Preliminary Engineering Report
Water System Improvements

Scatchet Head Water District
PWS ID: 76470 X
Clinton, WA 98236

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Water System Improvements

The technical material and data contained within this report has been prepared by or under the direction of the following registered professional engineer(s), licensed in accordance with the laws of the State of Washington to practice in the State of Washington.

QUICK REFERENCE PROJECT INFORMATION

General Project Information

Water System	Scatchet Head Water District
Water System ID	76470 X
Project Description	Replace aging watermains, source pumps, and other treatment and source improvements
Reservoir, Pumphouse, and Well Parcel #	S8110-00-05013-0.
Consulting Engineer	Robert Bennion, PE – Davido Consulting Group, Inc.

Project Summary

Component	Description
Source	S01- Well #1: Abandoned S02- Well #2: 1980 – 10" casing – 295' deep Screened Interval: 231-234' Static Water Level – 190' S03- Well #3: 1995 – 8" casing – 403' deep Screened Interval: 242-246' Static Water Level – not recorded
Submersible Pumps	S02- Well #2 - 125 gpm, 30 HP pump, Goulds Model 160CLC030, 12 stage, 3450 rpm, 480/277 VAC, three phase S03- Well #3 - 66 gpm, Goulds Model 70J15, 15 HP, 13 stages, 3450 rpm, 480/277 VAC, three phase
Reservoirs	#1 – 300,000 gallon Guemes Avenue Reservoir: 24.0' diameter x 85' tall #2 – 120,000 gallon Maple Point Drive Reservoir: 14.6' diameter x 95.0' tall
Booster Pump Station	(4) Aurora Series 340 / 360, 7.5 HP, 3500 RPM – 200 gpm at 45 psi (260 gpm at 30 psi) Horizontal Pneumatic Tank - 2,120 gallon Canal Boiler Works 66" diameter x 10' horizontal
Structures	1,125 SF Pumphouse
Chemical Injection Systems	Hypochlorinator – Pre and Post Treatment LMI Series A17 Pump: 2.0 GPH, 50 psi
Filtration	Iron and Manganese Reduction System (4) 48" Diameter, 463 Gallon Filter Tanks
Distribution System	2" & 2.5" (various materials) – 6,636' 4" (polyvinyl chloride, PVC) – 8.695' 6" (asbestos cement, AC) – 9,755' 6" (ductile iron, DI) – 940' 6" (PVC, class 150) – 1,313' 6" (C-900 PVC, class 150) – 11,034' 8" (ductile iron, DI) – 312' 8" (C-900 PVC, class 150) – 567'

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1. PROJECT PLANNING

The Scatchet Head Water District (SHWD) is a Group A Community water system currently providing potable water to 410 connections within its service area south of Clinton, WA. The SHWD is in the southern end of Whidbey Island in Island County, Washington. See Appendix A for a detailed service area map. Figure 1 below shows the approximate site location for this project. A summary of the system connections, sources, and contacts are included in the Water Facility Inventory (WFI) from provided in APPENDIX B.

The proposed project will replace aging water mains, provide fire flow capacity throughout the distribution system, and will include other improvements to the distribution system, treatment system and sources. The total proposed projects are expected to cost $3,070,000.

1.1 Location

The water system is located on the southern end of Whidbey Island between Cultus Bay and Useless Bay as seen in Figure 1. The service area for the system is shown in Figure 2.

Figure 1: Locator map

Figure 2: Scatchet Head Water District Service Area

1.2 Environmental Resources Present

There are several sensitive areas within the SHWD as shown in Figure 3. Unstable slope areas are present at southern end of the service area along the coastline. Some streams and wetlands are also present within the service area. An environmental report is being developed to support this project. The environmental report will comply with the National Environmental Protection Act (NEPA) to support the loan application. The project is considered categorically exempt because it is replacing existing utility pipes.

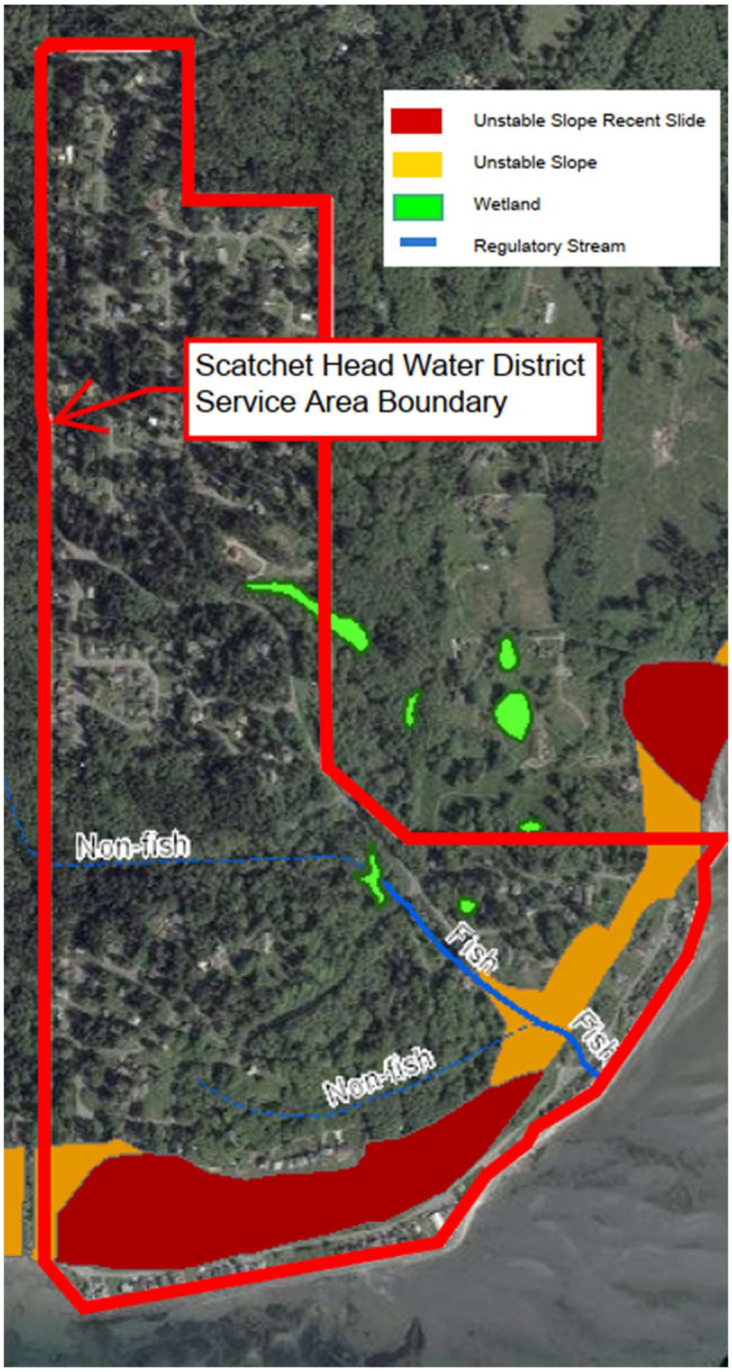


Figure 3: Sensitive Areas Map

1.3 Population Trends

The SHWD serves 409 full-time residential connection and 1 commercial connection. With approximately 900 residents, there are about 2.2 residents per connection. There are 492 residential lots within the service area. Therefore, if all residential lots are developed, the population within the service area has the potential to increase to about 1,100 residents in the future.

1.4 Community Engagement

The SHWD engages the community in the project planning process by holding monthly committee meetings and seeking community feedback. The projects proposed in this report are also discussed in the Water District's 2020 Water System Plan. With the release of the Water System Plan, the community had the opportunity to provide feedback on the capital improvements proposed in this report.

The SHWD informs the community of the aging infrastructure within the system and informs the community of the maintenance and repair costs. When water shutoffs are required for repairs, the residences are notified either in person or by phone. The members of the community are aware of the need to replace aging and failing infrastructure, including the asbestos concrete (AC) water mains.

2. EXISTING FACILITIES

2.1 History

The Scatchet Head Water District is located at the south end of Whidbey Island between Useless Bay and Cultus Bay. The SHWD provides water for the Plat of Scatchet Head (1965) and Cottage Glenn PRD (1996). Construction for the water system began in 1958.

Well #1 was the first well to supply the system and was located on Driftwood Drive (Lot 22 of Block 15). This well was abandoned in 1996 due to poor water quality. The well casing has been cut off below grade and filled in accordance with the criteria outlined by the Washington Department of Ecology. Well #2 (DOE Tag #ABR417) was first installed in 1980 and is located southwest of the intersection of George Drive and Samish Court. With the poor water quality from Well #1 on Driftwood Drive, Well #3 (DOE Tag #ABW832) was installed in 1995 on the same parcel as Well #2. In 1997, a reservoir at Maple Point for storage and a new distribution lines were added to serve 26 new lots. The wells, reservoirs, pressure zones and other facilities are shown in Figure 4.

With the installation of Well #3, the SHWD undertook a significant upgrade to the distribution system in 1999. The upgrades consisted of the installation of a dedicated transmission main from Wells #2 and #3 to the reservoir located on Guemes Avenue along with associated electrical and control elements. At the same time a building was constructed on the Guemes Avenue reservoir parcel to provide water treatment, booster pumps, and other associated appurtenances to monitor and control the distribution system. The new booster pumps allowed the reservoir to provide additional useful storage to the system and increased operating pressures. With this increase in operating pressure to replacement pressure reducing valves were installed which allowed for the removal of two old storage tanks to be abandoned.

The SHWD currently has 410 connections to its water system. The number of DOH approved connections is 451 connections. There are currently no pending requests for connections or annexations to serve property outside of the service area.

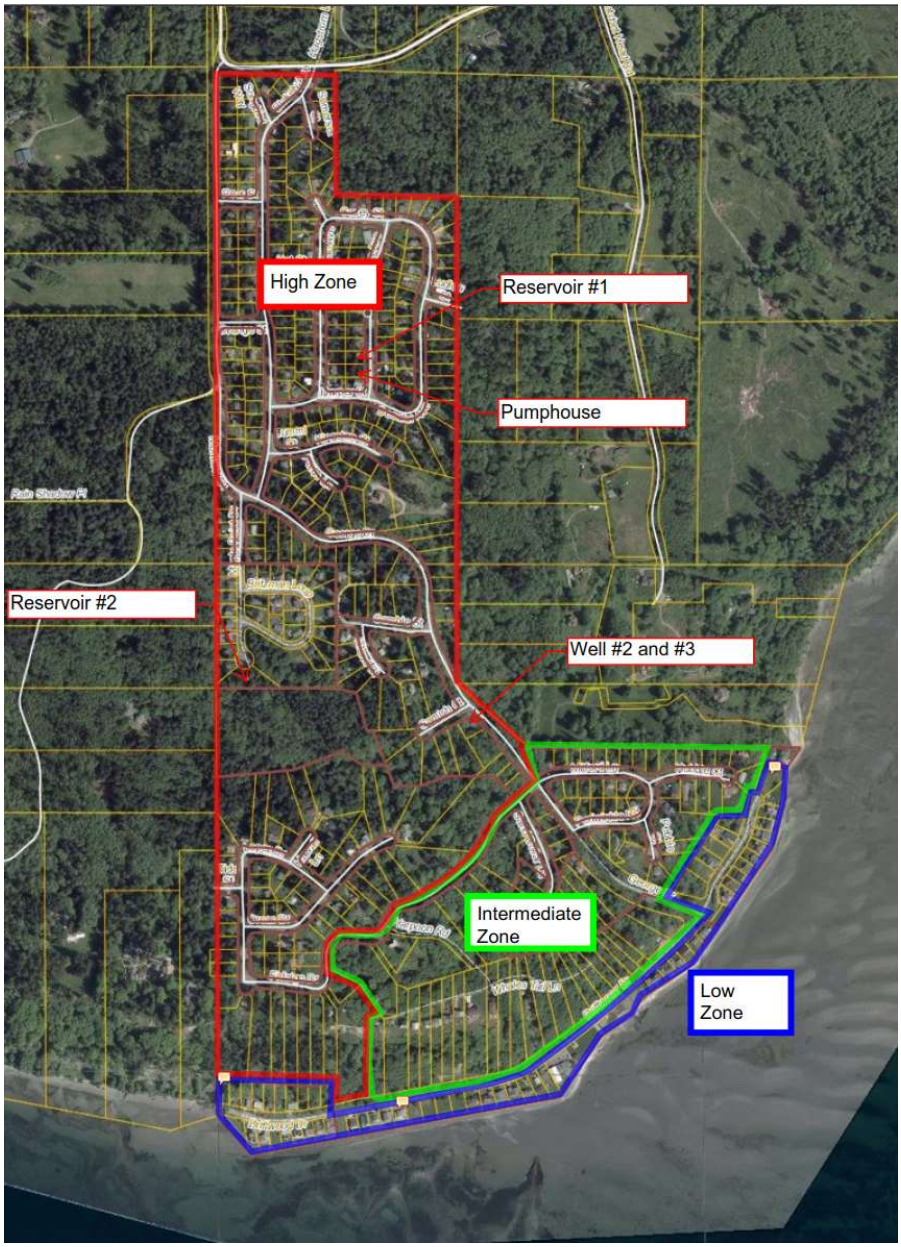


Figure 4: Pressure Zone and Facilities Map

2.2 Existing Conditions

2.2.1 Source:

The SHWD's distribution system is served by 2 groundwater wells. Both wells are located in parcel number S8110-00-12018-2. Well #2 has a capacity of 150 gpm and Well #3 has a capacity of 80 gpm (See the WFI in Appendix B). Both Wells #2 and #3 have pumps and meters that were installed in 1995 and 1997, respectively. Submersible well pumps and meters have an anticipated useful life of 10 to 15 years. Both the submersible well pumps and source meters and submersible well pumps are at or have surpassed their anticipated useful life and will need to be replaced.

In addition to the replacement of the source meter and submersible well pump, Well #3 has an undersized, 2-inch service line from the well to the pumphouse feed line. This 2-inch service line should be replaced with a 3- or 4-inch service line capable of conveying the full well capacity. Water quality data for each source is provided in Appendix F.

2.2.2 Storage:

There are two storage reservoirs in the system. Reservoir 1, located on Guemes Avenue, is a round steel reservoir with an inside diameter of 24.0-feet and a height of 85-feet with a total storage capacity of 300,000-gallons. Reservoir 2, located at the end of Maple Point Drive, has a diameter of 14.6-feet and a height of 95-feet and a total storage capacity of 120,000 gallons. Reservoirs 1 and 2 were installed in 1980 and 1997, respectively.

The existing reservoirs provide sufficient storage for the existing system demand. These reservoirs are projected to be adequate to serve the system through the projected 20-year planning period and are projected to provide at least 85% of the DOH-recommended standby storage. The only deficiency in the current storage is the ability to operate the system's booster pumps while Reservoir 1 is not in service. Piping configurations should be updated so that the system's booster pumps can still be operated while Reservoir 1 is not in service.

2.2.3 Booster Pumps, Pressure tanks, and Controls:

Four Aurora Series 340/360 7.5 hp booster pumps were installed in 1999 along with new booster pump controls. The other booster pumps appear to be functioning properly in accordance with system pressure settings. The booster pumps work in conjunction with a 2,120-gallon Canal Boiler Works pressure tank that was installed in 1980. Although it is aging, the pressure tank still functions properly and can hold pressure without any leaks. The only improvements to the booster system proposed in this project will be the modifications necessary to allow the distribution system to use the booster pumps while Reservoir 1 is not in service, as noted in Section 2.2.2.

2.2.4 Distribution System:

The system has a total of about 36,000-feet of distribution piping. The distribution piping consists of 4-inch, 6-inch, and 8-inch PVC piping, 6-inch AC piping, 6-inch and 8-inch ductile iron (DI) piping, and other 2-inch and 2½-inch piping. The larger PVC piping was primarily installed in 1996 and/or 1997. The AC, DI and other piping were installed in 1958. Distribution piping typically has an anticipated useful life of approximately 50-years. The AC piping is all over 60-years old and has been prone to leaks. This is a particular concern for the system since a 6-inch AC main down George Drive is the sole source of water for a significant number of houses in the southern portion of the system, including all of Driftwood Drive. It is recommended that the SHWD replace all the AC water mains within their distribution system.

There have been recent complaints from consumers regarding discoloration of water following recent repairs that were not satisfactorily addressed by flushing of the system. This is likely due to various parameters including various dead-end mains, improper placement of blow-off assemblies, pipe scale builds up in aging water mains, etc. When water mains are replaced, particular care should be given ensuring proper installation of pipes, placement of blow-off assemblies, and water mains should be looped to the extent possible.

The water main running north and south just west of Samish Court passes through a wetland area and is exposed, resting on wooden supports. This watermain should be prioritized for reburial or replacement, as necessary.

Currently, the system does not have fire hydrants located throughout the majority of the southern portion of the distribution system. There are various portions of the system with water mains that are insufficiently sized to provide the Island County's recommended residential fire flow rate of 500-gpm. Although the SHWD does not currently have plans to expand the service area, it would like to have the ability to serve all structures within the retain service area with hydrants capable of providing the recommended fire flow capacities. Water mains that are replaced should be sized to provide current and future demands, including residential fire flow. Hydrants should be located along the replaced water mains in accordance with Island County standards to serve structures in the service area to the extent that is particle.

2.2.5 Treatment/Pumphouse:

The system's pumphouse is located on the same property as Reservoir 1 on Guemes Avenue (Island County parcel S8110-00-05013-0). The pumphouse houses the booster pumps, pressure tanks, controls, and treatment system.

The treatment system was installed to reduce the elevated levels of ion and manganese in the system's source water. The treatment system consists of pre-chlorination, aeration, contact time in retention vessel (contact tank) and pressure filtration utilizing Birm® media. The treatment system was designed to reduce levels of iron and manganese to less than 50% of the Maximum Contaminant Level (MCL). The pre-chlorination is provided to mitigate the fouling of the treatment media by iron and sulfate-reducing bacteria. Following treatment, treated water is discharged directly to the top of the adjacent 300,000-gallon reservoir. The chlorinator and filtration system were installed in 2001. These systems typically have a life expectancy of about 30 years. The treatment system currently provides sufficient disinfection and has capacity to meet the current demands through the initial planning period. Filters are individually backwashed with backwash water discharged into a storage pond located directly adjacent to the pumphouse. The storage pond water is used to irrigate the lawn of the neighboring parcel since the lot's soils do not provide sufficient infiltration capabilities.

