IVINS CITY CULINARY WATER MASTER PLAN AND IMPACT FEE FACILITIES PLAN

Adopted by City Council
November 7, 2013

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COMMON ABBREVIATIONS

AF or ac-ft: Acre-feet

AF/Y or ac-ft/yr: Acre-feet per year

AYD: Average Yearly Demand

BLM: United States Bureau of Land Management

cfs: cubic feet per second

EPA: United States Environmental Protection Agency

ERU: Equivalent Residential Unit

GIS: Geographical Information Systems

GOPB: State of Utah Governor's Office of Planning and Budget

gpcd: gallons per capita per day

gpm: gallons per minute

HOA: Home Owners Association

IFC: International Fire Code 2012

IFFP: Impact Fee Facilities Plan

ISO: Insurance Services Office

KWU: Kayenta Water Users Private Water System

MG: million gallons

MGD: Million Gallons per Day

MPO: Dixie Area Metropolitan Planning Organization

PDD: Peak Day Demand

PID: Peak Instantaneous Demand

ppb: parts per billion

ppm: parts per million

PRV: pressure reducing valve

psi: pounds per square inch

SITLA: State of Utah Institutional Trust Lands Administration

TDS: Total Dissolved Solids

WCWCD: Washington County Water Conservancy District

WTP: Water Treatment Plant

IMPACT FEE FACILITIES PLAN CERTIFICATION

The following certification is required by Utah State Code Section 11-36a-306.

I certify that the attached impact fee facilities plan:

1. Includes only the costs of public facilities that are:
    a. Allowed under the Impact Fees Act; and
    b. Actually incurred; or
    c. Projected to be incurred or encumbered within six years after the day on which each impact fee is paid;
2. Does not include
    a. Costs of operation and maintenance of public facilities;
    b. Costs of qualifying public facilities that will raise the level of service for the facilities, through impact fees, above the level of service that is supported by existing residents; or that is consistent with generally accepted cost accounting practices and the methodological standards set forth by the federal Office of Management and Budget for federal grant reimbursement; and
3. Complies in each and every relevant respect with the Impact Fees Act.

IVINS CITY

Charles R. Gillette
Ivins City Engineer

EXECUTIVE SUMMARY

The Ivins City 2013 Culinary Water Master Plan and Impact Fee Facilities Plan considers the culinary water needs of Ivins City for the next 30 years. The needs of Ivins City are addressed in the areas of water resources, storage, transmission of sources, and distribution piping facilities. This plan meets the requirements of an impact fee facilities plan as defined in most current Utah Impact Fee Act (Utah Code, Title 11, Chapter 36a).

POPULATION AND LAND USE ANALYSIS

Ivins City has rapidly grown over the past three decades from a sparsely populated rural city to a significant suburban city being the fourth largest city in Washington County. This study evaluated past growth and has projected future growth. Also, part of this analysis was review of the current Land Use Plan and an identification of the future build out of the City. Based on this in-depth analysis, the following information was determined:

- The future build-out population is approximately 19,100.
- It is expected that the City will reach this population in approximately 2046, although it may occur sooner if growth follows closer to the GOPB estimate.

WATER DEMAND ANALYSIS

In the evaluation of past water demands, Ivins City has not seen any increase in use since 2008. Some of this is from a reduction in water system loss from as high as 15% to current rates of 7 to 10%.

COPY OF TABLE 11. SUMMARY OF CURRENT DEMANDS IN IVINS CITY

	Average Annual Demand (acre-feet/year)	Peak Month Demand (gpm)	Peak Day Demand (gpm)
Total Ivins City (includes KWU)	1,700	2,070	2,275
KWU System	140	160	175
Ivins City Municipal Water System	1,560	1,910	2,100

This study includes an evaluation of water meter data and found that when considering irrigation uses and correcting for landscaping of common areas in subdivisions, it could be safely assumed that each household on average to use 0.65 acre-feet/year. Kayenta use per household is approximately 66% of the typical household of the Municipal system. However, to ensure that the plan has adequate supply, this study assumes 0.89 acre-feet/year is used by the average household. This equates to the following future demands.

COPY OF TABLE 12. ESTIMATED FUTURE DEMANDS AT BUILDOUT (YEAR 2046)

	Future Average Annual Demand (acre-feet/year)	Peak Day Demand (gpm)
Future Municipal Irrigation System	3,100	4,700
KWU	1,100	1,400
Ivins City Municipal Water System	3,900	4,900
Total:	**8,100**	**11,000**

WATER SOURCE & TRANSMISSION

The following table summarizes all of the water rights and water supply agreements that Ivins City relies on for current and future water.

COPY OF TABLE 15. SUMMARY OF IVINS CITY WATER RIGHTS/WATER SUPPLY AGREEMENTS

Description	Flow Capacity (gpm)	Annual Production (acre-feet/year)
Irrigation Water Shares	As needed	347
Snow Canyon Compact Water Rights	350	393
Gunlock Wells Agreement	As needed	614
Ence Wells Water Supply Agreement	600	900
Quail Creek Water Block Purchase	1,700	1,000 (with option to purchase additional 1,000)
	Total:	2,252
Regional Water Supply Agreement	As needed for all future needs	As needed for all future needs

The Regional Water Supply Agreement with the Washington County Water Conservancy District guarantees a full supply of water Ivins City to build-out conditions. It is anticipated that along with the current taps into the Snow Canyon, Gunlock and Regional water systems, that there is a possibility of a surface water treatment plant to deliver water from the Gunlock system. This plan anticipates that this water source would become available to Ivins somewhere near the Ivins Reservoir and then be delivered via pump station and transmission line into the Ivins system.

WATER STORAGE

Water storage is essential to a municipal water system. The storage allows for equalization of flow as the demand varies throughout the day. Also the storage provides water for emergencies such as

fires and power outages. Ivins City currently has 4.3 million gallons of storage spread across six water storage facilities. Current analysis shows that the system is currently short in necessary storage in the 3290/3312 zone and will soon be out of the required storage in the 3460 Taviawk zone. **This plan recommends increasing storage by 1 million gallons and also to accelerate the implementation of the secondary water system to prevent a deficiency of storage.**

DISTRIBUTION PIPING SYSTEM

The distribution piping network consists of 61.5 miles of pipe. The system was analyzed looking at multiple scenarios. The analysis shows that some minor improvements could solve some of the system deficiencies. The plan identified a few small areas of the City where fire flows less than 1,750 gpm are available. This would limit building size (including garage) to 3,600 sq. ft. unless indoor sprinklers are used. Some other deficiencies are outlined and improvements are recommended in the facilities plan.

FACILITIES PLAN

As a result of the analyses conducted for the preparation of this plan. The following improvements to the facilities are recommended as provided in the following table.

COPY OF TABLE 39. LIST OF CAPITAL FACILITY PROJECTS

Project ID	Project Description	Facility Type	Time Frame	Project Cost	Notes	Impact Fee Fund
Priority #1: Current Needs						
IA	Upsize Taviawk Pumping Station to 480 gpm Capacity	Transmission	0-5 years	$60,000	Current Pumping Station is at maximum capacity.	100%
IB	Upsize 6" Waterline to 12" on 400 W from 400 S to Hwy 91	Distribution	0-5 years	$190,000	Provides Fire Flow for Future Development	100%
IB	Install 12" Waterline in Hwy 91 from 400 W to Earl Rd	Distribution	0-5 years	$90,000	Provides Fire Flow for Future Development	100%
IC	Install Check Valves on 1MG & 2MG Tanks	Storage	0-5 years	$15,000	Prevents Snow Canyon Taps from Overflowing Tanks	50%
ID	Remove Check Valves at 50 N 200 E and Red Mountain Spa	Distribution	0-5 years	$10,000	Increase interflow between 3290 Zones	50%
IE	Connect 14" to 12" @ 200 W/300N	Distribution	0-5 years	$20,000	Provides better pressures in higher elevation areas of 3290 zone	100%
IF	Combine 3165 and 3220 Pressure Zones in a 3175 Zone	Distribution	When Developed	Paid by Developer	Adjust the pressures on the PRVs. Connection of system for future pending development.	n/a
IF	Combine 3165 and 3220 Pressure Zones in a 3175 Zone	Distribution	When Developed	Paid by Developer	Adjust the pressures on the PRVs. Connection of system for future pending development.	n/a
Priority #2: Bolster 3290 Zone						
IIA	Add Water Storage to 3290 Zone	Storage	0-5 years	$2,300,000	Replace 1MG steel tank with 2MG concrete tank	100%
IIB	Upsize Outflow Pipeline from 8" to 16" in Taviawk Dr (450 N to Tank)	Distribution	5-15 years	$540,000	Necessary to maintain pressures while accommodating growth	100%
IIB	Upsize Outflow Pipeline from 8" to 12" in 400 W (450 N to 300 N)	Distribution	5-15 years	$70,000	Necessary to maintain pressures while accommodating growth	100%
IIB	Upsize main line from 8" to 12" in 400 W (200 N to Center St)	Distribution	5-15 years	$150,000	Necessary to maintain pressures while accommodating growth	100%
IIC	Separate Irrigation System	Irrigation	5-10 years	Paid by Irrigation Funds	Necessary as system will become undersized without removing the irrigation demand	n/a

TABLE 38, LIST OF CAPITAL FACILITY PROJECTS (CONT.)

Project ID	Project Description	Facility Type	Time Frame	Project Cost	Notes	Impact Fee Fund
Priority #3: Bolster Transmission of Source						
IIIA	Install Pumping Station at 200 W	Transmission	15-25 years	$170,000	As demands increase, necessary to ensure flow capacity	100%
IIIB	Upgrade Pumping Station at 400 W	Transmission	15-25 years	$60,000	As demands increase, reliability of pumping is necessary	50%
IIIC	Pumping Station Transmission Line from Ivins Reservoir	Transmission	15-25 years	$1,360,000	Future Pumping Station & Pipeline from Possible Treated Water Source	100%
IIID	Upgrade Tuacahn Pumping Station	Transmission	5-15 years	$50,000	Install Backup Pump to improve redundancy	100%
Future Priorities Per Development & Major Tank Replacements						
IVA	450 North (400 W to 550 W) 12" Pipe	Distribution	When Developed	$15,000	Impact Fees Fund upsize from 8"	100%
IVB	Guy Lane (Hwy 91 to Fitness Way) Replace 8" with 12"	Distribution	When Developed	Paid by Developer	For Fire flow (see page 61) for more details.	n/a
IVC	400 S (400 W to 480 W) Replace 6" with 8"	Distribution	When Developed	Paid by Developer	6” pipe not viable to handle future flows.	n/a
IVD	Center St (600 W to 750 W) Replace 6" with 8"	Distribution	When Developed	Paid by Developer		n/a
IVE	Upsize Pumping Station at Tuacahn	Transmission	When Developed	Paid by Developer	As necessary for development paid for by development	n/a
IVF	Replace Tuacahn Tank with concrete tank at end of service life	Storage	Year 2035 +/-	$940,000	Lower water temperatures, Reduce maintenance costs	0%
IVG	Replace Taviawk Tank with concrete tank at end of service life	Storage	Year 2039 +/-	$940,000	Lower water temperatures, Reduce maintenance costs	0%
IVH	Replace 2MG Tank with concrete tank at end of service life	Storage	Year 2042 +/-	$2,250,000	Lower water temperatures, Reduce maintenance costs	0%

Note: All cost estimates are in 2012 dollars

CHAPTER 1: INTRODUCTION

BACKGROUND

This water master plan is an update to the 2006 Water Capital Facilities Plan prepared by Alpha Engineering. Prior to the 2006 plan, there is a 2001 plan prepared by Alpha Engineering and a 1997 plan prepared by Bush and Gudgell Engineering which were also referred to in the preparation of this plan.

