
SUMMIT COUNTY SERVICE AREA No. 3

DRINKING WATER MASTER PLAN

(HAL Project No.: 358.05.100)

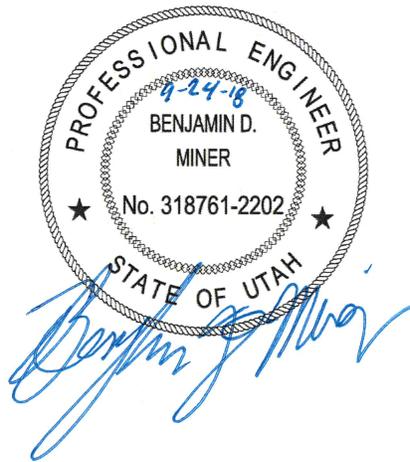
FINAL REPORT
(Updated)

September 2018

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(HAL Project No.: 358.05.100)



Benjamin D. Miner, P.E.
Project Engineer



September 2018

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Board of Trustees

Suzanne Carpenter
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Eileen Galoostian

Service Area Personnel

Marla Howard, General Manager
Chris Bullock, Water System Operator

GLOSSARY OF TECHNICAL TERMS

Average Daily Flow: The average yearly demand volume expressed in a flow rate.

Average Yearly Demand: The volume of water delivered to consumers during a typical year.

Build-out: When the development density reaches maximum allowed by planned development.

Demand: Required water flow rate or volume.

Distribution System: The network of pipes, valves, booster pump stations and appurtenances contained within a water system.

Drinking Water: Water that is approved for use in a public water system. Also referred to as Culinary or Potable water.

Dynamic Pressure: The pressure exerted by water within the pipelines and other water system appurtenances when water is flowing through the system.

Equivalent Residential Connection (ERC): A measure used in comparing water demand from non-residential connections to residential connections.

Fire Flow Requirements: The rate of water delivery required to extinguish a particular fire. Usually it is given in rate of flow (gallons per minute) for a specific period of time (hours).

Head: A measure of the pressure in a distribution system that is exerted by the water. Head represents the height of the free water surface (or pressure reduction valve setting) above any point in the hydraulic system.

Head Loss: The amount of pressure lost in a distribution system under dynamic conditions due to the wall roughness and other physical characteristics of pipes in the system.

Peak Day: The day of the year in which a maximum amount of water is used in a 24-hour period.

Peak Day Demand: The average flow required to meet the needs imposed on a water system during the day of highest water consumption.

Peak Instantaneous Demand: The flow required to meet the needs imposed on a water system during maximum flow on a peak day.

Pressure Reducing Valve (PRV): A valve used to reduce pressure in a water distribution system.

Pressure Zone: The area within a distribution system in which water pressure is maintained within specified limits.

Service Area: The area that has been identified by the public water system as being eligible to receive water.

Static Pressure: The pressure exerted by water within the pipelines and other water system appurtenances when water is not flowing through the system, i.e., during periods of little or no water use.

Storage Reservoir: A facility used to store, contain and protect drinking water until it is needed by the customers of a water system. Also referred to as a Storage Tank.

Transmission Pipeline: A pipeline that transfers water from a source to a reservoir or from a reservoir to a distribution system.

Water Conservation: Planned management of water to prevent waste.

ABBREVIATIONS

ac	acre
ac-ft	acre-feet
UDDW	The Utah Division of Drinking Water
ERC	Equivalent Residential Connection
GIS	Geographic Information System
gpd	Gallons per Day
gpd/conn	Gallons per Day per Connection
gpm	Gallons per Minute
HAL	Hansen, Allen & Luce, Inc.
MG	Million Gallons
MRWSSD	Mountain Regional Water Special Service District
PRV	Pressure Reducing Valve

psi Pounds per Square Inch
SCADA Supervisory Control and Data Acquisition

CHAPTER 1 - INTRODUCTION

PURPOSE

The purpose of this master plan is to provide water system management guidance to Summit County Service Area No. 3. This guidance includes recommendations for water system improvements to the current system and recommendations for needed infrastructure as the system grows.

BACKGROUND

Summit County Service Area No. 3 is a public water supplier located in the Snyderville Basin of western Summit County. The Service Area manages the water system, which services the lower Silver Creek neighborhood, as well as roads and trails for all of the Silver Creek area. It also manages water rights. The Service Area is composed mostly of single-family residential lots (about 2 to 10 acres in size), although there are several businesses in the southern portion of the Service Area.

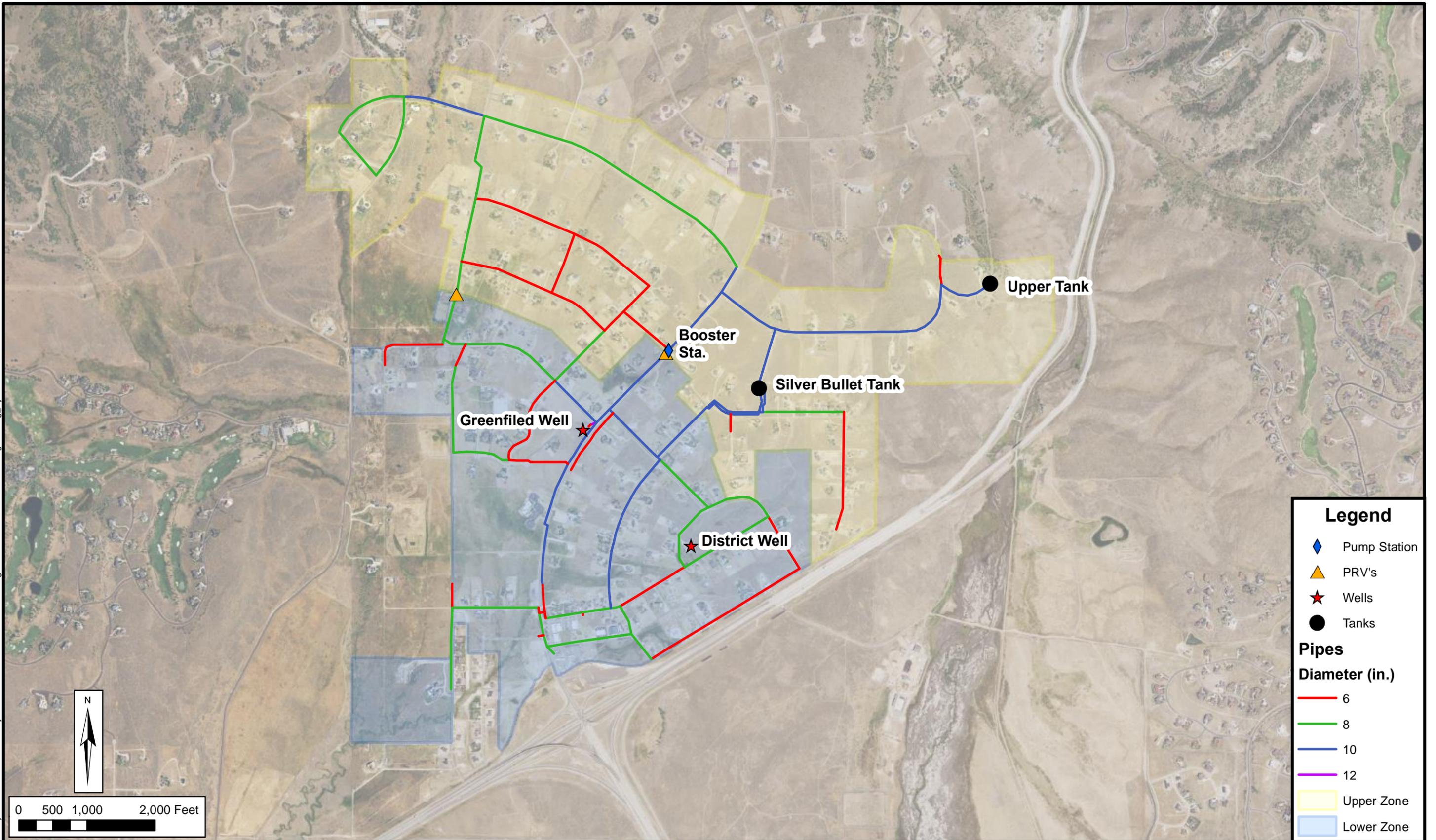
Summit County is experiencing rapid growth. The County has extensive equestrian, skiing and biking opportunities, as well as other recreational opportunities. This has led the Snyderville area to become a popular destination for residential and business growth. Summit County is predicted to grow from a population of about 40,000 in 2015 to a population of over 75,000 in 2065. Like the rest of Summit County, Service Area No. 3 needs to plan for this growth in order to continue to serve its residents. With this in mind, the Board of Trustees commissioned this master plan.

Currently, the Service Area water system serves approximately 197 connections, including the Service Area's businesses. It has two wells for water sources, two water storage tanks, a booster station and a pipe system. Figure 1-1 illustrates the extent of the Service Area's drinking water system.

