WILSON ARCH WATER AND SEWER SPECIAL SERVICE DISTRICT
CULINARY WATER SYSTEM MASTER PLAN 2022

Wilson Arch,
La Sal, UT 94530

July 2022

PREPARED BY:
Sunrise Engineering

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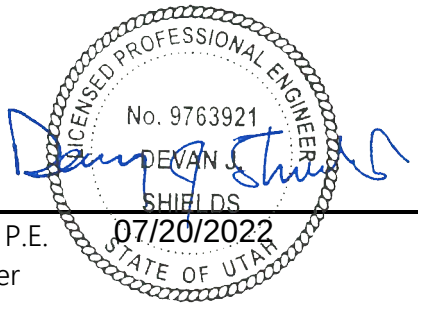

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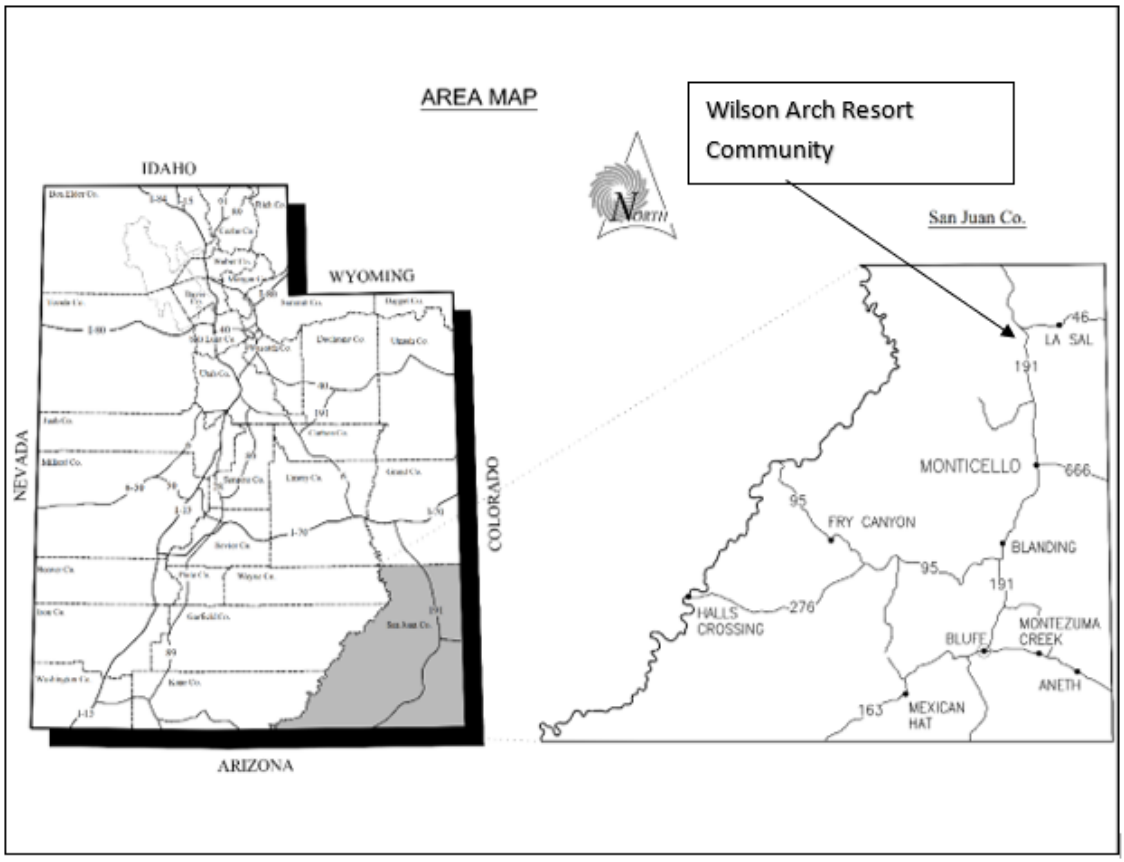
1.0 INTRODUCTION

Wilson Arch Resort Community is located at the northern end of San Juan County, approximately 20 miles south of Moab, Utah along Highway 191. An area map is provided as Figure 1.1. The Wilson Arch Resort Community water system is currently managed by the Wilson Arch Water and Sewer Company, business set up by the community's founder. Management is currently being transitioned to Wilson Arch Water and Sewer Special Service District (SSD). For brevity, the owner will be addressed as Wilson Arch SSD. The water system managed by Wilson Arch SSD is currently two distinct water systems with independent sources and storage. The two systems are separated by Highway 191, with one on the east side and the other on the west side. This report will consider the two systems as one collective entity since much of the data used is reported in such a manner. Distinction of east or west side will occasionally be made for clarification as appropriate. This culinary water master plan has been prepared for Wilson Arch SSD as a tool to help the community effectively manage its existing culinary water system, as well as to plan and prepare for future growth and improvements.

This water system master plan is based on a five-point analysis of the Wilson Arch SSD culinary water system, which includes water right, source capacity, treatment, storage capacity, and distribution in accordance with the *State of Utah Rules Governing Public Drinking Water Systems (Rules)*. This plan analyzes each of these five aspects of the water system and identifies deficiencies found in each of these areas. An accompanying hydraulic water model has been created with this master plan in order to analyze the capacity of the existing distribution system and model proposed improvements. A capital improvements plan has been included, which addresses the recommended improvements. The capital improvements plan outlines an engineer's opinion of probable costs for the recommended improvements, along with a recommended timeline for implementation.

Figure 1.1: Area Map of Wilson Arch Resort Community



2.0 SYSTEM USER ANALYSIS

2.1 LENGTH OF PLANNING PERIOD

The planning period for this Water System Master Plan will be 20 years, beginning in 2022 and running through 2042. For purposes of this report, full buildout of Phase 1 of development as specified by Wilson Arch SSD records will be assumed complete at the end of the 20-year planning period. Phase 1 development and the 20-year planning period will be considered to have the same time basis and will be referred to interchangeably. Wilson Arch SSD should review and update this water system master plan every five to ten years.

2.2 RECOMMENDED GROWTH RATE

In most cases an essential element in the development of a culinary water master plan is the determination of an estimated system growth rate. Historical population growth rate gives the planner a glimpse of future demands that may need to be accommodated by the culinary water system.

The Wilson Arch SSD water system currently provides water to approximately 27 people. Typically, historical census data is considered the most reliable data source when determining a town's future

growth. Official census data specific to Wilson Arch Resort Community could not be found. Data from the Division of Water Rights indicates that Wilson Arch SSD has had an average population growth of 1.19% from the year 2004 to 2020. The Gardner Institute projects a 0.53% average growth rate for San Juan County through the year 2062. The historical data found was observed to have significant variance, which can be explained by the transient nature of Wilson Arch Resort Community.

Wilson Arch SSD reports aggressive advertising for development and growth over the next 20 years for Phase 1 of its development. Historical population data is not expected to be a strong predictor for the future needs of the community's water system.

2.3 CULINARY WATER CONNECTIONS

2.3.1 Existing Culinary Water Connections and ERCs

According to the data provided by Wilson Arch SSD and the department of water rights, there are 17 residential connections and 1 commercial connection on the system. This includes connections on both the east and west sides of the highway.

In this plan, reference will be made to equivalent residential connections (ERCs). One ERC is defined as the amount of culinary water required by an average residential connection. In accordance with the Division of Drinking Water's standards, an average residential connection is expected to use 400 gallons per day for indoor use, or approximately 12,000 gallons per month. Because an ERC relates to the amount of water required for the average residential connection, use of this term allows commercial, industrial, or other water connections accounted for as equivalent number of residential connections. ERCs are factored into calculations for impact fees, user rates, and other analyses as required for design purposes.

Table 2.3.1 shows the number of connections for each usage category along with its associated ERC value.

Table 2.3.1: ERC Equivalents per Connection Category

ERC Connection by Type			
Category	Current Connections	ERC/Connection	Total Current ERCs
Residential	17	1	17
Commercial	1	7	7
Industrial	0	0	0
Institutional	0	0	0
		Total	24

The project team reviewed the water usage from current residential connections. The most recent water use data from the year 2021 indicates that 241 gallons per day are used by the 24 ERCs on the system. The system does not currently service any industrial or institutional facilities. However, the board anticipates that there will be new commercial connections added during the planning period. Wilson Arch SSD has designated a specific water use density on commercial lots slated for

development. These lots range from approximately 1 acre to 5.5 acres. Development is not certain, but Wilson Arch SSD hopes to include a community center, convenience store, spa, sales office, and hotel on the commercial lots. Wilson Arch SSD has designated a water use density of 2 ERCs per acre on commercial lots. This conversion factor and acreage values taken from plat maps are used to obtain the number of commercial connections Wilson Arch SSD will require in the future. A list of planned ERCs per lot is given in Appendix A. With rounding, this report considers one commercial connection as equivalent to 7 ERCs on average. No industrial or institutional connections are anticipated in the planning period.

According to Wilson Arch SSD representatives no residential connections use culinary water for irrigation use. For the purposes of this master plan, it will be assumed that the total number of ERCs that use secondary water for irrigation purposes will remain the same through the planning period. This number will not be expected to increase because community ordinances do not allow it.

2.3.2 Projected Culinary Water Connections and ERCs

The relation between growth rate, current number of ERCs, future ERCs, and planning period is given by the compound interest formula as follows: F = Current Connections x $(1 + R)^{20\ years}$ where F is the projected number of future connections and R is the rate of growth. The projection curve is obtained by determining a residential growth rate and future number of residential connections. Data gathered from Wilson Arch SSD indicates that at full buildout of Phase 1 there will be 51 residential ERCs. With known residential values inserted, the compound interest formula is written as follows:

51 Future Residential ERCs = 17 Current Residential ERCs x $(1 + R)^{20}$

With just residential growth rate left as an unknown, the equation can be rearranged to solve for R, yielding 5.62%. This would be the average residential growth rate Wilson Arch SSD should expect if they are to reach full Phase 1 buildout in 20 years.

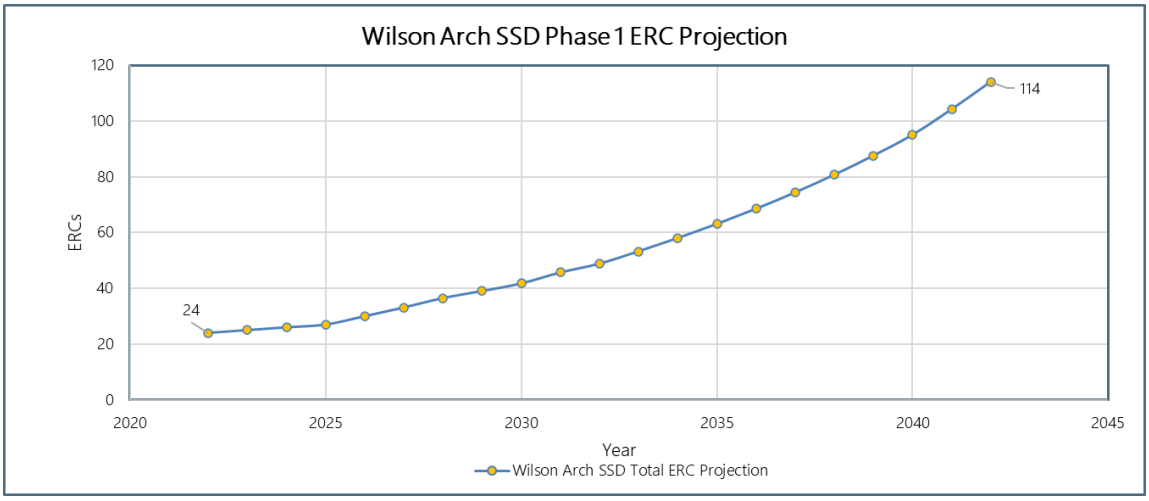
Commercial growth rate is solved using the same process. Data gathered from Wilson Arch SSD indicates that 63 commercial ERCs are desired at full buildout of Phase 1. With known commercial growth values inserted, the compound interest formula is written as follows:

63 Future Commercial ERCs = 7 Current Commercial ERCs x $(1 + R)^{20}$

This equation can then be rearranged to solve for commercial growth rate yielding 12.26%. This is to say that Wilson Arch SSD should expect to see an average commercial growth rate of 12.26% if they are to reach full buildout for Phase 1 in 20 years.

The projected number of ERCs at every year of the planning period are calculated using the average residential and commercial growth. In our formulation 1 residential ERC is equivalent to 7 commercial ERCs. Application of the conversion allows the ERCs to be summed together at each time point. This gives a total ERC projection curve for the 20-year planning period, see Figure 2.3.1.

Figure 2.3.1: Projected Growth by Total ERCs



3.0 WATER RIGHT ANALYSIS

3.1 EXISTING WATER RIGHT

According to the Utah Division of Water Rights there is one public water right for Wilson Arch SSD, WR# 05-2992. This water right allows a quantity of 110.5 ac-ft/yr or 0.153 cfs to be taken collectively from four points of diversion specified as four underground wells. Three of these wells are existing and one is proposed. Coordinates for each are listed in Table 3.1.1. WR# 05-2992 is a segregated portion of water right 41-3479, which was segregated from water right 41-2963.

Two notable change applications were found in the Utah Division of Water Rights database, application numbers a28592 and a36959. Application number a28592 was filed in 2004 and appears to propose changes to the points of diversion, place of use, nature of use, and period of use. This application specifies an original quantity of 100 ac-ft/yr. Documentation of application endorsement and approval was found. Application number a36959 proposes changes to the points of diversion, place of use, nature of use, and period of use. This application appears to show a change in the quantity of water divertible from 100 acre-ft to 110.5 acre-ft. This change application was filed in 2010 and is indicated by the Utah Division of Water Rights as approved.

It is noted that there are eight records filed under the name Wilson Arch Properties LLC, which is specified as the owner. They are indicated to be rights to 5.73 acre-ft, diverted at eight underground wells. This report will only consider rights explicitly owned by Wilson Arch SSD on the Division of Water Rights website.

The water rights that are owned by Wilson Arch SSD are listed below in Table 3.1.1. A total of 110.5 acre-feet are owned, and this number is used in the calculations for water rights.

