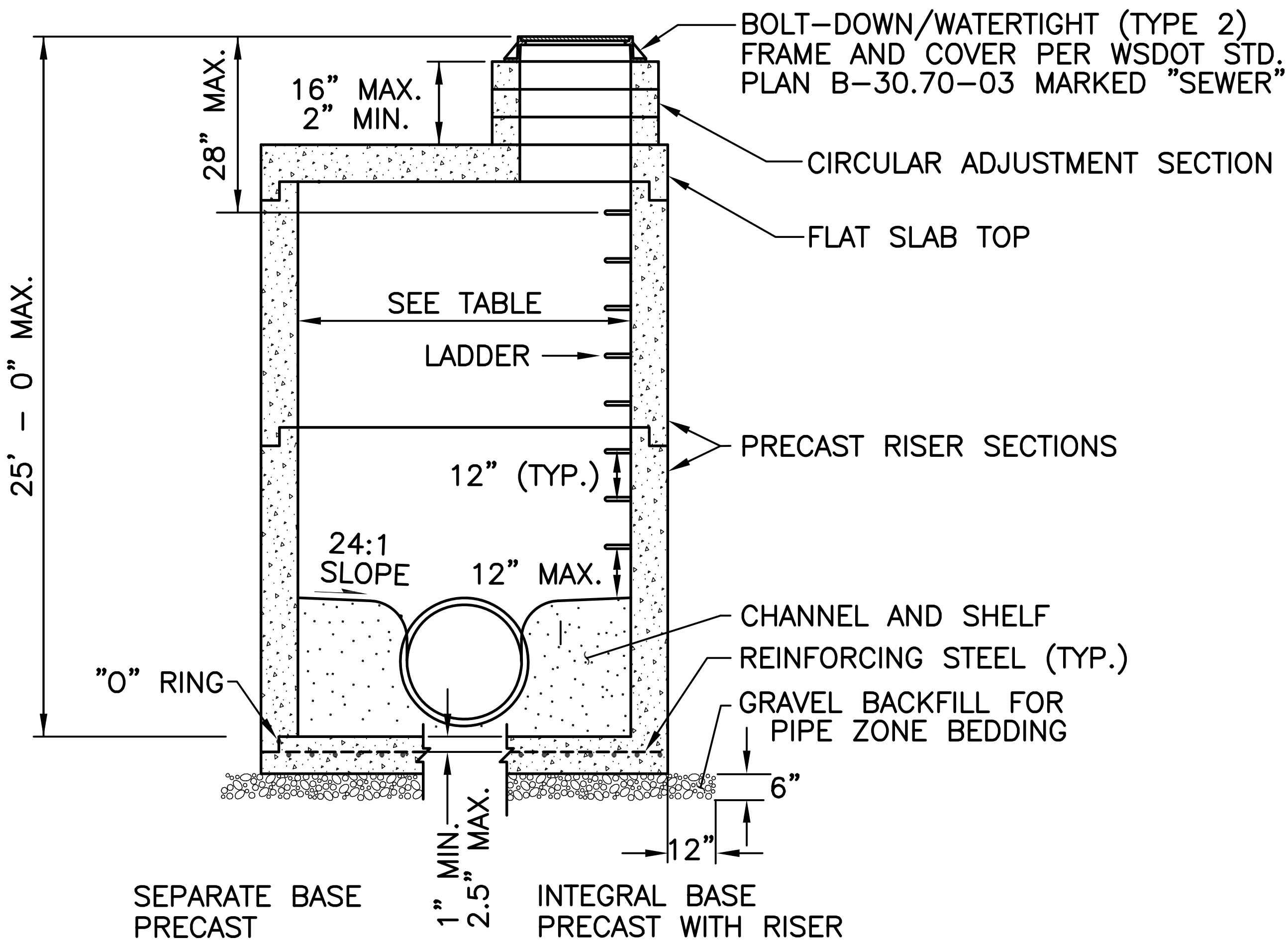
7. All sewer pipe and appurtenances shall be flushed and cleaned prior to being put into service. Debris shall not be allowed into the existing sewer system.

8. District Engineer or their appointed representative shall witness testing. Contractor shall provide the District Engineer 48 hours notice prior to conducting tests or sampling.

9. Pipe shall be tested after backfill by the low–pressure air test method per WSDOT 7–17.3(2)F. PVC pipe shall have a mandrel passed through it to check for any deflections in the pipe per WSDOT 7–17.3(2)G. The District at their option may require any or all sewers to be inspected by the use the District television camera before final acceptance. The costs incurred in making the inspection shall be borne by the Contractor. Connection to the existing system is not permitted until final acceptance.

10. Downspouts, foundation/crawl space sump pumps, yard drains, or any outside drains shall not be connected to sanitary sewer mains or services.

SEWER SYSTEM NOTES	STANDARD DETAIL S1 9/20/2017



MANHOLE DIMENSION TABLE						
DIAM	MIN. WALL THICKNESS	MIN. BASE THICKNESS	MAXIMUM KNOCKOUT SIZE	MINIMUM DISTANCE BETWEEN KNOCKOUTS	PIPE ALLOWANCES PIPE MATERIAL WITH MAX. INSIDE DIAM.	
					ALL METAL	SOLID WALL PVC
48"	4"	6"	36"	8"	30"	30"
54"	4.5"	8"	42"	8"	36"	36"
60"	5"	8"	48"	8"	42"	42"
72"	6"	8"	60"	12"	54"	48"
84"	8"	12"	72"	12"	60"	48"
96"	8"	12"	84"	12"	72"	48"

NOTES:
1. Knockouts shall have a wall thickness of 2" minimum to 2.5" maximum.

2. No steps are required when height is 4' or less.

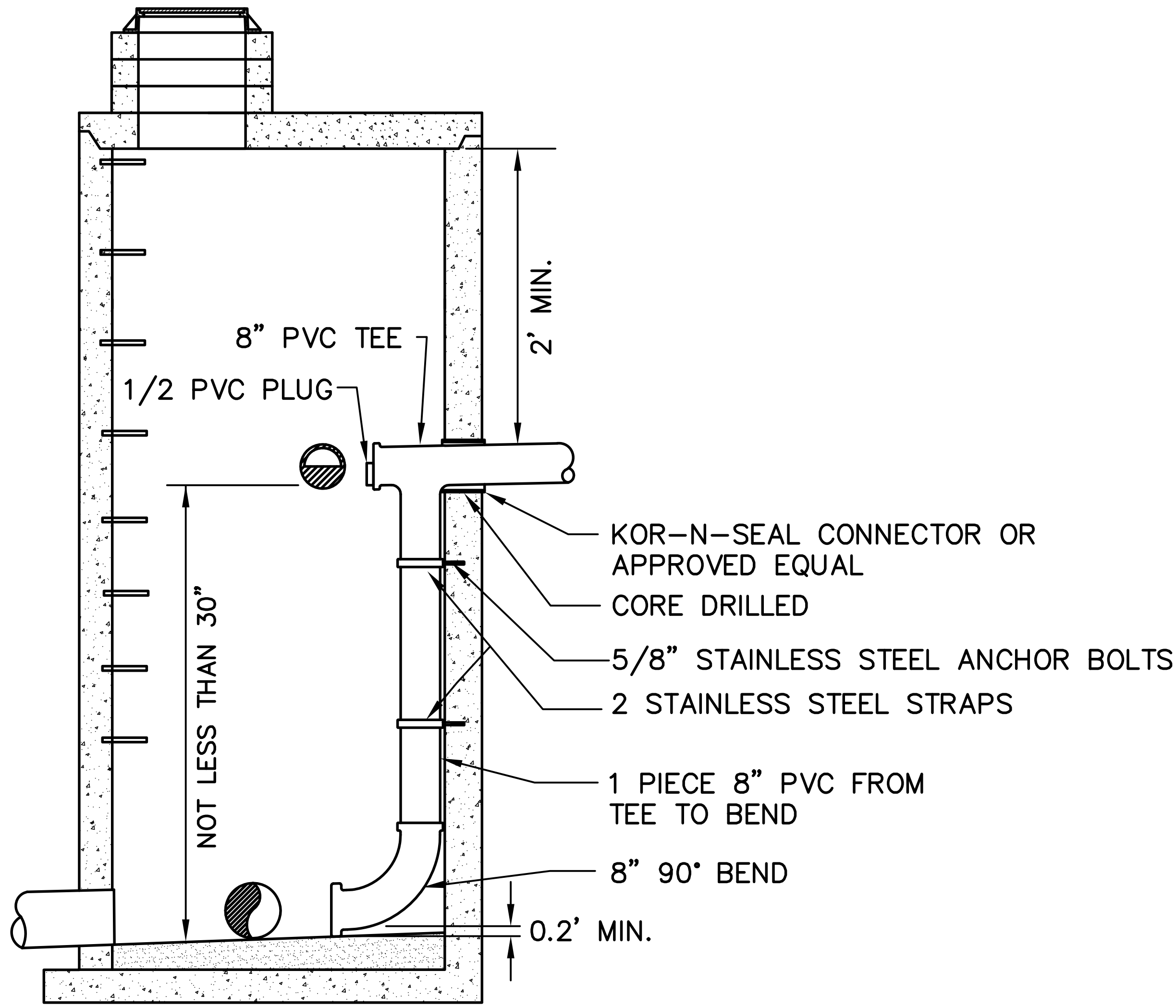
BASED ON WSDOT STANDARD PLANS B-15.60-02 AND B-10.20-01.

SANITARY SEWER MANHOLE TYPE 3

STANDARD DETAIL

S2

9/20/2017



NOTES:

1. Drop tee to be installed minimum of 2' below ceiling.

2. Inside drop manhole shall be installed only where approved the District.

3. Size of manhole will increase with larger diameter pipe and shall be approved by the District Engineer.

4. Channel to outlet.

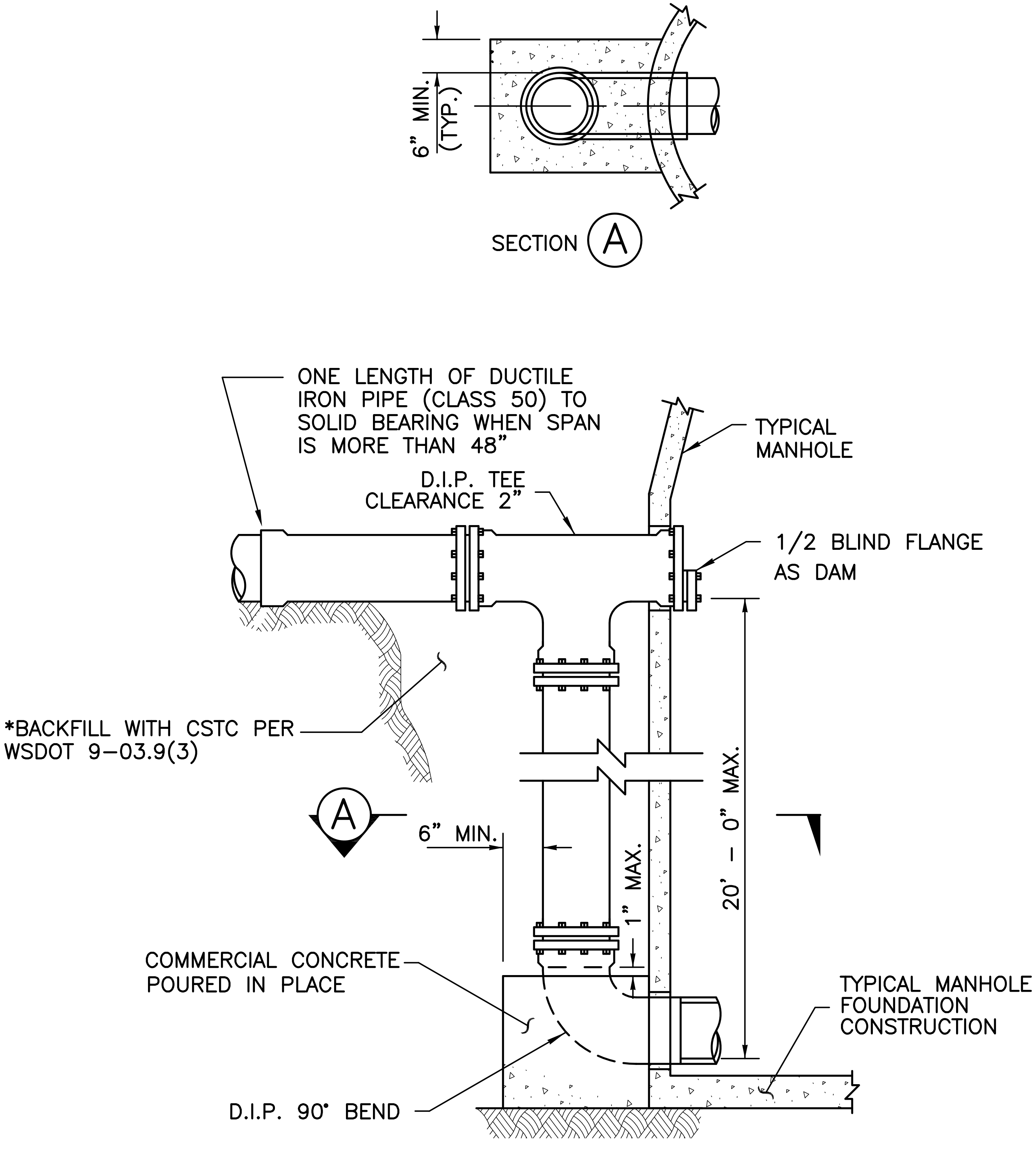
BASED ON CITY OF BELLINGHAM DRAWING SS-715 DATED 11/29/04.