STUDY OBJECTIVES

The scope of study for this master plan includes a review of the Service Area's drinking water system and water use including: build-out growth projections, source requirements, storage requirements, distribution system requirements and water quality. From this study of the water system, an implementation plan with recommended improvements has been prepared. The implementation plan includes conceptual level cost estimates for the recommended improvements.

The conclusions and recommendations of this study are limited by the accuracy of the development projections and other assumptions used in preparing the study. It is expected that the Service Area will review and update this master plan every 5-10 years as new information about development, system performance, and water use becomes available.



Legend

- ◆ Pump Station
- ▲ PRV's
- ★ Wells
- Tanks

Pipes

Diameter (in.)

- 6
- 8
- 10
- 12

- Upper Zone
- Lower Zone

WATER SYSTEM MASTER PLANNING METHODOLOGY

The Service Area's water system includes wells, storage facilities, valves, fire hydrants, a booster pump station and pipes. The Service Area water system must be capable of responding to daily and seasonal variations in demand while concurrently providing adequate capacity for firefighting and other emergency needs. In order to meet these goals, each of the distribution system components must have capacity to address supply needs. Planning is required in order to ensure that the distribution system is capable of meeting the area's needs over the next several decades.

Both present and projected future needs were estimated in this master plan. Existing water needs were evaluated according to Summit County Concurrency and Utah Division of Drinking Water (UDDW) requirements. These estimates were compared with water use records obtained from billing and production data. Future water use projections were made based on the estimated number of future connections and estimated water demand from the Summit County Concurrency standards.

In order to predict the capacity of the water system, a computer model of the system was prepared. The model was used to analyze performance of existing facilities based on water demand. Projected future demands were also added to the future conditions model and were analyzed. Based upon the results of these analyses, deficiencies were identified for the existing conditions and potential needs were identified for the projected future conditions. Recommendations for additional needed infrastructure were prepared.

KEY SYSTEM DESIGN CRITERIA AND PERFORMANCE FINDINGS

Summaries of the key water system design criteria and performance findings for the drinking water system are included in Table 1-1. The design criteria were used in evaluating system performance and in recommending future water system improvements. Criteria development is described in later chapters.

**TABLE 1-1
KEY SYSTEM DESIGN CRITERIA**

ITEM	CRITERIA	2018 EXISTING	ESTIMATED FUTURE
EQUIVALENT RESIDENTIAL CONNECTIONS	Calculated	197	464
SOURCE Peak Day Demand Average Yearly Demand	Concurrency Standard Concurrency Standard	170.0 gpm 70 gpm	399 gpm 162 gpm
STORAGE Equalization Fire Suppression Total	R309-510-8(2) Total fire flow volume	113,000 gal <u>240,000 gal</u> 353,000 gal	270,000 gal <u>240,000 gal</u> 510,000 gal
DISTRIBUTION MODELING Peak Instantaneous Minimum Fire Flow Max Pressure Min. Pressure (pre-2007 areas) Min. Pressure (fire flow) Min. Pressure (peak instantaneous) Min. Pressure (peak day)	1.50 x Peak Day Demand @ 20 psi Industry standard {R309-105-9 U.A.C.} {R309-105-9 U.A.C.} {R309-105-9 U.A.C.} {R309-105-9 U.A.C.}	255.0 gpm 1,500* gpm 140 psi 20 psi 20 psi 30 psi 40 psi	600 gpm 1,500* gpm 140 psi 20 psi 20 psi 30 psi 40 psi

*A fire flow of 2,000 gpm is required for commercial areas.

Table 1-2 presents the design flows analyzed for the distribution system modeling.

**TABLE 1-2
DISTRIBUTION MODELING FLOW SUMMARY**

DEMAND	DEMAND PER ERC (gpm)	TOTAL EXISTING DEMAND (gpm)	TOTAL BUILD-OUT DEMAND (gpm)
Average Day	0.35	70	160
Peak Day	0.86	170	399
Peak Instantaneous	1.29	255	600

CHAPTER 2 - CONNECTIONS

EXISTING CONNECTIONS

The number of existing connections that receive water from the Service Area were determined by reviewing billing data and discussing system users with Service Area personnel. Standby connections don't actively use water and were not included in the connection count. The available data was not coded for residential vs commercial demands, but it is estimated that about 10 connections are commercial or institutional, with the balance being residential.

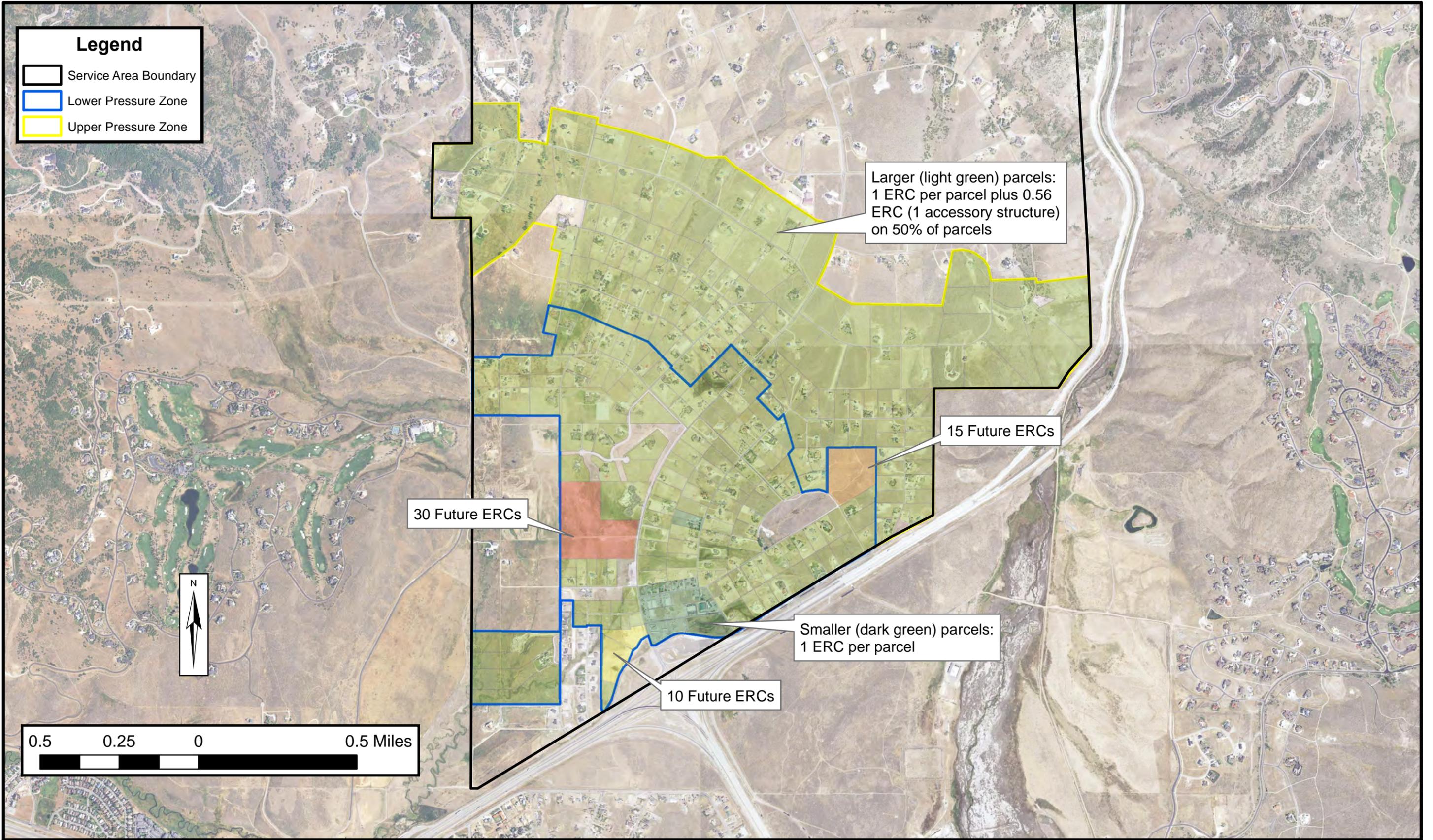
Table 2-1 provides the number of existing connections. The number of connections is provided for each pressure zone.

**TABLE 2-1
EXISTING CONNECTIONS BY PRESSURE ZONE**

ZONE	CONNECTIONS
Upper Pressure Zone	63
Lower Pressure Zone - Residential	124
Lower Pressure Zone - Non-Residential	10
TOTAL	197

CONNECTIONS PROJECTED AT BUILD-OUT

The number of future connections was predicted after reviewing current growth trends and after discussions with the Service Area Board of Trustees and staff. The Board indicated that growth should include all existing Silver Creek Estates platted lots within the water system service area that have not yet been built. Growth should assume an accessory structure on half of all lots within the Service Area (except for about 34 small lots in the lower pressure zone that appear too small for accessory structures). Additionally, four larger unbuilt parcels were discussed and a number of connections was assumed. The build-out growth assumptions are shown on Figure 2-1. A summary of the build-out demands is provided in Table 2-2.