The treatment system's filter backwash rate is about 15%, which is higher than what would be anticipated from similar systems. This excessive backwash rate is indicative of an inefficient filtration process. The filter media has not been replaced since the original installation and is past its anticipated useful life. Well #3 in the system has had high arsenic values but is being mixed with Well #2 to keep system values under the MCL. It is anticipated that the proposed improvement will not have sufficient funds to address arsenic treatment. At a minimum, the filter process should be analyzed to ensure proper dosing and backwash and the filter media should be replaced.

The pumphouse has experienced leaking and a deterioration of the ductile iron piping within the building in the past few years. The chlorine storage tank is currently kept too close to the piping and accelerates the oxidation process. The corroded piping needs to be replaced, and the chlorine storage tank needs to be moved to a new location where it will be sealed off from the ductile iron piping and proper ventilation provided.

As it is currently configured, the filter-backwash process is pressurized from the booster pumps located within the pumphouse. However, as noted above, in the event that Reservoir 1 is taken offline for maintenance or repairs, the booster pumps are unable to function since the booster pumps are fed from Reservoir 1. In these circumstances the treatment system is taken offline until the reservoir is back in service. An analysis should be performed to determine if a piping configuration can be developed to allow booster pumps system to function while Reservoir 1 is not in use.

2.3 Financial Status of Any Existing Facilities

The expenditures and incomes for the SHWD have been compiled and outlined in Table 1 below. Detailed financial data are available in Appendix D.

Table 1: SHWD Expenditures and Income for 2016, 2017, 2018 and 2020

Year	Total Expenses	Total Income	Net Income
2016	$127,881	$134,910	$7,029
2017	$136,574	$141,442	$4,867
2018	$150,344	$137,334	-$13,011
2020 (anticipated expenses & income)	$117,150	$170,900	$53,750

In 2016 and 2017, the SHWD had a net positive income of about $7,000 and $4,900. However, in the year 2018, there was a net deficit of $13,000. In 2019 and 2020 the SHWD updated their comprehensive Water System Plan with the Washington Department of Health. With the update, the system's financial data was analyzed in conjunction with the anticipated Capital Improvement needs for the system. Due to this analysis, the SHWD implemented a revised rate structure with the intent of funding system needs into the future. In 2020, the SHWD is expected to have a net surplus of about $54,000 due to increased water rates starting in 2020.

Detailed financial sheets are included in Appendix D of this report. An engineer's preliminary construction cost estimate was completed and shows that the proposed system upgrades would cost approximately $3,070,000 (see Appendix D). The SHWD is currently in the process of finalizing an interim loan to pay for the upfront costs associated with design and contract development prior to approval of the USDA Rural Development loan. This report has been prepared for application to the USDA Rural Development Program to acquire the needed funding to complete this project.

2.4 Water/Energy/Waste Audits

The most recent Water Efficiency Reports submitted to the Washington State Department of Health (DOH) are included in Appendix E of this report. The system is 100% metered. The reported average Distribution System Leakage (DSL) in 2019 was 14.1%.

The SHWD is designated as a group A Community Water System by the DOH. Using data from the 2019 Water Use Efficiency Report, the ADD (average day demand) was found to be 139 gpd/ERU. The ADD is consistent with other residential communities on Whidbey Island.

3. NEED FOR PROJECT

3.1 Health, Sanitation and Security

In the existing conditions, the SHWD is at risk of failed water mains, well pumps and other aging infrastructure. This presents a health risk from potential intrusion of contaminated surface water or back siphoning from the higher service connections. If a watermain breaks, a depressurization event will occur, presenting a cross-contamination risk throughout the system. Additionally, each break provides a point of entry for foreign contaminants to enter the system.

3.2 Aging Infrastructure

As frequently occurs with small systems, the system has been operated for an extended period without a proper plan in place for replacing and updating the aging infrastructure. Much of the system components are at or are nearing the end of their useful life. It is known that the distribution system has lost significant water in the past few years, which is characteristic of deteriorating infrastructure. There are several residences with aging water mains that are only served by dead-end mains. Therefore, if one of these watermains breaks and has to be taken out of service, all homes that are served by that main will have no water service until repairs can be made.

Neither of the well pumps have been serviced in more than 20 years. There is a risk of one or both well pumps failing. If this occurs, there will be a water outage for the entire system and the customers will have to rely on standby storage until reparations are made.

3.3 Fire Flow

Island County requires that new or expanding Group A residential system be capable of delivering fire flow at 500-gpm for 30 minutes with a minimum pressure of 20-psi at all locations, with the largest pump out of service. This would require at least 15,000 gallons of fire suppression storage in addition to the other required storage components including operational, equalizing, and dead storage. The existing reservoirs have a nominal storage volume of 420,000 gallons and can provide the necessary storage for fire flow.

Currently, the system is configured with four 7.5 HP Aurora Series 340/360 booster pumps, each of which is capable of providing approximately 220-gpm. DOH standards require that system be evaluated for fire flow with the largest pump out of service while the system supplies MDD. With one of the four operating booster pumps out of service, the three remaining pumps can provide 660-gpm combined, which is in compliance with DOH standards.

Several areas within existing system have 2-inch- and 4-inch watermains and are not capable of supplying 500-gpm without excessive loss of pressure. Generally, a minimum of 6-inch piping is necessary to allow for MDD and fire flow demand. Where water mains are replaced lines should be sized to allow for fire flow demand and hydrants should be installed or replaced as necessary to service structures.

3.4 Reasonable Growth

The SHWD currently has 410 connections to its water system and, with the updated Water System Plan, has been determined to be adequate to serve 597 equivalent residential units (ERUs). There is a total of 492 lots within the service area boundary with no current plans to expand the retail service area.

4. ALTERNATIVES CONSIDERED

4.1 No Action

The system could attempt to maintain the existing water mains and continue to repair leaks as they occur. Each repair represents a loss of service and potential contamination event. This does not provide the reliable level of service that is required by the DOH, due to the potential health concerns. In addition, it is anticipated that these problems will become exacerbated over time as the water mains age. Many of the existing pipes are beyond their useful life. Continued corrosion of the ductile iron piping in the pumphouse piping is no longer sustainable. Piping is already failing and being replaced as needed. Allowing the piping to file will increase outages, degrade other infrastructure, and provide increased potential for contamination of the water in the distribution system. If the system continues to use the well pumps without replacing them, they will eventually fail and will have to be taken offline until an emergency replacement can occur.

In the year 2018, the SHWD spent about $17,500 on repairs and maintenance. If no improvements are made to the system, the cost of maintenance and repairs is estimated to be about $18,000 per year and will likely continue to increase significantly over time because of the aging infrastructure. If any emergency repairs or replacement need to occur, the cost of repairs and maintenance will likely increase significantly.

4.2 Distribution System Improvement Alternatives

Several potential improvements to the distribution system were considered. It is the intention of the SHWD to include as many of the AC water mains for replacement as is financially feasible. System as-builts for system have been analyzed to identify those AC water main over 60 years old that should be replaced as a major component of their system improvements. Several alternatives were considered for the repair or replacement of the aging water main including standard watermain replacement and trenchless water main replacement options such as slip-lining, cured in place pipe (CIPP), and pipe bursting. The improvement alternatives and descriptions are summarized in Table 2.

Various water mains are optional projects depending on available funding. Orcas Drive, Lopez Drive, and Fidalgo Drive are all insufficiently sized for residential fire flow. Fidalgo Drive, east of Harpoon Lane, has had issues with landslide in the past. If this line is replaced it, HDPE pipe should be used for its increased durability and flexibility. This location could potentially be an option for pipe bursting as discussed in the sections below.

The water mains through Mitford Lane, Pebble Court, and Periwinkle Road are insufficiently sized and have experienced continued issues with discolored water. These lines should be replaced and should loop back into the proposed water main on George Drive. Particular care should be given to minimize isolated low points during installation. A blow-off assembly should be installed at any isolated low spot for system maintenance.

Table 2: Distribution Improvement

Street	Length	Existing Size/Type	Proposed Size/Type
Blakely Avenue	725-ft	4” AC	6” PVC
	1,010-ft	6” AC	6” PVC
Pear Street	215-ft	4” AC	6” PVC
Hat Street	310-ft	6” AC	6” PVC
San Juan Avenue	230-ft	6” AC	6” PVC
Casey Street	340-ft	6” AC	6” PVC
Guemes Avenue	730-ft	6” AC	6” PVC
Harper Street	530-ft	6” AC	6” PVC
George Drive	3,720-ft	6” AC	8” PVC *
Mitford Lane	710-ft	2” PVC	6” PVC
Pebble Court/Periwinkle Road	640-ft	2” PVC	6” PVC
Harpoon Lane	670-ft	4” AC	6” PVC
Driftwood Drive	1,620-ft	4” AC	6” PVC
	1,230-ft	6” AC	6” PVC
OPTIONAL SECTIONS			
Hubble Court	370-ft	2” PVC	6” PVC
Orcas Drive	505-ft	4” PVC	6” PVC
Lopez Drive	290-ft	4” PVC	6” PVC
Driftwood Drive	625-ft	2” PVC	6” PVC
Fidalgo Drive	915-ft	4” PVC	6” HDPE
	1,210-ft	4” AC	6” HDPE

* The watermain down George could potentially be an 8” HDPE line depending on system configurations

A map of the proposed water main replacements is provided in APPENDIX A.

4.2.1 Trenchless Installation Options

The following sections discuss means and methods of replacing water mains through trenchless installation methods. These methods all involve some trenching to access mains and connections and were evaluated for applicability for the main replacements proposed by SHWD.

4.2.1.1 *Slip-Lining Water Mains*

Slip-lining involves threading a smaller pipe through the existing water main pipe. The annular space between the new pipe and existing main is then sealed with a grout so that they act as a single pipe. As with other trenchless technologies, slip-lining, has the benefit of allowing the installation of new pipe without the need for extensive trenching. This process can be particularly beneficial though sensitive areas and where there are conflicts with other utilities.

Consideration should be given to the installation process. The process will require the existing water main to be out of service throughout installation, testing, and reconnection of the services and to the existing system. Although trenching is reduced, it is still necessary to open the main at each service connection, tee, cross, and at some fittings. Also, the resulting pipe size is smaller and will provide less capacity which can negatively impact system efficiency. All these factors should be considered with the potential selection of slip-lining as an installation method.

4.2.1.2 *Cured in Place Pipe (CIPP)*

CIPP consists of installing a flexible liner into the existing water main. The liner is embedded with epoxy and resin so that the system can be sealed and pressurized with hot air. The process of pressurizing with hot air allows the liner to conform to the existing pipe shape and hardens the liner in that process. The installed liner is thin allowing the water main to maintain a similar capacity.

Consideration should be given to the process and limitations presented with CIPP installation. The lining does not conform well to fitting in a system. Therefore, access to the water main is required at all fittings and service connections to allow for other connections. During this process, the existing main will be out of service affecting all service connections off of that line or dependent on that section of main. This process is most efficient on straight uninterrupted section of water main. Cost benefits occur from avoiding disturbances to critical areas, pavement, adjacent utilities, and structures.

4.2.1.3 *Pipe Bursting*

Pipe-bursting involves pulling or pushing a new pipe through the existing water main with a pipe bursting head. The bursting head is pulled through the existing main via a hydraulic. As it is pulled back through, the blades on the bursting head cut apart the existing pipe. An expander head then follows and pushes the pipe fragments out into the surrounding soil. Following this expander, a new pipe is pulled into place in the space once occupied by the original pipe.

As with the other trenchless technologies discussed above, pipe bursting requires access to the existing main at all crossing, and service connections. Customer connections off the section of pipe will be affected as will other sections of pipe dependent of repaired sections.

4.2.1.4 *Trenchless Installation Conclusions*

These methods of pipe repair/replacement are advantageous in that they do not involve trenching and digging. Cost benefits arise from avoiding redesign due to avoiding critical areas, minimizing impact the pavement and other structures, avoiding impacts to other utilities, and delays from unforeseen obstacles that can occur with open trenching.

However, each method discussed requires that the existing mains be shut down during the entirety of the construction process. This will leave the connections off the repaired water main, or connections dependent on that section of water main, without water during mobilization, installation, curing, testing, and reconnection of the system. At times, overground lines can be run to serve various connections, but the is only recommended for short distances that can be typically be accessed from hydrants. Although trenching is reduced it will still be necessary to access the existing main at all tees, service connections, hydrants, and at some fittings.

The current system has extensive sections of system that are dependent on a single water main due to the lack of loops in the system. This reduces the efficiency of the trenchless solutions since it would be cost prohibitive to prove a significant number of connections with water throughout the installation and testing process. Due to the location of water mains outside of asphalt, except at crossing, and limited conflicts with existing utilities, many of the benefits of trenchless installation are nullified. It is anticipated that the most efficient and cost effective means of water main replacement, in most cases, will be to install a new line via open cut processes so that the existing services can be maintained until reconnection to the new water main is prepared and approved. The exceptions to this is the portion of Fidalgo Drive between Harpoon Lane and George Drive. This section of pipe has no services and passes

through a critical slope. Pipe bursting should be considered for this location. If pipe bursting is used, it is recommended to increase the water main size to 8" HDPE.

4.3 Pressure Reducing Valves

The SHWD is also planning on replacing and relocating the Pressure Reducing Valve (PRV) stations located on the water mains to maintain system pressures within the recommended values set by the DOH. The configuration of the system will mimic the existing pressures zones that exist in the current system with some potential minor modifications dependent on the improvements along Fidalgo Drive.

A PRV station will be located on George Dr close to Fidalgo Dr. There is an existing PRV on Fidalgo Drive that will be relocated with the proposed water main improvements to improve the functionality and service along Mitford Lane, Hubble Court and Periwinkle Road.

The PRV station at Harpoon Lane will be replaced with the waterline improvements. The location of the PRV station could be relocated to the intersection with Whales Tail Lane depending on available space and access issues.

The PRV station located at the intersection of Driftwood Drive and George Drive was installed in 2007 and appears to be in good condition. Improvements along Driftwood Drive will connect into this existing PRV vault.

An alternative to the PRV on George Dr that was considered is the installation of PRVs on each residence served on Mitford Ln. This option, however, was not selected because the installation cost is greater, and the pressure would only be reduced for the service lines, not the mains. The watermains would also remain at higher pressures which could be detrimental to the system.

4.4 System Loops and

Depending on available funds there are some additional loops that should be considered to improve water movement in the distribution system. Currently Driftwood Drive is only served by the water main down George Drive. It would be advisable to have a second source of water to these residences. Similarly, Mitford Lane and the streets connected to it will also only be served by the water main down George Drive if the line down Fidalgo Drive is abandoned at Harpoon Lane.

Various options were considered to loop Driftwood Dr. In Option A, a water main would be added to connect Hubble Court to the north end of the main along Driftwood Drive. A PRV station would be added to Hubble Court to reduce pressures going down to Driftwood Drive. This would require the installation of a line through a critical slope. Installation of a water main in this located should be installed by directional drilling to avoid impacts to the slope. HDPE pipe should be used due to its durability, fused connections, and flexibility. This option includes the optional replacement of water mains along Hubble Court and the 2-inch PVC on Driftwood Drive. Option B would be to install a new line by directionally drilling from the end of Whales Tail Lane to a point on the western portion of Driftwood Drive. This option would also require the installation of a PRV station and the replacement of water mains on Whales Tail Lane. to provide adequate flow. Option A is more cost effective and would also remove the dead-end line on the north end of Driftwood Drive. However, it is advisable to install one of the two options, if funds are available, in order provide an additional source of water to Driftwood Drive and to reduce the stagnation of water in the dead ends of those portions of the distribution system.

4.5 Exposed Piping

The water main running north and south just west of Samish Court is passing through a wetland area and is exposed, resting on wooden supports. It is advisable to bury this section of pipe to protect it from debris and potential impacts. Alternatively, work could be undertaken to encase the pipe and replace the pipe supports.

4.6 Pumphouse and Treatment Improvements

The pumphouse and treatment system are at the core of the distribution system. The system required various improvements to address existing system problems as discussed in pervious sections. Those deficiencies are discussed in greater detail in the sections below.

4.6.1 Treatment System Improvements

The treatment system has an abnormally high backwash rate and has experienced disinfection byproducts in the past. Both issues are indicative of inefficient treatment. In addition, the treatment system was originally designed with alternate forms of oxidation which has been replaced due to its ineffectiveness. The treatment system should be analyzed to determine the cause of these issues. The filter bedding, which was originally designed to be compatible with ozone treatment, will likely need to be replaced and upgraded with an improved filter media. The filters currently have Birm® media filter bedding which was installed in 2001. One alternative that was considered is replacing the existing filter media with Greensand Plus®. At a minimum, the filter media should be replaced, dosing rates and oxidation methods should be analyzing to improve the efficiency of the system in removing iron and manganese. A thorough analysis of the system should be done to diagnose the cause of the issues. Another improvement alternative is to replace the entire filtration system with a new ATEC® filter system which could be designed to treat and remove arsenic that is also present in Well #2. Any improvements to the treatment system should, at a minimum, be designed to match the instantaneous water right of the SHWD. Due to the age of the current system and the anticipated age at the time of completion this improvement will be scoped for a full replacement of the treatment system. A full improvement can have the added benefit of modifying the backwash method as discussed below.

4.6.2 Disposal of Backwash Water

The SHWD currently uses a pond to store backwash water. The backwash pond is metered out with a separate pump and used for irrigation of Island County parcel S8110-00-05014-0. Using the backwash water for irrigation works well during the dry season, but it is not ideal during the wet season as the ground is often already saturated, causing excess water to flow back into the pond for continued use. Alternative methods of disposal should be considered for the backwash water. The option that is being considered is discharging the backwash water into the roadside ditch on the east side of Guemes Avenue. The ditch conveys water to the south, east and then north following Decatur Avenue. An Island County outfall conveys stormwater from the roadside ditch in Decatur Avenue into a natural ravine located along the east edge of the Scatchet Head Plat. Any potential improvements would need to ensure a properly sized drainage path to ensure that there will not be adverse impacts to neighboring properties.