Table 3.1.1: Wilson Arch SSD Water Right Summary

Wilson Arch SSD Water Rights Summary					
Well	W.R. #	Point of Diversion	Source Type	Total Divertible (cfs)	Total Divertible (ac-ft/yr)
1	05-2992	N 78 feet E 637 feet from S4 corner, Sec 15 T 29S R 23E SLBM	Underground Well	0.153	110.5
2	05-2992	N 406 feet E 333 feet from N4 corner, Sec 22 T 29S R 23E SLBM	Underground Well		
3	05-2992	N 1818 feet E 845 feet from N4 corner, Sec 22 T 29S R 23E SLBM	Underground Well		
4*	05-2992	N 2215 feet W 200 feet from N4 corner, Sec 22 T 29S R 23E SLBM	Underground Well		
*Proposed Well			Total:	0.153	110.5

Table 3.1.1 represents a cursory review of the water rights on record with the Utah Division of Water Rights. A more detailed water rights analysis can be performed, and a report can be provided at the request of Wilson Arch SSD.

3.2 EXISTING REQUIRED WATER RIGHT

Required water right is divided into two categories: indoor and outdoor. The *Rules* state that a community should have adequate water right to supply each residential culinary connection with a minimum of 400 gallons per day for indoor water use.

As noted in section 2.3.1 above, no current residential connections also use culinary water for their outdoor irrigation needs. Outdoor irrigation is limited by community ordinance, and it is not considered in current and future calculations. If Wilson Arch SSD adjusts this ordinance in the future, it will have significant impact on water needs.

According to the *Rules*, Utah has six climate zones (excluding non-arable lands), which correspond with consumptive use and annual precipitation. In the central mountains, outside watering requirements are quite low (Zone 1), compared with the southern part of the state where the climate is usually very warm and dry (Zone 6). As a result, these zones have different outside watering requirements. Rule R309-510 provides minimum recommended requirements for outside consumptive use for each zone.

According to consumptive use zone maps Wilson Arch SSD is in zone 3, but the on-site terrain observed by the project team could easily be classified as consumptive use zone 4. This report will assign zone 3, but notes that zone 4 could easily be considered. According to the *Rules*, a public water supplier must have enough water right to cover the average annual demand for the system. The *Rules* recommend that 1.66 ac-ft per irrigated acre to be used to estimate the required water right for outdoor uses of culinary water in Zone 3. Using this value of 1.66 and the average irrigated area per ERC, the existing and projected required water right can be calculated. Since no residents

use water for outdoor irrigation, it is not considered a contributing factor to future water right requirement. Consideration of outdoor use is included below as part of the full analysis promised to Wilson Arch SSD.

Existing Required Water Right:

Residential Use:

Indoor

$$17 \text{ ERCs} \times \frac{400 \text{ gal}}{\text{ERC day}} \times \frac{365 \text{ day}}{1 \text{ year}} \times \frac{1 \text{ ac-ft}}{325{,}851 \text{ gal}} = 7.62 \text{ ac-ft}$$

Outdoor (Assume 0% of ERCs)

$$0 \text{ ERCs} \times \frac{1 \text{ ir. Acre}}{3 \text{ ERCs}} \times \frac{1.66 \text{ ac-ft/yr}}{\text{ir.-acre/yr}} = 0.00 \text{ ac-ft}$$

Commercial Use:

Indoor

$$7 \text{ ERCs} \times \frac{400 \text{ gal}}{\text{ERC day}} \times \frac{365 \text{ day}}{1 \text{ year}} \times \frac{1 \text{ ac-ft}}{325{,}851 \text{ gal}} = 3.14 \text{ ac-ft}$$

Outdoor (Assume 0% of ERCs)

$$0 \text{ ERCs} \times \frac{1 \text{ ir. acre}}{3 \text{ ERCs}} \times \frac{1.66 \text{ ac-ft/yr}}{\text{ir.-acre/yr}} = 0.00 \text{ ac-ft}$$

Total Existing Required Water Right =	**10.75 ac-ft**
Total Existing Water Right =	**110.50 ac-ft**
Estimated Existing Water Right Surplus =	**99.75 ac-ft**

Wilson Arch SSD currently has a water right surplus of 99.75 ac-ft.

3.3 20-YEAR PROJECTED REQUIRED WATER RIGHT

The projected required water right is calculated using the total projected ERCs for each category at the end of a 20-year planning period. For Wilson Arch SSD, there are 51 residential and 63 commercial ERCs projected for full buildout of Phase 1 assuming it is completed by the end of the 20-year planning period.

Based on the information above, the projected required water right is calculated as follows:

Projected Required Water Right - 20 Yrs

Residential Use:

Indoor

$$51 \text{ ERCs} \times \frac{400 \text{ gal}}{\text{ERC day}} \times \frac{365 \text{ day}}{1 \text{ year}} \times \frac{1 \text{ ac-ft}}{325{,}851 \text{ gal}} = 22.85 \text{ ac-ft}$$

Outdoor (Assume 0% of New Indoor)

$$0 \text{ ERCs} \times \frac{1 \text{ ir. Acre}}{3 \text{ ERCs}} \times \frac{1.66 \text{ ac-ft/yr}}{\text{ir.-acre/yr}} = 0.00 \text{ ac-ft}$$

Commercial Use:

Indoor

$$63 \text{ ERCs} \times \frac{400 \text{ gal}}{\text{ERC day}} \times \frac{365 \text{ day}}{1 \text{ year}} \times \frac{1 \text{ ac-ft}}{325{,}851 \text{ gal}} = 28.23 \text{ ac-ft}$$

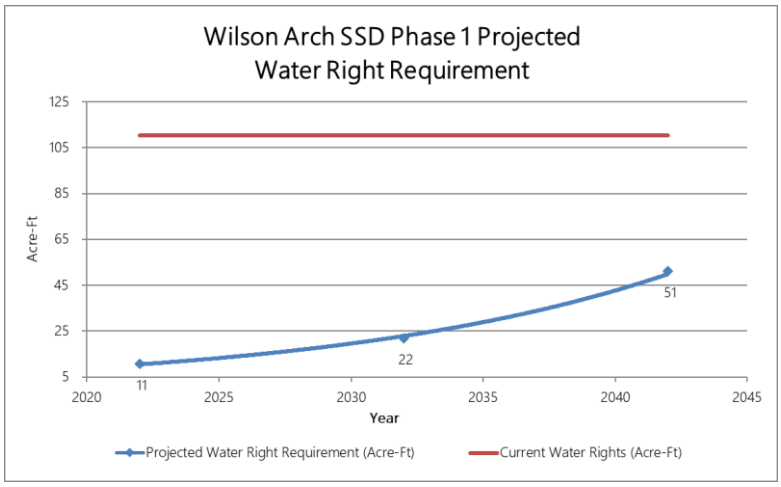
Outdoor (Assume 0% of ERCs)

$$0 \text{ ERCs} \times \frac{1 \text{ ir. acre}}{3 \text{ ERCs}} \times \frac{1.66 \text{ ac-ft/yr}}{\text{ir.-acre/yr}} = 0.00 \text{ ac-ft}$$

Total Projected Required Water Right =	**51.08**	**ac-ft**
Total Existing Water Right =	**110.50**	**ac-ft**
Estimated Projected Water Right Surplus =	**59.42**	**ac-ft**

Wilson Arch SSD has a projected water right surplus of 59.42 ac-ft at the end of the 20-year planning period. Figure 3.3.1 illustrates the required culinary water rights through the 20-year planning period compared to the current culinary water rights that are owned by Wilson Arch SSD.

Figure 3.3.1: Wilson Arch SSD 20-Year Projection of Required Water Rights



3.5 RECOMMENDED WATER RIGHT ACTIONS

Wilson Arch SSD has a surplus of 99.75 ac-ft of water rights based on current system conditions. Our projection shows the system will have a surplus of 59.42 ac-ft of water rights at the end of the 20-year planning period. It is not recommended that action to obtain further water rights be taken during this planning period.

4.0 SOURCE CAPACITY ANALYSIS

4.1 EXISTING SOURCE CAPACITY

Underground wells 1, 2, and 3 are the sources of Wilson Arch SSD culinary water system. According to information obtained from Wilson Arch SSD, source capacity of these wells is 12.5 gallons per minute (gpm) each. At this time flow readings are not available at the pump and the value of 12.5 gpm is used as the source capacity of each well.

4.2 EXISTING REQUIRED SOURCE CAPACITY

Existing source capacity requirements are separated into indoor and outdoor use. The *Rules* state that a community should have an adequate water source capacity to supply a peak demand of 800 gallons per day per ERC for indoor use. The regulations also require the source to be capable of meeting peak day irrigation demands where no secondary source of irrigation water is available. In this case community ordinance prohibits outdoor irrigation using culinary water and irrigation demand discounted.

As noted previously, the *Rules* list six climate zones (excluding non-arable lands), which correspond with consumptive use and annual precipitation. Wilson Arch SSD is in Zone 3. According to the *Rules*, 3.39 gpm per irrigated acre is the peak day demand to be used in calculations to determine required source capacity for residential irrigation.

Based on the information above, the existing required source capacity is calculated as follows:

Existing Required Source Capacity:
Residential Use:

Indoor

$$17 \text{ ERCs} \times \frac{800 \text{ gpd}}{\text{ERC}} \times \frac{1 \text{ day}}{24 \text{ hr}} \times \frac{1 \text{ hr}}{60 \text{ min.}} = 9.44 \text{ gpm}$$

Outdoor (Assume 0% of ERCs)

$$0 \text{ ERCs} \times \frac{1 \text{ acre}}{3 \text{ ERCs}} \times \frac{3.39 \text{ gpm}}{\text{irr. acre}} = 0.00 \text{ gpm}$$

Commercial Use:

Indoor

$$7 \text{ ERCs} \times \frac{800 \text{ gpd}}{\text{ERC}} \times \frac{1 \text{ day}}{24 \text{ hr}} \times \frac{1 \text{ hr}}{60 \text{ min.}} = 3.89 \text{ gpm}$$

Outdoor (Assume 0% of ERCs)

$$0 \text{ ERCs} \times \frac{1 \text{ acre}}{3 \text{ ERCs}} \times \frac{3.39 \text{ gpm}}{\text{irr. acre}} = 0.00 \text{ gpm}$$

Total Existing Required Source Capacity =	**13.33 gpm**
Total Available Source Capacity =	**37.50 gpm**
Estimated Existing Source Capacity Surplus =	**24.17 gpm**

The calculations show that Wilson Arch SSD currently has a source capacity *surplus* of 24.17 gpm while staying in compliance with the *Rules*.

4.3 PROJECTED REQUIRED SOURCE CAPACITY

The total projected number of ERCs of each category is used to calculate the required source capacity. As noted above, it will be assumed that the number of residential ERCs that use secondary water for irrigation purposes will remain at zero through the planning period.

The 20-year projected source capacity requirement is calculated as follows:

Projected Required Source Capacity - 20 Yrs

Residential Use:

Indoor

$$51 \text{ ERCs} \times \frac{800 \text{ gpd}}{\text{ERC}} \times \frac{1 \text{ day}}{24 \text{ hr}} \times \frac{1 \text{ hr}}{60 \text{ min.}} = 28.33 \text{ gpm}$$

Outdoor (Assume 0% of New Indoor)

$$0 \text{ ERCs} \times \frac{1 \text{ acre}}{3 \text{ ERCs}} \times \frac{3.39 \text{ gpm}}{\text{irr. acre}} = 0.00 \text{ gpm}$$

Commercial Use:

Indoor

$$63 \text{ ERCs} \times \frac{800 \text{ gpd}}{\text{ERC}} \times \frac{1 \text{ day}}{24 \text{ hr}} \times \frac{1 \text{ hr}}{60 \text{ min.}} = 35.00 \text{ gpm}$$

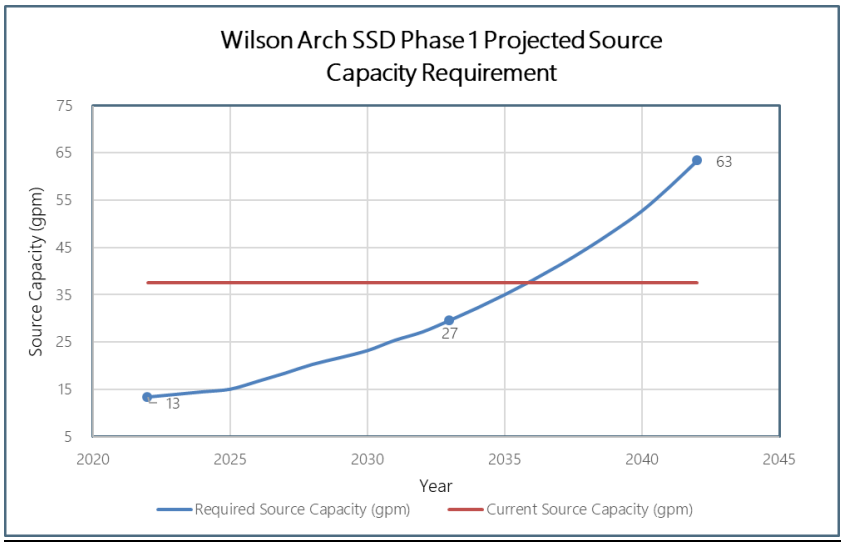
Outdoor (Assume 0% of ERCs)

$$0 \text{ ERCs} \times \frac{1 \text{ acre}}{3 \text{ ERCs}} \times \frac{3.39 \text{ gpm}}{\text{irr. acre}} = 0.00 \text{ gpm}$$

Total Projected Required Source Capacity =	**63.33 gpm**
Total Available Source Capacity =	**37.50 gpm**
Estimated Projected Source Capacity Deficit =	**(25.83) gpm**

The calculation above shows that Wilson Arch SSD has a 20-year projected source capacity d*eficit* of 25.83 gpm. Wilson Arch SSD's projected source capacity requirement over the 20-year planning period is shown below in Figure 4.3.1.

Figure 4.3.1: Projected Source Capacity Requirement



4.4 RECOMMENDED SOURCE CAPACITY IMPROVEMENTS

According to the requirements set forth by the Rules, Wilson Arch SSD has a current source capacity surplus of 24.17 gpm and a projected deficit of 25.83 gpm by the end of the 20-year planning period. This is to say that by the time full buildout of Phase 1 is complete Wilson Arch SSD source capacity will have a 25.83 gpm deficit.

The well drillers logs indicate that the wells yielded more water than is currently being taken. Well 3 yielded nearly 40 gpm under an air lift test that was conducted after it was drilled. However, this is not enough information alone to determine the safe yield of the well, which is considered the maximum flow rate that should be taken from a well. We recommend that Wilson Arch SSD start by verifying the safe yield of each current well.

