Draft Preliminary Engineering Report

Drinking Water System Improvements

Prepared for:

Lake Shastina Community Services District

December 2023

520022.300

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Reference: 520022.300

December 20, 2023

Paula Mitchell and Rick Tompson, General Managers
Lake Shastina Community Services District
16309 Everhart Drive
Weed, CA 96094

Subject: Draft Preliminary Engineering Report for Drinking Water Planning Grant SWRCB Agreement Number D1902019, SWRCB Project Number 4710013-001P

Dear Paula Mitchell and Rick Tompson:

Please find enclosed the draft preliminary engineering report (PER) for the drinking water planning grant. Please review and provide any comments. If no changes are needed, please submit this document to the State Water Resources Control Board Division of Financial Assistance.

If you have any questions, please contact me at (541) 827-7855 or arasmussen@shn-engr.com.

Respectfully submitted,

SHN

Anders H. Rasmussen, PE
Regional Principal

AHR/SRB:lam

Enclosure: Draft Preliminary Engineering Report, Drinking Water Planning Grant
c. w/Encl.: Rodney Villa, LSCSD

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Prepared for:

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Prepared by:

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QA/QC: AHR:___
Reference: 520022.300

Executive Summary

SHN performed a review of the Lake Shastina Community Services District (LSCSD) drinking water system and made recommendations for improvements in the major areas shown in Table E-1.

Table E-1. System Concerns Summary
Lake Shastina Community Services District

System Concerns	Recommended Improvement
Water storage tanks are degrading	Isolate, empty, inspect, repair, recoat, and refill all tanks. Implement new/repaired cathodic protection to protect rehabilitated tank.
In the event of a power loss situation, no backup power is currently available	Install backup power generators with automatic transfer switches to maintain power to wells and booster pumps to maintain water flow in the event of a power outage, this is especially important in the event of a fire to protect district property, structures and to prevent loss of life.
No backup for the main well	Drill additional wells, to provide more water capacity and redundancy (this has yet to be finalized from test well installation and testing).
Most booster and filling pump stations do not have VFD[a] motors and cannot connect to backup power	Most booster and filling pump stations do not have VFD motors, install these motors and create connections at each pump station to accept the LSCSD's[b] portable or permanent generators.
Low pressure in southeast zone	Add a booster pump station in the southeast area and install two gate valves that will be shut to increase pressure. Install a new fire hydrant near the gate valves to function as blow-off valves, as necessary.
Manual water meter reading is time consuming	Implement new water meters that can report data to LSCSD staff from a distance, reducing person-hours spent.
Fire Hydrants and valves have exceeded design life	Replace all fire hydrants and associated valves to maintain safety for LSCSD customers.

a. VFD: variable frequency drive
b. LSCSD: Lake Shastina Community Services District

The proposed improvements total an estimated cost of $ 8,590,000. Project cost estimates for individual projects are shown in each individual section and summarized in Table 5-12. Detailed project descriptions and costs are provided in Section 7 and detailed within Appendix 3.

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Abbreviations and Acronyms

Units of Measure

gpm	gallons per minute
hp	horsepower
kW	kilowatts
MGD	million gallons per day
psi	pounds per square inch

Additional Terms

AMI	advanced metering infrastructure
AMR	automatic meter reading
ATS	automatic transfer switch
B-#	booster pump-number/filling station-number
CEQA	California Environmental Quality Act
CWS	community water system
DFA	(SWRCB) Division of Financial Assistance
EA	each
FY	fiscal year
GWUDI	groundwater under direct influence of surface water
LF	linear foot
LS	lump sum
LSCSD	Lake Shastina Community Services District
MCL	maximum contaminant level
MTS	manual transfer switch
O&M	operations and maintenance
PER	preliminary engineering report
PS	pump station
PWS	public water system
SCADA	supervisory control and data acquisition
SDWA	Safe Drinking Water Act
SF	square foot
SWRCB	California State Water Resources Control Board
T-#	test well-number
VFD	variable frequency drive
VOCs	volatile organic compounds

1.0 Introduction

1.1 Purpose

The purpose of this preliminary engineering report (PER) is to evaluate the existing Lake Shastina Community Services District (LSCSD) drinking water system and provide recommendations for needed upgrades. The existing system consists of three production wells, four storage tanks with corresponding booster and/or filling pump stations, water meters, and a fire hydrant network.

Funding for this PER has been provided in full through a small community drinking water planning grant from the California State Water Resources Control Board (SWRCB), under SWRCB Agreement Number D1902019 and SWRCB Project Number 4710013-001P. The contents of this document do not necessarily reflect the views and policies of the foregoing, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

1.2 Scope

The scope of this project was to review the existing system and determine alternatives and recommendations for the needs identified by the LSCSD, which are the following, as described in detail in the following sections:

- Provide redundancy for Well 4.
- Rehabilitate or replace aging storage tanks.
- Increase storage capacity to alleviate strain on Tank 2.
- Complete the supervisory control and data acquisition (SCADA) system (specifically add Booster Pump Station B-57).
- Boost water pressures in the southeast portion of the service area.
- Improve billing efficiency by replacing the manual read water meters.
- Replace aging fire hydrants.
- Install backup power at critical locations.

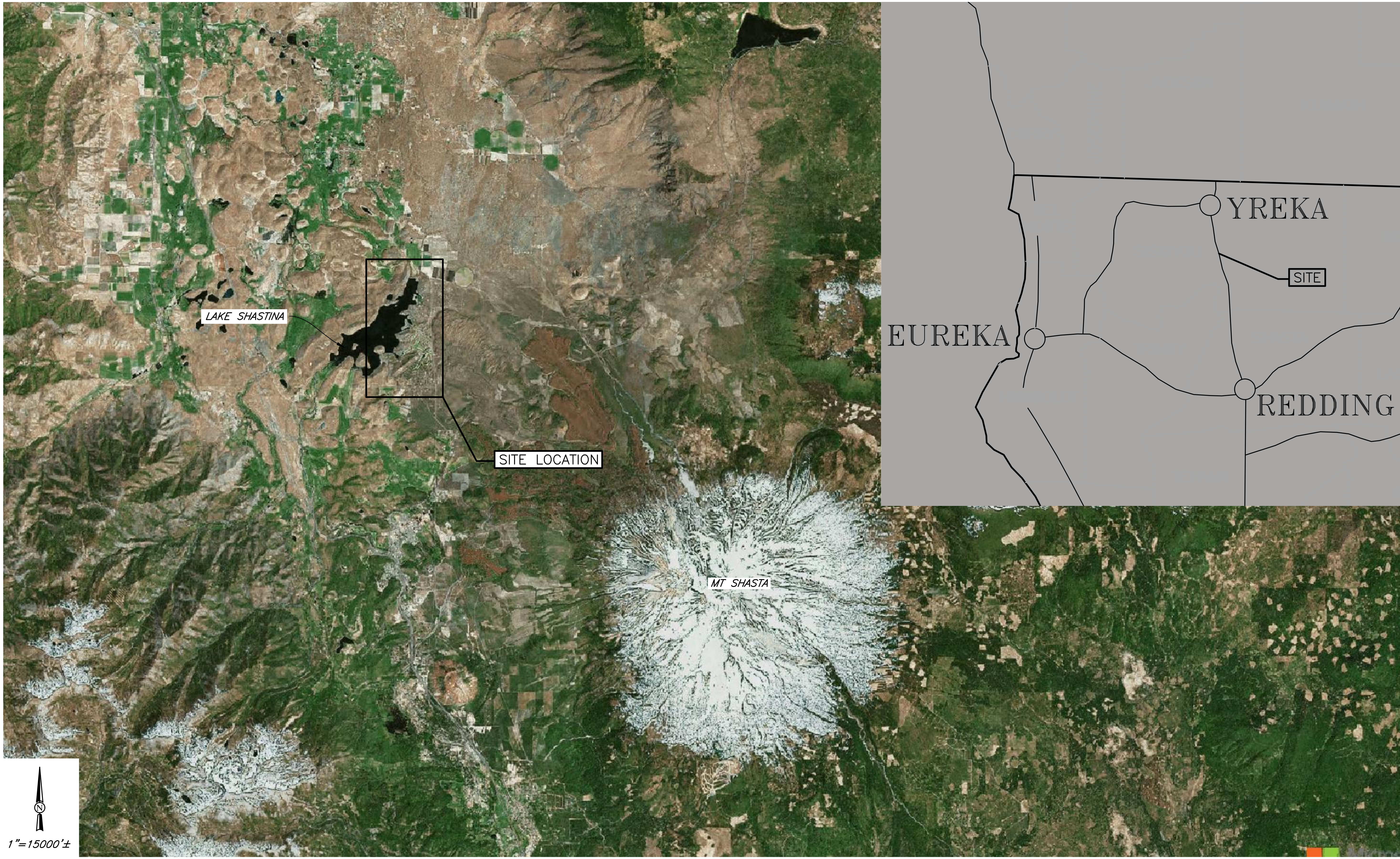
2.0 Project Planning

2.1 Location

The LSCSD is in Siskiyou County, California, just north of the City of Weed (see Figures 2-1 and 2-2).

2.2 Environmental Resources Present

The Lake Shastina community is located around Lake Shastina, California, which is a reservoir that is approximately 2.85 square miles and holds roughly 50,000 acre-feet of water. Lake Shastina supplies irrigation water to agricultural lands to the north and potable water for the City of Montague and is used for recreation. The topography is hilly with significant tree cover throughout the service area. Wildlife presents include various birds, deer, and other animals commonly found in the area. There are no



Lake Shastina CSD Drinking Water System Improvements Lake Shastina, CA		Project Location Map SHN 520022
November 2023	520022-LSCSD-FIGS	Figure 2-1

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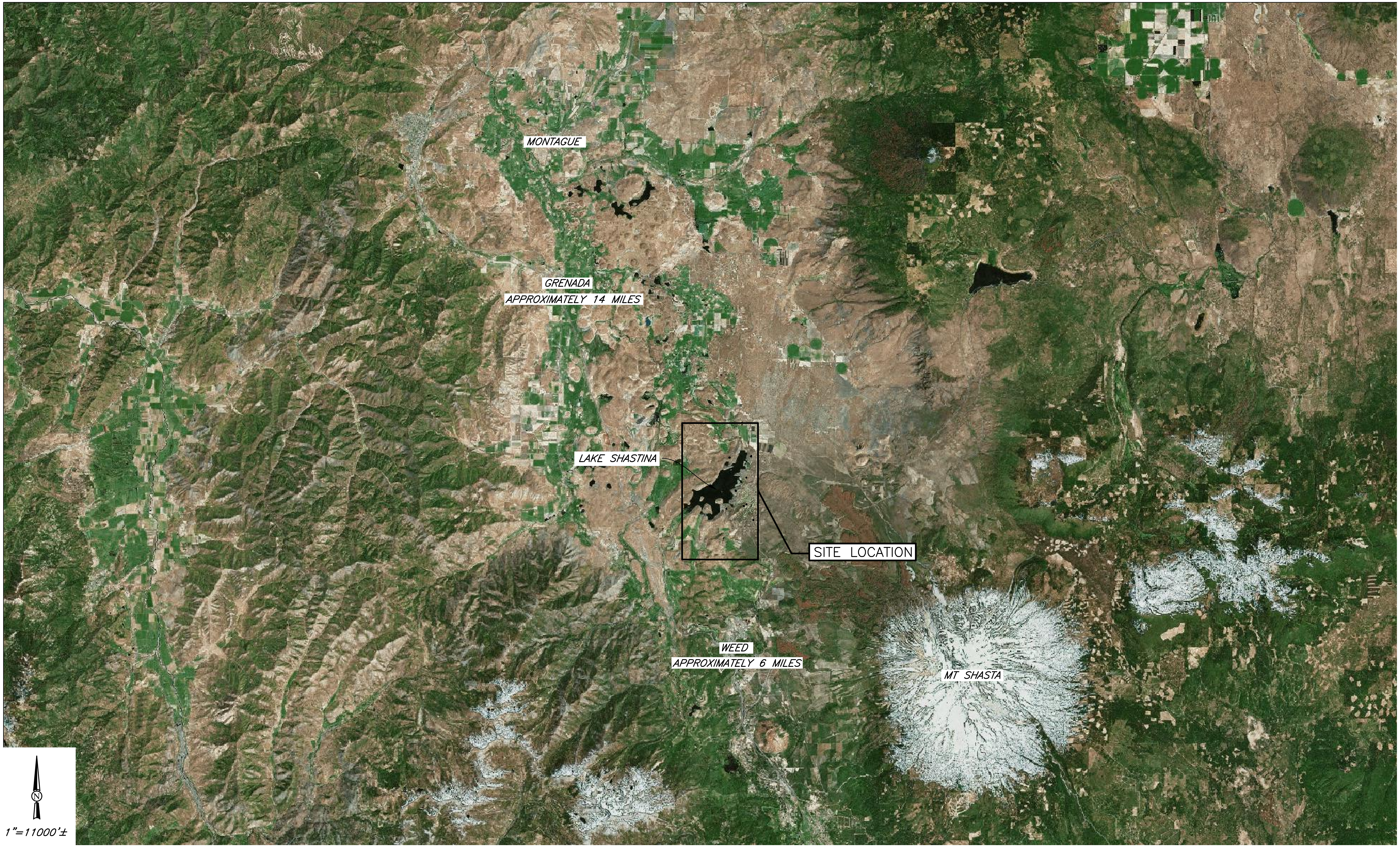

Lake Shastina CSD
Drinking Water System Improvements
Lake Shastina, CA

Map of Surrounding Cities
SHN 520022

Novermber 2023 | 520022-LSCSD-FIGS | Figure 2-2

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known wetlands or cultural resources in the proposed project areas at the time of this analysis. An environmental review in accordance with the California Environmental Quality Act (CEQA) will be conducted once this PER is complete.

2.3 Population Trends

The population of Lake Shastina has remained stable since the 1980s, with a small growth rate prior to that. The most significant recent growth in population occurred in 2014 due to the Boles Fire. The fire destroyed more than 100 homes and structures in nearby Weed, California. Some of these displaced residents moved permanently to Lake Shastina. The current population of Lake Shastina is approximately 2,800. The current growth level is anticipated to be approximately ten residential units per year, based on the current trend.

2.4 Community Engagements

The LSCSD holds regular meetings of the Board of Directors; Budget/Finance Committee; Fire Department Advisory committee; Environmental Control Committee; Lake Shastina Community Foundation, Inc; the Greater Lake Shastina Fire Safe Council; and others. The District maintains 24-hour on-call service for maintenance issues. The service area for the LSCSD includes areas governed by four different property owners' associations, of which the Lake Shastina Property Owners Association is the largest.

3.0 Existing Facilities

3.1 Location Map

The project location relative to the greater area is included as Figure 2-1, with a plot plan view as Figure 3-1. Figure 3-2 is a schematic map of the water distribution system. The LSCSD service area is roughly 5 square miles, and elevations range from 2,700 feet at Well 9 to nearly 3,200 feet at the top of Zen Mountain where Tank 4 is located.

3.2 History

The Lake Shastina reservoir was formed with the construction of Dwinnell Dam, beginning in 1926, to serve the surrounding agricultural community. The community began as a second home recreation area in 1968, evolving into a community of families and retirees. LSCSD was formed in 1978 by the Siskiyou County Board of Supervisors after successful petitioning by the voters. The community has consistently had many of its residents' commute to other cities for employment.

3.3 System Description Summary

The LSCSD service area (see Figure 3-1) currently has 1,266 active residential connections and 26 active commercial connections. There are an additional 2,558 unimproved residential lots that the system will need to support once they are developed.

The LSCSD drinking water system consists of the following major elements:

- 3 production wells
- 4 storage tanks
- 3 booster pump stations providing pressure zones around tanks

Lake Shastina CSD Drinking Water System Improvements Lake Shastina, CA	Existing Conditions District SHN 520022
November 2023	520022-LSCSD-FIGS

Figure 3-1

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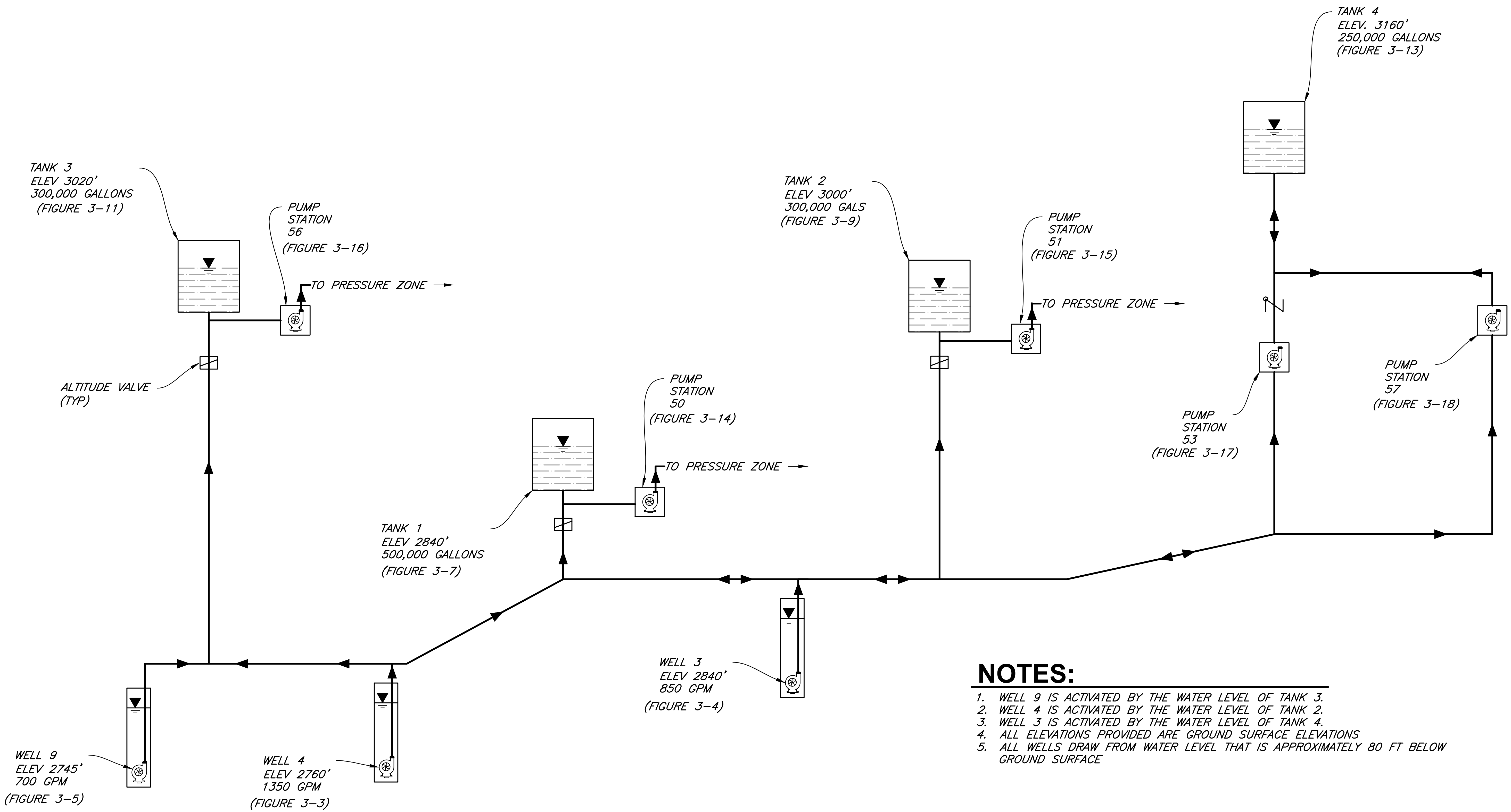


NOTES:

1. WELL 9 IS ACTIVATED BY THE WATER LEVEL OF TANK 3.
2. WELL 4 IS ACTIVATED BY THE WATER LEVEL OF TANK 2.
3. WELL 3 IS ACTIVATED BY THE WATER LEVEL OF TANK 4.
4. ALL ELEVATIONS PROVIDED ARE GROUND SURFACE ELEVATIONS
5. ALL WELLS DRAW FROM WATER LEVEL THAT IS APPROXIMATELY 80 FT BELOW GROUND SURFACE

SHN	Lake Shastina CSD Drinking Water System Improvements Lake Shastina, CA	Lake Shastina CSD Service Area Existing Conditions Schematic Plan SHN 520022
November 2023	520022-LSCSD-FIGS	Figure 3-2

- 2 booster pump stations used to fill Tank 4
- 1,292 water meters
- 319 fire hydrants
- Emergency Power
- Supervisory Control and Data Acquisition (SCADA)
- Distribution System

Locations of the wells, tanks, and pump stations are shown in Figure 3-1. The system requires the booster pump stations due to some homes being level with the storage tanks (Tanks 1, 2, and 3 with corresponding Booster Pump Stations B-50, B-51, and B-56, respectively). Tank filling booster stations are used when the tank is significantly higher than the distribution system, so the water requires more energy to reach the water level of the tank (Tank 4 and its corresponding Booster Stations B-53 and B-57).

The current average winter level water flow demand is 0.26 million gallons per day (MGD), and the average summer water flow demand is 1.50 MGD. The reason the average winter weather flow is so much lower is due to two main factors: 1) “snowbird” residences where the occupants are gone during the winter season, and 2) lower outdoor usage such as lawn irrigation.

There have been no recent violations or enforcement actions related to the LSCSD drinking water system, although there are occasional complaints from customers in the southeast of the district service area due to low water pressure.

3.4 Condition of Existing Facilities

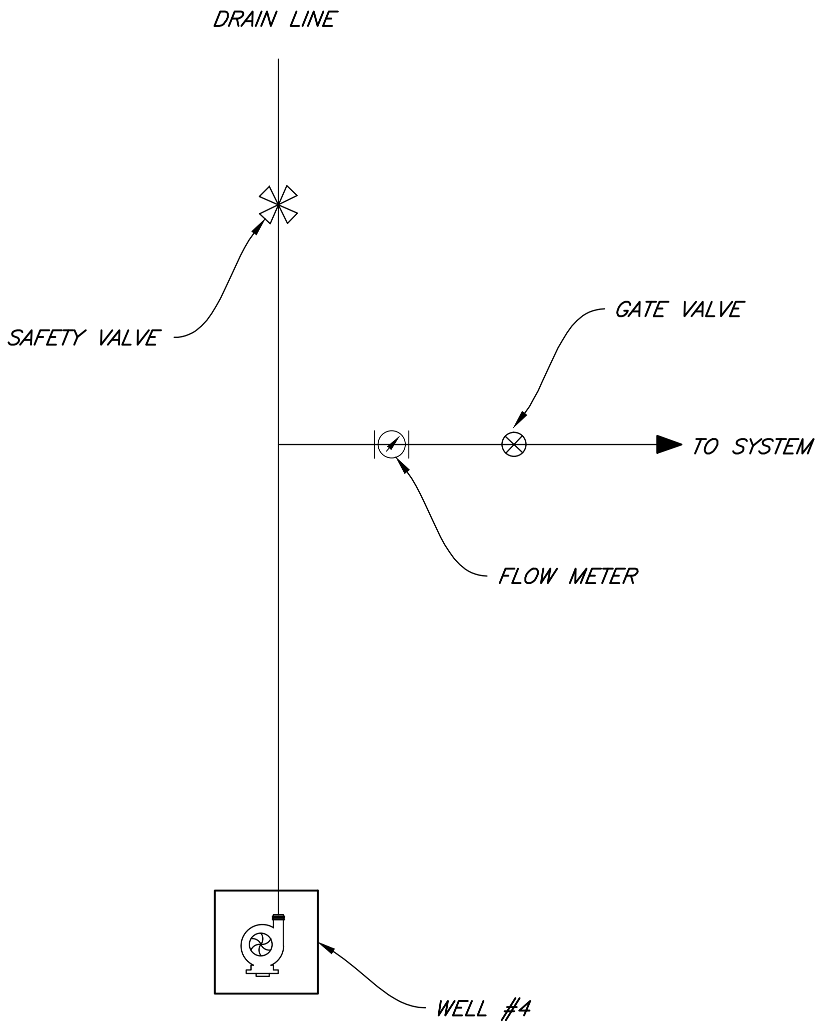
3.4.1 Production Wells

3.4.1.1 Well 4

Well 4 (Photograph 3.1) is the highest producing well, at 1,350 gallons per minute (gpm), and is the most important to the system. If this well ceases to function, especially during the summer months, customers could be forced to conserve, or be completely without water service. The consequences depend on where the customer is in the system, how much storage is available when the well goes down, and how long the well is offline. Figure 3-3 shows a piping schematic for this well.

Photograph 3.1 Well #4 Well House

Well 4 has a grade elevation of 2,760 feet above sea level and has a 200 horsepower (hp) pump to withdraw the water from the underground aquifer. The average water level is roughly 80 feet below ground surface. This well has the capability of connecting to the LSCSD’s mobile generator, but there is no permanent electrical backup supply. Overall, this well is in operable condition having undergone mechanical repairs and electrical motor upgrades after an unplanned shutdown. However, with this being the most important well to the system, it is imperative to have a redundant/backup well in case Well 4 ever needs to be taken offline for service, especially during the summer months.



Lake Shastina CSD
Water Planning Study
Lake Shastina, California

Well #4
Existing Piping Schematic
SHN 520022

November 2023 | 520022-LSCSD-FIGS | Figure 3-3

3.4.1.2 Well 3

Well 3 (Photograph 3.2), which is the second most important well within the production system and is the primary winter well, produces an average of 850 gpm. Well 3 is situated 2,840 feet above sea level and is located centrally within the system, at the LSCSD maintenance yard (location shown in Figure 3-1). Well 3 has a 150-hp vertical motor that pumps the water located from 80 feet below ground. This well has a permanent generator in case of emergency. Overall, this well is in operable condition having undergone mechanical repairs and electrical motor upgrades after being shut down due to mechanical issues. Well 3 does not have adequate yield to meet summer water needs if Well 4 were to go offline. Figure 3-4 shows a piping schematic.

Photograph 3.2 Well #3 Well House

3.4.1.3 Well 9

Well 9 (Photograph 3.3) is in the northwestern section of the Lake Shastina water system, as shown on Figure 3-2. It was constructed to serve the Rancho Hills subdivision. It is currently used to supplement Well 4 and to boost the water levels within Tank 3. Well 9 provides an average of 700 gpm to the system.

Photograph 3.3 Well #9 Well House

Well 9 has a 100-hp, 700-gpm turbine pump, drawing water from 80 feet below the ground surface, and the elevation of the pump is roughly 2,745 feet. This well does not have electrical connections for the LSCSD mobile generator, and there is no permanent electrical backup supply to keep this well running in the event of an electrical outage. Figure 3-5 shows a piping schematic for this well.

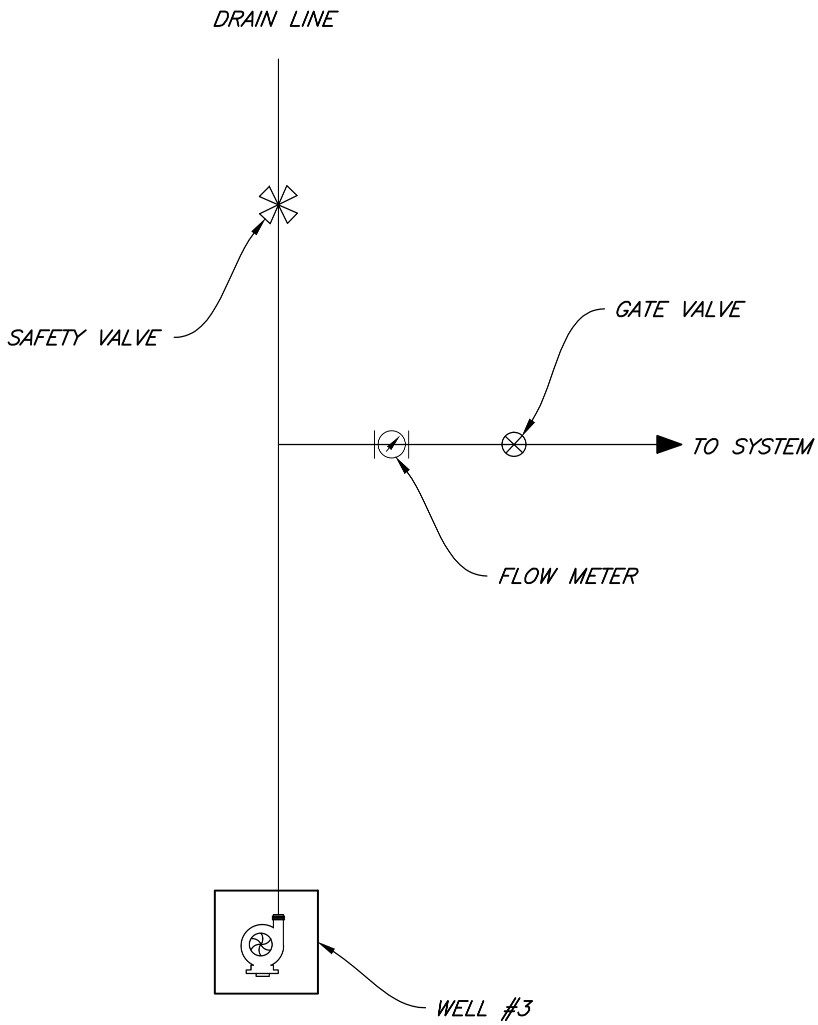
3.4.1.4 Additional System Deficiencies

The LSCSD has insufficient redundancy with its wells. In October 2016, Well 4, the highest producing well, became inoperable due to needed maintenance. During that time, the customers experienced lower water flow and pressures and reduced storage supply when Well 3 shut down as well, which forced the smallest and most remote well, Well 9, to be used exclusively. Thankfully, this down time happened outside of the summer months, when rationing or running out of water completely could have occurred.