4.6.3 Configuration to Serve Booster Pumps

As it is currently configured, the filter-backwash process is pressurized from the booster pumps located within the pumphouse. However, as noted previously in this report, in the event that Reservoir 1 is taken offline for maintenance or repairs, the booster pumps will be unable to function because they are fed from Reservoir 1. In these circumstances, the treatment system is taken offline until the reservoir is

back in service. An analysis should be performed to determine if a piping configuration can be developed to allow booster pumps system to function while Reservoir 1 is not in use. There are various options that could be considered.

An option would be to feed the booster pumps directly from the dedicated raw water line. This option would require gate valves to reroute raw water from the filter process into the suction line of the booster pumps. A check valve would be installed to ensure water is not pressurized back toward the wells. This option would also not allow for the use of the treatment system while Reservoir 1 is out of service.

Another option would be to backwash the filters from the raw water wells. This would require reconfiguration of the piping in the pumphouse to direct raw water from the wells through the backwash with a pressure sustaining valves. The design would need to ensure that the smaller capacity well would have a sufficient flowrate to properly backwash the filters.

4.6.4 Corroded Piping

The corroded ductile iron piping in the pumphouse needs to be replaced. The existing piping was designed and installed appropriately, however the chlorine tank is currently stored too close to the iron piping which accelerated the oxidation of several pipes. The chlorine tank will be relocated to a new ventilated storage room to avoid corrosion of the new piping. When this piping is replaced the necessary reconfiguration of the piping system to account for changes to the treatment system can be implemented.

4.7 Source Improvement

Both well pumps were last replaced approximately 20-years ago. It is essential that both well pumps be replaced. No other alternatives to pump replacement were considered. When the well pumps are replaced, the meters will also be replaced along with any piping that is undersized for the associated well capacity.

The well pumps are not able to function when there are power outages on the system. During these times, the SHWD attempts to limit consumption so that the system can be served by its available standby storage. System pressures are maintained by the booster pumps which can be powered by a backup generator. To improve the District's emergency preparedness, an emergency generator should be installed to power the well pumps in the event of an extended power outage or other emergency. Installation of an emergency storage tank of 5,000 gallons can also be installed on the well site to provide a source of potable water for residents in an emergency event where the distribution system is significantly compromised.

5. SELECTION OF AN ALTERNATIVE

The costs associated with the various alternatives for repairing the aging infrastructure at Scatchet Head Water District are summarized in **Error! Reference source not found.**. Detailed preliminary cost estimates are included in Appendix D. The combined capital cost of all proposed improvements is expected to be about $2,590,000.

Table 3: Improvement Alternatives – Cost Estimate Summary

Category	Alternatives	Capital Costs	Lifespan (years)	Annual O&M Cost
Distribution	1) Open Trench Replacement	$2,810,000	60	$5,000
	2) Pipe Bursting	$5,220,000	60	$5,000
	3) Cured in Place Pipe	$4,920,000	60	$5,000
	4) Do Nothing	$0	n/a	$20,000
Pumphouse & Treatment	1) Improvements with Greensand® Plus Filter Bedding	$40,000	15-20	$20,000
	2) Improvements with New ATEC® Filtration System	$140,000	15-20	$4,800
Source	1) Well pump, piping, and meter replacement	$80,000	15-20	$4,800

As noted previously, it was determined that standard open trench installation of new water mains would be the best, in most cases, due to lower costs and the ability to maintain water service to most of the SHWD's consumers. The water main replacements will also include the replacement of any fire hydrants off those water mains and the placement of additional hydrants where adequate flows can be provided. New dedicated sampling stations will be located to provide for necessary system testing and maintenance and any meters located in the back of parcels will be relocated to the right-of-way to allow for improved access and maintenance with accordance with system standards. Preliminary schematic drawings of the proposed improvements are included in Appendix A.

For pumphouse and treatment improvements it is anticipated that the full replacement of the treatment system will be most beneficial to the long-term maintenance of the facility. The ability to properly size the filter vessels for use with backwash from the wells, improved media, and the ability to provide treatment for arsenic will improve the system functions with the benefits of low-cost future maintenance. Chlorine and any other chemicals used in the treatment process will be relocated to a new storage room with proper ventilation to protect pumphouse piping and infrastructure from corrosion. Details of the proposed improvements are included in Appendix A.

The source improvements will consist of replacing the well pumps, some of the piping, and the source meters, as well as installation of an emergency generator, and a 5,000-gallon emergency storage tank as detailed in Appendix A.

5.1 Life Cycle Cost Analysis

The cost for the various alternatives were analyzed for the present worth to aid in determination of an appropriate alternative. A life cycle cost analysis was performed and is included with Appendix D. Results are presented below in **Error! Reference source not found.**. The present values were calculated assuming an inflation rate of 1.5%/yr.

Table 4: Net Present Value

Category	Alternatives	Capital Costs	Inflation Rate	Net Present Value
Distribution	1) Open Trench Replacement	$2,810,000	2.5%	$2,965,000
	2) Pipe Bursting	$5,220,000	2.5%	$5,375,000
	3) Cured in Place Pipe	$4,920,000	2.5%	$5,075,000
	4) Do Nothing	$0	2.5%	$618,000
Pumphouse & Treatment	1) Improvements with Greensand® Plus Filter Bedding	$40,000	2.5%	$99,000
	2) Improvements with New ATEC® Filtration System	$140,000	2.5%	$199,000
Source	1) Well pump, piping, and meter replacement	$80,000	2.5%	$96,000

6. PROPOSED PROJECT

6.1 Preliminary Project Design

Bentley WaterCAD was used to create a hydraulic model of the preliminary design of the proposed distribution system. Three scenarios were modelled: Scenario 1 included no water demand and the high pressure setting, Scenario 2 modelled the system at PHD and the low pressure setting, and Scenario 3 modelled fire-flow at MDD. Model results are summarized below. Detailed results can be found in Appendix G.

Scenario 1 modelled the high-pressure scenario where there is no demand on the system, and the pressure at the booster pump station is set to 55-psi, which is the high setting of the booster pumps. This scenario resulted in pressures ranging from 40-psi to 117-psi in the distribution system. However, at the residential service connections, the pressures range from 42 psi to 85-psi. The highest pressures that occur at service connections happen at the end of Hubble Ct. All other static water pressures at service connections are below 85-psi. These pressures will likely be the highest pressures that the system will experience during operation.

Scenario 2 modelled the system at a PHD of 297-gpm, which is the expected peak flow rate of the system in the with all 455 available lots using a connection. In this scenario, the pressure at the booster pump station was set to 45-psi. The pressures in the system ranged from 40-psi to 117-psi. The pressure of the mains at water service connections ranged from 41-psi to 104-psi. The highest pressures are located at the end of Samish Ct (104-psi), along Fidalgo Drive close to Harpoon Road (91-psi) and at the end of Hubble Court (85-psi). These high-pressure areas represent few potential connections which could be managed with individual PRVs. All other pressures at service connections were found to be below 80-psi.

Scenario 3 represents the system during fire-flow situation during MDD. The MDD that was used is 425 gpd/ERU, as found in the 2020 Water System Plan. In 20 years, the system is anticipated to have 455 connections, therefore the overall MDD of the system that was modelled was 193,375 gpd or 135-gpm. A demand of 500-gpm was also placed on the fire-hydrant at the highest elevation within the system

which is located along Blakely Avenue and Swede Hill Road. This scenario resulted in pressures in the distribution system that ranged from 39-psi to 114-psi.

All scenarios that were modelled produced acceptable results. The static-pressure scenario resulted pressures that were less than 90-psi for all but two service connections. The PHD scenario resulted pressures that met the 30-psi minimum requirement. And the fire-flow scenario showed that the distribution system is capable of conveying fire-flow without any pressures within the system dropping below 20-psi.

6.2 Project Schedule

The Scatchet Head Water District is currently submitting a preliminary engineering report for USDA Loan approval, and the loan review period is expected to take 3 to 4 months. Assuming the loan application is approved, the next step would be preparation and submittal of a project report to the Washington State Department of Health (DOH) for any projects not accounted for in the District's Water System Plan. This project report can be completed in conjunction with the development of construction documents, contract documents, and engineering specifications. The development of these documents is anticipated to take 4 to 5 months. Following the development and approval of relevant construction documents, the project will be publicly bid, a contractor selected, and construction contracts can be finalized. The public bid process through finalization of the construction contract typically is a 2 to 3 month process.

Project construction, testing, approval, and closeout procedures would follow contract approval and typically last an additional 4 months. The complete schedule estimate from November 2020 is approximately 15 to 18 months. The project could be expected to be completed in the first or second quarter of 2022.

6.3 Permit Needs

The following permits will be required to support the proposed work:

- The waterline installation will require a Permit to Work in the Right of Way from Island County Public Works.
- Additional easements may be needed from some homeowners
- A Clearing and Grading Permit may be required from Island County Planning (depending on total estimated combined cut and fill quantities).
- A Project Report outlining the proposed water system improvements will be submitted for approval to the Washington State DOH for any projects not addressed in the District's Water System Plan.

Any additional, relevant permits will be obtained by the selected contractor. The water system will need to obtain or update their Franchise agreement, if needed, prior to the start of Construction. The project is SEPA exempt since it involves replacing existing utilities.

6.4 Annual Operating Budget

The operational budget is provided in Appendix D and summarized in Table 1. The system currently receives income from water service fees, late fees, and reimbursed expenses. Residents are charged a base quarterly service charge and are charged water rates that are described in Table 3. The rates will be gradually increasing in the coming years as shown below.

Table 3: Increasing Block Rate Structure

	2019	2020 *	2021	2022
Metered Connection**	$94.52	$116.58	$142.31	$154.39
2,0000 -3,000 CF***	$0.070	$0.070	$0.070	$0.070
Over 3,000 CF***	$0.090	$0.090	$0.090	$0.090

* Effective rate as of November 2020.

** Meter connection includes the cost for the first 2,000 cubic feet of water.

*** The cost shown is the cost of water per cubic foot of usage.

Annual expenditures are summarized in Table 1 and are laid out in Appendix D. In 2018, the total operating expenses were about $150,000. The repairs and maintenance costs for 2018 were about $17,500. After construction of the project described in this report, the costs for repairs and maintenance are expected to be reduced.

7. CONCLUSIONS AND RECOMMENDATIONS

The SHWD currently provides potable water to 410 connections within their service area in Clinton, WA. The system is obligated to provide reliable service to its customers and the proposed project will provide the infrastructure needed to deliver water in compliance with county, state, and federal requirements. Much of the distribution system was installed more than 50 years ago. The proposed project improvements will include replacing aging water mains, providing fire flow capacity throughout the distribution system, installing pipe supports for an exposed watermain, loop dead end watermains, and install a new PRV station. The project will also include improvements to the treatment system and sources such as upgrading the filter bedding, replacing corroded piping within the pumphouse, installing a new backwash water disposal location, adding a new ventilated storage room for the chlorine storage tank, replacing well pumps, piping and meters, and installing an emergency generator and storage tank. The proposed project will greatly improve system reliability and reduce contamination risk. The total project costs are expected to be approximately $3,070,000.

APPENDIX A Maps and Schematics

Scatchet Head Water District

5/7/2019, 3:43:39 PM

1:9,028

0 0.05 0.1 0.2 mi

0 0.1 0.2 0.4 km

Plats

Plat

Existing Service Area

Parcels

Quarter Sections

One Way Directions

Road Closures

Roads

Highway

Collector and Arterial

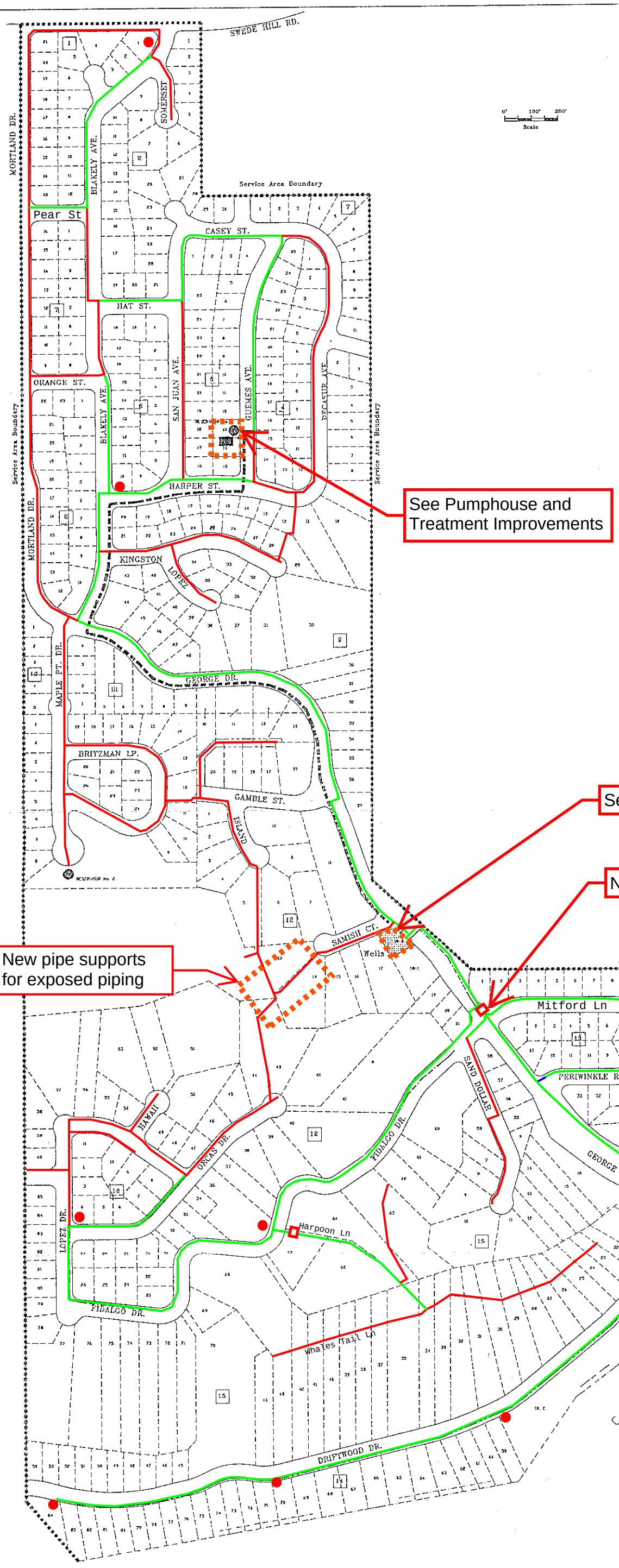
Local

Private

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/ Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Island County

Island County Parcel Viewer Map Export

Proposed Distribution System Improvements



NOTES:

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LOT INFORMATION COPIED FROM THE FOLLOWING ISLAND COUNTY SECTION MAPS:

S.W. 1/4 SEC. 10, TWP. 28 N., R. 3 E., W.M.
WEST PART SEC. 15, TWP. 28 N., R. 3 E., W.M.

SEE SHEET 2 THROUGH 8 FOR 1" = 100' SCALE PLANS SHOWING PIPE SIZES, VALVES, HYDRANTS, ELEVATION CONTOURS, ETC.

PROPOSED 1998 IMPROVEMENTS

- RESERVOIR SUPPLY LINE FROM WELLS TO GUEMES AVE. RESERVOIR
- BOOSTER PUMP STATION AT THE GUEMES AVE. RESERVOIR SITE TO SUPPLY HIGH ELEVATION SERVICE AREA
- Existing Watermains to Remain
- Watermains to be Replaced
- New Watermains
- New or Replaced Fire Hydrant

LATEST REVISION: 1/27/98

Sht. 1 of 10

SCATCHET HEAD WATER DISTRICT
3792 EAST HUBBLE COURT
Clinton, Washington 98236

WATER DISTRIBUTION SYSTEM
COMPREHENSIVE MAP
Water Service Area
Proposed 1998 Improvements

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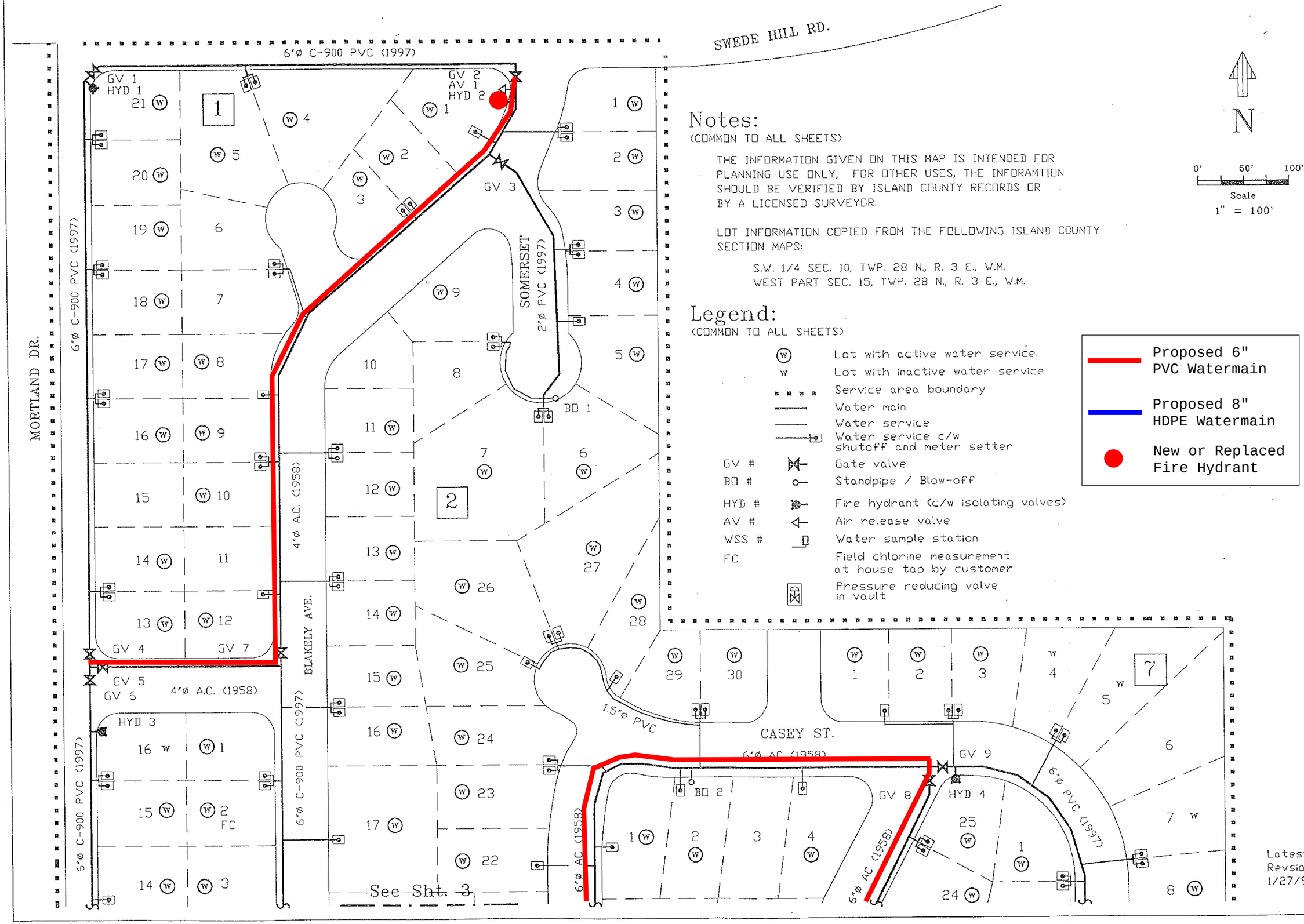
P. O. Box 607
Coupeville, Washington 98239
Job 297 November 1997



Notes:

(COMMON TO ALL SHEETS)

THE INFORMATION GIVEN ON THIS MAP IS INTENDED FOR PLANNING USE ONLY, FOR OTHER USES, THE INFORAMTION SHOULD BE VERIFIED BY ISLAND COUNTY RECORDS OR BY A LICENSED SURVEYOR.