If no improvements can be made to the wells to increase capacity, we recommended that Wilson Arch SSD develop Well 4 by the year 2036 to anticipate source capacity requirements needed for the full buildout of Phase 1. Drilling Well 4 does not guarantee the addition of sufficient source capacity because flow from Well 4 cannot be predicted with certainty. A strategy to prepare for insufficient flow from Well 4 is to obtain required permits and plan locations for additional wells to be drilled on the west side. Discussion with Wilson Arch SSD representatives indicated that this is a future possibility for later stages of development. This strategy would allow quick response if Well 4 did not produce enough flow and would prepare Wilson Arch SSD for further development after Phase 1 is complete.

5.0 STORAGE CAPACITY ANALYSIS

5.1 EXISTING STORAGE CAPACITY

Wilson Arch SSD has three operational storage tanks with a combined storage volume of 80,000 gallons, see table 5.5.1 Each cylindrical fiberglass tank is buried, the 20,000-gallon tank on the east side of the Highway and the two connected 30,000-gallon tanks on the west side of the Highway. A summary of the water storage tank capacities is shown in table 5.1.1. According to a sanitary survey conducted in 2018 Wilson Arch SSD was not found deficient in sanitary requirements. This analysis assumes that this survey included the storage tanks and that they meet lid, vent, drain, and overflow requirements.

Table 5.1.1: Wilson Arch SSD Existing Storage Tank Capacities

Structure	Material	Capacity (Gal)
East Side Storage Tank	Fiberglass	20,000
West Side, West Tank	Fiberglass	30,000
West Side, East Tank	Fiberglass	30,000
Total Storage Capacity		**80,000**

5.2 EXISTING REQUIRED STORAGE CAPACITY

Water storage capacity requirements are separated into three categories, which are indoor, outdoor, and fire protection. The *Rules* require a minimum storage capacity of 400 gallons per day per connection for indoor use.

As noted in previous sections of this master plan, each of the 24 existing connections and all future connections are not expected to use culinary water for irrigation now or in the future.

Wilson Arch is in climate zone 3 which, according to the *Rules*, requires that 2,528 gallons of storage be provided per irrigated acre.

San Juan County Fire Marshal has given Wilson Arch SSD a 500-gpm fire flow requirement. Letters from San Juan County Fire Marshal and other relevant authorities indicate that the time basis of this requirement is 2 hrs. Therefore, the minimum recommended fire flow used in this master plan is 500 gpm for a duration of two hours. This is significantly lower than the typical 1000 gpm minimum requirement. Discussion with Wilson Arch SSD representatives indicated that this exemption requires commercial lots to provide their own fire suppression system. Such an agreement is very unique. If fire flow requirements change and increase in the future, the water system analysis must be promptly reevaluated to prevent the water system from being compromised. The uniqueness of the reduced fire flow requirement puts greater responsibility on Wilson Arch SSD. The team recommends that Wilson Arch SSD establish a detailed fire response plan with the surrounding communities to ensure that a flow of more than 500 gpm is not drawn from the system.

Based on the above information, the existing required storage capacity is calculated as shown below.

Existing Required Storage Capacity:

Residential Use:

Indoor

17 ERCs x (400 gal. / ERC) = 6800 gal.

Outdoor (Assume 0% of ERCs)

0 ERCs x (1 acre / 3 ERCs) x (2528 gal / irr. acre) = 0 gal.

Commercial Use:

Indoor

7 ERCs x (400 gal. / ERC) = 2800 gal.

Outdoor (Assume 0% of ERCs)

0 ERCs x (1 acre / 3 ERCs) x (2528 gal / irr. acre) = 0 gal.

Fire Protection:

500 gal./min x 2 hr. x (60 min. / hr) = 60000 gal.

Total Current Required Storage Capacity =	**69,600 gal.**
Total Existing Storage Capacity =	**80,000 gal.**
Estimated Existing Storage Capacity Surplus =	**10,400 gal.**

Wilson Arch SSD has an existing storage capacity surplus of 10,400 gallons according to the *Rules*.

5.3 PROJECTED REQUIRED STORAGE CAPACITY

The analysis calculates projected required storage capacity at the end of the 20-year planning period using the total projected ERCs for each category. As noted in previous sections of this master plan, each of the 24 existing connections and all future connections are not expected to use culinary water for irrigation now or in the future.

Based on the information above and the total number of ERCs, the following calculations for projected storage capacity are performed:

Projected Required Storage Capacity - 20 Yrs

Residential Use:

Indoor

51 ERCs x (400 gal. / ERC) = 20400 gal.

Outdoor (Assume 0% of New Indoor)

0 ERCs x (1 acre / 3 ERCs) x (2528 gal / irr. acre) = 0 gal.

Commercial Use:

Indoor

63 ERCs x (400 gal. / ERC) = 25200 gal.

Outdoor (Assume 0% of ERCs)

0 ERCs x (1 acre / 3 ERCs) x (2528 gal / irr. acre) = 0 gal.

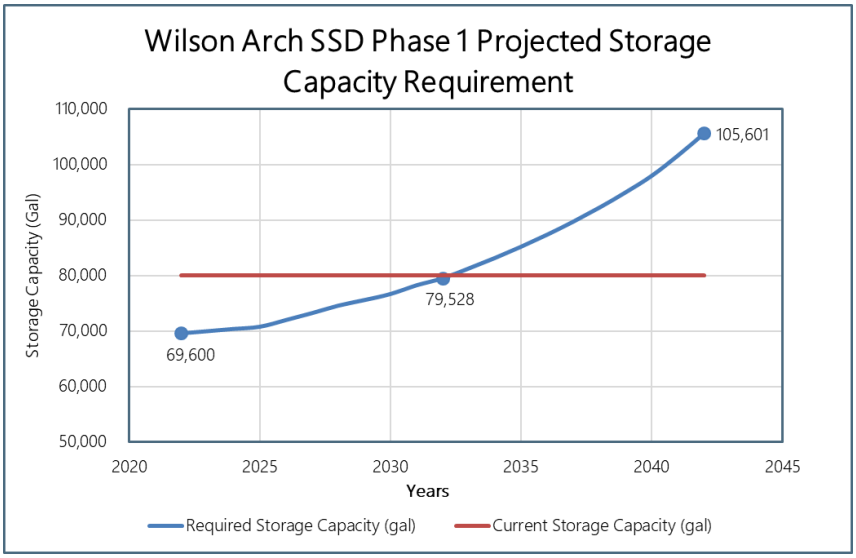
Fire Protection:

500 gal./min x 2 hr. x 60 min./hr = 60000 gal.

Total Projected Required Storage Capacity =	**105,600 gal.**
Total Existing Storage Capacity =	**80,000 gal.**
Estimated Projected Storage Capacity Deficit =	**(25,600) gal.**

According to the *Rule's* requirements, Wilson Arch has a projected storage capacity *deficit* of 25,600 gallons at the end of the 20-year planning period. Figure 5.3.1 illustrates the projected required storage capacity.

Figure 5.3.1: Projected Storage Capacity Requirement



5.4 RECOMMENDED STORAGE CAPACITY IMPROVEMENTS

This analysis recommends the Wilson Arch SSD consider adding additional water storage to their system. Projected storage capacity requirement will reach current storage capacity by the time that Phase 1 buildout is half complete. Wilson Arch SSD needs to add an additional 25,600 gallons (minimum) of storage by the year 2032. The community, located within view of the iconic Wilson Arch, has strong desires to preserve scenery. Therefore, using methods of concealment are a strong priority. Such methods would incur added cost but could include burying the tank or using natural-colored paints. If installed correctly, a buried tank offers safety and protection advantages.

It is recommended an additional 30,000-gallon storage tank be buried and connected to the current 30,000-gallon tanks on the west side. The quantity will increase the total storage to 110,000 gallons, approximately 5% greater than projected need. Fiberglass is recommended for decreased construction costs and its ability to be buried. The useful life will be less than that of a concrete tank, which is an attractive alternative. A buried concrete tank has higher construction cost but would have a longer useful life if installed correctly. Wilson Arch SSD has a very small population despite its projected growth. The ability to raise significant funds now for projected need is smaller than a large municipality. For this reason, greater priority for decreased upfront construction cost is considered. Should Wilson Arch SSD choose to add more than 30,000 gallons of storage this analysis recommends that a concrete tank be chosen. A new fiberglass tank must adhere to all sanitary requirements including but not limited to lid, vent, drain, and overflow requirements. Assuming that the existing tanks were part of the compliant sanitary survey conducted in 2018, the new tank may be of comparable design.

6.0 WATER TREATMENT REQUIREMENTS

The system requires no treatment, and this analysis gives no projections for future treatment requirements.

7.0 DISTRIBUTION SYSTEM ANALYSIS

This report analyzes the Wilson Arch SSD distribution system for compliance with the *Rules*. The analysis is based on a review of the existing system's physical attributes and topography. It also considers outputs from a hydraulic model of the Wilson Arch SSD water system.

7.1 COMPUTER MODEL OF THE DISTRIBUTION SYSTEM

The project team modeled the existing Wilson Arch SSD culinary water distribution system using InfoWater, a hydraulic modeling program. The project team created the hydraulic model using existing maps of the system and information obtained from Wilson Arch SSD representatives. The model simulates scenarios including average day conditions, peak instantaneous demand, and peak day demand under fire flow conditions. During the fire flow analysis, the program calculates the maximum design fire flow at each of the nodes on the system without causing the residual

pressure at any node in the system to fall below 20 psi, which is the minimum pressure allowed by the *Rules*.

Exhibit 1 shows the existing system map and the model output data for the existing system under the current average day conditions.

The model analyzes the projected system demands based on the projected growth rate and determines what impacts these projected demands may have on the system. Plat maps of planned development guided the creation of the model. Any distribution system analysis beyond the 20-year planning period is not recommended at this point. Wilson Arch SSD should update this plan and hydraulic model on a regular basis.

7.2 SYSTEM ANALYSIS

7.2.1 Minimum Pressures and Demands

The *Rules* require that distribution systems equipped with fire hydrants shall be designed to ensure that a minimum of 20 psi exists at all points within the system when fire flows are imposed on the system on top of peak day demand flows. For systems constructed after January 2007, the minimum residual pressure at peak day demand is 40 psi and the minimum dynamic pressure at peak instantaneous demand is 30 psi. The Utah DDW encourages existing systems to meet the new rule requirements whenever possible.

Average Day Demand

According to the *Rules,* the required storage capacity in a system should represent the quantity of water required by the system during an average day, which is 400 gpd/ERC.

Peak Day Demand

Because Wilson Arch SSD has fire hydrants in its distribution system, the analysis considers peak day demand with an imposed fire flow in the computer model. According to the *Rules,* the peak day demand is the anticipated water demand on the day of highest water consumption. This is also the value used to estimate the required source capacity for the system, 800 gpd/ERC.

Peak Instantaneous Demand

The peak instantaneous demand represents the point of maximum usage in the system and typically occurs during the hottest part of the year when indoor and outdoor usages are the highest. The peak instantaneous demand will be estimated by applying a peaking factor of two to the peak day demand.

7.2.2 System Pressures

7.2.2.1 Current Pressures

The analysis broke the existing water system down into two separate systems, one on the east side of Highway 191 one on the west side of Highway 191. For both the east and west sides, pressure is

provided by booster pumps. These pumps act as boosters for each side of the system since the tanks for each side are not elevated. The pumps on the west side include two 6CHC Goulds and two Berkley pumps, which are equipped with a pressure sensor. According to pump curves provided by APE, the design point of the Goulds pumps are 250 gpm at 180 ft of head. The design of the Berkley pump is 50 gpm at 160 ft of head. The east side has one Sta-Rite pump, one Munro pump, and two hydro-tanks that keep the east side pumps from activating every time there is a small pressure drop in the system. Information obtained indicates that the Sta-Rite pump design rating is 30 gpm at 210 ft of head. Information for the Monroe pump provided by Wilson Arch SSD does not appear to be filed correctly and exact output is not certain. It is possible that it was replaced at some point with a similarly sized Berkley pump. Outside information suggests that the 3 hp 3 phase Monroe pump or comparable Berkley pump has a flow output between 30-50 gpm and 160-210 ft of head. For a level of redundancy, the analysis did not include the largest pump on each booster system in the model calculations. This is a standard practice for providing a factor of safety if a pump fails during the planning period. The model provides pressure and flow values with an assumed safety factor of one backup pump per booster system. The current peak instantaneous demand pressures on the west side range from approximately 46 psi to 81 psi. The current peak instantaneous demand pressures on the east side range from approximately 52 psi to 81 psi. For this system, pressure is dependent on the pumps and elevation differences at each node. As currently configured, the existing culinary water system can maintain adequate pressures under existing peak instantaneous demands on both the east and west sides.

Exhibit 1 shows existing average day pressures in the system. Exhibit 2 shows dynamic pressures under current peak instantaneous demand.

7.2.2.2 Projected Pressures

On the west side, system pressures for the 20-year projected peak instantaneous demands range from approximately 46 psi to 81 psi, which doesn't differ significantly from current peak instantaneous demand. The capacity of the three pumps is the reason the pressures don't differ significantly on the west side. The total flow capacity of the pumps on the west side is large enough that the increased future demand doesn't cause the pressure to decrease significantly in the model.

The east side boosters cannot meet the future demand on the system. The model predicts that under 20-year projected peak instantaneous demands, the east side system pressures will not provide enough flow to meet demands. This means that by the completion of Phase 1 buildout, the east side pressures would often fall below the minimum values the Rules require. Low pressures can be harmful to existing infrastructure and can potentially introduce bacteria into the culinary water system. Recall from section 7.2.1 that the *Rules* require pressure to remain above 20 psi. Failure to maintain the minimum required pressure is significant cause for concern and should be addressed before full Phase 1 buildout is reached. Dynamic pressures under projected peak instantaneous demands are shown in Exhibit 4.

7.2.3 Hydrants & Fire Flow

The *Rules* require 8-inch minimum pipelines for new distribution pipelines in systems with fire hydrants unless it can be demonstrated using computer modeling that a smaller main line will meet minimum fire flow requirements without dropping any other model node in the system below 20 psi. The *Rules* require systems with fire hydrants to provide the minimum fire flow capacity as directed by the local fire authority, or the minimum fire flow allowed by the State adopted fire flow in the absence of direction from the local fire authority. According to documentation provided by Wilson Arch SSD, the San Juan County Fire Chief determined the minimum required fire flow for the system to be 500 gpm. Letters received by Wilson Arch SSD indicate two hours as the time basis of this requirement. This report assumes this requirement stays constant throughout the duration of the planning period. This fire flow is significantly lower than the typical 1000 gpm minimum standard. Discussion with Wilson Arch SSD indicates that the exemption requires the HOA to require all commercial facilities to provide their own fire suppression. This analysis must be promptly revised if the fire flow requirement given by local authority changes.

