

CULINARY WATER MASTER PLAN AND CAPITAL FACILITY PLAN

(HAL Project No.: 416.01.100)

DRAFT

October 2019

PAYSON CITY

CULINARY WATER MASTER PLAN
AND CAPITAL FACILITY PLAN

(HAL Project No.: 416.01.100)

Steven C. Jones, P.E.
Principal, Project Manager

HANSEN ALLEN & LUCE inc
ENGINEERS

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GLOSSARY OF TECHNICAL TERMS

Average Daily Flow: The average yearly demand volume, divided by 365 days and expressed as a flow rate.

Average Yearly Demand: The volume of water used during an entire year.

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

Culinary Water: Water of sufficient quality for human consumption. Also referred to as Drinking or Potable water.

Demand: Required water flow rate or volume.

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

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: 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(s) of the year in which a maximum amount of water is used in a 24-hour period.

Peak Day Demand: The average daily flow required to meet the needs imposed on a water system during the peak day(s) of the year.

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 excessive 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: Typically the area within the boundaries of the entity or entities that participate in the ownership, planning, design, construction, operation and maintenance of a water system.

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 Culinary 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 AND UNITS

ac	acre [area]
ac-ft	acre-foot (1 ac-ft = 325,851 gal) [volume]
CIP	Capital Improvement Plan
CFP	Capital Facilities Plan
CUWCD	Central Utah Water Conservancy District
CWP	Central Water Project
DIP	Ductile Iron Pipe
DBP	disinfection byproduct
EPA	U.S. Environmental Protection Agency
EPANET	EPA hydraulic network modeling software
ERC	Equivalent Residential Connection
ft	foot [length]
ft/s	feet per second [velocity]
gal	gallon [volume]
gpd	gallons per day [flow rate]
gpm	gallons per minute [flow rate]
HAL	Hansen, Allen & Luce, Inc.
hp	horsepower [power]
hr	hour [time]
IFA	Impact Fee Analysis
IFC	International Fire Code
IFFP	Impact Fee Facilities Plan
in.	inch [length]
kgal	thousand gallons [volume]
kW	kilowatt [power]
kWh	kilowatt hour [energy]
MG	million gallons [volume]
MGD	million gallons per day [flow rate]
mg/L	milligram per liter [concentration]
µg/L	microgram per liter [concentration]
mi	mile [length]
psi	pounds per square inch [pressure]
s	second [time]
SCADA	Supervisory Control And Data Acquisition
THM	trihalomethane
UV	ultraviolet radiation (disinfection method)
wsfu	water supply fixture unit
yr	year[time]

CHAPTER 1 INTRODUCTION

PURPOSE AND SCOPE

The purpose of this master plan is to provide direction to the City of Payson regarding decisions that will be made now and well into the future to provide an adequate culinary water system for its customers at the most reasonable cost. Recommendations are based on demand data, growth projections, standards of the Utah Division of Drinking Water (DDW), city zoning, known planned developments, and standard engineering practices.

The master plan is a study of the City's culinary water system and customer water use. The planning horizon for this master plan is the year 2050. The following topics are addressed herein: growth projections, source requirements, storage requirements, and distribution system requirements. Based on this study, needed capital improvements have been identified and conceptual-level cost estimates for the recommended improvements have been provided.

The results of the study are limited by the accuracy of growth projections, data provided by the City, and other assumptions used in preparing the study. It is expected that the City will review and update this master plan every 5–10 years as new information about development, system performance, or water use becomes available.

BACKGROUND

Payson City is located in southern Utah County, Utah. While it has roots in agriculture, Payson's economy has diversified to include other industries such as healthcare, industrial manufacturing, food service, and retail sales. Payson grew at a slow pace from its inception in 1850 until about 1970, when growth began to accelerate. Growth has become even more rapid in recent years as the population in Utah County has expanded, and areas further north have built out or become more expensive. The City has a current estimated population of 23,207 (Fregonese 2019). See Figure 1-1. At the end of 2018, the City provided water service to about 6,059 connections.

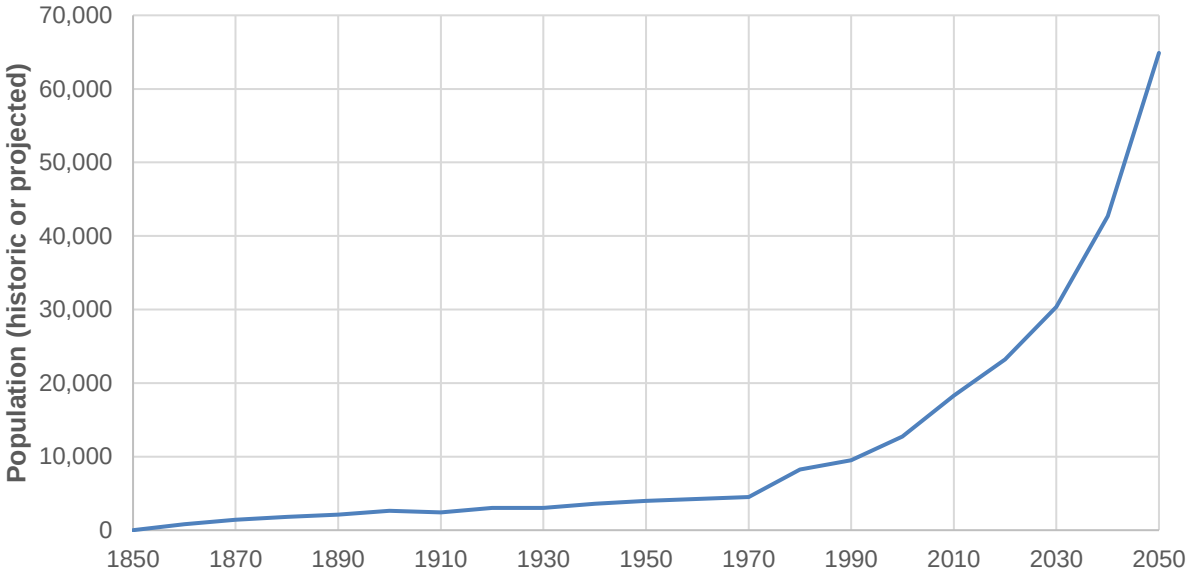


Figure 1-1: Payson Historic and Projected Population
(U.S. Census Bureau 2018)

The City's existing culinary water system includes four wells, three tanks, three pressure zones, and about 100 miles of pipe with diameters of 4 to 16 inches. See Figure 1-2. The City recognizes that its continued growth necessitates proactively planning additional culinary water facilities to maintain the current level of service for indoor water use.

The City also maintains a secondary water system for outdoor use. While culinary water is used for irrigation by some customers, both systems are being master planned to operate independently and to have adequate capacity for their own indoor or outdoor purposes. The secondary water system is addressed in a separate master plan.

In November 2014, the City prepared a Capital Facilities Plan, Impact Fee Facilities Plan (IFFP), and Impact Fee Analysis (IFA) for its culinary and secondary water systems (Horrocks 2014). This master plan will provide the bases for updating those studies and providing a basic full system layout design to guide new development.

MASTER PLANNING METHODOLOGY

Culinary water systems consist of water sources, storage facilities, distribution pipes, pump stations, valves, and other components. Design and operation of the individual components must be coordinated so that they operate efficiently under a range of demands and conditions. The system must be capable of responding to daily and seasonal variations in demand while simultaneously providing sufficient capacity for firefighting and other emergency situations.

Identifying present and future water system needs is essential in the management and planning of a water system. For this study, existing water demands were calculated from SCADA data and billed water use. Future and build-out water demands were predicted using current water use data, current zoning and densities provided by the City, and growth rates prepared by Fregonese and Associates as part of the City's 2019 general plan update.

Main St
I-15
Arrowhead Trail Rd
SR 198
Salem Canal Rd
Well 1
Well 5
Well 2
800 S Well
800 S
Tanks 1 and 2
Patterson Tank
Payson Canyon Springs
Gladstan Well
State St

N

0 3,000 6,000 12,000 Feet

Legend

- PRV
- Storage Tank
- Well

Pipe Diameter (inches)

- Other/Unknown
- 16
- 12
- 10
- 8
- 6
- 4

Pressure Zones

- Lower City
- Upper City
- Patterson

Date: 10/18/2019
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HANSEN ALLEN & LUCE INC ENGINEERS

PAYSON CITY

EXISTING DRINKING WATER SYSTEM

FIGURE 1-2

This report follows the DDW requirements of Rule R309-510 ("Facility Design and Operation: Minimum Sizing Requirements") and Rule R309-105 ("Administration: General Responsibilities of Public Water Systems") of the Utah Administrative Code. The report addresses sources, storage, distribution, minimum pressures, hydraulic modeling, capital improvements, funding, and other topics pertinent to Payson' culinary water system.

Computer models of the City's culinary water system were prepared to simulate the performance of facilities under existing and build-out conditions. System improvement recommendations were prepared from the analysis and are presented in this report.

DESIGN AND PERFORMANCE CRITERIA

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

Table 1-1: System Design Criteria

	Criteria	Existing Requirements	Estimated Build-out Requirements
Equivalent Residential Connections		10,433	22,930
Irrigated Acres		19	96
Source			
Peak Day Demand	Section R309-510-7/ LOS	3,737 gpm	8,536 gpm
Average Yearly Demand	Section R309-510-7/ LOS	3,191 ac-ft	7,186 ac-ft
Storage			
Equalization	Section R309-501-8/ LOS	2.69 MG	6.15 MG
Emergency	City preference /LOS	0.00 MG	0.00 MG
Fire Suppression	IFC/ Fire Marshall/LOS	1.38 MG	1.56 MG
Total		4.07 MG	7.71 MG
Distribution			
Peak Instantaneous	2.0 X Peak Day Demand	7,474 gpm	17,076 gpm
Minimum Peak Day Fire Flow	IFC/ Fire Marshall/IFFP	1500 gpm @ 20psi	1500 @ 20psi
Max. Operating Pressure	City Preference	120 psi	120 psi
Min. Pressure: Peak Day	Section R309-510-9/ IFFP	40 psi	40 psi
Peak Instantaneous	Section R309-510-9/ IFFP	30 psi	30 psi

CHAPTER 2 SYSTEM GROWTH

EXISTING CONNECTIONS

Culinary water demands are expressed in terms of equivalent residential connections (ERCs), which for planning purposes are the same as equivalent residential units (ERUs). The use of ERCs is a standard engineering practice to describe the entire system in a common unit of measurement. One ERC is equal to the average demand of an average residential connection. Non-residential demands are converted to ERCs for planning purposes. For example, a commercial building requiring six times as much water as a typical residential connection is assigned an ERC count of 6. The entire water demand then can be described with a single ERC count.