LOT INFORMATION COPIED FROM THE FOLLOWING ISLAND COUNTY SECTION MAPS:

S.W. 1/4 SEC. 10, TWP. 28 N., R. 3 E., W.M.
WEST PART SEC. 15, TWP. 28 N., R. 3 E., W.M.

Legend:

(COMMON TO ALL SHEETS)

(W)	Lot with active water service.
W	Lot with inactive water service
	Service area boundary
	Water main
	Water service
	Water service c/w shutoff and meter setter
GV #	Gate valve
BO #	Standpipe / Blow-off
HYD #	Fire hydrant (c/w isolating valves)
AV #	Air release valve
WSS #	Water sample station
FC	Field chlorine measurement at house tap by customer
PRV	Pressure reducing valve in vault

Proposed 6" PVC Watermain

Proposed 8" HDPE Watermain

New or Replaced Fire Hydrant

N

0' 50' 100'

Scale

1" = 100'

Latest Revsion: 1/27/98

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WATER DISTRIBUTION SYSTEM
COMPREHENSIVE MAP

SCATCHET HEAD WATER DISTRICT
3792 EAST HUBBLE COURT
Clinton, Washington 98236

Sht. 2 of 10

See Sht. 2

See Sht. 4

Service Area Boundary

MORTLAND DR.

BLAKELY AVE.

SAN JUAN AVE.

GUEMES AVE.

DECATUR AVE.

ORANGE ST.

HAT ST.

HARPER ST.

RESERVOIR No. 1
(see Site Plan)

WSS # 1

WSS # 2

HYD 5

HYD 6

HYD 7

HYD 8

HYD 9

HYD 10

GV 2

GV 10

GV 11

GV 13

GV 14

GV 15

GV 16

GV 17

GV 18

GV 19

GV 20

GV 21

GV 22

GV 23

AV 2

AV 3

AV 4

AV 11

BO 3

BO 4

BO 5
(in box)

6"ø PVC (19--)

6"ø AC (19--)

FC

N

1" = 100'

Proposed 6"
PVC Watermain

Proposed 8"
HDPE Watermain

New or Replaced
Fire Hydrant

Latest
Revsion:
1/31/98

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WATER DISTRIBUTION SYSTEM
COMPREHENSIVE MAP

SCATCHET HEAD WATER DISTRICT
3792 EAST HUBBLE COURT
Clinton, Washington 98236

See Sht. 3

MORTLAND DR.

BLAKELY

KINGSTON

LOPEZ

AV 5

GEORGE DR.

MAPLE PT. DR.

BRITZMAN LP.

AV 6

AV 7

Easement

Service Area Boundary

Service Area Boundary

6"ø PVC (19--)

6"ø AC (19--)

8"ø PVC (1996)

6"ø PVC (1996)

2"ø PVC (19--)

GV 24 GV 25 GV 26 GV 27 GV 28 GV 29 GV 30 GV 31 GV 32 GV 33 GV 34

HYD 11 HYD 12 HYD 13 HYD 14 HYD 15

BO 6 BO 7 BO 8

FC

Proposed 6" PVC Watermain

Proposed 8" HDPE Watermain

New or Replaced Fire Hydrant

N

1" = 100'

9

10

11

See Sht. 5

Latest Revsion: 1/31/98

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WATER DISTRIBUTION SYSTEM
COMPREHENSIVE MAP

SCATCHET HEAD WATER DISTRICT
3792 EAST HUBBLE COURT
Clinton, Washington 98236

Sht. 4 of 10

See Sht. 4

MAPLE PT. DR.

8"ø PVC (1996)

GV 35
GV 36

6"ø PVC (1996)

6"ø PVC (1996)

GV 37
GV 38

BO 9

GAMBLE ST.

6"ø PVC (19--)

ISLAND

GV 39

GEORGE DR.

6"ø AC (19--)

Service Area Boundary

N
1" = 100'

STANDPIPE
WWS

RESERVOIR No. 2
(see Site Plan)

WSS
3

HYD 16
AV 8
GV 40

6"ø PVC (19--)

Easement

FC

12

SAMISH CT.

HYD 17

6"ø PVC (19--)

GV 41

6"ø PVC (19--)

13

14

15

16

GV 42

GV 44

GV 43

See Sht. 10

Service Area Boundary

235*036

New pipe supports
for exposed
watermain

Proposed 6"
PVC Watermain

Proposed 8"
HDPE Watermain

New or Replaced
Fire Hydrant

See Sht. 6

Latest
Revsion:
1/28/98

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WATER DISTRIBUTION SYSTEM
COMPREHENSIVE MAP

SCATCHET HEAD WATER DISTRICT
3792 EAST HUBBLE COURT
Clinton, Washington 98236

Sht. 5 of 10

See Sht. 5

See Sht. 10

N

1" = 100'

Service Area Boundary

HAWAII

LOPEZ DR.

ORCAS DR.

FIDALGO DR.

WSS # 4

PRV STA. # 2

Easement

BD 10

BD 11

BD 12

BD 30

HYD 18

FC

GV 45

AV 9

GV 49

GV 50

GV 51

GV 52

GV 53

GV 54

GV 55

GV 46

GV 47

GV 48

6"ø PVC (19--)

4"ø PVC (19--)

2"ø PVC (19--)

4"ø AC (19--)

Proposed 6" PVC Watermain

Proposed 6" HDPE Watermain

New or Replaced Fire Hydrant

Option A - Fire Flow to Lopez & Harpoon

Option C - Fidalgo Loop

New PRV

Option A - Fire Flow to Lopez & Harpoon

See Sht. 7

Latest Revsion: 1/31/98

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WATER DISTRIBUTION SYSTEM
COMPREHENSIVE MAP

SCATCHET HEAD WATER DISTRICT
3792 EAST HUBBLE COURT
Clinton, Washington 98236

Sht. 6 of 10

See Sht. 6

Service Area Boundary

Option A - Fire Flow to Lopez & Harpoon

FIDALGO DR.

4"ø PVC (19--)

2"ø PVC (19--)

Easement

BO 13
AV 10

BO 15

BO 14

DRIFTWOOD DR.

4"ø PVC (19--)

4"ø PVC (19--)

Proposed 6" PVC Watermain

Proposed 8" HDPE Watermain

New or Replaced Fire Hydrant

See Sht. 8

Latest Revsion: 1/31/98

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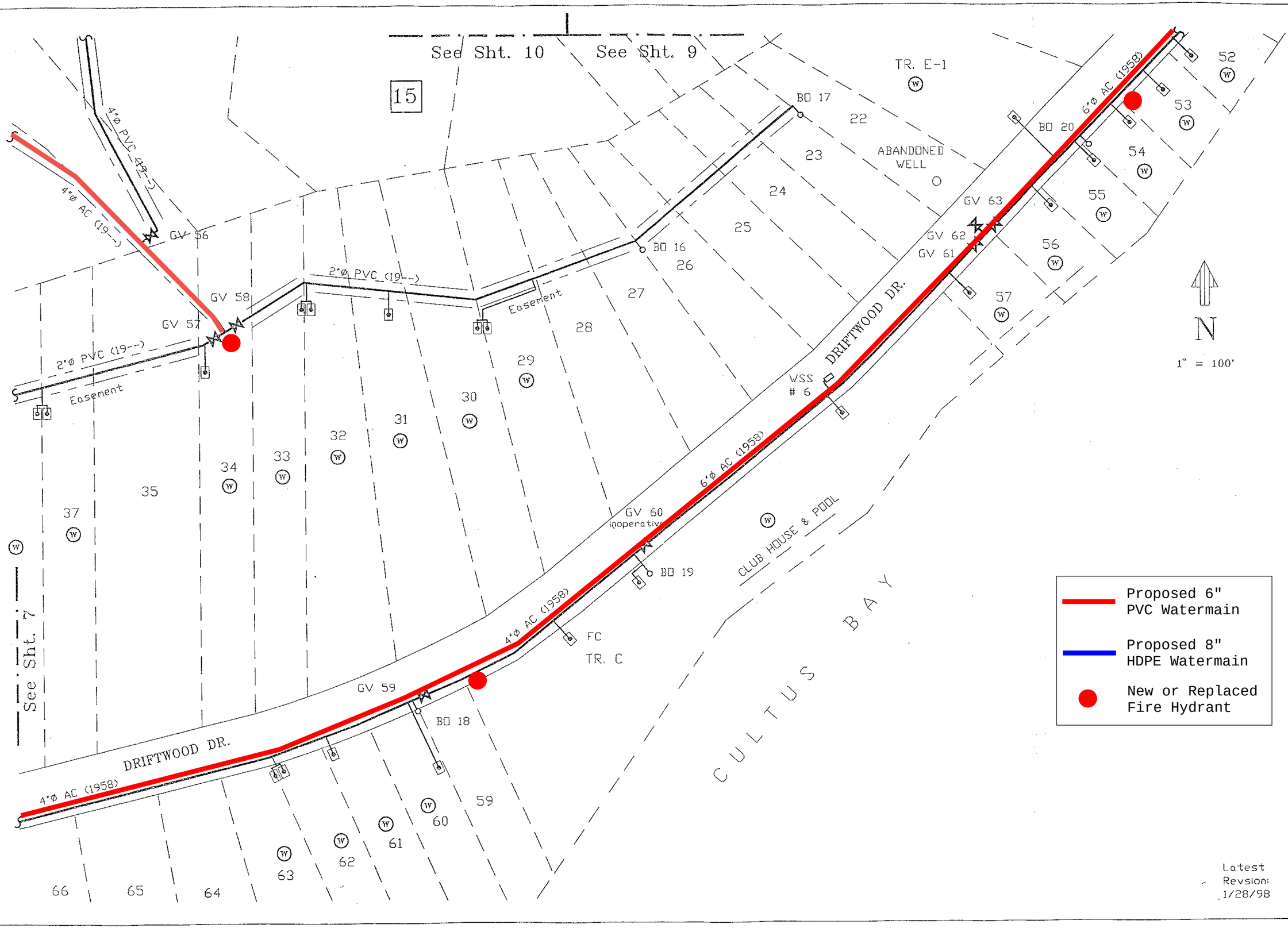
WATER DISTRIBUTION SYSTEM
COMPREHENSIVE MAP

SCATCHET HEAD WATER DISTRICT
3792 EAST HUBBLE COURT
Clinton, Washington 98236

Sht. 7 of 10



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WATER DISTRIBUTION SYSTEM
COMPREHENSIVE MAP

SCATCHET HEAD WATER DISTRICT
3792 EAST HUBBLE COURT
Clinton, Washington 98236

Sht. 8 of 10

Service Area Boundary

Option B - Hubble & Driftwood Loop

New PRV

Existing PRV

Mitford Ln

HUBBLE CT.

PERIWINKLE RD.

PEBBLE

DRIFTWOOD DR.

GEORGE DR.

2"ø PVC (1958)

6"ø A.C. (1958)

6"ø A.C.

WSS # 4

BO 24

BO 22

BO 25 Inoperative

BO 23

FC

GV 66

GV 65

GV 64

TR. E-2

N

1" = 100'

Proposed 6" PVC Watermain

Proposed 6" HDPE Watermain

New or Replaced Fire Hydrant

See Sht. 8

Latest Revision: 1/28/98

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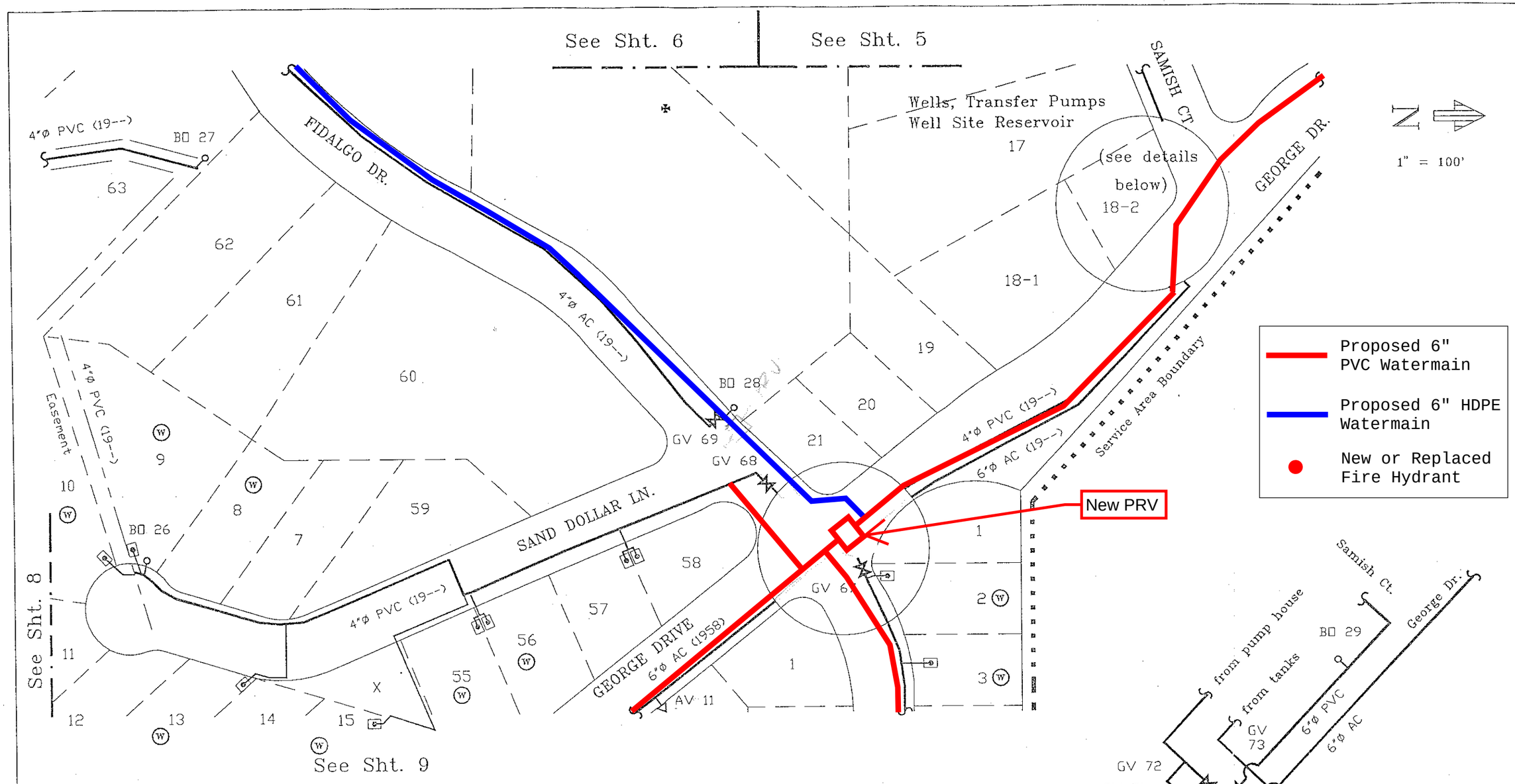
Job 297 November 1997

WATER DISTRIBUTION SYSTEM
COMPREHENSIVE MAP

SCATCHET HEAD WATER DISTRICT
3792 EAST HUBBLE COURT
Clinton, Washington 98236



GATE VALVES # 71 AND #73 TEMPORARILY CLOSED TO REDUCE CHLORINE COMPLAINTS

George Dr. Well Site
Piping Diagram
n.t.s.