7.2.3.1 Current Fire Flow

According to the model, the west side fire flow capacity under current peak day conditions ranges from 527 gpm to 562 gpm. This range meets the requirements set by the San Juan County Fire Marshall.

Under the same conditions, the model predicts that current fire flow capacities on the east side stay consistently near 38 gpm, well below the required 500 gpm. Model results show flow on the east side is limited significantly by the flow capacity of the booster pump. The pipe diameters on the east side are small in general and the nodes do vary in elevation. However, since the pump capacity limits by such a large margin these factors play a minor role in limiting fire flow capacity. This explains why there is such little variance in flow for the nodes on the east side. See Exhibit 3 for a map of current fire flows under peak day conditions.

7.2.3.2 Future Fire Flow

Phase 1 buildout is expected to create significant demand increase on the system, which is to say that as growth occurs a greater amount of water is expected to be drawn from the system. According to the model, the west side fire flow capacity under future peak day conditions ranges from 507 gpm to 538 gpm. Exhibit 5 shows the nodal analysis computed by the hydraulic model.

The model predicts that future fire flow capacities on the east side stay near 15 gpm, well below the required 500 gpm. See Exhibit 5 for flow under future peak day demands for both the east and west side.

7.2.4 Pipes & Loops

Information gathered from Wilson Arch SSD indicates that most of the pipe used in the culinary water distribution system is schedule 40 PVC that is 20 years old. Wilson Arch SSD believes most the pipe on the west side is 6-inch diameter and that on the east side most pipe is 4-inch diameter.

According to drawings provided by Wilson Arch SSD, the current system has no looping segments. Not only does the system have no loops, but it is also separated by Highway 191. The separation has a dramatic effect on fire flow because it keeps the pumps on each side from helping each other in high demand conditions. It also raises storage concerns because the east side depends entirely on the smaller 20,000-gallon storage tank.

7.3 RECOMMENDED DISTRIBUTION SYSTEM IMPROVEMENTS

This report recommends immediate action be taken to increase fire flow capacity to the east side of the culinary water distribution system. Low booster pump capacity is the most significant factor limiting the system. The addition of an 8-inch diameter line that connects the west and east sides will have a large impact on fire flow. Connecting the two sides will allow the large pumps on the west side to help the east side. It will also make the water storage on the west side available to the east side, which is important. A fire flow rate of 500 gpm is an order of magnitude larger than the total flow rate that can be taken from all the system wells combined, which means that essentially all the water required to fight a fire will come from stored supply. To meet fire storage requirements on its own, the east side would need a total of 60,000 gallons when it currently only has 20,000 gallons. By connecting the two sides, the 60,000 gallons of storage on the west side will become available to the east. Connecting the two sides will also create greater redundancy, which adds a factor of safety should a pump fail.

The hydraulic model allows many what-if scenarios to be observed. An 8-inch diameter line connecting the two sides is a relatively simple solution to increase fire flow dramatically. With the connecting line alone fire flow values remained near 400 gpm for most of the east side system and some of the west side nodes begin to drop below 500 gpm. Although helpful, further looping and increases in pipe diameter on the east side alone is insufficient in providing it with required fire flow. Therefore, it is recommended that pump capacity be increased on the east side as well.

Records obtained from Wilson Arch SSD indicate that on the east side, the smaller Sta-rite pump, was installed in 2018 and isn't due for replacement until 2033. The larger Munro pump, which was reserved as a backup in the model, was due for replacement in 2017 according to Wilson Arch SSD records. There is question whether this pump was replaced by a similarly sized Berkley pump in the recent past. To meet fire flow requirements in either case, it is recommended that Wilson Arch SSD add a new pump to the east booster system. To maintain a backup pump at this booster system, this report recommends Wilson Arch SSD replace the Munro pump with a pump that has a capacity equal to the new one. Horsepower, diameter, brand, and control system specifications are beyond the scope of this report. For modeling purposes, specifications for a 5CHC007 Goulds pump were added to the east side booster system. If a larger pump was selected it is possible to

get required fire flow from nearly all areas of the system, but such a pump would have higher operational and replacement costs. This report recommends that Wilson Arch SSD make pipe improvements in conjunction with smaller pump improvements. This report recommends Wilson Arch SSD replace approximately 1,100 ft of existing line with an 8-inch line north of the proposed connection on the east side and add approximately 600 ft of new 4-inch line to close loops. This will allow the fringes of the system to have sufficient fire flow while only making essential pumping improvements on the east side.

Exhibit 7 shows the projected available fire flow with these system improvements. According to the results from the model, the 20-year projected available fire flow ranges from approximately 577 gpm to 760 gpm with the recommended improvements.

Connecting the two sides will require the two pump control systems to be adjusted to keep the pressures in the system within range and will require a bore under Highway 191. Setting the pumps on the east and west side to the same hydraulic grade line is possible according to the model and will allow the pumps on each side to work together. To simulate setting the pump control systems to the same hydraulic grade line in the model, pump pressure on the east was set governed at 60 psi and pump pressure on the west was set at 79.5 psi. With these controls in place, dynamic pressures under a 20-year projected peak instantaneous demand would range from approximately 42 psi to 101 psi, see Exhibit 6. High-pressure points are seen as a necessary consequence of keeping the east and west sides connected and operating in concert. To remedy the locations that exceed 90 psi this report recommends that Wilson Arch SSD add pressure reducing valves at existing and future residential connections in the high-pressure zones. Adding the pressure reducing valves at residential connections will be more cost effective than adding them into the main line.

8.0 CAPITAL IMPROVEMENTS PLAN

8.1 SUMMARY OF RECOMMENDED IMPROVEMENTS

The culinary water planning period for Phase 1 begins with the year 2022 and ends with the year 2042. This is a long stretch of time and not all the recommendations made for the planning period need to be made at the same time. A breakdown of the 20-year planning period and corresponding recommendations are given. The timeline should be considered a minimum recommended timeline for implementation only. Improvements can be made sooner than the timeline specifies.

8.1.1 Immediate Improvements (0-6 Years)

Distribution System – This report recommends that Wilson Arch SSD take immediate action to increase fire flow on the east side of the system to meet requirements set forth by the San Juan County Fire Marshal. This report recommends that Wilson Arch SSD complete these improvements within the next 6 years.

- Install a new 8-inch PVC pipe connecting the east side to the west side. Location for that pipe is flexible but could be placed following the property lines of parcel G, under Highway 191, and along the southern line of lot 19. The line should avoid Tract C-1 which is a leech field.
- Replace the existing 6-inch and 4-inch PVC pipe with 8-inch PVC starting at the new east-west connection. It should run approximately 1,100 ft up along the eastern edge of Lots 20, 18, 21, and 23. Line replacement should terminate at the property line of Lots B-1 and B-2.
- Install a new booster pump on the east side in parallel with the existing Sta-Rite pump and replace the outdated Munro pump on the east side with one of equal capacity. Addition of a pump producing a maximum flow rate of 215 gpm at 100 ft of head is shown by the model to provide minimum hydraulic requirements. Further pump and control system specifications and are not given in this report. If the Munroe pump was recently replaced by a similarly sized Berkley pump it may stay and the new pump should be added in parallel.
- Pressure reducing valves are to be installed on residential connections at nodes exceeding 90 psi, as seen in Exhibit 6. This includes current and future connections.
- Install water meters on existing connections and install new fire hydrants.

Table 8.1.1 below shows the estimated costs of the recommended immediate improvements for years 2022-2028. Complete engineer's opinions of probable costs for these improvements are provided in Appendix B.

Table 8.1.1 Summary of Immediate Phase 1 Improvements

WILSON ARCH SSD IMMEDIATE PHASE 1 IMPROVEMENTS	
IMPROVEMENT	EST. COST
INSTALL METERS ON NEW AND EXISTING CONNECTIONS	$100,300
PUMP CAPACITY INCREASE	$80,000
NEW 8" AND 4" LINES	$203,300
REPLACE EXISTING 4" AND 6" PVC PIPE WITH 8"	$157,150
MOBILIZATION (10%)	$55,000
CONTINGENCY (20%)	$119,150
INCIDENTALS & PROFESSIONAL SERVICES	$162,500
TOTAL	**$877,400**

8.1.2 Future Improvements for Phase 1 Development

Storage Tank- Wilson Arch SSD will need to add 25,600 gallons (minimum) of culinary water storage by the year 2032 to accommodate projected growth of Phase 1 development. Location for this tank is optimal near the existing tanks on the west side. Burying the tank will incur added cost but will add a degree of security and will fall best in line with the community's goal to preserve scenery.

This report recommends that Wilson Arch SSD bury an additional 30,000-gallon fiberglass storage tank and connect it to the current 30,000-gallon fiberglass tanks on the west side. If Wilson Arch SSD chooses to increase capacity by more than 30,000-gallons, this report recommends a concrete tank. The recommended fiberglass tank must adhere to all sanitary requirements including but not limited to lid, vent, drain, and overflow requirements. Assuming that the existing tanks were part of the compliant sanitary survey conducted in 2018, the new tank may be of similar construction.

Culinary Well #4 – This report recommends that Wilson Arch SSD investigate further the yield of its current wells. There is question whether the current wells could yield more water than is currently being taken. Well driller logs alone are insufficient in determining definitively whether the wells can produce a safe yield greater than what is being produced currently. This report recommends that Wilson Arch SSD verify the safe yield of the current wells to determine if they could be refitted to produce more water. If the safe yield of the wells is less than or equal to 12.5 gpm, this report recommends that Wilson Arch SSD develop Well 4 by the year 2036 to accommodate source capacity requirements needed for the full buildout of Phase 1.

Table 8.1.2 below shows the estimated costs of the recommended future improvements. Complete Engineer's Opinions of Probable Costs for these improvements are provided in Appendix B.

Table 8.1.2. Summary of Future Phase 1 Improvements

WILSON ARCH SSD FUTURE PHASE 1 IMPROVEMENTS	
IMPROVEMENT	EST. COST
CONSTRUCT 30,000 GAL FIBERGLASS STORAGE TANK	$150,000
CONSTRUCT NEW CULINARY WELL	$463,100
WELL EQUIPPING	$376,500
CONSTRUCTION MOBILIZATION & CONTINGENCY	$353,920
INCIDENTALS & PROFESSIONAL SERVICES	$265,000
TOTAL	**$1,608,520**

Wilson Arch SSD may choose to complete all Phase 1 improvements immediately as one project. Table 8.1.3 below shows a summary of these costs and Appendix B gives a full breakdown.

Table 8.1.3. Summary of Combined Phase 1 Improvements

WILSON ARCH SSD COMBINED PHASE 1 IMPROVEMENTS	
IMPROVEMENT	EST. COST
CONSTRUCT NEW CULINARY WELL	$463,100
WELL EQUIPPING	$376,500
CONSTRUCT 30,000 GAL FIBERGLASS STORAGE TANK	$150,000
NEW 8" AND 4" LINES	$203,300
INSTALL METERS ON NEW AND EXISTING CONNECTIONS	$100,300
REPLACE EXISTING 4" AND 6" PVC PIPE WITH 8"	$157,150
PUMP CAPACITY INCREASE	$80,000
MOBILIZATION (10%)	$200,000
CONTINGENCY (20%)	$346,070
INCIDENTALS & PROFESSIONAL SERVICES	$404,500
TOTAL	**$2,480,920**

8.2 PROJECT FUNDING

There are three primary funding agencies that typically fund large culinary water improvement projects in the State of Utah, which include USDA Rural Development Services (USDA-RD), Division of Drinking Water - Drinking Water Board (DDW), and the Permanent Community Impact Board Fund (CIB). Each agency has its own criteria and precedent for authorization of limited grant funds. DDW, USDA-RD, and CIB offer low interest loan funds and grant funds to allocate to projects.

Grant eligibility for the DDW is based on a community's Median Adjusted Gross Income (MAGI) as published by the DDW each year and the community's current water rates. The threshold for grant eligibility is typically reached when a community's water system obligations require the average monthly water rate (base rate plus overages) to exceed 1.75% of the monthly MAGI. Wilson Arch SSD does not have a specific MAGI listed by the DDW, because census data is not collected for Wilson Arch SSD individually. The nearest zip code listed are those for La Sal, which are reported as $38,300. For purposes of this report, a MAGI of $38,300 will be assumed. If this assumed MAGI is to be used, then 1.75% would be $670/Year or approximately $55.85/month.

Wilson Arch SSD collects a base rate of $255 per quarter or $85 per month from 18 connections currently. According to records provided by Wilson Arch SSD, the existing commercial connection is currently being billed equally with the existing residential connections. Typical water systems bill per ERC, which makes the payment by commercial connections greater than residential connections. For purposes of this report, the conceptual financing plan assumes this billing strategy. Actual billing strategy is at the discretion of Wilson Arch SSD.

DDW funding for eligible communities is determined on a case-by-case basis. Although the Wilson Arch SSD base rate exceeds the 1.75% monthly MAGI threshold, most of the community is comprised of secondary homes and 100% loan is a realistic scenario. The DDW typically offers loan terms of 1% - 2.5% over 20 – 30 years.

The USDA-RD uses a slightly different parameter, termed the Median Household Income (MHI), to determine grant eligibility. Again, Wilson Arch SSD has no discrete MHI value assigned, so the MHI of the nearest municipality, La Sal, will be assumed. For purposes of this report $54,718 will be the assumed MHI. This MHI is above the $47,860 MHI threshold for receiving USDA-RD grants. Wilson Arch SSD would be expected to receive only loan from USDA-RD. The current typical USDA-RD loan conditions are 2.50% over 40 years.

Conceptual financing plans have been prepared and included in Appendix D for two scenarios, which are typical stand-alone funding packages from each of the two funding agencies mentioned above. The financing plans were created to cover the project costs for immediate improvements only. The conceptual funding plans hinge on the assumptions made regarding MAGI and MHI. Actual MAGI and MHI values used in determining funds will come down to the discretion of each respective funding agency. To determine the most accurate estimated rate required to cover loans and expenses, this report takes the average rate of the two scenarios presented in Appendix D.

The resulting average water rate required to cover the current estimated system costs and the projected new debt service for immediate improvements only would be approximately $271.56/month per ERC.

Appendix D also includes separate conceptual financing plans for two scenarios where all recommended improvements are completed as one project. One scenario is a loan by USDA-RD, the other is a loan by DDW. The average monthly rate of these two plans is $605.29/ERC.

9.0 PHASE 2 ANALYSIS

According to Wilson Arch SSD business plans, Phase 2 of development is a possibility. Per request of Wilson Arch SSD, projections for Phase 2 have been calculated. To do this, the analysis assigns a twenty-year planning period to Phase 2 of development. This analysis uses the same methods described previously and will not restate them. Instead, it will reference the methodology described in previous sections as needed.