This document is encompassing of a water master plan in that it covers all of the future planning for the culinary water system. It is also intended to meet all of the requirements of an impact fee facilities plan as defined in most current Utah Impact Fee Act (Utah Code, Title 11, Chapter 36a).

SCOPE OF WORK

This report is a result of updating the information in the 2006 plan. The following tasks were completed in this effort:

- Land use data was re-evaluated and the future build-out population was determined.
- New land use mapping was created.
- Population projections were revised with the new data from the 2010 Census
- An analysis of water demands and water sources was conducted. This included an intensive analysis of meter usage in the City for the period of 2010-2011.
- Water Rights were evaluated to determine the City's existing holdings.
- Water quality data was collected and evaluated for the various water sources.
- Water storage facilities were evaluated for current and future demands and for fire flow storage.
- Transmission facilities were evaluated. Pumping stations and pipelines were evaluated to determine what upgrades might be needed in the future.
- The existing and future distribution pipe system was evaluated using a hydraulic pipeline network computer model using the software Bentley Systems WaterGEMS. The following scenarios were evaluated:
    - Existing Conditions
    - Existing Conditions with the development of all existing vacant lots
    - Future Buildout Conditions assuming that a separate irrigation system has been implemented.
- The model scenarios were evaluated under the following conditions.
    - Peak Day Demand with Fire Flow Analysis (Static System Analysis)
    - Peak Instantaneous Demand (Static System Analysis)
    - Peak Day Demand 72-hr extended period analysis.
- Existing deficiencies were identified and a capital facilities plan was developed to provide practical improvements to correct the existing deficiencies.
- Future improvements were identified that will need to be installed as part of the capital facilities plan.
- Cost estimates and prioritization was provided for the capital facilities plan.

SERVICE STANDARDS

The following table provides a summary of the Ivins City service standards:

TABLE 1. IVINS CITY SERVICE STANDARDS

Category	Service Standard

System Pressure	• Normal Operation Range: 30 to 130 psi
	• Peak Day Demand (PDD): minimum 40 psi
	  ○ Indoor: 800 gallons per day per ERU
	  ○ Outdoor: 4.90 gpm per irrigated acre
	• Peak Instantaneous Demand (PID): minimum 30 psi
	  ○ Indoor: Qgpm = 10.8 x $ERU^{0.64}$ (minimum 1.5 x PDD)
	  ○ Outdoor: 9.80 gpm per irrigated acre
	• Peak Day Demand (PDD) with Fire Flow: minimum 20 psi
	  ○ Fire Flow: minimum 1000 gpm or per requirements for largest individual building per IFC
	• Daily Pressure Fluctuations: < 20 psi when service pressure is < 80 psi

Supply Source	• Water rights or water agreements to source:
	  ○ Average yearly demand (AYD):
	  ▪ Indoor: 146,000 gallons per ERU
	  ▪ Outdoor: 3.26 acre-feet per year per irrigated acre
	  ○ Peak Day Demand (PDD):
	  ▪ Indoor: 800 gallons per day per ERU
	  ▪ Outdoor: 4.90 gpm per irrigated acre
	• Supply capacity will refill the tank fire storage in a 24 hour period.
	• Supply capacity will completely refill storage tanks in 3 days with all sources in service.

Storage Capacity	• Equalization Storage:
	  ○ Indoor: Minimum 400 gallons per ERU
	  ○ Outdoor: 4,964 gallons per irrigated acre
	• Fire Suppression Storage:
	  ○ Meet need of individual buildings per IFC Appendix B.
	• Emergency Storage: None unless source supplies are unable to meet supply source standards as provided above.

Pump Station Design	• Capacity for Open Systems:
	  ○ Peak Day Demand with largest pump out of service, plus
	  ○ The flow required to refill the tank fire storage in a 24 hour period.
	• Capacity for Closed Systems (No gravity storage): The greater of Peak Day Demand with Fire Flow or Peak Instantaneous Demand.

Pipeline Sizes	• Standard pipe sizes to be used are 4, 6, 8, 12, 16, 20, 24, and 30 inches. Larger pipe sizes shall be in 6-inch increments thereafter. • Mainline pipelines servicing hydrants shall not be less than 8-inches.
Transmission Pipelines	• Sized to meet peak day demand plus flow required to refill tank fire storage in a 24 hour period. • Target velocity: less than 5 feet per second • Max velocity: 8 feet per second
Distribution Pipelines	• Sized to meet the greater of Peak Instantaneous Demand or Peak Day Demand with Fire Flow. • Max velocity: 10 feet per second except with fire flow

This list of service standards does not represent any proposed increase in level of service.

SERVICE AREA

Ivins City is serviced by two water systems, one public system operated by Ivins City and one private system operated by KWU. The KWU system represents the Kayenta area with the exclusion of most of the Taviawk area which is serviced by Ivins City. Figure 1 shows a map of the two service areas.

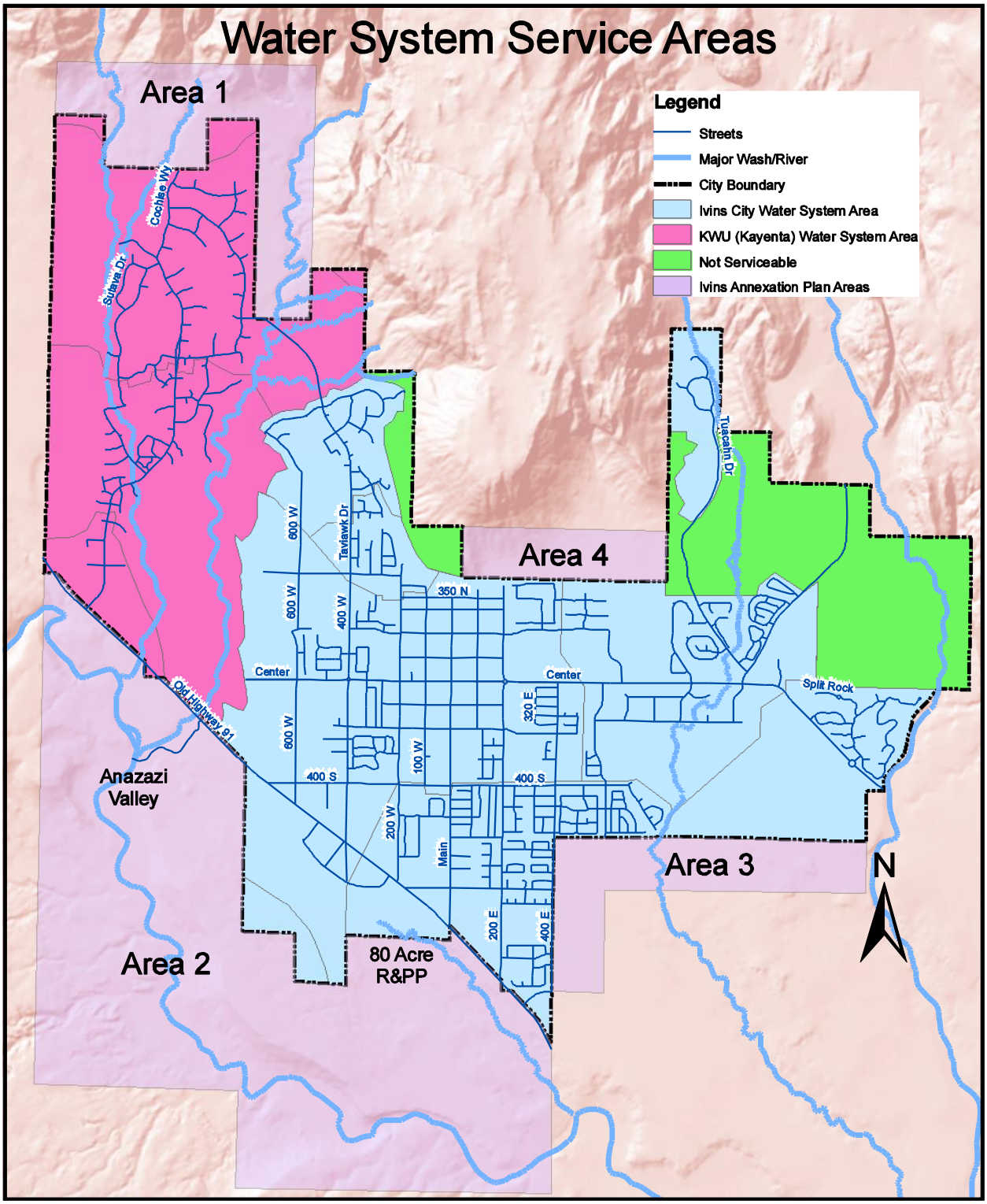
The KWU system has limited supply of water based on its agreement to use the Ence Wells owned by the WCWCD. The agreement states as follows:

> It is recognized that the water transferred, together with the water presently allocated to the Ence well, would allow for a maximum of Six Hundred Twelve (612) culinary connections and that [KWU] reserves without cost to Ence until connections are actually made Sixty (60) connections for the use of Ence.

This results in the KWU system having 552 connections as a maximum. Further on in this study, under the Land Use Analysis section, it is shown that the KWU system is very close to surpassing this limit and that in the future as many as 1,500 equivalent residential connections should be considered.

It may be necessary in the near future for the private KWU to be sold to Ivins City Municipal System to enable additional water resources which would allow for additional growth in this area. Regardless, this master plan document does not evaluate the future improvements needed for the KWU system other than identifying future land use and associated population projections and identifying the associated future water needs.