3.4.2 Storage System

3.4.2.1 Tank 1–Juniper Tank

Tank 1 (Photograph 3.4 on the next page) is the largest tank in the district at 500,000 gallons. It is a cylindrical welded-steel tank that was erected in 1971. This tank is located between Juniper Peak Road and Windmill Drive as shown on Figure 3-6. The elevation of the base of the tank is approximately 2,840 feet, and the external tank dimensions are 56 feet in diameter and 28 feet in height. A piping schematic drawing of Tank 1 is shown on Figure 3-7.



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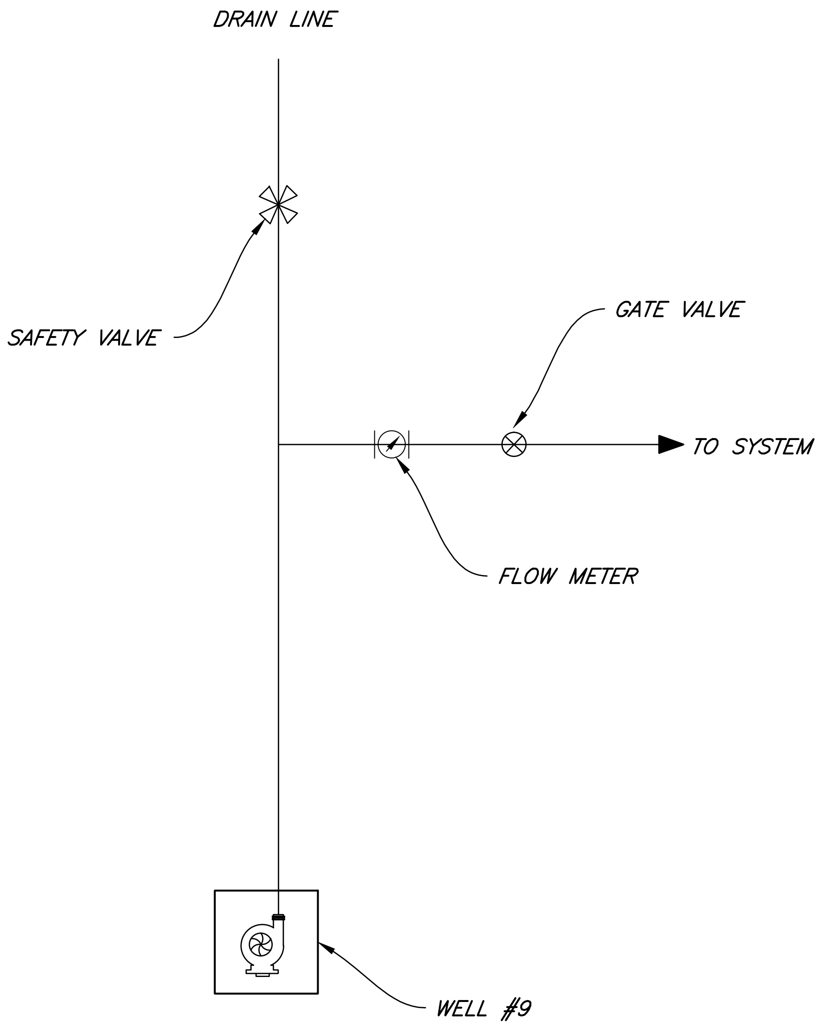
Lake Shastina CSD Water Planning Study Lake Shastina, California	Well #3 Existing Piping Schematic SHN 520022	
November 2023	520022-LSCSD-FIGS	Figure 3-4



Lake Shastina CSD
Water Planning Study
Lake Shastina, California

Well #9
Existing Piping Schematic
SHN 520022

November 2023 | 520022-LSCSD-FIGS | Figure 3-5

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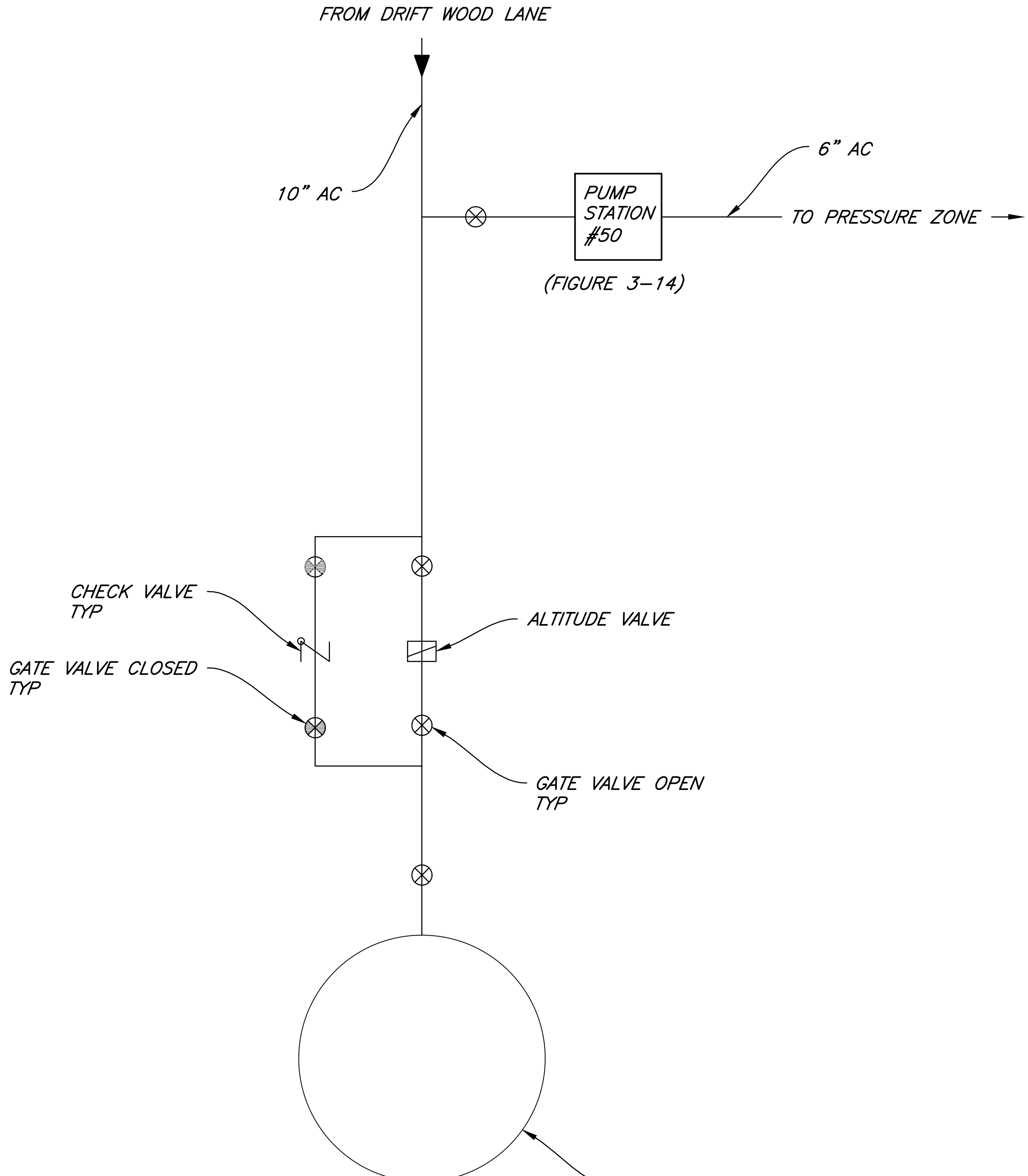
SHN	Lake Shastina CSD Drinking Water System Improvements Lake Shastina, California	Tank #1 Site Map SHN 520022
	Novermber 2023 / 520022-LSCSD-FIGS	Figure 3-6



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Lake Shastina CSD Drinking Water System Improvements Lake Shastina, California	Tank #1 Piping Schematic SHN 520022
November 2023 — 520022-LSCSD-FIGS	Figure 3-7

An inspection performed in April 2017 (Appendix 1) had the following findings:

- The interior coating is at the end of its service life as evidenced by significant blistering and corrosion.
- Sediment depth is ¼ inch inside the tank.
- Entry hatch gasket is not sealing and has corrosion on the underside of the lid.
- The exterior coating has minor rust spots on the roof, ladder, and handrails and corrosion in low spots on the roof.
- The exterior shell is in good condition.

Photograph 3.4 Juniper Tank (Tank 1) showing manual tank level gauge.

The inspection report made the following recommendations to address the deficiencies:

- Sandblast and recoat the interior coating.
- Replace the entry hatch gasket.
- Touch up the exterior coating.

Tank 1 includes an altitude valve, which prevents overfilling. Operational information is described in Section 3.4.7.

3.4.2.2 Tank 2–Stag Tank

Erected in 1971, Tank 2 (Photograph 3.5) is a 300,000-gallon cylindrical welded-steel tank that has external dimensions of 24 feet tall by 47 feet in diameter.

This tank's location is between Stag Mountain Road and Stag Street (Figure 3-8). The base elevation of the tank is approximately 3,000 feet. A piping schematic for this tank is shown on Figure 3-9.

Photograph 3.5 Stag Tank (Tank 2).

An inspection performed in April 2017 (Appendix 1) had the following findings:

- The interior coating is at the end of its service life as evidenced by significant blistering and corrosion.
- Sediment depth is ¼ inch inside the tank.
- Entry hatch gasket is partly missing.
- The exterior coating is heavily oxidized and is thinning out.
- Cathodic plates are in place with no corrosion.

Lake Shastina CSD
Drinking Water System Improvements
Lake Shastina, California

Tank #2
Site Map
SHN 520022

Novermber 2023	520022-LSCSD-FIGS	Figure 3-8

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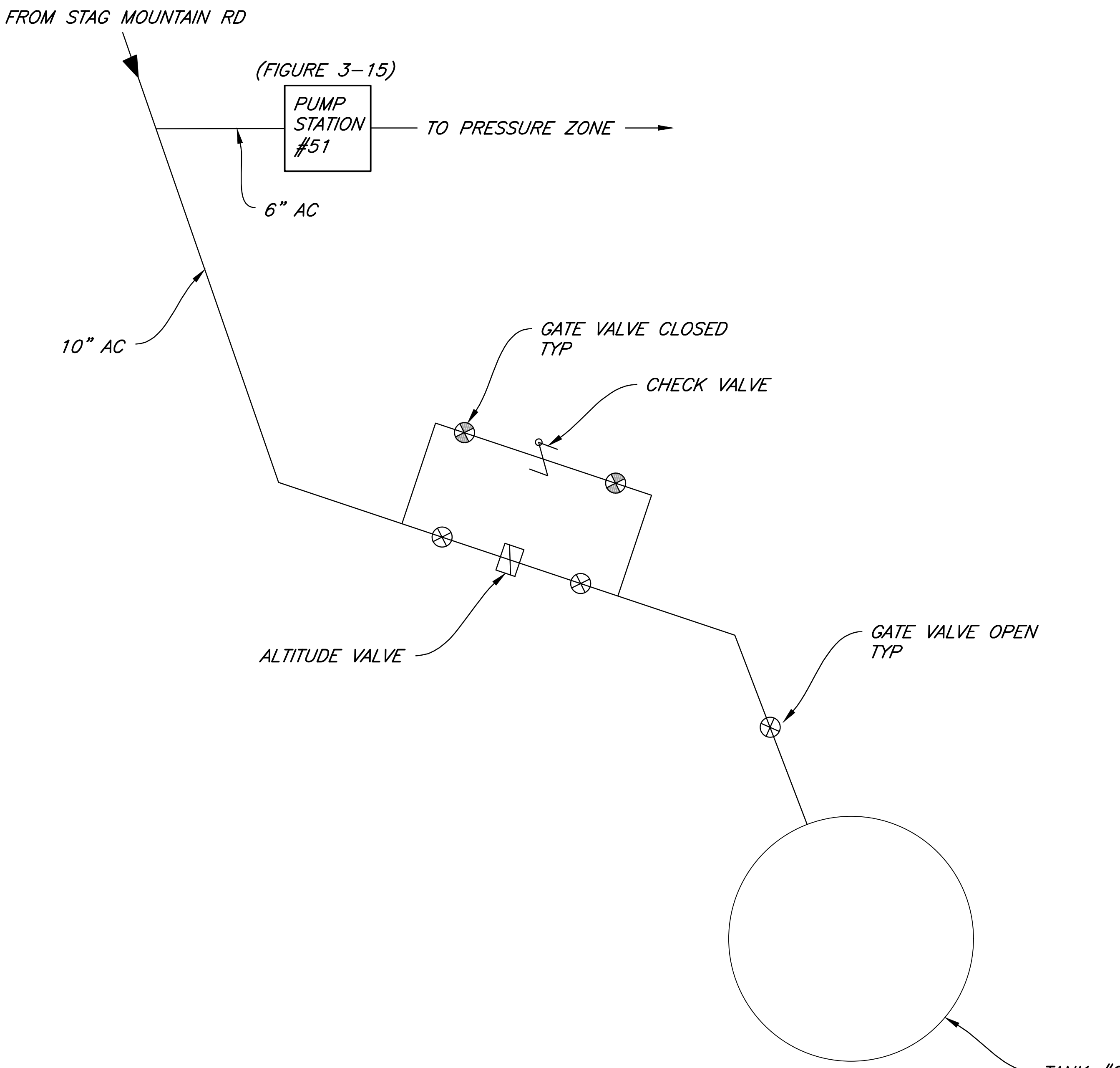

Lake Shastina CSD
Drinking Water System Improvements
Lake Shastina, California

Tank #2
Piping Schematic
SHN 520022

November 2023 | 520022-LSCSD-FIGS | Figure 3-9

The inspection report made the following recommendations to address the deficiencies:

- Sandblast and recoat the interior coating.
- Replace the entry hatch gasket.
- Touch up the exterior coating in areas with nicks and scratches.

Tank 2 includes an altitude valve that prevents overfilling. Operational information is described in Section 3.4.7.

The LSCSD has expressed concern that Tank 2 does not have sufficient storage capacity. During high use periods in summer and when Tank 4 calls for water, the water level in Tank 2 drops quickly, indicating that the system draws significantly from Tank 2. These quick drops in water level can present challenges with providing fire flows in and around Tank 2.

3.4.2.3 Tank 3–Rancho Tank

Erected in 1974, Tank 3 (Photograph 3.6) is a 300,000-gallon cylindrical welded-steel tank that has external dimensions of 24 feet tall and 47 feet in diameter. This tank' is at the corner of Stone Crest Drive and Eagle Rest Court, in the Rancho Hills subdivision (see Figure 3-10 for location). Figure 3-11 shows the piping schematic for this tank. The base elevation of this tank is 3,020 feet.

Photograph 3.6 Rancho Tank (Tank 3).

An inspection performed in April 2017 (Appendix 1) had the following findings:

- The interior coating is at the end of its service life as evidenced by significant blistering and corrosion.
- Sediment depth is ¼ inch inside the tank.
- Entry hatch gasket is not sealing.
- The exterior coating on the roof is thin with primer exposed and indications of corrosion starting to form,
- There is minor rust on the ladder.
- The exterior shell is in good condition.

The inspection report made the following recommendations to address the deficiencies:

- Sandblast and recoat the interior coating.
- Replace the entry hatch gasket.
- Place a new topcoat on the exterior roof.

Tank 3 includes an altitude valve to prevent overfilling. Operational information is described in Section 3.4.7.

SHN	Lake Shastina CSD Drinking Water System Improvements Lake Shastina, California	Tank #3 Site Map SHN 520022
	Novermber 2023 / 520022-LSCSD-FIGS	Figure 3-10

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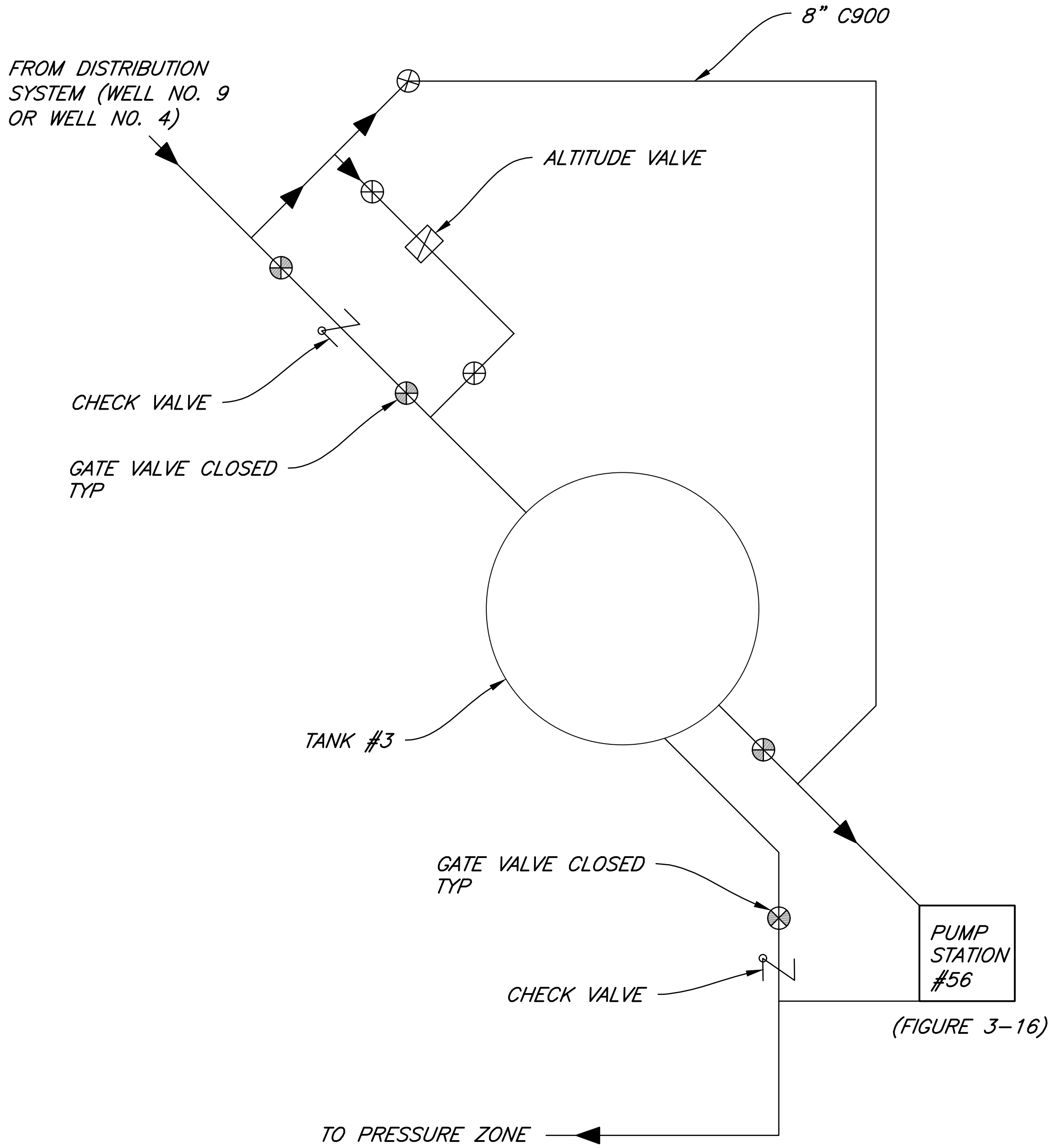


Lake Shastina CSD Drinking Water System Improvements Lake Shastina, California		Tank #3 Piping Schematic SHN 520022
November 2023	520022-LSCSD-FIGS	Figure 3-11

3.4.2.4 Tank 4–Zen Mountain Tank

Erected in 1977, Tank 4 (Photograph 3.7) is a 250,000-gallon cylindrical welded-steel tank with external dimensions of 30 feet in height and 38 feet in diameter. It is located at the top of Zen Mountain (Figure 3-12). Figure 3-13 shows the piping schematic for this tank. The closest street is Tennis Court, which also is the beginning of the access road to this tank. The base elevation of this tank is approximately 3,160 feet.

Photograph 3.7 Zen Mountain Tank (Tank 4).

An inspection performed in April 2017 (Appendix 1) had the following findings:

- The interior coating is at the end of its service life as evidenced by significant blistering and corrosion.
- Sediment depth is 1/8 inch inside the tank.
- Various exterior areas exhibit minor rusting and nicks and scratches around the roof entry hatch, shell, ladder, and overflow pipe.
- The exterior shell has many areas that have already been recoated and these locations are holding up with no corrosion present.
- Coating is peeling around the edges of the manway entries.
- The manual level indicator has water in the interior float and is losing buoyancy.

The inspection report made the following recommendations to address the deficiencies:

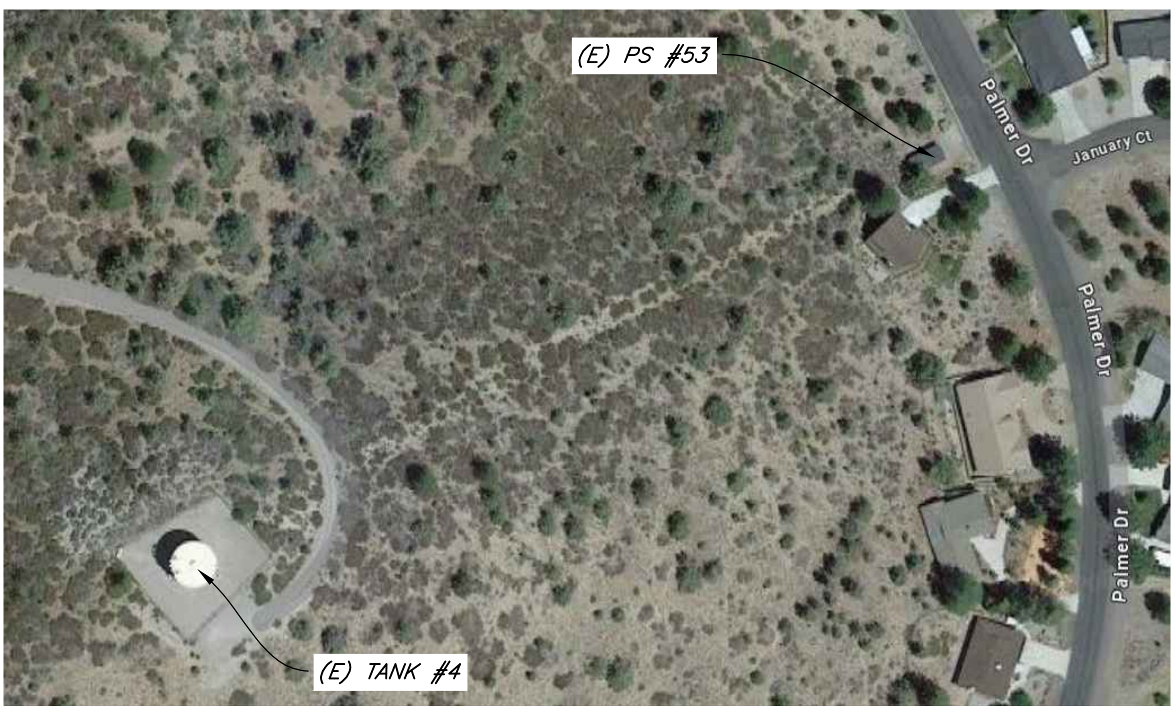
- Sandblast and recoat the interior coating.
- Replace the entry hatch gasket.
- Replace the interior float for the level indicator.
- Touch up the exterior coating.

This tank is the southernmost and highest tank and, therefore, the furthest away from the production wells. Booster Pump Stations B-53 and B-57 provide additional pressure to fill Tank 4. Tank 4 does not have an altitude valve and has historically been subject to overfilling. However, overfilling incidents have been reduced by tying B-53 to the SCADA system and placing B-57 on a timer (see Section 3.4.4.4 for additional operational information).

3.4.3 Booster Pump Stations

3.4.3.1 General

Three of the five booster pump stations in the LSCSD service area are used to provide adequate pressure to the residences located at similar elevations to their corresponding water tanks because the static pressure that would be provided from the tanks is below allowable pressure minimums. Each booster station has pressure tanks and two small pony pumps in addition to a larger pump. The pony pumps pressurize the system for minor demands, and the larger pump activates when the demand is higher than what the pony pumps can provide. The pressure tanks serve two purposes: 1) to provide steady pressure before the pony pumps turn on to pressurize the system and 2) to prevent damage



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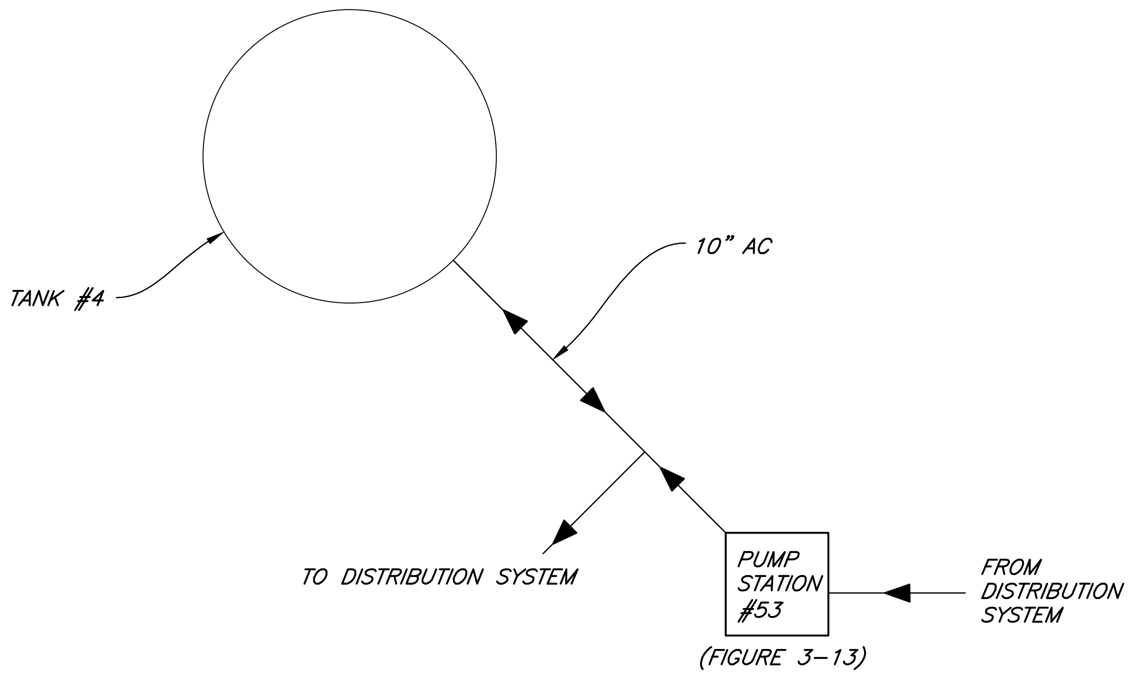
SHN	Lake Shastina CSD Drinking Water System Improvements Lake Shastina, California		Tank #4 Site Map SHN 520022
	Novermber 2023	520022-LSCSD-FIGS	Figure 3-12



Lake Shastina CSD Drinking Water System Improvements Lake Shastina, California	Tank #4 Piping Schematic SHN 520022
November 2023 · 520022-LSCSD-FIGS	Figure 3-13

from surging or water hammer effects. Two pump stations are used solely to pump water to Tank 4, to overcome the height differential between the tank and the rest of the distribution system, due to this tank being higher than the distribution system (see Figure 3-2 and Section 5.4.3.4, below).