HAL analyzed the City's water use data from 2016 to 2018 along with discussion with the City and determined that the existing system serves 10,433 ERCs. An extended-period hydraulic model was updated with current water use and pipe information to represent existing conditions.

Customers south of the High Line Canal (except those facing Riley Drive) do not have a separate pressurized irrigation system, so their indoor and outdoor water is provided by the drinking water system. For this reason, acres irrigated by the drinking water system in this area were evaluated and considered separately. In other areas of the City, any incidental outdoor watering was accounted for in an aggregate analysis of billing data.

A breakdown of the existing ERCs and irrigated acreage by pressure zone is shown in Table 2-1.

Table 2-1
Existing ERCs and Irrigated Acreage

Zone	ERCs	Irrigated Acreage
Lower City	5,824	0*
Upper City	4,513	0*
Patterson	96	19
Total	**10,433**	**19**

* Irrigated acreage in these zones is accounted for using other methods

Raw data used to calculate the ERCs are included in Appendix B along with water usage and connection data.

FUTURE CONNECTIONS

Growth projection, land use plans, and development densities determined by Fregonese and Associates as part of the 2019 General Plan update, and development plans the City has acquired, were used to forecast the number of future ERCs. Table 2-2 shows the expected development density for each type of land use.

Table 2-2
Development Density by Land Use Type

Land Use	Development Density (ERC/ac)
Commercial	5
High Density Residential	15
Industrial	3
Low Density Residential	3
Medium Density Residential	10
Mixed Use Center	5
Mixed Use Neighborhood	5
Ofifce Flex	5
Parks/Open Space	2
Public Facilities	5
Rural Residential	3
Transit-Oriented Development	5

In 2050, 22,930 ERCs are expected. This is an increase of 12,497 ERCs beyond the existing 10,433 ERCs. Irrigated acreage is also projected to increase as the Patterson and Rocky Ridge areas develop. Although actual build-out conditions may be different if zoning and density change significantly, the basic full system layout plan developed by this study will help guide the construction of a responsible system.

A breakdown of future ERCs and irrigated acreage by pressure zone is shown in Table 2-3.

Table 2-3
Future ERCs and Irrigated Acreage

Zone	ERCs	Irrigated Acreage
Arrowhead	2,570	0
Lower City	12,870	0*
Upper City	6,950	0*
Patterson	390	61
Rocky Ridge	150	35
Total	**22,930**	**96**

* Irrigated acreage in these zones is accounted for using other methods

GROWTH PROJECTIONS

The development of impact fees requires growth projections over the next ten years. In addition to impact fee projects, this report will also highlight anticipated projects 10-20 years out in the "Capital Facilities Plan" section of this report. Growth projections for Payson were made as part of the City's strategic, general, and master planning efforts by Fregonese Associates, Inc.

Growth projections are shown in Table 2-4.

Table 2-4
Growth Projections

Year	ERCs	Irrigated Acreage
2019	10,433	19
2029	12,759	61
2039	16,766	61
2050	23,195	96

CHAPTER 3 WATER SOURCES

Culinary water requirements in this study are based on equivalent residential connections (ERCs) and irrigated acres. HAL estimated existing ERCs using billing and water use data, and build-out ERCs from the City's current land use and zoning plan.

EXISTING WATER SOURCES

Payson uses culinary water from its springs as well as three wells. The City currently relies on the springs and Well #2 to provide most of the necessary drinking water flow. The other wells serve chiefly as a backup supply. Table 3-1 contains the capacity of each drinking water source.

Table 3-1
Existing Culinary Water Sources

Source	Zone	Peak Day Source Capacity (gpm)	Peak Day Source Capacity (MGD)	Annual Source Capacity[1] (ac-ft)
Springs	Patterson	700	1.01	565
Well #1	Upper City	1,000	1.44	807
Well #2	Upper City	1,800	2.59	1452
Well #5	Upper City	1,200	1.73	968
Total		**4,700**	**6.77**	**3,792**

1. Annual spring and well capacity assumes about half of the year-round flow at the given flow rate. Actual volume may be limited by demand, water rights, or hydrologic constraints.

A summary of the water rights that are owned by Payson is included in Appendix C. Existing groundwater right capacity is 5,935 acre-feet.

PUMP STATIONS

There are no pump stations in the existing Payson culinary water system.

EXISTING WATER SOURCE REQUIREMENTS

According to DDW standards (Section R309-510-7), water sources must be able to meet the expected water demand for two conditions. First, sources must be able to provide an adequate supply of water for the peak day demand (flow requirement). Second, sources must also be able to produce one year's supply of water, or the average yearly demand (volume requirement).

Existing Peak Day Demand

Peak day demand is the water demand on the day of the year with the highest water use. It is used to determine required source capacity under existing and future conditions. Since the drinking water system is used by some customers for outdoor irrigation, peak day demands occur

during the summer months. Indoor peak day demand may be calculated by either applying the DDW standard of 800 gpd/ERC and 5,702 gpd/irr-ac or computing the demand from actual water use data (Subsection R309-510-7(2)).

Data from the City's SCADA system was analyzed to determine the actual peak day production volume. Based on data for summer 2018, a level of service of 500 gpd/ERC and 8,640 gpd/irr-ac was proposed for this study. Table 3-2 summarizes the peak day demand for both the former DDW standard and the level of service.

Table 3-2
Existing Peak Day Demand

Method	Connections (ERCs)	Irrigated Acres	Peak Day Demand (gpd/ERC)	Peak Day Demand (gpd/irr-ac)	Peak Day Demand (gpm)
Former DDW standard	10,433	19	800	5,702	5,871
Level of Service			500	8,640	3,737

A breakdown of the existing peak day demand by pressure zone is shown in Table 3-3.

Table 3-3
Existing Peak Day Source Requirements

Zone	ERCs	Irrigated Acres	Demand (gpm)	Existing Supply (gpm)	Net Zone Transfer in (+) or out (-) (gpm)	Surplus (+) or Deficit (-) (gpm)
Lower City	5,824	0	2,022	0	+2,022	0
Upper City	4,513	0	1,567	4,000	-1,470	+411
Patterson	96	19	147	700	-553	+553
Total	**10,433**	**19**	**3,737**	**4,700**	**-**	**+963**

Existing sources are adequate to meet peak day demand. No immediate source projects are necessary.

Existing Average Yearly Demand

Average yearly demand is the volume of water used during an entire year, and is used to ensure the sources can supply enough volume to meet demand under existing and future conditions.

As with peak day demand, average yearly demand may be calculated by either applying the DDW standard of 0.45 ac-ft/ERC (146,000 gal/yr/ERC) and 1.87 ac-ft/irr-ac or computing the demand from actual water use data (Subsection R309-510-7(2)). If calculated by the DDW standard, Payson's average yearly culinary water demand is 4,730 ac-ft. As derived from Payson's 2016-

2018 water use data, the average yearly culinary water demand is 0.30 ac-ft/ERC and 3.2 ac-ft/irr-ac, for a total average yearly demand of 3,191 ac-ft. Table 3-4 summarizes these data.

Table 3-4
Existing Average Yearly Demand

Method	Connections (ERCs)	Irrigated Acres	Average Yearly Demand (ac-ft/ERC)	Average Yearly Demand (ac-ft/irr-ac)	Average Yearly Demand (ac-ft)
Former DDW standard	10,433	19	0.45	1.87	4,730
Level of Service			0.30	3.20	3,191

A breakdown of the existing average yearly demand by pressure zone is included in Table 3-5.

Table 3-5
Existing Average Yearly Source Requirements

Zone	ERCs	Irrigated Acres	Demand (ac-ft/yr)	Existing Supply (ac-ft/yr)	Net Zone Transfer in (+) or out (-) (ac-ft/yr)	Surplus (+) or Deficit (-) (ac-ft/yr)
Lower City	5,824	0	1,747	0	+1,747	0
Upper City	4,513	0	1,354	3,226	-1,272	+125
Patterson	96	19	90	565	-475	+475
Total	**10,433**	**19**	**3,191**	**3,791**	**-**	**+600**

Existing sources are adequate for average yearly demand. No immediate source projects are needed.

FUTURE WATER SOURCE REQUIREMENTS

As with existing water source requirements, future water source requirements were evaluated on two criteria (Section R309-510-7). First, sufficient water source capacity is needed to meet peak day flow. Second, the water sources must also be capable of meeting the average yearly demand.

Future Peak Day Demand

Following the methodology described for existing conditions and estimating 22,930 ERCs and 96 irrigated acres at build-out, the peak day source requirement per DDW standards is projected to be 13,119 gpm. Assuming that future water use is similar to that observed in 2016 – 2018, the peak day demand is projected to be 8,536 gpm. See Table 3-6.

Table 3-6
Future Peak Day Demand

Method	Connections (ERCs)	Irrigated Acres	Peak Day Demand (gpd/ERC)	Peak Day Demand (gpd/irr-ac)	Peak Day Demand (gpm)
Former DDW Standard	22,930	96	800	5,702	13,119
Level of Service			500	8,640	8,536

A breakdown of the future peak day demand by pressure zone is shown in Table 3-7.

Table 3-7
Future Peak Day Source Requirements

Zone	ERCs	Irrigated Acres	Demand (gpm)	Existing Supply (gpm)	Net Zone Transfers in (+) or out (-) (gpm)	Surplus (+) or Deficit (-) (gpm)
Arrowhead	2,570	0	893	0	+893	0
Lower City	12,870	0	4,468	0	+631	-3,836
Upper City	6,950	0	2,413	4,000	-1,587	0
Patterson	390	61	501	700	-199	0
Rocky Ridge	150	35	261	0	+261	0
Total	**22,930**	**96**	**8,536**	**4,700**	**-**	**-3,836**

Overall, under build-out conditions there is a projected source capacity deficit of 3,836 gpm based on the capacity of the existing sources.

Future Average Yearly Demand

Following the methodology described for existing conditions and estimating 22,930 ERCs at build-out, the average yearly source requirement per DDW standards is projected to be 10,498 ac-ft. Assuming that future water use is similar to that observed in 2016 – 2018, the average yearly demand is projected to be 7,186 ac-ft. This study uses the proposed level of service. See Table 3-8.