FIGURE 1. WATER SYSTEM SERVICE AREAS OF IVINS CITY



ANNEXATION CONSIDERATIONS

The annexation zones are shown in water system service area map provided in Figure 1. There are four areas which are described as follows:

Area 1: North of Kayenta – This area is within the desert tortoise reserve and owned by the U.S. Bureau of Land Management (BLM). The likelihood of an annexation in this area is too low to be considered in the future planning of water systems, therefore this area does not impact this study.

Area 2: Santa Clara River Valley – This is a large area and currently encompasses much of the Santa Clara River area including the Anazazi Valley and areas identified and protected by the BLM as the Santa Clara River Reserve. The majority of the area is not viable for future annexation and development as the BLM has assigned the area around the Santa Clara River as an avoidance area, however, there are three subareas within that are developable as follows:

- Anazazi Valley – The Anazazi Valley has a significant amount of private property that might be developable minus the areas with extremely steep slopes and the flood plain areas of the Santa Clara River. It is expected that at most 320 acres would be developable. The current land use plan does not address a land use for this area, however, for the purpose of this study it is assumed to be low density residential at a density no more than one unit per acre. The servicing of this area could be completed as one of the following options:
    - Service directly from the 3 MG tank owned by City of St. George located on the Shivwits Reservation. Through an agreement with the City of St. George, a connection to the 20-inch Gunlock pipeline could provide sufficient pressure to the upper elevations and a PRV would need to be provided to service some of the lower elevations.
    - Service by connection to the KWU system, but this would require some significant length of pipelines and require that KWU system be part of the Ivins City municipal system.

- There is 70 acres of SITLA/private property adjacent to the Villas at Bellagio project that could be easily serviced by Ivins. This area was assumed to be developable at 3.3 units per acre which would add 230 units. This is speculative as it would be subject to zoning and density determinations made by the Planning Commission and City Council. The property would receive secondary irrigation through the future system as discussed in the following section.

- 80 Acre R&PP – There is 80 acres south of the Pendleton properties which is owned by BLM but available for a recreation and public purpose (R&PP) right-of-way grant. The public purpose could be varied from a public works yard to a park, equestrian or other recreational facility. This 80 acres is considered to be 50% irrigated and 2 indoor ERUs in the future for water planning purposes. The property would be considered part of the future secondary irrigation system.

Area 3: Santa Clara Boundary – This area is established for the case that there are adjustments to the boundary between Santa Clara and Ivins City. It is not possible to perfectly foresee any changes to this boundary at this time; therefore this area does not impact this study.

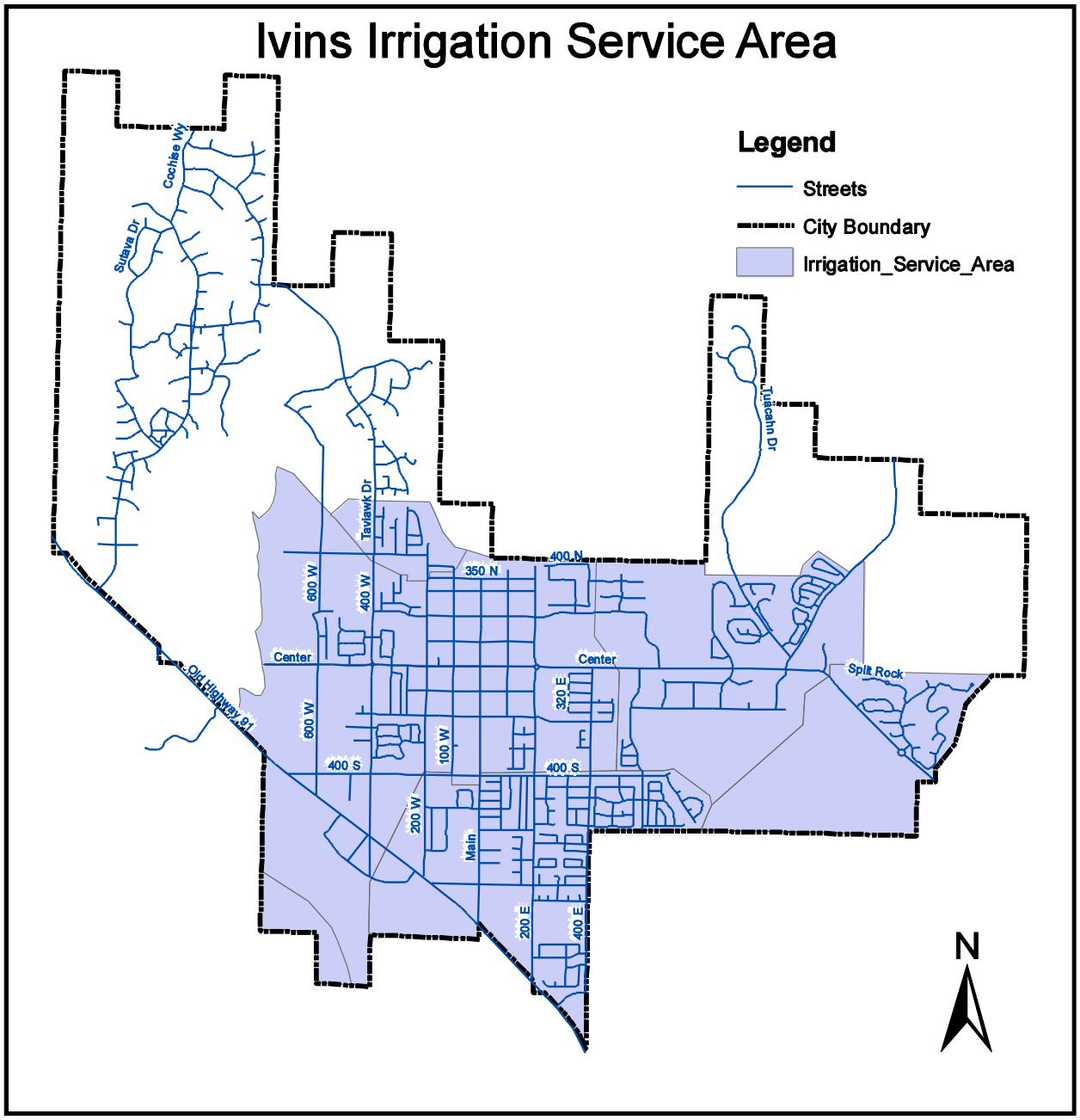
Area 4: Base of Red Mountain – This area was once considered to be viable for future development when it was administered by the State of Utah Institutional Trust Lands Administration (SITLA). This land was purchased by State Parks and is no longer considered for future development; therefore this area does not impact this study.

IRRIGATION WATER CONSIDERATIONS

The current water system handles both indoor water use and outdoor water use except for those properties that are receiving water from the irrigation company. All subdivisions constructed since the 1990s, have been required to install secondary irrigation pipe for a future irrigation system. The need for Ivins City to implement a secondary irrigation system is becoming apparent to the entire region as arsenic reduction rules are reducing the usability of the Gunlock Wells and irrigation grade water is becoming more abundant on the west side of the region.

It is still unclear how this system will be phased into the City, whether it be by a transferring of the Ivins Irrigation Company system to the City or by development of an independent system. Ivins has identified the service area of the irrigation system as shown in Figure 2 as follows. These areas are considered to be serviced by the irrigation for some of the future build out analyses.

FIGURE 2. IVINS IRRIGATION SERVICE AREA



CHAPTER 2: POPULATION AND LAND USE ANALYSIS

This section reviews historical population, existing land use, future land use and estimate of buildout population, and a population projection to determine the approximate year of buildout.

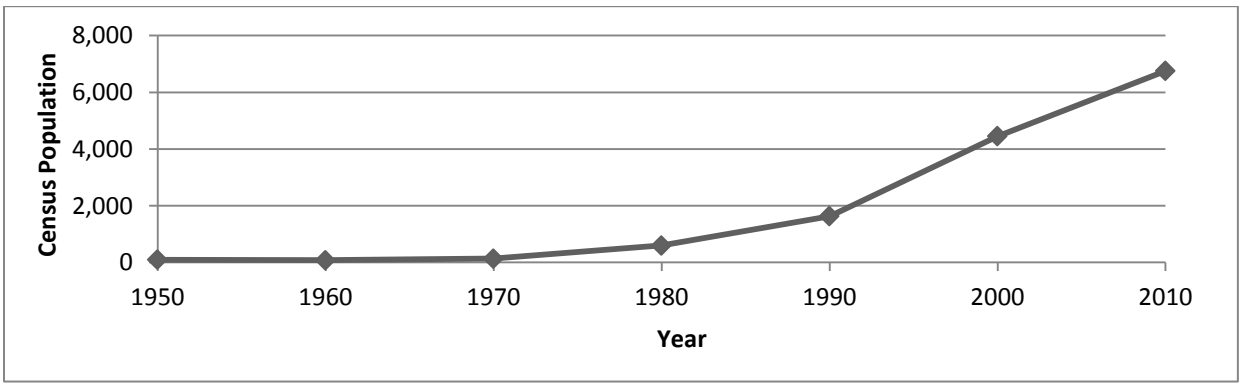
HISTORICAL POPULATION

Ivins City has rapidly grown over the past three decades from a sparsely populated rural city to a significant suburban city being the fourth largest city in Washington County. Table 2 and Figure 3 below shows the historical growth of Ivins since 1950 based U.S. Census data.

TABLE 2. HISTORICAL POPULATION OF UTAH, WASHINGTON COUNTY AND IVINS CITY

	1950	1960	1970	1980	1990	2000	2010
State of Utah	688,862	890,627	1,059,273	1,461,037	1,722,850	2,246,553	2,763,885
% Growth		29.3%	18.9%	37.9%	17.9%	30.4%	23.0%
Washington County	9,836	10,271	13,669	26,065	48,560	90,354	138,115
% Growth		4.4%	33.1%	90.7%	86.3%	86.1%	52.9%
Ivins City	95	77	137	600	1,630	4,450	6,753
% Growth		-18.9%	77.9%	338.0%	171.7%	173.0%	51.8%

FIGURE 3. GRAPH OF IVINS CITY HISTORICAL POPULATION



In previous decades, Ivins had been growing at a rate well above the County rate. In the last decade, the growth rate shows to have slowed to be nearly the same as the County. In review of Ivins City garbage account data, which is a good indicator of the number of homes in Ivins, it indicates that construction growth was more than the population growth as Ivins City grew from 1,690 garbage accounts to 2,841 accounts indicating a 68.1% growth rate. This is shown in the table below.