Latest Revision: 2/16/98

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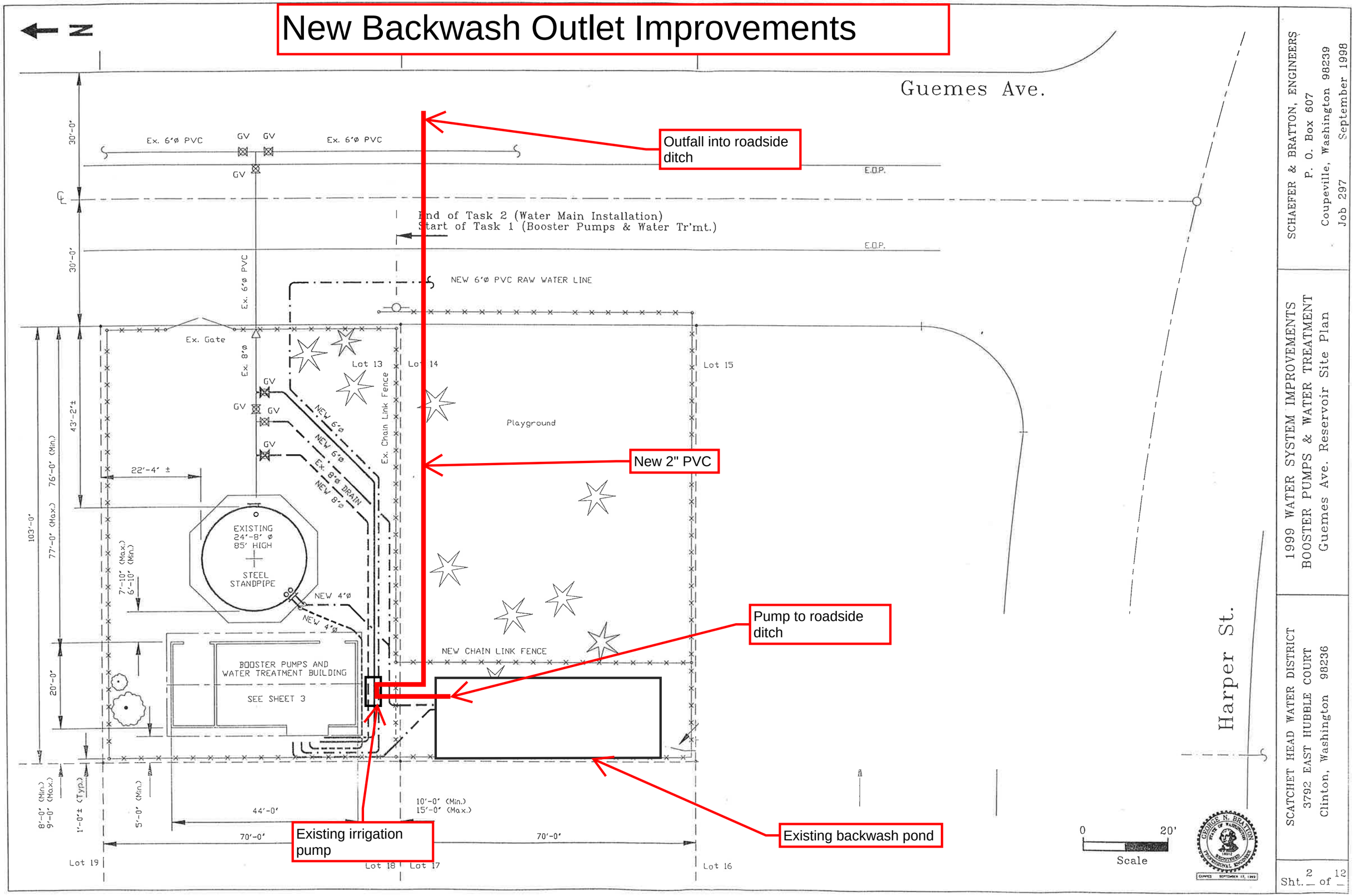
WATER DISTRIBUTION SYSTEM
COMPREHENSIVE MAP

SCATCHET HEAD WATER DISTRICT
3792 EAST HUBBLE COURT
Clinton, Washington 98236

New Backwash Outlet Improvements



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P. O. Box 607
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Job 297 September 1998

1999 WATER SYSTEM IMPROVEMENTS
BOOSTER PUMPS & WATER TREATMENT
Guemes Ave. Reservoir Site Plan

SCATCHET HEAD WATER DISTRICT
3792 EAST HUBBLE COURT
Clinton, Washington 98236

GEORGE N. BRATTON STATE OF WASHINGTON REGISTERED PROFESSIONAL ENGINEER

Pumphouse and treatment improvements

Replace Treatment System

Chlorine solution tanks to be relocated to new room

New wall and door

New Shelf

New location for hypochlorite feed pumps

New hypochlorite feed line to contact tank

Replace Corroded Ductile Iron Piping

N

44' - 0"

10' - 0"

34' - 0"

10' - 0"

6' - 0" W
8' - 0" H
DOUBLE METAL DOOR
c/w GLASS LITE

3' - 0"

6' - 0" W
c/w 1/2 W GLASS LITE

ELEC. METER

L. Vent

2A:10BC FIRE EXTINGUISHER

FIRST AID KIT

2A:10BC FIRE EXTINGUISHER

ELECTRICAL & PUMP CONTROL CENTER

48'ø + FILTER TANK

48'ø + FILTER TANK

48'ø + FILTER TANK

48'ø + FILTER TANK

Skylight

Skylight

48'ø + CONTACT TANK

48'ø + CONTACT TANK

SAMPLE TAPS & GAUGES

FLOOR DRAIN

4'ø TREATED WATER

4'ø BACKWASH WASTE

4'ø BACKWASH SUPPLY

HYPOCHLORINATOR

4'ø RAW WATER

METERS (2)

GAUGES (2)

Closed

Closed

EMERGENCY EYEWASH HOSE

BOOSTER PUMPS (4)

66'ø x 120' (156' overall) HYDROPNEUMATIC TANK

8'ø

6'ø

STORAGE ROOM

Non-load Bearing Wall, Allowable for Filter Tank Replacement

20' - 0"

EXHAUST FAN (WALL EXHAUST)

EXHAUST FAN (FLOOR INTAKE ROOF EXHAUST)

Lean-to extension above pipe vault

5' - 0"

70'-0"

WES

STANDPIPE OVERFLOW

STANDPIPE DRAIN (FROM EX. 8'ø)

TREATED WATER

PUMP SUCTION

PUMPED DISCHARGE

RAW WATER

4'ø

8'ø

6'ø

6'ø

4'ø

SOUTH PROPERTY LINE

103'-0"

FLOOR DRAINS TO SWALE

DRAIN / OVERFLOW TO SWALE

BACKWASH WASTE TO SWALE

4'ø

0 2' 4'
Scale

12/2/98

GEORGE N. BRATTON
STATE OF WASHINGTON
REGISTERED PROFESSIONAL ENGINEER
EXPIRES SEPTEMBER 17, 1999

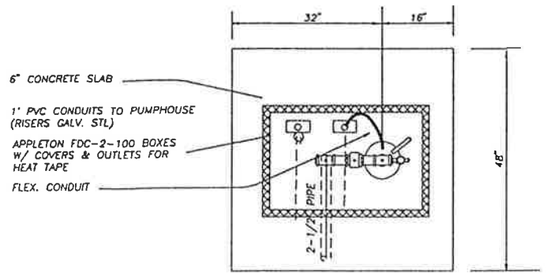
SCHAEFER & BRATTON, ENGINEERS
P. O. Box 607
Coupeville, Washington 98239
Job 297 September 1998

1999 WATER SYSTEM IMPROVEMENTS
BOOSTER PUMPS & WATER TREATMENT
Building Layout

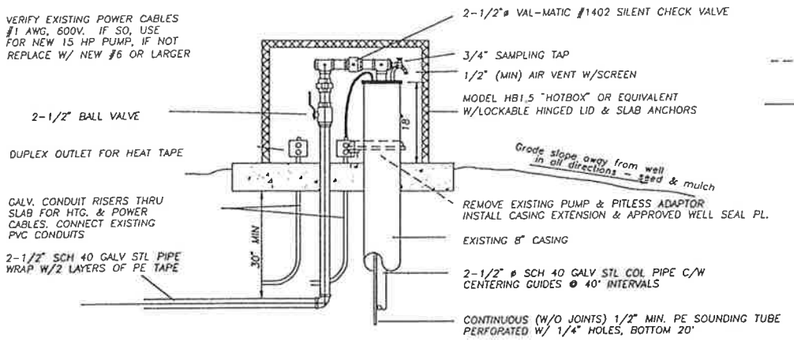
SCATCHET HEAD WATER DISTRICT
3792 EAST HUBBLE COURT
Clinton, Washington 98236

Sht. 3 of 12

Source Improvements

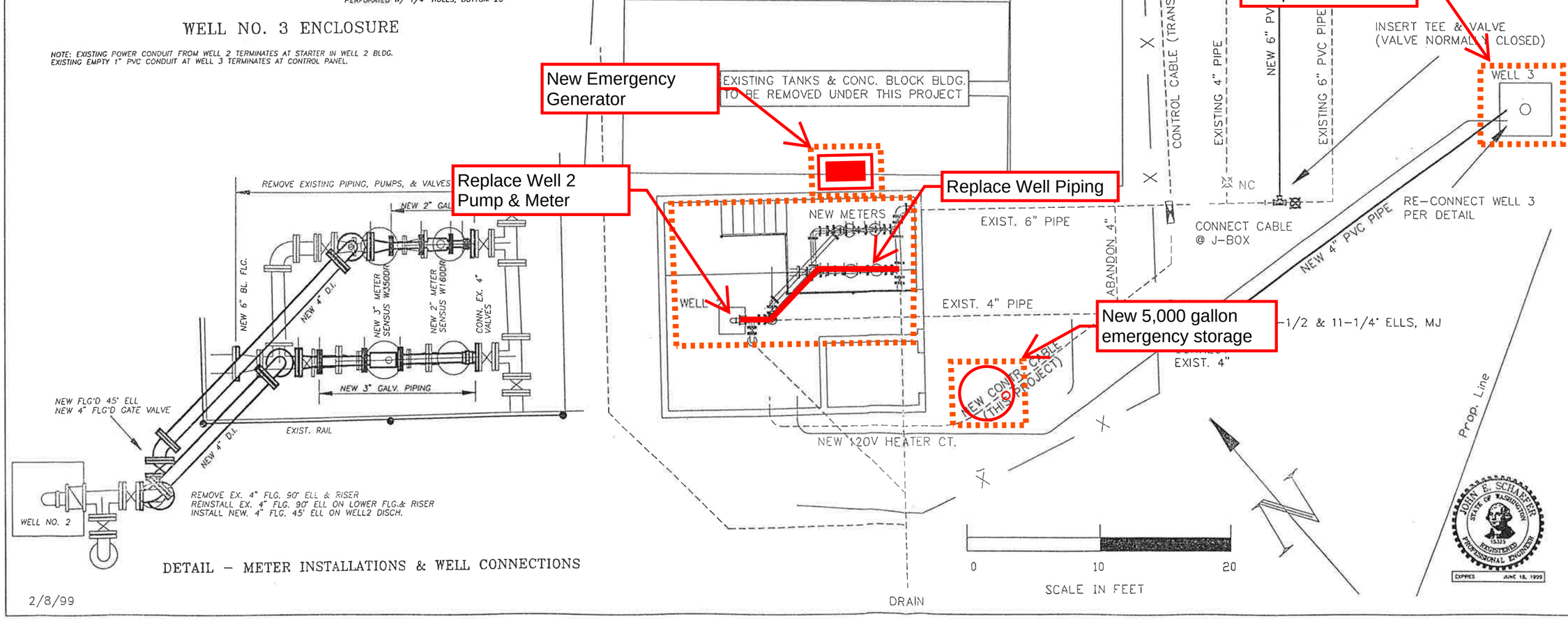


PLAN



WELL NO. 3 ENCLOSURE

NOTE: EXISTING POWER CONDUIT FROM WELL 2 TERMINATES AT STARTER IN WELL 2 BLDG.
EXISTING EMPTY 1" PVC CONDUIT AT WELL 3 TERMINATES AT CONTROL PANEL.



DETAIL - METER INSTALLATIONS & WELL CONNECTIONS

2/8/99

SCHAEFER & BRATTON, ENGINEERS
P. O. Box 607
Coupeville, Washington 98239
Job 297 December 1998

1999 WATER SYSTEM IMPROVEMENTS
EXISTING WELL AND PUMP HOUSE
Yard Piping Modifications

SCATCHET HEAD WATER DISTRICT
3792 EAST HUBBLE COURT
Clinton, Washington 98236

Sht. 9 of 12

APPENDIX B Water Facility Inventory Form

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: 06/03/2020
Printed: 8/24/2020
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
76470 X	SCATCHET HEAD WATER DISTRICT	ISLAND	A	Comm

6. PRIMARY CONTACT NAME & MAILING ADDRESS

SANDRA V. BODAMER [CONTACT]
KING WATER CO
PO BOX 2243
OAK HARBOR, WA 98277

7. OWNER NAME & MAILING ADDRESS

SCATCHET HEAD WATER DISTRICT COMMISSIONER
DAVE MULLINS
7906 GUEMES AVE
CLINTON, WA 98236

STREET ADDRESS IF DIFFERENT FROM ABOVE

ATTN KING WATER CO.
ADDRESS 107 SOUTH MAIN ST. STE. A-203
CITY COUPEVILLE STATE WA ZIP 98239

STREET ADDRESS IF DIFFERENT FROM ABOVE

ATTN
ADDRESS
CITY STATE ZIP

9. 24 HOUR PRIMARY CONTACT INFORMATION

Primary Contact Daytime Phone: (360) 678-5336
Primary Contact Mobile/Cell Phone: (360) 969-1019
Primary Contact Evening Phone:
Fax: (360) 678-8302 E-mail: xxxxxxxxxxxxxxxxxxx

10. OWNER CONTACT INFORMATION

Owner Daytime Phone: (206) 794-4747
Owner Mobile/Cell Phone:
Owner Evening Phone:
Fax: E-mail: xxxxxxxxxxxxxxxxxxx

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

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

SMA NAME: KING WATER COMPANY SMA Number: 128

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)

420,000

15	16	17	18										19			20	21						22	23	24			
	SOURCE NAME	INTERTIE	SOURCE CATEGORY										USE				TREATMENT						DEPTH		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	PERMANENT	SEASONAL	EMERGENCY	SOURCE METERED	NONE	CHLORINATION	FILTRATION	FLUORIDATION	IRRADIATION (UV)	OTHER	DEPTH TO FIRST OPEN TERVAL IN FEET	CAPACITY (GALLONS PER MINUTE)	1/4, 1/4 SECTION	SECTION NUMBER	TOWNSHIP	RANGE
S01	InAct 02/21/1997 ABANDONED		X												X		X						100	125	SW NW	10	28N	03E
S02	ABR417 Well 2				X								X			Y		X	X			X	242	150	NE NW	15	28N	03E
S03	ABW832 Well 3				X									X		Y		X	X			X	231	80	NE NW	15	28N	03E
S04	Wells 2 & 3 WF			X									X					X	X			X	231	230	NE NW	15	28N	03E

WATER FACILITIES INVENTORY (WFI) FORM - Continued

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
76470 X	SCATCHET HEAD WATER DISTRICT	ISLAND	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?)		410	451
A. Full Time Single Family Residences (Occupied 180 days or more per year)	410		
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		410	451

29. FULL-TIME RESIDENTIAL POPULATION

A. How many residents are served by this system 180 or more days per year? 900

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

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:** _____

APPENDIX C Asset Inventory

Component Inventory and Assessment

System:	Scatchet Head Water District
PWS ID#	76470 X
Location:	7906 Guemes Ave, Clinton, WA 98236
Owner:	Scatchet Head Water District
Operator:	King Water Management Co.
Operator Address:	PO Box 2243, Oak Harbor, WA 98277
Prepared By:	Tabatha Dye, EIT & Robert Bennion, PE

Component	Component Information	Installed Date	Effective Life	Condition Rating	Critical Number	Remaining Life	Replacement Cost/Unit	Quantity	Unit	Replacement Total Cost	Inflation Rate	Replace in 6 Years?	Future Cost
Well #2	10", 295' Depth	1980	50	1	2	11	$ 30,000	1	LS	$ 30,000	2.0%	No	$ 37,301
Well #2 Pump	Goulds 160CLC030 30 HP	1999	15	1	2	-5	$ 6,000	1	LS	$ 6,000	2.0%	Yes	$ 6,000
Well #3	8", 403' Depth	1997	50	1	2	28	$ 30,000	1	LS	$ 30,000	2.0%	No	$ 52,231
Well #3 Pump	Goulds 70J15 15 HP	1999	15	1	2	-5	$ 6,000	1	LS	$ 6,000	2.0%	Yes	$ 6,000
Well Meters		1995	25	2	2	1	$ 1,500	2	EA	$ 3,000	2.0%	Yes	$ 3,060
Well Controls		1995	15	2	1	-9	$ 2,000	1	LS	$ 2,000	2.0%	Yes	$ 2,000
Chlorinator	LMI Series A17	2001	30	2	2	12	$ 2,000	1	LS	$ 2,000	2.0%	No	$ 2,536
Treatment System	Filtration: (4) 48"D, 463 gal Tanks	2001	30	3	1	12	$ 20,000	1	LS	$ 20,000	2.0%	No	$ 25,365
Storage Reservoir #1	Guemes 300,000 (24.5' D x 85' T)	1980	60	3	1	21	$ 2	300,000	GAL	$ 450,000	2.0%	No	$ 682,050
Storage Reservoir #2	Maple Point 120,000 (14.6' D x 95' T)	1997	60	3	2	38	$ 2	120,000	GAL	$ 180,000	2.0%	No	$ 382,014
Reservoir Controls		1999	15	4	2	-5	$ 5,000	1	LS	$ 5,000	2.0%	Yes	$ 5,000
Pressure Tank	Canal Boiler Works (66" D x 10' L)	1980	10	2	1	-29	$ 10	2,120	GAL	$ 21,200	2.0%	Yes	$ 21,200
Air Charger	Whitewater Air Rite D610	1999	15	2	2	-5	$ 3,000	1	EA	$ 3,000	2.0%	Yes	$ 3,000
Booster Pump #1-4	Aurora Series 340/360 7.5 HP	1999	15	4	2	-5	$ 3,000	4	EA	$ 12,000	2.0%	Yes	$ 12,000
Booster Pump Controls		1999	15	3	2	-5	$ 10,000	1	LS	$ 10,000	2.0%	Yes	$ 10,000
Distribution System Piping*	8" PVC	1997	50	2	5	28	$ 160	567	LF	$ 90,720	2.0%	No	$ 157,946
Distribution System Piping*	6 & 8" DI	1958	50	3	5	-11	$ 200	1,252	LF	$ 250,400	2.0%	Yes	$ 250,400
Distribution System Piping*	6" PVC	1996	50	3	2	27	$ 150	9,212	LF	$ 1,381,800	2.0%	No	$ 2,358,576
Distribution System Piping*	6" AC	1958	50	3	5	-11	$ 200	9,755	LF	$ 1,951,000	2.0%	Yes	$ 1,951,000
Distribution System Piping*	4" PVC	1997	50	2	2	28	$ 120	8,695	LF	$ 1,043,400	2.0%	No	$ 1,816,585
Distribution System Piping*	2/2.5 other	1958	50	2	5	-11	$ 100	6,636	LF	$ 663,600	2.0%	Yes	$ 663,600
Dedicated Fill Line Piping	6" PVC	1997	50	1	1	28	$ 150	3,135	LF	$ 470,250	2.0%	No	$ 818,717