INSIDE DROP SEWER MANHOLE CONNECTION

STANDARD DETAIL

S3

9/20/2017

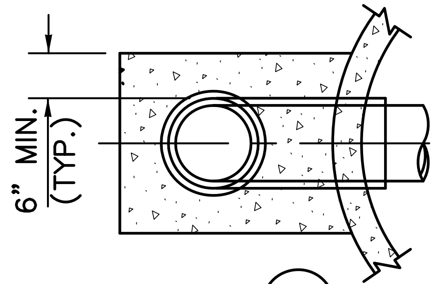


NOTES:

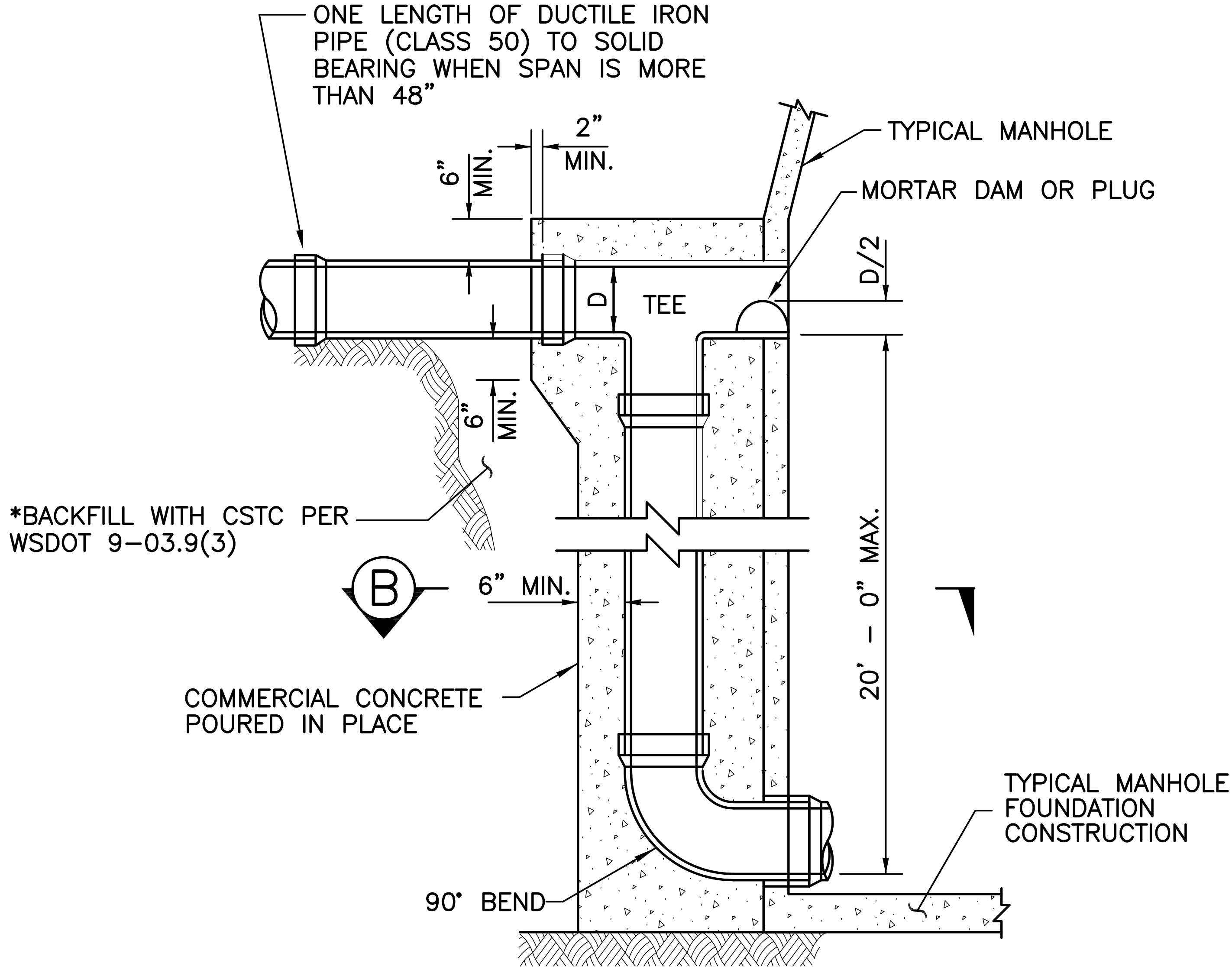
1. * Differs from WSDOT Std. Plan B–85.50–01

BASED ON WSDOT STANDARD PLAN
B–85.50–01 DATED 6/10/08.

OUTSIDE DROP SEWER MANHOLE CONNECTION Sheet 1 of 2	STANDARD DETAIL S4 9/20/2017



SECTION B



NOTES:

1. All pipe, except ductile iron pipe, shall be concrete encased.

2. Inside drop manhole shall be installed only where approved by the district.

3. * Differs from WSDOT Std. Plan B-85.50-01.

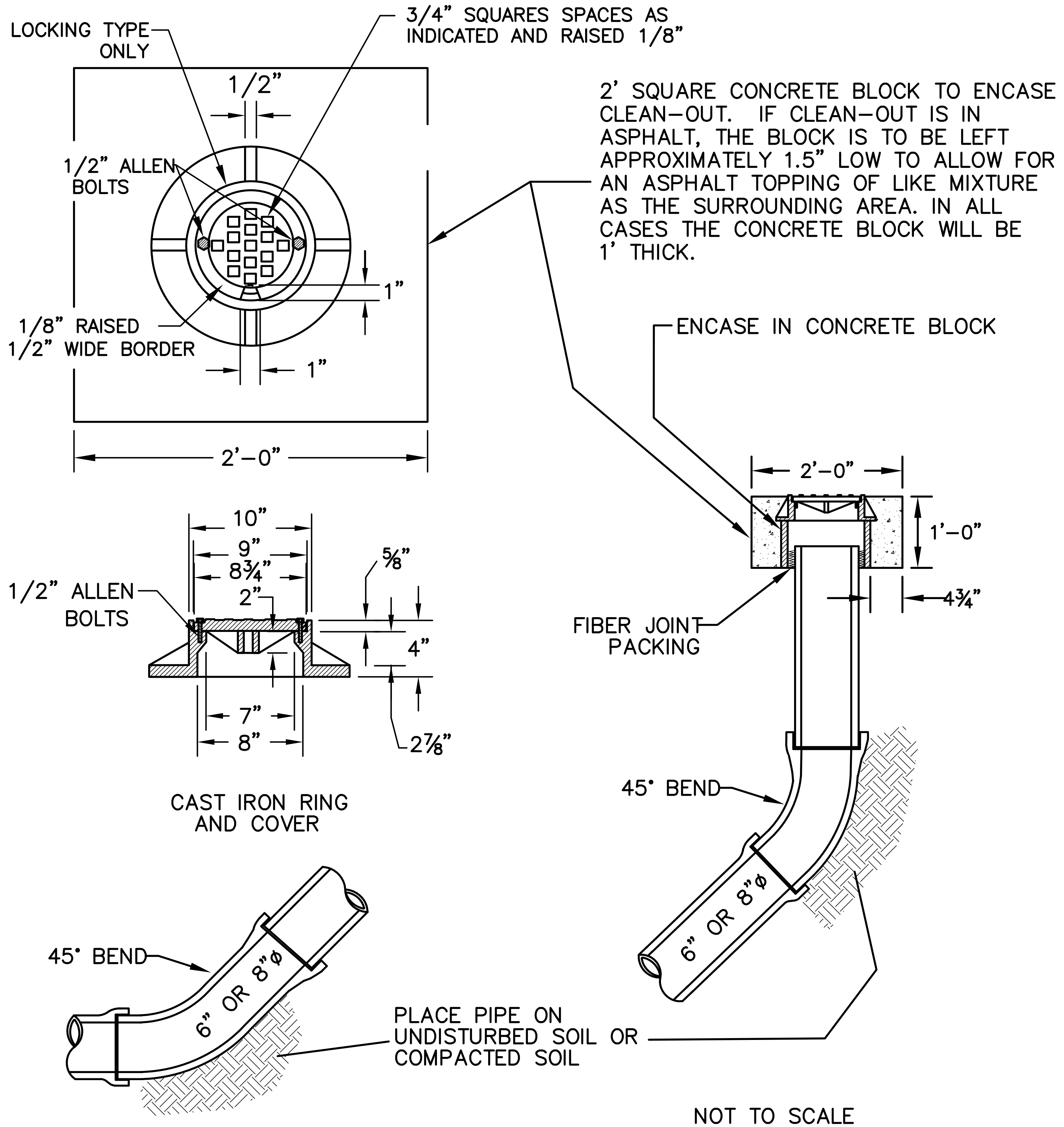
BASED ON WSDOT STANDARD PLAN B-85.50-01 DATED 6/10/08.

OUTSIDE DROP SEWER MANHOLE CONNECTION
Sheet 2 of 2

STANDARD DETAIL

S4

9/20/2017

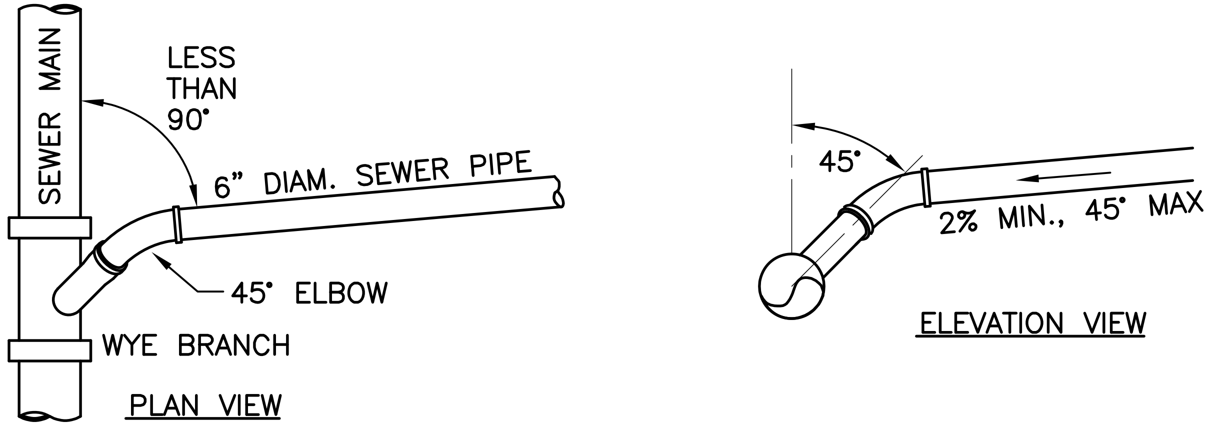


SEWER MAIN CLEANOUT

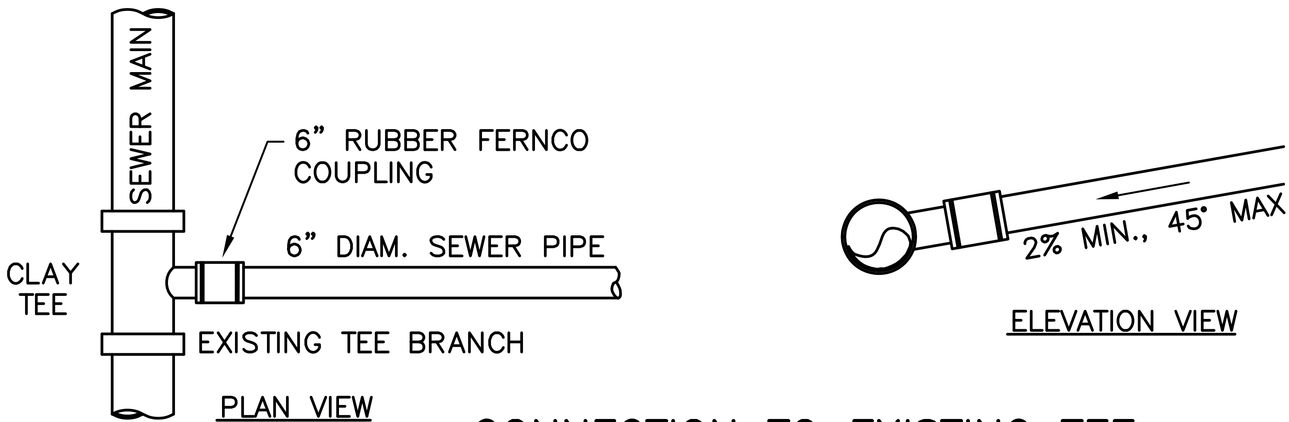
STANDARD DETAIL

S5

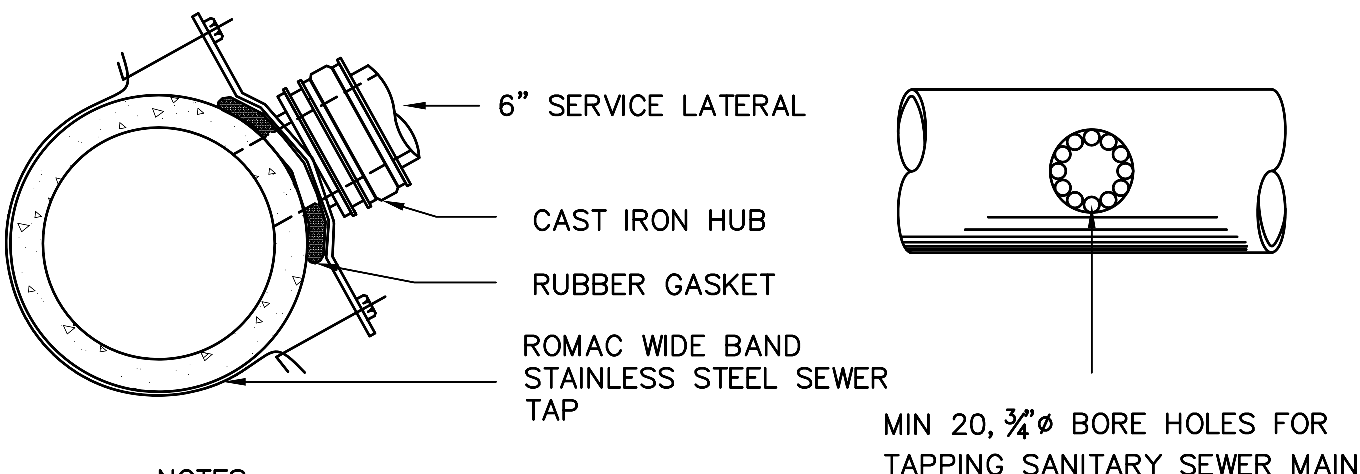
5/1/2014



SERVICE LATERAL INSTALLED WITH NEW MAINS



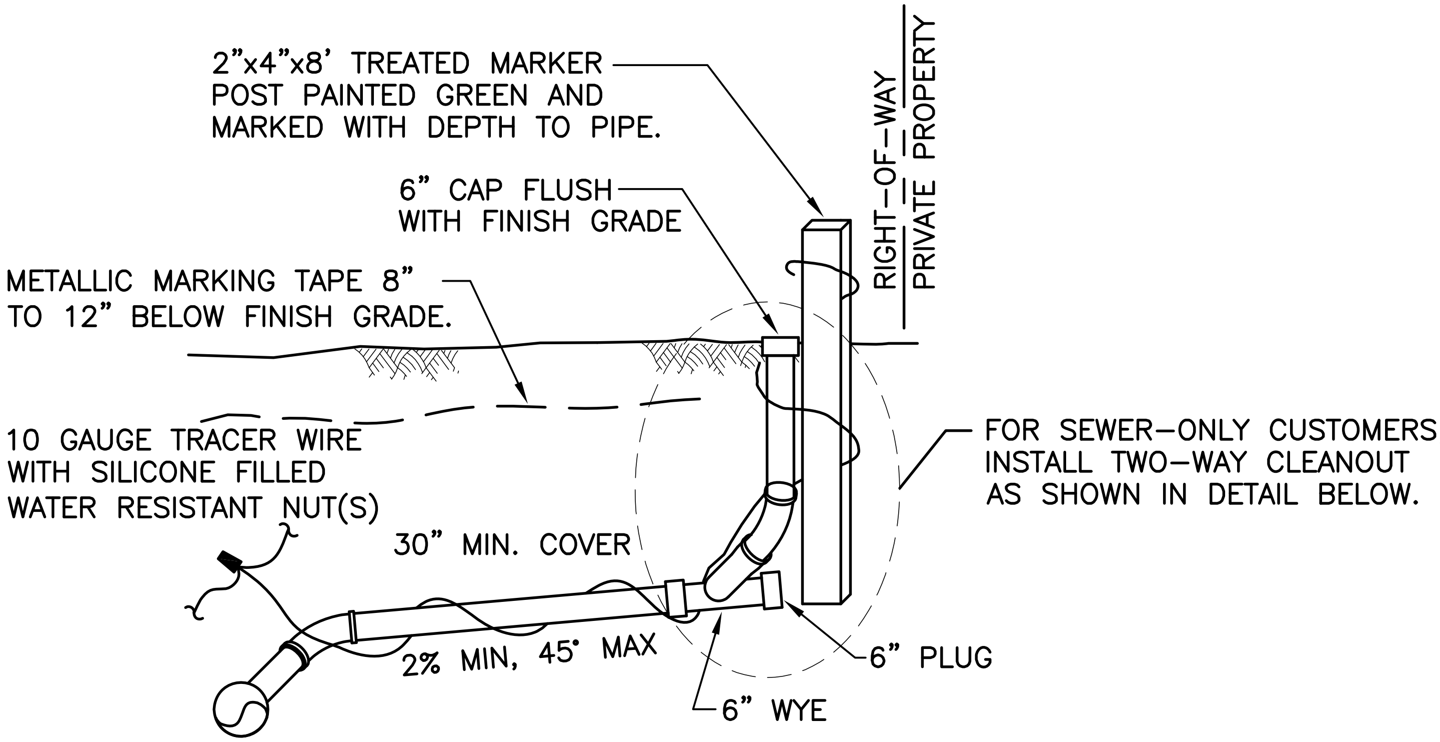
CONNECTION TO EXISTING TEE



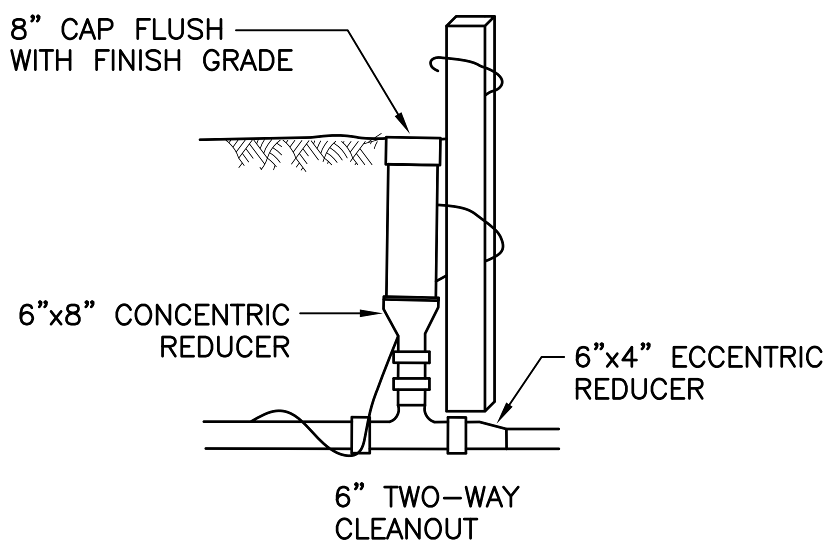
NOTES;
1. Install wye fitting with gaskets for new sewer installations
2. Pipe bedding shall be sand or pea gravel 6" all around.
3. Minimum cover to finish grade is 30".
4. Drill multiple 3/4' holes (20 min for 6") then break out