TABLE 3. US CENSUS POPULATION 2000 VS. 2010

	Year 2000	Year 2010	% Growth
US Census Population	4450	6753	51.8%
US Census Households	1435	2427	69.1%
US Census Housing Units	1598	2880	80.2%
US Census Persons per Household	3.10	2.78	
Vacant Housing Units including second homes	163 (10.2%)	453 (15.7%)	178%
Second Homes (Seasonal, Recreational, or Occasional Use)	91 (5.7%)	289 (10%)	217%

Even though population has only increased 52 percent over the 10 years between censuses, the housing units have increased 80 percent. The large gap between population growth and housing growth can be attributed to the following. First, the quantity of persons per household has significantly decreased to 2.78 from 3.10. This may be indicative of the attractiveness of Ivins as a retirement community as our population 65 and older has increased from 10.2 percent to 19.8 percent. There may also be a trend in local population demographics towards smaller sized families. Lastly, the attractiveness of Ivins for second homes has increased.

As shown in the table above the number of second homes has more than doubled and vacant housing (which includes second homes) now accounts for nearly 16 percent of Ivins residences versus 10 percent in the previous census. These homes may use less water for indoor, but should not use less water for outdoor use. For the purposes of this study it is assumed that each housing unit uses the same amount of water.

EXISTING LAND USE

Land use analysis is basic to City planning. It is necessary to understand the existing land use and compare to the future land use as determined by the adopted Land Use Plan which is Figure 1 of the General Plan. The City area was analyzed to determine the number of existing residences, irrigated acres, and extent of commercial land uses.

Table 4 below shows a summary of the existing land use analyzed by area in acres. Of the more than 6,000 acres of the Ivins City Boundary, 2,242 acres or 36% is developed. Another 14.5% is considered to be permanent open space.

TABLE 4. SUMMARY OF EXISTING DEVELOPMENT

	KWU (acres)	Ivins (acres)	Total (acres)	%
Developed Residential	576	1503	2,079	33.7%
Developed Commercial/Civic/School/Church	16	147	163	2.6%
Undeveloped	1,142	1,886	3,028	49.1%
Open Space	83	809	892	14.5%
Total	1,817	4,345	6,162	

As shown 49% of the city still yet remains to be developed and is currently either naturally vegetated, cultivated, or fallow. A portion of this area may be undevelopable due to slopes, flood plains and other natural geographical features. This does not include the 400 acres of potentially developable land in the Anazazi Valley annexation zone.

The existing land use was further evaluated to determine a more exact number of residences, multi-family units and an estimation of irrigated acreage. These results are given in Table 5 below.

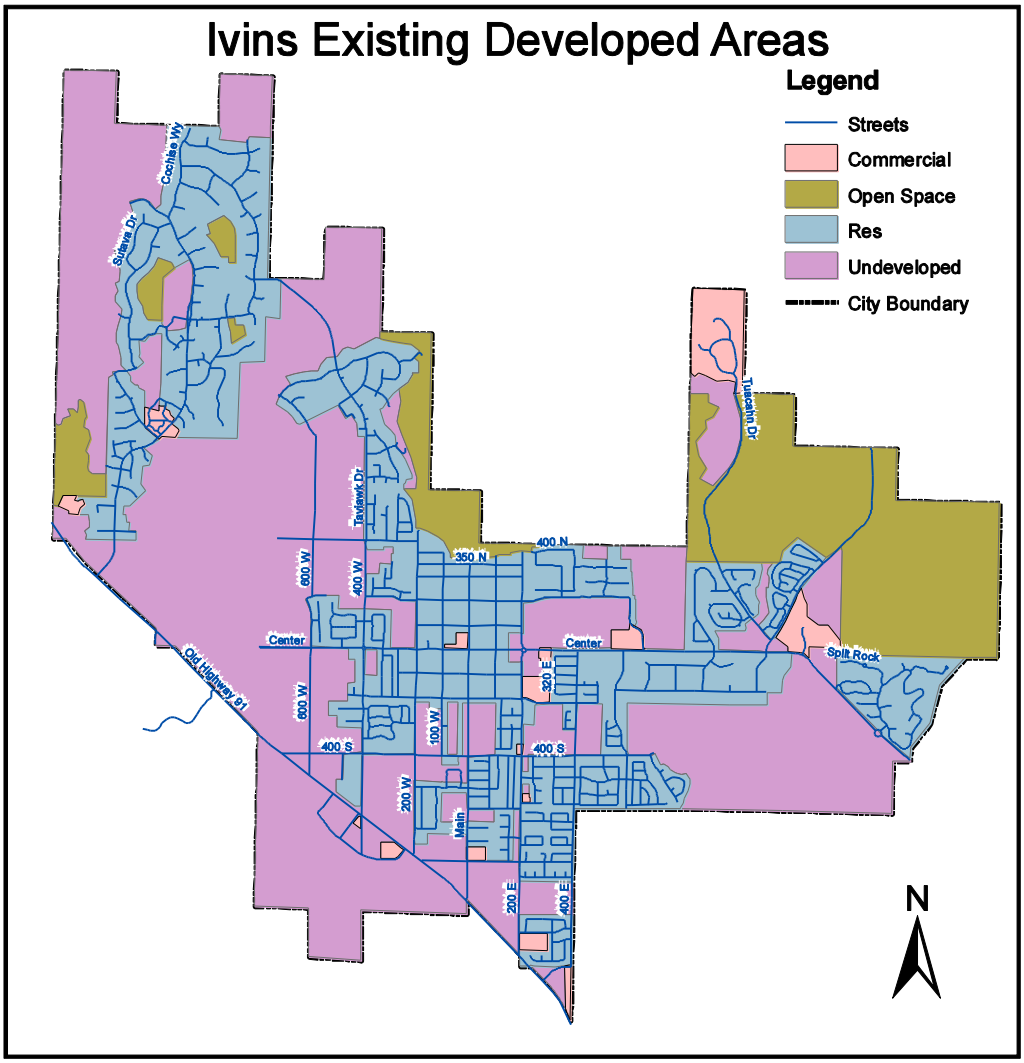
TABLE 5. EXISTING LAND USE IN IVINS CITY AS OF APRIL 2011

	All Ivins City	Ivins Municipal Water System	KWU System (Kayenta)
Single Family Residences	2874*	2562	312
Multi Family Units	69	65	4
Estimated Irrigated Acres (Developed Areas)	336 acres	303 acres	33 acres
Irrigated Acres (Cultivated Areas with Irrigation Co.)	480 acres	480 acres	0 acres
Hotel/Spa Units	140	140	0
Single Family Vacant Lots	857	709	148
Commercial ERUs	120	115	5
Total ERUs	3114	2793	321
With Build out of existing vacant lots			
Total ERUs	3971	3502	469
Irrigated Acres (Developed areas)	422 acres	374 acres	48 acres

*Based on garbage accounts with Ivins City.

The following Figure 4 shows the existing developed areas of Ivins.

FIGURE 4. EXISTING LAND USE DEVELOPMENT



FUTURE LAND USE & PROJECTED BUILDOUT

The following Figure 5 shows the current land use plan as of April 2011. The build out population is based on a detailed analysis of the land use plan and existing plans that have been submitted to Ivins City at various stages. This detailed analysis was completed using GIS technology and the resulting workmap is provided in Appendix A. The analysis identified areas for infill development as well as the development of the undeveloped areas. Table 6 as follows the land use plan figure shows the results of this analysis.

FIGURE 5. IVINS CITY LAND USE PLAN (APRIL 2011)