It's noted that this analysis addresses Wilson Arch SSD. In most municipalities, the extension of utilities to accommodate additional development is typically the responsibility (cost) of the developer. Although Phase 2 of this report addresses Wilson Arch SSD and gives them a tool for making business decisions, the costs of developing Phase 2 infrastructure will ultimately be the responsibility of the developing entity.

This analysis estimated the number of ERCs needed at full buildout of Phase 2 by using developmental plat maps provide by Wilson Arch SSD. According to the maps 73 residential lots and 0 commercial lots are set aside for Phase 2 development. This analysis considers 1 residential lot as 1 ERC.

Section 2.3 demonstrates that 51 Residential and 63 Commercial connections are required for buildout of Phase 1. The Phase 2 analysis projects that an additional 73 ERCs are required for phase 2 buildout.

The water right analysis for Phase 1 shows a projected surplus of 59.42 acre-ft. Phase 2 buildout will require an additional 32.71 acre-ft of water right, reducing the water right surplus to 26.71 ac-ft. With the same assumptions specified in Section 3.0, this report finds that Wilson Arch SSD will have sufficient water right for both Phase 1 and Phase 2 development.

Section 4.0 determined that Wilson Arch SSD will have a projected source capacity deficit of 25.83 gpm. Phase 2 buildout will require an additional 40.56 gpm of source capacity, which increases the projected source capacity deficit to 66.39 gpm if no Phase 1 improvements are considered.

Section 5.0 established that Phase 1 buildout will have a storage capacity deficit of 25,600-gallons. Phase 2 buildout will require an additional 29,200-gallons of storage, which increases the storage capacity deficit to 54,800-gallons if no Phase 1 improvements are considered.

9.1 PHASE 2 DISTRIBUTION SYSTEM ANALYSIS

The Phase 2 distribution system analysis was performed following the same process described in Section 7, which the reader may use as a reference for definitions and methods.

9.1.1 Existing and Projected Pressures

As described in Section 7.2.2.1, the existing pressures of the system are within a range that complies with requirements set forth by the *Rules*. The existing peak instantaneous demand pressures on the west side range from approximately 46 psi to 81 psi. The current peak instantaneous demand pressures on the east side range from approximately 52 psi to 77 psi. Exhibit 1 shows existing average day pressures and Exhibit 2 shows existing peak instantaneous pressures.

On the west side, system pressures for Phase 2, 20-year projected, peak instantaneous demands range from approximately 46 psi to 80 psi. On the east side, system pressures are projected to be insufficient. This means that at full Phase 2 buildout the east side pressures will not be met. Keep in mind that these projected pressures do not consider the recommended improvements for Phase 1.

9.1.2 Existing and Projected Fire Flow

As determined in Section 7.2.3.1 west side existing fire flow capacity under existing peak day conditions ranges from 528 gpm to 560 gpm. Under the same conditions, the model predicts that existing fire flow capacities on the east side are consistently near 39 gpm. See Exhibit 3 for a map of existing fire flows under peak day conditions.

At full buildout of Phase 2 plans, the west side is predicted to have fire flow ranging from 404 gpm to 451 gpm under future peak day demands. Throughout the east side portion of the system, fire flow projections stay near 13 gpm. It appears in the model that the pump capacity is the most significant limitation on the east side. Keep in mind that these projected flows do not consider the recommended improvements for Phase 1.

9.1.3 Proposed Distribution System Improvements

To address observed deficiencies and plan for future growth, multiple scenarios were tested by the hydraulic model. In the calculations, fire flow on the east side is most significantly impacted by pump capacity. The current pumps on the east side support the system under average day conditions but don't have near the capacity to meet fire flow demands. Not only is the fire flow rate too low, but the fire storage on the east side is considered insufficient as well. Even on the west side, Phase 2 development creates too much demand for the west side pumps to handle fire flow on their own. The most effective way to solve existing deficiencies is to implement the recommendations summarized in Section 8.1.1

In addition to the recommendations summarized in Section 8.1.1, this report recommends that Wilson Arch SSD construct additional new water lines that can be visualized in Exhibit 8. New proposed water lines border anticipated roadways and property lines specified in plat maps provided by Wilson Arch SSD representatives. Easements and lot planning should include

provisions for the proposed water line to pass through lot 79 and 55. Easements should follow lot boundaries when possible. New line placement considers looping while prioritizing cost of implementation. Looping significantly impacts fire flow capacity and should be implemented as presented in Exhibit 9. Greater looping could be achieved, but natural geographic barriers would make further looping improvement costly. The project team recommends that new terminal lines be 4-inch in diameter and new main lines be 8-inch in diameter. As drawn, 500 gpm fire flow can be narrowly achieved in newly developed areas with only a 6-inch main line. However, the added expense of a larger diameter line is justified by potential costs that could be saved if the fire flow requirements ever increased. In addition to the new lines, it is recommended that a small section of 6-inch lined extending from the pump to new improvements be replaced with 8-inch.

With each of these proposed improvements, the fire flow rate across the system is expected to range from 571 gpm to 714 gpm if the southernmost node is discounted. See Exhibit 9 for a visual of flow across the proposed system. With each of the proposed improvements, pressure under future peak instantaneous demand is projected to range from 42 psi to 101 psi. To visualize the pressure range across the system, refer to Exhibit 8. Pressure above 90 psi can damage household connections. To remedy this, it is recommended that pressure reducing valves be placed between the distribution system residential connections at the locations where pressure exceeds 90 psi. It is possible to build these valves into the distribution lines directly, but the costs associated would be greater than adding the valves at the residential connection points.

9.2 PHASE 2 CAPITAL IMPROVEMENTS PLAN

Sunrise Engineering recommends that Wilson Arch SSD make improvements to source capacity, storage capacity, and the distribution system to accommodate Phase 2 growth. This includes improvements recommended for Phase 1 development. Although required for Phase 2 development, Phase 1 improvements are not restated in this section. Phase 1 improvements are not recounted in the Phase 2 estimate of additional probable cost found in Appendix C either. The total cost estimate of improvements needed for Phase 2 development is the sum of the costs found in Appendix B and C.

Distribution System – In addition to the distribution improvements given in Section 7.3, Phase 2 development will require that Wilson Arch SSD do the following.

- Install approximately 7300 ft of new 8-inch PVC pipe and 3100 ft of new 4-inch PVC pipe extending to new developments on the west side. Replace approximately 425 ft of 6-inch pipe with 8-inch PVC pipe extending from the west side pumps to new developments.
- Install pressure reducing valves between the main line and residential connections at nodes exceeding 90 psi on the newly added lines.

Source Capacity – Section 4.0 determined that Wilson Arch SSD will have a projected source capacity deficit of 25.83 gpm for Phase 1 development. With Phase 2 connections, the projected source capacity deficit increases to 66.39 gpm. In addition to investigating existing well capacity

further and developing Well 4, it is likely Wilson Arch SSD will need to develop at least one additional well on the West side to accommodate Phase 2 growth. It is possible that multiple wells other than Well 4 will have to be developed. To do this, the Wilson Arch SSD should start by ensuring ownership of the rights to the points of diversion located in the Phase 2 development area. According to the DWRi, these are owned by Wilson Arch Properties LLC. The water right to these records allow 8 acre-ft at each point of diversion per year at maximum. This is to say that the water rights owned by Wilson Arch Properties LLC would only allow the addition of 9.92 gpm of source capacity per new well drilled. Output of Well 4 can't be predicted, but if it is assumed for example that it produces 20 gpm and no improvements to existing wells can be made, water right limitations would require at least 5 more wells to be drilled. This report does not give an estimate on the number of wells Wilson Arch SSD should expect to drill because output can't be predicted. The additional cost estimate for Phase 2 estimates that the cost of drilling and equipping one of these wells is nearly $900,000. Only the cost of one well is given in the cost estimate so that Wilson Arch SSD may consider the cost of each well that would have to be drilled. Even though only one well is listed in the additional Phase 2 cost estimate, it should not be inferred that only one additional well is probable. If more wells are needed, the cost for drilling and equipping a new culinary well in Appendix C and Table 9.2 roughly multiplies with each additional well.

Storage Capacity – Phase 1 development requires a storage capacity increase of 25,600 gallons. With the addition of Phase 2 connections, the storage capacity increase required is 54,800 gallons. For a higher upfront cost and lower overall cost, Wilson Arch SSD could choose to construct one 60,000-gallon concrete tank to accommodate the growth of Phase 1 and Phase 2. With only 24 existing ERCs to fund improvements this may not be financially feasible. Instead, this report recommends that, Wilson Arch SSD bury the 30,000-gallon fiberglass tank recommended for Phase 1 growth. Then, once additional storage is required for Phase 2 development, Wilson Arch SSD should bury an additional 30,000-gallon tank. Probable costs for this additional 30,000-gallon tank are given in Appendix C.

Table 9.2 below summarizes the engineer's opinion of additional probable cost for Phase 2 improvements found in Appendix C. Cost includes the construction and equipping of one culinary well. As described previously, it is possible several more wells could be needed. For each additional well that is needed the construction and equipping cost roughly multiplies.

Table 9.2: Summary of Additional Costs For Phase 2 Buildout

WILSON ARCH SSD ADDITIONAL PHASE 2 IMPROVEMENTS	
IMPROVEMENT	EST. COST
NEW 8" AND 4" LINES	$1,053,500
CONSTRUCT 30,000 GAL FIBERGLASS STORAGE TANK	$150,000
CONSTRUCT 1 NEW CULINARY WELL	$463,100
EQUIP 1 WELL	$400,000
CONSTRUCTION MOBILIZATION & CONTINGENCY	$749,320
INCIDENTALS & PROFESSIONAL SERVICES	$439,000
TOTAL	**$3,254,920**

If more wells are required for Phase 2 development the total cost increases roughly by $900,000 per well. The significant variance in the estimate is due to the uncertainty of actual well output.

EXHIBIT 1

EXISTING SYSTEM PRESSURE UNDER AVERAGE DAY DEMANDS

Legend

PRESSURE

- PRESSURE < 20.00 PSI
- PRESSURE = 20.00 PSI ~ 40.00 PSI
- PRESSURE = 40.00 PSI ~ 60.00 PSI
- PRESSURE = 60.00 PSI ~ 90.00 PSI
- PRESSURE > 90.00 PSI

DIAMETER

- 2" PIPE
- 4" PIPE
- 6" PIPE

0 0.045 0.09 Miles

46.63 psi
56.60 psi
62.67 psi
63.53 psi
62.67 psi
64.33 psi
64.40 psi
63.97 psi
75.67 psi
73.07 psi
66.13 psi
78.27 psi
67.87 psi
69.32 psi
74.80 psi
77.83 psi
80.86 psi
75.23 psi
76.93 psi
56.57 psi
60.47 psi
52.67 psi
60.90 psi
Leech Field
73.90 psi
52.23 psi
56.57 psi
70.87 psi
75.20 psi
68.70 psi
68.27 psi
59.17 psi
Leech Field
72.60 psi
64.80 psi
74.77 psi
81.27 psi

Wilson Arch SSD	Current Average Day Demand	SUNRISE ENGINEERING 25 East 500 North Fillmore, Utah 84631 Tel. 435-743-6151 Fax 435-743-7900

EXHIBIT 2

EXISTING SYSTEM PRESSURE UNDER CURRENT PEAK INSTANTANEOUS DEMANDS

Legend

PRESSURE

- PRESSURE < 20.00 PSI
- PRESSURE = 20.00 PSI ~ 40.00 PSI
- PRESSURE = 40.00 PSI ~ 60.00 PSI
- PRESSURE = 60.00 PSI ~ 90.00 PSI
- PRESSURE > 90.00 PSI

DIAMETER

- 2" PIPE
- 4" PIPE
- 6" PIPE

0 0.045 0.09 Miles

46.63 psi
56.60 psi
62.67 psi
63.53 psi
62.67 psi
64.33 psi
64.40 psi
63.96 psi
75.66 psi
73.06 psi
66.13 psi
78.26 psi
67.86 psi
69.31 psi
74.79 psi
77.83 psi
80.86 psi
75.22 psi
76.93 psi
56.56 psi
60.46 psi
52.66 psi
60.90 psi
Leech Field
73.90 psi
52.23 psi
56.57 psi
70.86 psi
75.20 psi
68.70 psi
68.27 psi
Leech Field
72.60 psi
64.80 psi
74.76 psi
81.26 psi

Wilson Arch SSD	Current Peak Instantaneous Demand	SUNRISE ENGINEERING 25 East 500 North Fillmore, Utah 84631 Tel. 435-743-6151 Fax 435-743-7900

EXHIBIT 3

EXISTING SYSTEM FIRE FLOW UNDER CURRENT PEAK DAY DEMANDS

Legend

HYD_DSN_FL

- AVAILABLE FLOW < 50 GPM
- 50 GPM < AVAILABLE FLOW < 200 GPM
- 200 GPM < AVAILABLE FLOW < 500 GPM
- AVAILABLE FLOW > 500 GPM

DIAMETER

- 2" PIPE
- 4" PIPE
- 6" PIPE
- 8" PIPE

0 0.045 0.09 Miles

545.09 gpm
555.05 gpm
558.58 gpm
562.09 gpm
562.09 gpm
562.09 gpm
562.09 gpm
562.09 gpm
562.09 gpm
562.09 gpm
556.10 gpm
556.10 gpm
556.10 gpm
550.34 gpm
554.40 gpm
526.70 gpm
38.43 gpm
38.42 gpm
38.42 gpm
38.34 gpm
38.41 gpm
38.43 gpm
38.44 gpm
38.44 gpm
38.44 gpm
38.43 gpm
38.44 gpm
38.44 gpm
Leech Field
Leech Field

Wilson Arch SSD	Fire Flow Under Current Peak Day Demands	SUNRISE ENGINEERING 25 East 500 North Fillmore, Utah 84631 Tel. 435-743-6151 Fax 435-743-7900

EXHIBIT 4

PHASE 1 SYSTEM PRESSURES UNDER 20-YR PROJECTED PEAK INSTANTANEOUS DEMANDS

Legend

PRESSURE

- PRESSURE < 20.00 PSI
- PRESSURE = 20.00 PSI ~ 40.00 PSI
- PRESSURE = 40.00 PSI ~ 60.00 PSI
- PRESSURE = 60.00 PSI ~ 90.00 PSI
- PRESSURE > 90.00 PSI