CONNECTION TO EXISTING SEWER (TAP)

SEWER LATERAL CONNECTION TO MAIN	STANDARD DETAIL S6 5/1/2014



TYPICAL SEWER LATERAL & CLEANOUT



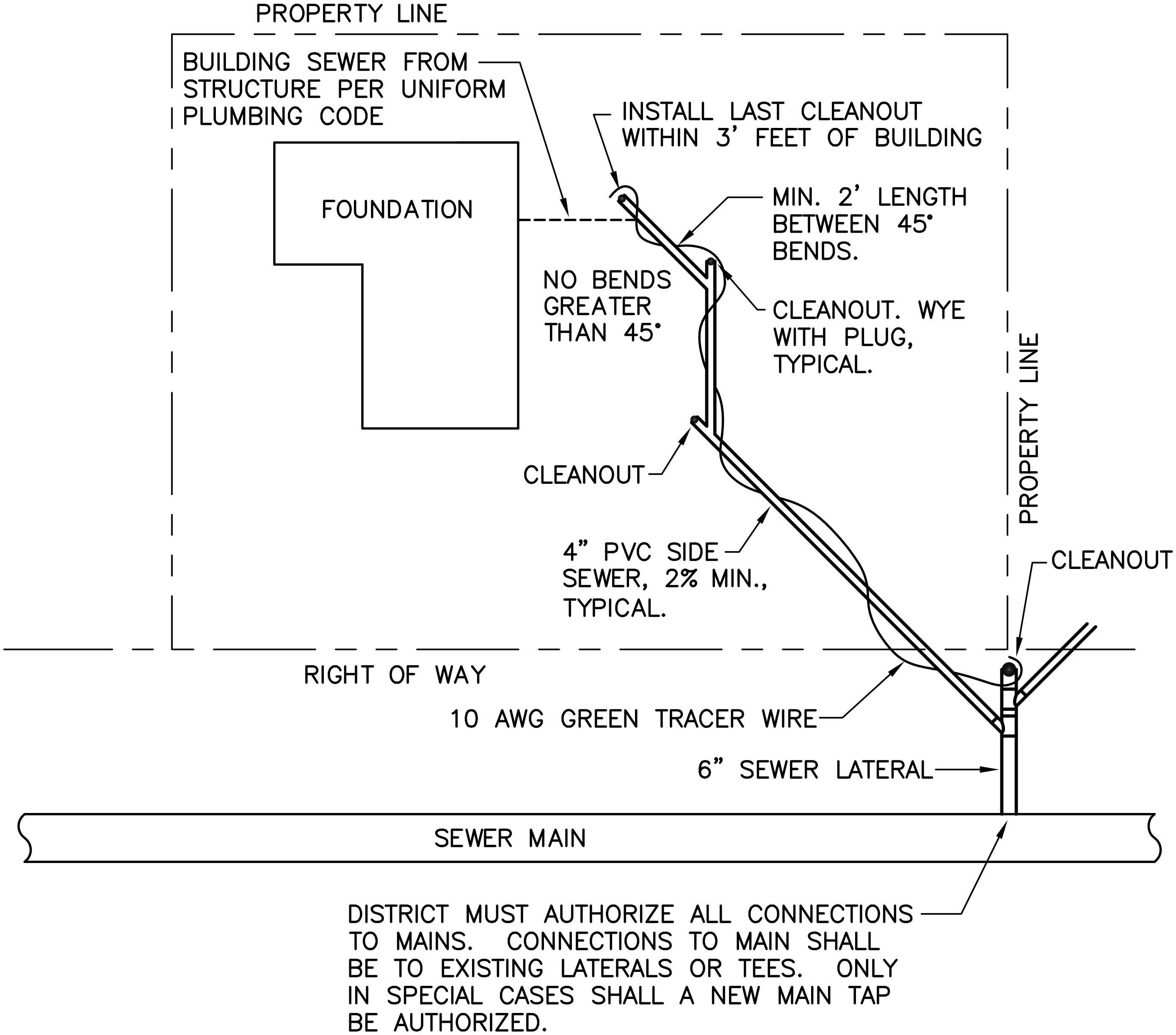
CLEANOUT FOR SEWER-ONLY CUSTOMERS.

SEWER LATERAL AND CLEANOUT

STANDARD DETAIL

S7

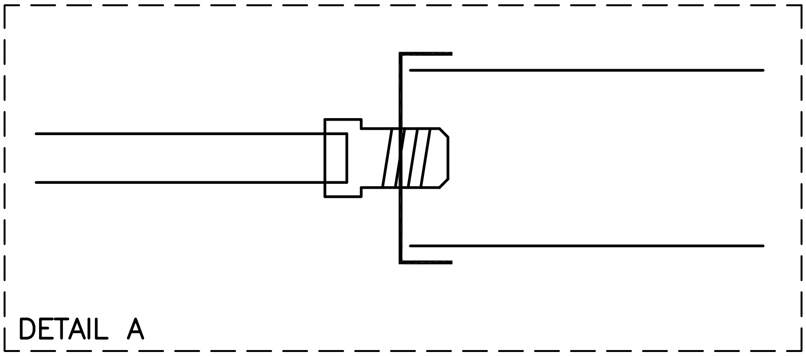
5/1/2014



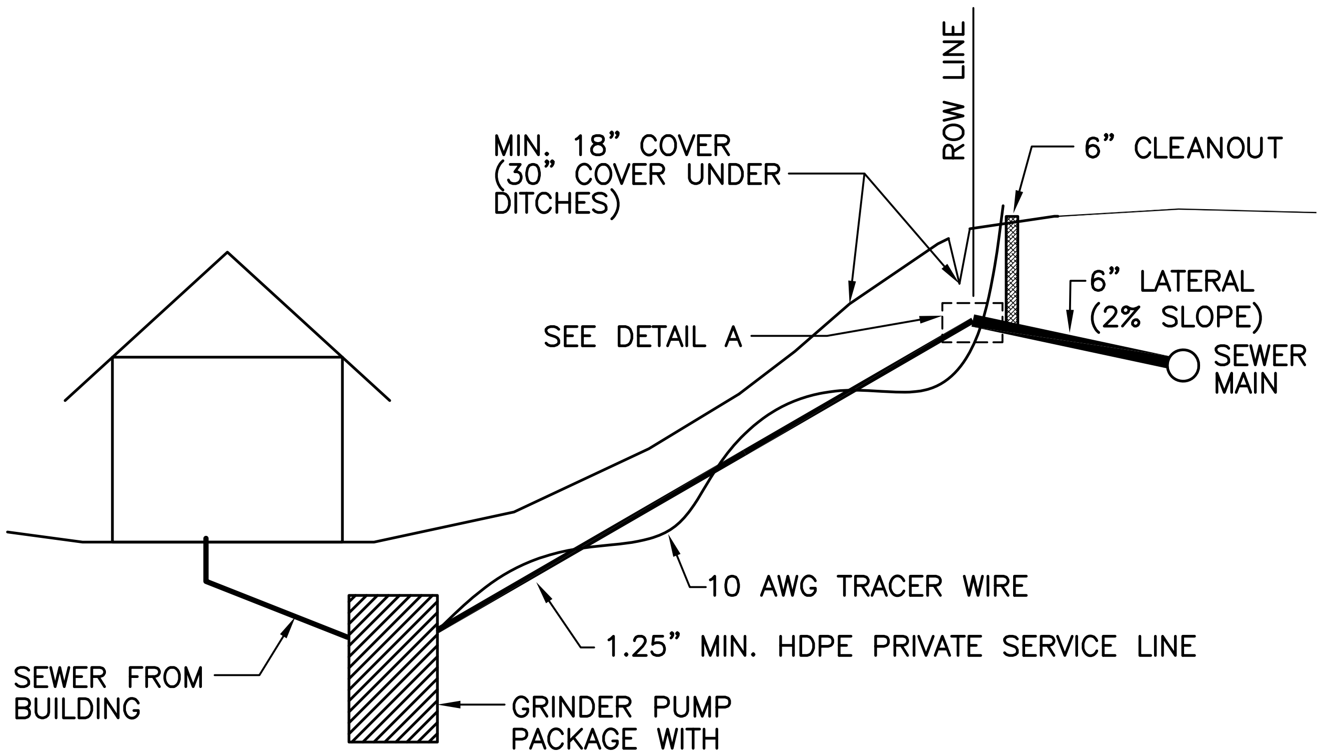
Notes:

1. All pipe from main to cleanout at foundation shall be PVC ASTM D3034 SDR 35, joints shall conform to ASTM D3212 using elastomeric gaskets conforming to ASTM F477. Fittings shall be injection molded, factory welded, or factory solvent cemented.
2. Minimum 18" of cover from property line to building.
3. Down spouts, sump pumps, and outside drains shall not be connected to the sewer line.
4. Bends greater than 45° will not be accepted.
5. Minimum size for sewer lines will be 4" for single family residence and 6" for multi–family residence up to a 4 plex.
6. Cleanouts on service lines shall be installed at every change in alignment or grade in excess of 22 1/2 degrees.
7. Cleanouts shall be spaced no greater than 100' apart.
8. A cleanout shall be installed within 3' of the building.

GRAVITY SIDE SEWER INSTALLATION	STANDARD DETAIL S8 5/1/2014



DETAIL A



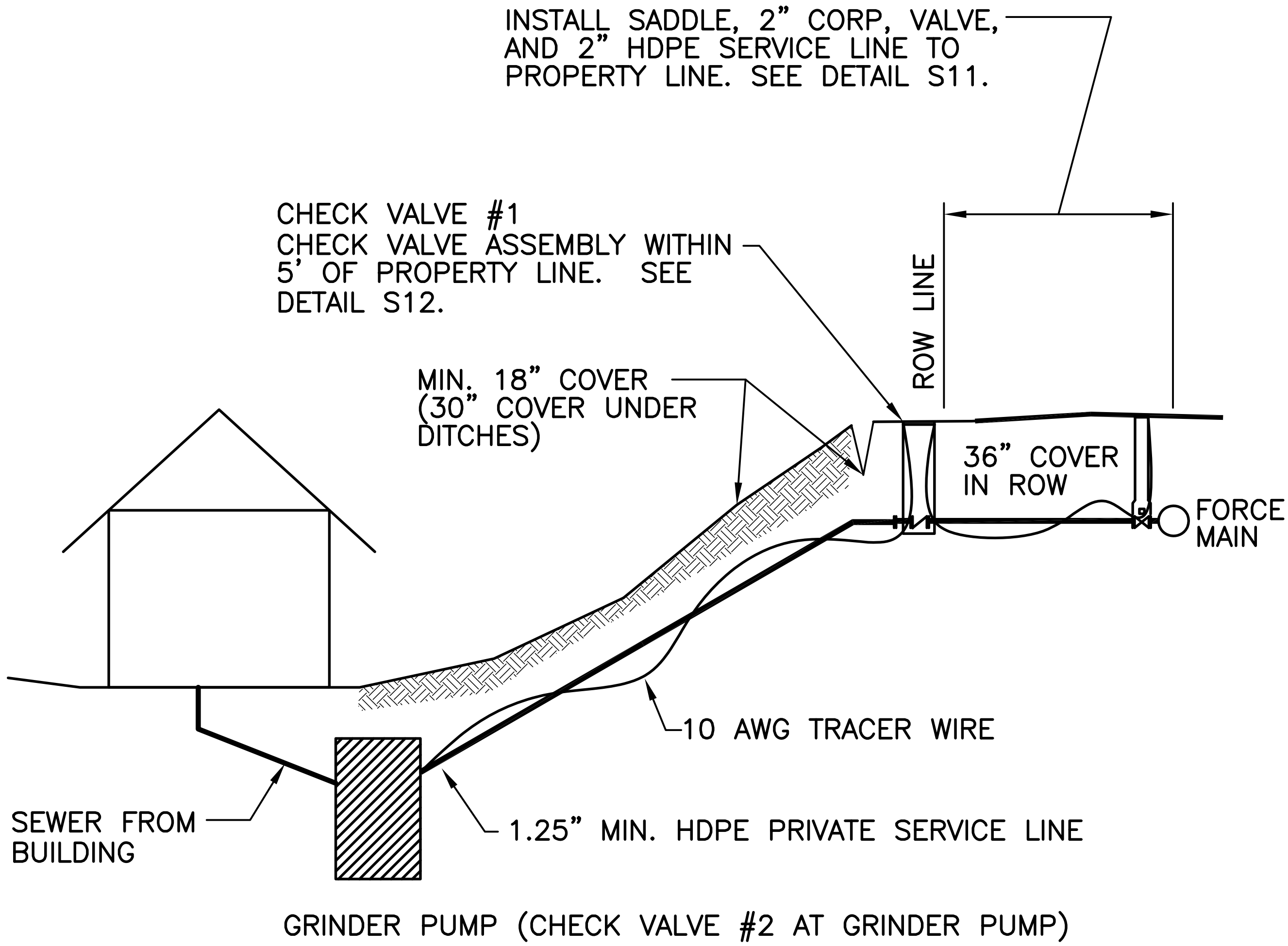
SEE DOE'S CRITERIA FOR
SEWAGE WORKS DESIGN,
SECTIONS C1–10.1 & C1–10.2
FOR GRINDER PUMP DESIGN &
COMPONENT INFORMATION

NOTES:

1. Pressure sewer service pipe shall be PE 3408 HDPE conforming to the requirements of ASTM D–3350. Piping shall be SDR11, IPS (OD), pressure rated at 160 PSI, conforming to the requirements of AWWA C901 and ASTM F714.