Table 3-8
Future Average Yearly Demand

Method	Connections (ERCs)	Irrigated Acres	Average Yearly Demand (ac-ft/ERC)	Average Yearly Demand (ac-ft/irr-ac)	Average Yearly Demand (ac-ft)
DDW standard/ Level of service	22,930	96	0.45	1.87	10,498
Actual demand			0.30	3.20	7,186

A breakdown of future average yearly demand by pressure zone is shown in Table 3-9.

Table 3-9
Future Average Yearly Source Requirements

Zone	ERCs	Irrigated Acres	Demand (ac-ft/yr)	Existing Supply (ac-ft/yr)	Net Zone Transfers in (+) or out (-) (ac-ft/yr)	Surplus (+) or Deficit (-) (ac-ft/yr)
Arrowhead	2,570	0	772	0	+772	0
Lower City	12,870	0	3,860	0	+466	3,394
Upper City	6,950	0	2,085	3,226	-1,141	0
Patterson	390	61	312	565	-252	0
Rocky Ridge	150	35	156	0	+156	0
Total	**22,930**	**96**	**7,185**	**3,791**	**-**	**-3,394**

WATER SOURCE RECOMMENDATIONS

This section recommends actions the City can take to ensure adequate source capacity in the future.

Existing Water Sources

As shown in Tables 3-3 and 3-5, existing sources are adequate for peak day demand and average yearly demand. Remaining source capacity occurs in the highest zones of the drinking water system, so there is capacity for growth in any existing pressure zone. No immediate source projects are required.

Future Water Sources

As shown in Tables 3-7 and 3-9, future sources are inadequate for peak day and average yearly demand. Existing sources are sufficient to meet 2050 demands in the Rocky Ridge, Patterson,

and Upper City zones, while more source is needed to serve the Arrowhead and Lower City zones. Because the Arrowhead zone is relatively small, supplying it from sources in the Lower City zone is recommended.

To meet future demands, it is recommended that the City develop additional sources in the Lower City zone totaling 4,000 gpm and 3,500 ac-ft/yr.

Groundwater is the most readily available and inexpensive source of water available to Payson at this time, and most likely will be through year 2050. The City owns Gladstan well, which irrigates the golf course, but it is located far enough from most anticipated development that it may not be a cost-effective source to the remainder of the City many years.

When more source is needed, the first recommended action is to switch the 800 South well from the pressurized irrigation system to the drinking water system. There will be capacity in the pressurized irrigation system to do this as soon as the City begins taking water from the planned ULS pipeline (see Chapter 3 of the City's Pressurized Irrigation Master Plan for details). When further source is needed, drilling wells in strategic locations in the Lower City zone, closer to development, is the recommended strategy to support growth through 2050. The Gladstan well should be utilized whenever development occurs close enough to the golf course to make it cost-effective.

Central Utah Water Conservancy District (CUWCD) has plans to construct a drinking water treatment plant in Salem, Utah to provide water to surrounding municipalities. This may become a viable source option in the distant future, but this master plan assumes it will not be constructed within the planning horizon.

Table 3-10summarizes the attributes of the City's known planned culinary water sources. Other wells also need to be constructed to meet future peak day demands.

Table 3-10
Future Planned Culinary Water Sources

Source	Peak Day Source Capacity (gpm)	Peak Day Source Capacity (MGD)	Annual Capacity[1] (ac-ft)
Gladstan Well	1500	2.16	1,210
800 South Well	1600	2.30	1,290

1. In the absence of other data, annual well capacity assumes half of the year-round flow at the given flow rate. Actual volume may be limited by water rights or hydrologic constraints.

System Interconnections

A system interconnection is a low-cost way to prepare for emergency situations and add redundancy to a drinking water system. Payson City and Salem City recently constructed drinking water transmission lines in the vicinity of 2200 West and Arrowhead Trail Road, and their two respective drinking water systems now have pipes within 1,500 feet of each other. This represents a good opportunity to secure an emergency system interconnection between the two systems. Constructing this interconnection is recommended as soon as is practical.

Redundancy

The Patterson zone is supplied only by the Payson Canyon springs. If these springs become contaminated or unusable, there are no other water sources available to the Patterson zone at this time. The City should have a plan in place to supply the Patterson zone if this occurs. A pump station would provide an effective long-term solution, and is recommended prior to development in the Rocky Ridge zone.

SUMMARY OF SOURCE RECOMMENDATIONS

The following actions are recommended to secure adequate sources for the drinking water system through 2050:

1. Develop a plan to supply the Patterson zone with water in the event that the Payson Canyon springs become contaminated or unusable. A pump station is a recommended long-term solution. Other solutions, such as trucking water or the use of portable pumps, may be possible in the short term, but will become less feasible as the area develops. This should be done as soon as possible.

2. Secure an emergency system interconnection with the Salem City drinking water system to provide source redundancy. This should be done as soon as is practical.

3. Use wells to meet drinking water demands through 2050. Switch the 800 South well to the drinking water system when more source is needed. Drill other wells as necessary. The Gladstan well can be utilized as development occurs near the golf course, but it is expected to be more cost-effective to drill new wells to meet demands closer to the main portion of the City. Further guidance on the location and timing of these improvements is included in the Capital Facility Plan in Chapter 6.

CHAPTER 4 WATER STORAGE

WATER STORAGE

Storage is an essential component of a water system. Storage provides capacity for fire protection and allows the system to efficiently meet peak demands. This chapter outlines the existing and future water storage requirements for the Payson City culinary water system, and recommends actions the City can take to ensure adequate storage capacity is available as development continues.

EXISTING WATER STORAGE REQUIREMENTS

According to DDW standards outlined in Section R309-510-8, storage tanks must be able to provide: 1) equalization storage volume to make up the difference between source and demand; 2) fire suppression storage to supply water for firefighting; and 3) emergency storage, if deemed necessary. Each of the requirements is addressed below.

Equalization Storage

Drinking water storage requirements can be determined either by applying the DDW standard of 400 gal/ERC and 2,848 gal/irr-ac, or by evaluating water use data. HAL evaluated water use data for 2016 – 2018 and proposed a level of service of 250 gal/ERC and 4,320 gal/irr-ac (see Appendix B). This study uses the proposed level of service.

With 10,433 ERCs and 19 irrigated acres under existing conditions, Payson requires 2.69 MG of equalization storage in its culinary water system.

Fire Suppression Storage

Fire suppression storage is required for water systems that provide water for firefighting (Subsection R309-510-8(3)). The local fire authority determines the need for fire suppression storage. Payson's Fire Chief provided fire flow requirements for each zone according to the International Fire Code (IFC), building size, flow rates, and fire duration. Scott Spencer is the Payson Fire Chief. Contact information for the Payson Fire department is as follows:

Phone: 801-465-5252

Address: 439 West Utah Avenue
Payson, UT 84651

Storage was allocated to each tank according to simulations of fire flow during peak day conditions, considering that fire flow may be supplied by storage in higher zones. Fire suppression storage was determined with the following assumptions:

- Tank 3 must have sufficient fire storage to supply 1,500 gpm for 2 hr, or 0.18 MG, since it is the only storage tank for the Patterson zone.
- Tanks 1 and 2 were each allocated half of the fire demand for the Upper City Zone, where the highest fire flow requirement is located. Tank 3 makes minimal contributions to fire demands in that zone.

Table 4-1 summarizes the fire suppression storage assumed in each storage facility.

Table 4-1
Existing Fire Suppression Storage by Tank

Tank	Zone	Fire Suppression Storage (MG)
1	Upper City	0.60
2	Upper City	0.60
3	Patterson	0.18
Total		**1.38**

Emergency Storage

While there are no specific DDW requirements for emergency storage (Subsection R309-510-8(4)), some water systems maintain emergency storage to mitigate risks, provide system reliability, and protect public health and welfare. Emergency storage may be used in case of pipeline failures, equipment failures, power outages, source contamination, and natural disasters.

Payson has not planned for additional emergency storage, because their very large fire flow requirement already requires them to keep a substantial amount of water in storage at all times.

Summary

Requirements for equalization, fire suppression, and emergency storage for each of the City's pressure zones are shown in Table 4-2.

Table 4-2
Existing Culinary Water Storage Requirements by Pressure Zone

Zone	ERCs	Irrigated Acres	Equalization (MG)	Fire Suppression (MG)	Emergency (MG)	Total Required Storage (MG)	Existing Storage (MG)
Lower City	5,824	0	1.46	0	0	1.46	0
Upper City	4,513	0	1.13	1.20	0	2.33	5.00
Patterson	96	19	0.11	0.18	0	0.29	0.60
Total	**10,433**	**19**	**2.69**	**1.38**	**0**	**4.07**	**5.60**

Table 4-3 presents key physical attributes of the City's water storage tanks.

Table 4-3
Physical Attributes of Existing Storage Tanks

Name	Type	Diameter (ft)	Volume (MG)	Outlet Level	Emergency Storage Level	Fire Suppression Level	Overflow/ Equalization Level
Tank 1 (Upper City)	Concrete	140	2.5	4,910.0	4915.5 (5.5 feet)	4915.5 (5.5 feet)	4,933.0 (23.0 feet)
Tank 2 (Upper City)	Concrete	140	2.5	4,910.0	4915.5 (5.5 feet)	4915.5 (5.5 feet)	4,933.0 (23.0 feet)
Tank 3 (Patterson)	Concrete	83	0.6	5,104.0	5109.4 (5.4 feet)	5109.4 (5.4 feet)	5122.3 (18.3 feet)

FUTURE WATER STORAGE REQUIREMENTS

Table 4-4 presents the future culinary water storage requirements by pressure zone, based on the proposed level of service. A minimum requirement of 7.71 MG is expected in year 2050.