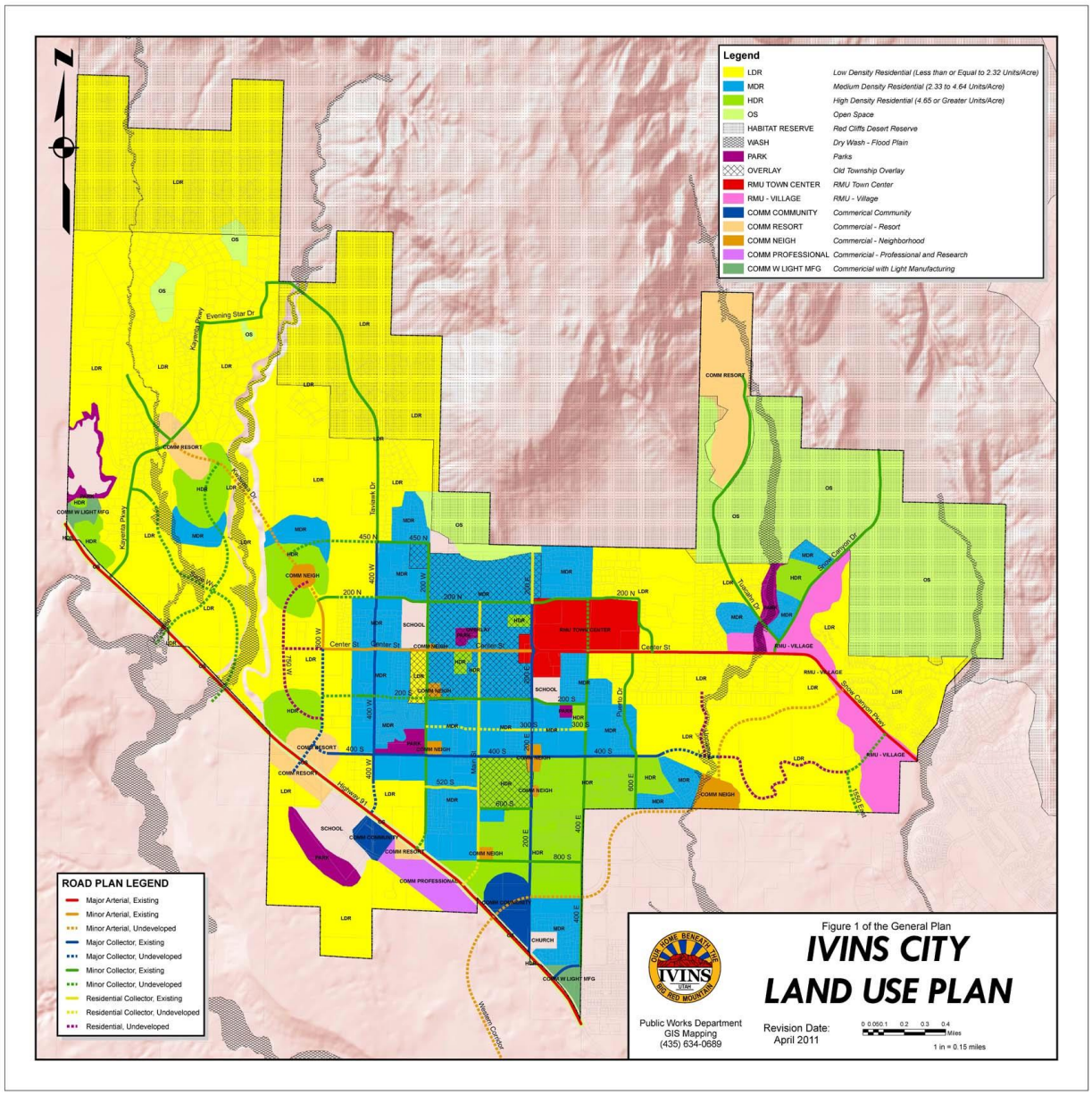


TABLE 6. LANDUSE DATA FOR FUTURE BUILDOUT CALCULATIONS

	Ivins City		Ivins Municipal Water		KWU (Kayenta)	
	Existing	Buildout	Existing	Buildout	Existing	Buildout
Single Family Housing Units	2,874	7,332	2,562	5,909	312	1,423
Multi Family Housing Units	69	475	65	471	4	4
Total Housing Units	2,943	7,807	2,627	6,379	316	1,427
Vacant Lots for Single Family Housing	857	0	709	0	148	0
Anazazi Valley SF Residences	0	500	0	90	3	410
Landscaped Areas (acres)	437	1107	405	992	32	115
Areas (acres)	480	0	480	0	0	0
Transient Units	140	582	140	552	0	30
Commercial ERUs (indoor use)	120	1,171	115	1,096	5	76
Total ERUs	3,114	9,560	2,793	8,057	321	1,503

Based on this analysis, the buildout number of residences is 7,807 plus 500 residences added for the annexation of Anazazi Valley for a **total of 8,307 residences**. Assuming that 15% of the residences are second homes or unoccupied in accordance with current conditions as calculated in the discussion of Historical Population, 7061 would be considered resident households and using a household size of 2.7 (see population projections below) indicates a **buildout population of 19,100**.

This buildout population estimate will change with any changes to the land use plan. Lately the trend has been towards allowing more and more dense development with each modification of the land use plan, so there is a possibility that the estimated buildout population will increase as time moves forward. In prior capital facilities plans, an effort was made to estimate this larger population in anticipation of the land use plan being modified, however, this has been deemed unnecessary as these plans are updated every four to six years and should simply be adapted as the land use plan changes over time.

POPULATION PROJECTIONS

The population projections identify the timing of community growth and provide information to determine how soon capital facilities need to be placed into service. This growth projection is based on analysis of previous years of growth and an understanding of the local demographics. The State of Utah Governor's Office of Planning and Budget (GOPB) is a source for population projections as well as other studies that are looking at the regional growth.

Figure 6 as follows shows different population projections for Ivins City. The 2008 Baseline City Population Projection produced by the GOPB is the most aggressive and may be too aggressive based on the latest census data that was recently released. The Dixie Area Metropolitan Planning

Organization (MPO) is working with RSG Consultants in updating the transportation model and has provided a preliminary population projection as shown on the figure. This population projection seems to be more in line with the actual growth recorded by the census but still overestimates the population of Ivins in Year 2010. However, the growth percentages seem to better fit current observed growth; therefore these percentages were used in the population projection. The Ivins Projected Population represents the one to be used in this study which uses the same growth predictions and average household size predictions used in the MPO study with the correction to the Year 2010 based on the census data.

FIGURE 6. POPULATION PROJECTIONS

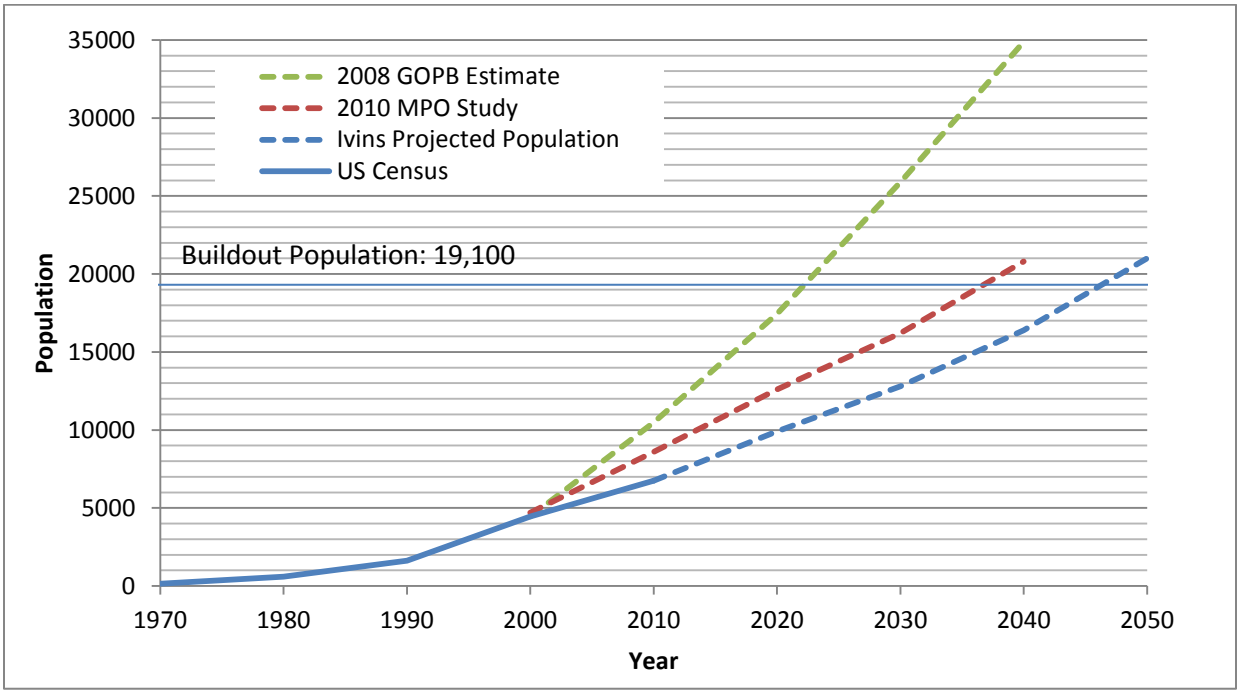


TABLE 7. IVINS POPULATION PROJECTION DATA

Year	Population	Population % Growth	Total Housing Units	Total Residences % Growth	Resident Households*	Household Size
1970	137					
1980	600	338%				
1990	1630	172%				
2000	4450	173%	1690		1435	3.10
2010	6753	52%	2880	70%	2427	2.78
↓ Projected Data ↓						
2020	9900	47%	4240	49%	3600	2.75
2030	12800	29%	5520	30%	4690	2.73
2040	16400	28%	7140	29%	6070	2.7
2050	21000	28%	9150	28%	7780	2.7

*Resident households are considered to be 85% of the total housing units accounting for 15% of homes considered to be second homes or otherwise unoccupied as currently exists per the 2010 US Census.

The resulting population projection shows that **buildout population of 19,100 will be reached in 33 years in 2046**. With 857 vacant lots in Ivins City and this growth projection, it is estimated that these lots would be filled with 30 percent growth from 2010 which would occur in 2016.

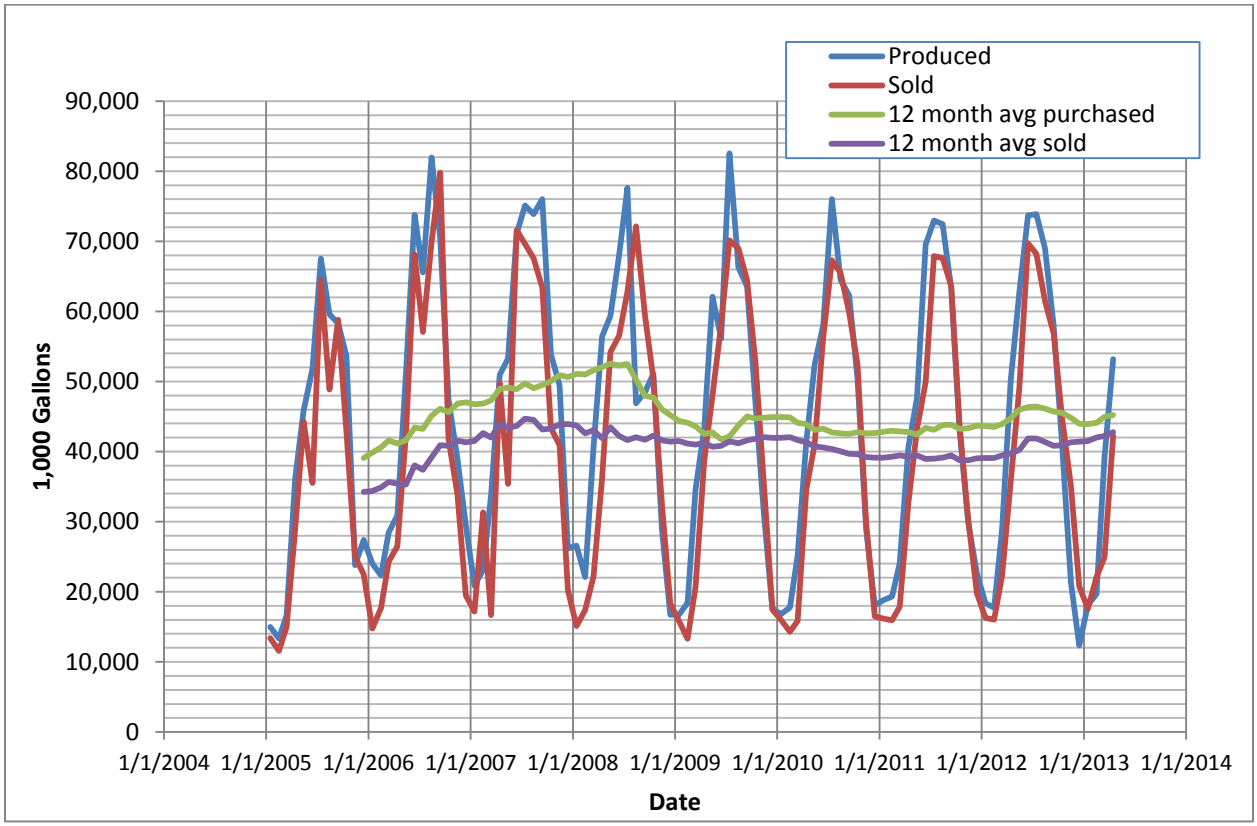
CHAPTER 3: WATER DEMAND ANALYSIS

This section evaluates current water demands annually and on a peak day through review of metering data, and then provides an estimate of the future demands.