2. Brass compression fittings only – no hose clamps.

GRINDER PUMP SERVICE TO GRAVITY MAIN INSTALLATION	STANDARD DETAIL S9 9/20/2017



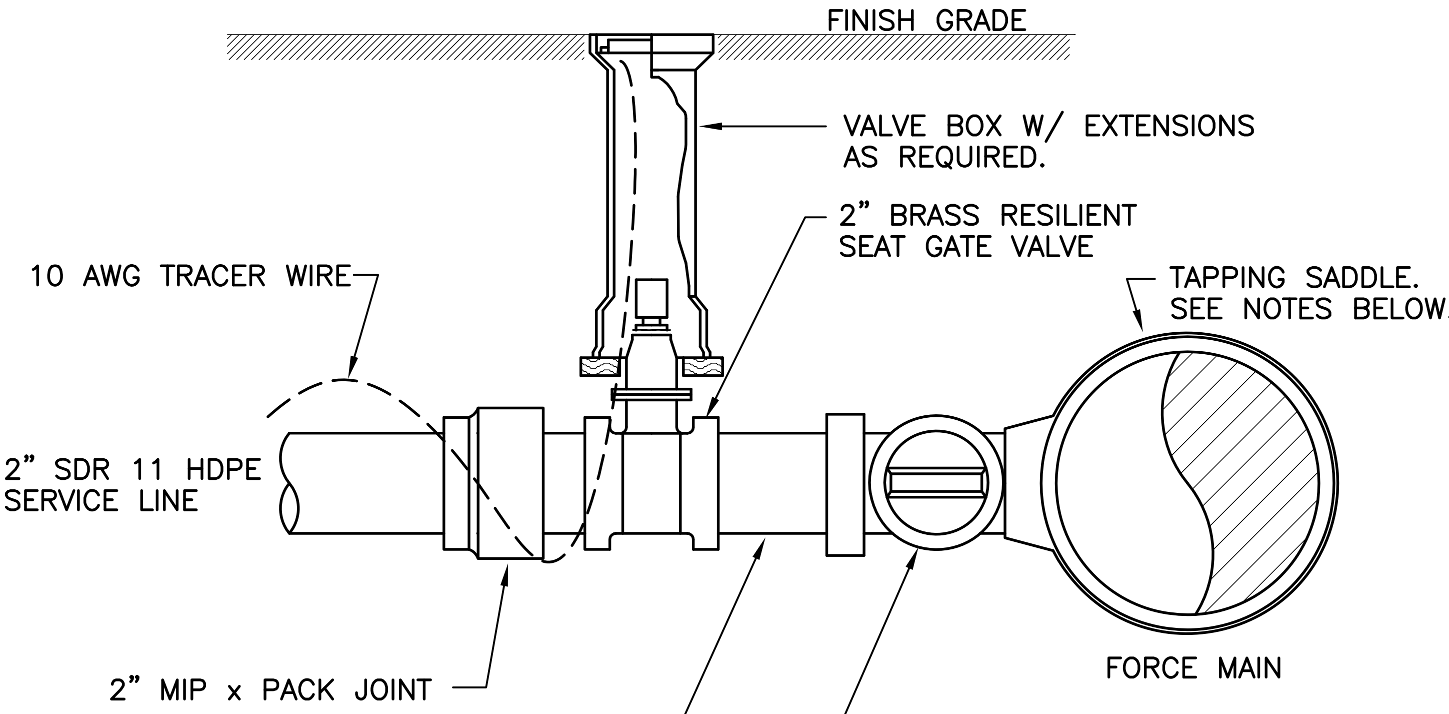
SEE DOE'S CRITERIA FOR SEWAGE WORKS DESIGN, SECTIONS C1–10.1 & C1–10.2 FOR GRINDER PUMP DESIGN & COMPONENT INFORMATION

NOTES:

1. Pressure sewer service pipe shall be PE 3408 HDPE conforming to the requirements of ASTM D–3350. Piping shall be SDR11, IPS (OD), pressure rated at 160 PSI, conforming to the requirements of AWWA C901 and ASTM F714.

2. Two check valves are required between the pump station and the force main. One check valve shall be installed within 5' of the right–of–way in the check valve vault. The second valve shall be installed at the grinder pump.

GRINDER PUMP SERVICE TO FORCE MAIN INSTALLATION	STANDARD DETAIL S10 5/1/2014



** NOTE! FUSED HDPE TEES SHALL BE INSTALLED WITH NEW HDPE FORCE MAINS. (NO TAPPING SADDLE OR CORP STOP.)

NOTES:

1. HDPE Service Saddles. Saddles for use on SDR 17 HDPE mains shall be epoxy or nylon coated ductile iron tapping saddles with a double stainless steel strapping mechanism specifically recommended by the manufacturer for use on HDPE piping. Saddles shall be Romac style 202N–H or approved equal.

2. PVC Service Saddles. Saddles for use on AWWA C900 PVC mains shall have epoxy or nylon coated ductile iron tapping saddles with a double strap stainless steel strapping mechanism. Service saddles shall be Romac style 202N or approved equal.

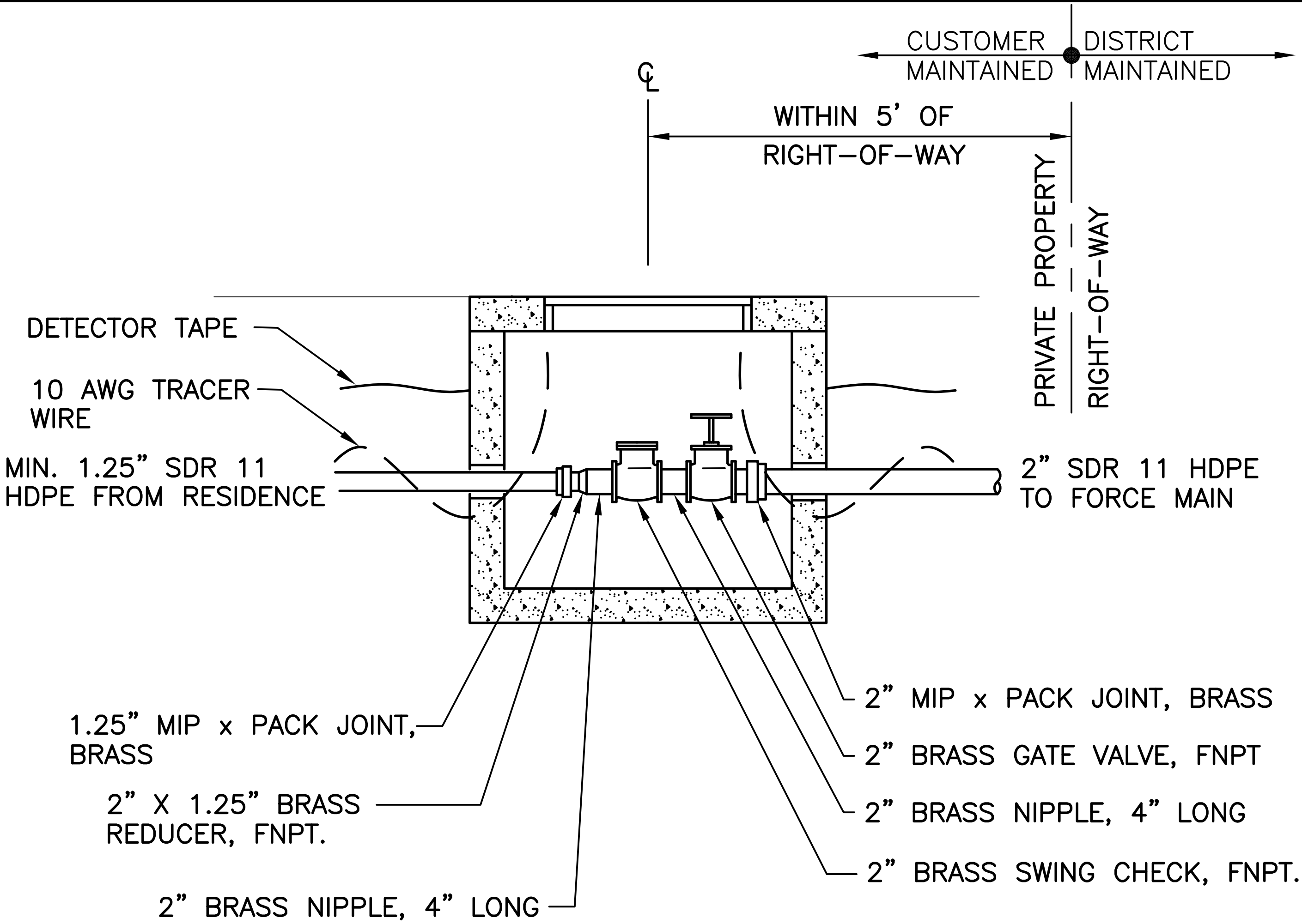
3. Ductile Iron Service Saddles. Saddles for use on ductile iron mains shall have epoxy or nylon coated ductile iron tapping saddles with stainless steel tapping mechanism. Service saddles shall be Romac style 101NS or approved equal.

4. Customer Service Shutoff Valves. Shutoff valves shall be resilient wedge type gate valves in conformance with AWWA C515. Valves shall be suitable for sewage service and be equipped with transition gaskets where needed. Gate valves shall have a non–rising stem and be fusion–bonded epoxy coated inside and out meeting AWWA C550. Gate valves shall be Clow resilient wedge gate valves or approved equal.

5. Valve boxes shall have the word "SEWER" cast into the cover.

6. Fittings. All fittings shall be brass.

CONNECTION TO FORCE MAIN	STANDARD DETAIL S11 9/20/2017



Notes

1. Check Valve. Check valve shall be horizontal swing type manufactured out of brass and be pressure rated to 125 psi. Valve shall have metal to metal seal and threaded NPT end connections. Valve shall be a Milwaukee Valve UP509 or equal.

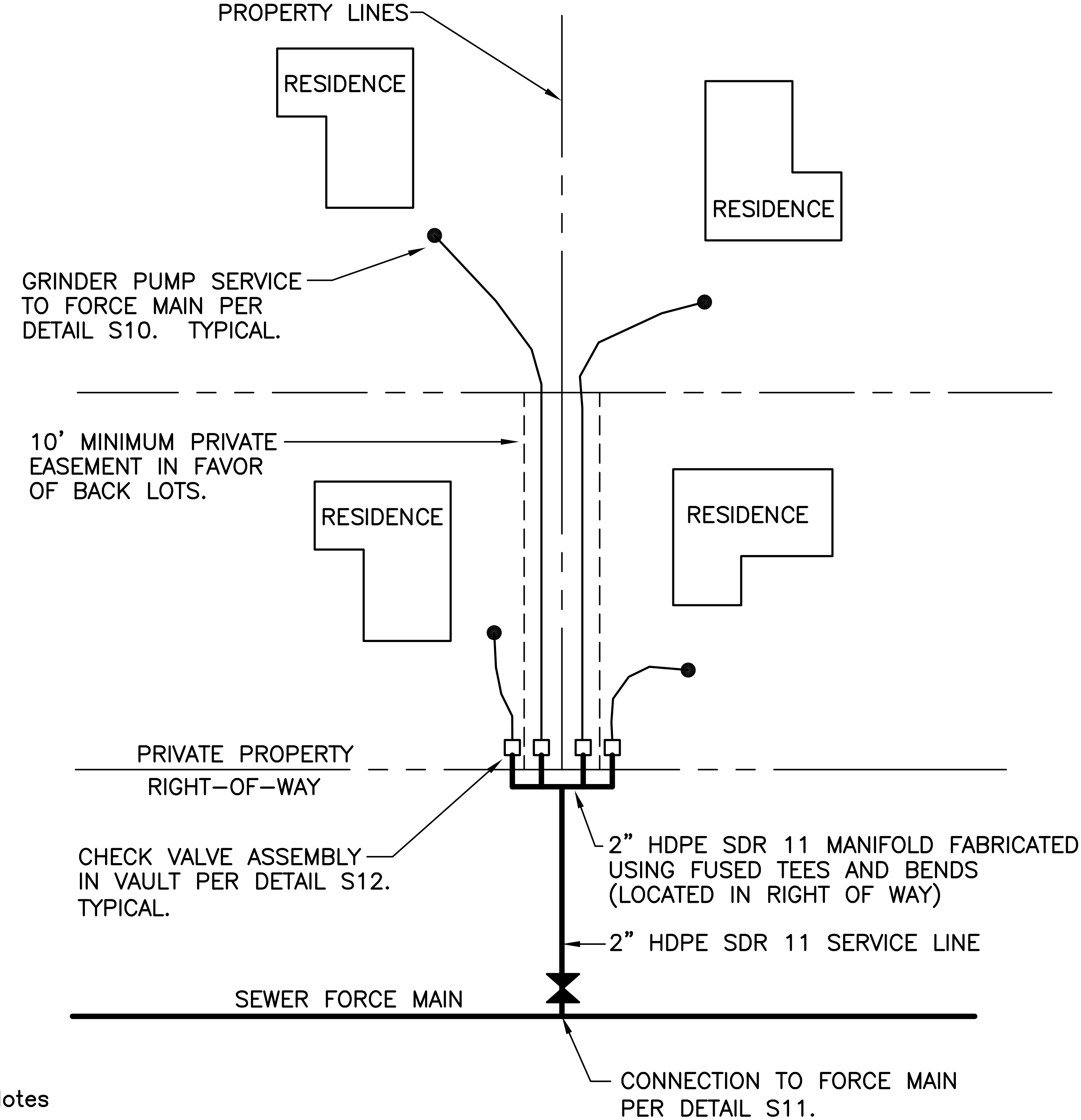
2. Gate Valve. Gate valve shall be manufactured out of brass and be pressure rated to 200 psi. Valve shall have threaded bonnet and non-rising stem. Valve shall be a Watts Regulator Company Series WGV-X or equal.

3. Vault. Vault shall be a pre-cast concrete hand hole with a 2'-0" by 3'-0" inside diameter and a maximum 4'-0" inside depth. Hand hole and access hatch shall be traffic rated. Access hatch shall be galvanized steel checker plate with pick holes and bolt down holes in plate. Check valve vaults shall be Utility Vault Model 2436 hand hole or approved equal.

4. Air/Vacuum Valve. Where required, air relief and combination air relief/ vacuum relief valves shall be as manufactured by Orenco, Apco, Crispin, ARI, or equivalent for sewer service. All valves shall be on private property and be fully accessible to enable customer's operation, maintenance and repair.