Hydrants*		1980	50	3	4 / 5	11	$ 5,000	20	EA	$ 100,000	2.0%	No	$ 124,337
Gate Valves*		1980	20	2	4 / 5	-19	$ 2,500	70	EA	$ 175,000	2.0%	Yes	$ 175,000
Air-release Valves*		1980	20	2	4 / 5	-19	$ 3,000	18	EA	$ 54,000	2.0%	Yes	$ 54,000
Blow-offs*		1980	20	2	4 / 5	-19	$ 3,000	14	EA	$ 42,000	2.0%	Yes	$ 42,000
Pressure Reducing Valve Stations													
	Fidalgo PRV Station:	1980	20	3	2	-19	$ 40,000	1	EA	$ 40,000	2.0%	Yes	$ 40,000
	Fidalgo/George PRV Station:	1980	20	3	2	-19	$ 40,000	1	EA	$ 40,000	2.0%	Yes	$ 40,000
	Driftwood Drive PRV Station:	2007	20	1	2	8	$ 40,000	1	EA	$ 40,000	2.0%	No	$ 46,866
Service meters		1980	15	Varies	4 / 5	-24	$ 200	410	EA	$ 82,000	2.0%	Yes	$ 82,000
Generator		1980	50	2	3	11	$ 6,000		EA	$ -	2.0%	No	$ -
Propane Tank		1980	30	2	3	-9	$ 2,000		EA	$ -	2.0%	Yes	$0
Pumphouse		1980	75	3	3	36	$ 200	1,125	SF	$ 225,000	2.0%	No	$ 458,975
Facility Maintenance		1980	50	n/a		11	$ 2,000	6	Year	$ 12,000		No	$ 12,000

*From 1998 WSP

Major Anticipated Projects
• Treatment System Replacement
• Old Water Main Replacement
• 2nd Line to Beach
• Looping Periwinkle to George
• Expansion West

Total Cost Estimate for 6-year	$10,329,758

APPENDIX D Financial Information

System Financial Information

	2015	2016	2017	2018
REVENUES				
Water Fees	134,396.46	132,192.15	137,928.41	134,670.49
Late Fees	773.47	420.63	785.14	402.09
Reimbursed Expenses	3,382.00	2,297.35	2,728.00	2,261.00
Total Income	138,551.93	134,910.13	141,441.55	137,333.58
EXPENSES				
Bond				
Transfer to Bond Fund	45,000.00	45,000.00	45,000.00	45,000.00
Direct Salaries and Wages				
Manager Salary	7,200.00	7,200.00	7,200.00	7,200.00
Commissioners Pay	3,648.00	3,762.00	3,534.00	4,186.00
Meter Reading	600.00	600.00	600.00	700.00
Payroll Expenses	1,140.56	1,147.80	1,156.44	1,136.09
Total Direct Salaries and Wages	12,588.56	12,709.80	12,490.44	13,222.09
Water Maintenance				
Water Management	12,348.00	12,348.00	12,348.00	13,058.00
Water Repairs and Maintenance	7,385.06	9,402.05	7,356.54	17,512.05
Water Testing	1,455.50	1,548.00	1,523.00	3,071.00
Chlorine and Chemicals	2,518.53	2,325.60	2,706.46	2,923.83
Reservoir Cleaning	0.00	3,206.65	0.00	0.00
Sanitary Survey	1,142.92	0.00	0.00	0.00
Capital Improvement	2,450.10	0.00	0.00	0.00
Supplies/Parts	0.00	0.00	59.17	262.51
Flushing	0.00	0.00	0.00	1,747.90
Water System Site Maintenance	0.00	0.00	0.00	19.90
Total Water Maintenance	27,300.11	28,830.30	23,993.17	38,595.19
Utilities				
Telephone	214.44	214.44	214.44	214.44
Propane	441.79	189.59	92.40	92.51
Electric	8,886.43	11,319.06	11,145.02	13,566.50
Total Utilities	9,542.66	11,723.09	11,451.86	13,873.45
General and Administrative				
Liability Insurance	4,397.00	4,503.00	4,657.00	5,017.00
Dues and Subscriptions	637.23	651.99	422.70	629.05
Island County NSF Fee	40.00	80.00	240.00	160.00
Licenses and Permits	724.00	724.00	724.00	1,202.76
Office Supplies	248.64	153.30	294.66	85.76
Billing Cards and Stamps	1,329.68	1,083.30	1,451.09	1,545.26
Certified Letter Fees	2,241.59	2,233.79	2,299.03	1,630.50
Mailings	0.00	0.00	0.00	1,946.05

Lien Filling Fees	507.00	154.44	155.44	190.23
Printing and Reproduction	44.46	75.60	234.55	70.51
Professional Development	0.00	152.89	270.40	0.00
Freedom of Information Response	0.00	0.00	0.00	1,395.71
Total General and Administrative	10,169.60	9,812.31	10,748.87	12,477.12
Professional Services				
Engineering	0.00	600.00	13,780.49	6,345.49
Accounting	9,600.00	9,600.00	9,600.00	10,080.00
Audit	0.00	1,391.12	205.44	145.66
Legal Fees	0.00	0.00	0.00	1,890.50
Subcontractor/Maintenance	0.00	0.00	2,282.70	0.00
Total Professional Services	9,600.00	11,591.12	25,868.63	18,461.65
Taxes				
State Utility Tax	-150.55	8,136.59	6,943.22	7,240.78
Property	78.26	78.26	78.26	78.26
Total Taxes	-72.29	8,214.85	7,021.48	7,319.04
Total Expenses	114,128.64	127,881.47	136,574.45	150,344.25
NET				
Total Income	138,551.93	134,910.13	141,441.55	137,333.58
Total Expenses	114,128.64	127,881.47	136,574.45	150,344.25
Net Income	24,423.29	7,028.66	4,867.10	-13,010.67

	Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025
REVENUES						
Water Fees	$168,000.00	$201,600.00	$236,300.00	$254,100.00	$254,100.00	$254,100.00
Late Fees	$400.00	$400.00	$400.00	$400.00	$400.00	$400.00
Reimbursed Expenses	$2,500.00	$2,500.00	$2,500.00	$2,500.00	$2,500.00	$2,500.00
Total Income	$170,900.00	$204,500.00	$239,200.00	$257,000.00	$257,000.00	$257,000.00
EXPENSES						
Direct Salaries and Wages						
Manager Salary	$7,200.00	$7,200.00	$7,700.00	$7,700.00	$8,200.00	$8,200.00
Commissioners Pay	$4,000.00	$4,400.00	$4,600.00	$4,600.00	$4,600.00	$4,800.00
Meter Reading	$700.00	$900.00	$900.00	$900.00	$900.00	$900.00
Payroll Expenses	$1,150.00	$1,350.00	$1,350.00	$1,550.00	$1,550.00	$1,550.00
Total Direct Salaries and Wages	$13,050.00	$13,850.00	$14,550.00	$14,750.00	$15,250.00	$15,450.00
Water Maintenance						
Water Management	$13,100.00	$14,000.00	$14,000.00	$15,000.00	$15,000.00	$15,000.00
Water Repairs and Maintenance	$10,500.00	$10,500.00	$10,500.00	$10,500.00	$10,500.00	$10,500.00
Water Testing	$2,750.00	$2,750.00	$2,750.00	$3,000.00	$3,000.00	$3,250.00
Chlorine and Chemicals	$3,600.00	$3,600.00	$3,600.00	$3,800.00	$3,800.00	$3,800.00
Reservoir Cleaning	$0.00	$0.00	$4,500.00	$0.00	$0.00	$0.00
Sanitary Survey	$2,000.00	$0.00	$0.00	$3,000.00	$0.00	$0.00
Capital Improvement	See Capital Improvements Budget in Appendix O					
Supplies/Parts	$300.00	$300.00	$400.00	$400.00	$500.00	$500.00
Flushing	$2,000.00	$2,000.00	$2,000.00	$3,000.00	$3,000.00	$3,000.00
Total Water Maintenance	$34,250.00	$33,150.00	$37,750.00	$38,700.00	$35,800.00	$36,050.00

Utilities						
Telephone	$250.00	$250.00	$250.00	$250.00	$300.00	$300.00
Propane	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00
Electric	$14,000.00	$14,150.00	$14,600.00	$14,600.00	$14,600.00	$14,900.00
Total Utilities	$14,400.00	$14,550.00	$15,000.00	$15,000.00	$15,050.00	$15,350.00
General and Administrative						
Liability Insurance	$5,100.00	$5,100.00	$5,500.00	$5,500.00	$6,000.00	$6,000.00
Dues and Subscriptions	$650.00	$650.00	$650.00	$700.00	$700.00	$800.00
Island County NSF Fee	$200.00	$200.00	$200.00	$250.00	$250.00	$250.00
Licenses and Permits	$1,250.00	$1,250.00	$1,250.00	$1,250.00	$1,250.00	$1,250.00
Office Supplies	$250.00	$250.00	$250.00	$250.00	$250.00	$250.00
Billing Cards and Stamps	$1,600.00	$1,600.00	$1,600.00	$1,600.00	$1,600.00	$1,600.00
Certified Letter Fees	$3,000.00	$3,000.00	$3,500.00	$3,500.00	$3,500.00	$4,000.00
Mailings	$1,500.00	$1,500.00	$1,500.00	$2,000.00	$2,000.00	$2,000.00
Lien Filling Fees	$200.00	$200.00	$200.00	$200.00	$200.00	$200.00
Printing and Reproduction	$100.00	$100.00	$100.00	$100.00	$100.00	$100.00
Professional Development	$500.00	$500.00	$500.00	$500.00	$500.00	$500.00
Freedom of Information Response	$1,500.00	$1,500.00	$1,500.00	$1,500.00	$1,500.00	$1,500.00
Total General and Administrative	$15,850.00	$15,850.00	$16,750.00	$17,350.00	$17,850.00	$18,450.00
Professional Services						
Engineering	$15,000.00	$15,000.00	$18,000.00	$18,000.00	$20,000.00	$20,000.00
Accounting	$11,000.00	$12,000.00	$12,000.00	$13,000.00	$14,000.00	$14,000.00
Audit	$1,000.00	$1,000.00	$2,000.00	$2,000.00	$2,500.00	$2,500.00
Legal Fees	$2,000.00	$2,000.00	$2,000.00	$3,000.00	$3,000.00	$3,000.00
Subcontractor/Maintenance	$2,500.00	$2,500.00	$2,500.00	$3,000.00	$3,000.00	$3,000.00
Total Professional Services	$31,500.00	$32,500.00	$36,500.00	$39,000.00	$42,500.00	$42,500.00
Taxes						

State Utility Tax	$8,000.00	$9,600.00	$11,300.00	$12,100.00	$12,100.00	$12,100.00
Property	$100.00	$100.00	$100.00	$100.00	$100.00	$100.00
Total Taxes	$8,100.00	$9,700.00	$11,400.00	$12,200.00	$12,200.00	$12,200.00
Total Expenses	$117,150.00	$119,600.00	$131,950.00	$137,000.00	$138,650.00	$140,000.00
NET						
Total Income	$170,900.00	$204,500.00	$239,200.00	$257,000.00	$257,000.00	$257,000.00
Total Expenses	$117,150.00	$119,600.00	$131,950.00	$137,000.00	$138,650.00	$140,000.00
Net Income	$53,750.00	$84,900.00	$107,250.00	$120,000.00	$118,350.00	$117,000.00

Full Project Cost Estimate

ENGINEER'S PRELIMINARY CONSTRUCTION COST ESTIMATE
CLIENT: Scatchet Head Water District
PROJECT: Full System Improvement Project
DATE: October 2020

NO.	ITEM	UNIT	UNIT COST	QUANTITY	TOTAL COST
	Distribution System Improvements				
1	Mobilization	LS	$ 102,000.00	1	$102,000
2	Project Temporary Traffic Control	LS	$ 10,000.00	1	$10,000
3	Connection to existing waterline	EA	$ 3,500.00	11	$38,500
4	6" PVC C-900 Water Main (Blakely Ave)	LF	$ 65.00	1,735	$112,775
5	6" PVC C-900 Water Main (Pear St)	LF	$ 65.00	215	$13,975
6	6" PVC C-900 Water Main (Hat St)	LF	$ 65.00	310	$20,150
7	6" PVC C-900 Water Main (San Juan Ave)	LF	$ 65.00	230	$14,950
8	6" PVC C-900 Water Main (Casey St)	LF	$ 65.00	340	$22,100
9	6" PVC C-900 Water Main (Guemes Ave)	LF	$ 65.00	730	$47,450
10	6" PVC C-900 Water Main (Harper St)	LF	$ 65.00	530	$34,450
11	6" PVC C-900 Water Main (George Dr)	LF	$ 65.00	3,720	$241,800
12	6" PVC C-900 Water Main (Mitford Lan)	LF	$ 65.00	710	$46,150
13	6" PVC C-900 Water Main (Pebble & Periwinkle)	LF	$ 65.00	640	$41,600
14	6" PVC C-900 Water Main (Harpoon Ln)	LF	$ 65.00	670	$43,550
15	6" PVC C-900 Water Main (Driftwood)	LF	$ 65.00	2,850	$185,250
16	12" Road Bore & Casing Pipe	LF	$ 300.00	320	$96,000
17	PRV Station (Mitford & Harpoon)	LS	$ 40,000.00	2	$80,000
19	Water Service	EA	$ 1,500.00	173	$259,500
20	Sample Stations	EA	$ 5,000.00	4	$20,000
21	Fire Hydrants	EA	$ 5,000.00	8	$40,000
	Pumphouse & Treatment Improvements				
22	New Treatment Filter System	LS	$ 75,000.00	1	$75,000
23	New Wall, Door and Shelf (for chemicals)	LS	$ 4,500.00	1	$4,500
24	Hypochlorite Feed Line Reconnection	LS	$ 1,500.00	1	$1,500
25	4" Ductile Iron Piping	LF	$ 100.00	50	$5,000
26	4" Meter	EA	$ 3,000.00	2	$6,000
27	4" Gate Valve	EA	$ 2,500.00	5	$12,500
	Source Improvements				
28	New Submerssible Well Pumps	EA	$ 10,000.00	2	$20,000
29	Well Meters	EA	$ 1,500.00	2	$3,000
30	25 kW Generator and Concrete Pad	LS	$ 15,000.00	1	$15,000
31	Propane Tank	EA	$ 2,000.00	1	$2,000
32	5,000 Gallon Storage Tank	EA	$ 10,000.00	1	$10,000
33	3" DI Well Piping	LF	$ 90.00	15	$1,350
	Optional A - Fire Flow to Lopez & Harpoon				
34	6" PVC C-900 Water Main (Orcas Dr)	LF	$ 65.00	505	$32,825
35	6" PVC C-900 Water Main (Lopez Dr)	LF	$ 65.00	290	$18,850
36	8" HDPE Water Main (Fidalgo Dr)	LF	$ 85.00	915	$77,775
37	12" Road Bore & Casing Pipe	LF	$ 300.00	100	$30,000
38	Fire Hydrants	EA	$ 5,000.00	2	$10,000
	Option B - Hubble to Driftwood Loop				
39	6" PVC C-900 Water Main (Lopez Dr)	LF	$ 65.00	370	$24,050
40	6" PVC C-900 Water Main (Driftwood Dr)	LF	$ 65.00	625	$40,625
41	PRV Station (Mitford & Harpoon)	LS	$ 40,000.00	1	$40,000
42	Directional Drill Installation - 6" HDPE Water Main	LF	$ 300.00	200	$60,000
	Option C - Fidalgo Loop				
43	6" HDPE Water Main - Pipe Bursting (Fidalgo Dr)		$ 150.00	1,210	$181,500

Construction Cost =	**$2,141,675**
Contingency (20%) =	**$428,335**
Sales Tax (8.7%) =	**$224,000**
Total Estimated Construction Cost =	**$2,794,000**
Permitting Fees, Engineering, Survey, etc. (15%)	**$279,000**
Rough Estimate of Project Total	**$3,070,000**

Alternates Cost Analysis

ENGINEER'S PRELIMINARY CONSTRUCTION COST ESTIMATE
CLIENT: Scatchet Head Water District
PROJECT: Distribution System Options
DATE: October 2020

Option 1: Replace Aging Watermains

NO.	ITEM	UNIT	UNIT COST	QUANTITY	PROJECT TOTAL TOTAL COST
1	Mobilization	LS	$ 89,000.00	1	$89,000
2	Project Temporary Traffic Control	LS	$ 10,000.00	1	$10,000
3	Connection to existing waterline	EA	$ 3,500.00	11	$38,500
4	PVC Pipe for Water Main, 6 in. Diameter	LF	$ 65.00	15,680	$1,019,200
5	HDPE Pipe for Water Main, 8 in. Diameter	LF	$ 85.00	915	$77,775
6	PRV Stations	LS	$ 40,000.00	3	$120,000
7	Directional Drill - Road Bores and Slope Installation	LF	$ 300.00	620	$186,000
8	Water Service	EA	$ 1,500.00	173	$259,500
9	Sample Stations	EA	$ 5,000.00	4	$20,000
10	Fire Hydrants	EA	$ 5,000.00	10	$50,000

Construction Cost =	**$1,870,000**
Contingency (20%) =	**$374,000**
Sales Tax (8.7%) =	**$195,000**
Total Estimated Construction Cost =	**$2,439,000**
Permitting Fees, Engineering, Survey, etc. (15%)	**$366,000**
Rough Estimate of Project Total	**$2,810,000**

Option 2: Pipe Bursting

NO.	ITEM	UNIT	UNIT COST	QUANTITY	PROJECT TOTAL TOTAL COST
1	Mobilization	LS	$ 165,700.00	1	$165,700
2	Project Temporary Traffic Control	LS	$ 10,000.00	1	$10,000
3	Connection to existing waterline	EA	$ 3,500.00	11	$38,500
4	Pipe Bursting	LF	$ 160.00	16,595	$2,655,200
5	Temporary Water Service	LS	$ 100,000.00	1	$100,000
6	PRV Stations	LS	$ 40,000.00	3	$120,000
7	Directional Drill - Road Bores and Slope Installation	LF	$ 300.00	200	$60,000
8	Water Service	EA	$ 1,500.00	173	$259,500
9	Sample Stations	EA	$ 5,000.00	4	$20,000
10	Fire Hydrants	EA	$ 5,000.00	10	$50,000