**TABLE 2-2
BUILD-OUT CONNECTIONS**

LAND USE TYPE	ASSUMED AVERAGE CONNECTIONS
Residential	317
Commercial	10
Accessory Units*	82
Undeveloped Large Parcels	55
TOTAL	464

*Assume half of all lots have an accessory unit at 0.56 x typical connection demand.

The numbers of connections provided in Table 2-2 are assumed to be typical average connections. Since the billing data was not coded for residential vs non-residential demand, average water demand per unit includes an average of both commercial and non-residential values. This is relevant in predicting the water demand for the accessory units. The accessory units are assumed to be occupied part time and are expected to be smaller in size than the primary units. Therefore, the accessory units are calculated to have a water demand of 0.56 x the typical connection. The 82 average connections provide in Table 2-2 represent 147 assumed accessory structures. The multiplier of 0.56 is based on the Utah Division of Water Rights part time water duty vs. full time water duty for domestic water use.

Table 2-3 provides the estimated number of future connections by zone.

**TABLE 2-3
BUILD-OUT CONNECTIONS BY PRESSURE ZONE**

ZONE	CONNECTIONS
Upper Pressure Zone	183
Lower Pressure Zone	281
TOTAL	464

CHAPTER 3 - SOURCES

EXISTING SOURCES

The Service Area currently has two sources of water for the drinking water system, as well as an emergency connection with Mountain Regional Water. The sources are listed in Table 3-1.

**TABLE 3-1
WATER SOURCES**

NAME	PRESSURE ZONE	PUMPING CAPACITY (gpm)	RATED CAPACITY¹ (gpm)
District Well (Echo Well)	Lower Pressure Zone	150	116
Greenfield Well	Lower Pressure Zone	230	217
Mountain Regional Water District (Emergency) ²	Lower Pressure Zone	-	-
TOTAL		380	333

¹The Utah Division of Drinking Water rates wells at less than the production capacity to accommodate declines in capacity. The rated capacity must be used in determining how many connections may be served by the source.

²The connection with Mountain Regional Water District is only for very limited emergency use. No specific flowrate or volume has been established.

Based on these values, the sources currently have a total rated capacity of 333 gpm during the peak day. However, the Service Area system does not have a capacity of 333 gpm year-round due to the level of arsenic in the Greenfield Well. The maximum contaminant limit (MCL) for arsenic in drinking water is 10 parts per billion (ppb). This limit applies to a yearly average of water delivered to customers. Water in the Greenfield Well has an arsenic level ranging from 12 to 22 ppb. Since using Greenfield Well year-round has the potential to push the average annual arsenic concentrations delivered to customers over the MCL, the Service Area is limited to operating the Greenfield Well for a few months each year. This strategy keeps arsenic levels below the MCL on an annual basis. Strategies to deal with arsenic are discussed in Chapter 3.

BOOSTER PUMP STATION

The Service Area has a booster pump station for the purpose of lifting water from the lower pressure zone to the upper pressure zone. Both wells pump into the Silver Bullet Tank via the lower pressure zone piping. The booster station lifts the water from the lower pressure zone into the Upper (Highfield) Tank. The Silver Bullet Tank serves as a storage facility for the lower pressure zone residents and for the booster station intake storage. The pump station's details are provided in Table 3-2.

**TABLE 3-2
PUMP STATION CAPACITY**

NAME	FROM PRESSURE ZONE	TO PRESSURE ZONE	PUMPS	RATED CAPACITY (gpm)
Booster Station	Lower Pressure Zone	Upper Pressure Zone	2 x 130 gpm	130*

*Note that the booster station has two pumps. One pump is redundant per UDDW rules.

The rated capacity of a pump station is the total flow of the pump station with largest pump out of service. This pump station is the sole supply of water to the upper zone.

EXISTING SOURCE REQUIREMENTS

UDDW standards require that public drinking water sources be able to meet the existing peak day demand and average yearly demand. These criteria are discussed as follows:

Existing Peak Day Demand

Peak day demand is the water demand on the day of the year with the highest water use and is used to determine the required source capacity under existing and build-out conditions. A comparison of supply and existing peak day demand is provided in Table 3-3.

**TABLE 3-3
EXISTING SOURCE SUPPLY AND DEMAND COMPARISON**

ITEM	FLOWRATE (gpm)
District Well Rated Capacity / Pumping Capacity	116 / 150
Greenfield Well Rated Capacity / Pumping Capacity	217 / 230
Total Rated Well Capacity / Well Pumping Capacity	333 / 380
Booster Pump Capacity (to Upper Pressure Zone)	130
Existing Peak Day Demand Upper Pressure Zone	54
Existing Peak Day Demand Lower Pressure Zone	116
Total Existing Peak Day Demand	170
Remaining Rated Well Capacity / Well Pumping Capacity	163 / 210*
Remaining Booster Station Capacity	76

*Both wells operating.

In Table 3-3, it may be observed that under existing conditions there is excess capacity if the Greenfield Well is operational. However, if the Greenfield Well is no longer able to pump because of the arsenic level, the District Well may not be able to meet peak day demands.

Existing Average Yearly Demand

Average yearly demand is the average volume of water used during one year. According to the 2016 Concurrency Report, the average yearly demand for the Service Area distribution system is about 90 ac-ft. An estimate based on state standards predicts the similar number of 110 ac-ft. The two wells have successfully provided the water system with its average yearly demand, and it is anticipated that they will be able to continue meeting the existing Service Area's production needs including some growth.

FUTURE SOURCE REQUIREMENTS

Water demand is expected to increase as the Service Area develops. A number of existing parcels have not yet been built. Additionally, it is assumed that up to half the Service Area lots will build accessory structures. This is the assumed build-out conditions for the water system. As with existing water use, future water source needs were evaluated on the basis of peak day demand and average yearly demand. Each requirement is addressed in the following paragraphs.

Future Peak Day Demand

Peak day demand is the water demand on the day of the year with the highest water use and is used to determine the required source capacity under existing and build-out conditions. A comparison of supply and future peak day demand is provided in Table 3-4.

**TABLE 3-4
ESTIMATED FUTURE SOURCE SUPPLY AND DEMAND COMPARISON**

ITEM	FLOWRATE (gpm)
District Well Rated Capacity / Pumping Capacity	116 / 150
Greenfield Well Rated Capacity / Pumping Capacity	217 / 230
Total Rated Well Capacity / Well Pumping Capacity	333 / 380
Booster Station Capacity (to Upper Pressure Zone)	130
Future Peak Day Demand Upper Pressure Zone	157
Future Peak Day Demand Lower Pressure Zone	242
Total Future Peak Day Demand	399
Rated Capacity Deficit / Pumping Capacity Deficit	66 (Deficit) / 19 (Deficit)*
Remaining Booster Station Capacity Deficit	27 (Deficit)

*Both wells operating.

In Table 3-4, it may be observed that at some point before the future (build-out) condition occurs, the water system may have difficulty meeting the peak production demands. Additional source capacity will need to be found and the booster station may need to be upgraded.

Future Average Yearly Demand

Water utilities must be able to supply the average yearly demand. Average yearly demand is the average volume of water used during the course of one year. The predicted annual water demand for the build-out condition is 260 ac-ft. This could possibly be achieved if the District Well and the Greenfield Well operate half time. It is unknown if the wells could achieve this level of production. In order to evaluate this possibility, the Service Area should closely monitor well performance as growth occurs. An additional source of water should be considered before reaching the build-out condition.

FUTURE SOURCES AND REDUNDANCY

It is recommended that redundancy be provided for the water system. The system should have adequate capacity to meet all of the demands with a major source unavailable. The capacity of the Service Area's two wells is predicted as inadequate to meet the future demand. As the Service Area develops, it will likely become necessary to secure an additional source of water. This can be accomplished by developing a new well or by purchasing water from a nearby wholesale supplier. For example, the Service Area has an emergency connection with Mountain Regional Water. It may be possible to enter into an agreement with Mountain Regional to change the connection from an emergency only connection to a supply connection.

GREENFIELD WELL AND ARSENIC

While the Greenfield Well has proven to be a successful water source for the Service Area, its use has been limited due to high arsenic content. The Service Area drilled the Greenfield Well in 2003. Water quality testing in Greenfield Well revealed an arsenic concentration of up to about 22 ppb. At that time, the EPA maximum contaminant limit (MCL) for arsenic in drinking water was 50 ppb, and therefore, the well was compliant with drinking water standards. However, the MCL for arsenic in drinking water was reduced to 10 ppb in 2006, bringing water from the Greenfield Well out of compliance. The UDDW did not allow the water to be used as a source.

In order to allow use of the well, Service Area, with the assistance of HAL, entered into an agreement with the UDDW. A program of increased sampling and analysis was prepared and proposed to the UDDW, who approved it. The plan allows use of the Greenfield Well for several months each year as long as water users receive water which is less than 10 ppb arsenic. This is accomplished by running both wells at the same time, which results in the blending of lower arsenic water from the District Well and higher arsenic water from the Greenfield Well. Sampling, laboratory analysis and reporting are required to confirm compliance with the agreement.