CURRENT DEMANDS

Figure 7 below shows the historical water use for Ivins City Municipal Water System 2005 to 2013. All water is delivered to Ivins City Municipal Water System customers through one of four master metered delivery points. These points are indicated by the "Purchased" data line. The "Sold" data line represents the summation of the retail meter data. As is typical with most water systems, the Ivins System exhibits a water loss of 7 to 10 percent. This water loss is shown more obviously in the 12 month moving averages. As shown the water losses have been decreased from approximately 15 percent. Much of this improvement and success is thought to be attributed to the City's meter replacement program as well as the leak detection program.

FIGURE 7. IVINS CITY HISTORICAL MUNICIPAL WATER USE 2005 TO 2013



It is notable that Ivins City municipal water usage has been somewhat level over the past years. This seems to be indicative of a slowing economy where at least a portion of the water usage was based on the economic activity despite the fact that the City continues to add more housing albeit at

a slower rate. The trend of water usage is most recently starting to show a slow increase after two or three years of no increase.

The following table shows a summation of all water use from June 2010 to May 2011 in Ivins City including KWU (Kayenta) private water system and the Ivins Irrigation Company.

TABLE 8. CURRENT AVERAGE ANNUAL WATER USAGE JUNE 2010 TO MAY 2011

	Gallons/Year	Acre-Feet/Year	MGD	CFS	GPM
Ivins City Purchased	508,881,000	1,562	1.39	2.2	968
Ivins City Sold	470,305,000	1,443	1.29	2.0	895
KWU Purchased from WCWCD	44,482,500	137	0.12	0.2	85
Total KWU + City Usage	553,363,500	1,699	1.51	2.4	1,053
Ivins Irrigation Company	485,596,000	1,490	1.33	2.1	924
Total Usage	1,038,959,500	3,189	2.84	4.5	1,977

As a standard metric for comparison purposes to other communities, the typical measure is gallons per capital per day (gpcd). **Ivins City usage including KWU is 224 gpcd** when excluding the water used by Ivins Irrigation Company. When considering this usage, the equivalent usage increases significantly to 421 gpcd.

The following table below provides a water use comparison chart.

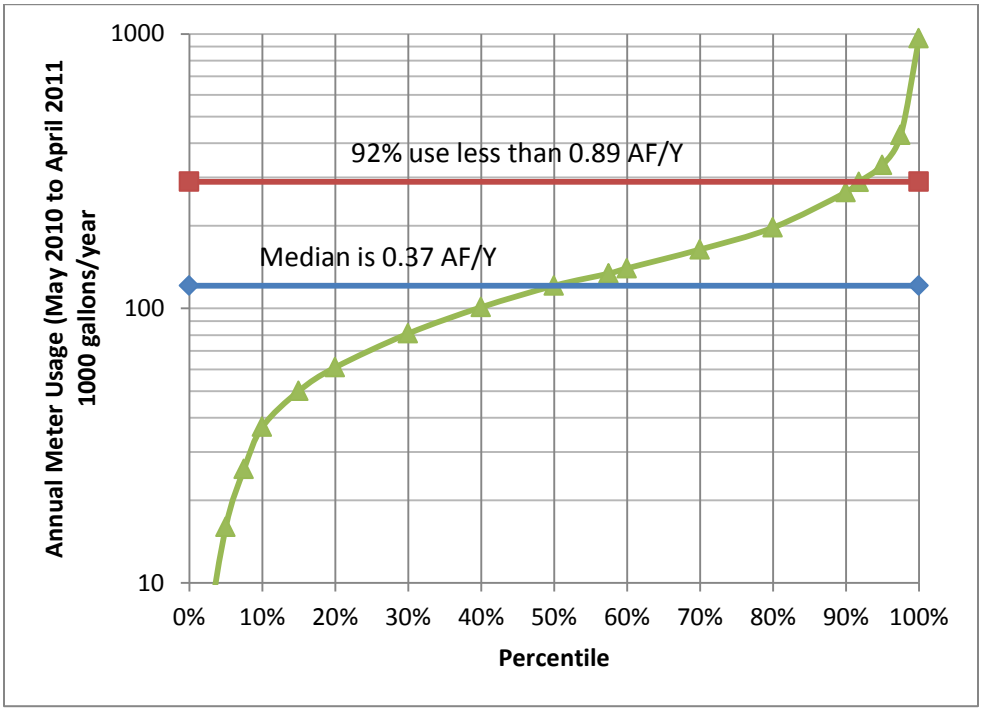
TABLE 9. WATER USE COMPARISON

Area	Water Use (gpcd)
WCWCD	294
Utah	321
Mountain States	245
U.S.	179

Source: Utah Division of Water Resources, Utah's M&I Water Conservation Plan (2003)

As part of this study the water meter data was analyzed in a detailed manner. The following Figure 8 shows the distribution of water usage from the approximately 2,400 residential meters over the period from May 2010 to April 2011.

FIGURE 8. RESIDENTIAL WATER METER USAGE DISTRIBUTION (MAY 2010 TO APRIL 2011)



The State requirements for estimating average annual water usage is 400 gallons per day for indoor usage and another 400 gallons per day for outdoor usage (this assumes 0.14 irrigated acreage per residential unit) for a total of 800 gallons per day (0.89 acre-feet per year). As shown in the figure above, 92 percent of all residential meters are using less than the 0.89 acre-feet per year level. The median usage was 0.37 acre-feet per year.

Table 10 as follows shows that when evaluating all residential usage including meters that are servicing irrigation common areas such as would be maintained by a home owners association, the average usage is 154,000 gallons per year (0.47 acre-feet per year). The use of water on efficient landscapes and the high number of second homes, unoccupied (bank owned), and partially occupied homes may be a large factor in the low water usage. However, this figure is not the full picture of Ivins water use as described below in further analysis.

When considering the tabulation of all water uses including the non-residential meters on a per ERU (Equivalent Residential Unit) basis, the average usage is as follows:

City Water System ERUs	Usage June 2010 to May 2011 (gallons)	Annual Usage per ERU (gallons/year/ERU)	Annual Usage per ERU (AF/year/ERU)
2731	472,175,000	173,000	0.53

TABLE 10. TABULAR ANALYSIS OF METER USAGE BASED ON METER TYPES (MAY 2010 TO APRIL 2011)

Type of Meter	Count	ERU	Sum of Annual Usage (1000 gallons)	Sum of Maximum Month (1000 gallons)	Average Annual Usage per meter (or unit) (1000 gallons)	% Share
Commercial, Industrial & Institutional	101	115	69123	14597	684	14.6%
Ag	14		5028	774	359	1.1%
Church	4		7608	1490	1902	1.6%
Commercial	22		29871	5124	1358	6.3%
Hydrant	12		2497	1091	208	0.5%
Landscape Buffer	25		1186	411	47	0.3%
Municipal	9		843	151	94	0.2%
Park	13		18870	5044	1452	4.0%
School	2		3220	512	1610	0.7%
Residential	2,453	2,616	403052	71496	154	85.4%
Single Family Residential	2,404	2,404	340196	60932	142	72.0%
Multi-unit Meters	13	208	35203	5486	169	7.5%
HOA (Common Space)	36	0	27653	5078	768	5.9%
Grand Total	2554	2731	472175	86093	184.9	

This data may yet still be skewed because many home owners have shares in the Ivins Irrigation Company. In review of the Irrigation Company records, there are 61 shares that are owned in quantities of less than 2. Another 41 shares are owned by Padre Lakes Home Owners Association which uses the water to irrigate all landscaping within the subdivision. Each share is generally worth one acre-foot of water but when supplies are available will represent 1.5 acre-feet. If you include this usage into the calculations, one would calculate an increase of 18,000 gallons per year per ERU which equates to 191,000 gallons per year per ERU or 0.59 acre-feet per year per ERU. If you consider that 10 percent water loss through system leakage is possible in our system, then usage in our system could be safely assumed to be **0.65 acre-feet per year per ERU**.

An analysis of KWU usage was also conducted for the period of June 2010 to May 2011. The usage was shown to be as follows:

KWU ERUs	Usage June 2010 to May 2011 (gallons)	Annual Usage per ERU (gallons/year/ERU)	Annual Usage per ERU (AF/year/ERU)
321	44,482,500	139,000	0.43

This number already includes any leakage rates since it is based on master metering by WCWCD. This analysis shows that the Kayenta average annual ERU usage is 66% of the Ivins City Municipal system (using the 0.65 acre-feet/year estimate). This is indicative of the high number of second homes and the style of development which limits landscaping areas.

As a summary of this analysis, Table 11 is provided as follows. The average annual demand and peak month demand is based on the actual data provided by metering. The peak day demand has been assumed to be 10 percent higher than the peak month demand.

TABLE 11. SUMMARY OF CURRENT DEMANDS IN IVINS CITY

	Average Annual Demand (acre-feet/year)	Peak Month Demand (gpm)	Peak Day Demand (gpm)
Total Ivins City (includes KWU)	1,700	2,070	2,275
KWU System	140	160	175
Ivins City Municipal Water System	1,560	1,910	2,100

FUTURE DEMANDS

State requirements indicate that indoor usage should be estimated at 146,000 gallons per year per ERU and outdoor usage should be based on irrigated acreage at 3.26 acre-feet per irrigated acre. For the purposes of determining this future demand, Ivins has determined to follow the state standards and assume that 0.14 acres of land is irrigated on average per lot. **This equates to 0.89 acre-feet per year per ERU.** This is considered to be a conservative estimate in consideration of the 0.65 acre-feet per year per ERU that is shown to be currently used. It is important for this analysis to use conservative figures to ensure that adequate capacity with redundancies are built into the system.

The future ERUs as calculated in Table 6 in the Land Use Analysis section of this report indicate that Ivins City will grow from the current 3,100 ERUs (includes KWU) to approximately 10,100 ERUs, or in other words, more than a tripling in size. Table 12 below shows the estimated future demands at buildout of the City. This provides the total capacities that are needed in the future to construct necessary capital facilities to accommodate the future growth and is the basis for the hydraulic calculations that were completed and described in the following sections of this report.