5. Fittings and Adapters. All fittings and adapters shall be brass.

FORCE MAIN SERVICE CHECK VALVE	STANDARD DETAIL S12 9/20/2017

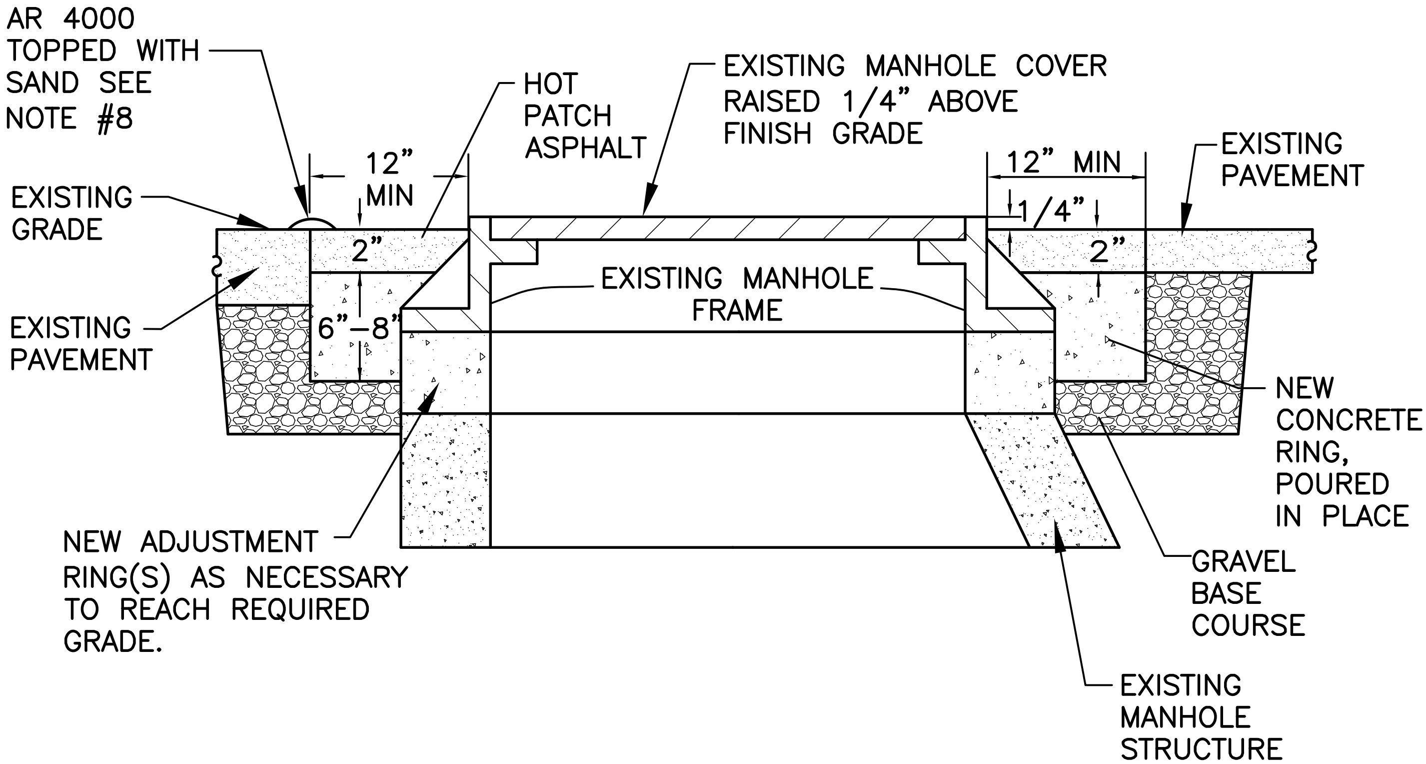


Notes

1. If approved by the District Engineer, a single 2" service tap may be shared with multiple residences. District will review requests for shared taps on a case by case basis. Property owners desiring to install a shared tap, shall individually but at the same time, submit a sewer permit application with the grinder pump check list for review by the District.

2. Manifold must be fabricated using fused HDPE tees and bends by a contractor certified by a HDPE pipe or fusion machine manufacturer.

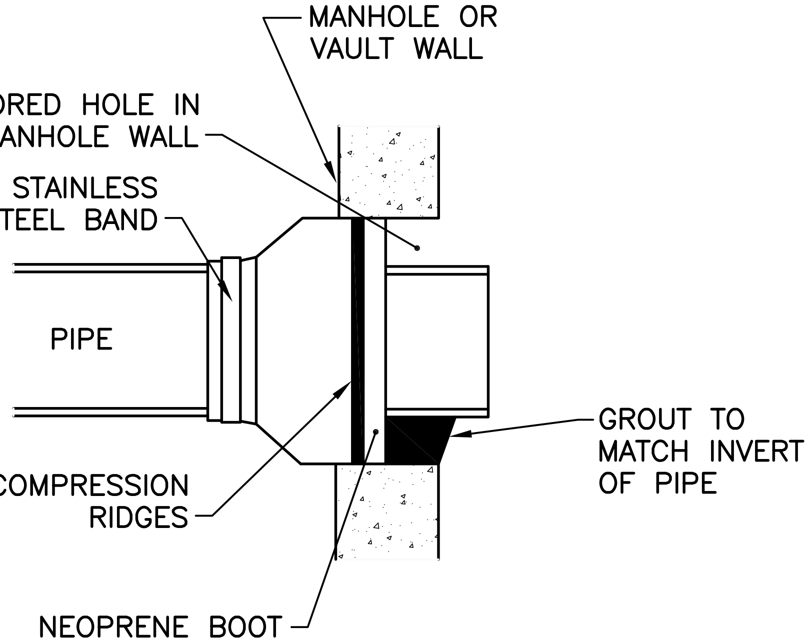
SHARED FORCE MAIN SERVICE TAP	STANDARD DETAIL S13 5/1/2014



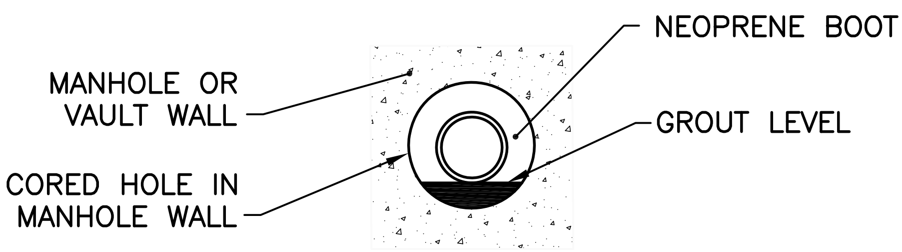
Notes

1. All manhole frames and covers shall be removed, cleaned and raised to finished grade.
2. Cut the asphalt or remove shoulder ballast in an even circle around the structure casting to be adjusted.
3. Remove the fill material within the cut pavement or shoulder area to 8 inches below finish grade, or to expose adjustment ring.
4. All joints shall be grouted with material conforming to WSDOT 9-20.3(2).
5. Place Portland Cement concrete to within the top 2 inches of finish grade.
6. Apply tack to the structure casting, cut pavement, and PC concrete.
7. Place and compact 2 inches hot mix asphalt patch to finish grade.
8. Seal pavement joints with hot AR4000 and top with sand.

MANHOLE RIM & VALVE BOX RE-ADJUSTMENT	STANDARD DETAIL S14 9/20/2017



FLEXIBLE SEAL ADAPTER

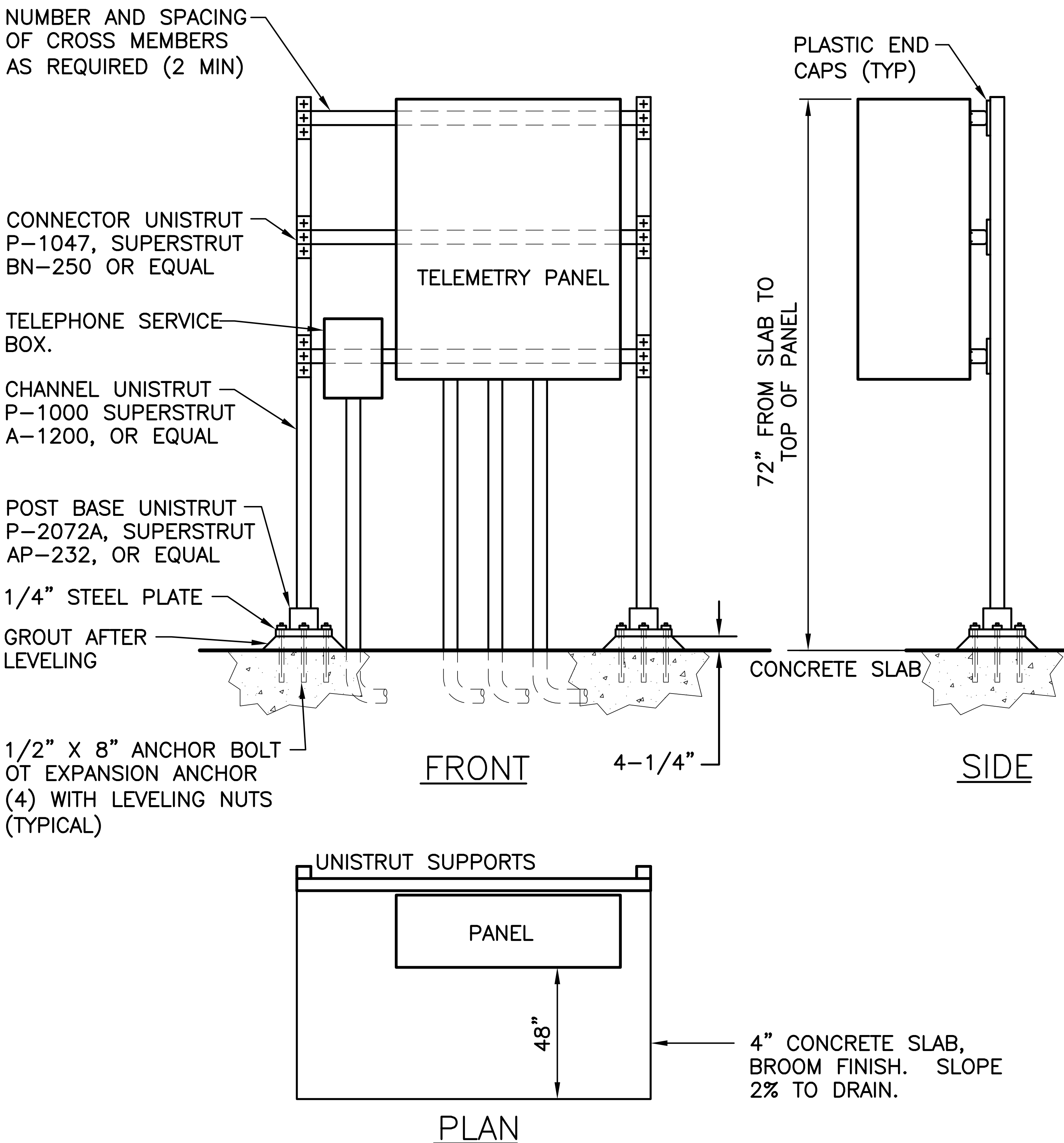


GROUT DETAIL

NOTES:

1. ALL MANHOLE CONNECTIONS SHALL BE 100% WATERTIGHT.
2. ALL PIPE SHALL EXTEND 2" INTO MANHOLE.
3. NEOPRENE BOOT ON THE FLEXIBLE SEAL ADAPTER SHALL BE A MINIMUM OF ⅜" THICK PER ASTM C-443, AND SHALL BE HELD IN PLACE WITH AN INTERNAL EXPANDING STAINLESS STEEL BAND SUCH AS "KOR-N-SEAL" OR APPROVED EQUAL.
4. DEFLECTION AT THE ADAPTER MUST NOT EXCEED MANUFACTURER'S RECOMMENDATION. IF SLOPE OF PIPE AT PENETRATION EXCEEDS RECOMMENDED DEFLECTION, CAST OR CORE HOLE AT AN ANGLE SUCH THAT DEFLECTION DOES NOT EXCEED MANUFACTURER'S RECOMMENDATION.

MANHOLE PIPE PENETRATION DETAILS	STANDARD DETAIL S15 9/20/2017



NOTES:

1. Rack channels and fittings shall be hot dipped galvanized steel.

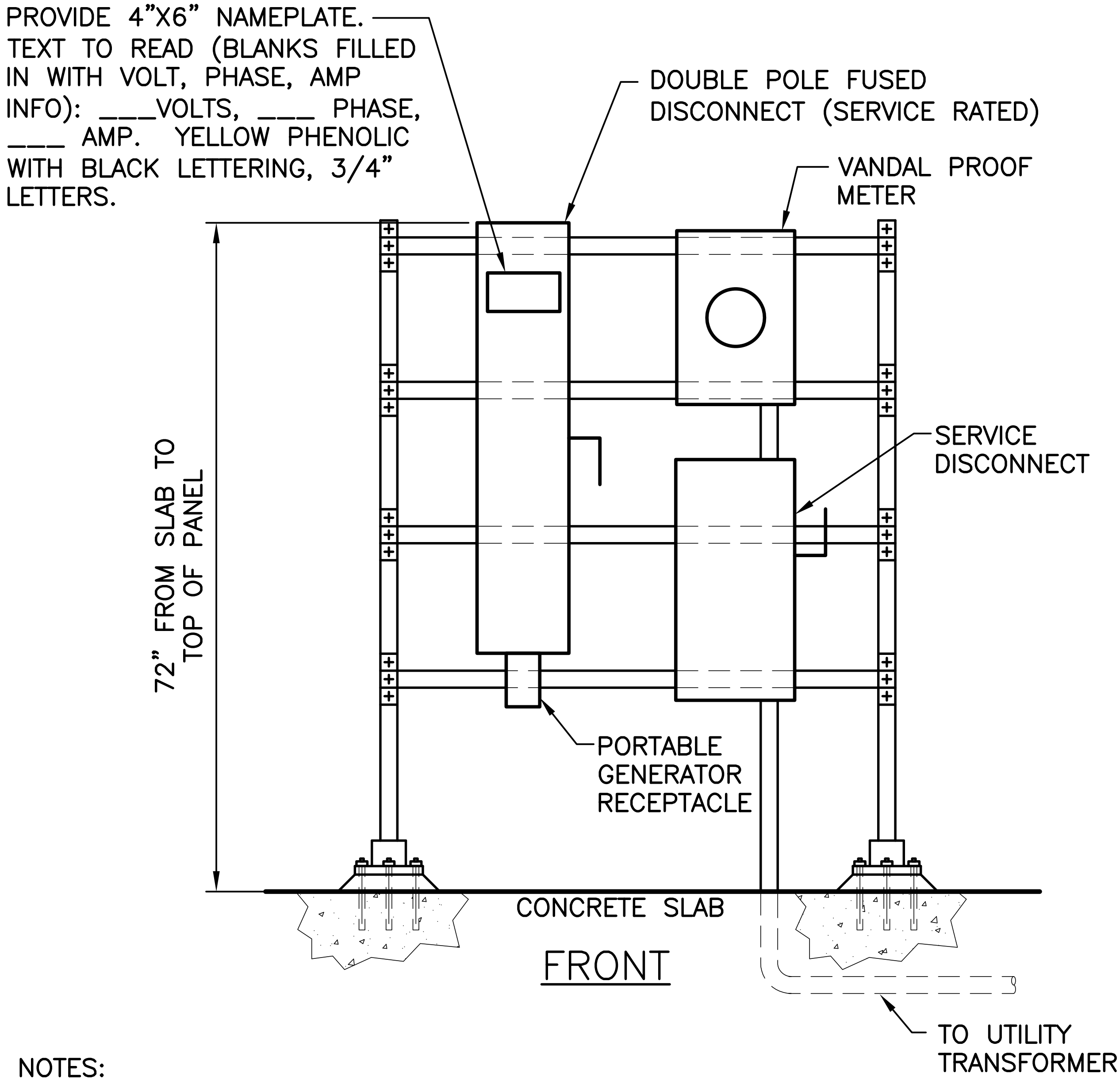
2. Telephone service lines shall be installed in conduit, both above and underground.