DIAMETER

- 2" PIPE
- 4" PIPE
- 6" PIPE
- 8" PIPE

0 0.0425 0.085 Miles

46.62 psi
56.58 psi
62.65 psi
63.52 psi
62.65 psi
64.31 psi
64.36 psi
63.91 psi
75.59 psi
72.99 psi
66.05 psi
78.17 psi
67.77 psi
69.22 psi
74.70 psi
77.73 psi
80.76 psi
75.10 psi
-16.78 psi
-37.14 psi
-33.24 psi
-41.04 psi
-32.80 psi
-19.79 psi
-41.44 psi
-37.11 psi
-22.80 psi
-18.45 psi
-24.93 psi
-25.38 psi
-21.06 psi
-28.86 psi
-18.90 psi
-12.39 psi
Leech Field
Leech Field

Wilson Arch SSD

Phase 1 Projected Peak Instantaneous Demand

SUNRISE ENGINEERING
25 East 500 North Fillmore, Utah 84631
Tel. 435-743-6151 Fax 435-743-7900

EXHIBIT 5

PHASE 1 SYSTEM FIRE FLOW UNDER 20-YR PROJECTED PEAK DAY DEMANDS

Legend

HYD_DSN_FL

- AVAILABLE FLOW < 50 GPM
- 50 GPM < AVAILABLE FLOW < 200 GPM
- 200 GPM < AVAILABLE FLOW < 500 GPM
- AVAILABLE FLOW > 500 GPM

DIAMETER

- 2" PIPE
- 4" PIPE
- 6" PIPE
- 8" PIPE

0 0.045 0.09 Miles

522.11 gpm
531.33 gpm
534.62 gpm
537.90 gpm
537.90 gpm
537.90 gpm
537.90 gpm
537.90 gpm
537.90 gpm
533.28 gpm
533.28 gpm
533.28 gpm
528.93 gpm
532.70 gpm
507.91 gpm
Leech Field
15.42 gpm
15.38 gpm
15.44 gpm
15.43 gpm
15.42 gpm
15.44 gpm
15.44 gpm
15.44 gpm
Leech Field
15.44 gpm
15.41 gpm
15.44 gpm
15.44 gpm

Wilson Arch SSD	Phase 1 Fire Flow Under Future Peak Day Demands	SUNRISE ENGINEERING 25 East 500 North Fillmore, Utah 84631 Tel. 435-743-6151 Fax 435-743-7900

EXHIBIT 6

PROPOSED PHASE 1 IMPROVEMENTS UNDER 20-YR PROJECTED PEAK INSTANTANEOUS DEMAND

Legend

PRESSURE

- PRESSURE < 20.00 PSI
- PRESSURE = 20.00 PSI ~ 40.00 PSI
- PRESSURE = 40.00 PSI ~ 60.00 PSI
- PRESSURE = 60.00 PSI ~ 90.00 PSI
- PRESSURE > 90.00 PSI

DIAMETER

- 2" PIPE
- 4" PIPE
- 6" PIPE
- 8" PIPE

0 0.0425 0.085 Miles

66.30 psi
76.27 psi
82.33 psi
83.20 psi
82.33 psi
84.00 psi
84.07 psi
83.65 psi
66.83 psi
59.03 psi
46.47 psi
50.37 psi
50.80 psi
42.57 psi
63.80 psi
42.14 psi
64.67 psi
60.77 psi
46.47 psi
65.10 psi
58.69 psi
58.21 psi
49.09 psi
62.53 psi
54.72 psi
64.69 psi
71.19 psi
95.36 psi
87.99 psi
85.83 psi
92.76 psi
97.98 psi
87.18 psi
87.59 psi
89.03 psi
94.51 psi
97.54 psi
100.57 psi
94.91 psi
Leech Field
Leech Field

Wilson Arch SSD

Phase 1 Future Peak Instantaneous Demands With Improvements

SUNRISE ENGINEERING
25 East 500 North Fillmore, Utah 84631
Tel. 435-743-6151 Fax 435-743-7900

EXHIBIT 7

PROPOSED PHASE 1 IMPROVEMENTS UNDER 20-YR PROJECTED PEAK DAY & FIRE FLOW DEMAND

Legend

HYD_DSN_FL

- AVAILABLE FLOW < 50 GPM
- 50 GPM < AVAILABLE FLOW < 200 GPM
- 200 GPM < AVAILABLE FLOW < 500 GPM
- AVAILABLE FLOW > 500 GPM

DIAMETER

- 2" PIPE
- 4" PIPE
- 6" PIPE
- 8" PIPE

0 0.045 0.09 Miles

760.03 gpm
760.02 gpm
760.04 gpm
755.72 gpm
750.80 gpm
744.73 gpm
731.22 gpm
731.21 gpm
731.22 gpm
731.21 gpm
719.08 gpm
719.09 gpm
719.09 gpm
719.09 gpm
719.09 gpm
719.08 gpm
719.09 gpm
Leech Field
708.88 gpm
708.88 gpm
708.87 gpm
708.89 gpm
708.87 gpm
673.40 gpm
606.09 gpm
712.00 gpm
670.43 gpm
Leech Field
644.09 gpm
577.19 gpm
602.10 gpm
627.89 gpm

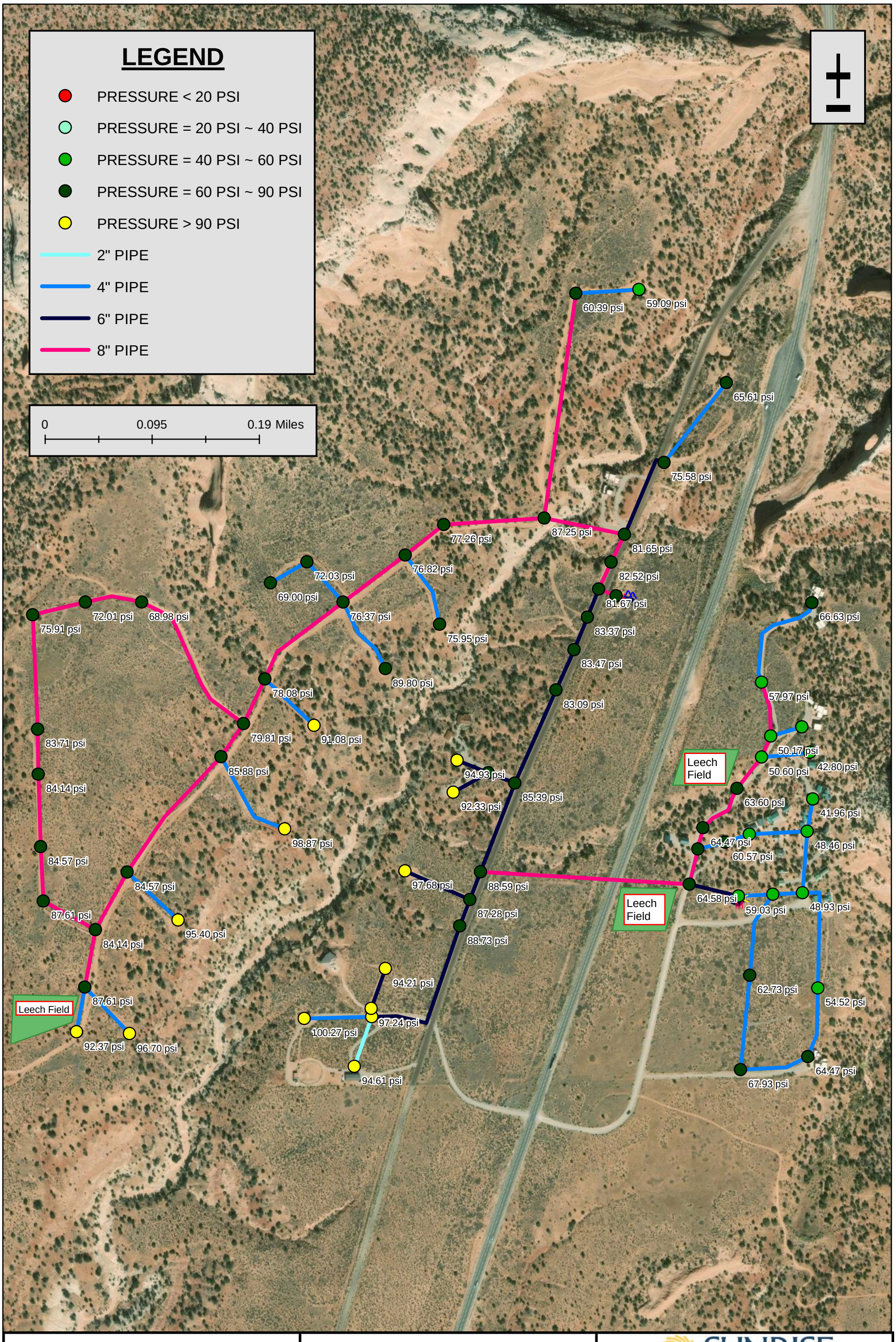
Wilson Arch SSD

Phase 1 Improvements Under Fire Flow & Peak Day Demands

SUNRISE ENGINEERING
25 East 500 North Fillmore, Utah 84631
Tel. 435-743-6151 Fax 435-743-7900

EXHIBIT 8

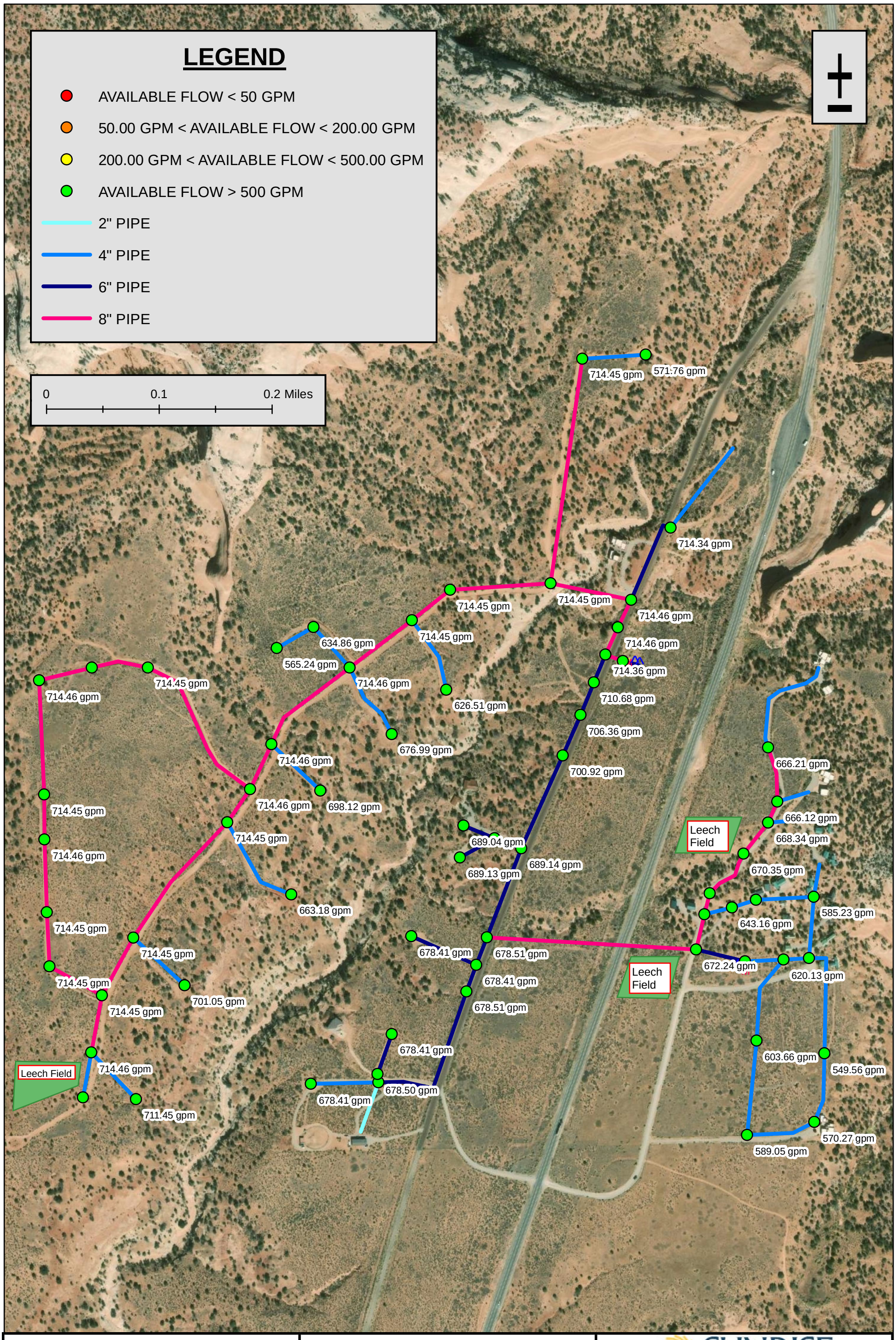
PROPOSED PHASE 2 IMPROVEMENTS UNDER 20-YR PROJECTED PEAK INSTANTANEOUS DEMAND



Wilson Arch SSD	Phase 2 Future Peak Instantaneous Demands With Improvements	SUNRISE ENGINEERING 25 East 500 North Fillmore, Utah 84631 Tel. 435-743-6151 Fax 435-743-7900

EXHIBIT 9

PROPOSED PHASE 2 IMPROVEMENTS UNDER FIRE FLOW & 20-YR PROJECTED PEAK DAY DEMANDS



Wilson Arch SSD

Phase 2 Improvements Under Fire Flow & Peak Day Demands

SUNRISE ENGINEERING
25 East 500 North Fillmore, Utah 84631
Tel. 435-743-6151 Fax 435-743-7900

APPENDIX A

ERCS PER LOT FOR PHASE 1 DEVELOPMENT

East Side Lots	ERC In use	Allowed First Come	R=Residential C=Commercial
C1	1		R
C3		1	R
C4		1	R
C6	1		R
C7	1		R
C8	1		R
C10	1		R
C11	1		R
C12	1		R
C13		1	R
C14	1		R
C15		1	R
C16		1	R
C17		1	R
C18		1	R
C19		1	R
C20	1		R
C21		1	R
C23		1	R
C24		1	R
C25		1	R
C26	1		R
C28	1		R
B1	1		R
B2	1		R
D1		1	R
D2		1	R
D3		1	R
D4		1	R
D5	1	1	R
D6		1	R
ParcelD		9	C
Total Residential ERCs			32
Total Commercial ERCs			9

West Side Lots	ERC In use	Allowed First Come	R=Residential C=Commercial
1		1	R
2		1	R
3		1	R
4		1	R
5	1		R
6		1	R
7		1	R
8		1	R
9		1	R
10		1	R
11		1	R
12		1	R
13		1	R
14		1	R
15		1	R
16		1	R
17		1	R
18	1		R
19		1	R
E		11	C
F		7	C
G		9	C
H		9	C
I		9	C
J		7	C
K		2	C
L		2	C
Total Residential ERCs			19
Total Commercial ERCs			56