Treatment Option

As growth continues, the limitation on use of the Greenfield Well is expected to become a constraint. The Service Area may wish to construct a water treatment plant to remove arsenic. This would allow the Greenfield Well to be used without restriction.

SOURCE RECOMMENDATIONS

Based on the analysis for the existing conditions and build-out projections, the Board of Trustees has agreed that additional source capacity be developed. The Service Area is currently analyzing treatment options to allow the Greenfield Well to be used without restriction. A list of alternatives that were discussed is as follows:

1. Water Treatment Plant at the Greenfield Well for arsenic removal.
2. New Well and Well House
3. Wholesale water connection.

Source alternatives were discussed with the Board of Trustees in the June 18, 2018 Board meeting. The Board of Trustees selected the Water Treatment Plant alternative as the preferred alternative for the next project to provide source capacity. However, it is important to note that the water demand projections show that even if a water treatment plant is constructed at the Greenfield Well location, eventually additional source capacity may be needed at some point in the future. A new well and well house could potentially be constructed to provide more source, which is assumed at this point for cost estimating purposes.

CHAPTER 4 - STORAGE

EXISTING STORAGE

The Service Area's current drinking water system includes two storage tanks with a total capacity of 700,000 gal. However, only about 45,000 gallons of the capacity of the Silver Bullet Tank is effective due to its low elevation. The locations of storage facilities are shown on Figure 1-1. Table 4-1 presents a listing of the names and select attributes of the Service Area's water storage tanks.

**TABLE 4-1
EXISTING STORAGE TANKS**

NAME	TYPE	VOLUME (gal)	EFFECTIVE VOLUME (gal)	FIRE SUPPRESSION VOLUME (gal)	FIRE SUPPRESSION LEVEL (ft above tank bottom)
Silver Bullet	Steel	200,000	45,000	0	NA
Upper Tank	Concrete	500,000	500,000	240,000	5.8

UDDW standards indicate that emergency storage can be considered in the sizing of storage facilities {R309-510-8(1)(c) U.A.C}. Emergency storage is intended to provide a safety factor that can be used in case of unexpectedly high demands, pipeline failures, equipment failures, electrical power outages, water supply contamination, or natural disasters. Based on previous experience developing master plans, no emergency storage has been recommended because the required equalization storage as set by Utah {R309-510-8 U.A.C.} is generally sufficiently conservative such that additional storage for emergencies is not needed. Accordingly, no tank levels were specified for emergency storage in Table 4-1. These may be implemented in the future if the Service Area desires.

EXISTING STORAGE REQUIREMENTS

According to UDDW standards, storage tanks provide equalization storage volume to make up the difference between the peak day flow rate and the peak instantaneous demand and fire suppression storage.

Equalization Storage

The need for equalization storage is highest during the irrigation season on days of peak water use. Equalization storage is used to meet peak demands during the time when demand exceeds the capacity of the sources. For the Service Area, the required equalization storage was calculated according to state standards. For indoor demand, the state standards indicate that 400 gallons/connection must be provided. For outdoor demand in this area, a storage

volume of 1,873 gallons/irrigated acre must be provided. While each lot and connection is different, a typical irrigated area of 0.093 acres per connection was estimated by random sampling of lots and by estimation of irrigated area by using aerial photography. Based on this the required storage for outdoor use is 175 gallons per connection. Combining indoor and outdoor use, the total required storage volume is 575 gallons/connection.

Fire Suppression Storage

Fire suppression storage is required by the UDDW for water systems that provide water for firefighting. The Park City Fire District has jurisdiction over the Service Area. Contact information for the Park City Fire District is as follows:

Phone:	435-940-2500
Mailing Address:	Park City Fire District P.O. Box 980010 Park City, Utah 84098-0010
Physical Address:	736 W Bitner Road Park City, Utah 84098-5432

Fire Marshall Mike Owens was contacted. He indicated that the minimum fire flow requirement is 2,000 gpm for 2 hours in commercial areas and 1,500 gpm for 2 hours in Silver Creek residential areas.

The water system should be managed so that the storage volume dedicated to fire suppression is available to meet fire flow requirements whenever it is needed. This can be accomplished by designating minimum storage tank water levels that provide reserve storage equal to the required fire suppression storage. Although it is important to utilize equalization storage, typical daily water fluctuations in the tanks should be maintained above the minimum established levels except during fire or emergency situations. The fire suppression tank level is included in Table 4-1.

It is also important to note that fire storage for one pressure zone can be stored in another. Water stored in the Upper Tank can be used in the lower pressure zone in the event of a fire. However, water use from the Silver Bullet Tank is limited to lower pressure zone use.

A summary of existing storage requirements is provided in Table 4-2.

**TABLE 4-2
EXISTING STORAGE REQUIREMENTS**

REQUIRED STORAGE TYPE*	AMOUNT (gallons)
Upper Pressure Zone - Required Equalization Storage	36,000
Lower Pressure Zone - Required Equalization Storage	76,000
Required Fire Storage	240,000
TOTAL REQUIRED STORAGE	352,000
PROVIDED EFFECTIVE STORAGE	AMOUNT (gallons)
Silver Bullet Tank	45,000
Upper Tank	500,000
TOTAL PROVIDED EFFECTIVE STORAGE	545,000

*Note: Fire storage for all areas is provided from the Upper Tank. Value may be rounded.

In Table 4-2, it may be observed that the Service Area has a storage of approximately 193,000 gallons beyond the minimum requirement.

BUILD-OUT STORAGE REQUIREMENTS

The storage volumes required at build-out are based on the same unit utilization, fire suppression, and operational storage requirements as were calculated for the existing conditions. The build-out equalization storage will be higher than existing conditions because the number of connections is projected to increase. The Service Area's future storage requirements at build-out are presented in Table 4-3.

**TABLE 4-3
FUTURE STORAGE REQUIREMENTS**

REQUIRED STORAGE TYPE	AMOUNT (gallons)
Upper Pressure Zone - Required Equalization Storage	105,000
Lower Pressure Zone - Required Equalization Storage	162,000
Required Fire Storage*	240,000
TOTAL REQUIRED STORAGE	507,000
PROVIDED EFFECTIVE STORAGE	AMOUNT (gallons)
Silver Bullet Tank	45,000
Upper Tank	500,000
TOTAL PROVIDED EFFECTIVE STORAGE	545,000

*Note: Fire storage for all areas is provided from the Upper Tank. Values may be rounded.

It may be observed in Table 4-3 that the Service Area is expected to have adequate storage even with the anticipated future growth.

SILVER BULLET TANK

Condition

The Service Area inquired as to whether the Silver Bullet Tank should be replaced. There is concern that due to its age, it may be reaching a condition wherein it may not provide reliable service much longer. However, despite its age, the tank is performing well and doesn't have obvious signs of significant corrosion.

It has been reported that the Silver Bullet Tank has been inspected inside and outside by a tank inspections company within recent years. The previous water operator reported this information to HAL. The operator also reported that the company found the tank to be in good condition. Unfortunately, a copy of the inspection report is not available, so it is not possible to directly document the results. In order to verify the condition of the tank, it is recommended that the inspection report be located if possible. Otherwise, it is recommended that a tank inspection company be retained and have a current inspection performed. The name of the inspection company is not known.

It is recommended that the Silver Bullet Tank remain in service at this time. Once the inspection is performed in the near future, the need for replacement can be reevaluated.

Replacement Cost

It is anticipated that the replacement cost for the Silver Bullet Tank will be between \$250,000 to \$350,000.

Silver Bullet Tank Operations

It is important to consider the existing operational state of the Silver Bullet Tank. The tall and narrow shape of the tank creates the potential for large pressure swings in the system. Pressures in the system are approximately 20 psi higher when the tank is full (at a level of almost 50 feet) than when the tank is nearly empty. Additionally, the tank will be unable to deliver water at the necessary pressures once the water drops to a certain level. To avoid pressure issues, the Service Area does not generally let the level in the tank drop below 30 feet. This means that only the top 40% of the tank is used effectively as equalization storage, while the rest is not used except in emergencies (the water can still be used as intake water for the Booster Station).

If replacement of the Silver Bullet Tank is desired, the new tank should be located at the same elevation or higher. This would provide better pressures in the lower pressure zone and allow operators to more fully utilize the volume of the tank. The new tank could potentially be of a different design, such as an elevated tank.

Alternatively, the Service Area could choose a different tank site at a higher elevation and construct a pipeline to connect the tank to the existing pipes in the lower pressure zone. In this case, the tank could be located between Crescent Drive North and Crescent Drive South, or east of the current site at a location on the hillside east of Whileaway Road.

STORAGE RECOMMENDATIONS

As noted above, the amount of available water storage is predicted to be adequate for both existing conditions and future growth. Therefore, there is no need for expansion of storage facilities as this time or the near term future. Adequacy of the water storage volume should be re-assessed during the next master plan update in 5 to 10 years (or as needed based on growth or changes to the water system). Additionally, the Service Area should continue to periodically inspect the condition of the storage tanks as part of operations and maintenance procedures so that any deterioration can be identified in a timely manner.