TABLE 12. ESTIMATED FUTURE DEMANDS AT BUILDOUT (YEAR 2046)

	Future Average Annual Demand (acre-feet/year)	Peak Day Demand (gpm)
Future Municipal Irrigation System	3,100	4,700
KWU	1,100	1,400
Ivins City Municipal Water System	3,900	4,900
Total:	**8,100**	**11,000**

The following charts show the projected demands from 2010 to 2046. As shown, the municipal irrigation system is planned to start reducing the load on the municipal culinary water system in 2014. By 2020 the irrigation system is projected to be fully built out.

FIGURE 9. PROJECTED ANNUAL DEMANDS 2010 TO 2046

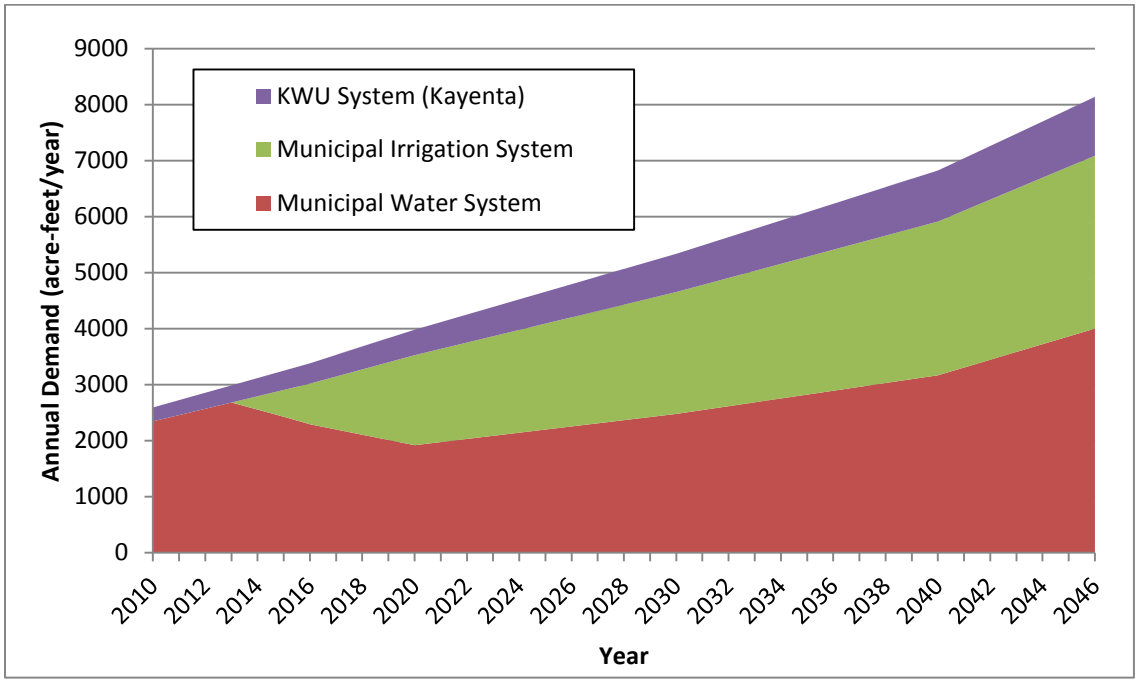
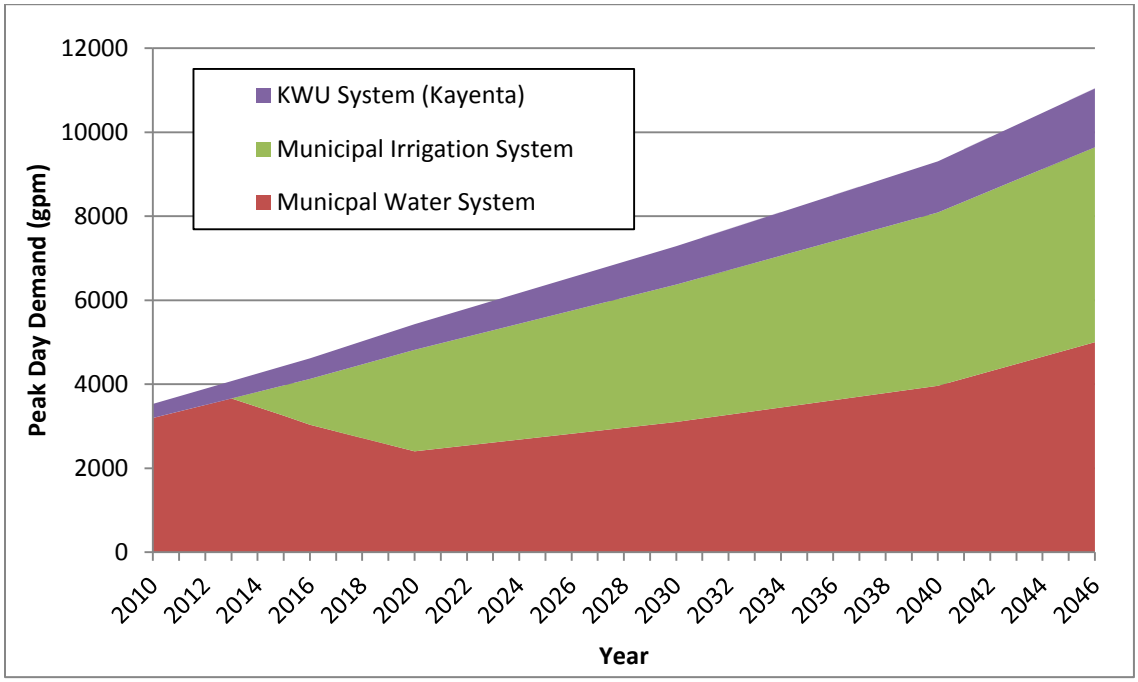


FIGURE 10. PROJECTED PEAK DAY DEMANDS 2010 TO 2046



CHAPTER 4: WATER SOURCE & TRANSMISSION ANALYSIS

This analysis reviews water rights, existing water sources, water quality considerations, and future considerations in terms of water sourcing to the water system.

WATER RIGHTS

Ivins water rights are based on shares in irrigation companies and actual appropriated water rights that have been transferred into the Snow Canyon Wells which are jointly owned by the City of St. George, City of Santa Clara, and Ivins City.

Table 13 as follows shows a summary of the water rights owned by Ivins City on the basis of shares and appropriated water rights. As shown, Ivins has 738 acre-feet of water rights. The 393 acre-feet of water in the Snow Canyon Wells is directly accessible to the City as well as the 103.7 ac-ft of water in the irrigation company which is used to irrigate the cemetery, Ivins City Park, UNITY Park and the Red Mountain Elementary Fields.

The water in St. George Clara Irrigation Company and Santa Clara Irrigation Company could be used with connections to the water reuse line in Highway 91.

TABLE 13. EXISTING IVINS CITY WATER RIGHTS

Source	Water Right No. Or number of shares	Water Right			Use
		Flow	Total	Depletion Limit	
		cfs	ac-ft	ac-ft	
St. George Clara Irrigation Company	47.5 shares x 4.08 ac-ft/share (81-203)	NR	193.8	96.9**	Irrigation
Ivins Irrigation Company	103.69 shares x 1 ac-ft/share	NR	103.69	51.8**	Irrigation
Santa Clara Irrigation Company	11 shares x 4.51 ac-ft/share	NR	49.6	24.8**	Irrigation
Snow Canyon Wells	• 81-1427(a35599) • 81-1322(a32324) • 81-86 (a32501) • 81-2207, 81-2328, 81-2411, 81-2457 (a35599) Total:	NR 0.42 0.10 NR	138.72 138 72.4* 43.45 392.57	82.84 82.4 72.4* 26.01 263.3	Municipal
		Totals:	740	435.9	

*Calculated from cubic-feet per second
** Calculated as 50% of total water right volume
NR: No Restriction

Ivins City has submitted applications for water rights which are yet to be approved by the State and are listed as follows in Table 14.

TABLE 14. IVINS CITY UNAPPROVED WATER RIGHT APPLICATIONS

Source	Water Right No.	Diversion cfs
West Ivins Wells	81-1786	2.0
West Ivins Wells	81-1702	2.0
Beaver Dam Wash	81-3656	9.0

WATER SUPPLY AGREEMENTS

Ivins City has secured the remainder of the necessary water rights through agreements. The **Gunlock well agreement** signed in 1969 with the City of St. George guarantees the delivery of water from the Gunlock wells which consist of eleven wells located near Gunlock Reservoir. These wells deliver water in a 20-inch pipeline to a 3 MG tank located on the Shivwits Paiute Indian Reservation and then another 18-inch and 20-inch pipeline delivers this water through Ivins City to the City of St. George. Ivins taps into this pipeline at 200 West and 400 West. The agreement with the City of St. George is the guarantee of the following deliveries.

2008	175,219,200 gallons/year	538 AF/Y
2013	188,000,000 gallons/year	577 AF/Y
2018	200,000,000 gallons/year	614 AF/Y

The City of St. George has allowed Ivins City to take more water than allowed by the agreement with as much as 809 AF/Y taken in a previous year.

The **Snow Canyon Compact,** originally signed in 1978, is a joint project with the City of St. George and the City of Santa Clara to construct five wells in the West Canyon of Snow Canyon connecting to two storage tanks, each 3 MG in size. The compact was reworked and resigned in 2006. By agreement, Ivins City owns 12 percent of the storage capacity and production capacity which is estimated at 324 gpm. As indicated in the previous section, Ivins City owns 393 acre-feet of the annual well production water rights. The agreement allows for Ivins City to withdraw additional water beyond its ownership and compensate the other members of the compact accordingly.

The **Ence Well Water Supply Agreement** signed in 2001 with the WCWCD enabled the delivery of water from the Ence Wells located in the Anazazi Valley at a flow capacity estimated at 600 gpm, provided that the District first meet its obligations to "Priority Users" which are defined as Terry Marten in connection with KWU, the Ence Properties (future development), and successors of the Shela Wilson property. This is estimated to provide approximately 900 acre-feet of water annually to the Ivins portfolio.

In 2000 the City agreed to purchase a 1000 acre-foot block of annual water supply from the **Quail Creek Project** from WCWCD with a right to purchase another 1000 acre-foot block of water. This water would be treated in the Quail Creek Water Treatment Plant (WTP) and then delivery of this water was enabled through the **Regional Pipeline Project**. Since the Snow Canyon wells exceed the arsenic standards which were lowered by the EPA in 2001, this water could be used to blend water and meet the standard. The 2002 Regional Pipeline Agreement with the WCWCD, City of St. George, and Santa Clara enabled the construction of a pipeline which has a capacity to supply 7,000 gpm to the Snow Canyon Area. Ivins City purchased 8 percent of the portion of the line that is 60-inch in diameter and 24.5 percent of the capacity of the 24-inch/30-inch pipeline for a flow capacity of approximately 1,700 gpm providing potentially the 2000 acre-feet of water annually.