Table 4-4
Future Culinary Water Storage Requirements

Zone	ERCs	Irrigated Acres	Equalization (MG)	Fire (MG)	Emergency (MG)	Total Required (MG)	Existing Storage (MG)	Surplus (+) or Deficiency (-) (MG)
Arrowhead	2,570	0	0.64	0	0	0.64	0.0	-0.64
Lower City	12,870	0	3.22	0	0	3.22	0.0	-3.22
Upper City	6,950	0	1.74	1.20	0	2.94	5.0	+2.06
Patterson	390	61	0.36	0.18	0	0.54	0.6	+0.06
Rocky Ridge	150	35	0.19	0.18	0	0.37	0.0	-0.37
Total	**22,930**	**96**	**6.15**	**1.56**	**0**	**7.71**	**5.60**	**-2.11**

WATER STORAGE RECOMMENDATIONS

As demonstrated in Table 4-4, existing storage is not sufficient to support the City through 2050. The following actions are recommended to ensure adequate storage is available:

1. Carefully monitor capacity in the Patterson Tank. Based on assumptions made in this master plan, there is barely enough capacity in the Patterson Tank to serve all development in this pressure zone. However, the adequacy of the tank to serve the development ultimately depends on the development density and outdoor irrigation requirements of the developments in this area.

2. Conduct a thorough review of proposed development in the future Rocky Ridge zone in order to verify appropriate tank sizing. Based on assumptions made in this master plan, a minimum size requirement of 0.5 – 0.6 MG for the Rocky Ridge pressure zone is expected. Note, however, that this recommended size could change significantly depending upon proposed development density and irrigated acreage in these areas.

3. Construct two storage tanks in the Lower City pressure zone, with a combined total capacity of at least 2 MG. 3 MG is recommended in order to provide capacity beyond 2050. Some storage capacity from the Upper City zone can be used in the Lower City zone, but this alone is not enough to support growth in the Lower City and Arrowhead pressure zones through 2050.

Further guidance on the location and timing of proposed storage improvements is included in the Capital Facility Plan in Chapter 6.

CHAPTER 5 WATER DISTRIBUTION

HYDRAULIC MODEL

Development

A computer model of the City's culinary water distribution system was developed to analyze the performance of the existing and future distribution system and to prepare solutions for existing facilities not meeting the distribution system requirements. The model was developed with the software EPANET 2.0, published by the U.S. Environmental Protection Agency (EPA 2014; Rossman 2000). EPANET simulates the hydraulic behavior of pipe networks. Sources, pipes, tanks, valves, controls, and other data used to develop the model were obtained from GIS data of the city's culinary water system and other updated information supplied by the City.

HAL developed models for two phases of culinary water system development. The first phase was a model representing the existing system (existing model). This model was used to calibrate the model and identify deficiencies in the existing system. Calibration was performed using fire hydrant tests and by comparing model results to the City's SCADA output. Calibration data is included in Appendix D.

The second phase was a model representing future conditions and the improvements necessary to accommodate growth (future model).

Model Components

The two basic elements of the model are pipes and nodes. A pipe is described by its inside diameter, length, minor friction loss factors, and a roughness value associated with friction head losses. A pipe can contain elbows, bends, valves, pumps, and other operational elements. Nodes are the endpoints of a pipe and 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 added (source) or removed (demand). A boundary node is a point where the hydraulic grade is known (a reservoir, tank, or PRV). Other components include tanks, reservoirs, pumps, valves, and controls.

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

Pipe Network

Payson's culinary water distribution system consists of all pipelines, valves, fittings, and other appurtenances used to convey water from sources and storage tanks to water users. The existing water system contains approximately 100 miles of distribution pipe with diameters of 4 inches to 16 inches. Figure 5-1 presents a summary of pipe length by diameter.

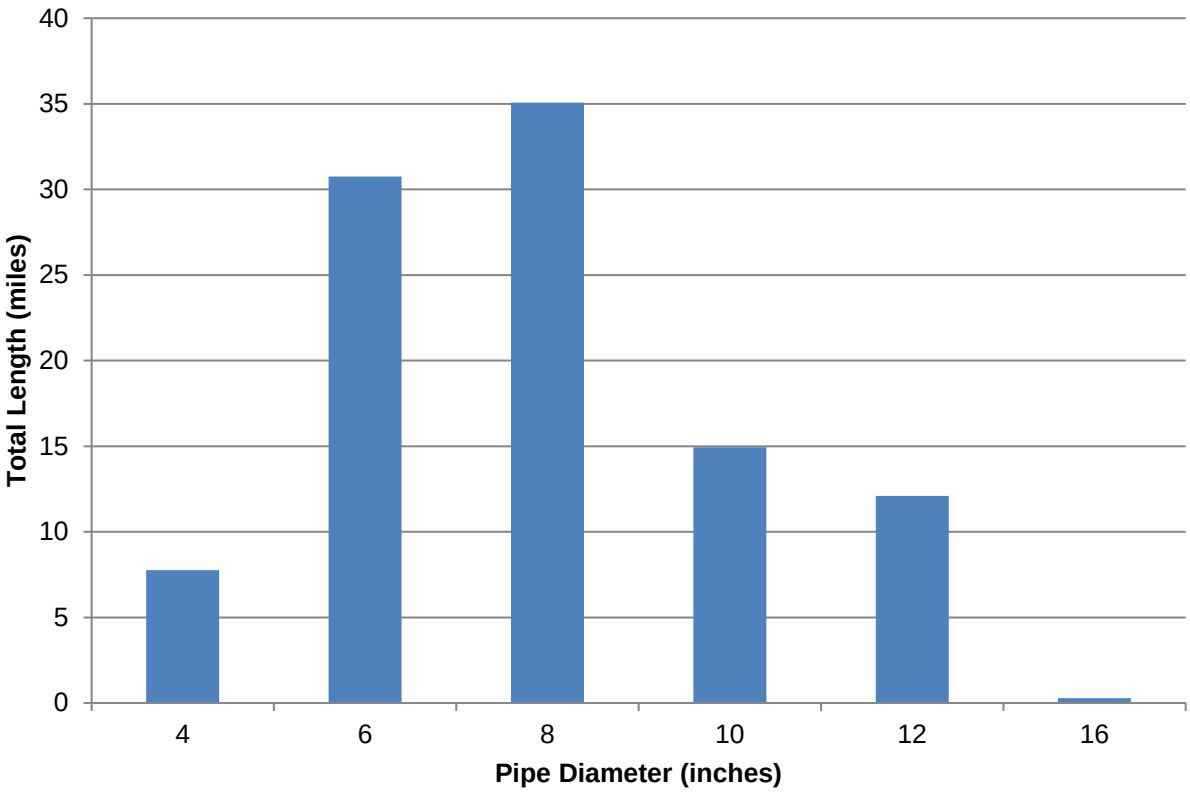


Figure 5-1: Summary of Pipe Length by Diameter

The pipe network layout originated from GIS data provided by the City. Elevation information was obtained from the LiDAR data obtained by the State of Utah. Smaller 8-inch and 10-inch pipes are generally PVC. Hazen-Williams roughness coefficients for pipes in this model ranged from 130 - 150, which is typical for these pipe materials in EPANET (Rossman 2000, 31).

Water Demands

Water demands were allocated in the model based on billed usage and billing addresses. Demand was determined for each billing address, and the addresses were geocoded in order to link the demands to a physical location. The geocoded demands were then assigned to the closest model node. With the proper spatial distribution, demands were scaled to reach the peak day demand determined in Chapter 3. For the future model, future demands were estimated according to current zoning and densities. Future demands were assigned to new nodes representing the expected location of new development in each pressure zone.

The pattern of water demand over a 24 hr period is called the diurnal curve or daily demand curve. An indoor diurnal curve with a peak factor of 2.0 was selected for this study based on water demand patterns identified by the SCADA system and information from other similar water systems. The diurnal curve was input into the model to simulate changes in water system demands throughout the day.

In summary, the spatial distribution of demands followed geocoded water use data; the flow and volume of demands followed the level of service criteria described in Chapter 3;

and the temporal pattern of demand followed a diurnal curve developed from SCADA data and similar water systems.

Water Sources and Storage Tanks

The sources of water in the model are the existing and proposed future wells. A well is represented by a reservoir and pump. Tank location, height, diameter, and volume are represented in the model. The extended-period model predicts water levels in the tanks as they fill from sources and as they empty to meet demand in the system.

ANALYSIS METHODOLOGY

HAL used extended-period and steady-state modeling to analyze the performance of the water system with current and projected future demands. An extended-period model represents system behavior over a period of time: tanks filling and draining, pumps turning on or off, pressures fluctuating, and flows shifting in response to demands. A steady-state model represents a snapshot of system performance. The peak day extended period model was used to set system conditions for the steady-state model, calibrate zone to zone water transfers, analyze system controls and the performance of the system over time, and to analyze system recommendations for performance over time. The steady-state model was used for analyzing the peak day plus fire flow conditions.

Two operating conditions were analyzed with the extended period model: peak day conditions and peak instantaneous conditions. Peak day plus fire flow conditions were analyzed using a static model. Each of these conditions is a worst-case situation so the performance of the distribution system may be analyzed for compliance with DDW standards and City preferences.

EXISTING WATER DISTRIBUTION SYSTEM DEMANDS

Existing Peak Day Conditions

A minimum pressure of 40 psi must be maintained during peak day demand (Subsection R309-105-9(2)). As described in Chapter 3, existing peak day demand is 3,737 gpm. Hydraulic modeling indicated that the existing system is able to provide this flow while meeting the pressure requirements outlined by R309-105-9.

Existing Peak Instantaneous Conditions

A minimum pressure of 30 psi must be maintained during peak instantaneous demand (Subsection R309-105-9(2)). Peak instantaneous demand was defined based on the diurnal curve for the indoor water demand of Payson. The highest peaking factor present on the peak day diurnal curve was 2.0; therefore, the existing peak instantaneous demand was calculated as 3,737 x 2.0 = 7,474 gpm. Pressure requirements are currently met under peak day demand conditions.

Existing Peak Day plus Fire Flow Conditions

A minimum pressure of 20 psi must be maintained while delivering fire flow to a particular location within the system and supplying the peak day demand to the entire system (Subsection R309-105-9(2)). For modeling analysis, a minimum fire flow of 1,500 gpm was selected for all fire hydrants in the system. Higher flows were modeled for select locations as directed by the Payson Fire Chief.

Several fire flow deficiencies were identified, and they are described in the Capital Facility Plan in Chapter 6. However, identifying every pipe which is not capable of supplying the required fire flow is beyond the scope of this study. The computer analysis should not replace physical fire flow tests at fire hydrants as the primary method of determining fire flow capacity.

FUTURE WATER DISTRIBUTION SYSTEM DEMANDS

Future Peak Day Conditions

A minimum pressure of 40 psi must be maintained at all connections during peak day demand (Subsection R309-105-9(2)). As described in Chapter 3, future peak day demand is projected to be 8,538 gpm. Hydraulic modeling indicated that the future system can meet this requirement with the future pipelines shown on the Master Plan Map.