Construction Cost =	**$3,479,000**
Contingency (20%) =	**$695,800**
Sales Tax (8.7%) =	**$363,000**
Total Estimated Construction Cost =	**$4,538,000**
Permitting Fees, Engineering, Survey, etc. (15%)	**$681,000**
Rough Estimate of Project Total	**$5,220,000**

Option 3: Cure In Place Pipe (CIPP)

NO.	ITEM	UNIT	UNIT COST	PROJECT TOTAL QUANTITY	PROJECT TOTAL TOTAL COST
1	Mobilization	LS	$ 156,100.00	1	$156,100
2	Project Temporary Traffic Control	LS	$ 10,000.00	1	$10,000
3	Connection to existing waterline	EA	$ 3,500.00	11	$38,500
4	Water Line Inspection & De-scaling	LF	$ 25.00	15,595	$389,875
4	Cure In Place Pipe - 6" Diameter	LF	$ 125.00	16,595	$2,074,375
5	Temporary Water Service	LS	$ 100,000.00	1	$100,000
6	PRV Stations	LS	$ 40,000.00	3	$120,000
7	Directional Drill - Road Bores and Slope Installation	LF	$ 300.00	200	$60,000
8	Water Service	EA	$ 1,500.00	173	$259,500
9	Sample Stations	EA	$ 5,000.00	4	$20,000
10	Fire Hydrants	EA	$ 5,000.00	10	$50,000

Construction Cost =	**$3,278,000**
Contingency (20%) =	**$655,600**
Sales Tax (8.7%) =	**$342,000**
Total Estimated Construction Cost =	**$4,276,000**
Permitting Fees, Engineering, Survey, etc. (15%)	**$641,000**
Rough Estimate of Project Total	**$4,920,000**

Life Cycle Cost Estimate

LIFE CYCLE COST ANALYSIS
CLIENT: Scatchet Head Water District
PROJECT: Main Replacement
DATE: October 2020

Inflation (%/yr)	2.5%

Category	Alternative	Capital Cost	Annual O&M Cost	PV of O&M Costs	Lifespan (years)	NPV
Distribution	#1) Main Replacement	$2,810,000	$5,000	$155,000	60	$2,965,000
	#2) Pipe Bursting	$5,220,000	$5,000	$155,000	60	$5,375,000
	#3) Slip lining	$4,920,000	$5,000	$155,000	60	$5,075,000
	#4) Do Nothing	$0	$20,000	$618,000	60	$618,000
Pumphouse and Treatment	#1) Improvements with Greensand Plus Filter Bedding	$40,000	$4,800	$59,000	15	$99,000
	#2) Improvements with New ATEC Filtration System	$140,000	$4,800	$59,000	15	$199,000
Source	#1) Well pump, piping, and meter replacement	$80,000	$1,000	$16,000	20	$96,000

PV = Present Value
NPV = Net Present Value

APPENDIX E Water Use Efficiency Reports

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

Date Submitted: 6/27/2018

Water Use Efficiency
Annual Performance Report - 2017

WS Name: SCATCHET HEAD WATER DISTRICT Water System ID# : 76470 WS County: ISLAND

Report submitted by: *Sandra Bodamer*

Meter Installation Information:

Estimate the percentage of metered connections: *100%*

If not fully metered - Current status of meter installation:

Production, Authorized Consumption, and Distribution System Leakage Information:

12-Month WUE Reporting Period: *12/01/1916* To *11/30/1917*

Incomplete or missing data for the year? *No*

If yes, explain:

Distribution System Leakage Summary:

Total Water Produced and Purchased (TP) – Annual Volume	*20,367,292* gallons
Authorized Consumption (AC) – Annual Volume	*17,896,618* gallons
Distribution System Leakage – Annual Volume TP – AC	*2,470,674* gallons
Distribution System Leakage – Percent DSL = [(TP – AC) / TP] x 100	*12.1 %*
3-year annual average	*11.1 %*

Goal-Setting Information:

Date of Most Recent Public Forum: _____ Has goal been changed since last performance report? *No*

Note: Customer goal must be re-established every 6 years through a public process

WUE Goals:

Customer Goal (Demand Side):

Maintain average usage per house at 122 gpd through 2018 - actual for 2012 was 108 gpdph and 2011 was 112 gpdph.

Describe Progress in Reaching Goals:

Customer (Demand Side) Goal Progress:

Average usage per day per house was 136 gpd, this was attributable to a contractor installing a new cable throughout the entire neighborhood and breaking the line on numerous times.

Additional Information Regarding Supply and Demand Side WUE Efforts

Include any other information that describes how you and your customers use water efficiently:

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

Date Submitted: 6/29/2019

Water Use Efficiency
Annual Performance Report - 2018

WS Name: SCATCHET HEAD WATER DISTRICT Water System ID# : 76470 WS County: ISLAND

Report submitted by: *Sandra Bodamer*

Meter Installation Information:

Estimate the percentage of metered connections: *100%*

If not fully metered - Current status of meter installation:

Production, Authorized Consumption, and Distribution System Leakage Information:

12-Month WUE Reporting Period: *01/01/2018* To *12/31/2018*

Incomplete or missing data for the year? *No*

If yes, explain:

Distribution System Leakage Summary:

Total Water Produced and Purchased (TP) – Annual Volume	*21,882,590* gallons
Authorized Consumption (AC) – Annual Volume	*18,599,325* gallons
Distribution System Leakage – Annual Volume TP – AC	*3,283,265* gallons
Distribution System Leakage – Percent DSL = [(TP – AC) / TP] x 100	*15.0 %*
3-year annual average	*13.6 %*

Goal-Setting Information:

Date of Most Recent Public Forum: _____ Has goal been changed since last performance report? *No*

Note: Customer goal must be re-established every 6 years through a public process

WUE Goals:

Customer Goal (Demand Side):

Maintain average usage per house at 122 gpd through 2018 - actual for 2012 was 108 gpdph and 2011 was 112 gpdph.

Describe Progress in Reaching Goals:

Customer (Demand Side) Goal Progress:

Average usage per house per day was 146 gpd. This is above the goal of 122 gpd, due to ten leaks that were repaired in 2018 and a house fire.

Additional Information Regarding Supply and Demand Side WUE Efforts

Include any other information that describes how you and your customers use water efficiently:

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

Date Submitted: 6/30/2020

Water Use Efficiency
Annual Performance Report - 2019

WS Name: SCATCHET HEAD WATER DISTRICT Water System ID# : 76470 WS County: ISLAND

Report submitted by: *Sandra Bodamer*

Meter Installation Information:

Estimate the percentage of metered connections: *100%*

If not fully metered - Current status of meter installation:

Production, Authorized Consumption, and Distribution System Leakage Information:

12-Month WUE Reporting Period: *12/01/2018* To *11/30/2019*

Incomplete or missing data for the year? *No*

If yes, explain:

Distribution System Leakage Summary:

Total Water Produced and Purchased (TP) – Annual Volume	*20,757,449* gallons
Authorized Consumption (AC) – Annual Volume	*17,830,988* gallons
Distribution System Leakage – Annual Volume TP – AC	*2,926,461* gallons
Distribution System Leakage – Percent DSL = [(TP – AC) / TP] x 100	*14.1 %*
3-year annual average	*13.7 %*

Goal-Setting Information:

Date of Most Recent Public Forum: _____ Has goal been changed since last performance report? *No*

Note: Customer goal must be re-established every 6 years through a public process

WUE Goals:

Customer Goal (Demand Side):

Maintain average usage per house at 122 gpd through 2018 - actual for 2012 was 108 gpdph and 2011 was 112 gpdph.

Describe Progress in Reaching Goals:

Customer (Demand Side) Goal Progress:

Customer demand was 139 gpd per consumer. This is slightly above goal. Have increased the rate structures to have with conservation.

Additional Information Regarding Supply and Demand Side WUE Efforts

Include any other information that describes how you and your customers use water efficiently:

In the process of securing loans to replace all main distribution lines.

APPENDIX F Water Quality Results

HYDROGEOLOGIC DATABASE
Chemical Analysis

Click HERE to View Information for Well 4WG

Sample Results Color Code Legend

Sample Exceeds: None / Secondary / Primary — MCL

Owner Name: Dept. of Natural Resources
Well Key: 4WG **Site Type:** Well w/in W **TRS:** 28N/03E-15F
PWS Name: Scatchet Head Water District **DOH PwsID:** 76470 **DOH Source #:** 2

Source	Date	Alk	As	Bicarbonate	Ca	Cl	Conductivity	Fe	Hardness	K	Mg	Mn	Na	NO3	SO4	Turbidity	TDS
DOE	12/16/1984					14											
DOE	4/1/1985					10											
DOH	8/12/1985					10											
DOH	2/10/1986		0.014			< 10	400	0.19	130			0.18	41	< 0.2		1	
DOE	4/14/1986					90											
DOH	10/27/1986					180											
DOH	4/28/1987					10											
DOH	11/9/1987					< 10											
DOH	5/9/1988					13											
DOE	8/29/1988					10											
DOH	4/28/1989					10	400										
DOH	8/18/1989					< 10	390										
DOE	4/15/1990					10											
DOH	8/27/1990					15	410										
DOH	4/22/1991					9	410										
DOH	8/26/1991					10	410										
DOH	4/20/1992					10	410										
DOH	10/12/1992					11	410										
DOH	5/10/1993					13	420										
DOH	9/13/1993					9	420										
DOH	4/11/1994					9	410										
DOH	5/9/1994													< 0.5			
DOH	9/12/1994					10	420										
DOH	5/8/1995					9.5	400										
DOH	11/4/1995					10											
DOH	11/4/1995					10											
DOH	3/3/1997		0.01			< 20	410	0.24	140			0.25	38	< 0.5	< 10	0.3	
DOH	5/4/1998		< 0.01		27	< 20	400	0.24	140		17	0.26	39	< 0.5	< 10	0.3	
DOH	9/14/1998					< 20								< 0.5			
DOH	7/19/1999					< 20								< 0.5			

Source	Date	Alk	As	Bicarbonate	Ca	Cl	Conductivity	Fe	Hardness	K	Mg	Mn	Na	NO3	SO4	Turbidity	TDS
DOH	2/14/2000		0.01		26	< 20	400	0.24	130		17	0.26	38	< 0.5	< 10	0.34	
DOH	6/12/2000					< 20		0.26				0.25		< 0.5			
DOH	5/7/2001					< 20								< 0.5	< 10		
DOH	10/8/2001					< 20		0.28				0.25		0.6			
DOH	2/19/2002							0.038				0.031					
DOH	3/17/2002							< 0.1				0.11					
DOH	3/17/2002							< 0.1				0.13					
DOH	4/1/2002							< 0.1				0.063					
DOH	4/1/2002							0.35				0.24		< 0.5			
DOH	5/15/2002							< 0.021				0.008					
DOH	8/12/2002		0.007			< 20								< 0.5			
DOH	9/4/2002							0.65				0.021					
DOH	9/4/2002							< 0.021				0.017					
DOH	9/25/2002							0.025				0.014					
DOH	9/25/2002							0.1				0.014					
DOH	10/23/2002							0.242				0.018					
DOH	10/23/2002							0.03				0.02					
DOH	11/27/2002							0.19				0.012					
DOH	11/27/2002							0.029				0.009					
DOH	12/18/2002							< 0.021				0.009					
DOH	12/18/2002							0.3				0.008					
DOH	1/22/2003							0.04				0.011					
DOH	1/22/2003							0.25				0.019					
DOH	2/3/2003													< 0.5			
DOH	2/19/2003							0.5				0.023					
DOH	3/12/2003							0.037				0.037					
DOH	3/12/2003							0.22				0.037					
DOH	4/15/2003							0.031				0.034					
DOH	4/15/2003							0.027				0.025					
DOH	5/21/2003							< 0.021				0.02					
DOH	5/21/2003							0.038				0.02					
DOH	6/16/2003							< 0.1				0.036					
DOH	6/16/2003							< 0.1								0.2	
DOH	7/6/2003							< 0.1				0.07					
DOH	7/6/2003							< 0.1				0.053					
DOH	7/15/2003							0.059				0.067					

Source	Date	Alk	As	Bicarbonate	Ca	Cl	Conductivity	Fe	Hardness	K	Mg	Mn	Na	NO3	SO4	Turbidity	TDS
DOH	7/15/2003							0.078				0.076					
DOH	8/11/2003							0.16				0.036					
DOH	8/11/2003							< 0.1				0.028					
DOH	8/11/2003					< 20								< 0.5			
DOH	9/10/2003							0.052				0.032					
DOH	9/10/2003							0.052				0.029					
DOH	10/21/2003							0.039				0.022					
DOH	10/21/2003							0.039				0.023					
DOH	11/11/2003							1.1				0.029					
DOH	11/11/2003							0.062				0.031					
DOH	12/9/2003							0.04				0.032					
DOH	12/9/2003							0.023				0.028					
DOH	1/13/2004							0.058				0.034					
DOH	1/13/2004							0.047				0.031					
DOH	2/3/2004							0.049				0.062					
DOH	2/3/2004							0.067				0.091					
DOH	2/15/2004							< 0.1				0.028					
DOH	2/15/2004							< 0.1				0.035					
DOH	3/2/2004							0.041				0.021					
DOH	3/2/2004							< 0.021				0.022					
DOH	4/6/2004							0.056				0.04					
DOH	4/6/2004							0.046				0.024					
DOH	4/20/2004							0.053				0.022					
DOH	4/20/2004							0.049				0.025					
DOH	5/11/2004							0.047				0.024					
DOH	5/11/2004							0.047				0.062					
DOH	6/1/2004							0.037				0.018					
DOH	6/1/2004							0.062				0.02					
DOH	7/13/2004							0.05				0.032					
DOH	7/13/2004							0.056				0.023					
DOH	8/4/2004							0.086				0.025					
DOH	8/4/2004							0.096				0.03					
DOH	9/14/2004							0.058				0.013					
DOH	9/14/2004							0.22				0.25					
DOH	9/14/2004							0.1				0.009					
DOH	10/6/2004							0.053				0.009					

Source	Date	Alk	As	Ca	Cl	Fe	K	Mg	Mn	Na	NO3	SO4	TDS
DOH	11/2/2004					0.043			0.014				
DOH	11/2/2004					0.045			0.012				
DOH	12/15/2004					< 0.021			0.006				
DOH	12/15/2004					0.044			0.009				
DOH	1/5/2005					0.053			0.005				
DOH	1/5/2005					0.048			0.008				
DOH	3/9/2005					0.041			0.007				
DOH	3/9/2005					0.044			0.009				
DOH	4/5/2005					0.041			0.007				
DOH	4/5/2005					0.055			0.007				
DOH	5/10/2005					0.069			0.015				
DOH	5/10/2005					0.055			0.02				
DOH	6/8/2005					0.092			< 0.005				
DOH	6/8/2005					0.042			< 0.005				
DOH	7/6/2005					0.12			0.006				
DOH	7/6/2005					0.064			0.005				
DOH	8/16/2005					0.023			0.006				
DOH	8/16/2005					0.043			0.006				
DOH	10/4/2005					< 0.021			0.017				
DOH	10/4/2005					0.046			0.018				
DOH	11/2/2005					0.033			0.012				
DOH	11/2/2005					0.082			0.012				
DOH	12/13/2005					< 0.021			0.022				
DOH	12/13/2005					0.042			0.016				
DOH	1/4/2006					0.047			0.018				
DOH	1/4/2006					0.12			0.047				
DOH	2/1/2006		< 0.002		< 20	0.068			0.039		< 0.5		
DOH	2/1/2006		< 0.002		< 20	0.069			0.041		< 0.5		
DOH	3/7/2006					0.07			0.054				
DOH	3/7/2006					0.11			0.054				
DOH	4/4/2006					0.059			0.024				
DOH	4/4/2006					0.076			0.028				
DOH	5/9/2006					0.047			0.013				
DOH	5/9/2006					0.092			0.017				
DOH	6/6/2006					0.048			0.034				
DOH	6/6/2006					0.082			0.024				

Source	Date	Alk	As	Bicarbonate	Ca	Cl	Conductivity	Fe	Hardness	K	Mg	Mn	Na	NO3	SO4	Turbidity	TDS
DOH	7/4/2006							0.074				0.027					
DOH	7/4/2006							0.078				0.032					
DOH	8/2/2006							0.069				0.038					
DOH	8/2/2006							0.054				0.039					
DOH	9/12/2006							0.12				0.068					
DOH	9/12/2006							0.12				0.092					
DOH	10/4/2006							0.064				0.034					
DOH	10/4/2006							0.16				0.034					
DOH	12/12/2006							0.064				0.031					
DOH	12/12/2006							0.096				0.026					
DOH	1/10/2007							0.055				0.054					
DOH	1/10/2007							0.051				0.064					
DOH	9/13/2010		0.009					0.35				0.22					
DOH	4/27/2020					< 20	363										
DOH	8/31/2020					< 20	363										

Select Summary Statistics

Avg As:	0.007	Avg Cl:	16.3	Avg Hardness:	135	Avg NO3:	0.26
Median As:	0.008	Median Cl:	10.0	Median Hardness:	135	Median NO3:	0.25
Max As:	0.014	Max Cl:	180.0	Max Hardness:	140	Max NO3:	0.6

Bacteria Samples (distribution): **381 sample(s)**

Disclaimer: Data presented has been collected from a variety of sources. Island County makes no guarantee as to the validity or accuracy of this data. Please report any errors to the Island County Hydrogeologist.

Generated by the Island County Hydrogeologic Database

153 records printed on 10/6/2020

Note: Items with blue frames and blue text are clickable hyperlinks to additional information / resources.

Parameter labels with a red fill color are exhibiting an increasing trend, and those with a green fill color are exhibiting a decreasing trend.