According to the LSCSD, all pump stations have variable frequency drives (VFDs) on the pumps, most of which have been installed in the last few years.

Photograph 3.8 Booster Pump Station B-50

3.4.3.2 Station B-50

Booster Pump Station B-50 (Photograph 3.8) is located adjacent to Tank 1 and provides a local pressure zone where the homes surrounding the tank are at approximately the same elevation as Tank 1. The location is shown in Figure 3-1 and the piping schematic is shown on Figure 3-14. This pump station consists of two 45-gpm pony pumps, one 300-gpm pump, and four 75-gallon pressure tanks. This pump station is in fair condition.

Photograph 3.9 Booster Pump Station B-51

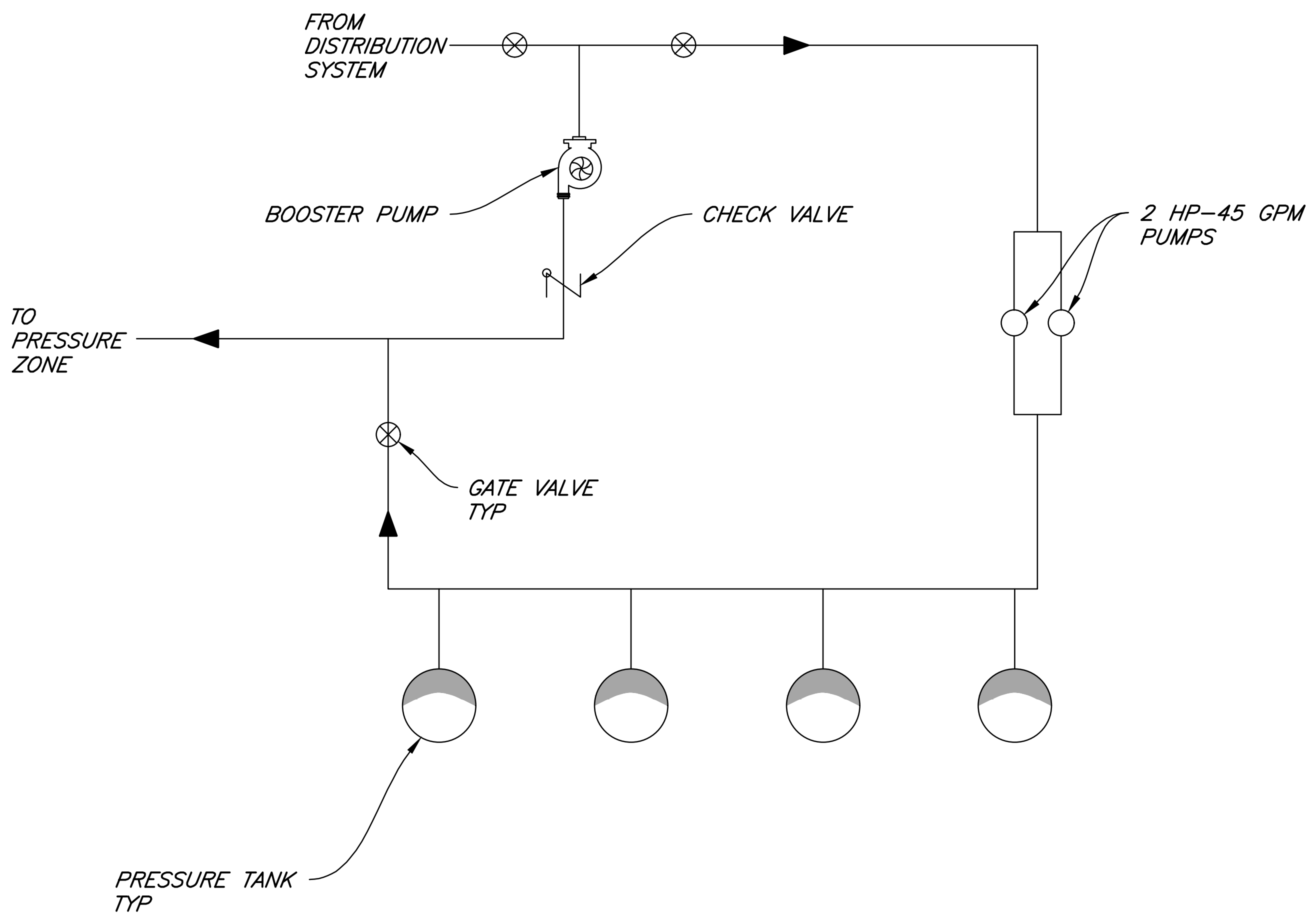
3.4.3.3 Station B-51

Booster Pump Station B-51 (Photograph 3.9) is located adjacent to Tank 2 and provides a local pressure zone where the homes surrounding the tank are at approximately the same elevation as Tank 2. The location is shown on Figure 3-1 and the piping schematic is shown on Figure 3-15. This pump station consists of two 45-gpm pony pumps, one 250-gpm pump, and three 75-gallon pressure tanks. This pump station is in fair condition.

Photograph 3.10 Booster Pump Station B-56

3.4.3.4 Station B-56

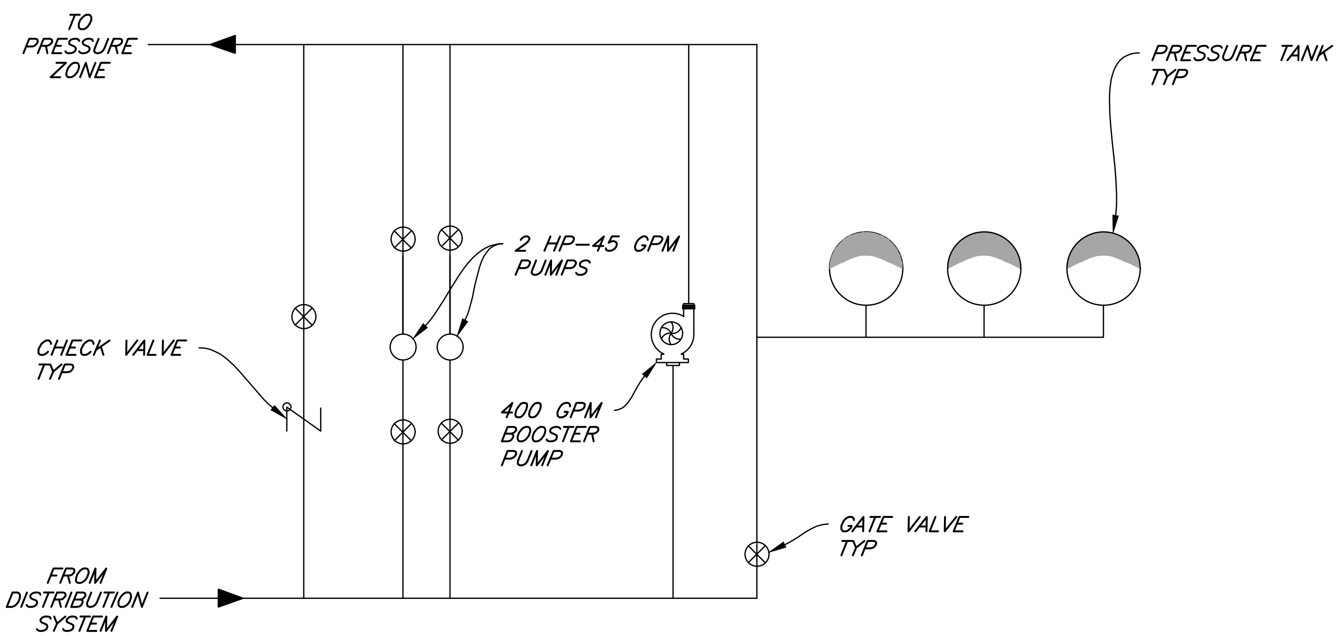
Booster Pump Station B-56 (Photograph 3.10) is located adjacent to Tank 3 and provides a local pressure zone where the homes surrounding the tank are at approximately the same elevation as Tank 3. The location is shown on Figure 3-1 and the piping schematic is shown on Figure 3-16. This pump station consists of two 45-gpm pony pumps, one 400-gpm pump, and three 75-gallon pressure tanks. This pump station is in fair condition.



Lake Shastina CSD
Drinking Water System Improvements
Lake Shastina, California

Booster Pump Station #50
Existing Piping Schematic
SHN 520022

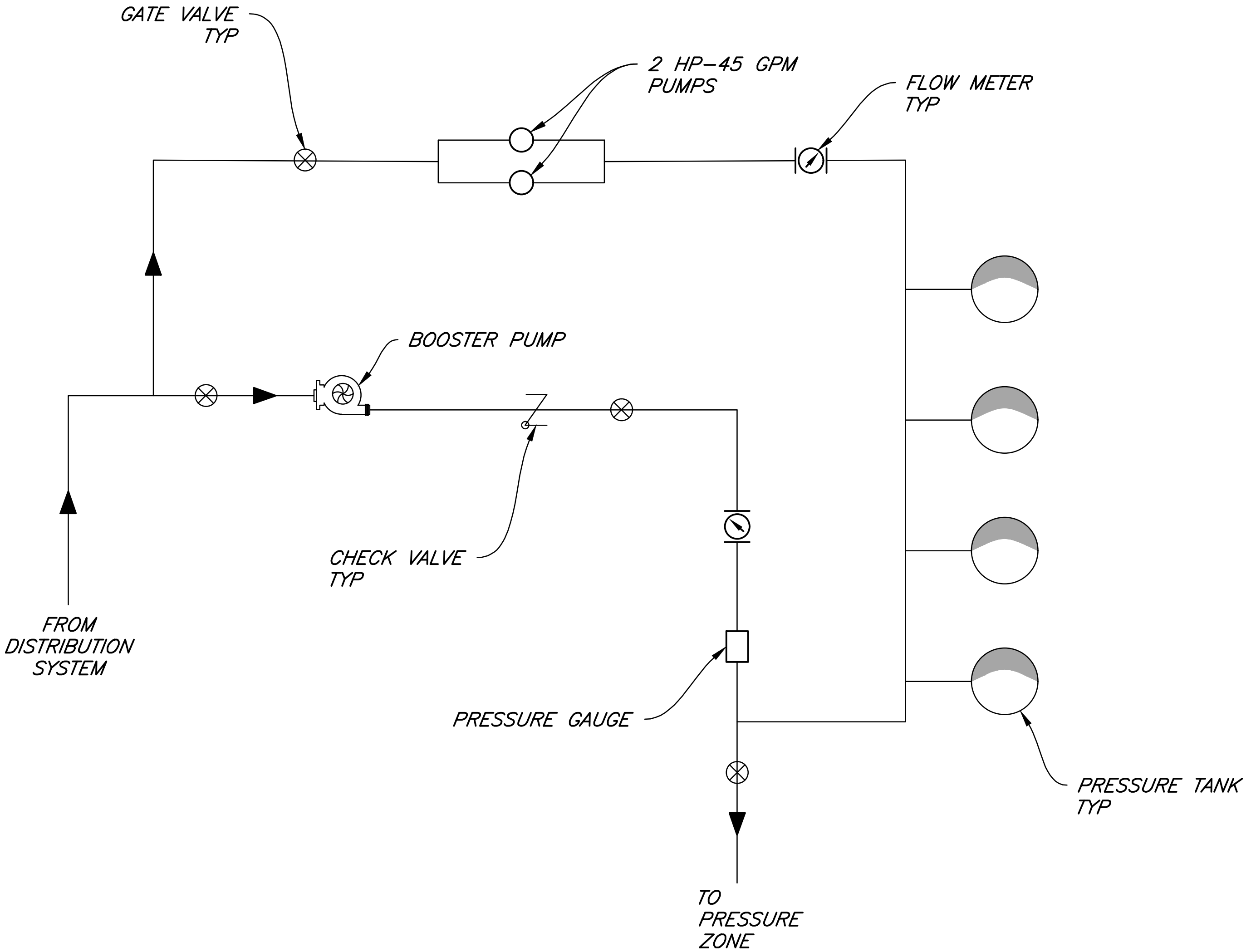
Novermber 2023 | 520022-LSCSD-FIGS | Figure 3-14



Lake Shastina CSD
Drinking Water System Improvements
Lake Shastina, California

Booster Pump Station #51
Piping Schematic
SHN 520022

Novermber 2023 | 520022-LSCSD-FIGS | Figure 3-15



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SHN	Lake Shastina CSD Drinking Water System Improvements Lake Shastina, California	Booster Pump Station #56 Piping Schematic SHN 520022
	Novermber 2023 / 520022-LSCSD-FIGS	Figure 3-16

3.4.3.5 Station B-53

Booster Pump Station B-53 (Photograph 3.11) pumps water from the distribution system up to Tank 4, located approximately 200 feet in elevation above B-53, as well as to the southern distribution system. Figure 3-1 shows the location of this station, and Figure 3-17 shows the piping schematic.

The pump station consists of two pumps with VFDs in parallel, a 20-hp 250-gpm pump and a 50-hp, 500-gpm pump. Operational information is described in Section 3.4.7. This pump station is in good condition.

Photograph 3.11 Booster Station B-53

3.4.3.6 Station B-57

Pump Station B-57 (Photograph 3.12) provides an alternate means to fill Tank 4. It is located along Lakeshore Drive near the intersection with Cottonwood Drive (Figure 3-1). This station is also used to ensure that the water in the western side of Zen Mountain is not allowed to become stagnant. B-57 is not connected to the SCADA system, but is set to activate on a timer between the hours of 3 a.m. to 7 a.m. However, because of this, Tank 4 has been overfilled in the past. To minimize overfilling events, the water level of Tank 4 which is tied to the SCADA system is monitored closely. This station is in operable condition; however, it can be improved by tying the station into the SCADA system and removing the reliance on a timer to activate the pump. A schematic drawing of the pump and piping for this station in presented on Figure 3-18.

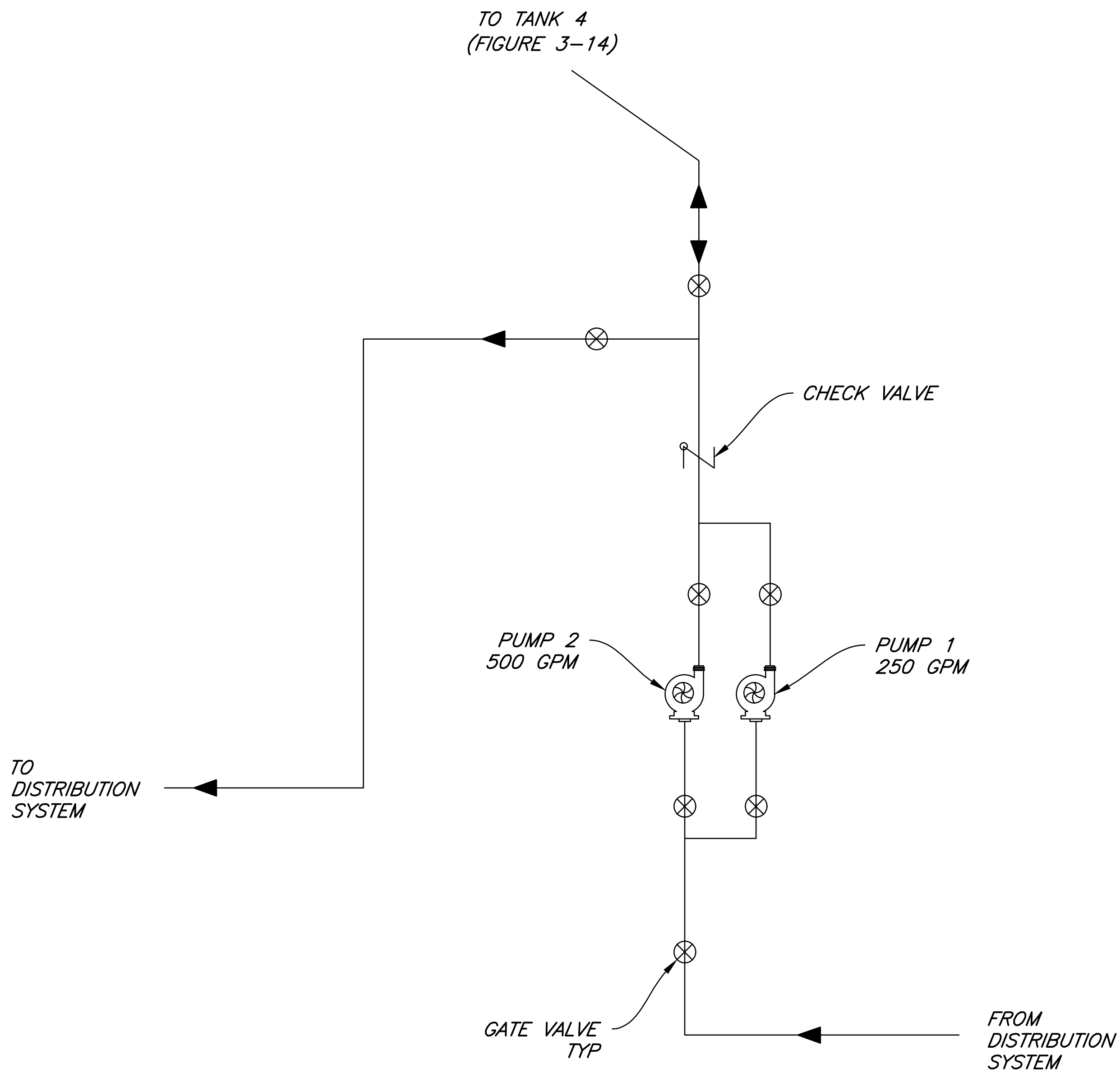
Photograph 3.12 Filling Station B-57

3.4.4 Water Meters

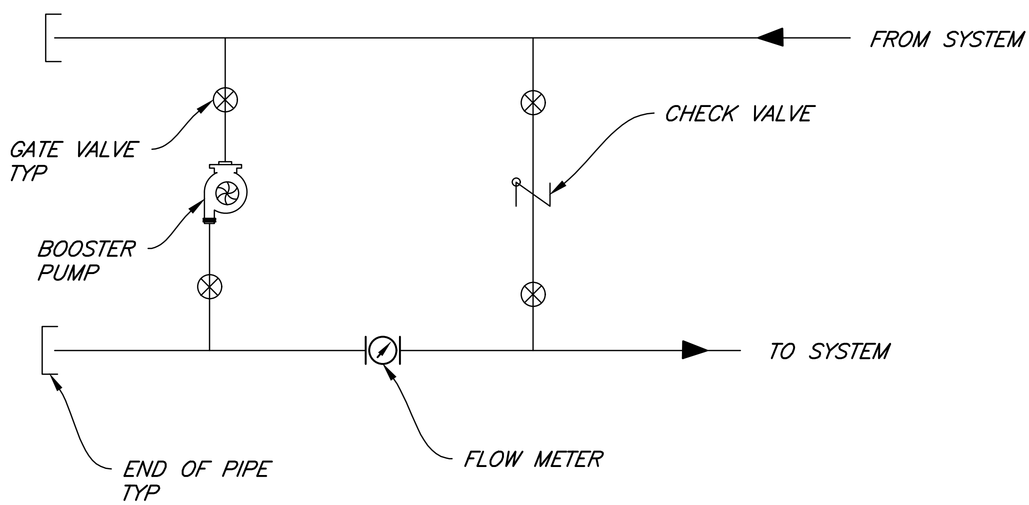
The LSCSD has two types of meters: 1) system meters and 2) customer meters. The system meters, which primarily provide volumetric data for reporting purposes, are in good condition. The customer meters, which number 1,292, need replacement.

The customer meters are nearing the end of their useful life. Further, LSCSD staff manually read each meter quarterly for the purpose of billing. LSCSD employees currently spend approximately 128 person-hours (estimated 4 people working 8 hours a day for

Photograph 3.13 Typical Water Meter
Note: LSCSD is using this type of manual read meter.



SHN	Lake Shastina CSD Drinking Water System Improvements Lake Shastina, California	Booster Pump Station #53 Piping Schematic SHN 520022
Novermber 2023	520022-LSCSD-FIGS	Figure 3-17



Lake Shastina CSD
Drinking Water System Improvements
Lake Shastina, California

Filling Pump Station #57
Piping Schematic
SHN 520022

Novermber 2023 | 520022-LSCSD-FIGS | Figure 3-18

4 days) manually reading the water meters for quarterly water bills. This method of meter reading is time consuming and costly to the district and its users. The quarterly billing makes it difficult to detect potential leaks in a timely fashion.

3.4.5 Fire Hydrants

There are 319 fire hydrants in the LSCSD service area. Many of these hydrants are the same ones installed when the water system was constructed in the late 1960s and early 1970s, making them well over 50 years old. LSCSD staff have been exercising the hydrant valves and have found some to be stuck or broken. LSCSD staff have been replacing four to five hydrants annually, and 20 hydrants have been replaced so far. The LSCSD is matching the old hydrant type with new to keep maintenance and operations for the hydrants as similar as possible. At this rate, though, it will take the LSCSD between 60 and 75 years to complete the replacements.

Photograph 3.14 Typical Lake Shastina Fire Hydrant

3.4.6 Emergency Power

The one permanent backup power generator inside the entire service area is found at Well 3; however, it is 11 years old and needs replacement. There is a portable power generation unit that can be taken to a well or booster pump that is set up to accept this type of power. This arrangement, though, places the LSCSD in danger of being unable to provide backup power in the event of a power outage. If such a power outage were to occur in tandem with a fire in or near the district, the LSCSD could face serious liability for either loss of property or life by not being able to supply fire water during this scenario.

Currently there is no permanent generator for any well or pump station in the LSCSD drinking water system other than Well 3. Well 4 can accept a portable generator in an emergency but Pump Station B-57 and Well 9 do not have proper connections for backup power. With its many pump stations unable to accept back up power, including the booster pump stations, and limited LSCSD staff, there is risk for service interruptions in the event of a power outage.

Without retrofits, a power outage would prevent most customers from receiving adequate or any water supply. This would also drop the water pressure throughout the service area, especially in areas served by booster pumps, requiring potentially a boil water notice. Due to the lack of backup power or acceptable connections, this would pose a severe problem in the event of a fire and/or loss of power to provide fire water to suppress even a small fire within the LSCSD service area.

3.4.7 SCADA System and Operational Logic

The LSCSD recently selected a supervisory control and data acquisition (SCADA) system for its drinking water system and requested an evaluation for use with the wastewater system. The selected system for the drinking water system is the XiO Cloud Based SCADA, created by XiO, Inc. (www.xiowatersystems.com). This SCADA system is currently in place for the drinking water system for the LSCSD. Figure 3-19 shows a screenshot of the current SCADA schematic.

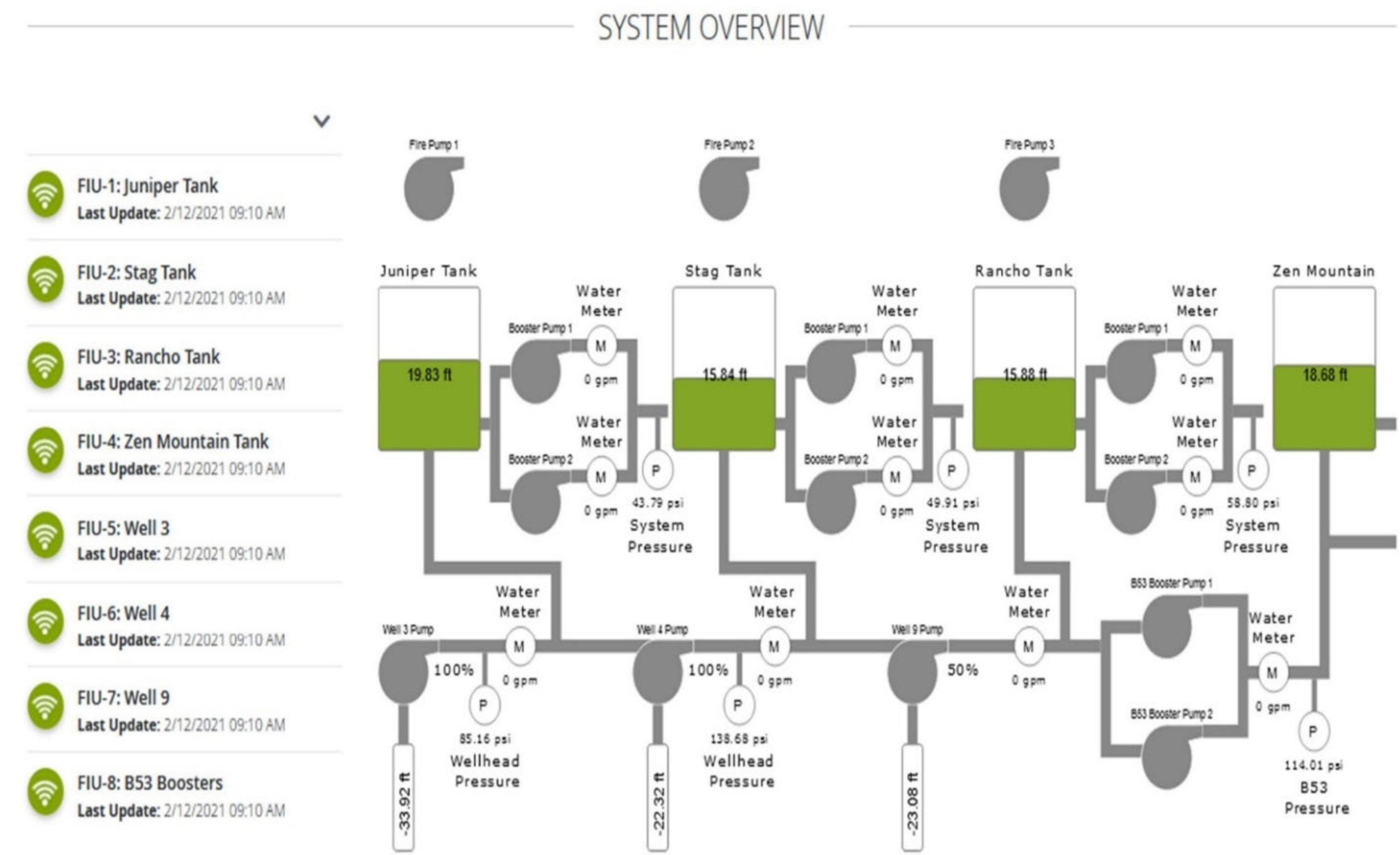


Figure 3-19 Example Setup of SCADA System for LSCSD
(Re-printed with permission from the LSCSD SCADA system)

The XiO SCADA system provides unlimited historical data storage. XiO operates geographically distributed and redundant database servers to keep the data safe from catastrophic events such as natural disasters or potential cyber-attacks. The use of XiO Cloud Control Center for system data storage will allow only authorized system operators with secure login credentials to access the data using a smartphone, tablet, or computer.

The SCADA system provides the following:

- Water level in each tank;
- On/off status of all well pumps and booster pumps, except the B-57 booster pump station;
- Water pressure at areas with pressure monitors;
- Programmable logic for start/stop for well pumps and booster pumps (except B-57) using inputs from the SCADA system such as tank water level, or pressure;
- Records of historical data for most inputs, such as tank water tank level, pump flow, and pressures.

When the water level in Tanks 1, 2, or 3 drops below the defined setpoints, a call for water is sent through the SCADA system and Well 3 turns on. If Well 3 cannot keep up with demand, then Well 4 turns on. However, during the summer, the operational logic is reversed and Well 4 turns on first, then Well 3. When the water level in Tank 4 drops below the defined setpoint, Booster Pump Station B-57 turns on and draws water from the system, namely Tank 2 (the nearest tank). This creates additional water demand on Tank 2 (see discussion in Section 3.4.2.3).

Well 9 is manually operated to allow groundwater levels around Well 4 to recover.

3.4.8 Distribution System

The distribution system consists of piping, valves, and service connections, along with other features (such as water meters and pump stations) discussed in other sections. The existing pipe network and valves are in good condition based upon the indirect evidence of lack of problems, such as leaks, stuck valves, and so on.

3.5 Financial Status of Existing Facilities

The LSCSD currently has no outstanding debt regarding its drinking water system. Financial reports for the past five years are provided in Appendix 2.

3.6 Water/Energy Audits

As part of this work, SHN prepared an energy management study to review historical usage within the water system. The memo can be found in Appendix 3. The LSCSD periodically has reviewed its electrical usage. Each pump station has an individual meter and can be reviewed for any inconsistencies. Based on review of recent electrical usage, the LSCSD has found no unusual power usage at any of the wells or pump stations.

The energy management study recommended variable frequency drives (VFDs); however, the LSCSD has already installed VFDs at all of its pumps and pump stations, so no further recommendations with respect to energy use are made.

No water audits have been performed. With the recommended project of new water meters (see Section 6.9) and monthly billing, leaks could be detected in a timelier fashion.