Future Peak Instantaneous Conditions

Peak instantaneous demands were calculated in a similar manner to existing conditions. The peak day to peak instantaneous peaking factor was 2.0, making the total peak instantaneous demand 17,076 gpm. Hydraulic modeling indicated that the future system can meet this requirement with the future pipelines shown on the Master Plan Map.

Future Peak Day plus Fire Flow Conditions

A minimum pressure of 20 psi must be maintained while delivering fire flow to a particular location within the system and supplying the peak day demand to the entire system (Subsection R309-105-9(2)). For modeling analysis, a fire flow of 1,500 gpm was selected for all fire hydrants in the system. Additional analyses were performed for larger buildings as required by the Fire Chief. Hydraulic modeling indicated that the future system can meet the future fire flow requirements with the future pipelines shown on the Master Plan Map.

WATER DISTRIBUTION SYSTEM RECOMMENDATIONS

Recommendations for water distribution improvements are based on model output and input from City personnel. Results from the model are available on a CD in Appendix E. Most recommendations are discussed in detail in the Capital Facility Plan in Chapter 6. A few recommendations of note are included below:

1. Modify and/or extend pressure zone boundaries in the drinking water pressure zone to match the boundaries of the pressurized irrigation system (or vice versa). One hazard in Payson is the possibility of backflow from the secondary water system to the drinking water system. Creating consistent pressure zone boundaries will ensure that irrigation system pressures are lower than drinking water system pressures, which makes backflow physically impossible even if a cross-connection exists. Recommended zone boundaries are included on the Culinary Water Master Plan Map in Appendix A.
2. Upsize transmission lines out of the existing tanks. Transmission lines out of the existing tanks in the Upper City pressure zone are not large enough to meet peak day demands under future scenarios.

Other distribution projects are associated with providing transmission capacity to and from future storage tanks and sources. Alignments for these projects are conceptual, and may change during subsequent stages of design. Anticipated future pipes larger than 10 inches in diameter have been conceptually designed according to zone demand following proposed road alignments. The locations of these pipes are illustrated on the Culinary Water Master Plan Map in Appendix A.

CHAPTER 6 CAPITAL FACILITY PLAN

GENERAL

The purpose of this section is to identify the culinary water facilities that are required, for the 20-year planning period, to meet the demands placed on the system by future development. Proposed facility capacities were sized to adequately meet the 20-year growth projections and were compared to current master planned facilities. A detailed design analysis will need to be provided before construction of the facilities to ensure that the location and sizing is appropriate for the actual growth that has taken place since this capital facility plan (CFP) was developed. Specific projects with costs are presented at the end of this chapter.

METHODOLOGY

Projected future water demands were added incrementally by year to existing demands. At the year a source, storage, or transmission facility is projected to reach capacity, a solution was identified that would accommodate growth for the 20-year planning period. A hydraulic model was developed for the purpose of assessing the system operation and capacity with future demands added to the system. The model was used to identify problem areas in the system and to identify the most efficient way to make improvements to transmission pipelines, sources, pumps, and storage facilities.
The future system was evaluated in the same manner as the existing system, by modeling (1) Peak Instantaneous Demands and (2) Peak Day Demands plus fire flow conditions.

FUTURE WATER SOURCE

Groundwater is recommended as the supply to meet demands in Payson throughout the 20-year planning period. The proposed level of service requires 500 gpd/ERC of peak day source capacity. The following are projects selected to meet the source requirements for future growth:

- Secure an emergency interconnection with the Salem City drinking water system to provide a redundant water supply to the system.
- Switch the 800 South pressurized irrigation well to the drinking water system to provide source to the Lower City pressure zone.

FUTURE WATER STORAGE

The proposed level of service requires that the water system have 250 gallons per ERC for equalization storage along with appropriate fire suppression storage for the structures in each pressure zone. The following tanks are anticipated to meet future demands:

- Construct a storage tank with a volume of at least 1.5 MG to serve the southern portion of the Lower City pressure zone.

FUTURE ZONE PUMPING

Future zone pumping requirements were evaluated to determine pump station needs to meet future peak day demands. All zones requiring pump stations were evaluated using the source capacity level of service of 500 gpd/ERC for indoor water use and 4,320 gpd/irr-ac. Findings regarding zone pumping are described below:

- A pump station from the Upper City zone to the Patterson zone is needed to provide a redundant water source to this area. As the area grows, it will become necessary in order to meet peak day requirements. It should be sized to deliver water to a future tank for the Rocky Ridge zone.

FUTURE TRANSMISSION PIPING

Additional transmission lines are needed to support projected growth in the undeveloped areas of the City. The model was used to determine the most efficient way to keep water pressures and pressure swings within the level of service with added future demands. The majority of the waterline projects are required to connect sources to storage tanks and to the existing and future areas of the system. These transmission lines are described below:

- Upsize water lines out of the existing drinking water storage tanks in Payson Canyon Road, 1200 S, 1100 S, and Main Street to provide increased conveyance to the growing southern and western areas of the Upper City and Lower City pressure zones.
- Construct additional transmission in the southern portion of the Lower City zone to serve areas on both sides of I-15, including a transmission line from the service area to the storage tank.

FUTURE WATER RIGHTS

The existing demand at the proposed level of service of 0.30 ac-ft/ERC and 3.2 ac-ft/irr-ac is 3,191 acre-feet, while the existing supply is 3,791 acre-feet (see Table 3-5) and the existing water rights capacity is 5,935 ac-ft (see Appendix C). This equates to a water rights surplus of 2,744 ac-ft, but a surplus in physical capacity of 600 ac-ft. The existing surplus in water rights, in addition to water acquired through the City's water transfer ordinance (Payson City Title 10.6), is anticipated to meet increasing water demands through the 20-year planning period.

MASTER PLANNING

Throughout the master planning process, the three main components of the City's water system (source, storage, and distribution) were analyzed to determine the system's ability to meet existing demands and also the anticipated future demands. This section of the report will specifically detail development over the next 20 years. Each of the system deficiencies identified in the master planning process and described previously in this report were presented to City staff. Possible solutions were discussed for each of the identified system deficiencies. After these discussions, HAL studied the feasibility of the solution alternatives, developed conceptual costs, and identified preferred alternatives.

One important 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 resolve existing deficiencies, and which projects provide capacity for future 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:

Type of Estimate	Precision
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, source, storage and distribution system capacity expansion will be needed to meet the demands of future growth. The City's Culinary Water Master Plan Map (Appendix A) includes recommended projects over the period from existing conditions through 20 years into the future. Cost estimates have been prepared for the recommended projects and are included in Appendix F.

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

1. "Means Heavy Construction Cost Data, 2019"
2. Price quotes from equipment suppliers

3. Recent construction bids for similar work

All costs are presented in 2019 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. The recommended projects that are expected to be needed through 2039 are presented in Table 6-1. Fire flow projects are presented in Figure 6-1. System improvement projects are presented in Figure 6-2. For a breakdown of cost estimates provided in Table 6-1, refer to Appendix F.

TABLE 6-1
RECOMMENDED 20 YEAR PROJECTS

TYPE & PHASING YEAR	MAP ID	RECOMMENDED PROJECT	DEFICIENCY COST	GROWTH COST
Fire Flow – Deficiency Project **0-10 Years**	F-1	Replace approximately 1,000 feet of transmission line in 450 S and 900 W with 8-inch pipe to provide minimum fire flow to the area.	$143,000	$0
Fire Flow – Deficiency Project **0-10 Years**	F-2	Replace approximately 1,400 feet of transmission line in Salem Canal Road, 350 S, 900 E, and Sunnyhill Cir with 8-inch pipe to provide minimum fire flow to the area.	$200,000	$0
Source – Deficiency Project **0-10 Years**	1	Install a pump station to provide the Patterson Zone with a redundant drinking water supply.	$600,000	$0
Transmission – Growth Project **0-10 Years**	2	Upsize approximately 4,400 feet of pipe pipe in Arrowhead Trail Road from 10-inch to 12-inch diameter to provide capacity for growth in the Arrowhead Pressure Zone.	$0	$17,432
Fire Flow Deficiency / Transmission Growth Project **0-10 Years**	3	Install approximately 2,200 feet of pipe in Salem Canal Road between Goosenest Drive and 2300 West to resolve fire flow deficiencies and allow for future growth.	$314,000	$69,000
Transmission – Growth Project **0-10 Years**	4	Install approximately 1,200 feet of 24-inch pipe in Nebo Loop Road from the existing main tanks to 1300 South; 1,200 feet of 20-inch pipe in 1300 S from Nebo Loop Road to Canyon Road and in Canyon Road from 1300 S to 500 E; 1600 feet of 12-inch pipe in 500 East and Riley Dr to 1260 S and in 1260 S to the downstream side of the PRV; 300 ft of 10-inch pipe in 1170 S from 50 E to Main St; and 550 feet of 16-inch pipe in Main Street from 1260 South to 1400 S.	$0	$1,059,000
Source – Growth Project **0-10 Years**	5	Install approximately 2,000 feet of 12-inch pipe in 2200 West from Arrowhead Trail Road to the existing Salem City drinking water line near the City boundary. Construct system interconnection. Cost estimate assumes Payson will be responsible for 50% of construction costs.	$0	$190,000

TYPE & PHASING YEAR	MAP ID	RECOMMENDED PROJECT	DEFICIENCY COST	GROWTH COST
Source – Growth Project **0-10 Years**	6	Switch 800 S well from the pressurized irrigation system to the drinking water system to provide additional source. Well is equipped to do so.	$0	$0
Source, Storage and Transmission – Growth Project **10-20 Years**	7	Construct a 1.5 MG tank to serve the Lower City pressure zone. Acquire a site for a future well. Construct approximately 6,500 feet of 16-inch pipe to provide transmission from the tank to the well site and zone, and upsize approximately 16,000 feet of 12-inch pipe to provide transmission to the zone.	$0	$4,047,000
Transmission – Growth Project **10-20 Years**	8	Upsize approximately 7,000 feet of 12-inch transmission main to provide further transmission capacity to the Arrowhead Zone.	$0	$244,000
TOTAL			$1,257,000	$5,626,432

1. The Map ID corresponds to the project number on the Capital Facility Plan Improvements map. Refer to Figures 6-1 and 6-2.