TELEMETRY PANEL

STANDARD DETAIL

E1

5/1/2014



FRONT

NOTES:

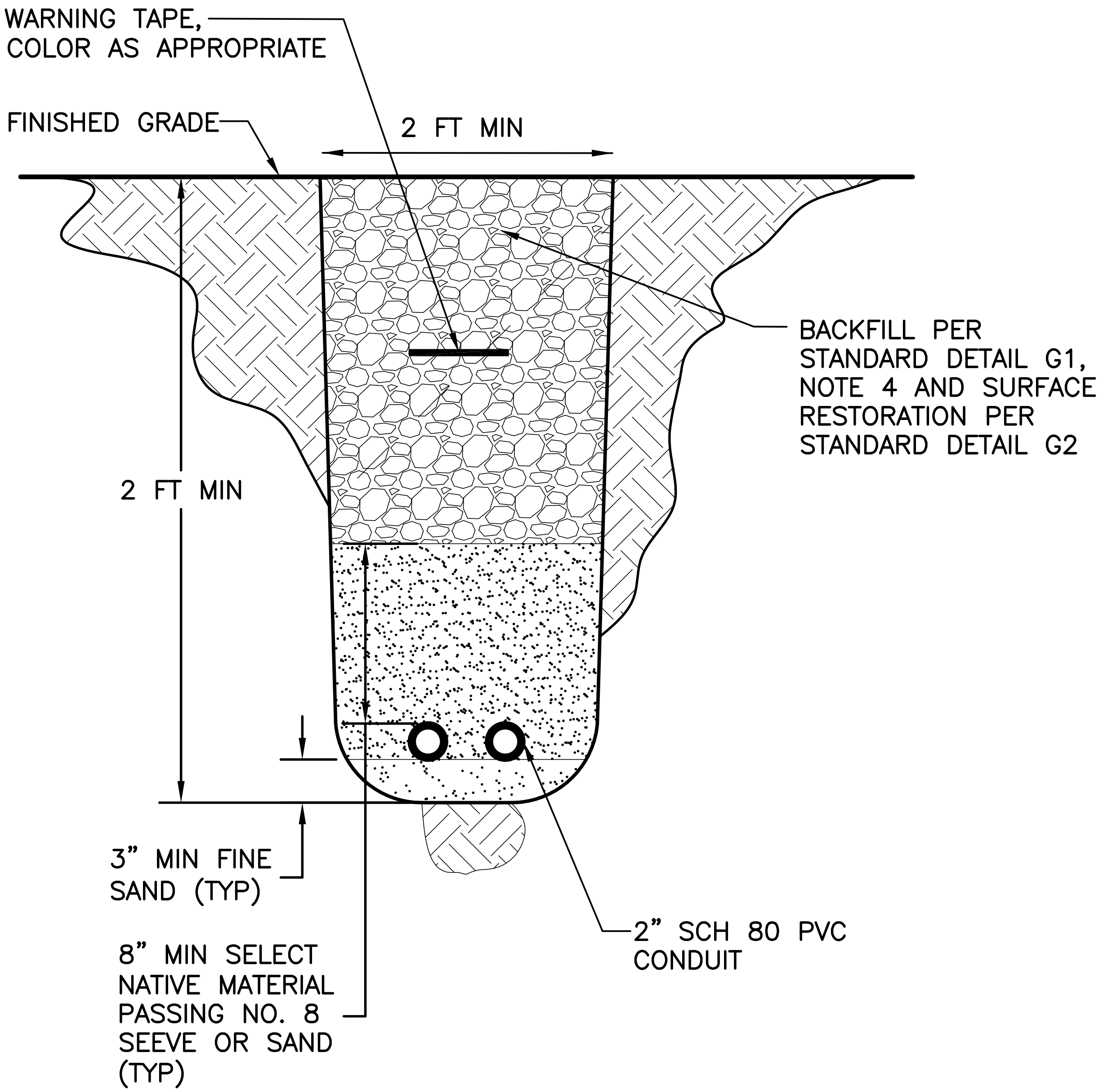
1. See LWWSD Standard Detail E1 – Telemetry Control Panel for unistrut system and concrete slab requirements. Concrete slab shall extend out 48" from face of panels.

2. Utility equipment may be mounted on back of telemetry panel rack.

3. Portable generator receptacle shall be 480 volt, 3–phase, 4 wire service, 100 amp with reversed contacts (female). Receptacle shall be provided complete with cast back box, angle adapter, gaskets, and a gasketed screw–type, weathertight cap with chain fastener. Receptacle shall be Crouse–Hinds "Arktite", Appleton "Powertite", or approved equal.

4. Manual transfer switch shall be a heavy duty (not general or light duty) double–throw MTS, fused as required to comply with NEC as manufactured by Cutler Hammer, Square D, Westinghouse, or equal.

UTILITY EQUIPMENT RACK	STANDARD DETAIL E2 5/1/2014

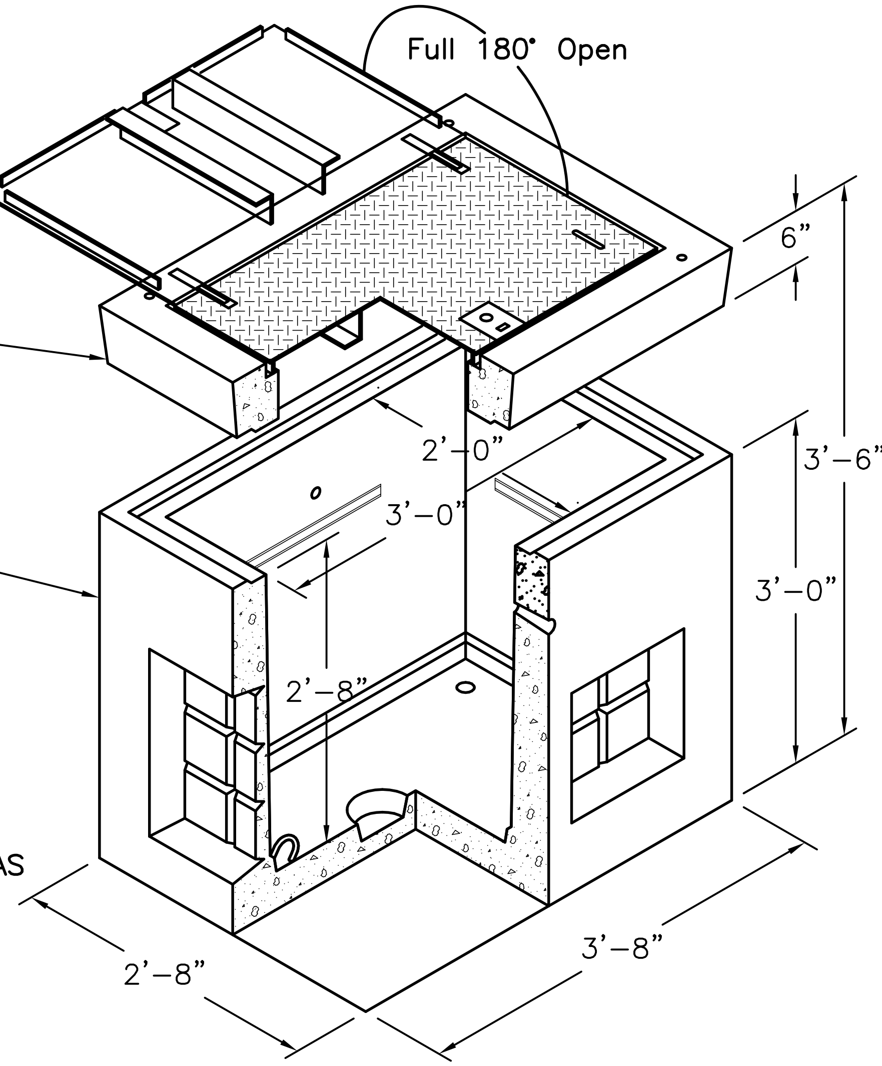


SCHEDULE 80 PVC TRENCH

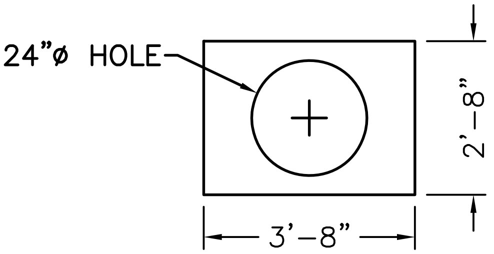
STANDARD DETAIL

E3

9/20/2017



COVER FOR PAVED TRAFFIC AREAS



No. 23–24C WITH 4220 DUCTILE
IRON COVER AND FRAME.

NOTES:

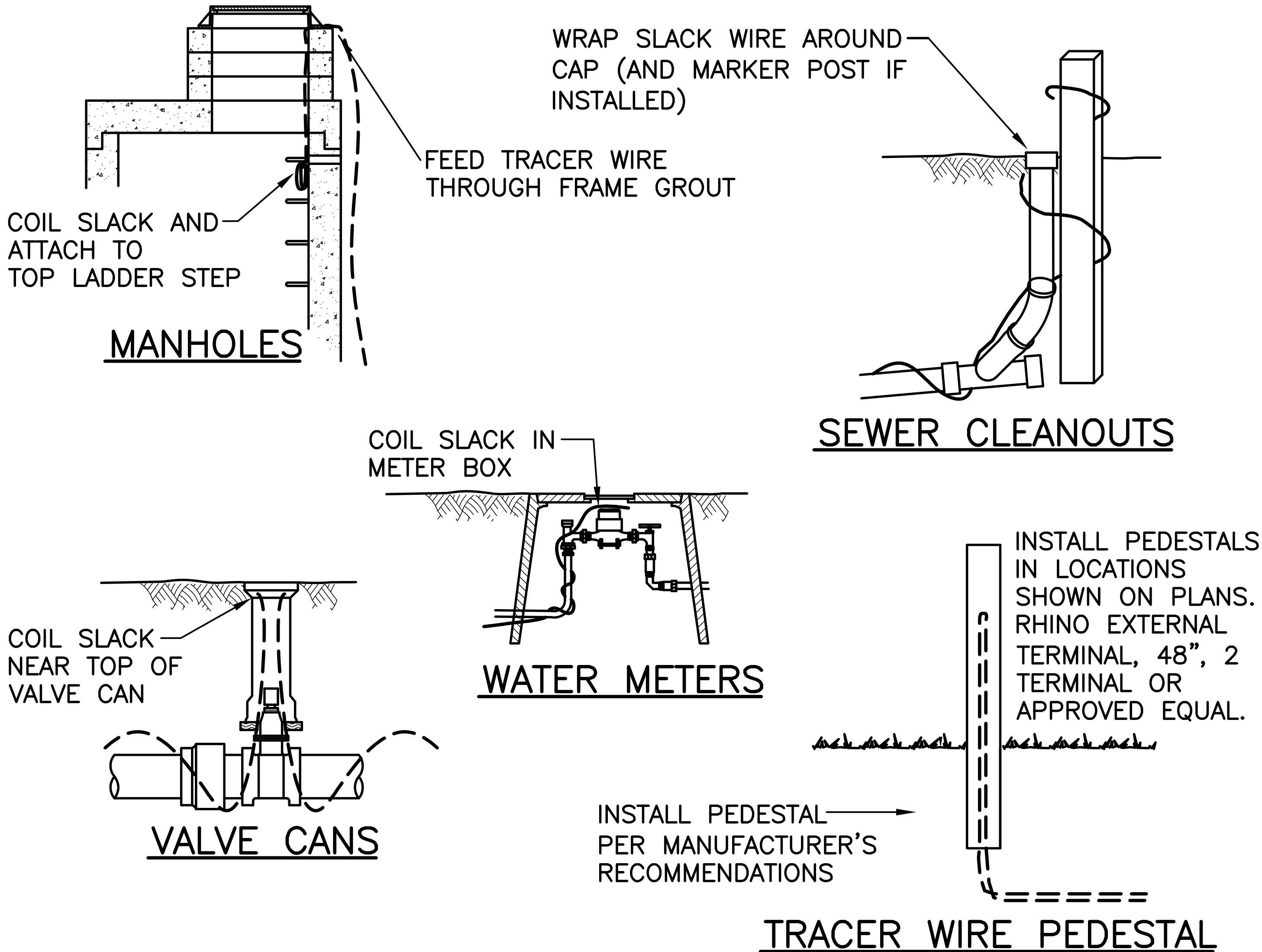
1. Utility Vault base No. 233–LA or approved equal. Dimensions shown as minimum.

2. Covers shall be rated for H–20 traffic loads. In non–traffic and gravel shoulder areas install hatch cover No. 23–2436P. In paved traffic areas install 4220 Ductile Iron Cover and Frame.

3. Sump knockout in floor.

4. Handholes shall be spaced every 500 to 1000 feet and installed at changes in conduit direction.

HANDHOLE	STANDARD DETAIL E4 9/20/2017



NOTES:

1. Tracer wire installation is required on all District owned pipe and communication lines. Tracer wire is also required on private side sewers.

2. Tracer wire shall be 10 AWG insulated copper wire rated for direct burial in wet locations. Use green insulation for sewer, blue insulation for water, and orange insulation for fiber/communication related utilities.

3. Install tracer wire in continuous lengths (no splices) between surface access points. Any direct bury splices shall be approved and inspected by the District Engineer prior to cover. Splices shall be made with silicone filled wire nuts rated for direct burial in wet locations such as "Ideal Underground Wire Connectors", "Ideal Mudbug Connectors," "Copperhead Snakebite Connectors," or "3M DBR Direct Bury Splice Kit."

4. Tape tracer wire to pipe at 10-foot intervals.

5. Provide at least 2-feet of coiled tracer wire slack at surface access points.

TRACER WIRE	STANDARD DETAIL E5 9/20/2017

Appendix I – Capital Improvement Plan – 2017 Update

Active Capital Improvement Projects

(values updated 10/30/2017)

Category	Project #	Project Title / Tasks	Projected Budget to Completion	Spent to Date	Amount Remaining	Notes
		Grant, Loan, and Bond Funded Projects				
Sewer	C1705	Geneva and Par Sewer Pump Stations				
		Geneva Pump Station Construction Estimate	$ 500,000.00	$ -	$ 500,000.00	RH2 estimate $493k
		Geneva Force Main Construction Estimate	$ 90,622.83	$ -	$ 90,622.83	RH2 estimate range $65k - $100k
		Assign Remaining 2016 Revenue Bond Funds	$ 590,622.83	$ -	$ 590,622.83	
		Sewer/Storm Water Contingency Fund Projects				
Sewer	C1607	Lake Whatcom North Shore Water Quality Testing				Coodination with City/County
		Herrera - Quality Assurance Project Plan	$ 18,052.00	$ 18,052.00	$ -	Original Agreement
		Herrera - Sampling, Data Analysis, Reporting	$ 69,295.00	$ 69,295.00	$ -	Amendment #1
		T&M Consultants for 2017 (Herrera, Attorney, Wilson)	$ 15,000.00	$ 6,773.95	$ 8,226.05	Misc Support
		T&M Consultants for 2018	$ 50,000.00	$ -	$ 50,000.00	Misc Support
		Grand Total for Sewer/Storm Water Contingency Projects	$ 152,347.00	$ 94,120.95	$ 58,226.05	
		Rate Funded Projects				
Sewer	C1407	Lowe Sewer PS VFD	$ 10,000.00	$ 6,548.68	$ 3,451.32	
Water	C1504	Reservoir Site Security	$ 5,000.00	$ 4,297.07	$ 702.93	
Water	C1605	Water System Plan Update	$ 111,813.00	$ 95,038.00	$ 16,775.00	Incl T/O Amend #1
Water	C1610	Little Strawberry Water Leak on Bridge	$ 10,000.00	$ -	$ 10,000.00	
Sewer	C1611	Country Club Sewer Pump Station				
		BHC Design, Permitting, Bidding	$ 206,222.00	$ 55,199.44	$ 151,022.56	Incl Amend #3
		BHC Services During Construction - Estimate	$ 80,000.00	$ -	$ 80,000.00	BHC estimate $75k
		Construction - Estimate	$ 450,000.00	$ -	$ 450,000.00	BHC estimate $435k
Sewer	C1705	Geneva and Par Sewer Pump Stations				
		RH2 Design, Permitting, Bidding	$ 269,288.00	$ 105,459.78	$ 163,828.22	Incl Amend #2
		RH2 Services During Construction - Estimate	$ 80,000.00	$ -	$ 80,000.00	
		Par Construction Estimate	$ 400,000.00	$ -	$ 400,000.00	RH2 estimate $386k
		Geneva Pump Station Construction Estimate	$ -	$ -	$ -	See bond funded projects above
		Geneva Force Main Construction Estimate	$ -	$ -	$ -	See bond funded projects above
Sewer	C1707	Beaver, Flat Car Level Transmitter Replacement	$ 50,000.00	$ 2,538.42	$ 47,461.58	
Sewer	C1709	CMOM	$ 25,000.00		$ 25,000.00	
Water	C1713	Eagleridge Booster Station - Decommission Pumps	$ 55,000.00		$ 55,000.00	
Sewer	C1716B	Geneva Booster Station - PRV's,Backflow, Roof	$ 40,000.00	$ 10,680.16	$ 29,319.84	
		Grand Total for Rate Funded Projects	$ 1,792,323.00	$ 279,761.55	$ 1,512,561.45	