4.0 Need for Project

4.1 Problem Description

4.1.1 General

The deficiencies identified in Section 3 for the LSCSD water system were ranked according to categories used by SWRCB Division of Financial Assistance (DFA) to prioritize funding. The SWRCB-DFA funding categories are described below with examples of deficiencies for each category. Generally, projects that address issues only in categories A, B, or C are eligible for grant funding through the State. The LSCSD's system deficiencies are summarized in Table 4-1. These deficiencies have been grouped such that the solutions to each are likely to be discrete subprojects that can be analyzed independently and bid separately.

Table 4-1. Water System Deficiencies
Lake Shastina Community Services District

Deficiency	Category[a]	Proposed Solution(s)
Lack of Well 4 Redundancy	C	New production well New well house and connection to distribution system
Aging Tanks	C	Refurbish tanks
Inadequate Water Storage	C	Install new 300,000-gallon tank
Inadequate Pressure in Southeast Zone	C	Install new booster pump station
Lack of Backup Power	C	Install stationary backup power at existing sites without backup power
Aging Fire Hydrants	C	Replace fire hydrants
Incomplete SCADA[b] System	D	Install SCADA at pump station B-57
Manual Read Water Meters	D	Replace water meters

a. Funding priority category as described in Section 4.1.2.
b. SCADA: Supervisory Control and Data Acquisition

4.1.2 SWRCB Priority Categories

The SWRCB-DFA funds projects based on priority categories. Generally, these categories are ordered based on violation history, risk to public health, risk of shortages, system reliability, risk to infrastructure, and so on.

The categories are presented below with example deficiencies for each category:

- **Category A: Immediate Health Risk**
  - Documented waterborne disease outbreaks attributable to the water system
  - Water systems under a court order to correct Safe Drinking Water Act (SDWA) violations or to correct water outage problems
  - Total coliform Maximum Contaminant Level (MCL) violations 8 attributable to active sources contaminated with coliform bacteria (for example., fecal, E. coli, or total coliform)
  - Severe domestic water supply outage(s) posing an imminent threat to public health and safety
  - The distribution of water containing nitrates/nitrites or perchlorate in excess of the MCL.

- **Category B: Untreated or At-Risk Sources**
  - Surface water or groundwater under direct influence of surface water (GWUDI) sources that are untreated, not filtered, or have other filtration treatment deficiencies that violate federal or state regulations
  - Non-GWUDI groundwater sources that are contaminated with fecal coliform or E. coli and are inadequately treated
  - Uncovered distribution reservoirs

- **Category C: Compliance or Shortage Problems**
  - Water quantity problems caused by source capacity, or water delivery capability that is insufficient to meet existing demand
  - The distribution of water containing chemical or radiological contamination in violation of a state or federal primary drinking water standard (other than nitrate/nitrite or perchlorate)
  - Total Coliform Rule violations for reasons other than source contamination

- **Category D: Inadequate Reliability**
  - Non-metered service connections, or defective water meters
  - community water systems (CWSs) and public water systems (PWSs) owned by public schools, with a single source and no backup supply
  - Distribution reservoirs with non-rigid covers in active use
    - Disinfection facilities that lack needed reliability features, such as chlorine analyzers or alarms
    - Violations of the Waterworks Standards related to disinfection

- **Category E: Secondary Risks**
  - The distribution of water that exceeds secondary drinking water standards
  - The distribution of water in excess of a published chemical notification level

- The distribution of water that has exceeded a primary drinking water standard in one or more samples but has not violated a running average standard
- A standby groundwater source that exceeds a primary drinking water standard
- Violations of the Waterworks Standards (other than those already covered above)

- **Category F: Other Projects**
  - Deficiencies attributable to the water system that address present or prevent future violations of health-based standards (other than those already covered above)

4.1.3 LSCSD System Deficiencies

The LSCSD water system deficiencies to be addressed by this PER are summarized in this section. Additional details can be found in Section 3. Table 4-1 (page 14, above) summarizes the deficiencies and lists the associated proposed solutions and SWRCB funding priority category.

Well 4 is the main production well and the other wells in the system do not produce as much water as Well 4. Without full redundancy, if Well 4 is offline, significantly less water would be produced, which could result in curtailment of water use within the service district.

The four water tanks are more than 50 years old and, based on inspections performed in 2017, need cleaning and recoating due to corrosion. The cathodic protection systems are well beyond their useful lives and need to be replaced. The tanks still have their original interior and exterior coatings.

During high use periods, Tank 2 has been nearly depleted. Due to the system configuration, Tank 2 cycles through more water than the other tanks. If the water level in Tank 2 were to fall below a minimum level, reduced or even negative pressures would be possible within portions of the distribution system. The system does not have adequate storage in this part of the service area.

The southeast portion of the LSCSD service area does not have adequate system pressure. There have been two consequences of this. First, some customers have complained about the inadequate water pressure. Second, the LSCSD allows local wildfire crews to fill fire trucks from fire hydrants in this zone; with inadequate pressure, the fire trucks have often gone within the residential area to fill from other higher-pressure fire hydrants, causing traffic concerns.

The water system lacks adequate backup power except at Well 3. In the event of an extended power outage, water supply and pressures may be inadequate thereby causing a disruption in water service.

Most of the system’s fire hydrants are the ones that were originally installed and are beyond their useful lives. This is exhibited by stuck valves, which can lead to inadequate fire-fighting ability.

While the LSCSD has recently installed a SCADA system for system monitoring and control, pump station B-57 was not included. Pump station B-57 requires manual operation, and Tank 4 has overflowed as a result of inadequate monitoring the system.

Most of the water meters are original and are well past their useful life. These meters are manually read, causing a significant strain on personnel due to the high level of effort needed. In addition, handwritten records of water use can be subject to error, leading to incorrect billing.

4.2 Reasonable Growth

The individual projects are being developed to provide upgrades for existing uses. The future anticipated growth within the community is for previously approved zoning designations for residential and commercial properties that are currently parceled but undeveloped.

The proposed projects address existing infrastructure at existing capacity levels and are not growth related. However, the upgrades to the existing system are expected to be able to accommodate anticipated growth within the 20-year planning horizon.

4.3 Consolidation Analysis

The closest public water systems to the LSCSD are the City of Weed to the south (approximately six miles) and the Grenada Sanitary District to the northwest (approximately 14 miles), as shown in Figure 2-2. Due to the distance from the LSCSD service area to both water systems, consolidation is not a feasible option. Furthermore, consolidation would address only the Well 4 deficiency. It is unknown if the City of Weed's system has available capacity, but it is likely that the Grenada system has insufficient capacity to provide the needed 1,350-gpm in the event that Well 4 is not operating.

No further evaluation of consolidation was performed for this PER.

5.0 Alternatives Analysis

5.1 General

Since each deficiency and solution listed in Table 4-1 (page 14, above) is generally independent of the other deficiencies, each deficiency is generally addressed independently with individual alternatives. Two or more alternatives were evaluated for each deficiency. The following sections summarize the evaluation process for each project.

The evaluation process incorporated consideration of how to address state planning priorities as described in the California Government Code Section 65041.1, which states the following:

> "a) To promote infill development and equity by rehabilitating, maintaining, and improving existing infrastructure that supports infill development and appropriate reuse and redevelopment of previously developed, underutilized land that is presently served by transit, streets, water, sewer, and other essential services, particularly in underserved areas, and to preserving cultural and historic resources.
>
> b) To protect environmental and agricultural resources by protecting, preserving, and enhancing the state's most valuable natural resources, including working landscapes such as farm, range, and forest lands; natural lands such as wetlands, watersheds, wildlife habitats, and other wildlands; recreation lands such as parks, trails, greenbelts, and other open space; and landscapes with locally unique features and areas identified by the state as deserving special protection.

c) To encourage efficient development patterns by ensuring that any infrastructure associated with development, other than infill development, supports new development that does all of the following:

   i. Uses land efficiently.

   ii. Is built adjacent to existing developed areas to the extent consistent with the priorities specified pursuant to subdivision (b)

   iii. Is located in an area appropriately planned for growth.

   iv. Is served by adequate transportation and other essential utilities and services.

   v. Minimizes ongoing costs to taxpayers."

Consideration was also given to how each alternative provides opportunity for water and energy efficiency. Given that none of the alternatives use additional process water to function, there was no need for any analysis related to water efficiency. Regarding energy efficiency, only those projects that require operational power are relevant, including the pump station, well house upgrades, new wells, and the additional water storage. Energy efficiency is discussed in the respective sections below.

5.2 Well 4 Redundancy

5.2.1 Description

5.2.1.1 Alternative 1: New Well

In 2019, the LSCSD drilled a new production well (Well 10) to the southeast of Well 4 along Big Springs Road. However, this well produced only 300 gpm, which is less than anticipated and needed (1,350 gpm). Additional locations, including a deeper well near Well 10, are contemplated.

The LSCSD is currently evaluating three locations for a backup production well to Well 4. These locations are as follows, in order of preference:

1. Test Well T-11, off Big Springs Road near Well 10
2. Test Well T-12, between Big Springs Road and Mountain Wood Drive, near Well 5
3. Test Well T-13, off Lake Shore Drive near Booster Pump Station B-57

Test well locations are shown on Figure 5-1. Test wells have been drilled and according to the Test Well Report by SHN (Appendix 3), Test Wells T-11 and T-12 are the recommended locations for a production well. Until a production well is drilled and yield verified this alternative has been analyzed based on conservative assumptions and well yield of 1,350 gpm.

This section describes the potential layouts of above-ground infrastructure and connection to the distribution system for each location. Once a specific well location, or locations, has been finalized, this PER will be updated or amended. Regardless of the ultimate location, the new production well will consist of the following elements:

- Production well
- Vertical turbine pump with a VFD, capable of 1,350 gpm
- Pump house
- Standby generator

- Security fencing
- Piping to connect to the nearest location of the distribution system

5.2.1.2 Alternative 2: Consolidation/Emergency Intertie

As discussed in Section 4.3, consolidation with a neighboring district, or even a mutual aid emergency intertie is not feasible due to the distance to the nearest water systems, so no further evaluation of this alternative was performed.

5.2.2 Design Criteria

Preliminary design criteria include the following:

- 1,350 gpm
- 480-volt, 3-phase power
- Enclosed pump house
- Backup power

Additional design criteria will be determined after the location of the proposed production well is finalized.

5.2.3 Environmental Impacts

Refer to the CEQA documents that will be prepared as part of this planning project.

5.2.4 Land Requirements

The LSCSD owns the land at each proposed test well location. Depending on the proposed location of the recommended well, easements may be required for piping from the well to the distribution system.

5.2.5 Construction and Site Considerations

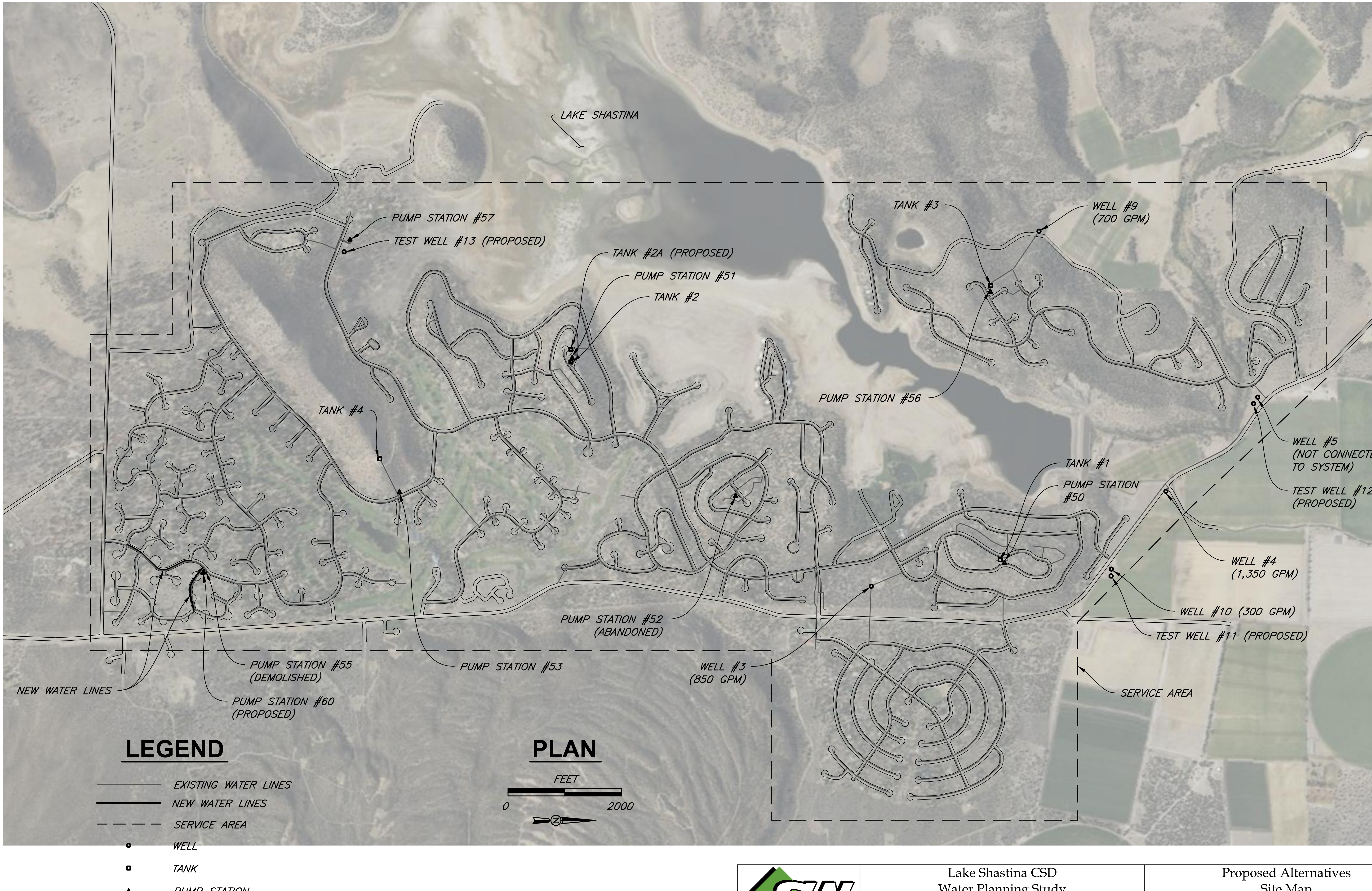
None of the three proposed well locations has unusual or atypical construction or site challenges. At the T-11 site, connection to the distribution system would require crossing Big Springs Road, a highly trafficked county road.

5.2.6 Cost Estimate

A generalized cost estimate for a new well, which is the only practical alternative, is presented in Table 5-1 (on the next page). For the purposes of developing budgetary estimates, a conservative estimate has been assumed.

Table 5-1. New Well Cost Estimate
Lake Shastina Community Services District

Item	Description	Units	Quantity	Unit Cost	Total Cost
1	Well Drilling	LS[a]	1	$150,000	$150,000
2	Well Pump	EA[b]	1	$15,000	$15,000
3	Well House	SF[c]	300	$250	$75,0000
4	Standby Generator w/ATS[d]	LS	1	$100,000	$100,000
5	New Power Connection	LS	1	$30,000	$30,000



Lake Shastina CSD
Water Planning Study
Lake Shastina, CA

Proposed Alternatives
Site Map
SHN 520022

November 2023

520022-LSCSD-FIGS

Figure 5-1

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Table 5-1. New Well Cost Estimate
Lake Shastina Community Services District

Item	Description	Units	Quantity	Unit Cost	Total Cost
6	Sitework	LS	1	$25,000	$25,000
7	Piping to Distribution System	LF[e]	250	$100	$25,000
8	Mobilization (8%)	LS	1	$34,000	$34,000
				Subtotal	$454,000
				Contingency (30%)	$137,000
				Construction Subtotal	$591,000
				Engineering (20%)	$119,000
				Project Total	**$847,000**

a. LS: lump sum
b. EA: each
c. SF: square foot
d. ATS: automatic transfer switch
e. LF: linear foot

Other monetary factors that can influence which alternative is selected include operations and maintenance (O&M) costs, present worth cost, and life cycle costs. None of these factors influenced which alternative was selected for this deficiency.

5.2.7 Advantages and Disadvantages

The advantage of a new well is redundancy to Well 4 and water supply security. There are no disadvantages to this alternative.

5.2.8 Alternative Evaluation and Selection

The only alternative to solving this deficiency is to install a new well with associated infrastructure.

5.3 Aging Tanks

5.3.1 Description

5.3.1.1 Alternative 1: Refurbish Existing Tanks

The most typical and cost-effective alternative for steel tanks with deteriorating coatings is to clean the tank and recoat a tank, on the interior, exterior, or both, presuming there are no significant structural issues with the tank (refer to Figure 5-1 for tank locations). Recoating the interior and exterior protects the steel from deterioration due to corrosion, and, thereby, protects the structural integrity of the tank.

The specific refurbishment recommended for each of the four tanks is based on the recommendations of the 2017 inspections, as described in Section 3 and summarized in Table 5-2:

- Remove accumulated sediment (all tanks).
- Sandblast and recoat the interior (all tanks).
- Replace entry hatch gasket (all tanks).
- Touch up exterior coating (all tanks).
- Recoat low spots on exterior roof (Tank 1).
- Recoat entire exterior roof (Tank 3).
- Replace interior float of level indicator (Tank 4)

Hydraulic modeling of the water system using Bentley's WaterCAD software indicated that Tanks 1, 2, and 3 can be taken offline during low use periods without impacting service to customers. Taking Tank 4 offline, because it is in a separate pressure zone, will require a temporary pressure system.

While the 2017 inspection recommendations generally recommended only touch-up painting on the tank exteriors, it may be prudent to recoat the entire tank exterior. This will be determined during the final design phase after lead and adhesion testing results are obtained. A bid alternate to recoat the entire exterior instead of just touch-up may be included in bid documents to evaluate actual costs.

In light of potentially recoating the entire tank exteriors, and given that the tanks still have their original coating, the existing exterior coating would be tested for lead. The proposed paints would be placed in test areas to check for adhesion on top of the existing paint. Removing the existing paint would only be necessary if the proposed coating does not properly adhere to the existing coating. If the existing coating contains lead and needs to be removed, significant additional costs would be incurred since paint removal would need to take place within an enclosed area to contain all removed lead. For the purposes of this alternative, no lead paint removal is assumed.

Once cleaned, each tank will undergo a complete sandblasting procedure to remove any rust and coatings to allow for a thorough inspection to determine whether structural or other metal improvements are needed to completely refurbish each tank. Afterward, a completely new coating system will be installed.

5.3.1.2 Alternative 2: Replace Existing Tanks

Another option for the LSCSD is to replace the existing water tanks instead of rehabilitating them. This option offers the benefit of providing new infrastructure to the system that will keep maintenance costs to a minimum. However, capital costs will be substantially higher than refurbishing the existing tanks, therefore this option was eliminated from consideration.

5.3.2 Design Criteria

Specific design criteria will be determined during final design.

5.3.3 Environmental Impacts

Refer to the CEQA documents being prepared as part of this project.

5.3.4 Land Requirements

Given that nothing new is anticipated to be added to the existing tank infrastructure, there will be no new land requirement associated with the tank improvements.

5.3.5 Construction and Site Considerations

Due to the age of the existing tanks, there is a possibility that the interior and/or exterior of each tank could contain lead paint. Therefore, testing will be required to determine if lead paint is present. If lead paint is found, some form of remediation may need to take place before repairs are completed. If lead paint is found in an area that does not need to be removed, verify that an overlay will be possible without first removing the lead.

5.3.6 Cost Estimate

Cost estimates for tank rehabilitation and replacement are provided in Table 5-2.

Table 5-2. Tank Rehabilitation Cost Estimate for Tanks 1, 3, and 4
Lake Shastina Community Services District

Item	Description	Units	Quantity	Unit Cost	Total Cost
1	Tank Recoating	LS[a]	4	$220,000	$880,000
2	Mobilization (8%)	LS	1	$71,000	$71,000
				Subtotal	$951,000
				Contingency (30%)	$286,000
				Construction Subtotal	$1,237,000
				Engineering (20%)	$248,000
				Project Total	**$1,771,000**

a. LS: lump sum

5.3.7 Advantages and Disadvantages

The advantage of tank rehabilitation versus replacement is cost. Recoating a tank that is generally in good condition is significantly less costly than a new tank as shown in the previous section. There are no substantial disadvantages to the rehabilitation alternative.

5.3.8 Alternative Evaluation and Selection

Based on cost considerations, tank rehabilitation was selected as the preferred alternative.

5.4 Inadequate Water Storage

5.4.1 Description

5.4.1.1 General

During high demand periods, the greatest strain on the storage system is at Tank 2. Alternatives to address this deficiency entails additional storage at or near Tank 2.

5.4.1.2 Alternative 1: Replace Tank 2 with Larger Tank

This alternative entails replacing the existing Tank 2 with a new, larger tank, increasing the storage capacity from 300,000 gallons to 500,000 gallons. The new tank would have the same footprint as the existing tank but be taller and be constructed of welded steel.

5.4.1.3 Alternative 2: Add a New Tank to the System

Under this alternative, Tank 2 is refurbished, and a new tank of similar size (300,000 gallons) would be constructed on an adjacent parcel (see Figure 5-2).

5.4.2 Design Criteria

General design criteria are as follows:

- 300,000 gallons storage
- Welded steel construction
- Same elevation as Tank 2
- Connected to the SCADA system

The tank can be installed either in series or parallel with Tank 2. This will be determined during final design. If the new tank is placed in parallel with Tank 2, an altitude valve will be needed for the new tank. A proposed piping schematic is shown on Figure 5-3.

5.4.3 Environmental Impacts

Refer to the CEQA documents being prepared as part of this project.

5.4.4 Land Requirements

Under Alternative 1, given that the replacement tank will occupy the same location as the existing tank, no additional land would be required. Under Alternative 2, additional land is needed to accommodate the new tank because there is insufficient land at the Tank 2 site. The most reasonable solution is for the LSCSD to purchase a nearby parcel, which would be a lot located across the adjacent road to the west. The closest lot is 0.47 acres in size, which will provide ample space.

5.4.5 Construction and Site Considerations

A geotechnical investigation will be needed for the foundation of the new tank. Minor grading will be required to be able to set the new tank at the same elevation as Tank 2.

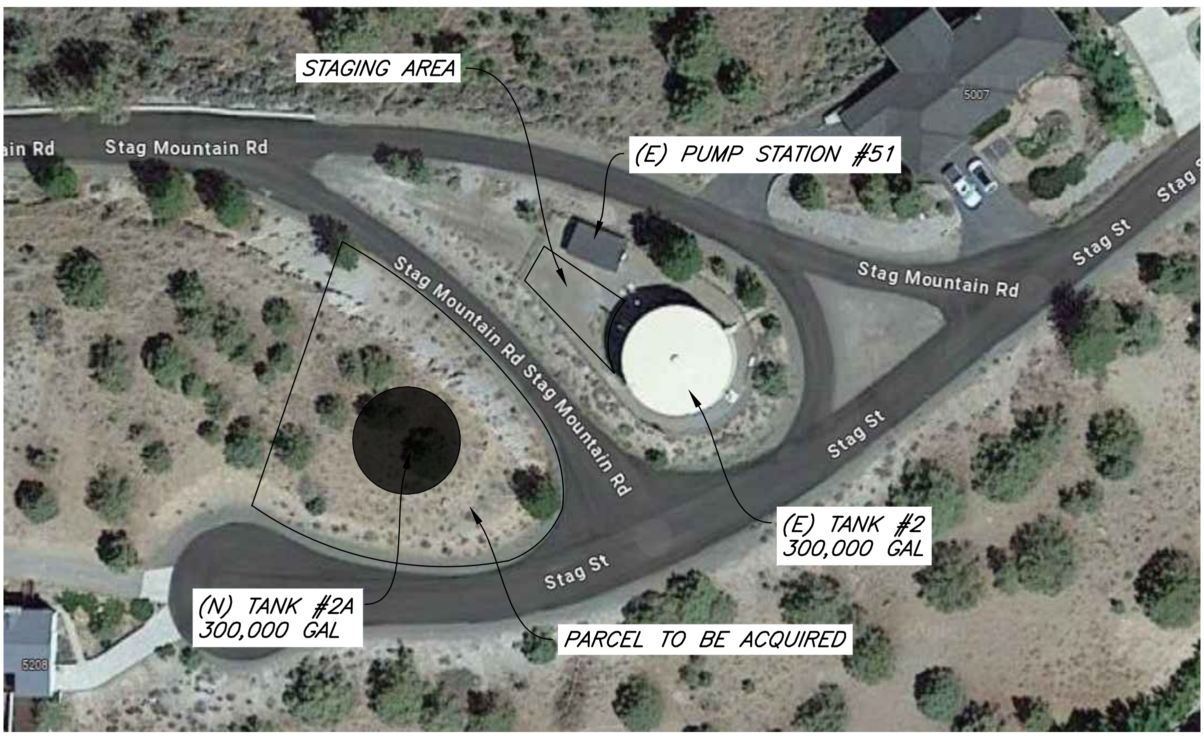
5.4.6 Cost Estimate

Cost estimates for Tank 2 replacement with a larger tank (Alternative 1) are provided in Table 5-3.

Table 5-3. Tank 2 Replacement Cost Estimate (Alternative 1: Replace with Larger Tank)
Lake Shastina Community Services District

Item	Description	Units	Quantity	Unit Cost	Total Cost
1	Tank 2 Demolition	LS[a]	1	$50,000	$50,000
2	Replace Tank Foundation	LS	1	$60,000	$60,000
3	New Welded Steel Tank (500,000 gallon)	LS	1	$500,000	$500,000
4	Mobilization (8%)	LS	1	$49,000	$49,000
				Subtotal	$649,000
				Contingency (30%)	$198,000
				Construction Subtotal	$857,000
				Engineering (20%)	$172,000
				Project Total	**$1,227,000**

a. LS: lump sum



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Lake Shastina CSD Drinking Water System Improvements Lake Shastina, California	Proposed Alternatives Tank 2 & Tank 2A Site Map SHN 520022	
Novermber 2023	520022-LSCSD-FIGS	Figure 5-2

Cost estimates for erecting an additional tank (Alternative 2) are provided in Table 5-4.

Table 5-4. Tank 2 Replacement Cost Estimate (Alternative 2: Erect Additional Tank) Lake Shastina Community Services District

Item	Description	Units	Quantity	Unit Cost	Total Cost
1	New Foundation	LS[a]	1	$60,000	$60,000
2	New Welded Steel Tank (300,000 gallon)	LS	1	$300,000	$300,000
3	Sitework	LS	1	$50,000	$50,000
4	Mobilization (8%)	LS	1	$33,0000	$33,000
				Subtotal	$443,000
				Contingency (30%)	$133,000
				Construction Subtotal	$576,000
				Acquire Adjacent Lot	$10,000
				Engineering (20%)	$116,000
				Project Total	**$702,000**

a. LS: lump sum

5.4.7 Advantages and Disadvantages

The advantage of Alternative 1 is that no additional land is needed for Alternative 1, while Alternative 2 provides a significant advantage by reducing the down time of Tank 2. If the new tank is constructed before Tank 2 is taken offline for refurbishing, there will be no down time for this storage and will allow for Tank 2 refurbishing to take place even during high water use periods. The disadvantages for Alternative 1 is a significant down time while Tank 2 is demolished and replaced.

5.4.8 Alternative Evaluation and Selection

Minimizing down time provides an overriding advantage for Alternative 2. Therefore, Alterative 2 was selected as the preferred alternative.