APPENDIX B

ENGINEERS OPPINION OF PROBABLE COSTS FOR PHASE 1 DEVELOPMENT

SUNRISE ENGINEERING, INC.
CONSULTING ENGINEERS AND SURVEYORS

Opinion of Probable Costs

Project: Wilson Arch Culinary Water Improvements 2022
Immediate Recommended Improvements Phase 1

By: MH
Date: Apr-22

WILSON ARCH SSD CULINARY WATER SYSTEM - IMMEDIATE PHASE 1 IMPROVEMENTS

ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	MOBILIZATION (10%)	1	LS	$ 55,000	$ 55,000
	NEW 8" AND 4" LINES				
2	8" Culinary Water PVC Pipeline	1,000	Ln. Ft.	$ 85.00	$ 85,000
3	Pipe Bedding	1,000	Ln. Ft.	$ 5.00	$ 5,000
4	4" Culinary Water PVC Pipeline	600	Ln. Ft.	$ 55.00	$ 33,000
5	Pipe Bedding	600	Ln. Ft.	$ 5.00	$ 3,000
6	Reconnect Exist Services	2	EA	$ 1,000.00	$ 2,000
7	Connections to Existing Pipes	4	EA	$ 2,000.00	$ 8,000
8	Directional Bore with 8" HDPE DR11 Installation and Casing	80	LN. FT.	$ 300.00	$ 24,000
9	Residential PRVs	5	EA	$ 400.00	$ 2,000
10	8" Gate Valve	2	EA	$ 3,200.00	$ 6,400
11	6" Gate Valve	2	EA	$ 2,200.00	$ 4,400
12	4" Gate Valve	2	EA	$ 2,000.00	$ 4,000
13	UBC	50	CY	$ 50.00	$ 2,500
14	Fire Hydrants	4	EA	$ 6,000.00	$ 24,000
	Subtotal New 8" and 4" Lines				**$ 203,300**
	INSTALL METERS ON NEW AND EXISTING CONNECTIONS				
15	3/4" Meter Setter Assembly	59	EA	$ 1,300.00	$ 76,700
16	3/4" Meters	59	EA	$ 400.00	$ 23,600
	Subtotal Install Meters on New and Existing Connections				**$ 100,300**
	REPLACE EXISTING 4" AND 6" PVC PIPE WITH 8"				
17	8" Culinary Water Pipeline	1,100	Ln. Ft.	$ 85.00	$ 93,500
18	Pipe Bedding	1,100	Ln. Ft.	$ 5.00	$ 5,500
19	Reconnect Exist Services	4	EA	$ 1,000.00	$ 4,000
20	UBC	107	CY	$ 50.00	$ 5,350
21	Connections to Existing Pipes	15	EA	$ 2,000.00	$ 30,000
22	8" Gate Valve	4	EA	$ 3,200.00	$ 12,800
23	4" Gate Valve	3	EA	$ 2,000.00	$ 6,000
	Subtotal Replace Existing 4" And 6" PVC Pipe With 8"				**$ 157,150**
	PUMP CAPACITY INCREASE				
24	Pump	2	EA	$ 15,000.00	$ 30,000
25	Pump Control System	2	EA	$ 10,000.00	$ 20,000
26	Pump Piping	2	EA	$ 5,000.00	$ 10,000
27	Pump Electrical	2	EA	$ 10,000.00	$ 20,000
	Subtotal Increase Pump Capacity				**$ 80,000**
	Construction Subtotal				**$ 595,750**
	Contingency		20%		$ 119,150
	Total Construction				**$ 714,900**
	INCIDENTALS & PROFESSIONAL SERVICES				
28	Planning & Administration	1	Est.	$ 5,000.00	$ 5,000
29	Preliminary Engineering Report (PER)/Env Report (ER)	1	LS	$ 20,000.00	$ 20,000
30	Engineering Design		7.8%	(of construction costs)	$ 56,000
31	Bid Phase Services	1	LS	$ 14,000.00	$ 14,000
32	Construction/Startup Phase Services	1	Hourly	$ 44,000.00	$ 44,000
33	Legal	1	Est.	$ 7,500.00	$ 7,500
34	Incidentals & Professional Services Contingency		10%		$ 16,000
	Incidentals & Professional Services Total				**$ 162,500**
	TOTAL PROJECT COST				**$ 877,400**

In providing opinions of probable construction cost, the Client understands that the Engineer has no control over costs or the price of labor, equipment or materials., or over the Contractor's method of pricing, and that the opinion of probable construction cost provided herein is made on the basis of the Engineer's qualifications and experience. The Engineer

SUNRISE ENGINEERING, INC.
CONSULTING ENGINEERS AND SURVEYORS

Opinion of Probable Costs

Project: Wilson Arch Culinary Water Improvements 2022
Recommended Future Improvements Phase 1

By: MH
Date: Apr-22

WILSON ARCH SSD CULINARY WATER SYSTEM - FUTURE PHASE 1 IMPROVEMENTS

ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	MOBILIZATION (10%)	1	LS	$ 130,000.00	**$ 130,000**
	CONSTRUCT 30,000 GAL FIBERGLASS STORAGE TANK				
2	Earthwork & Site Prep - Burried 30k Gal Fiberglass Water Tank	1	LS	$ 40,000.00	$ 40,000
3	30,000 Gal Fiberglass Water Tank	1	LS	$ 80,000.00	$ 80,000
4	Site Piping/Interconnect w/System	1	LS	$ 20,000.00	$ 20,000
5	Electrical & Instrumentation	1	LS	$ 10,000.00	$ 10,000
	Subtotal Construct 30,000 Gal Fiberglass Storage Tank				**$ 150,000**
	CONSTRUCT NEW CULINARY WELL				
7	Well Driller Mobilization (10%)	1	LS	$ 50,000.00	$ 50,000
8	8" Diameter Well Drilling & Log Prep	900	LF	$ 200.00	$ 180,000
9	Geophysical Well Log (e-log)	1	LS	$ 10,000.00	$ 10,000
10	7" Diameter 0.365" (min) Wall Thickness Casing	600	LF	$ 30.00	$ 18,000
11	7" Diameter 304 SS Well Screen	400	LF	$ 200.00	$ 80,000
12	2" Diameter Galvanized Steel Refill Pipe	150	LF	$ 10.00	$ 1,500
13	1.5" Diameter 304 SS Screened Instrument Well	600	LF	$ 30.00	$ 18,000
14	Filter (Gravel) Pack	580	LF	$ 60.00	$ 34,800
15	Sanitary Grout Seal	120	LF	$ 75.00	$ 9,000
16	Furnish & Set Test Pump and Power Unit for Well Testing & Development	1	LS	$ 10,000.00	$ 10,000
17	Well Development	120	HR	$ 300.00	$ 36,000
18	Test Pumping (Step Test and 24 Hour Continuous Pump Test)	36	HR	$ 300.00	$ 10,800
19	Well Disinfecting and Capping	1	LS	$ 5,000.00	$ 5,000
	Subtotal Construct New Culinary Well				**$ 463,100**
	WELL EQUIPPING				
20	Well House	1	LS	$ 40,000.00	$ 40,000
21	Earth Work for Well House	1	LS	$ 10,000.00	$ 10,000
22	Well House Electrical	1	LS	$ 30,000.00	$ 30,000
23	Well House Piping	1	LS	$ 50,000.00	$ 50,000
24	Well House Instrumentation & Control	1	LS	$ 25,000.00	$ 25,000
25	Standby Generator & ATS	1	LS	$ 20,000.00	$ 20,000
26	Equip Well - Submersible Pump	1	LS	$ 50,000.00	$ 50,000
27	4" Culinary Water Pipeline Column + Transmission to System	2,500	Ln. Ft.	$ 55.00	$ 137,500
28	Pipe Bedding	1,600	Ln. Ft.	$ 5.00	$ 8,000
29	4" Gate Valves	3	EA	$ 2,000.00	$ 6,000
	Subtotal Well Equipping				**$ 376,500**
	Construction Subtotal				**$ 1,119,600**
	Contingency		20%	(of construction)	$ 223,920
	Total Construction				**$ 1,343,520**
	INCIDENTALS & PROFESSIONAL SERVICES				
30	Planning & Administration	1	Est.	$ 10,000.00	$ 10,000
31	Topographic Survey (Tank Site)	1	Est.	$ 4,000.00	$ 4,000
32	Geotechnical Report (Tank Site)	1	Est.	$ 10,000.00	$ 10,000
33	Well PER/DWSP	1	LS	$ 18,000.00	$ 18,000
34	Engineering Design		7.1%	(of construction costs)	$ 95,000
35	Bid Phase Services (Assume One Bid)	1	LS	$ 12,000.00	$ 12,000
36	Construction/Startup Phase Services	1	Hourly	$ 80,000.00	$ 80,000
37	Legal	1	Est.	$ 10,000.00	$ 10,000
38	Incidentals & Professional Services Contingency		10%	(of incidentals)	$ 26,000
	Incidentals & Professional Services Total				**$ 265,000**
	TOTAL PROJECT COST				**$ 1,608,520**

In providing opinions of probable construction cost, the Client understands that the Engineer has no control over costs or the price of labor, equipment or materials., or over the Contractor's method of pricing, and that the opinion of probable construction cost provided herein is made on the basis of the Engineer's qualifications and experience. The Engineer

SUNRISE ENGINEERING, INC.
CONSULTING ENGINEERS AND SURVEYORS

Opinion of Probable Costs

Project: Wilson Arch SSD Culinary Water Improvements 2022
Combined Recommended Improvements Phase 1

By: MH
Date: Apr-22

WILSON ARCH SSD CULINARY WATER SYSTEM COMBINED RECOMMENDED IMPROVEMENTS PHASE 1

ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	MOBILIZATION (10%)	1	LS	$ 200,000.00	$ 200,000
	CONSTRUCT NEW CULINARY WELL				
2	Well Driller Mobilization (10%)	1	LS	$ 50,000.00	$ 50,000
3	8" Diameter Well Drilling & Log Prep	900	LF	$ 200.00	$ 180,000
4	Geophysical Well Log (e-log)	1	LS	$ 10,000.00	$ 10,000
5	7" Diameter 0.365" (min) Wall Thickness Casing	600	LF	$ 30.00	$ 18,000
6	7" Diameter 304 SS Well Screen	400	LF	$ 200.00	$ 80,000
7	2" Diameter Galvanized Steel Refill Pipe	150	LF	$ 10.00	$ 1,500
8	1.5" Diameter 304 SS Screened Instrument Well	600	LF	$ 30.00	$ 18,000
9	Filter (Gravel) Pack	580	LF	$ 60.00	$ 34,800
10	Sanitary Grout Seal	120	LF	$ 75.00	$ 9,000
11	Furnish & Set Test Pump and Power Unit for Well Testing & Development	1	LS	$ 10,000.00	$ 10,000
12	Well Development	120	HR	$ 300.00	$ 36,000
13	Test Pumping (Step Test and 24 Hour Continuous Pump Test)	36	HR	$ 300.00	$ 10,800
14	Well Disinfecting and Capping	1	LS	$ 5,000.00	$ 5,000
	Subtotal Construct New Culinary Well				**$ 463,100**
	WELL EQUIPPING				
15	Well House	1	LS	$ 40,000.00	$ 40,000
16	Earth Work for Well House	1	LS	$ 10,000.00	$ 10,000
17	Well House Electrical	1	LS	$ 30,000.00	$ 30,000
18	Well House Piping	1	LS	$ 50,000.00	$ 50,000
19	Well House Instrumentation & Control	1	LS	$ 25,000.00	$ 25,000
20	Standby Generator & ATS	1	LS	$ 20,000.00	$ 20,000
21	Equip Well - Submersible Pump	1	LS	$ 50,000.00	$ 50,000
22	4" Culinary Water Pipeline - Transmission to System	2,500	Ln. Ft.	$ 55.00	$ 137,500
23	Pipe Bedding	1,600	Ln. Ft.	$ 5.00	$ 8,000
24	4" Gate Valves	3	EA	$ 2,000.00	$ 6,000
	Subtotal Well Equipping				**$ 376,500**
	CONSTRUCT 30,000 GAL FIBERGLASS STORAGE TANK				
25	Earthwork & Site Prep - Burried 30k Gal Fiberglass Water Tank	1	LS	$ 40,000.00	$ 40,000
26	30,000 Gal Fiberglass Water Tank	1	LS	$ 80,000.00	$ 80,000
27	Site Piping/Interconnect w/System	1	LS	$ 20,000.00	$ 20,000
28	Electrical & Instrumentation	1	LS	$ 10,000.00	$ 10,000
	Subtotal Construct 30,000 Gal Fiberglass Storage Tank				**$ 150,000**