CHAPTER 5 - DISTRIBUTION SYSTEM

EXISTING DISTRIBUTION SYSTEM

The distribution system consists of all pipelines, valves, fittings, and other appurtenances used to convey water from the water sources and storage tanks to the water users. The existing water system contains about 13 miles of distribution pipe ranging in size from 6 to 10 inches in diameter. Table 5-1 presents a summary of pipe length by diameter.

**TABLE 5-1
SUMMARY OF PIPE LENGTH BY DIAMETER**

PIPE DIAMETER (in)	LENGTH (mi)
6	4.5
8	5.1
10	3.8
12	0.02

EXISTING DISTRIBUTION SYSTEM REQUIREMENTS

Pressure Standards

The UDDW has established minimum pressure standards for water systems {R309-105-9(1) U.A.C}. Existing systems approved prior to January 1, 2007 must maintain a minimum pressure of 20 psi at all points of connection during normal operating conditions and during conditions of fire flow plus peak day demand. For systems approved after the indicated date, the minimum water pressure must be (a) 20 psi during conditions of fire flow experienced during peak day demand; (b) 30 psi during peak instantaneous demand; and (c) 40 psi during peak day demand {R309 105-9(2) U.A.C}. Much of the Service Area is subject to the lower pressure standard (20 psi for all normal operating conditions), but if expansion occurs to new areas, the higher pressure standard applies.

Existing Peak Instantaneous Demand

Peak instantaneous demand is the highest demand on the peak day. The pipes in the distribution system must be large enough to convey the peak instantaneous demand while maintaining the pressure standard. The existing peak day instantaneous demand was determined based on the design flow of 170 gpm and a peaking factor of 1.5. The peaking factor was determined by analyzing SCADA production data for the Service Area. With this peaking factor, the peak instantaneous flow rate is estimated to be 255 gpm.

Existing Peak Day Demand Plus Fire Flow

In accordance with UDDW regulations, the distribution system must be capable of delivering fire flow to a specified location within the system while supplying the peak day demand defined by state standards to the entire distribution system and maintaining 20 psi minimum pressure at all delivery points within the distribution system.

FUTURE DISTRIBUTION SYSTEM REQUIREMENTS

The unit values established for the existing system are assumed to apply to the future (build-out) system. These are described as follows:

Future Peak Instantaneous Demand

The future peak day design flow for the distribution system is estimated to be 400 gpm. Assuming the same peaking factor of 1.5 applies to the build-out peak day demand gives a peak instantaneous demand of **600 gpm**. Please note that peak instantaneous demand which is in excess of the source capacity will be met through storage withdrawal.

Future Peak Day Plus Fire Flow Demand

The build-out peak day plus fire flow scenario was evaluated in a similar manner as the existing peak day plus fire flow scenario. It was assumed that the fire flow requirements would not change between the existing and build-out conditions. Generally, this is a conservative assumption as, over time, older buildings are replaced with newer buildings constructed in accordance with updated building codes.

COMPUTER MODEL

Computer models of the Service Area's water distribution system were developed to analyze the performance of the existing and future distribution system and to prepare solutions for existing facilities that cannot meet the UDDW or Service Area criteria for water system pressures. The software used for the model was EPANET 2.0, which is a computer program that models the hydraulic behavior of pipe networks. The model was calibrated using fire hydrant tests performed by the Service Area with HAL personnel attending.

Computer models were developed for three phases of water system development. The first phase was the development of a model of the existing system (existing model). This model was used for calibration and to identify deficiencies in the existing system. A second model was developed which was used to identify the corrections necessary to improve existing system deficiencies (corrected existing model). The third phase was the development of a future model to identify improvements that will be necessary for the projected "build-out" condition (future model).

MODEL COMPONENTS

The two basic elements of the computer model are pipes and nodes. A pipe is described by its inside diameter, overall length, minor friction loss factors, and a roughness value associated with friction head losses (Friction factors varied between a Hazen-William factor 130 to 150 as needed to calibrate the model). A pipe can include elbows, bends, valves, pumps, and other operational elements. Nodes are the end points of a pipe and they can be categorized as junction nodes or boundary nodes. A junction node is a point where two or more pipes meet, where a change in pipe diameter occurs, or where flow is put in or taken out of the system. A boundary node is a point where the hydraulic grade is known (a reservoir or PRV).

The computer model of the water distribution system is not an exact replica of the actual water system. Pipeline locations used in the model are approximate and every pipeline may not be included in the model, although efforts were made to make the model as complete and accurate as possible. It is not necessary to include all of the distribution system pipes in the model to accurately simulate its performance.

Demands

Water demands were input to the model based on billing data from June through August, 2017. The peak demand month was determined from the billing data, and then these demands were entered into the model. The peak monthly flows were then scaled in order to convert the monthly flow into a peak day demand flow. The scale factor was based on production data that was provided by the Service Area to HAL.

Diurnal demand curves were developed for the Service Area using SCADA production data. The non-dimensional demand curve for the Service Area is shown in Figure 5-1.

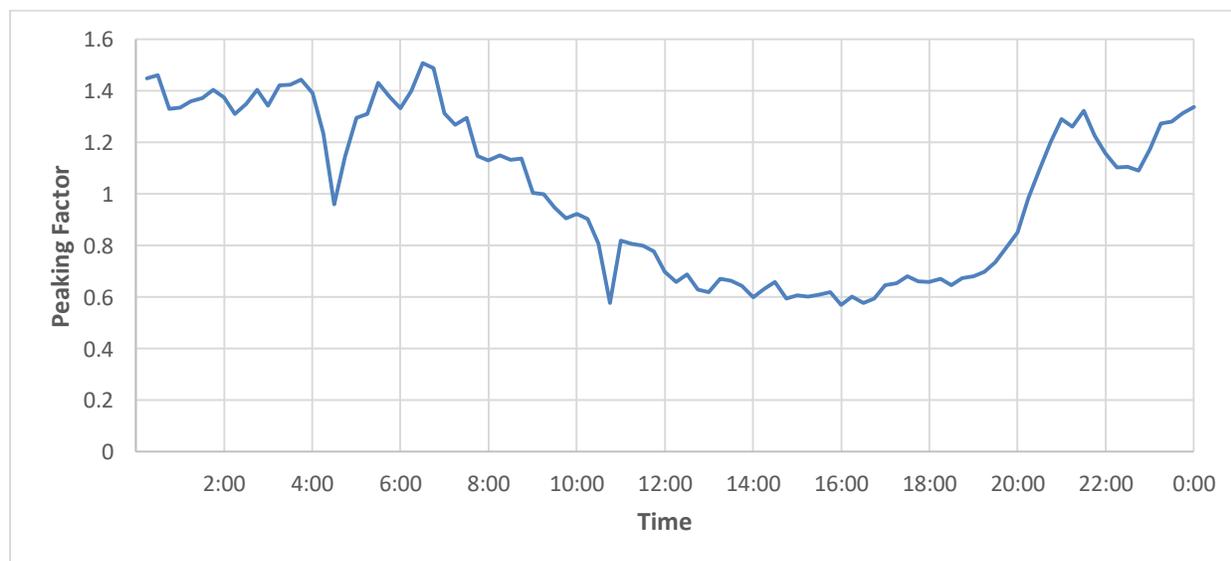


FIGURE 5-1: PEAK DAY DIURNAL CURVE FOR SCSA No. 3

The data included in Figure 5-1 shows typical demands for the Service Area. The water demand peaks at 6:00 AM before dropping during mid-day. A smaller secondary peak occurs at about 9:00 PM and flow remains relatively high throughout the night. It is believed that the primary driver of the elevated nighttime flows is nighttime irrigation.

Sources and Storage Tanks

The sources of water in the model are the Service Area's wells. The levels in the tanks are modeled in the extended period model scenario. The extended period model predicts the levels in the tanks as they fill from sources and empty to meet demand in the system.

MODEL CALIBRATION

A water system computer model calibration was performed on the Service Area water model. Calibration is a comparison of the computer results, field tests, and actual system performance. Field tests are accomplished by performing fire flow tests and pressure tests on the system. When the computer model does not match the field tests within an acceptable level of accuracy, the computer model was adjusted to match field conditions. Calibration is especially useful for identifying pipe sizes that are not correct and PRVs or isolation valves that are not operating as expected. Pipe roughness is an additional characteristic that may also be adjusted during calibration.

The model was calibrated primarily through the use of SCADA data, flow measurements, pressure measurements and hydrant testing. Source flows and tank levels were provided to HAL and the model was calibrated by adjusting elevation, pipe friction and flow data so that the overall behavior of network was reproduced within the model.

ANALYSIS METHODOLOGY

The EPANET model was used to analyze the performance of the water system for current and projected future demands under three main operating conditions: low flow (highest pressure) conditions, peak instantaneous conditions, and peak day plus fire flow conditions. Each of these conditions typically represent a worst-case situation for the water system, and provide the best test for compliance with UDDW requirements. The results of the model for each of the conditions are discussed below.