5.5 Inadequate Pressure in Southeast Zone

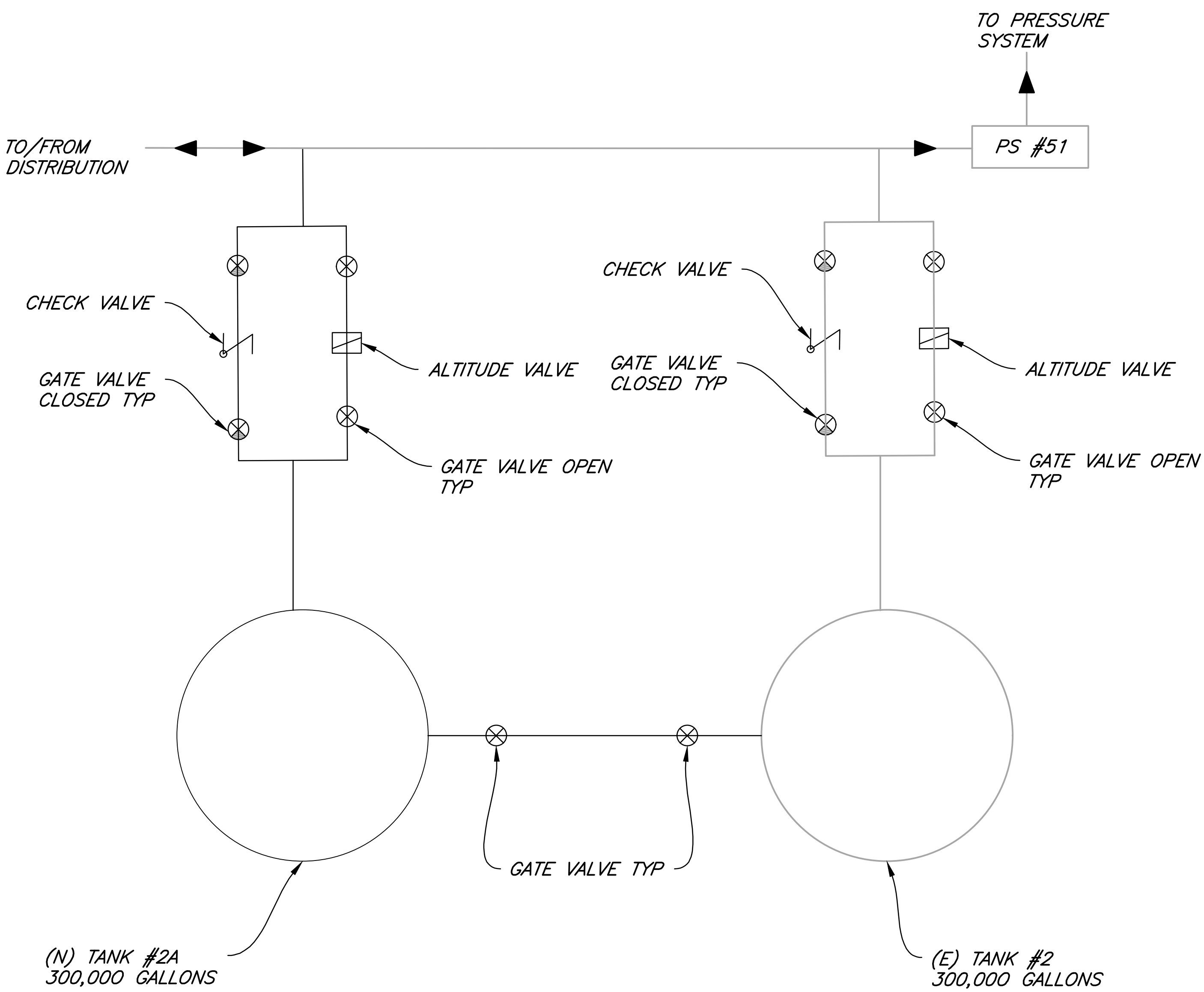
5.5.1 Description

5.5.1.1 Alternative 1: Install a New Booster Pump

To provide adequate system pressures in the southern area, additional energy must be supplied to the system. This can be accomplished by installing an additional booster pump or water tank at a higher elevation, or both simultaneously. Figure 5-4 shows the proposed location for this new booster pump station, which is at the site of a former booster pump station at the corner of Elk Trail Road and Cottontail Drive. Figure 5-5 shows the piping schematic for this new booster pump station.

5.5.1.2 Alternative 2: Install a New Tank

In order to provide adequate pressure in this zone with a tank, the elevation of the tank needs to be about 100 feet higher than the highest house in this zone. An elevated tank of this height is not practical. There are no nearby locations with enough elevation for a ground level tank. Therefore, a tank alternative was dismissed.



Lake Shastina CSD
Drinking Water System Improvements
Lake Shastina, California

Tank 2 & Tank 2A
Piping Schematic
SHN 520022

Novermber 2023 | 520022-LSCSD-FIGS | Figure 5-3

5.5.2 Design Criteria

Detailed design criteria will be established during final design. General design criteria are as follows:

- Minimum of 40 pounds per square inch (psi) within the new pressure zone
- Duplex pump for fire and high-use flow and one pump for low flow
- Backup power

5.5.3 Environmental Impacts

Refer to the CEQA documents being prepared as part of this project.

5.5.4 Land Requirements

The parcel where the previous booster pump station was located will need to be acquired. The LSCSD cannot find record of any easement on that property. Further, additional space will be required to accommodate the new booster pump station and associated backup power.

5.5.5 Construction and Site Considerations

Soils in the LSCSD service area can vary. During previous LSCSD projects, rocky soil has been encountered. However, there are no major construction problems anticipated. There will be minor traffic interruptions during excavation in roadways.

5.5.6 Cost Estimate

Cost estimates for Booster Pump Station B-60 is provided in Table 5-5.

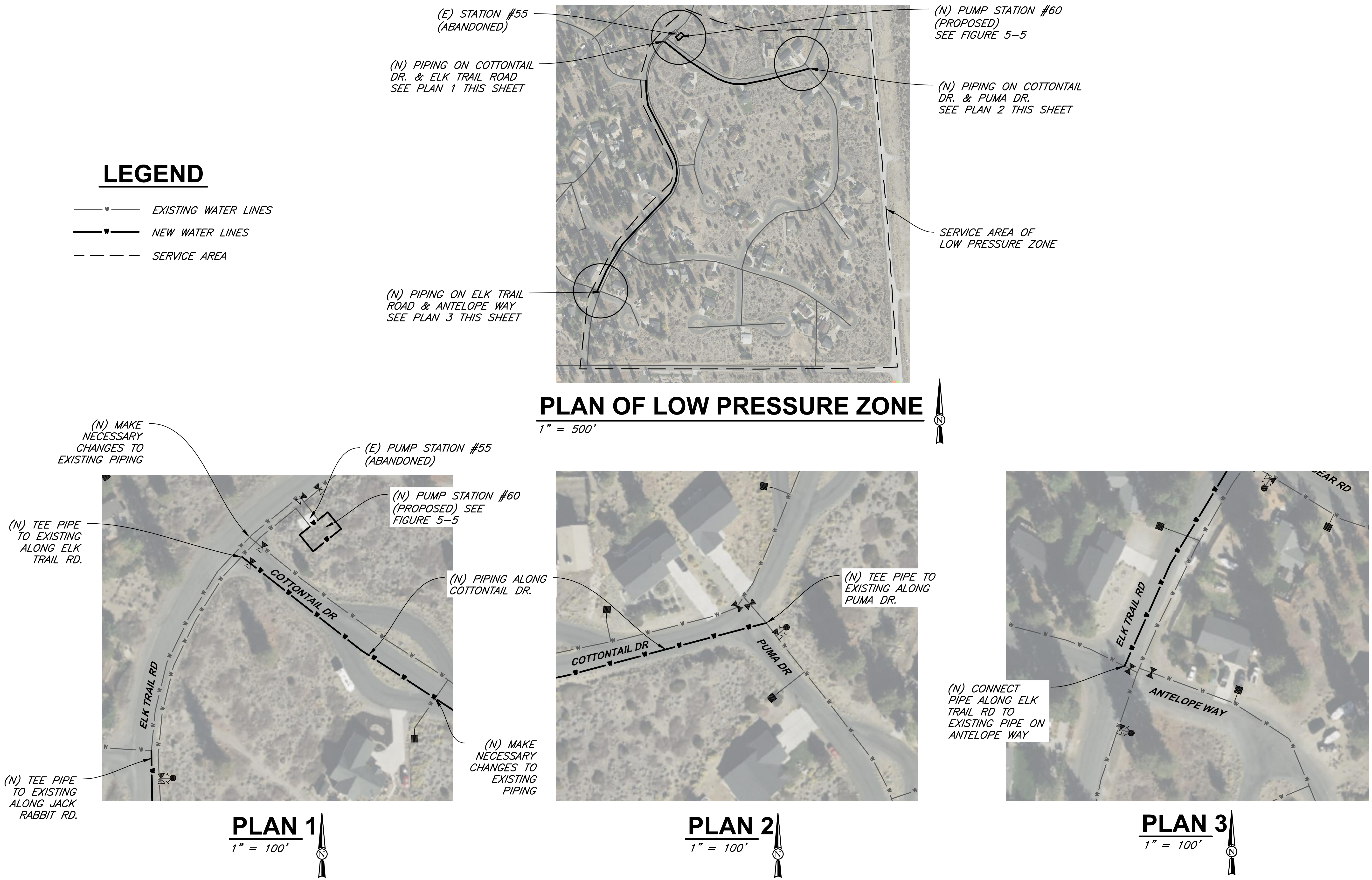
Table 5-5. New Booster Pump Station B-60
Lake Shastina Community Services District

Item	Description	Units	Quantity	Unit Cost	Total Cost
1	Pump Station Building	SF[a]	300	$250	$75,000
2	New Booster Pumps	LS[b]	1	$75,000	$75,000
3	Backup Generator (ATS)[c]	LF[d]	1	$40,000	$40,000
4	New Power service	LS	1	$30,000	$30,000
5	Sitework	LS	1	$25,000	$25,000
6	New Distribution Piping	LF	50	$100	$5,000
7	Mobilization (8%)	LS	1	$20,000	$20,000
				Subtotal	$270,000
				Contingency (30%)	$81,000
				Acquire Lot	$10,000
				Engineering (20%)	$71,000
				Project Total	**$432,000**

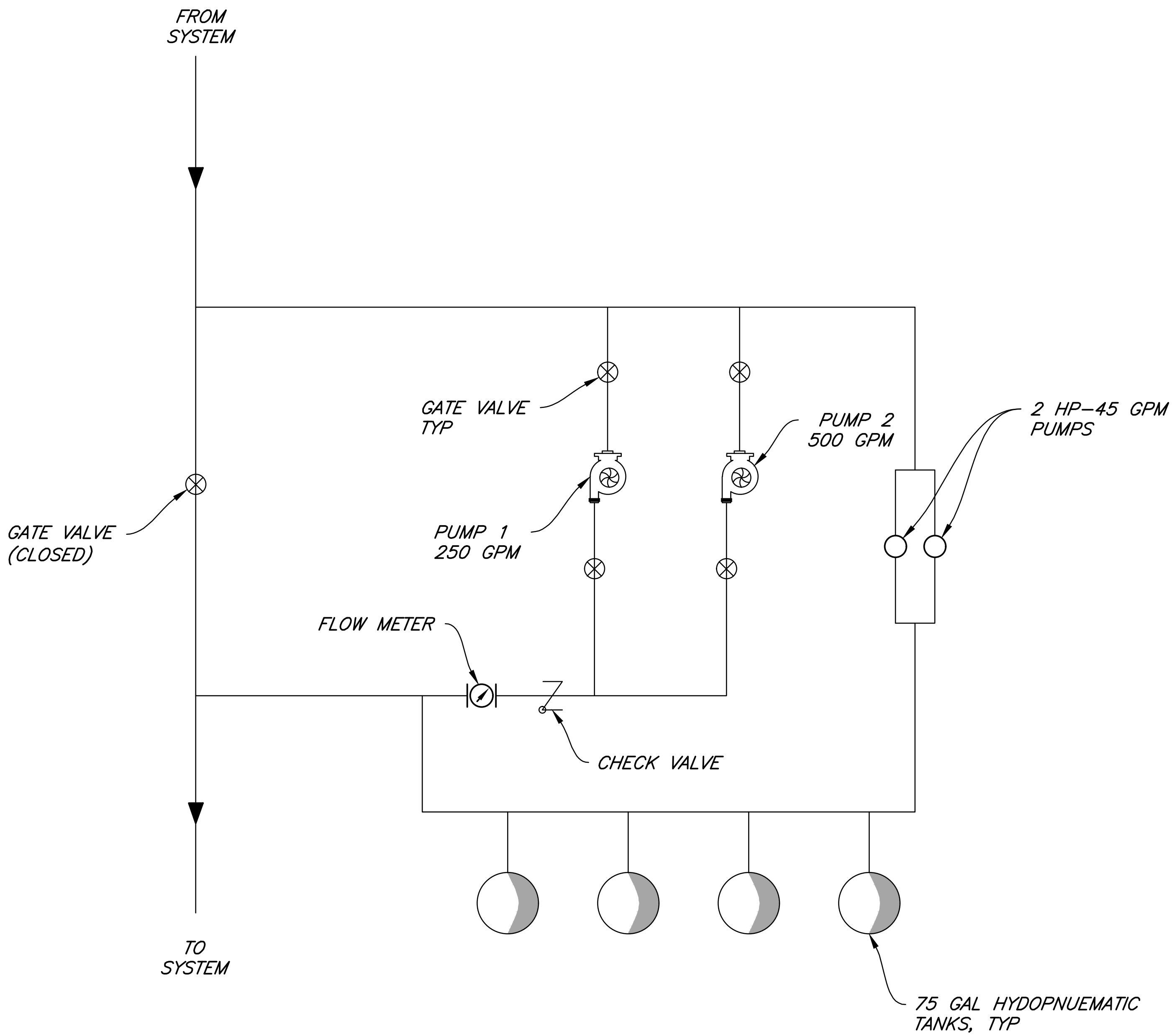
a. SF: square foot
b. LS: lump sum
c. ATS: automatic transfer switch
d. LF: linear foot

5.5.7 Advantages and Disadvantages

The only feasible alternative able to address this deficiency is to install a pump station and reestablish the previous pressure zone. There are no disadvantages to this alternative.



SHN	Lake Shastina CSD Water Planning Study Lake Shastina, CA	Proposed Alternatives Low Pressure Zone SHN 520022
	November 2023 / 520022-LSCSD-FIGS	Figure 5-4



Lake Shastina CSD Water Planning Study Lake Shastina, California		Proposed Station #60 Piping Schematic SHN 520022
Novermber 2023	520022-LSCSD-FIGS	Figure 5-5

5.5.8 Alternative Evaluation and Selection

The selected alternative is to reestablish the former pressure zone with a new booster pump station.

5.6 Lack of Backup Power

5.6.1 Description

5.6.1.1 General

This alternatives analysis applies only to existing sites without backup power. Backup power at new facilities, such as the new well and new booster pump station, is accounted for as part of those projects.

5.6.1.2 Alternative 1: Install Permanent Standby Generators

A permanent standby generator would be mounted on a concrete pad and have a self-contained fuel storage tank at each well (except Well 3) and each of the booster pump stations. Either an automatic transfer switch (ATS) or manual transfer switch (MTS) would be located by the electrical panels and, in the event of a power outage, would automatically switch the power source from the power company to the generator, which would automatically be started.

5.6.1.3 Alternative 2: Install Portable Generators with Hookups

An alternative standby power solution is to bring a trailer-mounted portable generator to the pump station(s) and well houses. The portable generator would be plugged into a receptacle and would supply power to the pump station. An operator would then manually switch the power source from the power company to the generator using an MTS.

5.6.2 Design Criteria

Specific design criteria will be developed during final design, including the following:

- Determine whether an automatic transfer switch or a more cost-effective manual transfer switch is sufficient.
- Determine generator size.

5.6.3 Environmental Impacts

Refer to the CEQA documents being prepared as part of this project.

5.6.4 Land Requirements

There is sufficient space at each location for a backup generator, except at station B-53, which will require a portion of the adjacent undeveloped parcel to the north, which may result in the LSCSD acquiring the entire parcel.

5.6.5 Construction and Site Considerations

No potential construction problems are anticipated. The only site consideration is at station B-53, which will require additional land, as discussed in the previous section.

5.6.6 Cost Estimate

Cost estimates are provided for permanent standby generators in Table 5-6 and summarized in Section 5.6.1.2 In general, non-monetary factors determined the recommendations presented in Section 7, this is further discussed within Section 6.

Table 5-6. Permanent Generators (Alternative 1)
Lake Shastina Community Services District

Item	Description	Units	Quantity	Unit Cost	Total Cost
1	Well 4 Generator w/ATS[a]	EA[b]	1	$100,000	$100,000
2	Well 9 Generator w/ATS	EA	1	$50,000	$50,000
3	B-50, B-51, B-53, & B-56 Generators w/ATS	EA	4	$40,000	$160,000
4	Sitework	EA	6	$15,000	$60,000
5	Mobilization (8%)	LS	1	$32,000	$32,000
				Subtotal	$432,000
				Contingency (30%)	$130,000
				Construction Subtotal	$562,000
				Engineering (20%)	$113,000
				Task Total	**$805,000**

a. ATS: an automatic transfer switch
b. EA: each
c. LS: lump sum

Cost estimates are provided for portable generators in Table 5-7 and summarized in Section 5.6.1.3

Table 5-7. Portable Generators (Alternative 2)
Lake Shastina Community Services District

Item	Description	Units	Quantity	Unit Cost	Total Cost
1	Generator Hookup	EA[a]	3	$1,500	$4,500
2	Manual Transfer Switch	EA	3	$800	$2,400
3	Generator For Pump Stations (50 kW)[b]	EA	2	$40,000	$40,000
4	Generator for Well 4 (144 kW)	EA	1	$100,000	$100,000
5	Mobilization (8%)	LS[c]	1	$7,000	$7,000
				Subtotal	$193,900
				Contingency (30%)	$59,000
				Construction Subtotal	$252,900
				Engineering (20%)	$51,000
				Project Total	**$363,000**

a. EA: each
b. kW: kilowatt
c. LS: lump sum

5.6.7 Advantages and Disadvantages

Both alternatives provide advantages in that they minimize the probability of service disruption in a power outage or other event, and in the event of a fire with power outage, would still allow water to be delivered to firefighting equipment. Permanent backup generators would provide better risk reduction to a service disruption resulting from a power outage. Although the permanent alternative has significantly higher capital cost, the temporary alternative would likely overstress limited resources in staff and mobile generators to respond to a power outage. LSCSD public works staff members oversee both the water and wastewater systems.

5.6.8 Alternative Evaluation and Selection

Temporary mobile generators were determined generally not to be feasible due to difficulty in getting to all the pump stations and wells with limited personnel and limited number of mobile generators, which could severely impact fire-fighting ability.

5.7 Aging Fire Hydrants

5.7.1 Description

5.7.1.1 Alternative 1: Replace Aging Fire Hydrants

The existing hydrants would all be replaced at once to provide better fire protection for the community.

5.7.1.2 Alternative 2: Do Nothing

Each fire hydrant has its valve exercised annually. However, with the age of the existing fire hydrants being well beyond their useful life, the possibility of having a stuck valve is a significant possibility, which could result in the fire department's inability to fight a fire. For this reason, a do-nothing alternative was not considered.

5.7.2 Design Criteria

Each fire hydrant would be replaced with a make and model acceptable to the LSCSD. The piping between the fire hydrant and the valve in the road would be replaced as well. The LSCSD does not have a standard detail for fire hydrant construction, so an acceptable detail from a nearby jurisdiction would be used as a basis for the design criteria.

5.7.3 Environmental Impacts

Refer to the CEQA documents being prepared as part of this project.

5.7.4 Land Requirements

No land requirements are expected for this part of this subproject.

5.7.5 Construction and Site Considerations

No potential construction problems or site considerations are expected.

5.7.6 Cost Estimates

Cost estimates are provided for fire hydrant replacement in Table 5-8 (on the next page) and summarized in Section 7. In general, non-monetary factors determined the recommendations presented in Section 7, this is further discussed within Section 6.

Table 5-8. Replace Fire Hydrants
Lake Shastina Community Services District

Item	Description	Units	Quantity	Unit Cost	Total Cost
1	Replace Fire Hydrants	EA[a]	319	$6,000	$1,914,000
2	Mobilization (8%)	LS[b]	1	$154,000	$154,000
				Subtotal	$2,068,000
				Contingency (30%)	$621,000
				Construction Subtotal	$2,689,000
				Engineering (20%)	$269,000
				Project Total	**$3,579,000**

a. EA: each
b. LS: lump sum

5.7.7 Advantages and Disadvantages

The advantage of replacing the fire hydrants is that it provides greater security with respect to water supply for firefighting. There are no disadvantages to replacing the existing fire hydrants.

5.7.8 Alternative Evaluation and Selection

Replacing the fire hydrants, excepting the 20 that have been replaced in recent years, was selected as the preferred alternative.

5.8 Incomplete SCADA System

5.8.1 Description

5.8.1.1 Alternative 1: Tying Station B-57 into SCADA

Station B-57 is currently activated and deactivated on a timer and is not connected to the SCADA system. Tying B-57 into the SCADA system would allow more flexibility in the operation of both B-53 and a more reliable and stable B-57 operation. Not only does B-57 activate to pump water into Tank 4, but it also allows for circulation of water within the area of B-57 to keep the water from becoming stagnant in this part of the distribution system.

It should be noted that this alternative applies only to B-57. All new facilities, such as a new well or new booster pump station, will incorporate SCADA as part of their respective projects.

5.8.1.2 Alternative 2: Do Nothing

Doing nothing would continue the existing timed operation of Station B-57, with the potential risk of overfilling Tank 4 remaining.

5.8.2 Design Criteria

The LSCSD would contact XiO to have them expand the existing SCADA system to include B-57.

5.8.3 Environmental Impacts

Refer to the CEQA documents being prepared as part of this project.

5.8.4 Land Requirements

No additional land is needed.

5.8.5 Construction and Site Considerations

There are no construction considerations for this subproject. The only site consideration is to make sure there is adequate ability to community between the base SCADA system and B-57. Depending on the system, it may require line-of-sight with another receiver.

5.8.6 Cost Estimate

The cost estimate to add B-57 to the SCADA system is provided in Table 5-9. In general, non-monetary factors, as discussed within Section 6, determined the recommendations presented in Section 7 (Not verified).

Table 5-9. Add B-57 to SCADA[a] System
Lake Shastina Community Services District

Item	Description	Units	Quantity	Unit Cost	Total Cost
1	Install Hardware	LS[b]	1	$10,000	$10,000
2	Update SCADA Programming	LS	1	$5,000	$5,000
3	Mobilization (8%)	LS	1	$2,000	$2,000
				Subtotal	$17,000
				Contingency (30%)	$6,000
				Construction Subtotal	$23,000
				Engineering (20%)	$5,000
				Project Total	**$34,000**

a. SCADA: Supervisory Control and Data Acquisition
b. LS: lump sum

5.8.7 Advantages and Disadvantages

The advantage to incorporating B-57 into the SCADA system is to allow it to shut off when Tank 4 reaches a set water level. The current timer setting does not prevent Tank 4 from overfilling.

5.8.8 Alternative Evaluation and Selection

Based on operational considerations and risk of overfilling Tank 4, the preferred alternative is to incorporate Station B-57 into the existing SCADA system,

5.9 Manual Read Water Meters

5.9.1 Description

5.9.1.1 Alternative 1: Install Automatic Meter Reading System

The automatic meter reading (AMR) system requires changing the meter register to an AMR register that transmits a radio signal along short intervals with unique identifying information and meter usage information. This signal is projected a short distance and is picked up by a receiver in a vehicle driven by a LSCSD employee. The water usage data is displayed and stored on a tablet and the information is then uploaded to the billing system at the district offices. The AMR system would allow for a LSCSD employee to perform the monthly meter reading in a matter of hours rather than days.

An AMR system would significantly decrease the number of hours required to read the meters as compared to the current system and would allow the LSCSD to transition from a quarterly to a monthly billing cycle. AMR does not provide some of the advanced functionality that the AMI system provides but it does achieve the LSCSD's goal of a significantly lower cost. An AMR system may also have the capability of migrating to an AMI system later without replacing the meters (see Section 5.9.1.2).

5.9.1.2 Alternative 2: Install Advanced Metering Infrastructure System

The advanced metering infrastructure (AMI) system requires a new register that sends a signal either through a cellphone network or signal-repeaters to a local hub that updates water usage continuously. The AMI system would further decrease the required time for meter reading while providing additional functionality not available through the AMR system.

The AMI system allows additional functions (such as water usage alerts and more in-depth water usage analysis) than the AMR system. AMI also allows the possibility of implementing a remote valve shutoff system in the future and provides person-hour savings over the AMR system because it does not require an employee to drive around the service area gathering usage data. This additional functionality and person-hour savings is achieved at higher implementation and maintenance cost than the AMR system.

5.9.2 Design Criteria

There are three main AMI and AMR system manufacturers available: Sensus, Badger, and Neptune. All three producers offer similar functionality at relatively similar costs. At the planning level of this report, it is not necessary to perform a cost benefit analysis between the providers as the products and costs are comparable. A determination will need to be made during the design/procurement phase as to which system to implement. The LSCSD currently has and prefers Badger meters.

The proposed meters are anticipated to fit within existing meter boxes. Only current service connections would get the new water meters. When undeveloped properties are developed, a new water meter would be installed.

5.9.3 Environmental Impacts

Refer to the CEQA documents being prepared as part of this project.

5.9.4 Land Requirements

No additional land is required.

5.9.5 Construction and Site Considerations

There are no construction or site considerations.

5.9.6 Cost Estimate

Cost estimates for water meter installation are provided in Table 5-10 and Table 5-11 (on the next page) and summarized in Section 7. In general, non-monetary factors, as discussed within Section 6, determined the recommendations presented in Section 7.

Table 5-10. Install AMR[a] Meters (Alternative 1)
Lake Shastina Community Services District

Item	Description	Units	Quantity	Unit Cost	Total Cost
1	AMR Meter	EA[b]	1,292	$200	$258,400
2	Orion Mobile Endpoint	EA	1,292	$100	$129,200
3	Tablet Cost	EA	1	$7,000	$7,000
4	Set-up Fee	LS[c]	1	$5,000	$5,000
				Subtotal	$399,600
				Contingency (10%)	$40,000
				Construction Subtotal	$399,600
				Engineering (5%)	$20,000
				Project Total	**$420,000**

a. AMR: Automatic Meter Reading
b. EA: each
c. LS: lump sum

Table 5-11. Install AMI[a] Meters (Alternative 2)
Lake Shastina Community Services District

Item	Description	Units	Quantity	Unit Cost	Total Cost
1	AMI Meter	EA	1292	$250	$323,000
2	Central Computer Station & Software	LS	1	$20,000	$20,000
3	Set-up Fee	LS	1	$5,000	$5,000
				Subtotal	$348,000
				Contingency (10%)	$35,000
				Construction Subtotal	$383,000
				Engineering (5%)	$20,000
				Project Total	**$438,000**

a. AMI: Advanced Metering Infrastructure
b. EA: each
c. LS: lump sum

5.9.7 Advantages and Disadvantages

The advantage of both systems is a reduction in staff time to read meters. However, the cost of the AMI system is much greater than the AMR system, and the incremental additional cost may not provide a commensurate benefit to the LSCSD.

5.9.8 Alternative Evaluation and Selection

Based on feedback from the LSCSD staff, Alternative 1, AMR meters, is the preferred alternative.

6.0 Selected Project

6.1 Overview

For each of the deficiencies listed in Table 4-1 (page 14), a single alternative was selected based on the analysis discussed in Section 5. The selected alternatives are listed below:

- Project 1: Install a new backup production well with pump house, backup power, and connection to the distribution system.
- Project 2: Refurbish all four existing tanks.

- Project 3: Install a new 300,000-gallon tank near Tank 2.
- Project 4: Install a new booster pump station and reinstate a former pressure zone.
- Project 5: Install stationary backup power.
- Project 6: Replace fire hydrants.
- Project 7: Install SCADA at Booster Pump Station B-57.
- Project 8: Replace water meters.

Generally, each alternative is treated as a separate project, due to how each may be bid as well as funded. The only exception would be that Projects 2 and 3 might be bid together since both will require the same type of contractor.

Each project is described in the following sections and includes discussion on the following topics, as applicable:

- Project description
- Schematic and map of proposed facilities
- Justification
- O&M challenges
- Consistency with local/county planning
- Inclusion of green and resilient components
- Land acquisition needs

6.2 Project 1: New Production Well

6.2.1 Project Description

A new production well with a yield of approximately 1,350 gpm will be located at either the T-11 or T-12 test well sites (see Figure 5-1). The project will consist of the following elements:

- Production well
- Vertical turbine pump with a VFD, capable of 1,350 gpm
- Pump house
- Standby generator
- Security fencing
- Piping to connect to the nearest location of the distribution system

The project cost is anticipated to be $847,000 as shown in Table 5-1.

6.2.2 Project Schematic and Map

Since the exact location of the well will not be known until it is drilled and tested for yield, a preliminary layout of the well and associated infrastructure, including connection with the distribution system, will be prepared after the production well is drilled. Conceptually, the layout will be similar to Well 4 (Figure 3-3).

6.2.3 Justification

As discussed in Section 3, the LSCSD lacks sufficient backup to Well 4, which is the main production well.

6.2.4 O&M Challenges
Operations and maintenance are expected to be typical for this project, with no unusual challenges anticipated.