	NEW 8" AND 4" LINES				
29	8" Culinary Water PVC Pipeline	1,000	Ln. Ft.	$ 85.00	$ 85,000
30	Pipe Bedding	1,000	Ln. Ft.	$ 5.00	$ 5,000
31	4" Culinary Water PVC Pipeline	600	Ln. Ft.	$ 55.00	$ 33,000
32	Pipe Bedding	600	Ln. Ft.	$ 5.00	$ 3,000
33	Reconnect Exist Services	2	EA	$ 1,000.00	$ 2,000
34	Connections to Existing Pipes	4	EA	$ 2,000.00	$ 8,000
35	Directional Bore with 8" HDPE DR11 Installation and Casing	80	LN. FT.	$ 300.00	$ 24,000
36	Residential PRVs	5	EA	$ 400.00	$ 2,000
37	8" Gate Valve	2	EA	$ 3,200.00	$ 6,400
38	6" Gate Valve	2	EA	$ 2,200.00	$ 4,400
39	4" Gate Valve	2	EA	$ 2,000.00	$ 4,000
40	UBC	50	CY	$ 50.00	$ 2,500
41	Fire Hydrants	4	EA	$ 6,000.00	$ 24,000
	Subtotal New 8" and 4"Lines				**$ 203,300**
	REPLACE EXISTING 4" AND 6" PVC PIPE WITH 8"				
42	8" Culinary Water Pipeline	1,100	Ln. Ft.	$ 85.00	$ 93,500
43	Pipe Bedding	1,100	Ln. Ft.	$ 5.00	$ 5,500
44	Reconnect Exist Services	4	EA	$ 1,000.00	$ 4,000
45	UBC	107	CY	$ 50.00	$ 5,350
46	Connections to Existing Pipes	15	EA	$ 2,000.00	$ 30,000
47	8" Gate Valve	4	EA	$ 3,200.00	$ 12,800
48	4" Gate Valve	3	EA	$ 2,000.00	$ 6,000
	Subtotal Replace Existing 4" And 6" PVC Pipe With 8"				**$ 157,150**
	INSTALL METERS ON NEW AND EXISTING CONNECTIONS				
49	3/4" Meter Setter Assembly	59	EA	$ 1,300.00	$ 76,700
50	3/4" Meters	59	EA	$ 400.00	$ 23,600
	Subtotal Install Meters on New and Existing Connections				**$ 100,300**
	PUMP CAPACITY INCREASE				
51	Goulds 5CHC007 Pump	2	EA	$ 15,000.00	$ 30,000
52	Pump Control System	2	EA	$ 10,000.00	$ 20,000
53	Pump Piping	2	Ft	$ 5,000.00	$ 10,000
54	Pump Electrical	2	Ft	$ 10,000.00	$ 20,000
	Subtotal Pump Capacity				**$ 80,000**
	Construction Subtotal				**$ 1,730,350**
	Contingency		20%		$ 346,070
	Total Construction				**$ 2,076,420**
	INCIDENTALS & PROFESSIONAL SERVICES				
55	Planning & Administration	1	Est.	$ 15,000.00	$ 15,000
56	Topographic Survey (Tank Site)	1	Est.	$ 4,000.00	$ 4,000
57	Geotechnical Report (Tank Site)	1	Est.	$ 10,000.00	$ 10,000
58	Well PER/DWSP	1	LS	$ 18,000.00	$ 18,000
59	Engineering Design		6.7%	(of construction costs)	$ 140,000
60	Bid Phase Services (Assume One Bid)	1	LS	$ 20,000.00	$ 20,000
61	Construction/Startup Phase Services		Hourly	$ 120,000.00	$ 120,000
62	Legal	1	Est.	$ 17,500.00	$ 17,500
63	Incidentals & Professional Services Contingency		10%	(of incidentals)	$ 40,000
59	Preliminary Engineering Report (PER)/Env Report (ER)	1	LS	$ 20,000.00	$ 20,000
	Incidentals & Professional Services Total				**$ 404,500**
	TOTAL PROJECT COST				**$ 2,480,920**

In providing opinions of probable construction cost, the Client understands that the Engineer has no control over costs or the price of labor, equipment or materials., or over the Contractor's method of pricing, and that the opinion of probable construction cost provided herein is made on the basis of the Engineer's qualifications and experience. The Engineer

APPENDIX C

ENGINEERS OPPINION OF ADDITIONAL PROBABLE COSTS FOR PHASE 2 DEVELOPMENT

SUNRISE ENGINEERING, INC.
CONSULTING ENGINEERS AND SURVEYORS

Opinion of Probable Costs

Project: Wilson Arch Culinary Water Improvements 2022
Additional Phase 2 Recommended Improvements

By: MH
Date: Apr-22

WILSON ARCH SSD CULINARY WATER SYSTEM

ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	MOBILIZATION (10%)	1	LS	$ 280,000.00	**$ 280,000**
	NEW 8" AND 4" LINES				
2	8" Culinary Water PVC Pipeline	7,300	Ln. Ft.	$ 85.00	$ 620,500
3	Pipe Bedding	4,400	Ln. Ft.	$ 1.00	$ 4,400
4	4" Culinary Water PVC Pipeline	3,100	Ln. Ft.	$ 55.00	$ 170,500
5	Pipe Bedding	6,000	Ln. Ft.	$ 1.00	$ 6,000
6	Reconnect Exist Services	3	EA	$ 1,000.00	$ 3,000
7	Connections to Existing Pipes	7	EA	$ 2,000.00	$ 14,000
8	Directional Bore with 8" HDPE DR11 Installation	80	LN. FT.	$ 300.00	$ 24,000
9	Residential PRV's	5	EA	$ 400.00	$ 2,000
10	8" Gate Valve	8	EA	$ 3,200.00	$ 25,600
11	4" Gate Valve	8	EA	$ 2,200.00	$ 17,600
12	UBC	30	EA	$ 50.00	$ 1,500
13	3/4" Water Meters and Assemblies On New Residential Connections	72	EA	$ 1,700.00	$ 122,400
14	Fire Hydrants	7	EA	$ 6,000.00	$ 42,000
	Subtotal New 8" and 4" Lines				**$ 1,053,500**
	CONSTRUCT 30,000 GAL FIBERGLASS STORAGE TANK				
15	Earthwork & Site Prep - Burried 30k Gal Fiberglass Water Tank	1	LS	$ 40,000.00	$ 40,000
16	30,000 Gal Fiberglass Water Tank	1	LS	$ 80,000.00	$ 80,000
17	Site Piping/Interconnect w/System	1	LS	$ 20,000.00	$ 20,000
18	Electrical & Instrumentation	1	LS	$ 10,000.00	$ 10,000
	Subtotal Construct 30,000 Fiberglass Storage Tank				**$ 150,000**
	CONSTRUCT 1 NEW CULINARY WELL				
19	Well Driller Mobilization (10%)	1	LS	$ 50,000.00	$ 50,000
20	8" Diameter Well Drilling & Log Prep	900	LF	$ 200.00	$ 180,000
21	Geophysical Well Log (e-log)	1	LS	$ 10,000.00	$ 10,000
22	7" Diameter 0.365" (min) Wall Thickness Casing	600	LF	$ 30.00	$ 18,000
23	7" Diameter 304 SS Well Screen	400	LF	$ 200.00	$ 80,000
24	2" Diameter Galvanized Steel Refill Pipe	150	LF	$ 10.00	$ 1,500
25	1.5" Diameter 304 SS Screened Instrument Well	600	LF	$ 30.00	$ 18,000
26	Filter (Gravel) Pack	580	LF	$ 60.00	$ 34,800
27	Sanitary Grout Seal	120	LF	$ 75.00	$ 9,000
28	Furnish & Set Test Pump and Power Unit for Well Testing & Development	1	LS	$ 10,000.00	$ 10,000
29	Well Development	120	HR	$ 300.00	$ 36,000
30	Test Pumping (Step Test and 24 Hour Continuous Pump Test)	36	HR	$ 300.00	$ 10,800
31	Well Disinfecting and Capping	1	LS	$ 5,000.00	$ 5,000
	Subtotal - Construct 1 New Culinary Well				**$ 463,100**
	EQUIP 1 WELL				
32	Well House	1	LS	$ 40,000.00	$ 40,000
33	Earth Work for Well House	1	LS	$ 10,000.00	$ 10,000
34	Well House Electrical	1	LS	$ 30,000.00	$ 30,000
35	Well House Piping	1	LS	$ 50,000.00	$ 50,000
36	Well House Instrumentation & Control	1	LS	$ 25,000.00	$ 25,000
37	Standby Generator & ATS	1	LS	$ 20,000.00	$ 20,000
38	Equip Well - Submersible Pump	1	LS	$ 50,000.00	$ 50,000
39	4" Culinary Water Pipeline - Transmission to System + Column Piping	3,000	Ln. Ft.	$ 55.00	$ 165,000
40	Pipe Bedding	2,000	Ln. Ft.	$ 2.00	$ 4,000
41	4" Gate Valves	3	EA	$ 2,000.00	$ 6,000
	Subtotal Equip 1 Well				**$ 400,000**
	Construction Subtotal				**$ 2,346,600**
	Contingency		20%	(of construction)	$ 469,320
	Total Construction				**$ 2,815,920**
	INCIDENTALS & PROFESSIONAL SERVICES				
42	Planning & Administration	1	Est.	$ 10,000.00	$ 10,000
43	Topographic Survey (Tank Site)	1	Est.	$ 4,000.00	$ 4,000
44	Geotechnical Report (Tank Site)	1	Est.	$ 10,000.00	$ 10,000

45	Well Siting Study	1	LS	$ 10,000.00	$ 10,000
46	Well PER/DWSP	1	LS	$ 18,000.00	$ 18,000
47	Engineering Design		6.6%	(of construction cost)	$ 185,000
48	Bid Phase Services (Assume One Bid)	1	LS	$ 12,000.00	$ 12,000
49	Construction/Startup Phase Services	1	Hourly	$ 140,000.00	$ 140,000
50	Legal	1	Est.	$ 10,000.00	$ 10,000
51	Incidentals & Professional Services Contingency		9%	(of incidentals)	$ 40,000
	Incidentals & Professional Services Total				**$ 439,000**
	TOTAL PROJECT COST				**$ 3,254,920**

In providing opinions of probable construction cost, the Client understands that the Engineer has no control over costs or the price of labor, equipment or materials., or over the Contractor's method of pricing, and that the opinion of probable construction cost provided herein is made on the basis of the Engineer's qualifications and experience. The Engineer

APPENDIX D

CONCEPTUAL FINANCING PLANS FOR PHASE 1 DEVELOPMENT

Wilson Arch SSD Water Improvements Project

Proposed Funding Plan - Phase 1 Immediate Improvements - USDA-RD

4/26/2022

Total Project Cost				$	877,400.00
Proposed Funding:			% of Project		
Self Participation			0%		-
CDBG Grant			0%		-
Drinking Water Loan			0%		-
Drinking Water Grant			0%		-
CIB Loan			0%		-
CIB Grant			0%		-
USDA RD Loan			100%		877,400.00
USDA RD Grant			0%		-
			100%		
		Total Project Funding		$	877,400.00
Annual Expenses: (Projected)					
Year 2022					41,425.00
		Total Operation and Maintenance			41,425.00
New Debt Service:					
DDW Loan	30	2.50%	-		($0.0)
CIB Loan	30	1.50%	-		($0.0)
USDA RD Loan	40	2.50%	877,400.00		$34,952.30
10% Debt Reserve					$3,495.22
		Total Estimated New Debt Service			$38,447.47
		Total Annual Income Required			**$79,872.47**
Annual Income:					
Standby Fees				$	16,065.00
Total Number of Active ERC's Billed					24
Total Annual Income Required					$63,807.47
Total Annual Income Required w/ 1.25% debt service coverage					73,419.34
Average Monthly Water Rate Per ERC				$	254.93
Average Monthly Overages				$	-
Average Monthly Total Water User Rate				$	254.93

Wilson Arch SSD Water Improvements Project

Proposed Funding Plan - Phase 1 Immediate Improvements - DDW

4/26/2022

Total Project Cost				$	877,400.00
Proposed Funding:			% of Project		
Self Participation			0%		-
CDBG Grant			0%		-
Drinking Water Loan			100%		877,400.00
Drinking Water Grant			0%		-
CIB Loan			0%		-
CIB Grant			0%		-
USDA RD Loan			0%		-
USDA RD Grant			0%		-
			100%		
	Total Project Funding			$	877,400.00
Annual Expenses: (Projected)					
Year 2022					41,425.00
	Total Operation and Maintenance				41,425.00
New Debt Service:					
DDW Loan	30	2.50%	877,400.00		$41,920.08
CIB Loan	30	1.50%	-		($0.0)
USDA RD Loan	40	2.50%	-		($0.0)
10% Debt Reserve					$4,192.00
	Total Estimated New Debt Service				$46,112.04
	Total Annual Income Required				**$87,537.04**
Annual Income:					
Standby Fees				$	16,065.00
Total Number of Active ERC's Billed					24
Total Annual Income Required					$71,472.04
Total Annual Income Required w/ 1.25% debt service coverage					83,000.05
Average Monthly Water Rate Per ERC				$	288.19
Average Monthly Overages					
Average Monthly Total Water User Rate				$	288.19
Median Adjusted Gross Income (MAGI)					38,300.00
1.75% of MAGI Per Month				$	55.85
% of MAGI Per Month Projected					9.03%

Wilson Arch SSD Water Improvements Project

Proposed Funding Plan - Phase 1 All Recommended Improvements - USDA-RD

4/26/2022

Total Project Cost				$	2,480,920.00
Proposed Funding:			% of Project		
Self Participation			0%		-
CDBG Grant			0%		-
Drinking Water Loan			0%		-
Drinking Water Grant			0%		-
CIB Loan			0%		-
CIB Grant			0%		-
USDA RD Loan			100%		2,480,920.00
USDA RD Grant			0%		-
			100%		
	Total Project Funding			$	2,480,920.00
Annual Expenses: (Projected)					
Year 2022					41,425.00
	Total Operation and Maintenance				41,425.00
New Debt Service:					
DDW Loan	30	2.50%	-		($0.0)
CIB Loan	30	1.50%	-		($0.0)
USDA RD Loan	40	2.50%	2,480,920.00		$98,830.49
10% Debt Reserve					$9,883.04
	Total Estimated New Debt Service				$108,713.49
	Total Annual Income Required				**$150,138.49**
Annual Income:					
Standby Fees				$	16,065.00
Total Number of Active ERC's Billed					24
Total Annual Income Required					$134,073.49
Total Annual Income Required w/ 1.25% debt service coverage					161,251.86
Average Monthly Water Rate Per ERC				$	559.90
Average Monthly Overages				$	-
Average Monthly Total Water User Rate				$	559.90

Wilson Arch SSD Water Improvements Project

Proposed Funding Plan - Phase 1 All Recommended Improvements - DDW

4/26/2022

Total Project Cost				$	2,466,520.00
Proposed Funding:			% of Project		
Self Participation			0%		-
CDBG Grant			0%		-
Drinking Water Loan			100%		2,466,520.00
Drinking Water Grant			0%		-
CIB Loan			0%		-
CIB Grant			0%		-
USDA RD Loan			0%		-
USDA RD Grant			0%		-
			100%		
	Total Project Funding			$	2,466,520.00
Annual Expenses: (Projected)					
Year 2022					41,425.00
	Total Operation and Maintenance				41,425.00
New Debt Service:					
DDW Loan	30	2.50%	2,466,520.00		$117,844.48
CIB Loan	30	1.50%	-		($0.0)
USDA RD Loan	40	2.50%	-		($0.0)
10% Debt Reserve					$11,784.44
	Total Estimated New Debt Service				$129,628.89
	Total Annual Income Required				**$171,053.89**
Annual Income:					
Standby Fees				$	16,065.00
Total Number of Active ERC's Billed					24
Total Annual Income Required					$154,988.89
Total Annual Income Required w/ 1.25% debt service coverage					187,396.11
Average Monthly Water Rate Per ERC				$	650.68
Average Monthly Overages					
Average Monthly Total Water User Rate				$	650.68
Median Adjusted Gross Income (MAGI)					38,300.00
1.75% of MAGI Per Month				$	55.85
% of MAGI Per Month Projected					20.39%