PROJECT TIMING

Table 6-2 shows guidance on the timing of proposed projects and other improvements listed in Table 6-1.

Table 6-2
Estimated Timing of Improvements

Project(s)	Comments	ERCs When Necessary	Est. Population When Necessary	Estimated Year of Construction
F-2, F-2, 1,	Deficiencies	-	-	As soon as is practical
2	-	-	-	Recently Constructed
4	Growth	11,400	25,000	2023
6	Growth	12,350	29,000	2028
7	Growth	14,600	36,000	2036
8	Development-driven upsizing	-	-	-

The year of construction for these projects may change depending on development patterns and the growth rate of the City. The City should evaluate each development as part of the plan review process to more precisely determine the timing and need for these projects.

Project F-1:
Replace with 8" Pipe to meet minimum fire flow requirements

Project F-2:
Replace with 8" Pipe to meet minimum fire flow requirements

N

0 1,000 2,000 4,000 Feet

Date: 9/18/2019
Document Path: H:\Projects\416 - Fregonese\01.100 - Payson Culinary Water Master Plan\GIS\Working\Fig 6-1 Fire Flow projects.mxd

HANSEN ALLEN & LUCE INC ENGINEERS

PAYSON CITY

PROPOSED FIRE FLOW PROJECTS

FIGURE 6-1

See Table 6-1 of the Master Plan report for detailed descriptions of each project.

Project 8

Arrowhead Trail Rd

Project 5

Project 2

Main St

I-15

I-15

SR 198

Project 6:
Switch 800 S well to drinking water system

800 S

W

I-15

Project 4

Salem Canal Rd

Project 3

Project 7

Project 1:
Construct pump station to supply Patterson Zone

I-15

State St

W

Acquire site for future well

1.5 MG Tank

0.75 MG Tank

N

0 3,000 6,000 12,000 Feet

Legend

- Interconnection
- W Future Wells
- Future Tank
- Existing Tank
- Existing pipes

Date: 10/18/2019
Document Path: H:\Projects\416 - Fregonese\01.100 - Payson Culinary Water Master Plan\GIS\Working\Fig 6-2 CFP projects_Oct_revision.mxd

HANSEN ALLEN & LUCE INC ENGINEERS

PAYSON CITY DRINKING WATER MASTER PLAN

CAPITAL FACILITY PLAN PROJECTS

FIGURE 6-2

FUNDING OPTIONS

Funding options for the recommended projects, in addition to water use fees, include: general obligation bonds, revenue bonds, State/Federal grants and loans, and impact fees. In reality, the City may need to consider a combination of these funding options. The following discussion describes each of these options.

General Obligation Bonds

This form of debt enables the City 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 in the future). G.O. bonds are debt instruments backed by the full faith and credit of the City which would be secured by an unconditional pledge of the City 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 City's revenue-generating authority. These bonds are supported by the City 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 City.

Revenue Bonds

This form of debt financing is also available to the City for utility-related capital improvements. Unlike G.O. bonds, revenue bonds are not backed by the City 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 quite low. 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 or 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 are clear indicators that local government may be left to its own devices regarding infrastructure finance in general. However, state or 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 state or federal 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 City.

Impact Fees

The Utah Impact Fees Act, codified in Title 11, Chapter 36a, of the Utah Code, authorizes municipalities to collect impact fees to fund public facilities. An impact fee is “a payment of money imposed upon new development activity . . . to mitigate the impact of the new development on public infrastructure” (Subsection 11-36a-102(8)). Impact fees enable local governments to finance infrastructure improvements without burdening existing development with costs that are exclusively attributable to growth.

Impact fees can be applied to water-related facilities under the Utah Impact Fees Act. The 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 City must follow in order to comply with the statute. 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. Impact fees cannot be applied retroactively.

An Impact fee facility plan and impact fee analysis is located in a separate document.

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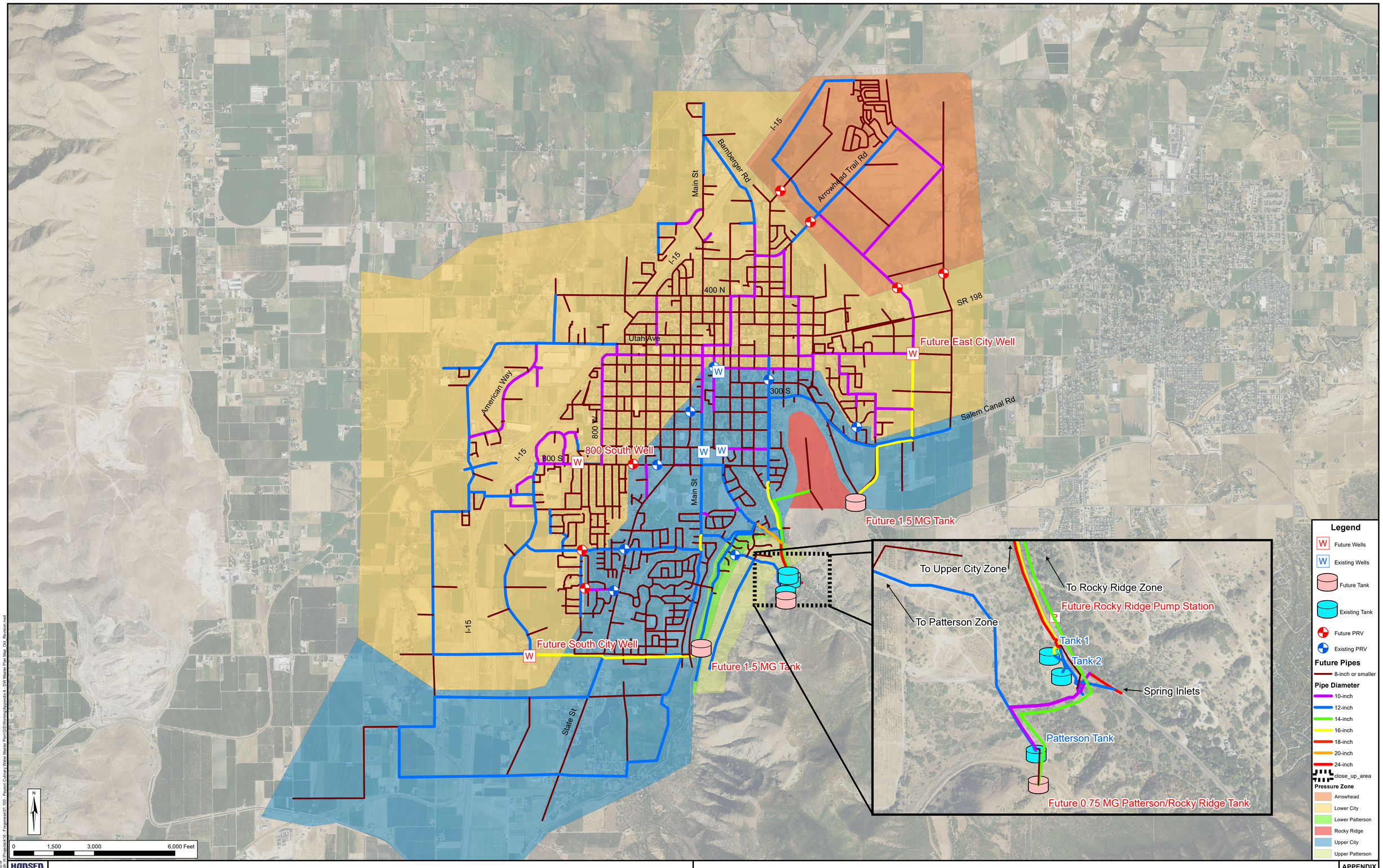
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APPENDIX A

Culinary Water Master Plan Map



Date: 10/1/2019
Drawn By: KH
I:\Projects\416 - Fregonese\01 100 - Payson Culinary Water Master Plan\GIS\Working\Appendix A - DW Master Plan Map_Oct_Revision.mxd

HANSEN ALLEN & LUCE inc ENGINEERS

PAYSON CITY DRINKING WATER SYSTEM

MASTER FACILITIES PLAN MAP

APPENDIX A

APPENDIX B

Water System Data and Calculations

Payson City
2019 Drinking Water System Master Plan
Existing and Future Requirements
09/30/2019 RJG

HANSEN ALLEN & LUCE INC ENGINEERS

Arrowhead Zone

All outdoor watering is accounted for in indoor calculations for this zone	Existing								Future (10-Year)								Future (20-Year)								Future (2050)							
	Service (ERC)	Irrigated Acres	Indoor Peak Day Source (gpm)	Outdoor Peak Day Source (gpm)	Indoor Avg. Yearly Source (ac-ft)	Outdoor Avg. Yearly Source (ac-ft)	Indoor Equalization Storage (MG)	Outdoor Equalization Storage (MG)	Service (ERC)	Irrigated Acres	Indoor Peak Day Source (gpm)	Outdoor Peak Day Source (gpm)	Indoor Avg. Yearly Source (ac-ft)	Outdoor Avg. Yearly Source (ac-ft)	Indoor Equalization Storage (MG)	Outdoor Equalization Storage (MG)	Service (ERC)	Irrigated Acres	Indoor Peak Day Source (gpm)	Outdoor Peak Day Source (gpm)	Indoor Avg. Yearly Source (ac-ft)	Outdoor Avg. Yearly Source (ac-ft)	Indoor Equalization Storage (MG)	Outdoor Equalization Storage (MG)	Service (ERC)	Irrigated Acres	Indoor Peak Day Source (gpm)	Outdoor Peak Day Source (gpm)	Indoor Avg. Yearly Source (ac-ft)	Outdoor Avg. Yearly Source (ac-ft)	Indoor Equalization Storage (MG)	Outdoor Equalization Storage (MG)
Unit Req.			0.35	6.0	0.3	3.2	0.00025	0.00432			0.35	6.0	0.3	3.2	0.00025	0.00432			0.35	6.0	0.3	3.2	0.00025	0.00432			0.35	6.0	0.3	3.2	0.00025	0.00432
			per ERC	per Irr-Ac	per ERC	per Irr-Ac	per ERC	per Irr-Ac			per ERC	per Irr-Ac	per ERC	per Irr-Ac	per ERC	per Irr-Ac			per ERC	per Irr-Ac	per ERC	per Irr-Ac	per ERC	per Irr-Ac			per ERC	per Irr-Ac	per ERC	per Irr-Ac	per ERC	per Irr-Ac
Total Demand	0	0	0	0	0	0	0.0	0.0	463	0	162	0	139	0	0.1	0.0	831	0	291	0	249	0	0.2	0.0	2,573	0	901	0	772	0	0.6	0.0
			0		0		0.0				162		139		0.1				291		249		0.2				901		772		0.64	
Total Capacity			0		0		0.00				0		0		0.00				0		0		0.00				0		0		0.00	
Surplus/Deficit			0		0		0.00				-162		-139		-0.12				-291		-249		-0.21				-901		-772		-0.64	