HYDROGEOLOGIC DATABASE
Chemical Analysis

Click HERE to View Information for Well 4WH

Sample Results Color Code Legend

Sample Exceeds: None / Secondary / Primary — MCL

Owner Name: Scatchet Head Water District
Well Key: 4WH **Site Type:** Well w/in W **TRS:** 28N/03E-15F
PWS Name: Scatchet Head Water District **DOH PwsID:** 76470 **DOH Source #:** 3

Source	Date	Alk	As	Bicarbonate	Ca	Cl	Conductivity	Fe	Hardness	K	Mg	Mn	Na	NO3	SO4	Turbidity	TDS
DOH	11/4/1995		0.016			11	374	< 0.03	80			0.127	53	< 0.2		0.2	
DOH	1/21/1997					11	320	2.2				0.13				190	
DOH	7/19/1999					< 20								< 0.5			
DOH	8/12/2002		0.004			< 20								< 0.5			
DOH	7/6/2003							< 0.1				0.07					
DOH	7/6/2003							< 0.1				0.053					
DOH	7/15/2003							0.059				0.067					
DOH	7/15/2003							0.078				0.076					
DOH	8/11/2003					< 20								< 0.5			
DOH	10/4/2005							< 0.021				0.017					
DOH	11/2/2005							0.082				0.012					
DOH	11/2/2005							0.033				0.012					
DOH	9/13/2010		0.02					0.36				0.2					
DOH	4/30/2020					< 20	384										
DOH	8/31/2020					< 20	361										

Select Summary Statistics

Avg As:	0.013	Avg Cl:	10.3	Avg Hardness:	80	Avg NO3:	0.21
Median As:	0.016	Median Cl:	10.0	Median Hardness:	80	Median NO3:	0.25
Max As:	0.02	Max Cl:	11.0	Max Hardness:	80	Max NO3:	0.25

Bacteria Samples (distribution): 381 sample(s)

Generated by the Island County Hydrogeologic Database

15 records printed on 10/6/2020

Note: Items with blue frames and blue text are clickable hyperlinks to additional information / resources.

Parameter labels with a red fill color are exhibiting an increasing trend, and those with a green fill color are exhibiting a decreasing trend.

APPENDIX G Hydraulic Model

Hydraulic Model - Scatchet Head Water District

		Scenario 1: Static Water Pressure		Scenario 2: Peak Hour Demand		Scenario 3: Fire-flow and MDD	
Junction ID	Elevation (ft)	Demand (gpm)	Pressure (psi)	Demand (gpm)	Pressure (psi)	Demand (gpm)	Pressure (psi)
J-83	360	0	31	0	31	0	31
J-84	360	0	31	0	31	0	31
J-85	360	0	31	0	31	0	31
J-86	360	0	31	0	31	0	31
J-69	190	0	40	0	40	0	40
J-64	230	0	42	9	41	4	41
J-77	185	0	42	0	42	0	42
J-78	170	0	49	6	49	3	49
J-1	368	0	52	7	41	0	39
J-2	365	0	53	8	42	4	39
J-35	365	0	53	0	42	0	39
J-36	365	0	53	5	42	2	39
J-72	160	0	53	0	53	0	53
J-7	360	0	55	8	44	4	41
J-8	360	0	55	6	44	3	41
J-33	360	0	55	4	44	2	41
J-34	360	0	55	0	44	0	41
J-87	360	0	55	0	45	0	45
J-88	360	0	55	0	45	0	44
J-89	360	0	55	0	45	0	44
J-90	360	0	55	0	45	0	44
J-75	20	0	55	7	55	3	55
J-76	20	0	55	8	55	4	55
J-80	20	0	55	2	55	1	55
J-81	20	0	55	5	55	2	55
J-82	20	0	55	21	55	10	55
J-23	355	0	57	0	46	0	42
J-24	355	0	57	0	46	0	42
J-25	355	0	57	0	46	0	43
J-26	355	0	57	6	46	3	43
J-39	355	0	57	8	46	4	42
J-40	355	0	57	0	46	0	42
J-13	352	0	58	7	47	3	44
J-31	352	0	58	3	47	1	44
J-9	350	0	59	0	48	0	45
J-27	350	0	59	3	48	1	45
J-30	350	0	59	0	48	0	45
J-38	350	0	59	4	48	2	45
J-41	350	0	59	4	48	2	45
J-42	350	0	59	2	48	1	45
J-43	350	0	59	1	48	1	45
J-45	350	0	59	7	48	3	45
J-46	350	0	59	7	48	3	45

		Scenario 1: Static Water Pressure		Scenario 2: Peak Hour Demand		Scenario 3: Fire-flow and MDD	
Junction ID	Elevation (ft)	Demand (gpm)	Pressure (psi)	Demand (gpm)	Pressure (psi)	Demand (gpm)	Pressure (psi)
J-70	145	0	59	11	59	5	59
J-12	347	0	61	0	50	0	46
J-3	345	0	61	0	51	0	48
J-10	345	0	61	7	51	3	48
J-11	345	0	61	0	50	0	47
J-71	140	0	62	6	62	3	62
J-5	340	0	64	11	53	5	50
J-6	340	0	64	0	53	0	50
J-14	340	0	64	5	53	2	48
J-21	340	0	64	3	53	1	48
J-22	340	0	64	0	53	0	48
J-29	340	0	64	3	52	1	49
J-32	340	0	64	4	53	2	50
J-44	340	0	64	0	52	0	49
J-54	340	0	64	0	52	0	49
J-55	340	0	64	3	52	1	49
J-73	135	0	64	6	64	3	64
J-63	175	0	65	0	65	0	65
J-28	335	0	66	1	55	1	51
J-37	335	0	66	6	55	3	49
J-53	335	0	66	0	54	0	51
J-58	335	0	66	1	54	1	51
J-59	335	0	66	1	54	1	51
J-56	332	0	67	3	56	1	52
J-15	330	0	68	0	57	0	52
J-16	330	0	68	0	57	0	51
J-17	330	0	68	0	57	500	50
J-18	330	0	68	5	57	2	50
J-20	330	0	68	3	57	1	52
J-52	330	0	68	4	56	2	53
J-4	325	0	70	4	59	2	57
J-49	325	0	70	2	59	1	55
J-50	325	0	70	0	59	0	55
J-51	325	0	70	6	59	3	55
J-57	325	0	70	3	59	1	55
J-19	320	0	72	4	61	2	55
J-65	150	0	76	15	74	7	76
J-60	300	0	81	13	69	6	66
J-66	290	0	85	9	74	4	71
J-74	85	0	85	9	85	4	85
J-67	275	0	92	0	80	0	77
J-61	250	0	103	1	91	1	88
J-47	225	0	113	0	102	0	99

		Scenario 1: Static Water Pressure		Scenario 2: Peak Hour Demand		Scenario 3: Fire-flow and MDD	
Junction ID	Elevation (ft)	Demand (gpm)	Pressure (psi)	Demand (gpm)	Pressure (psi)	Demand (gpm)	Pressure (psi)
J-92	223	0	114	3	103	1	100
J-68	220	0	116	0	104	0	101
J-79	215	0	118	0	106	0	103
J-62	190	0	129	0	117	0	114
J-91	190	0	129	0	117	0	114

						Scenario 1: Static Water Pressure		Scenario 2: Peak Hour Demand		Scenario 3: Fire-flow and MDD	
Pipe ID	Length (ft)	Diameter (inch)	Material	Start Node	Stop Node	Flow (gpm)	Velocity (ft/s)	Flow (gpm)	Velocity (ft/s)	Flow (gpm)	Velocity (ft/s)
P-1	189	6	PVC	J-1	J-2	0	0	194	2.21	426	4.83
P-2	130	6	PVC	J-2	J-3	0	0	71	0.8	145	1.64
P-3	657	6	PVC	J-32	J-4	0	0	-11	0.13	-18	0.2
P-4	775	6	PVC	J-1	J-5	0	0	96	1.09	211	2.4
P-5	19	6	PVC	J-5	J-6	0	0	15	0.17	19	0.22
P-6	579	6	PVC	J-6	J-4	0	0	15	0.17	19	0.22
P-7	242	6	PVC	J-2	J-7	0	0	116	1.32	277	3.15
P-8	446	6	PVC	J-7	J-8	0	0	19	0.21	80	0.91
P-9	270	6	PVC	J-8	J-9	0	0	12	0.14	77	0.87
P-11	249	6	PVC	J-9	J-10	0	0	-64	0.73	-184	2.08
P-12	300	6	PVC	J-10	J-5	0	0	-71	0.81	-187	2.12
P-13	304	6	PVC	J-9	J-11	0	0	76	0.87	261	2.96
P-14	24	6	Ductile Iron	J-11	J-12	0	0	32	0.37	-44	0.5
P-15	293	6	Ductile Iron	J-12	J-13	0	0	32	0.37	-44	0.5
P-16	359	6	PVC	J-11	J-14	0	0	44	0.5	304	3.45
P-17	284	6	PVC	J-14	J-15	0	0	14	0.16	284	3.23
P-18	357	6	PVC	J-15	J-16	0	0	14	0.16	284	3.23
P-19	134	6	PVC	J-16	J-17	0	0	8	0.09	282	3.2
P-20	29	6	PVC	J-17	J-18	0	0	8	0.09	-218	2.48
P-21	484	6	PVC	J-18	J-19	0	0	3	0.04	-221	2.5
P-22	386	6	PVC	J-19	J-20	0	0	-1	0.01	-223	2.53
P-23	318	6	PVC	J-20	J-21	0	0	-4	0.04	-224	2.54
P-24	228	6	PVC	J-21	J-14	0	0	-25	0.29	-18	0.2
P-25	27	6	PVC	J-21	J-22	0	0	19	0.21	-207	2.35
P-26	622	6	PVC	J-22	J-23	0	0	19	0.21	-207	2.35
P-27	20	6	PVC	J-23	J-24	0	0	-50	0.57	-125	1.42
P-28	253	6	PVC	J-24	J-13	0	0	-50	0.57	-125	1.42
P-29	423	6	PVC	J-13	J-25	0	0	-25	0.28	-173	1.96
P-30	17	6	PVC	J-25	J-26	0	0	-25	0.28	-173	1.96
P-31	281	6	PVC	J-26	J-7	0	0	-90	1.02	-194	2.2
P-32	239	6	PVC	J-26	J-27	0	0	59	0.67	19	0.21

						Scenario 1: Static Water Pressure		Scenario 2: Peak Hour Demand		Scenario 3: Fire-flow and MDD	
Pipe ID	Length (ft)	Diameter (inch)	Material	Start Node	Stop Node	Flow (gpm)	Velocity (ft/s)	Flow (gpm)	Velocity (ft/s)	Flow (gpm)	Velocity (ft/s)
P-33	300	6	PVC	J-27	J-28	0	0	126	1.43	174	1.98
P-34	75	6	PVC	J-28	J-29	0	0	26	0.29	121	1.37
P-35	165	6	PVC	J-29	J-30	0	0	-66	0.75	83	0.95
P-36	432	6	PVC	J-30	J-31	0	0	-66	0.75	83	0.95
P-37	349	6	PVC	J-31	J-23	0	0	-69	0.78	82	0.93
P-38	281	6	PVC	J-32	J-33	0	0	78	0.89	161	1.82
P-39	16	6	PVC	J-33	J-34	0	0	0	0	0	0
P-40	67	6	PVC	J-3	J-32	0	0	71	0.8	145	1.64
P-41	229	6	PVC	J-27	J-35	0	0	-70	0.79	-157	1.78
P-42	412	6	PVC	J-35	J-33	0	0	-75	0.85	-159	1.8
P-43	242	2	PVC	J-35	J-36	0	0	5	0.5	2	0.24
P-44	225	2	PVC	J-16	J-37	0	0	6	0.57	3	0.27
P-45	328	6	PVC	J-29	J-38	0	0	89	1.01	36	0.41
P-46	168	8	PVC	J-38	J-39	0	0	86	0.55	35	0.22
P-47	32	8	PVC	J-39	J-40	0	0	42	0.27	17	0.11
P-48	170	8	PVC	J-40	J-41	0	0	42	0.27	17	0.11
P-49	450	6	PVC	J-41	J-42	0	0	37	0.42	15	0.17
P-50	126	6	PVC	J-42	J-43	0	0	-35	0.4	-14	0.16
P-51	416	6	PVC	J-43	J-39	0	0	-36	0.41	-14	0.16
P-52	185	6	PVC	J-42	J-44	0	0	70	0.8	27	0.31
P-53	322	6	PVC	J-44	J-45	0	0	7	0.08	3	0.04
P-54	302	6	PVC	J-44	J-46	0	0	63	0.72	24	0.27
P-55	445	6	PVC	J-46	J-47	0	0	56	0.64	21	0.24
P-57	432	6	PVC	J-49	J-50	0	0	43	0.49	20	0.23
P-58	28	6	Ductile Iron	J-50	J-51	0	0	43	0.49	20	0.23
P-59	523	6	PVC	J-51	J-52	0	0	26	0.29	12	0.14
P-60	183	4	PVC	J-52	J-53	0	0	0	0	0	0.01
P-61	196	4	PVC	J-53	J-54	0	0	-2	0.04	-1	0.02
P-62	14	4	PVC	J-54	J-55	0	0	-3	0.08	-2	0.04
P-63	260	4	PVC	J-55	J-56	0	0	-6	0.15	-3	0.07
P-64	252	4	PVC	J-56	J-51	0	0	-11	0.29	-5	0.14

						Scenario 1: Static Water Pressure		Scenario 2: Peak Hour Demand		Scenario 3: Fire-flow and MDD	
Pipe ID	Length (ft)	Diameter (inch)	Material	Start Node	Stop Node	Flow (gpm)	Velocity (ft/s)	Flow (gpm)	Velocity (ft/s)	Flow (gpm)	Velocity (ft/s)
P-65	151	2	PVC	J-56	J-57	0	0	3	0.29	1	0.13
P-66	188	2	PVC	J-54	J-58	0	0	1	0.14	1	0.07
P-67	124	4	PVC	J-53	J-59	0	0	1	0.04	1	0.02
P-68	508	6	PVC	J-47	J-49	0	0	46	0.52	21	0.24
P-69	673	7	PVC	J-52	J-60	0	0	22	0.18	10	0.09
P-70	611	7	PVC	J-60	J-61	0	0	9	0.08	4	0.04
P-71	1,092	7	PVC	J-61	J-62	0	0	-16	0.14	-8	0.06
P-72	610	6	PVC	PRV-4	J-63	0	0	24	0.27	11	0.13
P-73	474	2	PVC	J-63	J-64	0	0	9	0.93	4	0.44
P-74	814	2	PVC	J-63	J-65	0	0	15	1.5	7	0.71
P-75	641	7	PVC	J-28	J-66	0	0	99	0.84	52	0.44
P-76	723	7	PVC	J-66	J-67	0	0	90	0.76	48	0.41
P-77	442	7	PVC	J-67	J-68	0	0	90	0.76	48	0.41
P-78	685	6	PVC	J-69	J-70	0	0	25	0.29	12	0.13
P-79	246	6	PVC	J-70	J-71	0	0	5	0.06	2	0.03
P-80	395	6	PVC	J-71	J-72	0	0	-7	0.08	-3	0.04
P-81	184	2	PVC	J-71	J-73	0	0	6	0.64	3	0.3
P-82	381	6	PVC	J-70	J-74	0	0	9	0.1	4	0.05
P-83	10	6	Ductile Iron	J-74	PRV-1	0	0	0	0	0	0
P-84	183	7	PVC	PRV-1	J-75	0	0	0	0	0	0
P-85	682	6	PVC	J-75	J-76	0	0	-7	0.08	-3	0.04
P-86	764	4	PVC	J-77	J-78	0	0	6	0.16	3	0.08
P-87	27	7	PVC	J-68	J-79	0	0	98	0.83	46	0.39
P-88	526	7	PVC	J-79	J-91	0	0	98	0.83	46	0.39
P-89	10	7	PVC	PRV-2	J-69	0	0	82	0.69	39	0.33
P-90	16	7	PVC	J-69	J-77	0	0	57	0.48	27	0.23
P-91	355	7	PVC	J-77	J-72	0	0	50	0.43	24	0.2
P-92	784	7	PVC	J-72	PRV-3	0	0	43	0.37	20	0.17
P-93	13	6	Ductile Iron	PRV-3	J-76	0	0	43	0.49	20	0.23
P-94	420	6	PVC	J-76	J-80	0	0	28	0.32	13	0.15
P-95	846	6	PVC	J-80	J-81	0	0	26	0.29	12	0.14

						Scenario 1: Static Water Pressure		Scenario 2: Peak Hour Demand		Scenario 3: Fire-flow and MDD	
Pipe ID	Length (ft)	Diameter (inch)	Material	Start Node	Stop Node	Flow (gpm)	Velocity (ft/s)	Flow (gpm)	Velocity (ft/s)	Flow (gpm)	Velocity (ft/s)
P-96	1386	6	PVC	J-81	J-82	0	0	21	0.24	10	0.11
P-97	30	8	Ductile Iron	T-1	J-83	0	0	0	0	0	0
P-98	25	8	Ductile Iron	J-83	J-84	0	0	0	0	0	0
P-99	25	8	Ductile Iron	J-84	J-85	0	0	0	0	0	0
P-100	25	8	Ductile Iron	J-85	J-86	0	0	0	0	0	0
P-101	15	4	Ductile Iron	J-86	PMP-4	0	0	0	0	0	0
P-102	15	2	PVC	PMP-4	J-87	0	0	0	0	0	0
P-103	25	6	Ductile Iron	J-87	J-88	0	0	298	3.38	637	7.23
P-104	25	6	Ductile Iron	J-88	J-89	0	0	298	3.38	637	7.23
P-105	25	6	Ductile Iron	J-89	J-90	0	0	298	3.38	637	7.23
P-106	77	6	Ductile Iron	J-90	J-1	0	0	297	3.38	637	7.23
P-107	15	6	Ductile Iron	J-83	PMP-1	0	0	0	0	0	0
P-108	15	2	PVC	PMP-1	J-90	0	0	0	0	0	0
P-109	15	6	Ductile Iron	J-84	PMP-2	0	0	0	0	0	0
P-110	15	2	PVC	PMP-2	J-89	0	0	0	0	0	0
P-111	15	4	Ductile Iron	J-85	PMP-3	0	0	0	0	0	0
P-112	15	2	PVC	PMP-3	J-88	0	0	0	0	0	0
P-115	25	6	Ductile Iron	T-3	J-87	0	0	298	3.38	637	7.23
P-116	38	6	Ductile Iron	J-91	J-62	0	0	16	0.18	8	0.09
P-117	12	6	Ductile Iron	J-91	PRV-2	0	0	82	0.93	39	0.44
P-118	55	6	PVC	J-61	PRV-4	0	0	24	0.27	11	0.13
P-119	174	6	PVC	J-47	J-92	0	0	11	0.12	-1	0.01
P-120	289	6	PVC	J-92	J-68	0	0	8	0.09	-2	0.02