Lake Whatcom Water and Sewer District - Capital Improvement Plan 2018 thru 2023

Program Area / CIP Project # / CIP Project Name		Fund	Total	2018	2019	2020	2021	2022	2023
Both Water and Sewer									
0175	Shake Alert Pilot Program - Integrate Device into SCADA - Auto Close Exist Seismic Valve at Div 22 Res		15,000	15,000					
A0005	Accounting & Administration Server - Replace/Update Hardware, Network Security, & OS		50,000			25,000			25,000
E0001	Replace Backhoe and Add Trailer		87,550			87,550			
E0002	Replace 5-yard Dump Truck		123,600					123,600	
E0008	Replace Flush and Vac Truck		420,000		420,000				
V0001	Replace Tool Truck (7 tool trucks in fleet)		195,000		65,000		65,000		65,000
V0002	Replace Administrative Staff Vehicle (4 cars in fleet)		26,000				26,000		
V0004	Replace Light-Duty Truck		35,000		35,000				
	Subtotal		**952,150**	**15,000**	**520,000**	**112,550**	**91,000**	**123,600**	**90,000**
Sewer System									
0032a	Agate Bay Pump Station - Predesign and Shorelines Permitting		100,000					100,000	
0032b	Agate Bay Pump Station - Design and Bidding		125,000						125,000
0044a	Edgewater Pump Station - Predesign and Shorelines Permitting		100,000				100,000		
0044b	Edgewater Pump Station - Design and Bidding		100,000					100,000	
0044c	Edgewater Pump Station - Construction		500,000						500,000
0053a	Dellesta Pump Station - Predesign and Shorelines Permitting		100,000			100,000			
0053b	Dellesta Pump Station - Design and Bidding		100,000				100,000		
0053c	Dellesta Pump Station - Construction		500,000					500,000	
0055a	Rocky Ridge Pump Station - Predesign and Shorelines Permitting		100,000		100,000				
0055b	Rocky Ridge Pump Station - Design and Bidding		100,000			100,000			
0055c	Rocky Ridge Pump Station - Construction		555,000				555,000		
0056a	Lakewood Pump Station - Predesign and Shorelines Permitting		100,000	100,000					
0056b	Lakewood Pump Station - Design and Bidding		100,000		100,000				
0056c	Lakewood Pump Station - Construction		595,000			595,000			
0128c	Camp Firwood Stationary Generator Design/Permitting/Easement		25,000	25,000					
0128d	Install Camp Firwood and Airport Sewer Pump Station Stationary Generators		115,000		115,000				
0157	Install Ball Check Valves at Cable, Ranch House, Flat Car, Beaver		106,090				106,090		
0161	Stationary Generator Closed Loop Cooling Retrofit - North Point, SV, Flat Car, Beaver		212,180						212,180
0163	Euclid Sewer Pump Station - Replace Controls, Add Transfer Switch, and Stationary Generator		159,135		159,135				
A0010	Update Sewer Comprehensive Plan (Current Plan Dated 6-14-2014)		71,027		71,027				
E0003	Replace Sewer Camera Vehicle		77,613					77,613	
E0004	Replace Camera Equipment		39,140					39,140	
S0001	EPA Capacity, Management, Operations, & Maintenance (CMOM) Projects - Sewer I&I		825,000		165,000	165,000	165,000	165,000	165,000
	Subtotal		**4,805,186**	**125,000**	**710,162**	**960,000**	**1,026,090**	**981,753**	**1,002,180**

051

Program Area / CIP Project # / CIP Project Name		Fund	Total	2018	2019	2020	2021	2022	2023
Water System									
0164	1010 Lakeview Street - Demo Old Concrete Reservoir		100,000			100,000			
0176	SVWTP - Replace 6 Turbimeters and 2 Chlorine Analyzers		38,000	38,000					
W0002a	Water System Rehab and Replacement Projects		500,000		100,000	100,000	100,000	100,000	100,000
W0002b	Water Meters - Radio Read Module Replacement		284,000	284,000					
W0002c	Water Meters - Radio Read Module Replacement		500,000		100,000	100,000	100,000	100,000	100,000
W0005	Reservoirs - Inspection & Maintenance		60,000	30,000					30,000
	Subtotal		**1,482,000**	**352,000**	**200,000**	**300,000**	**200,000**	**200,000**	**230,000**
* Note: Cost Estimates in 2018 Dollars	**Grand Total**		**7,239,336**	**492,000**	**1,430,162**	**1,372,550**	**1,317,090**	**1,305,353**	**1,322,180**

052

Capital Improvement Project List
Unscheduled Projects

CIP #	Project Name	Cost Est in Year $		Business Risk Exposure
Both Water and Sewer				
0169	Centimeter-Grade GPS Receiver	$15,000.00	in 2015	1
0142	Upgrade Shop Security Cameras and Coverage	$15,000.00	in 2016	1
0100	Car-Port Along Fence to Cover District Vehicles/Equipment	$250,000.00	in 2012	1
0143	Public Art at Cable Street (need to develop scope/fee and see if Board is interested)	$10,000.00	in 2016	1
0134	Kubota Jack Hammer Attachment	$11,500.00	in 2017	1
	Subtotal	$301,500.00		
Sewer System				
0124	Rehabilitate Old Flat Car Sewer Pump Station - Construction	$75,000.00	in 2015	42
0151	Pigging - Lake Whatcom Boulevard Interceptor	$50,000.00	in 2016	21
0152	Pigging - Lake Louise Road Interceptor	$30,000.00	in 2016	21
0153	Pigging - Cable Street Force Main	$35,000.00	in 2016	21
0154	Pigging - Plum Basin Gravity Outlet at Lake Whatcom Boulevard Interceptor	$20,000.00	in 2016	18
0171	Sudden Valley Sewer Pump Station - Recondition Electrical Controls	$150,000.00	in 0	18
0172	Flat Car Sewer Pump Station - Recondition Electrical Controls	$150,000.00	in 0	16
0173	Beaver Sewer Pump Station- Recondition Electrical Controls	$150,000.00	in 0	16
0160	Sudden Valley Sewer Pump Station - Recondition Drywell Pumps and Motors	$20,000.00	in 2016	14
0170	Telemtry-SCADA Reconfiguration between Beaver and Flat Car	$25,000.00	in 2015	14
0162	Lowe Sewer Pump Station - Retrofit Overhead Power to Underground Power	$50,000.00	in 2016	12
0156	Austin Sewer Pump Station - Install Ball Check Valves and Flow Meter	$15,000.00	in 2016	12
0155	Lake Whatcom Boulevard - Replace ~200LF at Gravity Outlet	$50,000.00	in 2016	9
0159	Airport Sewer Pump Station - Increase Pump Capacity (higher head pumps)	$30,000.00	in 2016	4
	Subtotal	$850,000.00		
Water System				
0144	South Shore Water System - 1992 SVWTP 0.235MG Chlorine Contact Tank Seismic Retrofit - Priority 2	$156,000.00	in 2016	70
0145	South Shore Water System - 1971 Division 7 1.0MG Reservoir Seismic Retrofit and Coatings - Priority 1	$721,000.00	in 2016	70
0146	South Shore Water System - 1971 Division 22 0.5MG Reservoir Seismic Retrofit and Coatings - Priority 3	$367,000.00	in 2016	70
0147	South Shore Water System - 1973 Division 30 0.15MG Reservoir Seismic Retrofit and Coatings - Priority 4	$541,000.00	in 2016	60
0148	South Shore Water System - 1979 Geneva 0.5MG Reservoir Seismic Retrofit - and Coatings Priority 5	$505,000.00	in 2016	50
0084a	Agate Heights Water System - Phase 1 WTP Upgrade 1/3 capacity (from 30gpm to 60gpm)	$485,000.00	in 2013	40
0110	Security - Intrusion Alarms at Reserviors, Cameras as SVWTP AHWTP	$10,000.00	in 2015	18
0083	South Shore Water System - SVWTP - Transfer and Transmission Pump VFD's	$425,000.00	in 2009	15
0135	Automatic Valve Excerciser (need to get quote)	$25,000.00	in 2016	1
0165	South Shore Water System - SVWTP - Spare Transfer Pump	$10,000.00	in 2016	1
0166	South Shore Water System - SVWTP - Convert from Chlorine Gas to Liquid	$100,000.00	in 2016	1

CIP #	Project Name	Cost Est in Year $		Business Risk Exposure
0186	Water Main Extension - Lake Whatcom Boulevard between Strawberry Pt and Sudden Valley	$1.00	in 2018	
0184	South Shore Water System - SVWTP - Replace Alum Tank	$1.00	in 2018	
0084b	Agate Heights Water System - Phase 2 WTP Upgrade 2/3 capacity, Tank 1 of 2, Main Ext to Trailer Park and Forks Restaurant	$1.00	in 2018	
0183	South Shore Water System - SVWTP - Remodel Entrance to have Roll-Up Door	$1.00	in 2018	
0182	All Water Systems - Pressure Monitoring and Alarming for Major Pressure Zone Areas	$1.00	in 2018	
0181	South Shore Water System - Reduce Number of Pressure Reducing Valves	$1.00	in 2018	
0180	South Shore Water System - New South Geneva Reservoir	$1.00	in 2018	
0179	South Shore Water System - Main Extension to Sudden Valley Campground	$1.00	in 2018	
0178	South Shore Water System - Glen Cove System Consolidation	$1.00	in 2018	
0084c	Agate Heights Water System - Phase 3 WTP Upgrade 3/3 capacity, Tank 2 of 2, Main Ext	$1.00	in 2018	
0185	South Shore Water System - SVWTP - Fiber Comm from SVPS to WTP (completes circuit from Shop to WTP)	$1.00	in 2018	
	Subtotal	$3,345,011.00		

Appendix N – Service Area Characteristics

SERVICE AREA CHARACTERISTICS

A. Sudden Valley

Sudden Valley is a planned community of 1,576 acres, nearly 3,000 single family lots, condominium areas, and recreational/open areas located on the west shore of Lake Whatcom. Development of the planned, residential resort began in 1968. The developers included access to all utilities, including water and sewer. Typically, the lot sizes were approximately 6,000 square feet.

The development of lots and utilities in Sudden Valley was unusual. The developers conceived the project as a single, large development with all platting and construction of utilities occurring at one time (as opposed to a phased development). The local economy experienced a down-turn in the late 1970s and early 1980s. All costs for the operation and maintenance of an extensive infrastructure had to be borne by a small base of customers. By the end of the 1970s, developers and home owners had built improvements on less than one-quarter of the lots.

1. Boundaries

For the purposes of this comprehensive plan, the Sudden Valley future service area is an area slightly larger than the original Sudden Valley development. The boundaries of the future service area follow the limits of the original development from the northwest corner of the development south and west to Lake Louise Road.

Upon reaching the District Boundaries at the boundary of Sections 7 and 18 the boundary continues east toward the lake. Beyond this point, the Sudden Valley future service area boundary deviates from the original Sudden Valley Development Boundary. The future service area boundary includes additional areas that have the *potential* for utility service (Camp Firwood, Morrison property, Lane Older, Byron Tract, Airstrip, etc.).

The Sudden Valley *Development* Boundary skirts north of an area zoned for R5A to Lake Whatcom northwest of Reveille Island. This area was down-zoned from UR3 and includes both Camp Firwood and an area of undeveloped land. This area was outside the original Sudden Valley Development. Therefore, the original developers did not design the Sudden Valley utilities, storage and treatment facilities to serve the entire area. An exception to this is the Camp Firwood area. When the Sudden Valley Development was designed, the developers negotiated with *the Firs Bible and Missionary Conference* to allow easements and a reservoir site on Camp property. As part of this negotiation, the *Sanwick Corporation* (Sudden Valley's developer) agreed to reserve service capacity for Camp Firwood. The District accepted these obligations when they accepted the Sudden Valley System in 1977, and Camp Firwood now has water and sewer service.

We have included the area within the future service area because of the proximity to the Sudden Valley Area rather than with South Lake future service area. Therefore, the Sudden Valley *future service area* Boundary includes Camp Firwood and the area potentially served by the Camp Firwood pump station.

2. Topography

The topography of the Sudden Valley Area is characterized by five topographic sub-areas. Each sub-area has its own slope orientation, height, and development and service challenges. The first area is characterized by a series of steep rides, Beaver Creek, Lake Louise Road and Lookout Mountain. The development on these ridges represents much of the Sudden Valley residential development. Further to the south, the Sudden Valley Development abuts Austin Creek and extends up the slopes of Lookout Mountain. At the extreme southeastern portion of the Area (immediately east of Lake Louise) a steep hill rises from Lake Whatcom. Sudden Valley Division 7 occupies the north side of this hill while Camp Firwood occupies the south. The remaining portion of the area is the valley floor and Lake Louise. This area is typically recreational. A topographic map of the District is included in Figure N-1.

3. Geology

The entire Lake Whatcom area forms part of the western foothills of the Cascade Range. Bedrock conditions are important considerations of the suitability of the land for different uses; the cost of development, and the production of ground water.

The predominant rock type in the Sudden Valley area consists of Tertiary sandstone, conglomerate, and shale of the Chuckanut Formation (TKc). This rock type also can be found to the north and east of Lake Whatcom.

Cross-bedding in both the sandstone and conglomerate formations are common. The relationship between the inclined bedding and fractures in the Chuckanut Formation is important to determine slope stability. Potential landslide hazards exist where either bedding or fracture planes intersect the land surface. Chuckanut Sandstone is generally a poor producer of ground water. However, wells that intercept a fracture zone can produce small yields.

4. Soils

Stream and runoff sediments (Qal) have accumulated in the delta of Beaver Creek/Austin Creek in Sudden Valley. These alluvial deposits can produce limited quantities of ground water. However, there has been no significant development of ground water within Sudden Valley.

5. Hydrology

The entire Lake Whatcom Watershed is 35,800 acres, of which approximately 5,003 acres are lake surface. The Lake itself is divided into three major basins. The deepest sections (to 100+ meters or 330 feet) are in the most southern basin north of South Bay. The large central basin has depths of over 85 meters or 280+ feet and is separated from the southern basin by the *Sunnyside Sill.* The northern basin is separated from the central basin by the *Strawberry Sill.* This is the smallest and shallowest of the basins with depths to 25 meters or 85 feet. The northern basin is separated into two minor basins by the *Geneva Sill.*

Austin Creek (and a large tributary Beaver Creek) is the major drainage course in the Sudden Valley area.

Lake Whatcom Water and Sewer District started recording daily rainfall in June 1983. The District maintains three rain gauges: one at the District shop at 1010 Lakeview Street; one at the District’s Airport Pump Station on Lake Whatcom Boulevard, and one at the Division 30 water reservoir at the south end of Sudden Valley. The City of Bellingham records their rainfall at the Post Point Sewage Treatment Plant (200 McKenzie Avenue). During some periods, there is significantly more rainfall at the Lake Whatcom Water and Sewer District rain gauge stations than at the City of Bellingham Station. The LWWSD shop recorded rainfall for the twelve months ending 1984-1985 with 60.45 inches. For the same year, the City of Bellingham recorded 36.81 inches.