High Pressure Conditions

Low flow or static conditions are usually when the high pressures occur in a water distribution system. In the wintertime, water demand during night time hours is very low, tanks are nearly full, and movement of water through the system is minimal. Under these conditions, the water system approaches a static condition and water pressure in the distribution system is dependent only upon the elevation differences and pressure regulating devices. The highest pressures in the system are predicted to be 140 psi.

Peak Instantaneous Demand Conditions

Peak instantaneous demand conditions can sometimes be the worst-case scenario for low pressures throughout a water distribution system. The water system reaches peak instantaneous demand conditions during the hottest days of the summer when both indoor and outdoor water use is the highest. This high demand increases velocities in the distribution pipes, which decreases pressure. The UDDW requires the pipes in the distribution system to be capable of delivering peak instantaneous demand to the entire service area and maintain a minimum pressure of 20 psi at any service connection within the distribution system. The lowest predicted pressures are near Highfield Road and Crescent Drive and are expected to be 25 psi. These pressures are in a portion of the water system constructed prior to 2007, so the 20 psi pressure standard applies.

Peak Day Demand Plus Fire Flow Conditions

Even though peak instantaneous conditions are the worst-case for the lowest pressure and highest demand for the entire system, the peak day plus fire flow is often the worst-case scenario for the lowest pressures at specific locations in the system. This condition occurs when fire hydrants are being used on a day of high water demand. The distribution system must be capable of delivering the required fire flow to the specified location within the system, while supplying the peak day demand to the entire distribution system. In accordance with the State standards, the required fire flows must be delivered while maintaining 20 psi minimum residual pressure at the delivery point and to all service connections within the distribution system.

Extended Period Model

An extended period model was prepared for the water system and used in the analyses. The peak day extended period model was run for several days with the peak day demand curve repeating every 24 hours such that the model operated in a stable pattern. The model has reached stabilization when the filling and emptying cycles of the tanks repeat in a consistent pattern without running empty. System recommendations for existing conditions and future conditions at build-out were checked with the extended period model to confirm adequacy.

ANALYSIS RESULTS OF THE EXISTING SYSTEM

The model output primarily consists of the computed pressures at nodes and flow rates through pipes. The model also provides additional data related to pipeline flow velocity and head loss to help evaluate the performance of the various components of the distribution system. Due to the large number of pipes and nodes in the model, it is impractical to prepare a figure which illustrates pipe numbers and node numbers. This information is provided in the model output.

The model predicts that the Service Area distribution system can meet demands during average, peak day and peak instantaneous demand conditions. The distribution system can meet peak day plus fire flow demands in most areas. However, there are a few areas that can't meet the fire flow standard. These areas are described in Table 5-2.

EXISTING DISTRIBUTION SYSTEM RECOMMENDATIONS

Existing Distribution System Projects

Recommendations for improvement projects were based on the modeling, as outlined above, and guidance provided by Service Area personnel. All of the recommendations are necessary to meet the fire flow demands. The locations of improvements are included on Figure 5-2.

**TABLE 5-2
EXISTING SYSTEM FIRE FLOW PROJECTS**

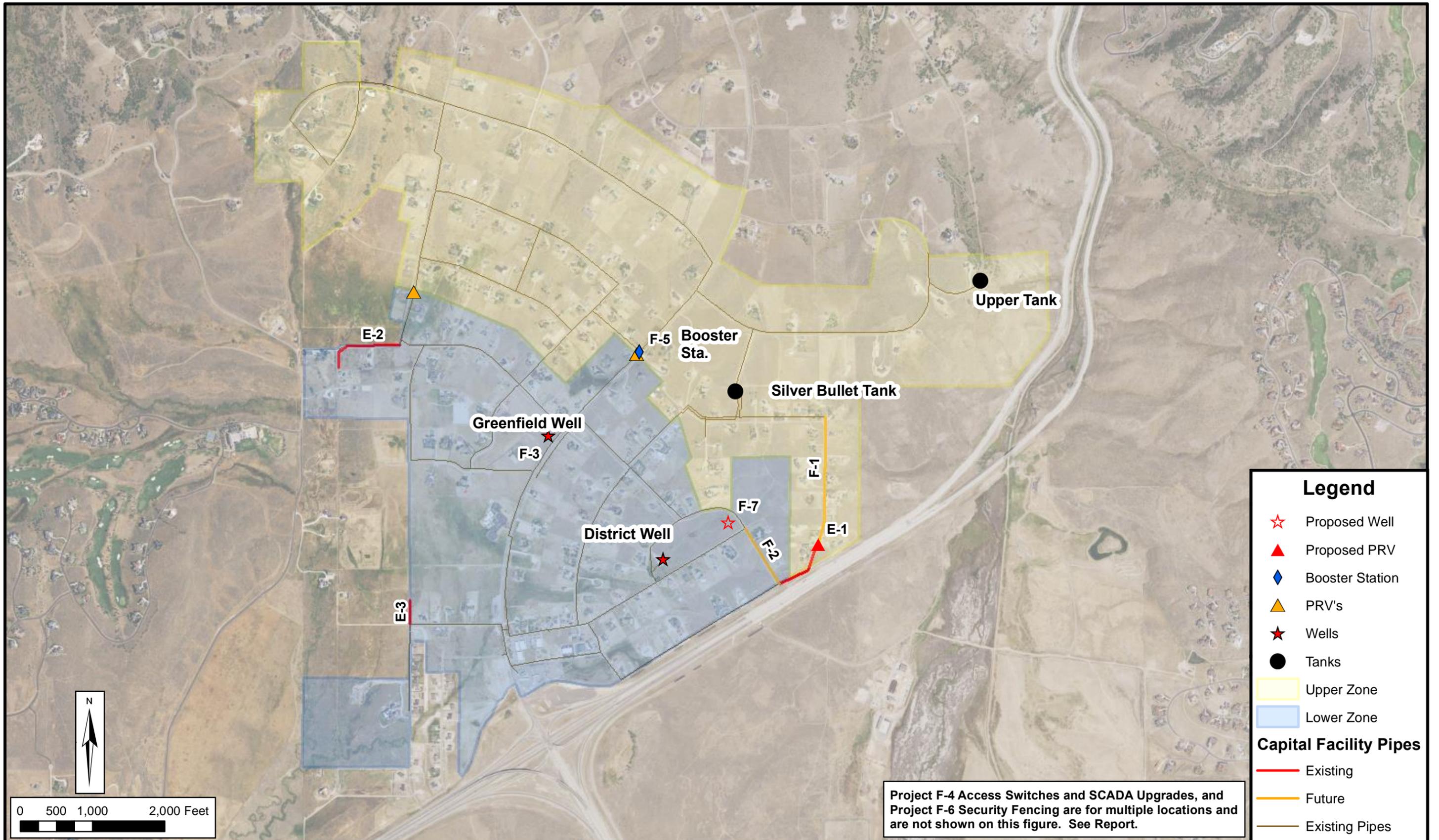
PRIORITY	MAP ID #	LOCATION	PROBLEM	SUGGESTED SOLUTION
1	E-1	Whileaway Road and Beehive Drive	Inadequate fire flow due to friction loss and available pressure	Connection between the dead-end Whileaway Road water line and the Echo Lane Water Line. A pressure reducing valve station with reverse flow bypass check valve is recommended.
2	E-2	Wasatch Way, North of Parkway Drive	Inadequate fire flow due to friction loss and available pressure	Replace existing waterline with an 8-inch diameter line.
3	E-3	Greenfield Drive, North of Valley Drive	Inadequate fire flow due to friction loss and available pressure	Replace existing waterline with an 8-inch diameter line.

As may be observed in the above table, a number of projects are recommended to improve the fire flow capacity of the water system. The fire flow projects represent existing deficiencies and should be addressed as soon as possible.

PRESSURE REDUCING VALVES (PRVS) AND SYSTEM PERFORMANCE

For water systems with facilities that are located across significantly different elevations, the lower elevation water is commonly at a higher pressure than in the higher elevations. This is the case for the Service Area. This creates a condition where water pressure in lower elevation areas can become high enough to damage the water system facilities and the water users' plumbing. In the Service Area, pressures in the lower pressure zone are controlled through the use of PRVs which reduce the pressure of water transferring from the upper pressure zone to the lower pressure zone.

While the Service Area's PRVs provide pressure reduction service, they also have a role in energy consumption and savings. Through the application of proper PRV settings, the Service Area potentially can reduce energy consumption and the related cost. However, setting a PRV too high can have the opposite effect within the upper pressure zone. High PRV flows elevate



Legend

- ★ Proposed Well
- ▲ Proposed PRV
- ◆ Booster Station
- ▲ PRV's
- ★ Wells
- Tanks
- Upper Zone
- Lower Zone

Capital Facility Pipes

- Existing
- Future
- Existing Pipes

Project F-4 Access Switches and SCADA Upgrades, and Project F-6 Security Fencing are for multiple locations and are not shown on this figure. See Report.