Currently has no dedicated capacity - fed by Lower Zone

Lower City Zone

All outdoor watering is accounted for in indoor calculations for this zone	Existing								Future (10-Year)								Future (20-Year)								Future (2050)							
	Service (ERC)	Irrigated Acres	Indoor Peak Day Source (gpm)	Outdoor Peak Day Source (gpm)	Indoor Avg. Yearly Source (ac-ft)	Outdoor Avg. Yearly Source (ac-ft)	Indoor Equalization Storage (MG)	Outdoor Equalization Storage (MG)	Service (ERC)	Irrigated Acres	Indoor Peak Day Source (gpm)	Outdoor Peak Day Source (gpm)	Indoor Avg. Yearly Source (ac-ft)	Outdoor Avg. Yearly Source (ac-ft)	Indoor Equalization Storage (MG)	Outdoor Equalization Storage (MG)	Service (ERC)	Irrigated Acres	Indoor Peak Day Source (gpm)	Outdoor Peak Day Source (gpm)	Indoor Avg. Yearly Source (ac-ft)	Outdoor Avg. Yearly Source (ac-ft)	Indoor Equalization Storage (MG)	Outdoor Equalization Storage (MG)	Service (ERC)	Irrigated Acres	Indoor Peak Day Source (gpm)	Outdoor Peak Day Source (gpm)	Indoor Avg. Yearly Source (ac-ft)	Outdoor Avg. Yearly Source (ac-ft)	Indoor Equalization Storage (MG)	Outdoor Equalization Storage (MG)
Unit Req.			0.35	6.0	0.3	3.2	0.00025	0.00432			0.35	6.0	0.3	3.2	0.00025	0.00432			0.35	6.0	0.3	3.2	0.00025	0.00432			0.35	6.0	0.3	3.2	0.00025	0.00432
			per ERC	per Irr-Ac	per ERC	per Irr-Ac	per ERC	per Irr-Ac			per ERC	per Irr-Ac	per ERC	per Irr-Ac	per ERC	per Irr-Ac			per ERC	per Irr-Ac	per ERC	per Irr-Ac	per ERC	per Irr-Ac			per ERC	per Irr-Ac	per ERC	per Irr-Ac	per ERC	per Irr-Ac
Total Demand	5,824	0	2,038	0	1,747	0	1.5	0.0	6,887	0	2,410	0	2,066	0	1.7	0.0	10,269	0	3,594	0	3,081	0	2.6	0.0	12,867	0	4,503	0	3,860	0	3.2	0.0
			2,038		1,747		1.5				2,410		2,066		1.7				3,594		3,081		2.6				4,503		3,860		3.22	
Total Capacity			0		0		0.00				0		0		0.00				0		0		0.00				0		0		0.00	
Surplus/Deficit			-2,038		-1,747		-1.46				-2,410		-2,066		-1.72				-3,594		-3,081		-2.57				-4,503		-3,860		-3.22	

Currently has no dedicated capacity - fed by Upper Zone

Upper City Zone

All outdoor watering is accounted for in indoor calculations for this zone	Existing								Future (10-Year)								Future (20-Year)								Future (2050)							
	Service (ERC)	Irrigated Acres	Indoor Peak Day Source (gpm)	Outdoor Peak Day Source (gpm)	Indoor Avg. Yearly Source (ac-ft)	Outdoor Avg. Yearly Source (ac-ft)	Indoor Equalization Storage (MG)	Outdoor Equalization Storage (MG)	Service (ERC)	Irrigated Acres	Indoor Peak Day Source (gpm)	Outdoor Peak Day Source (gpm)	Indoor Avg. Yearly Source (ac-ft)	Outdoor Avg. Yearly Source (ac-ft)	Indoor Equalization Storage (MG)	Outdoor Equalization Storage (MG)	Service (ERC)	Irrigated Acres	Indoor Peak Day Source (gpm)	Outdoor Peak Day Source (gpm)	Indoor Avg. Yearly Source (ac-ft)	Outdoor Avg. Yearly Source (ac-ft)	Indoor Equalization Storage (MG)	Outdoor Equalization Storage (MG)	Service (ERC)	Irrigated Acres	Indoor Peak Day Source (gpm)	Outdoor Peak Day Source (gpm)	Indoor Avg. Yearly Source (ac-ft)	Outdoor Avg. Yearly Source (ac-ft)	Indoor Equalization Storage (MG)	Outdoor Equalization Storage (MG)
Unit Req.			0.35	6.0	0.3	3.2	0.00025	0.00432			0.35	6.0	0.3	3.2	0.00025	0.00432			0.35	6.0	0.3	3.2	0.00025	0.00432			0.35	6.0	0.3	3.2	0.00025	0.00432
			per ERC	per Irr-Ac	per ERC	per Irr-Ac	per ERC	per Irr-Ac			per ERC	per Irr-Ac	per ERC	per Irr-Ac	per ERC	per Irr-Ac			per ERC	per Irr-Ac	per ERC	per Irr-Ac	per ERC	per Irr-Ac			per ERC	per Irr-Ac	per ERC	per Irr-Ac	per ERC	per Irr-Ac
Total Demand	4,513	0	1,580	0	1,354	0	1.1	0.0	4,755	0	1,664	0	1,427	0	1.2	0.0	5,011	0	1,754	0	1,503	0	1.3	0.0	6,949	0	2,432	0	2,085	0	1.7	0.0
			1,580		1,354		1.1				1,664		1,427		1.2				1,754		1,503		1.3				2,432		2,085		1.74	
Total Capacity			4,000		3,200		3.55				4,000		3,200		3.55				4,000		3,200		3.55				4,000		3,200		3.55	
Surplus/Deficit			2,420		1,846		2.42				2,336		1,774		2.36				2,246		1,697		2.30				1,568		1,115		1.81	

Show 3.8 MG for storage because 1.2 MG is for fire

Patterson Zone

Existing outdoor watering accounted for in indoor calculations. Future outdoor watering is separate.	Existing								Future (10-Year)								Future (20-Year)								Future (2050)							
	Service (ERC)	Irrigated Acres	Indoor Peak Day Source (gpm)	Outdoor Peak Day Source (gpm)	Indoor Avg. Yearly Source (ac-ft)	Outdoor Avg. Yearly Source (ac-ft)	Indoor Equalization Storage (MG)	Outdoor Equalization Storage (MG)	Service (ERC)	Irrigated Acres	Indoor Peak Day Source (gpm)	Outdoor Peak Day Source (gpm)	Indoor Avg. Yearly Source (ac-ft)	Outdoor Avg. Yearly Source (ac-ft)	Indoor Equalization Storage (MG)	Outdoor Equalization Storage (MG)	Service (ERC)	Irrigated Acres	Indoor Peak Day Source (gpm)	Outdoor Peak Day Source (gpm)	Indoor Avg. Yearly Source (ac-ft)	Outdoor Avg. Yearly Source (ac-ft)	Indoor Equalization Storage (MG)	Outdoor Equalization Storage (MG)	Service (ERC)	Irrigated Acres	Indoor Peak Day Source (gpm)	Outdoor Peak Day Source (gpm)	Indoor Avg. Yearly Source (ac-ft)	Outdoor Avg. Yearly Source (ac-ft)	Indoor Equalization Storage (MG)	Outdoor Equalization Storage (MG)
Unit Req.			0.35	6.0	0.3	3.2	0.00025	0.00432			0.35	6.0	0.3	3.2	0.00025	0.00432			0.35	6.0	0.3	3.2	0.00025	0.00432			0.35	6.0	0.3	3.2	0.00025	0.00432
			per ERC	per Irr-Ac	per ERC	per Irr-Ac	per ERC	per Irr-Ac			per ERC	per Irr-Ac	per ERC	per Irr-Ac	per ERC	per Irr-Ac			per ERC	per Irr-Ac	per ERC	per Irr-Ac	per ERC	per Irr-Ac			per ERC	per Irr-Ac	per ERC	per Irr-Ac	per ERC	per Irr-Ac
Total Demand	96	19	34	115	29	61	0.02	0.08	390	61	137	366	117	195	0.1	0.3	390	61	137	366	117	195	0.1	0.3	390	61	137	366	117	195	0.1	0.3
			149		90		0.11				503		312		0.4				503		312		0.4				503		312		0.36	
Total Capacity			700		565		0.37				700		565		0.37				700		565		0.37				700		565		0.37	
Surplus/Deficit			551		475		0.26				198		253		0.01				198		253		0.01				198		253		0.01	

Show 0.42 MG for storage because 0.18 MG is for fire

Rocky Ridge Zone

A portion of the zone will have PI. Outdoor watering for the remainder is included here.	Existing								Future (10-Year)								Future (20-Year)								Future (2050)							
	Service (ERC)	Irrigated Acres	Indoor Peak Day Source (gpm)	Outdoor Peak Day Source (gpm)	Indoor Avg. Yearly Source (ac-ft)	Outdoor Avg. Yearly Source (ac-ft)	Indoor Equalization Storage (MG)	Outdoor Equalization Storage (MG)	Service (ERC)	Irrigated Acres	Indoor Peak Day Source (gpm)	Outdoor Peak Day Source (gpm)	Indoor Avg. Yearly Source (ac-ft)	Outdoor Avg. Yearly Source (ac-ft)	Indoor Equalization Storage (MG)	Outdoor Equalization Storage (MG)	Service (ERC)	Irrigated Acres	Indoor Peak Day Source (gpm)	Outdoor Peak Day Source (gpm)	Indoor Avg. Yearly Source (ac-ft)	Outdoor Avg. Yearly Source (ac-ft)	Indoor Equalization Storage (MG)	Outdoor Equalization Storage (MG)	Service (ERC)	Irrigated Acres	Indoor Peak Day Source (gpm)	Outdoor Peak Day Source (gpm)	Indoor Avg. Yearly Source (ac-ft)	Outdoor Avg. Yearly Source (ac-ft)	Indoor Equalization Storage (MG)	Outdoor Equalization Storage (MG)
Unit Req.			0.35	6.0	0.3	3.2	0.00025	0.00432			0.35	6.0	0.3	3.2	0.00025	0.00432			0.35	6.0	0.3	3.2	0.00025	0.00432			0.35	6.0	0.3	3.2	0.00025	0.00432
			per ERC	per Irr-Ac	per ERC	per Irr-Ac	per ERC	per Irr-Ac			per ERC	per Irr-Ac	per ERC	per Irr-Ac	per ERC	per Irr-Ac			per ERC	per Irr-Ac	per ERC	per Irr-Ac	per ERC	per Irr-Ac			per ERC	per Irr-Ac	per ERC	per Irr-Ac	per ERC	per Irr-Ac
Total Demand	0	0	0	0	0	0	0.0	0.0	0	0	0	0	0	0	0.0	0.0	0	0	0	0	0	0	0.0	0.0	147	35	51	210	44	112	0.0	0.2
			0		0		0.0				0		0		0.0				0		0		0.0				261		156		0.19	
Total Capacity			0		0		0.00				0		0		0.00				0		0		0.00				0		0		0.00	
Surplus/Deficit			0		0		0.00				0		0		0.00				0		0		0.00				-261		-156		-0.19	

No existing access to source or storage. Remember to account for fire and emergency storage.