On January 9-10 1983, heavy continuous rains caused major slumping of unstable soils and the failure of large debris dams on major streams. Several days of rain (January 2-8) preceded the major storm event. When rainfall occurs, part of the water runs off directly into streams or over land into the Lake within a short period. Due to the combination of shallow soils in the area, bedrock and the heavy rains, the ground was not able to absorb the water. This resulted in the accretion and subsequent failure of large debris dams.

This flooding caused major changes in Lake chemistry, turbidity, phytoplankton, and loading rates of phosphorus, sediment, and other nutrients in streams. Because of the volume and shape of Lake Whatcom, the Lake took several years to return to an equilibrium state.[1]

Future similar flooding events have the potential for similar results. During these events, the Sudden Valley Water Treatment Plant will require careful monitoring. If the changes in water character are significant enough the Water Treatment Plant may require temporary changes in operations to handle the changes in raw water quality.

Records do not show the recurrences interval or the relative magnitude of the 1983 storm event. However, in the 1983 storm five inches of rain fell within the six day period. This combined with the presence of the debris dams made it difficult to evaluate on a relative scale. The Washington State Department of Emergency Services offered long-term mitigation recommendations for their *Flood Mitigation Implementation Measure Report for Whatcom County* in November 1983 (available from Whatcom County Department of Public Works).

These recommendations included suggestions on land use planning, zoning, the installation of rain gauges in higher altitudes, and debris collectors and surge dams.

B. Geneva

1. Boundaries

The Geneva future service area represents the area between the City of Bellingham and the Sudden Valley area described above. The boundary extends west along the City of Bellingham City Limits (at Lake Whatcom) to the boundary between Township 38-North and Range 4-East Sections 33 and 34. This north-south section line represents the City of Bellingham/ Lake Whatcom Water and Sewer District boundary lines and the approximate watershed boundaries.

The limits of the Geneva future service area continue along the southern edge of potential development in this area. The area south of the future service area has been purchased by the City of Bellingham and will not be developed. The future service area boundary continues roughly east along the south edge of areas down-zoned to R5A (from RR2 and R2A) to Lake

[1] The relatively rapid return of the lake to equilibrium was to some degree a result of increased diversion by the City of Bellingham from the Middle Fork of the Nooksack into the Lake through the City's Mirror Lake Inter-basin Water diversion.

Whatcom (approximately 1/2-mile northwest of Dutch Harbor) and continuing along Lake Whatcom to the Sudden Valley boundary.

2. Topography

The topography of the Geneva area is considerably less complex than the Sudden Valley Area. Most of the area forms moderately steep, north facing slopes leading down to Lake Whatcom. A series of broad north-south ravines and ridges traverse the western portions of this area. Further to the south and east, the topography forms the broad, steep, northeast facing slopes of Lookout Mountain. A topographic map of the District is included in Figure N-1.

3. Geology

The Geneva area also forms part of the western foothills of the Cascade Range. The bedrock conditions are similar to Sudden Valley. The existence of bed rock conditions is an important determinant of the suitability of the land for different uses, costs of development, and the production of ground water.

The predominant rock type in the area consists of Tertiary sandstone, conglomerate, and shale of the Chuckanut Formation (Tkc). Cross-bedding in both sandstone and conglomerate formations are also common in the Geneva Area. Likewise, the relationship between the inclined bedding and fractures in the Chuckanut Formation is important to determine slope stability. Potential landslide hazards exist where ever either bedding or fracture planes intersect the land surface. As above, Chuckanut Sandstone is a poor producer of ground water, although wells that intercept fracture zones can produce small yields.

4. Soils

Soils in the Geneva Area are typically shallow over bedrock. There are no significant ground water sources known in the Geneva Area.

5. Hydrology

No major creeks enter Lake Whatcom in the Geneva Area. However, Whatcom Creek flows from Lake Whatcom immediately north of the future service area. Although this out-fall is outside District Boundaries, the creek is important to all water uses in the area as the natural outlet from Lake Whatcom.

C. North Shore

1. Boundaries

The eastern boundary of the North Shore future service area starts at Lake Whatcom and heads north following the City of Bellingham / Lake Whatcom Water and Sewer District boundary. It then follows the District boundary to the east. It encompasses the areas adjacent to the North Shore interceptor, pump station service areas, and gravity service areas. Much of the potential development in this service area has been eliminated through density reduction programs where the property is purchased and restricted from development.

2. Topography

The topography of the North Shore future service area can be divided into five separate sub areas. The areas furthest to the west form moderate slopes. These lead down to North Shore Road and form a portion of the southern flank of Squalicum Mountain. Several shallow ravines with associated small creeks cross this section of the area to Lake Whatcom. The area then levels to form a gently sloped area that is over 1-mile wide.

Immediately west of Agate Bay, a steep north-south escarpment marks the western boundary of the second topographic area of North Shore. As with the area described above, this second area ends with a moderately sloped area approximately 1/8 of a mile wide.

The North Shore future service area enters a third topographic area of mild slopes that form Squalicum Valley between Squalicum Mountain and Stewart Mountain. Carpenter Creek flows from Stewart Mountain through Squalicum Valley into Lake Whatcom. Further to the east, the larger Olsen Creek flows from a deep ravine on the flanks of Stewart Mountain. Close to the lake, mild slopes continue approximately 1/2 mile east along the shore before running into the steep southwest-facing slopes of Stewart Mountain.

Steep slopes beginning at Olsen Creek form the boundary of the fourth area. Steep slopes lead up to the 2,800 MSL (feet above mean sea level) peak of Stewart Mountain. More moderate slopes exist close to the lake and southwest of the BPA power line. The steeper areas northeast of the power line are zoned for Forestry.

The fifth topographic area is the small area known as Sunnyside. The areas of steep ravines and slopes are zoned ROS (Rural Open Space) and Forestry.

Beyond this last portion of the North Shore future service area, Stewart Mountain continues as a steep ridge rising from the more southern portions of Lake Whatcom. The steep west facing slopes of this area preclude development. Zoning in this area is forestry. A topographic map of the District is included in Figure N-1.

3. Geology

The predominant rock type in the North Shore Area consists of Tertiary sandstone, conglomerate, and shale of the Chuckanut Formation (Tkc). Cross-bedding in both sandstone and conglomerate formations are common. The same factors we discussed above for this rock type apply in this area.

4. Soils

Along Agate Bay, construction would find out-wash sand and gravel (Qso), and undifferentiated glacial drift (Qf) deposits. Bellingham drift (Qb), and inter-glacial sandy silt occurs north of Agate Bay. Stream and runoff sediments (Qal) have accumulated in deltas at Sunnyside. The ground water developments are typically on the glacial outwash sands and gravels mapped at Agate Bay. The alluvial deposits at Sunnyside produce limited quantities of ground water.

5. Hydrology

Several major creeks enter Lake Whatcom in the North Shore area. Olsen, Carpenter, and Smith Creeks all enter the lake from the mountains to the east and provide significant recharge to the lake.

Other, smaller creeks also add significantly to the Lake recharge. The high and steep wet-facing slopes intercept much of the summer rains and winter snows that recharge the Lake. The sparsely developed residential areas and forested slopes combine to form the conditions for high quality surface recharge. In addition to the surface creeks, recharge on these high peaks provides artesian conditions in the Squalicum Aquifer. This aquifer eventually flows into the lake and also provides a significant source of lake water.

D. South Lake

1. Boundaries

The South Lake future service area begins at the northwest corner where it connects with the southeast corner of the Sudden Valley Area. From this point, the South Lake future service area boundary continues south and east along the Lake. This includes all residentially zoned areas south of the Sudden Valley area and the North Shore area.

2. Topography

There are three major topographic regions of the South Lake future service area. From the Sudden Valley Area south to South Lake, the area is steep with east facing slopes cut by small mountain streams. Areas closer to Lake Whatcom have progressively milder slopes. Lake Whatcom Boulevard crosses close to the lake to take advantage of the milder slopes within this first topographic sub-area. The flanks of Lookout Mountain continue to rise to the west beyond the District Boundaries.

South Bay is a narrow bay extending from Lake Whatcom to the southwest. The area including South Bay and the areas from South Bay to Blue Canyon form the second topographic sub-region of the South Lake future service area. Slopes to the northwest of South Bay are steep. However, slopes to the southeast are considerably milder.

The valley southwest of the Bay broadens as it extends to the Lake watershed / District boundaries. The topography in these areas is potentially well suited for development. The zoning in these areas is R5A for rural development. The lack of utilities and roads, the rural zoning, and the physical distance to either Bellingham or the Skagit Valley has limited growth in this area. [2]

Between South Bay and Blue Canyon, the flanks of a knoll form another area potentially suited to development. The eastern slopes of the knoll are gentle and lead to the broad valley of Brannian Creek. However, the zoning is R5A so any new development will be rural in nature. The higher slopes are zoned for Forestry.

---

[2] The broadest and most developed sections of this entire area are actually beyond both the watershed and the District Boundaries. This developed area includes *Glenhaven Lakes* and *Whatcom Meadows* and surrounds Reed (394 MSL) and Cain Lakes (391 MSL). However, both of these lakes drain away from Lake Whatcom south past the town of Alger into Friday Creek and eventually into the Samish River.

The State Fish Hatchery occupies a portion of the area zoned ROS (Recreation Open Space) south of the Creek. East of Brannian Creek (and immediately west of Blue Canyon) mild slopes lead up to Anderson Mountain.

Blue Canyon also forms a steep walled canyon. The flanks of Anderson Mountain bound one side of the canyon while the northeast side of the Canyon forms slopes leading up to Stewart Mountain. The floor of Blue Canyon is narrow and contains the small Mirror Lake. The outlet to this lake flows into Lake Whatcom. The City of Bellingham uses Mirror Lake and Anderson Creek as part of the inter-basin diversion from the Middle Fork of the Nooksack River. [3]

Areas immediately to the east of Mirror Lake flow the opposite direction. The water enters the South Fork of the Nooksack River close to the town of Acme. The County has zoned almost all of the floor of Blue Canyon as R5A. The surrounding slopes are zoned for Forestry. A topographic map of the District is included in Figure N-1.

3. Geology

Near Blue Canyon, pre-Jurassic phyllite (metamorphic slate, pJm) occurs in limited quantity. The ground water characteristics are similar to those of the Chuckanut Formation near South Bay, Sudden Valley and Geneva. Water in some locations in the phyllite yield sufficient quantities for single family residential use.

4. Soils

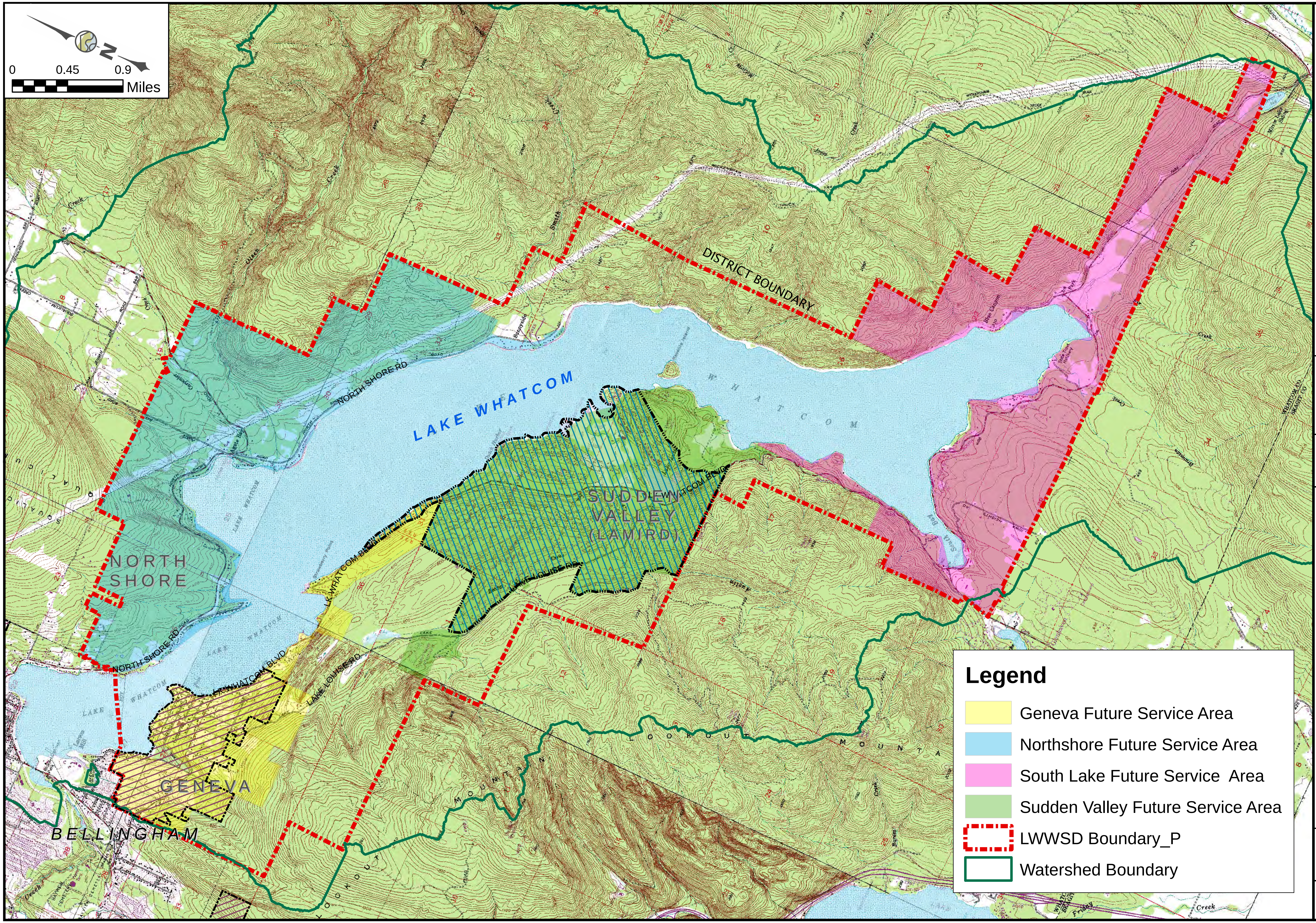
Along South Bay, there are areas of out-wash sand and gravel (Qso), and undifferentiated glacial drift (Qf) deposits. Stream and runoff sediments (Qal) have accumulated in deltas at the Lake Whatcom outlet of Anderson Creek. In some areas on the glacial out-wash sands wells have developed limited ground water. Limited quantities of ground water may also be available from the alluvial deposits at Anderson Creek.

5. Hydrology

Both Anderson Creek and Brannian Creek flow into Lake Whatcom in the South Lake area. While Anderson Creek is larger, Brannian Creek is important as a source of water for the State Fish Hatchery. Anderson Mountain, Anderson Creek, Brannian Creek and the sparse density and forestry zoning make this sub-area another valuable watershed area.

---

[3] The City of Bellingham diverts water from the Middle Fork of the Nooksack because that fork provides a better source than the closer South Fork. Waters from the Middle Fork are piped under the South Fork before entering Mirror Lake.



WILSON ENGINEERING, LLC
805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100 FAX (360) 647-9061
www.wilsonengineering.com

Wilson
SURVEY/ENGINEERING

DESIGNED BY MMM	DRAWN BY BMS	CHECKED BY MMM

LAKE WHATCOM WATER & SEWER DISTRICT

WHATCOM COUNTY WASHINGTON

FIGURE N-1
DISTRICT BOUNDARY

DATE Nov 2017	SCALE AS SHOWN	JOB NO. 2016-096

SHEET 1 OF 1