6.2.5 Consistency with Local/County Planning
This project is consistent with local and county planning.

6.2.6 Inclusion of Green and Resilient Components
The well pump will include a variable frequency drive (VFD) to reduce energy consumption.

6.2.7 Land Acquisition Needs
No new land is needed for the well and well house. Easements will be needed for the piping from the well to the connection point with the existing distribution system.

6.2.8 Estimated Useful Life
The estimated useful life of the new well is 75-100 years. The well pump has a typical useful life of 20 years. All other major items would have a useful life of 30-50 years.

6.3 Project 2: Refurbish Tanks

6.3.1 Project Description
All four existing tanks will be refurbished, which will include the following elements:

- Remove accumulated sediment (all tanks).
- Sandblast and recoat the interior (all tanks).
- Replace entry hatch gasket (all tanks).
- Touch up exterior coating (all tanks).
- Recoat low spots on exterior roof (Tank 1).
- Recoat entire exterior roof (Tank3).
- Replace interior float of level indicator (Tank 4).

6.3.2 Project Schematic and Map
The tank location sites are shown on Figures 3-6, 3-8, 3-10, and 3-12. Contractor staging areas will be within the fence area at each tank.

6.3.3 Justification
The existing tanks are showing signs of corrosion. Refurbishing the tanks is the least cost option.

6.3.4 O&M Challenges
Operations and maintenance are expected to be typical for this project, with no changes to existing practices.

6.3.5 Consistency with Local/County Planning

This project is consistent with local and county planning.

6.3.6 Inclusion of Green and Resilient Components

Durable paints with low volatile organic compounds (VOCs) will be specified if possible.

6.3.7 Land Acquisition Needs

No additional land is needed for this project.

6.3.8 Estimated Useful Life

The estimated useful life would be at least 50 years before recoating would be needed.

6.4 Project 3: New Tank

6.4.1 Project Description

A new 300,000-gallon water storage tank will be located near Tank 2 on a nearby parcel. Both Tank 2 and the new tank will be hydraulicly connected but be able to be isolated from one another and the distribution system in case one tank is taken out of service. The new tank is anticipated to be constructed of welded steel to match the existing tank types.

6.4.2 Project Schematic and Map

A preliminary site plan is shown in Figure 5-2. A preliminary piping schematic is presented in Figure 5-3.

6.4.3 Justification

As discussed in Sections 3 and 5, additional storage at the Tank 2 location is needed to prevent the water level in Tank 2 from dropping below minimum levels.

6.4.4 O&M Challenges

Operations and maintenance are expected to be typical for this project, with no unusual challenges anticipated.

6.4.5 Consistency with Local/County Planning

This project is consistent with local and county planning.

6.4.6 Inclusion of Green and Resilient Components

Durable paints with low VOCs will be specified if possible.

6.4.7 Land Acquisition Needs

An adjacent parcel of land would be needed for this project given that there is not sufficient space next to the existing Tank 2. The nearest parcel is 0.47 acres in size.

6.4.8 Estimated Useful Life

The estimated useful life of the new tank is at least 50 years.

6.5 Project 4: New Booster Pump Station

6.5.1 Project Description

A new booster pump station will be located at the site of a former pump station at the corner of Elk Trail Road and Cottontail Drive. A former pressure zone will be reinstated, which will require changes in piping in the distribution area along Elk Trail Road and Cottontail Drive. Detailed design criteria will be established during final design. General design criteria are as follows:

- Minimum of 40 psi within the new pressure zone
- Duplex pump for fire and high use flow and one pump for low flow
- Backup power

6.5.2 Project Schematic and Map

A project map and schematic are presented in Figures 5-4 and 5-5, respectively.

6.5.3 Justification

There is no other alternative for supplying adequate pressure to the southeast area.

6.5.4 O&M Challenges

Operations and maintenance are expected to be typical for this project, with no unusual challenges anticipated.

6.5.5 Consistency with Local/County Planning

This project is consistent with local and county planning.

6.5.6 Inclusion of Green and Resilient Components

Green materials for the pump station enclosure will be evaluated during final design.

6.5.7 Land Acquisition Needs

The parcel where the former pump station was located will need to be acquired. It is uncertain whether the LSCSD had an easement for the previous pump station. The new facility will need an additional area than what was previously used to accommodate backup power and maintenance access.

6.5.8 Estimated Useful Life

The estimated useful life of the new booster pump station is 30-50 years, apart from the pumps, which may require replacement after 20 years.

6.6 Project 5: Backup Power

6.6.1 Project Description

A permanent standby generator would be mounted on a concrete pad and have a self-contained fuel storage tank at each well (except Well 3, which already has backup power) and each of the existing booster pump stations (B-50, B-51, B-53, and B-57). Either an automatic transfer switch (ATS) or manual transfer switch (MTS) would be located by the electrical panels and, in the event of a power outage, would automatically switch the power source from the power company to the generator, which would automatically be started.

6.6.2 Project Schematic and Map

Refer to Figure 5-1 for the locations of the wells and booster pump stations that will be getting backup power.

6.6.3 Justification

There is currently no backup power for many of the existing water system facilities, and there are insufficient staff and mobile generators to provide adequate backup power in the event of a power outage.

6.6.4 O&M Challenges

Operations and maintenance are expected to be typical for this project, with no unusual challenges anticipated.

6.6.5 Consistency with Local/County Planning

This project is consistent with local and county planning.

6.6.6 Inclusion of Green and Resilient Components

Green alternative backup power sources will be considered during final design.

6.6.7 Land Acquisition Needs

No land acquisition is needed for this project except at B-53, where the adjacent lot would be acquired to provide sufficient space for a generator.

6.6.8 Estimated Useful Life

Backup generators have an estimated useful life of 25-40 years, depending on how well they are maintained.

6.7 Project 6: Replace Fire Hydrants

6.7.1 Project Description

Replace all aging fire hydrants up to the existing valve.

6.7.2 Project Schematic and Map
The fire hydrants are located throughout the service area shown in Figure 3-1.

6.7.3 Justification
The existing fire hydrants are exercised annually, but it has been determined that the valves could be prone to be stuck in the event of a fire, which could exacerbate fire damage to structures.

6.7.4 O&M Challenges
Operations and maintenance are expected to be typical for this project, with no unusual challenges anticipated.

6.7.5 Consistency with Local/County Planning
This project is consistent with local and county planning.

6.7.6 Inclusion of Green and Resilient Components
There are no special green or resilient components anticipated for this project.

6.7.7 Land Acquisition Needs
No additional land is needed for this project.

6.7.8 Estimated Useful Life
The new fire hydrants are estimated to have a useful life of at least 50 years.

6.8 Project 7: Install SCADA at B-57

6.8.1 Project Description
A SCADA controller with communications antenna would be installed at pump station B-57 and tie into the existing XiO SCADA system. The SCADA system would be programmed such that B-57 would turn on when needed (as backup to B-53) and turn off when the water level in Tank 4 reaches the high set point.

6.8.2 Project Schematic and Map
The location of B-57 can be found on Figure 5-1.

6.8.3 Justification
This project would prevent wasted water in that B-57 would turn off before Tank 4 overflows.

6.8.4 O&M Challenges
Operations and maintenance are expected to be typical for this project, with no unusual challenges anticipated.

6.8.5 Consistency with Local/County Planning

This project is consistent with local and county planning.

6.8.6 Inclusion of Green and Resilient Components

There are no special green or resilient components anticipated for this project.

6.8.7 Land Acquisition Needs

No additional land is needed for this project.

6.8.8 Estimated Useful Life

The estimated useful life of the SCADA for B-57 is 10-20 years.

6.9 Project 8: Replace Water Meters

6.9.1 Project Description

Water meters would be replaced with automatic meter reading (AMR) meters. These meters would be read remotely using a handheld device located in proximity to the meter. Only existing meters would be replaced. New connections would be required to install an approved AMR meter.

6.9.2 Project Schematic and Map

Water meters are located at each developed property within the service area shown in Figure 3-1.

6.9.3 Justification

This would significantly reduce the staff time needed to read meters, which are currently read manually, thereby saving operational costs.

6.9.4 O&M Challenges

Operations and maintenance are expected to be typical for this project, with no unusual challenges anticipated.

6.9.5 Consistency with Local/County Planning

This project is consistent with local and county planning.

6.9.6 Inclusion of Green and Resilient Components

The reduction of vehicle idling time at each meter over current procedures will be a significant reduction in fossil fuel use.

6.9.7 Land Acquisition Needs

No additional land is needed for this project.

6.9.8 Estimated Useful Life

The new water meters are anticipated to have a useful life of 20 years.

7.0 Cost Estimate for Selected Project

Detailed cost estimates for each project were presented in Section 5. Table7-1 summarizes the project costs for each individual project defined in Section 6.

Table 7-1. Summary of Recommended Projects
Lake Shastina Community Services District

Project	Project Totals
New Production Well	$847,000
Tank Rehab	$1,771,000
New Tank 2A (Alternative 2)	$702,000
New Booster Pump Station	$432,000
Permanent Generators (Alternative 1)	$805,000
Replace Fire Hydrants	$3,579,000
Add B-57 to SCADA[a]	$34,000
Install AMR[b] Meters (Alternative 1)	$420,000

a. SCADA: Supervisory Control and Data Acquisition
b. AMR: Automatic Meter Reading

8.0 Proposed Schedule

A proposed schedule is presented in Table 8-1

Table 8-1. Proposed Project Schedule
Lake Shastina Community Services District

Project	FY[a] 24-25	FY 25-26	FY 26-27	FY 27-28	FY 28-29
New Wall	Design	Construction			
Tank Rehab	Design			Construction	
New Tank 2A	Design			Construction	
New Booster PS[b]	Design		Construction		
Permanent Generators	Design	Construction			
Replace Fire Hydrants					Design Construction
SCADA[c] Improvements with B-57			Design Construction		
Replace Meters with AMR[d]					Design Construction

a. FY: fiscal year
b. PS: pump station
c. SCADA: Supervisory Control and Data Acquisition
d. AMR: Automatic Meter Reading

9.0 Overall Project Map

Figure 5-1 shows the overall LSCSD map and located each project, apart from fire hydrants and water meters.

10.0 Response to Climate Change

10.1 Vulnerability

Specific climate change effects that would be expected in this area are not well understood at this time. However, effects that have been blamed on climate change and that could influence the LSCSD water system include drought and wildfires.

Drought could have the effect of lowering the water table. Wildfires could damage various infrastructure elements that are above ground.

10.2 Adaptation

Adaptation measures include the following:

- Drought: water conservation during drought periods
- Wildfire: removal of trees adjacent to infrastructure to create a "clear zone" to reduce fire risk

10.3 Mitigation

During the recent drought period, none of the LSCSD wells went dry or was unable to produce water at the anticipated rate. This would indicate that the existing wells are sufficiently deep to be able to draw from the aquifer and that the water table did not significantly drop. The mitigation measure to this effect would be to drill the backup production well sufficiently deep to reduce the effects of a lowered water table.

As stated in Section 6.9.6, water meter replacement is in and of itself a mitigation measure to reduce greenhouse gas emissions by reducing vehicle idling while reading meters.

11.0 Permits

Permits that are required for the individual projects will be obtained closer to the time of construction. Anticipated permits include the following:

- Well drilling permit
- Well house building permit
- Booster Pump Station building permit
- Electrical permits for backup generators

12.0 Reference Cited

California Environmental Protection Agency. (March 2014). "California Government Code Section 65041.1: State Planning Priorities." Accessed at: Section 65041.1 - State planning priorities, Cal. Gov. Code § 65041.1 | Casetext Search + Citator

Tank Inspection Reports (2017)

1

Tank 1 Report 1A

866-789-3483

Lake Shastina Community Services District
Field Report

25-Apr-17

Underwater Cleaning & Inspection
500,000 Gallon
Tank 1
Potable Water Storage Tank

Submitted To:

Lake Shastina Community Services District
Robert Moser
16320 Everhart Dr.
Weed, CA 96094

Phone: 530-938-3281

Submitted By:

Potable Divers Inc.
PO Box 474
Vernal, UT 84078-0474

Phone: (866) 789-3483
Fax: (866) 913-4905
E-mail david@potabledivers.com

David Harvey Dive Supervisor

EXTERIOR ROOF

Safety Rail					
Satisfactory		Fair	X	N	
Coating		Good needs touch up			
Welds		Good			
Corrosion		Y	X	N	
Coating					
Satisfactory		Y	X	N	
Oxidized		Y	X	N	
Pitting		Y		N	X
Delamination		Y		N	X
Corrosion	<2%	Y	X	N	
Seams/Welds		Good			
Low Spots		Y	X	N	
Cathodic Protection Plates		Good			

Conclusion/Discrepancies: A few low spots around the outer edges
Coating is oxidized but in good condition needs minor touch up work
around the outer edges in the low areas and a few spots near the center
Hand railing also needs minor touch up work

ACCESS HATCH

Satisfactory	Fair	X	N		
Coating					
Corrosion	Y	X	N		
Proper Design	Y	X	N		
Locked	Y	X	N		
Gasket	Y	X	N		
Hinge	Good				
Hatch Size	2.5	FT	X	2.5	FT

Conclusion/Discrepancies Needs new gasket
present one is not sealing
Corrosion on the underside of the lid

VENTS

Satisfactory		Y	X	N	
Coating					
Corrosion	%	Y		N	X
Proper Design		Y	X	N	
Screens		Y	X	N	
Sealed Edges & Seams		Y	X	N	
Cap/Cover		Y	X	N	

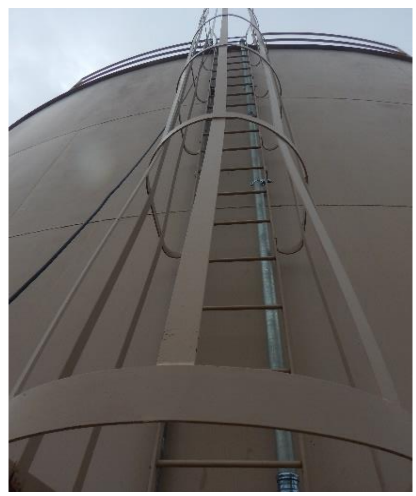
Conclusion/Discrepancies Screen in place and
well secured Vent is in good condition
no problematic concerns

EXTERIOR SHELL

Rings					
Chime		Good			
2nd Weld Ring		Good			
3rd Weld Ring		Good			
4th Weld Ring		Good			
5th Weld Ring		Good			
Ring(s)	5 in all	Good			
Wall to Roof Seam		Good			
Coating					
Satisfactory		Y	X	N	
Oxidized		Y	X	N	
Pitting		Y		N	X
Delamination		Y		N	X
Corrosion		Y		N	X

Conclusion/Discrepancies Coating is oxidized but holding up well no discrepancies noted

EXTERIOR LADDER



Construction		Coated Steel			
Satisfactory		Y	X	N	
Coating					
Satisfactory		Y	X	N	
Oxidized		Y	X	N	
Pitting		Y		N	X
Delamination		Y		N	X
Corrosion	2%	Y	X	N	
Welds/Joints		Good			
Supports		Good			
Safety Cage/Climb		Y	X	N	

Conclusion/Discrepancies Ladder, cage and braces all in working condition, minor rust noted

OVERFLOW STRUCTURE

Coating					
Satisfactory		Y	X	N	
Oxidized		Y	X	N	
Pitting		Y		N	X
Delamination		Y		N	X
Corrosion	10%	Y	X	N	
Welds/Joints		Good			
Supports		Good			
Screens		Y		N	
Attachments		In ground			
Foundation		Good			

Conclusion/Discrepancies Pipe and braces are in good condition with minor rust that needs touched up on the back side of the pipe

FOUNDATION

Concrete Slab/Ring Retention

Satisfactory	Y		N	
Cracking	Y		N	X
Spalling	Y		N	X
Exposed Aggregate	Y		N	X
Erosion Undermining	Y		N	X

Seismic Restraints None

Corrosion	Y		N	
Tight	Y		N	

Conclusion/Discrepancies Retention ring in place and in good condition no undermining or erosion noted overall satisfactory

MANWAY ENTRIES

Coating

Satisfactory		Y	X	N	
Oxidized		Y	X	N	
Pitting		Y		N	X
Delamination		Y		N	X
Corrosion	<1%	Y	X	N	

Welds/Joints Fair

Conclusion/Discrepancies Both man ways are in satisfactory condition with no discrepancies

MANUAL LEVEL INDICATOR

Float		Y	X	N	
Guide Wires		Y	X	N	
Guide Wire Anchors		Y	X	N	
Cable / Hardware		Y	X	N	
Corrosion	%	Y		N	X
Operation		Y	X	N	

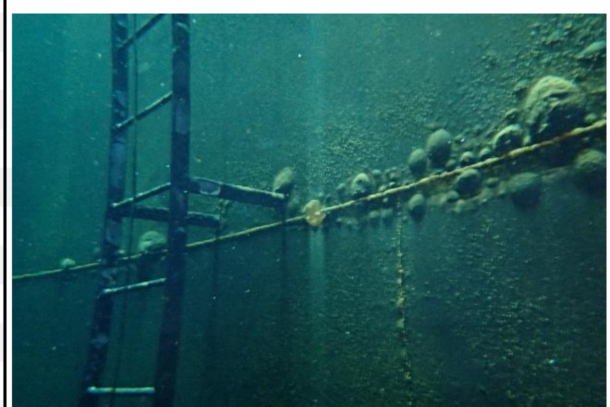
Conclusion/Discrepancies: Indicator appears to be in good condition

INTERIOR ROOF

Coating					
Satisfactory		Y		N	X
Blistering		Y		N	X
Cracking		Y		N	X
Peeling		Y		N	X
Holidays		Y		N	X
Corrosion	30%	Y	X	N	
Seams/Welds		Fair			
Trusses		Fair			
Gussets		Fair			
Coating					
Blistering		Y		N	X
Cracking		Y		N	X
Peeling		Y		N	X
Holidays		Y		N	X
Corrosion	5%	Y	X	N	
Vent Penetration		Good			
Roof Hatch		Fair			

Conclusion/Discrepancies: Surface corrosion covers the plates, minor corrosion on the trusses and hardware. Coating is at the end of its service life and needs redone

INTERIOR SHELL



Coating					
Satisfactory		Y		N	X
Blistering		Y	X	N	
Cracking		Y	X	N	
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	15%	Y	X	N	
Seams/Welds		Poor heavily blistered			
Rings					
Chime		Fair			
2nd Weld Ring		Poor heavily blistered			
3rd Weld Ring		Poor heavily blistered			
4th Weld Ring		Fair			
5th Weld Ring		Fair			
Ring(s)	5 in all	Fair			
Wall to Roof Seam		Fair			
Baffle/Support Walls		None			

Conclusion/Discrepancies: Weld seams are heavily blistered with corrosion present above the water line corrosion and cracking more extensive

SUPPORT COLUMNS

Coating					
Satisfactory		Y		N	X
Blistering		Y	X	N	
Cracking		Y	X	N	
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	10%	Y	X	N	
Seams/Welds		Fair			
Floor/Base Plates		Fair			
Construction		Coated steel			
Conclusion/Discrepancies:		Blistering and surface			

corrosion noted from exposed steel. Coating has failed sandblast and recoat

FLOOR

Coating					
Satisfactory		Fair	X	N	
Blistering		Y	X	N	
Cracking		Y		N	X
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	3%	Y	X	N	
Seams/Welds		Fair			
Conclusion/Discrepancies:		Majority if the coating			

is in good shape with no major discrepancies
A few sporadic spots of corrosion / bare steel

Sediment Depth: 1/4 of an inch

MANWAY ENTRIES

Coating					
Satisfactory		Y		N	X
Blistering		Y	X	N	
Cracking		Y		N	X
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	10%	Y	X	N	
Seams/Welds		Fair			
Conclusion/Discrepancies:		Blistering and surface			

corrosion noted around the outer edges and
interior of the doorway extension

LADDER

Construction		Coated Steel			
Satisfactory		Fair	X	N	
Coating					
Satisfactory		Y		N	X
Blistering		Y	X	N	
Cracking		Y	X	N	
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	3%	Y	X	N	
Seams/Welds		Fair			
Safety Cage/Climb		Y		N	X

Conclusion/Discrepancies: Coating has failed blistering and bare steel present. Little to no corrosion present

OVERFLOW

Coating					
Satisfactory		Y	X	N	
Blistering		Y		N	X
Cracking		Y		N	X
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	%	Y		N	X
Seams/Welds		Good			

Conclusion/Discrepancies: funnel and welds are in good condition

MANUAL LEVEL INDICATOR

Float		Y	X	N	
Guide Wires		Y	X	N	
Guide Wire Anchors		Y	X	N	
Cable / Hardware		Y	X	N	
Corrosion	1%	Y	X	N	
Operation		Y	X	N	

Conclusion/Discrepancies: Minor corrosion on the floor anchor otherwise in good condition

APPURTENANCES

Influent

Coating

Satisfactory		Fair	X	N	
Blistering		Y	X	N	
Cracking		Y		N	X
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	5%	Y	X	N	
Seams/Welds		Fair			

Conclusion/Discrepancies: Blistering and corrosion noted around the top edge of the pipe

Effluent

Coating

Satisfactory		Y		N	X
Blistering		Y	X	N	
Cracking		Y	X	N	
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	5%	Y	X	N	
Seams/Welds		Fair			

Conclusion/Discrepancies: Blistering and corrosion noted around the weld seam

Drain

Coating

Satisfactory		Y	X	N	
Blistering		Y		N	X
Cracking		Y		N	X
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	5%	Y	X	N	
Seams/Welds		Fair			

Conclusion/Discrepancies: Corrosion on the interior of the pipe. Welds and coating are intact and in good condition

Conclusion

Based on the results of this underwater inspection and the cleaning which took place, it appears this tank is in operational condition and should continue to provide a reliable water storage capacity for potable water use with and after proper maintenance.
Interior coating is at the end of its service life, the tank needs to be sandblasted and recoated in the near future.

Recommendations

PDI concurs with the recommendations of AWWA that all potable water reservoirs or storage tanks be cleaned and inspected at least every five years and in some cases, depending upon source waters, type and quantities of sediment, and presence (or lack thereof) of cathodic protection systems, more frequently.
The following recommendations are made to provide continued, uninterrupted service of your water storage tank:

1. Your tank should be inspected and cleaned every five years, as suggested by the AWWA. Routine inspections and cleanings provide ample time to perform remedial repairs to abnormalities discovered before having a chance to become problematic.
2. The entry hatch needs a new gasket put in place as the current one is not sealing
3. The exterior roof needs touch up work done around the outer edges, the low spots have minor surface corrosion present
4. The interior coating on the floor, shell, and roof, in addition to all the appurtenances need to be sandblasted and recoated as the coating has exceeded its useful service life. Blisters, and corrosion are present with some bare steel exposed as well. Sandblast and recoat the interior in the near future.

Tank 2 Report 1B

866-789-3483

Lake Shastina Community Services District
Field Report

25-Apr-17

Underwater Cleaning & Inspection
300,000 Gallon
Tank 2
Potable Water Storage Tank

Submitted To:

Lake Shastina Community Services District
Robert Moser
16320 Everhart Dr.
Weed, CA 96094

Phone: 530-938-3281

Submitted By:

Potable Divers Inc.
PO Box 474
Vernal, UT 84078-0474

Phone: (866) 789-3483
Fax: (866) 913-4905
E-mail david@potabledivers.com

____

David Harvey Dive Supervisor

EXTERIOR ROOF

Safety Rail				
Satisfactory	Y	X	N	
Coating	Oxidized and thin			
Welds	Good			
Corrosion	Y		N	X
Coating				
Satisfactory	Fair	X	N	
Oxidized	Y	X	N	
Pitting	Y		N	X
Delamination	Y		N	X
Corrosion	Y		N	X
Seams/Welds	Good			
Low Spots	Y	X	N	
Cathodic Protection Plates	Sealed and in place			

Conclusion/Discrepancies: Coating is thin and oxidized primer still intact corrosion very minimal. A few low spots around the outer edges with surface water staining noted Cathodic plates are in place and well secured with no corrosion

ACCESS HATCH

Satisfactory	Fair	X	N	
Coating				
Corrosion	Y	X	N	
Proper Design	Y	X	N	
Locked	Y	X	N	
Gasket	Y	X	N	
Hinge	Good			
Hatch Size	2 FT	X	2 FT	

Conclusion/Discrepancies Three sides have gasket in place, minor corrosion on the underside of the lid

VENTS

Satisfactory	Y	X	N	
Coating				
Corrosion <2%	Y	X	N	
Proper Design	Y	X	N	
Screens	Y	X	N	
Sealed Edges & Seams	Y	X	N	
Cap/Cover	Y	X	N	

Conclusion/Discrepancies Vent is in good condition with proper 24 gauge screen in place minor rust staining from the humidity escaping from the vent

EXTERIOR SHELL

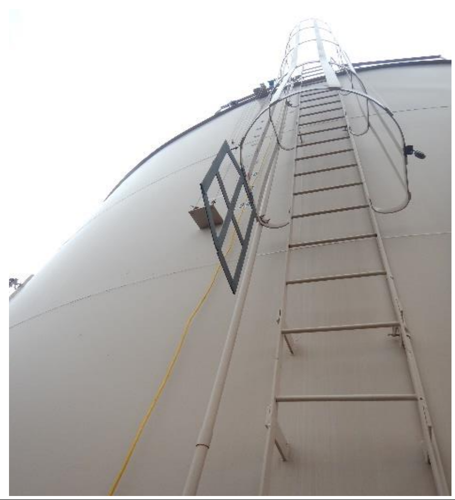
Rings					
Chime		Good			
2nd Weld Ring		Good			
3rd Weld Ring		Good			
4th Weld Ring		Good			
5th Weld Ring					
Ring(s)	4 in all	Good			
Wall to Roof Seam		Good			
Coating					
Satisfactory		Y	X	N	
Oxidized		Y	X	N	
Pitting		Y		N	X
Delamination		Y		N	X
Corrosion	<2%	Y	X	N	

Conclusion/Discrepancies Minor nicks and scratches, no coating adhesion problems shell is in satisfactory condition

EXTERIOR LADDER

Construction		Coated Steel			
Satisfactory		Y	X	N	
Coating					
Satisfactory		Y	X	N	
Oxidized		Y	X	N	
Pitting		Y		N	X
Delamination		Y		N	X
Corrosion	<2%	Y	X	N	
Welds/Joints		Good			
Supports		Good			
Safety Cage/Climb		Y	X	N	

Conclusion/Discrepancies Ladder, cage and hardware satisfactory minor nicks and scratches



OVERFLOW STRUCTURE

Coating					
Satisfactory		Y	X	N	
Oxidized		Y	X	N	
Pitting		Y		N	X
Delamination		Y		N	X
Corrosion	%	Y		N	X
Welds/Joints		Good			
Supports		Good			
Screens		Y	X	N	
Attachments		Piped to ground			
Foundation		Good			

Conclusion/Discrepancies Coating on pipe is thin primer peaking through, overall satisfactory

FOUNDATION

Concrete Slab/Ring Retention

Satisfactory		Y	X	N	
Cracking		Y	X	N	
Spalling		Y		N	X
Exposed Aggregate		Y		N	X
Erosion Undermining		Y		N	X

Seismic Restraints None

Corrosion		Y		N	
Tight		Y		N	

Conclusion/Discrepancies Minor superficial cracking noted commonly found no concerns

MANWAY ENTRIES

Coating

Satisfactory		Y	X	N	
Oxidized		Y	X	N	
Pitting		Y		N	X
Delamination		Y		N	X
Corrosion	<2%	Y	X	N	
Welds/Joints	Good				

Conclusion/Discrepancies Minor spots of rust around the interior of the door. Otherwise in good condition

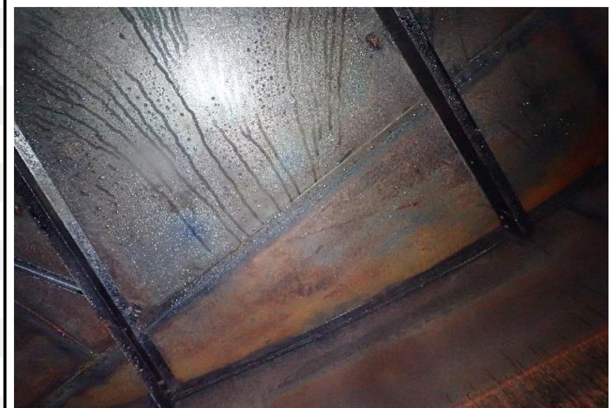
MANUAL LEVEL INDICATOR

Float		Y	X	N	
Guide Wires		Y	X	N	
Guide Wire Anchors		Y	X	N	
Cable / Hardware		Y	X	N	
Corrosion	%	Y		N	X
Operation		Y	X	N	

Conclusion/Discrepancies: All hardware is present and appears to be working properly

INTERIOR ROOF

Coating					
Satisfactory		Fair	X	N	
Blistering		Y		N	X
Cracking		Y		N	X
Peeling		Y		N	X
Holidays		Y	X	N	
Corrosion	15%	Y	X	N	
Seams/Welds		Fair			
Trusses		Fair			
Gussets		Fair			
Coating					
Blistering		Y		N	X
Cracking		Y		N	X
Peeling		Y		N	X
Holidays		Y	X	N	
Corrosion	10%	Y	X	N	
Vent Penetration		Good			
Roof Hatch		Good			



Conclusion/Discrepancies: More corrosion than typically found or expected. Corrosion forms due to the high humidity.