SUMMARY

	Existing								Future (10-Year)								Future (20-Year)								Future (2050)							
	Service (ERC)	Irrigated Acres	Indoor Peak Day Source (gpm)	Outdoor Peak Day Source (gpm)	Indoor Avg. Yearly Source (ac-ft)	Outdoor Avg. Yearly Source (ac-ft)	Indoor Equalization Storage (MG)	Outdoor Equalization Storage (MG)	Service (ERC)	Irrigated Acres	Indoor Peak Day Source (gpm)	Outdoor Peak Day Source (gpm)	Indoor Avg. Yearly Source (ac-ft)	Outdoor Avg. Yearly Source (ac-ft)	Indoor Equalization Storage (MG)	Outdoor Equalization Storage (MG)	Service (ERC)	Irrigated Acres	Indoor Peak Day Source (gpm)	Outdoor Peak Day Source (gpm)	Indoor Avg. Yearly Source (ac-ft)	Outdoor Avg. Yearly Source (ac-ft)	Indoor Equalization Storage (MG)	Outdoor Equalization Storage (MG)	Service (ERC)	Irrigated Acres	Indoor Peak Day Source (gpm)	Outdoor Peak Day Source (gpm)	Indoor Avg. Yearly Source (ac-ft)	Outdoor Avg. Yearly Source (ac-ft)	Indoor Equalization Storage (MG)	Outdoor Equalization Storage (MG)
Unit Req.			0.35	6.0	0.3	3.2	0.00025	0.00432			0.35	6.0	0.3	3.2	0.00025	0.00432			0.35	6.0	0.3	3.2	0.00025	0.00432			0.35	6.0	0.3	3.2	0.00025	0.00432
			per ERC	per Irr-Ac	per ERC	per Irr-Ac	per ERC	per Irr-Ac			per ERC	per Irr-Ac	per ERC	per Irr-Ac	per ERC	per Irr-Ac			per ERC	per Irr-Ac	per ERC	per Irr-Ac	per ERC	per Irr-Ac			per ERC	per Irr-Ac	per ERC	per Irr-Ac	per ERC	per Irr-Ac
Total Demand	10,433	19	3,652	115	3,130	61	2.6	0.1	12,495	61	4,373	366	3,749	195	3.1	0.3	16,501	61	5,775	366	4,950	195	4.1	0.3	22,926	96	8,024	576	6,878	307	5.7	0.4
			3,767		3,191		2.7				4,739		3,944		3.4				6,141		5,146		4.4				8,600		7,185		6.15	
Total Capacity			4,700		3,765		3.92				4,700		3,765		3.92				4,700		3,765		3.92				4,700		3,765		3.92	
Surplus/Deficit			933		574		1.23				-39		-179		0.53				-1,441		-1,381		-0.47				-3,900		-3,420		-2.23	

APPENDIX C

Water Rights Summary Data

Payson City Groundwater (Drinking Water) Rights

Water Right Number	Change #	ACFT	
51-7192	a21935	135.52	
51-7197			
51-7198			
51-7203	a22131	48.4	
51-7224	a22496	48.4	
51-7241	a22703	48.4	
51-7244	a22723	4.94	
51-7250	a22765	103.74	
51-7251	a22766	51.87	
51-7268	a23129	4.84	
51-7278	a23095	96.8	
51-7294	a23259	9.68	
51-7303	a23349	9.68	
51-7314	a23441	53.24	
51-7315	a23464	203.28	
51-7316	a23465	4.84	
51-7336	a23774	203.28	
51-7403	a24258	48.4	
51-7551	a25118	159.72	
51-7580	a25513	4.84	
51-7614	a25944	24.2	
55-9505			
51-7328	a23644	27.545	
51-7400	a24147	27.545	
51-7555	a25222	47.22	
51-7615	a25961	47.22	
51-7785	a27885	80	
59-5907	a41283	454.79	
51-1313	a40557	3807.4323	
51-1397	a40557		
51-1398	a40557		
51-1762	a40557		
51-1763	a40557		
51-1764	a40557		
51-1765	a40557		
51-2525	a40557		
51-2694	a40557		
51-3781	a40557		
51-4070	a40557		
51-7228	a40557		
51-7388	a40557		
51-7572	a40557		
51-8442	a40557		
51-7277	a23879	151	
51-3499	a42050	28.08	
Payson Municipal Groundwater Rights		**5,935**	**ac-ft**

APPENDIX D

Calibration Data

Content for this appendix will be included in a subsequent draft.

APPENDIX E

EPANET 2.0 Hydraulic Models
(compact disc)

APPENDIX F

Cost Estimate Calculations

Payson City Capital Facility Plan
Drinking Water Recommended Improvements
Preliminary Engineers Cost Estimates

	Item	Unit	Unit Price	Quantity	Total Price
F-1	***Fire flow - 450 S and 900 W***				
	8" Transmission Line	LF	$ 119	1000	$ 119,000
				Engineering & Admin. (10%)	$ 11,900
				Contingency (10%)	$ 11,900
				Total to Fire flow - 450 S and 900 W	**$ 143,000**
F-2	***Fire flow - 350 S, 900 E, Sunnyhill Cir***				
	8" Transmission Line	LF	$ 119	1400	$ 166,600
				Engineering & Admin. (10%)	$ 16,660
				Contingency (10%)	$ 16,660
				Total to Fire flow - 350 S, 900 E, Sunnyhill Cir	**$ 200,000**
DW 1.	***Source - Patterson Zone Pump Station***				
	Pump Station	LS	$ 500,000	1	$ 500,000
				Engineering & Admin. (10%)	$ 50,000
				Contingency (10%)	$ 50,000
				Total to Source - Patterson Zone Pump Station	**$ 600,000**
DW 2.	***Arrowhead Transmission***				
	Upsize from 10" to 12" diameter	LS	$ 17,432	1	$ 17,432
				Engineering & Admin. (0%)	$ -
				Contingency (0%)	$ -
				Total to Arrowhead Transmission	**$ 17,432**
DW 3.	***Transmission - Salem Canal Rd***				
	8" Transmission Line (address existing deficiency)	LF	$ 119	2200	$ 261,800
	Upsize to 12" diameter (growth-related)	LF	$ 26	2200	$ 57,200
				Engineering & Admin. (10%)	$ 31,900
				Contingency (10%)	$ 31,900
				Total to Transmission - Salem Canal Rd	**$ 383,000**
DW 4.	***Upper City Zone Transmission Improvements***				
	24" Transmission Line	LF	$ 229	1200	$ 274,800
	20" Transmission Line	LF	$ 200	1200	$ 240,000
	16" Transmission Line	LF	$ 173	550	$ 95,150
	12" Transmission Line	LF	$ 145	1600	$ 232,000
	10" Transmission Line	LF	$ 136	300	$ 40,800
				Engineering & Admin. (10%)	$ 88,275
				Contingency (10%)	$ 88,275
				Total to Upper City Zone Transmission Improvements	**$ 1,059,000**
DW 5.	***Source - Salem System Interconnection***				
	12" Transmission Line	LF	$ 73	2000	$ 146,000
	Interconnection	LS	$ 12,500	1	$ 12,500
				Engineering & Admin. (10%)	$ 15,850
				Contingency (10%)	$ 15,850
				Total to Source - Salem System Interconnection	**$ 190,000**
DW 6.	***Source - 800 S well***				
	Switch well to DW system	LS	$ -	1	$ -
				Engineering & Admin. (10%)	$ -
				Contingency (10%)	$ -
				Total to Source - 800 S well	**$ -**
DW 7.	***Southern Lower City Zone Expansion***				
	1.5 MG Storage Tank	LS	$ 1,500,000	1	$ 1,500,000
	Land - Tank	AC	$ 100,000	1	$ 100,000
	Land - Well Site	AC	$ 100,000	0.25	$ 25,000
	Bore under I-15	LS	$ 250,000	1	$ 250,000
	16" Transmission Line	LF	$ 159	6500	$ 1,033,500
	12" Transmission Line - Developer	LF	$ 109	16000	$ 1,744,000
	12" Transmission Line - City upsize	LF	$ 29	16000	$ 464,000
				Engineering & Admin. (10%)	$ 511,650

Payson City Capital Facility Plan
Drinking Water Recommended Improvements
Preliminary Engineers Cost Estimates

	Item	Unit	Unit Price	Quantity	Total Price
				Contingency (10%)	$ 511,650
				Total to Southern Lower City Zone Expansion	**$ 6,140,000**
DW 8.	***Arrowhead Zone Transmission Expansion***				
	12" Transmission Line - Developer	LF	$ 109	7000	$ 763,000
	12" Transmission Line - City Upsize	LF	$ 29	7000	$ 203,000
				Engineering & Admin. (10%)	$ 96,600
				Contingency (10%)	$ 96,600
				Total to Arrowhead Zone Transmission Expansion	**$ 1,159,000**
				Total for Improvements	**$ 9,891,432**

APPENDIX G

Checklist for Hydraulic Model
Design Elements Report

Content for this appendix will be included in a subsequent draft.