Summit County Service Area No.3

Capital Facility Projects

FIGURE 5-2

the flow velocity in the upper zone, which in turn increases pressure fluctuations. Furthermore, high PRV settings prevent the equalization storage in tanks from being fully utilized which causes a waste of energy. The solution is to set the PRVs at a level where pressures in the lower zones are maintained, but flow through the PRV is limited. The settings included within the previous chapter were chosen to minimize return flows to the lower zone under normal conditions.

Moreover, if PRV settings are too low, the booster pump station may activate prematurely which can cause water to be pumped in an energy consuming cycle. Water can be pumped to the Upper Pressure Zone and then pass through a PRV to the Lower Pressure Zone. This cycle consumes energy but provides no benefit to the system.

Recommended PRV Settings

During the course of analyzing the system, the PRV settings were adjusted within the model with the goal of maximizing the usage of equalization storage while minimizing pressure fluctuations and energy costs. Table 5-3 presents the recommended PRV settings.

**TABLE 5-3
RECOMMENDED PRV SETTINGS**

PRV Location	From Pressure Zone	To Pressure Zone	Setting (psi)
Booster Station	Upper Pressure Zone	Lower Pressure Zone	30
Redden Road	Upper Pressure Zone	Lower Pressure Zone	45

It may be observed in Table 5-3 that PRV settings are provided. These settings should be viewed as initial estimates and may be modified as needed based on operator experience or specific conditions encountered during operations.

ANALYSIS RESULTS OF THE BUILD-OUT SYSTEM

Recommendations have also been developed for the build-out distribution network. Table 5-4 lists the build-out distribution recommendations. No priority has been assigned to these projects because the priority of the build-out distribution projects will depend heavily of how development progresses within the Service Area.

**TABLE 5-4
BUILD-OUT DISTRIBUTION SYSTEM RECOMMENDATIONS**

ID #	LOCATION	PROBLEM	SUGGESTED SOLUTION
F-1	Whileaway Road	Inadequate fire flow. Approx. 1,700 gpm available.*	Replace 6-inch diameter water line with 8-inch diameter water line.
F-2	Echo Lane	Inadequate fire flow. Approx. 1,700 gpm available.*	Replace 6-inch diameter water line with 8-inch diameter water line.

*Assumes project E-1 is complete.

The recommended projects in the above table are fire flow projects that will become necessary as growth occurs in the water system.

PIPELINE REPLACEMENT PROGRAM

It is recommended that the Service Area implement a pipeline replacement program. Pipelines should be scheduled for replacement based on leakage and breakage history, pipe size, pipe age or other criteria that the Service Area may establish. Replacement pipelines should have a minimum diameter of 8 inches, but should not be smaller than the existing pipe size. Input from the water system operator is key in identifying problem areas. The State recommends that at least 5% of the annual drinking water budget be set aside for facility replacement {R309-700-5 U.A.C.}.

CONTINUED USE OF THE COMPUTER PROGRAM

It is recommended that the Service Area continue updating the model as the water system changes. Below is a list of ways in which the model could help the Service Area with water system management. The computer model can assist staff in determining:

- Effect on the system if individual facilities are added or taken out of service
- Selection of pipe diameters and location of proposed water mains
- Capacity of the water system to provide fire flows in specific areas
- Water age for water quality monitoring

The computer model should be maintained for future use. Necessary data required for continued use of the program are:

- The location, length, diameter, pipe material, and ground elevation at each end of each new pipeline constructed
- Changes in water supply location and characteristics
- Location and demand for new large customers

CHAPTER 6 - SYSTEM SECURITY

WATER SYSTEM SECURITY

Water systems face a number of threats. Some threats are as minor as vandalism, while others are as serious as terrorism. It is important to consider these threats in the planning and operation of a drinking water system. Many measures to guard against these threats are low-cost and simple. Others are more complex. A summary of common measures used to guard against threats to a water system are included in Table 6-1.

**TABLE 6-1
COMMON WATER SYSTEM SECURITY MEASURES**

Facility Type	Common Security Measures
Water Storage Tank	<ul style="list-style-type: none">• Fence perimeter of tank• Install signs warning against trespass• Install contact switches on tank hatches that are linked via SCADA to an alarm for the operator• Use security cameras to monitor the tank
Wells and Pump Station	<ul style="list-style-type: none">• Fence around the well house or pump station• Install signs warning against trespass• Install contact switches on hatches and doors that are linked via SCADA to an alarm for the operator• Use security cameras to monitor the tank
All Facilities	<ul style="list-style-type: none">• Utilize an access control card system for door and gate entry

Fencing and signage are easy to implement and require very little maintenance. They primarily serve as a deterrent to unwanted activity. Contact switches set off an alarm in the SCADA system when a hatch or doorway is opened, giving operators the ability to respond quickly if tampering occurs. Fencing, signage, and contact switches are all common water system security measures and are generally recommended. Security cameras are most useful in areas that are subject to recurring problems or carry especially high risks.

Judgment and discretion should be used when deciding which security measures to implement. Each security measure comes with costs, and may not be practical in all cases. For example, it does not make sense to post a sign warning against tampering with a buried pipeline, simply because it is buried and out of sight. Keeping it obscure is a better security measure than alerting everyone to its location with a sign.

The Service Area water system is in a relatively obscure location and serves a small population, making it very unlikely that it would ever be the target of an attack by an organized group. The most likely threats to the system are vandalism or a deliberate attack by a disgruntled or mischievous local citizen. Accordingly, measures to deter and delay such actions are most practical.

To evaluate the state of the water system from a security standpoint, critical facilities were identified, then an inventory of their security measures were taken. Recommendations made herein are based on this inventory. A critical facility will be defined, for purposes of this report, as a facility that is necessary to maintain the operational state of a large portion the water system. For example, a dead-end pipe serving three lots would not be considered a critical facility. While it is critical to supply water to those three lots, most of the system would continue to operate if it goes out of service.

The tanks, wells, and pump station are critical facilities for the Service Area water system. The upper tank contains the water system fire storage, maintains pressure in the upper pressure zone, and provides storage to both the upper and lower pressure zones. The Silver Bullet tank regulates pressure in the lower pressure zone. The pump station is the sole supply of water to the upper pressure zone. Failure of either the Upper Tank or the pump station would leave the upper pressure zone without water. Failure of either well would leave the system with an inadequate water supply during the summer months.

Security measures should be focused primarily on these critical facilities. Table 6-2 presents a security inventory of each of the critical facilities in the Service Area water system.

**TABLE 6-2
SECURITY INVENTORY OF CRITICAL FACILITIES**

Facility	Signage (Y/N)	Fencing (Y/N)	Contact Switches (Y/N)
Silver Bullet Tank	N	Y	N
Upper Tank	N	N	N
District Well House	Y	Y	N
Greenfield Well House	Y	N	N
Pump Station	N	N	N

The lack of contact switches on the Service Area’s tanks represents a potential vulnerability, allowing tampering at either tank to potentially go unnoticed for extended periods of time. That vulnerability is greater at the Upper Tank since it is not fenced and easily accessible. It is recommended that contact switches are installed on any hatch that can be used to access a tank. Fencing the Upper Tank and posting warning signage are also recommended.

The pump houses and booster station are quite visible, so fencing and signage are appropriate deterrents. There may not be adequate space at the Booster Station for a fence. Contact switches at these locations would provide an additional layer for security.

It is recommended that Service Area personnel develop alarm response procedures if contact switches are implemented. It is important for personnel to be ready in the event that tampering or other security problems occur.

CHAPTER 7 - CAPITAL IMPROVEMENTS PLAN

Throughout the master planning process, the three main components of the Service Area's water system (source, storage, and distribution) were analyzed to determine the system's ability to meet existing demands and the anticipated future demands at build-out. After identifying existing and future deficiencies in the water system, possible solutions were identified for each deficiency. Cost estimates were then developed in order to determine the feasibility of each alternative, and to assist in planning purposes.

One possible method of paying for system improvements is through impact fees. Impact fees are collected from new development and should only be used to pay for system improvements related to new development. For this reason, it is important to identify which projects are related to resolving existing deficiencies, and which projects are related to providing anticipated future capacity for new development.

PRECISION OF COST ESTIMATES

When considering cost estimates, there are several levels or degrees of precision, depending on the purpose of the estimate and the percentage of detailed design that has been completed. The following levels of precision are typical:

<u>Type of Estimate</u>	<u>Precision</u>
Master Planning	±50%
Preliminary Design	±30%
Final Design or Bid	±10%

For example, at the master planning level (or conceptual or feasibility design level), if a project is estimated to cost \$1,000,000, then the precision or reliability of the cost estimate would typically be expected to range between approximately \$500,000 and \$1,500,000. While this may seem very imprecise, the purpose of master planning is to develop general sizing, location, cost, and scheduling information on a number of individual projects that may be designed and constructed over a period of many years. Master planning also typically includes the selection of common design criteria to help ensure uniformity and compatibility among future individual projects. Details such as the exact capacity of individual projects, the level of redundancy, the location of facilities, the alignment and depth of pipelines, the extent of utility conflicts, the cost of land and easements, the construction methodology, the types of equipment and material to be used, the time of construction, interest and inflation rates, permitting requirements, etc., are typically developed during the more detailed levels of design.