INTERIOR SHELL

Coating					
Satisfactory		Y		N	X
Blistering		Y	X	N	
Cracking		Y	X	N	
Peeling		Y	X	N	
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	20%	Y	X	N	
Seams/Welds		Poor			
Rings					
Chime		Poor			
2nd Weld Ring		Poor			
3rd Weld Ring		Poor			
4th Weld Ring		Poor			
5th Weld Ring					
Ring(s)	4 in all	Poor-fair			
Wall to Roof Seam		Fair			
Baffle/Support Walls		None			

Conclusion/Discrepancies: Coating is severely blistered, numerous areas of bare steel; corrosion has begun, no pitting currently present

SUPPORT COLUMNS

Coating					
Satisfactory		Y		N	X
Blistering		Y	X	N	
Cracking		Y		N	X
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y	X	N	
Corrosion	15%	Y	X	N	
Seams/Welds		Fair			
Floor/Base Plates		Fair			
Construction		Coated steel			
Conclusion/Discrepancies:		Coating has failed			

corrosion is present with slight pitting

FLOOR

Coating					
Satisfactory		Y		N	X
Blistering		Y	X	N	
Cracking		Y	X	N	
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	<5%	Y	X	N	
Seams/Welds		Fair			
Conclusion/Discrepancies:		Coating is blistered			

a few areas of bare steel with minor corrosion starting

Sediment Depth 1/4 of an inch

MANWAY ENTRIES

Coating				
Satisfactory	Y		N	X
Blistering	Y	X	N	
Cracking	Y		N	X
Peeling	Y		N	X
Holidays	Y		N	X
Pitting	Y		N	X
Corrosion	Y	X	N	
Seams/Welds	Fair			
Conclusion/Discrepancies:	Coating has failed			

corrosion and blistering around outer edges

LADDER

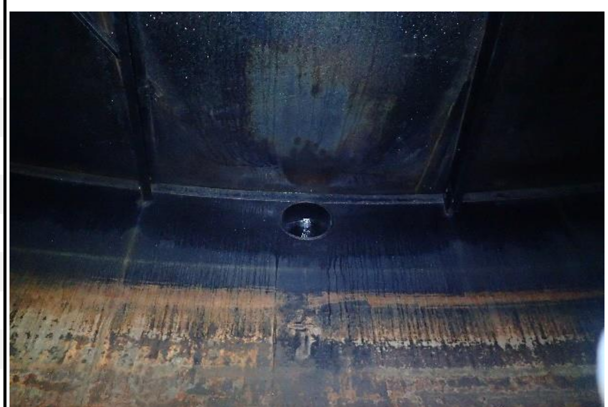
Construction		Coated Steel			
Satisfactory		Y	X	N	
Coating					
Satisfactory		Y		N	X
Blistering		Y	X	N	
Cracking		Y	X	N	
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y	X	N	
Corrosion	15%	Y	X	N	
Seams/Welds		Fair			
Safety Cage/Climb		Y		N	X

Conclusion/Discrepancies: Coating is failing
severe blistering with minor corrosion noted.

OVERFLOW

Coating					
Satisfactory		Y	X	N	
Blistering		Y		N	X
Cracking		Y		N	X
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	%	Y		N	X
Seams/Welds		Good			

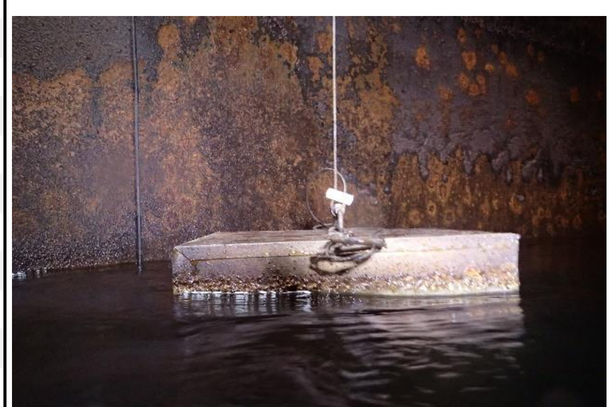
Conclusion/Discrepancies: Overflow pipe
and welds appeared to be satisfactory



MANUAL LEVEL INDICATOR

Float		Y	X	N	
Guide Wires		Y	X	N	
Guide Wire Anchors		Y	X	N	
Cable / Hardware		Y	X	N	
Corrosion	%	Y		N	X
Operation		Y	X	N	

Conclusion/Discrepancies: Float and hardware
were found to be in satisfactory condition



APPURTENANCES

Influent

Common in out

Coating					
Satisfactory		Fair	X	N	
Blistering		Y	X	N	
Cracking		Y		N	X
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	2%	Y	X	N	
Seams/Welds		Fair			

Conclusion/Discrepancies: Minor corrosion around the outer edges with blistering on the interior

Effluent

Common in out

Coating					
Satisfactory		Fair	X	N	
Blistering		Y	X	N	
Cracking		Y		N	X
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	2%	Y	X	N	
Seams/Welds		Fair			

Conclusion/Discrepancies: Minor corrosion around the outer edges with blistering on the interior

Drain

Coating					
Satisfactory		Y		N	X
Blistering		Y	X	N	
Cracking		Y		N	X
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	25%	Y	X	N	
Seams/Welds		Fair			

Conclusion/Discrepancies: Corrosion on the screen and interior of the pipe other wise in working condition

Conclusion

Based on the results of this underwater inspection and the cleaning which took place, it appears this tank is in operational condition and should continue to provide a reliable water storage capacity for potable water use with and after proper maintenance.
The interior coating is at the end of its service life and needs to be redone before the steel is compromised from present corrosion

Recommendations

PDI concurs with the recommendations of AWWA that all potable water reservoirs or storage tanks be cleaned and inspected at least every five years and in some cases, depending upon source waters, type and quantities of sediment, and presence (or lack thereof) of cathodic protection systems, more frequently.
The following recommendations are made to provide continued, uninterrupted service of your water storage tank:

1. Your tank should be inspected and cleaned every five years, as suggested by the AWWA. Routine inspections and cleanings provide ample time to perform remedial repairs to abnormalities discovered before having a chance to become problematic.
2. The roof lid needs to have a new gasket put in place as part is missing.
3. The exterior coating on the shell and the roof is heavily oxidized and thinning out. Touch up these areas along with the nicks and scratches to minimize corrosion and extend the service life of the coating.
4. The interior coating is at the end of its service life exhibiting severe blistering, minor cracking, with some pitting and bare steel exposed. The interior of the tank needs to be sandblasted and recoated at the earliest convenience.

Tank 3 Report

1C

866-789-3483

Lake Shastina Community Services District
Field Report

25-Apr-17

Underwater Cleaning & Inspection
300,000 Gallon
Tank 3
Potable Water Storage Tank

Submitted To:

Lake Shastina Community Services District
Robert Moser
16320 Everhart Dr.
Weed, CA 96094

Phone: 530-938-3281

Submitted By:

Potable Divers Inc.
PO Box 474
Vernal, UT 84078-0474

Phone: (866) 789-3483
Fax: (866) 913-4905
E-mail david@potabledivers.com

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David Harvey Dive Supervisor

EXTERIOR ROOF

Safety Rail	None				
Satisfactory				N	
Coating					
Welds					
Corrosion		Y		N	
Coating					
Satisfactory		Fair	X	N	
Oxidized		Y	X	N	
Pitting		Y		N	X
Delamination		Y		N	X
Corrosion	<2%	Y	X	N	
Seams/Welds		Good			
Low Spots		Y		N	X
Cathodic Protection Plates		Good			

Conclusion/Discrepancies: The coating is oxidized and thin, the primer is exposed with indications of corrosion starting to form.
Plan for a new coating in the near future

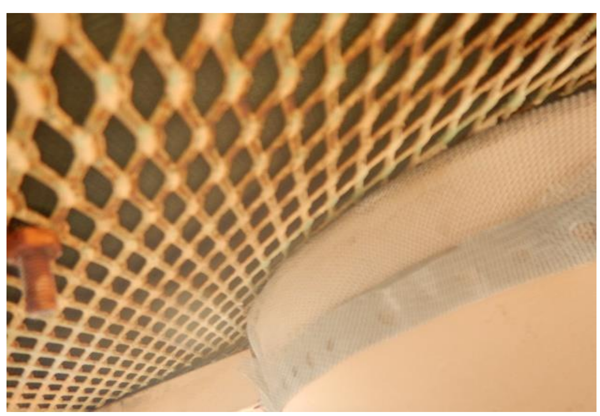
ACCESS HATCH

Satisfactory	Y	X	N		
Coating					
Corrosion	Y	X	N		
Proper Design	Y	X	N		
Locked	Y	X	N		
Gasket	Y		N	X	
Hinge	Good				
Hatch Size	2	FT	X		FT

Conclusion/Discrepancies Needs a gasket put in place, minor corrosion where gasket should be

VENTS

Satisfactory		Y	X	N	
Coating					
Corrosion	%	Y		N	X
Proper Design		Y	X	N	
Screens		Y	X	N	
Sealed Edges & Seams		Y	X	N	
Cap/Cover		Y	X	N	



Conclusion/Discrepancies Screen in place and well secured Vent is in good condition
no problematic concerns

EXTERIOR SHELL

Rings					
Chime	Good				
2nd Weld Ring	Good				
3rd Weld Ring	Good				
4th Weld Ring	Good				
5th Weld Ring					
Ring(s) 4 in all	Good				
Wall to Roof Seam	Good				
Coating					
Satisfactory	Y	X	N		
Oxidized	Y	X	N		
Pitting	Y		N	X	
Delamination	Y		N	X	
Corrosion	Y		N	X	
Conclusion/Discrepancies	Coating is oxidized but holding up well				
no discrepancies noted					

EXTERIOR LADDER

Construction		Coated Steel			
Satisfactory		Y	X	N	
Coating					
Satisfactory		Y	X	N	
Oxidized		Y	X	N	
Pitting		Y		N	X
Delamination		Y		N	X
Corrosion	2%	Y	X	N	
Welds/Joints		Good			
Supports		Good			
Safety Cage/Climb		Y	X	N	
Conclusion/Discrepancies		Ladder, cage and			
braces all in working condition, minor rust noted					

OVERFLOW STRUCTURE

Coating					
Satisfactory		Y	X	N	
Oxidized		Y	X	N	
Pitting		Y		N	X
Delamination		Y		N	X
Corrosion	1%	Y	X	N	
Welds/Joints		Good			
Supports		Good			
Screens		Y		N	
Attachments		In ground			
Foundation		Good			
Conclusion/Discrepancies		Pipe and braces are in			
good condition.					

FOUNDATION

Concrete Slab/Ring Retention

Satisfactory	Y	X	N	
Cracking	Y	X	N	
Spalling	Y		N	X
Exposed Aggregate	Y		N	X
Erosion Undermining	Y		N	X

Seismic Restraints None

Corrosion	Y		N	
Tight	Y		N	

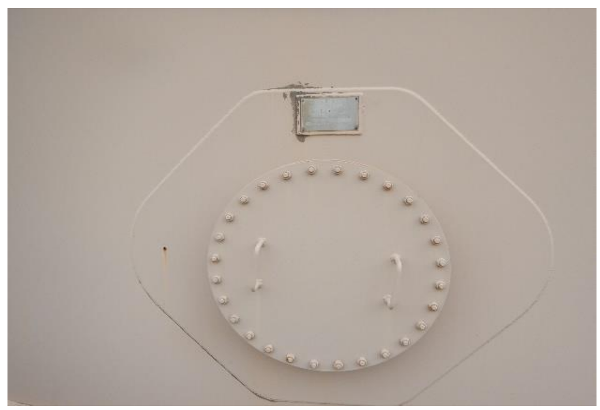
Conclusion/Discrepancies Concrete support ring has minor superficial cracking. No undermining or erosion noted overall satisfactory

MANWAY ENTRIES

Coating

Satisfactory		Y	X	N	
Oxidized		Y	X	N	
Pitting		Y		N	X
Delamination		Y		N	X
Corrosion	<1%	Y	X	N	
Welds/Joints		Fair			

Conclusion/Discrepancies Man way entry is in satisfactory condition with no discrepancies



MANUAL LEVEL INDICATOR

Float		Y	X	N	
Guide Wires		Y	X	N	
Guide Wire Anchors		Y	X	N	
Cable / Hardware		Y	X	N	
Corrosion	%	Y		N	X
Operation		Y	X	N	

Conclusion/Discrepancies: Indicator appears to be in good condition

INTERIOR ROOF

Coating						
Satisfactory		Y		N	X	
Blistering		Y		N	X	
Cracking		Y		N	X	
Peeling		Y		N	X	
Holidays		Y		N	X	
Corrosion	20%	Y	X	N		
Seams/Welds		Fair				
Trusses		Fair				
Gussets		Fair				
Coating						
Blistering		Y		N	X	
Cracking		Y		N	X	
Peeling		Y		N	X	
Holidays		Y		N	X	
Corrosion	5%	Y	X	N		
Vent Penetration		Good				
Roof Hatch		Fair				

Conclusion/Discrepancies: Surface corrosion covers the plates , minor corrosion on the trusses and hardware. Coating is at the end of its service life and needs redone

INTERIOR SHELL

Coating						
Satisfactory		Y		N	X	
Blistering		Y	X	N		
Cracking		Y	X	N		
Peeling		Y		N	X	
Holidays		Y		N	X	
Pitting		Y		N	X	
Corrosion	15%	Y	X	N		
Seams/Welds		Poor heavily blistered				
Rings						
Chime		Fair				
2nd Weld Ring		Poor heavily blistered				
3rd Weld Ring		Poor heavily blistered				
4th Weld Ring		Fair				
5th Weld Ring						
Ring(s)	4 in all	Fair				
Wall to Roof Seam		Fair				
Baffle/Support Walls		None				

Conclusion/Discrepancies: Weld seams are heavily blistered with corrosion present above the water line corrosion and cracking more extensive

SUPPORT COLUMNS

Coating					
Satisfactory		Y		N	X
Blistering		Y	X	N	
Cracking		Y	X	N	
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	10%	Y	X	N	
Seams/Welds	Fair				
Floor/Base Plates	Fair				
Construction	Coated steel				
Conclusion/Discrepancies:	Blistering and surface				

corrosion noted from exposed steel. Coating has failed sandblast and recoat

FLOOR

Coating					
Satisfactory		Y		N	X
Blistering		Y	X	N	
Cracking		Y	X	N	
Peeling		Y	X	N	
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	10%	Y	X	N	
Seams/Welds	Fair				
Conclusion/Discrepancies:	Coating is at the end				

of its service life with mineral build up and
corrosion noted, recoat in the near future

Sediment Depth	1/4 of an inch

MANWAY ENTRIES

Coating					
Satisfactory		Y		N	X
Blistering		Y	X	N	
Cracking		Y		N	X
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	5%	Y	X	N	
Seams/Welds	Fair				
Conclusion/Discrepancies:	Blistering and surface				

corrosion noted around the outer edges and
interior of the doorway extension

LADDER

Construction		Coated Steel			
Satisfactory		Fair	X	N	
Coating					
Satisfactory		Y		N	X
Blistering		Y	X	N	
Cracking		Y	X	N	
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	20%	Y	X	N	
Seams/Welds		Fair			
Safety Cage/Climb		Y		N	X

Conclusion/Discrepancies: Coating has failed blistering and bare steel present. Little to no coating present

OVERFLOW

Coating					
Satisfactory		Y	X	N	
Blistering		Y		N	X
Cracking		Y		N	X
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	%	Y		N	X
Seams/Welds		Good			

Conclusion/Discrepancies: funnel and welds are in good condition

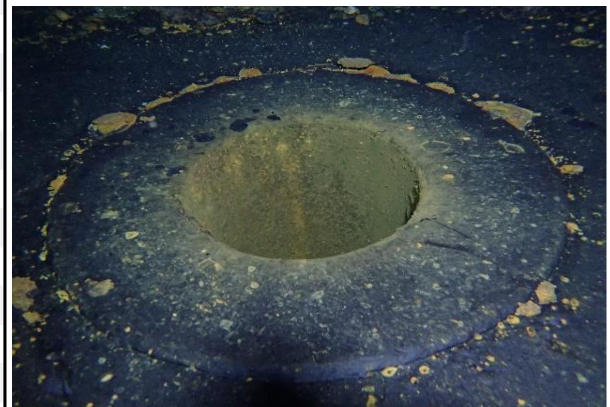
MANUAL LEVEL INDICATOR

Float		Y	X	N	
Guide Wires		Y	X	N	
Guide Wire Anchors		Y	X	N	
Cable / Hardware		Y	X	N	
Corrosion	5%	Y	X	N	
Operation		Y	X	N	

Conclusion/Discrepancies: Corrosion on the floor anchor where the guide wires connect

APPURTENANCES

Influent

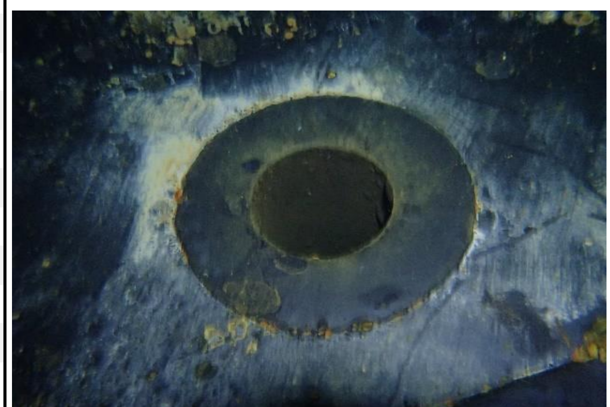


Coating

Satisfactory		Fair	X	N	
Blistering		Y	X	N	
Cracking		Y		N	X
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	5%	Y	X	N	
Seams/Welds		Fair			

Conclusion/Discrepancies: Blistering and corrosion noted around the weld seam, minor corrosion on the interior of the e pipe

Effluent

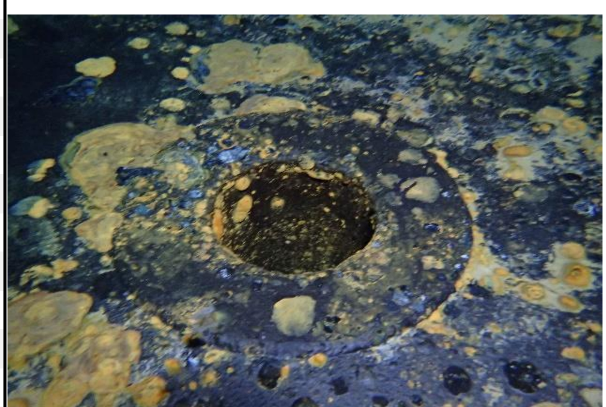


Coating

Satisfactory		Y		N	X
Blistering		Y	X	N	
Cracking		Y	X	N	
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	5%	Y	X	N	
Seams/Welds		Fair			

Conclusion/Discrepancies: Blistering and corrosion noted around the weld seam

Drain



Coating

Satisfactory		Y	X	N	
Blistering		Y		N	X
Cracking		Y		N	X
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	20%	Y	X	N	
Seams/Welds		Fair			

Conclusion/Discrepancies: Corrosion on the interior of the pipe and the weld seam coating in poor condition

Conclusion

Based on the results of this underwater inspection and the cleaning which took place, it appears this tank is in operational condition and should continue to provide a reliable water storage capacity for potable water use with and after proper maintenance.
Interior coating is at the end of its service life, the tank needs to be sandblasted and recoated in the near future.

Recommendations

PDI concurs with the recommendations of AWWA that all potable water reservoirs or storage tanks be cleaned and inspected at least every five years and in some cases, depending upon source waters, type and quantities of sediment, and presence (or lack thereof) of cathodic protection systems, more frequently.
The following recommendations are made to provide continued, uninterrupted service of your water storage tank:

1. Your tank should be inspected and cleaned every five years, as suggested by the AWWA. Routine inspections and cleanings provide ample time to perform remedial repairs to abnormalities discovered before having a chance to become problematic.
2. The entry hatch needs a gasket put in place to create a good seal and minimize the corrosion on the underside of the lid.
3. The exterior roof coating is very thin and the primer layer is visible. Plan for a new top coat in the near future.
4. The interior coating on the floor, shell, and roof, in addition to all the appurtenances need to be sandblasted and recoated as the coating has exceeded its useful service life. Blisters, and corrosion are present with some bare steel exposed as well. Sandblast and recoat the interior in the near future.

Tank 4 Report

1D

866-789-3483

Lake Shastina Community Services District
Field Report

25-Apr-17

Underwater Cleaning & Inspection
250,000 Gallon
Tank 4
Potable Water Storage Tank

Submitted To:

Lake Shastina Community Services District
Robert Moser
16320 Everhart Dr.
Weed, CA 96094

Phone: 530-938-3281

Submitted By:

Potable Divers Inc.
PO Box 474
Vernal, UT 84078-0474

Phone: (866) 789-3483
Fax: (866) 913-4905
E-mail david@potabledivers.com

____
David Harvey Dive Supervisor

EXTERIOR ROOF

Safety Rail					
Satisfactory	Fair	X	N		
Coating	Good needs touch up				
Welds	Good				
Corrosion	Y	X	N		
Coating					
Satisfactory	Y	X	N		
Oxidized	Y	X	N		
Pitting	Y		N	X	
Delamination	Y		N	X	
Corrosion <2%	Y	X	N		
Seams/Welds	Good				
Low Spots	Y	X	N		
Cathodic Protection Plates	Good				

Conclusion/Discrepancies: A few low spots around the outer edges
Coating is oxidized but in good condition needs minor touch up work
around the entry hatch

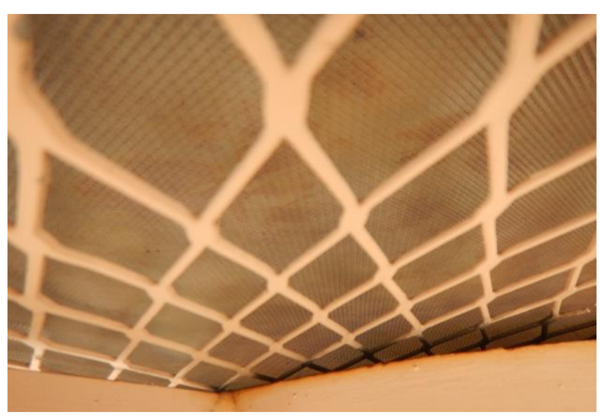
ACCESS HATCH

Satisfactory	Fair	X	N		
Coating					
Corrosion	Y	X	N		
Proper Design	Y	X	N		
Locked	Y	X	N		
Gasket	Y	X	N		
Hinge	Good				
Hatch Size	2	FT	X	2	FT

Conclusion/Discrepancies Needs new gasket
present one is broken and missing parts.
Corrosion on the underside of the lid

VENTS

Satisfactory	Y	X	N		
Coating					
Corrosion %	Y		N	X	
Proper Design	Y	X	N		
Screens	Y	X	N		
Sealed Edges & Seams	Y	X	N		
Cap/Cover	Y	X	N		



Conclusion/Discrepancies Screen in place and
well secured Vent is in good condition
no problematic concerns

EXTERIOR SHELL

Rings					
Chime		Good			
2nd Weld Ring		Good			
3rd Weld Ring		Good			
4th Weld Ring		Good			
5th Weld Ring		Good			
Ring(s)	5 in all	Good			
Wall to Roof Seam		Good			
Coating					
Satisfactory		Y	X	N	
Oxidized		Y	X	N	
Pitting		Y		N	X
Delamination		Y		N	X
Corrosion	<2%	Y	X	N	

Conclusion/Discrepancies Nicks and scratches that need touch up. Many areas already corrected and appears to be holding up with no corrosion present

EXTERIOR LADDER

Construction		Coated Steel			
Satisfactory		Y	X	N	
Coating					
Satisfactory		Y	X	N	
Oxidized		Y	X	N	
Pitting		Y		N	X
Delamination		Y		N	X
Corrosion	2%	Y	X	N	
Welds/Joints		Good			
Supports		Good			
Safety Cage/Climb		Y	X	N	

Conclusion/Discrepancies Ladder, cage and braces all in working condition, minor rust noted

OVERFLOW STRUCTURE

Coating					
Satisfactory		Y	X	N	
Oxidized		Y	X	N	
Pitting		Y		N	X
Delamination		Y		N	X
Corrosion	<1%	Y	X	N	
Welds/Joints		Good			
Supports		Good			
Screens		Y		N	
Attachments		In ground			
Foundation		Good			

Conclusion/Discrepancies Pipe and braces are in good condition with minor rust that needs touched up

FOUNDATION

Concrete Slab/Ring Retention					
Satisfactory		Y	X	N	
Cracking		Y	X	N	
Spalling		Y		N	X
Exposed Aggregate		Y		N	X
Erosion Undermining		Y		N	X
Seismic Restraints		None			
Corrosion		Y		N	
Tight		Y		N	

Conclusion/Discrepancies Minor superficial cracks noted in the concrete. No undermining or erosion noted overall satisfactory

MANWAY ENTRIES

Coating					
Satisfactory		Y		N	X
Oxidized		Y	X	N	
Pitting		Y		N	X
Delamination		Y	X	N	
Corrosion	5%	Y	X	N	
Welds/Joints		Fair			

Conclusion/Discrepancies Needs touch up work around the edges of the doorway as the coating is peeling

MANUAL LEVEL INDICATOR

Float		Y	X	N	
Guide Wires		Y	X	N	
Guide Wire Anchors		Y	X	N	
Cable / Hardware		Y	X	N	
Corrosion	%	Y		N	X
Operation		Y	X	N	

Conclusion/Discrepancies: Indicator appears to be in good condition

INTERIOR ROOF

Coating					
Satisfactory		Y		N	X
Blistering		Y		N	X
Cracking		Y		N	X
Peeling		Y		N	X
Holidays		Y		N	X
Corrosion	35%	Y	X	N	
Seams/Welds		Fair			
Trusses		Fair			
Gussets		Fair			
Coating					
Blistering		Y		N	X
Cracking		Y		N	X
Peeling		Y		N	X
Holidays		Y		N	X
Corrosion	20%	Y	X	N	
Vent Penetration		Good			
Roof Hatch		Fair			

Conclusion/Discrepancies: Surface corrosion covers the plates as well as the trusses and hardware. Coating has failed and needs to be sandblasted and recoated

INTERIOR SHELL

Coating					
Satisfactory		Y		N	X
Blistering		Y	X	N	
Cracking		Y	X	N	
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	35%	Y	X	N	
Seams/Welds		Fair			
Rings					
Chime		Fair			
2nd Weld Ring		Fair			
3rd Weld Ring		Fair			
4th Weld Ring		Fair			
5th Weld Ring		Fair			
Ring(s)	5 in all	Fair			
Wall to Roof Seam		Fair			
Baffle/Support Walls		None			

Conclusion/Discrepancies: Coating is severely blistered, most of which have cracked open and corrosion is forming. Sandblast and recoat in the immediate future

SUPPORT COLUMNS

Coating					
Satisfactory		Y		N	X
Blistering		Y	X	N	
Cracking		Y	X	N	
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	5%	Y	X	N	
Seams/Welds	Fair				
Floor/Base Plates	Fair				
Construction	Coated steel				

Conclusion/Discrepancies: Blistering and surface corrosion noted from exposed steel. Coating has failed sandblast and recoat

FLOOR

Coating					
Satisfactory		Y		N	X
Blistering		Y	X	N	
Cracking		Y		N	X
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	10%	Y	X	N	
Seams/Welds	Fair				

Conclusion/Discrepancies: Large areas of bare steel, minimal corrosion cathodic protection is working properly coating has failed

Sediment Depth 1/8 of an inch

MANWAY ENTRIES

Coating					
Satisfactory		Y		N	X
Blistering		Y	X	N	
Cracking		Y		N	X
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	5%	Y	X	N	
Seams/Welds	Fair				

Conclusion/Discrepancies: Blistering and surface corrosion noted around the outer edges
Hanger and hardware also exhibit corrosion and blistering

LADDER

Construction	None				
Satisfactory		Y		N	
Coating					
Satisfactory		Y		N	
Blistering		Y		N	
Cracking		Y		N	
Peeling		Y		N	
Holidays		Y		N	
Pitting		Y		N	
Corrosion	%	Y		N	
Seams/Welds					
Safety Cage/Climb		Y		N	

Conclusion/Discrepancies:
No interior ladder

866-789-3483

OVERFLOW

Coating					
Satisfactory		Y	X	N	
Blistering		Y		N	X
Cracking		Y		N	X
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	%	Y		N	X
Seams/Welds	Good				

Conclusion/Discrepancies: pipe and welds are in good condition

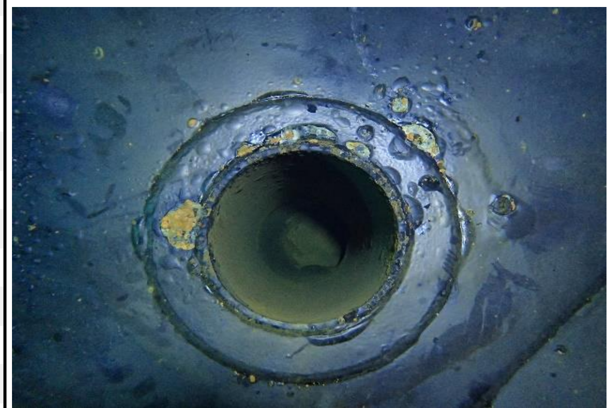
MANUAL LEVEL INDICATOR

Float		Y	X	N	
Guide Wires		Y	X	N	
Guide Wire Anchors		Y	X	N	
Cable / Hardware		Y	X	N	
Corrosion	15%	Y	X	N	
Operation		Y	X	N	

Conclusion/Discrepancies: Corrosion on the guide wire anchors, system is in working condition, float has some water on the interior and is losing buoyancy

APPURTENANCES

Influent

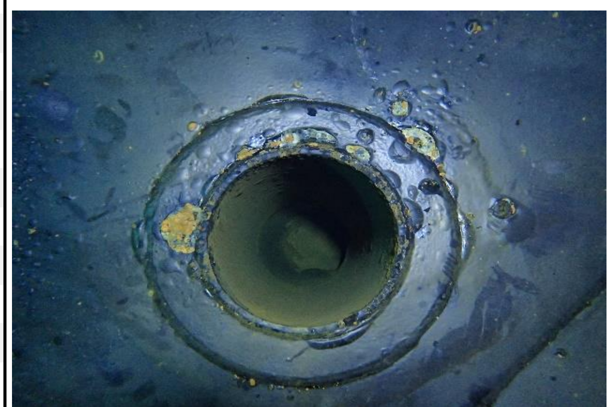


Coating

Satisfactory		Y		N	X
Blistering		Y	X	N	
Cracking		Y	X	N	
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	5%	Y	X	N	
Seams/Welds		Fair			

Conclusion/Discrepancies: Blistering and corrosion noted around the weld seam

Effluent



Coating

Satisfactory		Y		N	X
Blistering		Y	X	N	
Cracking		Y	X	N	
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	5%	Y	X	N	
Seams/Welds		Fair			

Conclusion/Discrepancies: Blistering and corrosion noted around the weld seam

Drain

Coating

Satisfactory		Y		N	X
Blistering		Y		N	X
Cracking		Y		N	X
Peeling		Y		N	X
Holidays		Y		N	X
Pitting		Y		N	X
Corrosion	15%	Y	X	N	
Seams/Welds		Fair			

Conclusion/Discrepancies: Corrosion around the weld seam and on the interior of the pipe

Conclusion

Based on the results of this underwater inspection and the cleaning which took place, it appears this tank is in operational condition and should continue to provide a reliable water storage capacity for potable water use with and after proper maintenance.

Interior coating is at the end of its service life, the tank needs to be sandblasted and recoated in the immediate future.

Recommendations

PDI concurs with the recommendations of AWWA that all potable water reservoirs or storage tanks be cleaned and inspected at least every five years and in some cases, depending upon source waters, type and quantities of sediment, and presence (or lack thereof) of cathodic protection systems, more frequently.

The following recommendations are made to provide continued, uninterrupted service of your water storage tank:

1. Your tank should be inspected and cleaned every five years, as suggested by the AWWA. Routine inspections and cleanings provide ample time to perform remedial repairs to abnormalities discovered before having a chance to become problematic.
2. The entry hatch needs a new gasket put in place as the current one is cracked and not all there.
3. The exterior roof needs touch up work done around the entry way, numerous nicks and scratches with minor corrosion are present.
4. The interior coating on the floor, shell, and roof, in addition to all the appurtenances need to be sandblasted and recoated as the coating has exceeded its useful service life. Blisters, and corrosion are present with some bare steel exposed as well. Sandblast and recoat the interior in the immediate future.
5. The float for the level indicator system needs to be replaced. The float has water inside and is losing buoyancy.

Energy Management Study

2

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Reference: 520022

May 4, 2022

Robert Moser, General Manager
Lake Shastina Community Services District
16320 Everhart Drive
Weed, CA 96094

Subject: Lake Shastina Community Services District Water System Energy Management Study

Objective

The purpose of this study is to determine the energy usage baseline and to recommend energy savings solutions for the Lake Shastina Community Services District (LSCSD) drinking water system.

Analysis

Monthly energy expenses to operate LSCSD's water supply and distribution pumps range between $4,300 and $14,000 with an average of $7,821. This variation is accounted for by the seasonal variation in water demand. Between the months of November and March, the average daily flow rate is 0.22 million gallons per day (MGD), and between April and October the average daily flow rate is 1 MGD. LSCSD is comprised of three supply wells and five booster stations, where 71% of the energy usage is expended by the supply wells.

SHN analyzed monthly energy usage and expense reports from Pacific Power and water volumetric production data provided by LSCSD. Averages of the system are provided in Table 1 and the detailed data are provided in Tables 3 through 10. It should be noted that this analysis has a limited amount of data, thus the findings provided are partly qualitative and rely on assumptions for evaluation.

Table 1. LSCSD's Municipal Water Supply Monthly Averages, Energy Usage, Production and Cost Summary

Average Monthly Cost	$7,821
Average Gallons per Month	19,921,000
Cost per Million Gallons (MG)	$509
Energy Usage (Kilowatt hour [kWhr])	46,800
Wire to Water (kWhr/MG)	2,634
Percent Well Consumption	71%

A key component of this study is the "Wire to Water Energy Ratio." The wire to water energy ratio is a measure of kilowatt-hour per million gallons of water (kWhr/MG); simply, it is the amount of energy used to produce a million gallons of water. A lower wire to water energy ratio is better, essentially using less power to move a million gallons of water. The wire to water energy ratio is used to assess how your system compares with other public water distribution systems and create new, energy efficiency goals. LSCSD's wire to water energy ratio is 2,634 kWhr/MG. According to the EPA and statistics on public water systems using ground water, "The average typical power usage is 1,800 kWhr/MG." The next figure looks at the fluctuating efficiency values and where the system is performing well and where there is room for improvement.

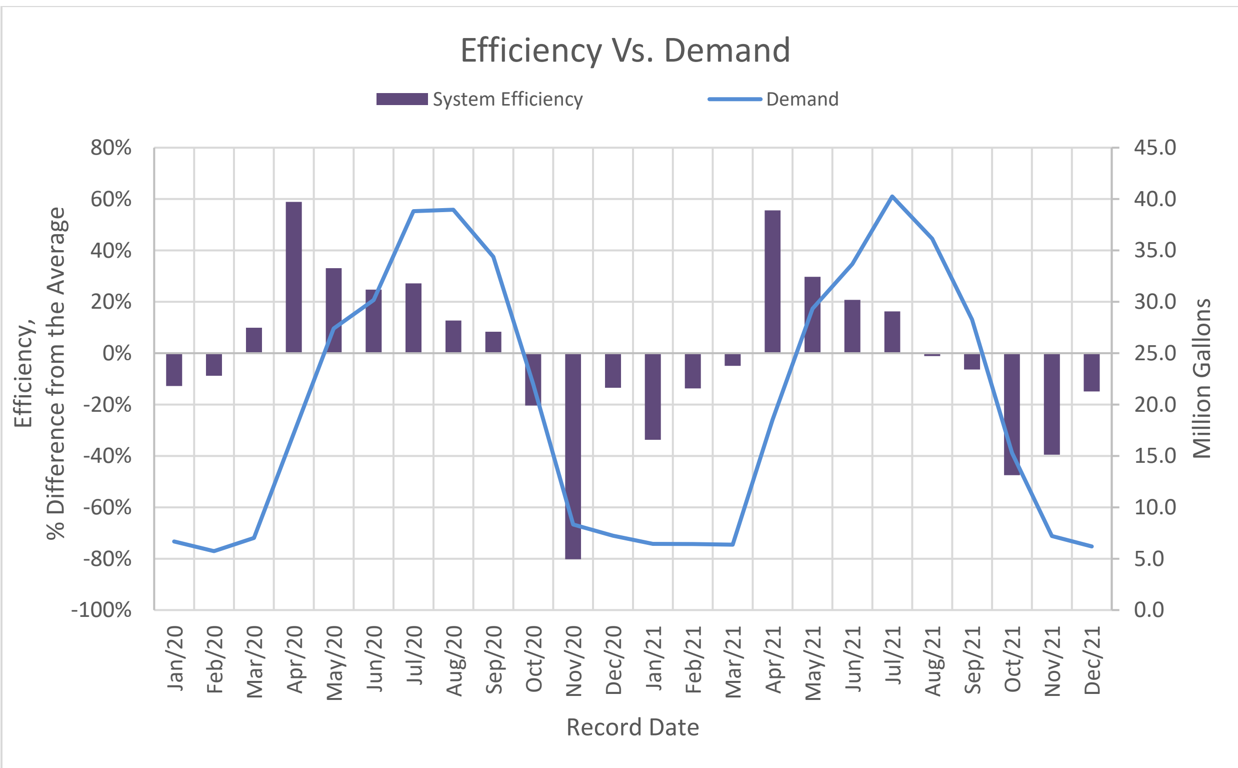

Figure 1: Efficiency Trends

- The y-axis is the % difference from the average efficiency of 2,634 kWhr/MG.
- Positive percentages represent improved efficiency.

Lake Shastina has seasonal trends for water use as seen above in Figure 1; generally these seasons are between the summer months of April and October, and the winter months between November and March. The influx of residents during the warmer months and an increased use for irrigation creates a high demand on LSCSD's water distribution system. The system observes a broad range of demands, and this results in a wide range of efficiencies. Figure 1 illustrates the seasonal trend and compares this with efficiency values (efficiency on the y-axis is the percent difference from the yearly average of 2,634 Kilowatt hour per million gallons [kWhr/MG], positive numbers reflect improved efficiency). A correlation between the two graphs can be seen; as demand increases so does efficiency, but as demand decreases, efficiency declines.

Figure 2 shows a correlation between efficiency and operational run time of Well Pumps 3 and 4. Run time is a measure of how long a pump is operational per day and does not account for the number of cycles per day. As the chart moves from left to right, run time increases and the wire to water ratio also improves. Additionally, the number of points to the left of the chart indicate that there are many instances a pump runs for a short duration.

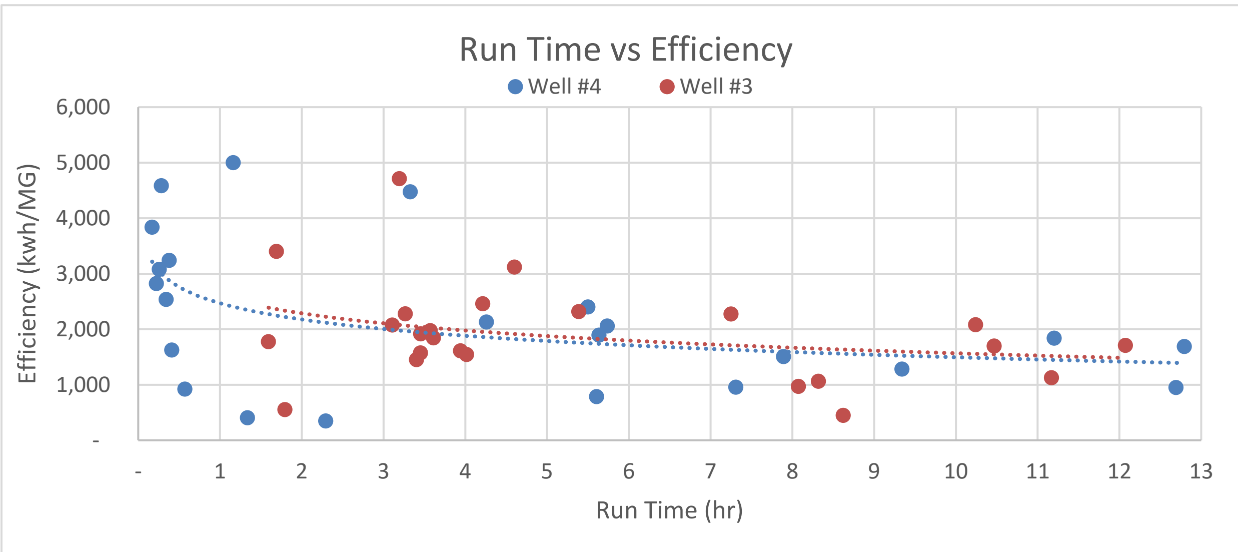

Figure 2: Daily Run Time vs Efficiency (kWhr/MG)

- "Run time" is a measure of how long a pump is operational per day and does not account for the number of cycles.

Figure 3 displays a distribution of daily total run times. Run times of less than 1.5 hours account for 40% of occurrences. These short durations are found to be inefficient and are considered a key factor of the inefficiencies in the system.

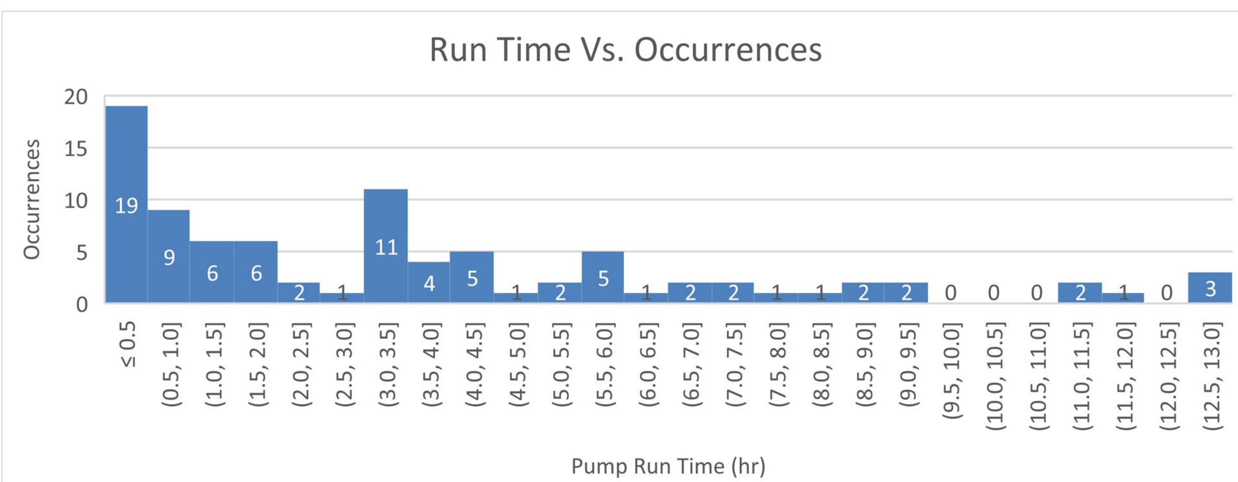

Figure 3: Daily Total Run Time Distribution.

The combination of lower demand and short cycles is a large contributor to the inefficiencies found within the system. Finding ways to decrease cycles of a pump and stay within the most efficient range will ultimately improve energy efficiency.

Analysis Results

The overall system runs efficiently when at high demands. Although, this is not the case when demand is low. An example for a low demand case is between the months of November and March when Well 4 kicks on to fill Tank 2. Well 4 is activated when the water elevation in Tank 2 falls below 15.8 ft and kicks off when the water elevation reaches 17.8 ft. Table 2 provides the characteristics of Tank 2 and Well 4 below. The estimated time to fill is only 18.6 minutes, these short cycles are leading to inefficiencies in the system.

Table 2. LSCSD's Well 4 to Fill Tank 2 (Winter Operation).

Well 4 "Run Time" Calculation	
Well 4 Capacity:	1,400 gallons per minute (GPM)
Tank 2 Total Volume:	300,000 gallons
Tank 2 Dimensions:	24 feet tall, 47-foot diameter
Tank 2 Fill Volume:	26,000 gallons (gal)
Time to Fill Tank 2:	26,000 gal /1400 GPM = 18.6 minutes

Overall, Well 3 performs the best and has the highest efficiency.

Well 9 is showing undesirable results but is subject to very little usage and short run times causing very poor efficiencies.

Recommended Improvements

SHN recommends the integration of Variable Frequency Drives (VFDs). This energy management device improves efficiency, performance, and reliability of the system. Our findings from the analysis suggest that the well pumps are oversized during the winter months and would benefit from the features of a VFD. A VFD will reduce the frequency of the motor, thus reducing the speed and ultimately the discharge of the pump. By reducing the frequency of the motor, significant energy savings are achievable.

A thesis study (Mancosky, 2017), out of the University of Wisconsin-Madison, found promising results for the installation of VFDs in deep well pump applications. Mancosky states:

> "Reduction in head and energy use is the primary benefit for VFD installation on deep well pumps, but there are additional energy and system benefits. Operating at lower speeds and flow rates increases the duration of pump run time and lessens the number of pump starts, saving additional energy… For this particular combination of deep well properties and pump attributes, reducing the speed by 10% from 1780 rpm to 1602 rpm translates to an 18% reduction in flow rate (2,390 gpm to 1,960 gpm), a 9% reduction in head (310 ft to 281 ft), and an increase of 2.3% in pump

> efficiency. This translates to a 28% reduction in input power required for the pump (180 kW to 130 kW) and a 12% savings in energy use when pumping the unit well daily average of 1.9 MG." (Mancosky, 2017)

Another feature of a VFD is the integrated soft start feature. A VFD employs a soft start feature that conserves energy by gradually increasing the frequency of a pump and reducing the initial current surge when a pump starts. The soft start feature improves efficiency while also reducing stresses to the pump and other system components.

Other energy savings strategies that can be utilized are:

- Time-of-use: Modify schedule/usage for off-peak operations
- Identify unnecessary processes/depowering of equipment.
- Efficient lighting fixtures, including reduced use and sensors.

By installing VFDs, LSCSD can expect to see a more versatile system and an improved wire-to-water energy ratio. A continued energy management program can be aided by the following resources and tools provided by the U.S. Environmental Protection Agency (EPA):

- "Strategies for Saving Energy at Public Water Systems"
- "Ensuring a Sustainable Future: An Energy Management Guidebook for Wastewater and Water Utilities"
- "The Plan-Do-Check-Act approach"

Reference Cited

Mancosky, C. (2017). "Methodology for Estimating Energy Savings Potential Form VFD Installation on Deep Well Pumps. Master's thesis." University of Wisconsin-Madison.

Please call me at (530) 221-5424 if you have any questions.

Sincerely,

SHN

Anders Rasmussen

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Signed
5/4/2022

Data Provided by LSCSD

2A

Data Provided by LSCSD

Table 3. LSCSD Monthly Electric Cost 2021

STA	Dec-21	Nov-21	Oct-21	Sep-21	Aug-21	Jul-21	Jun-21	May-21	Apr-21	Mar-21	Feb-21	Jan-21
B4	$1,104	$1,135	$2,771	$3,658	$4,558	$4,553	$4,217	$3,046	$1,144	$1,105	$1,082	$1,155
B3	$1,677	$2,495	$3,700	$4,406	$4,367	$3,813	$2,795	$2,854	$1,962	$1,532	$1,594	$1,850
B9	$546	$678	$835	$831	$1,107	$985	$850	$689	$546	$395	$609	$590
B50	$136	$105	$97	$97	$110	$109	$106	$105	$150	$174	$195	$213
B51	$121	$97	$95	$108	$120	$100	$94	$117	$146	$145	$150	$163
B52	$43	$20	$15	$15	$15	$15	$15	$20	$39	$43	$44	$47
B53	$605	$887	$1,619	$2,171	$2,590	$2,469	$2,021	$1,586	$818	$742	$718	$832
B54	$31	$18	$15	$15	$15	$15	$18	$27	$39	$45	$48	$51
B56	$107	$73	$62	$73	$82	$68	$59	$98	$141	$150	$153	$165
B57	$257	$243	$286	$288	$260	$191	$154	$130	$154	$239	$227	$280
TTL	$4,916	$6,186	$10,044	$12,205	$14,071	$13,112	$11,025	$9,231	$5,531	$4,726	$5,202	$5,656
* B4, B3, B9 are wells, 4, 3, and 9 respectively. Remaining stations are booster stations.												

Table 4. LSCSD Monthly Electric Usage 2021 (kWhr)

STA	Dec-21	Nov-21	Oct-21	Sep-21	Aug-21	Jul-21	Jun-21	May-21	Apr-21	Mar-21	Feb-21	Jan-21
B4	2,240	1,680	15,480	23,360	31,400	31,640	28,720	18,560	2,040	1,720	1,520	2,120
B3	10,120	15,829	26,030	32,542	32,564	28,028	19,193	19,707	11,963	8,291	8,844	11,133
B9	840	1,600	2,940	3,000	5,440	4,400	3,120	1,640	400	580	980	880
B50	781	531	480	495	582	587	562	559	851	1,014	1,151	1,280
B51	717	513	505	598	682	558	519	674	861	859	889	980
B52	187	30	-	-	-	-	-	39	159	188	195	218
B53	2,202	4,182	10,342	15,272	18,990	18,145	14,256	10,484	3,850	3,140	3,456	3,830
B54	109	17	-	-	-	-	26	82	162	203	219	239
B56	583	328	260	340	401	315	256	510	794	857	874	958
B57	1,600	1,400	1,680	1,720	1,560	1,120	880	720	880	1,440	1,360	1,720
TTL	18,619	26,310	58,977	78,607	95,499	88,073	69,772	53,895	21,480	17,432	19,108	22,518
* B4, B3, B9 are wells, 4, 3, and 9 respectively. Remaining stations are booster stations.												

Table 5. LSCSD Well Volume Production 2021

STA	Dec-21	Nov-21	Oct-21	Sep-21	Aug-21	Jul-21	Jun-21	May-21	Apr-21	Mar-21	Feb-21	Jan-21
B4	882,939	437,848	3,097,432	10,975,746	15,273,675	21,008,382	1,517,272	19,459,210	5,910,515	1,058,988	539,021	688,759
B3	5,281,246	6,440,952	11,451,032	15,651,670	19,068,820	1,653,553	17,070,709	8,512,249	12,340,183	5,276,811	5,731,216	5,642,814
B9	36,312	334,931	747,115	1,651,176	1,796,364	2,710,676	1,429,054	1,361,199	267,653	22,314	160,298	110,486
TTL	6,200,497	7,213,731	15,295,579	28,278,592	36,138,859	25,372,611	20,017,035	29,332,658	18,518,351	6,358,113	6,430,535	6,442,059

Table 6. LSCSD Well Volume Average Daily 2021 (gallons)

STA	Dec-21	Nov-21	Oct-21	Sep-21	Aug-21	Jul-21	Jun-21	May-21	Apr-21	Mar-21	Feb-21	Jan-21
B4	29,431	14,594	99,917	365,858	492,699	677,689	483,909	627,716	197,017	35,299	19,250	22,218
B3	176,041	214,698	369,388	521,722	615,123	533,340	569,023	274,588	411,399	175,893	204,686	182,026
B9	1,210	11,164	24,100	55,039	57,947	87,441	47,635	43,909	8,921	743	5,853	3,564
TTL	206,682	240,456	493,405	942,619	1,165,769	1,298,470	1,100,567	946,213	617,337	211,935	229,789	207,808

Table 7. LSCSD Monthly Electric Cost 2020

STA	Dec-20	Nov-20	Oct-20	Sep-20	Aug-20	Jul-20	Jun-20	May-20	Apr-20	Mar-20	Feb-20	Jan-20
B4	$1,248	$1,821	$5,315	$6,813	$7,291	$4,478	$5,359	$4,551	$2,198	$1,089	$1,170	$913
B3	$1,689	$3,019	$2,125	$1,701	$1,698	$3,233	$1,253	$1,077	$738	$1,676	$1,465	$2,090
B9	$578	$310	$490	$498	$505	$536	$394	$502	$213	$561	$414	$223
B50	$174	$107	$98	$107	$108	$98	$101	$94	$104	$112	$134	$158
B51	$146	$99	$94	$100	$111	$110	-	-	-	-	-	-
B52	$36	$14	$14	$14	$14	$13	-	-	-	-	-	-
B53	$748	$1,174	$1,922	$2,318	$2,488	$2,167	$1,818	$1,515	$703	$723	$712	$799
B54	$36	$14	$14	$14	$14	$13	-	-	-	-	-	-
B56	$123	$65	$57	$64	$65	$52	$58	$72	$106	$111	$128	$120
B57	$269	$203	$250	$280	$291	$138	$139	$133	$122	$140	$187	
TTL	$5,356	$6,933	$10,619	$12,127	$12,799	$11,236	$9,377	$8,313	$4,275	$4,833	$4,437	$4,526

* B4, B3, B9 are wells, 4, 3, and 9 respectively. Remaining stations are booster stations.

Table 8. LSCSD Monthly Electric Usage 2020 (kWhr)

STA	Dec-20	Nov-20	Oct-20	Sep-20	Aug-20	Jul-20	Jun-20	May-20	Apr-20	Mar-20	Feb-20	Jan-20
B4	3,280	8,480	39,640	53,000	57,520	32,080	39,520	31,840	11,320	1,760	3,240	1,400
B3	10,029	21,927	13,955	10,172	10,191	23,769	6,096	4,467	1,513	9,083	7,299	11,744
B9	920	60	200	240	260	300	120	360	540	560	560	620
B50	1,042	593	530	594	600	529	545	501	559	583	683	814
B51	888	576	543	583	660	648	-	-	-	-	-	-
B52	145	-	-	-	-	-	-	-	-	-	-	-
B53	3,399	7,225	13,905	17,238	19,082	16,070	12,679	10,022	3,445	3,400	3,324	3,910
B54	147	-	-	-	-	-	-	-	-	-	-	-
B56	699	307	255	306	313	224	256	354	574	578	646	588
B57	1,680	1,240	1,560	1,760	1,840	800	800	760	680	760	1,000	
TTL	21,469	39,228	69,228	82,373	88,886	73,920	59,336	47,904	18,491	16,524	16,312	19,696

* B4, B3, B9 are wells, 4, 3, and 9 respectively. Remaining stations are booster stations.

Table 9. LSCSD Well Volume Production 2020 (gallons)

STA	Dec-21	Nov-21	Oct-21	Sep-21	Aug-21	Jul-21	Jun-21	May-21	Apr-21	Mar-21	Feb-21	Jan-21
B4	1,012,546	1,022,526	8,861,089	28,857,879	34,058,052	33,783,270	16,463,169	24,862,764	14,440,690	4,346,982	706,821	1,522,405
B3	6,225,437	7,032,743	13,139,957	5,521,569	4,910,765	5,045,902	13,618,691	2,517,401	2,745,467	2,671,482	5,029,034	5,160,176
B9	-	271,629	-	-	-	-	90,041	21,048	31,354	-	-	-
TTL	7,237,983	8,326,898	22,001,046	34,379,448	38,968,817	38,829,172	30,171,901	27,401,213	17,217,511	7,018,464	5,735,855	6,682,581

Table 10. LSCSD Well Volume Average Daily 2020 (gallons)

STA	Dec-21	Nov-21	Oct-21	Sep-21	Aug-21	Jul-21	Jun-21	May-21	Apr-21	Mar-21	Feb-21	Jan-21
B4	32,662	32,984	285,841	961,929	1,098,646	1,089,782	472,360	802,024	481,356	114,899	24,373	49,109
B3	200,820	234,424	423,869	184,052	158,411	162,771	439,312	81,206	91,515	86,176	173,414	166,457
B9	0	9,054	0	0	0	0	3,001	676	1,045	0	0	0
TTL	233,482	276,462	709,710	1,145,981	1,257,057	1,252,553	914,673	883,906	573,916	201,075	197,787	215,566

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