At the preliminary or 10% design level, some of the aforementioned information will have been developed. Major design decisions such as the size of facilities, selection of facility sites, pipeline alignments and depths, and the selection of the types of equipment and material to be used during construction will typically have been made. At this level of design the precision of

the cost estimate for a \$1,000,000 project would typically be expected to range between approximately \$700,000 and \$1,300,000.

After the project has been completely designed, and is ready to bid, all design plans and technical specifications will have been completed and nearly all of the significant details about the project should be known. At this level of design, the precision of the cost estimate for the same \$1,000,000 project would typically be expected to range between approximately \$900,000 and \$1,100,000.

SYSTEM IMPROVEMENT PROJECTS

As discussed in previous chapters, several system deficiencies were identified during the system analysis. Project costs for water system improvements are presented in Table 7-1 with the location of each project shown in Figure 5-2. Each recommendation includes a conceptual cost estimate for construction.

Unit costs for the construction cost estimates are based on conceptual level engineering. Sources used to estimate construction costs include:

1. Price quotes from equipment suppliers
2. Recent construction bids for similar work

All costs are presented in 2018 dollars. Recent price and economic trends indicate that future costs are difficult to predict with certainty. Engineering cost estimates provided in this study should be regarded as conceptual level for use as a planning guide. Only during final design can a definitive and more accurate estimate be provided for each project. A cost estimate calculation for each project is provided in Table 7-1.

**Table 7-1
EXISTING CAPITAL FACILITIES LIST**

TYPE	MAP ID	RECOMMENDED PROJECT	COST
Fire	E-1	Connection between the dead-end Whileaway Road water line and the Echo Lane Water Line. A pressure reducing valve station with reverse flow bypass is recommended. Length of new 8-inch pipe is 800 feet.	\$140,000
Fire	E-2	Replace existing waterline with an 8-inch diameter line at Wasatch Way. Length of new 8-inch pips is 1,100 feet.	\$130,000
Fire	E-3	Replace existing waterline with an 8-inch diameter line at Greenfield Drive. Length of new 8-inch pipe is 350 feet.	\$40,000
TOTAL			\$310,000

It is recommended that the fire flow improvement described in Table 7-1 be completed as soon as possible so that the adequate fire protection can be provided. The additional improvements are expected to be needed before the Service Area build-out are included in Table 7-2.

**Table 7-2
BUILD-OUT CAPITAL FACILITIES LIST**

TYPE	MAP ID	RECOMMENDED PROJECT	COST
Fire	F-1	Replace existing waterline with an 8-inch diameter line at Whileaway Drive between Silver Bullet Tank access road and Beehive Drive. Length of new 8-inch pipes is 1,750 feet.	\$200,000
Fire	F-2	Replace existing waterline with an 8-inch diameter line on Echo Lane between Parkway Drive and Beehive Drive. Length of new 8-inch pipes is 900 feet.	\$105,000
Source	F-3	Arsenic Removal Treatment Plant*	\$600,000
Source	F-4	Access Switches and SCADA Upgrade at: <ul style="list-style-type: none"> • District Well • Greenfield Well • Booster Station • Upper Tank • Silver Bullet Tank 	\$17,000
System	F-5	Booster Station Upgrade	\$30,000
System	F-6	Security Fencing at: <ul style="list-style-type: none"> • District Well • Greenfield Well • Booster Station • Upper Tank 	\$110,000
Source	F-7	New Well and Well House*	\$650,000
TOTAL			\$1,712,000

*No land acquisitions costs assumed.

PRIORITY

A priority order of project completion has been developed by HAL. It is recommended that the fire flow projects listed in Table 7-1 be completed initially, as these projects represent deficiencies. Next, it is recommended that project F-3 be completed since it will improve the water quality and operational flexibility for the existing system and since it will make it easier to support the anticipated growth.

SCHEDULE

An estimated construction completion schedule has been prepared for implementation of the above projects assuming the funding is available. The schedule is included as Table 7-3.

**Table 7-3
ESTIMATED SCHEDULE**

MAP ID	RECOMMENDED PROJECT	ESTIMATED COMPLETION DATE
E-1	Connection between the dead-end Whileaway Road water line and the Echo Lane Water Line. A pressure reducing valve station with reverse flow bypass is recommended. Length of new 8-inch pipe is 800 feet.	2019
E-2	Replace existing waterline with an 8-inch diameter line at Wasatch Way. Length of new 8-inch pips is 1,100 feet.	2019
E-3	Replace existing waterline with an 8-inch diameter line at Greenfield Drive. Length of new 8-inch pipe is 350 feet.	To Be Determined (Once service is connected to north)
F1, F-2	Pipeline Upgrades*	2023+
F-3	Arsenic Removal Treatment Plant	2021
F-4, F-6	Security Measures	2019
F-5	Booster Station Upgrade*	2023+
F-7	New Well and Well House*	2023+

*It is estimated that these projects will be required at a time beyond 5 years in the future assuming growth rates provided by the Utah Governor's Office of Management and Budget.

FUNDING OPTIONS

Funding options for the recommended projects, in addition to water use fees, could include the following options: General obligation bonds, revenue bonds, State/Federal grants and loans, and impact fees (check with bond and legal counsel to determine applicability of each funding type). In reality, the Service Area may need to consider a combination of these funding options. The following discussion describes each of these options.

With respect to water use fees, it is recommended that the Service Area evaluate water rates periodically. Rates should be sufficient to cover the full cost of producing and delivering water and maintaining the system so that it is not necessary to subsidize with other funding sources. Not keeping up with proper maintenance and pipeline replacement will create an eventual significant financial burden on ratepayers. Old, unstable and leaky pipes cause significant

inefficiency, interfere with conservation efforts, and increase the potential for a water quality health risk. Charging customers for the true current cost of water reinforces the idea that water is a valuable commodity, does not create future financial instability, and protects the health of the public.

General Obligation Bonds

This form of debt enables an agency to issue general obligation bonds for capital improvements and replacement. General Obligation (G.O.) Bonds would be used for items not typically financed through the Water Revenue Bonds (for example, the purchase of water source to ensure a sufficient water supply for the City's in the future). G.O. bonds are debt instruments backed by the full faith and credit of the agency, which would be secured by an unconditional pledge of the agency to levy assessments, charges or ad valorem taxes necessary to retire the bonds. G.O. bonds are the lowest-cost form of debt financing available to local governments and can be combined with other revenue sources such as specific fees, or special assessment charges to form a dual security through the agency's revenue generating authority. These bonds are supported by the agency as a whole, so the amount of debt issued for the water system is limited to a fixed percentage of the real market value for taxable property within the agency.

Revenue Bonds

This form of debt financing is also available to the Agency for utility related capital improvements. Unlike G.O. bonds, revenue bonds are not backed by the Agency as a whole, but constitute a lien against the water service charge revenues of a Water Utility. Revenue bonds present a greater risk to the investor than do G.O. bonds, since repayment of debt depends on an adequate revenue stream, legally defensible rate structure and sound fiscal management by the issuing jurisdiction. Due to this increased risk, revenue bonds generally require a higher interest rate than G.O. bonds, although currently interest rates are at historic lows. This type of debt also has very specific coverage requirements in the form of a reserve fund specifying an amount, usually expressed in terms of average or maximum debt service due in any future year. This debt service is required to be held as a cash reserve for annual debt service payment to the benefit of bondholders. Typically, voter approval is not required when issuing revenue bonds.

State/Federal Grants and Loans

Historically, both local and county governments have experienced significant infrastructure funding support from state and federal government agencies in the form of block grants, direct grants in aid, interagency loans, and general revenue sharing. Federal expenditure pressures and virtual elimination of federal revenue sharing dollars are clear indicators that local government may be left to its own devices regarding infrastructure finance in general. However, state/federal grants and loans should be further investigated as a possible funding source for needed water system improvements.

It is also important to assess likely trends regarding federal / state assistance in infrastructure financing. Future trends indicate that grants will be replaced by loans through a public works revolving fund. Local governments can expect to access these revolving funds or public works trust funds by demonstrating both the need for and the ability to repay the borrowed monies, with interest. As with the revenue bonds discussed earlier, the ability of infrastructure programs to wisely manage their own finances will be a key element in evaluating whether many secondary funding sources, such as federal/state loans, will be available to the Service Area.

Impact Fees

Impact fees can be applied to water related facilities under the Utah Impact Fees Act. The Utah Impacts Fees Act is designed to provide a logical and clear framework for establishing new development assessments. It is also designed to establish the basis for the fee calculation which the Service Area must follow in order to comply with the statute. However, the fundamental objective for the fee structure is the imposition on new development of only those costs associated with providing or expanding water infrastructure to meet the capacity needs created by that specific new development. Also, impact fees cannot be applied retroactively.