As the region became more interconnected with the regional pipelines operated by the WCWCD, the need for the **Regional Water Supply Agreement** (RWSA) was determined the best way to handle everyone's growing water supply needs in the Dixie area region. The RWSA is signed by the majority of regional cities and towns which includes Ivins, St George, Santa Clara, Washington, Hurricane, La Verkin, Toquerville, Virgin, Leeds, and Apple Valley. The agreement puts the responsibility of all future sources of water to be supplied to each community on WCWCD including the "construction and acquisition of improvements, additions, and extensions to the System." **This agreement guarantees a full supply of water to Ivins City to build-out conditions.**

TABLE 15. SUMMARY OF IVINS CITY WATER RIGHTS/WATER SUPPLY AGREEMENTS

Description	Flow Capacity (gpm)	Annual Production (acre-feet/year)
Irrigation Water Shares	As needed	347
Snow Canyon Compact Water Rights	350	393
Gunlock Wells Agreement	As needed	614
Ence Wells Water Supply Agreement	600	900
Quail Creek Water Block Purchase	1,700	1,000 (with option to purchase additional 1,000)
	Total:	2,252
Regional Water Supply Agreement	As needed for all future needs	As needed for all future needs

EXISTING SOURCES & TRANSMISSION PIPING

The City has four main connections that provides water into the system plus one additional connection that is rarely used. Each of these connections have a master meter that is used to determine how much water has been delivered into the system. The following Figure 11 shows a schematic of the piping network that delivers water to Ivins City. The connections are shown on this map along with the transmission piping that is required to deliver this water to the Ivins City system. The piping shown as dark blue lines represents the transmission piping that is operated by City of St. George or WCWCD. The light blue lines represents the transmission piping that is operated by Ivins City.

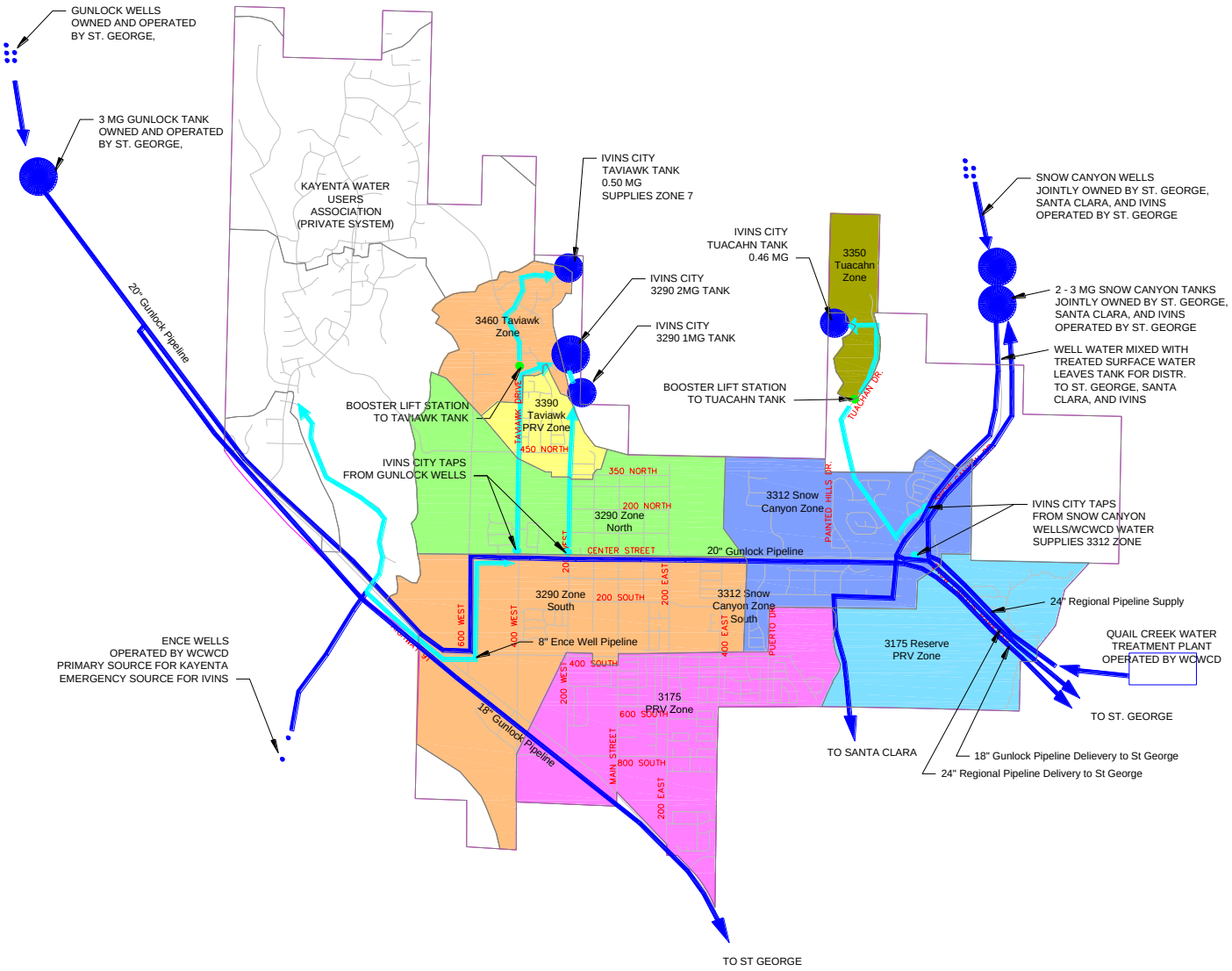


FIGURE 11. WATER SOURCING PIPELINE NETWORK SCHEMATIC

Snow Canyon Drive Tap – This is a 6-inch tap feeding into a 6-inch master meter tapped from the 24-inch outlet from the Snow Canyon Tanks providing blended water from the Snow Canyon Wells and the treated water from Quail Creek WTP. The tap feeds into a 10-inch waterline in the 3312 Snow Canyon Pressure Zone which then provides connectivity to the 3290 North Zone as the 10-inch waterline passes along 200 North to the west. The Tuacahn Pumping Station is connected to this 10-inch line and there is connectivity to the south part of the 3312 Zone via an 8-inch pipeline on Painted Hills Drive. This connection has historically provided 200 to 490 acre-feet per year with a peak day flow estimated to range from 308 to 500 gpm.

Snow Canyon Parkway Tap – This is a 10-inch tap feeding into an 8-inch master meter tapped from the 24-inch outlet from the Snow Canyon Tanks providing blended water from the Snow Canyon Wells and the treated water from Quail Creek WTP. The tap feeds into a 10-inch waterline that runs west on Center Street to provide connectivity to the 3290 North and South Zone. The 10-inch waterline also runs east and connects to the PRV that feeds into the 3175 Reserve PRV Zone. A

connection near the upstream side of the PRV provides water into the Red Mountain Spa looping back into pipelines that are connected to the Snow Canyon Drive Tap. This metering point was moved three to four years ago after it was discovered that the tap was connected to the pumping side of the regional pipeline rather than the tank outlet. The original location was closer to the Reserve PRV, but is now closed and locked. This connection was causing significant pressure spikes in the system. This connection has historically provided 560 to 910 acre-feet per year with a peak day flow estimated to range from 600 to 1250 gpm.

200 West Tap – This is a 10-inch tap feeding into an 8-inch master meter tapped from the 20-inch Gunlock pipeline owned and operated by the City of St. George providing water from five wells near Gunlock Reservoir. The tap feeds into a 10-inch dedicated transmission pipeline delivering water directly into the 2 MG tank located adjacent to the 1 MG tank at the Cliff Rose tank site in the Taviawk subdivision. St. George has had problems with the Gunlock Wells arsenic levels, with currently only Well 2 and Well 11 having low enough arsenic levels to meet EPA standards. This project has typically been capable of providing 4,000 gpm, but now only provides 1,450 gpm. As a result, the City of St. George has installed an isolation valve that has enabled this tap to be supplied with treated water from the Quail Creek WTP. This connection has historically provided 280 to 520 acre-feet per year with a peak day flow estimated to range from 400 to 930 gpm.

400 West Tap – This is a 10-inch tap feeding into a 6-inch master meter tapped from the 20-inch Gunlock pipeline owned and operated by the City of St. George providing water from five wells near Gunlock Reservoir. The tap feeds into a 10-inch dedicated transmission pipeline delivering water directly into the 1 MG tank located adjacent to the 2 MG tank at the Cliff Rose tank site in the Taviawk subdivision. A 1300 gpm pump is available to boost pressures and increase flow to the tank. This pump is typically used when there is a high demand on the Gunlock 20-inch pipeline from St. George. Since construction of the Regional Pipeline, the pump has not been necessary. The Taviawk Pumping Station connects to this 10-inch transmission line and boosts water to the higher Taviawk Tank. Near the tap there is a PRV station that would allow for water to bypass the tanks and pass directly into the distribution system. The PRV is set so that this would only occur during major peaking in the system. This tap continues to be serviced with the Gunlock wells despite the reduced production capacities as previously described. This connection has historically provided 150 to 290 acre-feet per year with a peak day flow estimated to range from 270 and 540 gpm.

At the 400 West Tap the 8-inch **Ence Well pipeline** connects into the same 10-inch pipeline that delivers water to the 1 MG tank. This connection is rarely used due to some taste and odor complaints that began occurring when the source was originally connected. The master meter for this pipeline is located at Highway 91 near the Anazazi Valley access road.

Table 16 and 17 show a summary of the Annual Use from each tap along with the estimated peak flows as follows. Figure 12 shows the charting of this annual use.

TABLE 16. ANNUAL DELIVERIES TO IVINS CITY CATEGORIZED BY LOCATION OF DELIVERY POINT 2005 – 2012

	Annual Use (Acre-feet/year)							
	2005	2006	2007	2008	2009	2010	2011	2012
Snow Canyon Drive Tap	281	292	410	197	489	424	267	99
Snow Canyon Parkway Tap	623	631	831	912	671	557	679	798
200 West Tap	282	519	417	405	308	355	417	421
400 West Tap	254	290	206	153	186	236	259	301
Ence Wells	0	0	0	0	0	0	0	0
Total	1,440	1,732	1,865	1,665	1,654	1,571	1,609	1,619

FIGURE 12. ANNUAL DELIVERIES TO IVINS CITY CATEGORIZED BY LOCATION OF DELIVER POINT 2005-2012

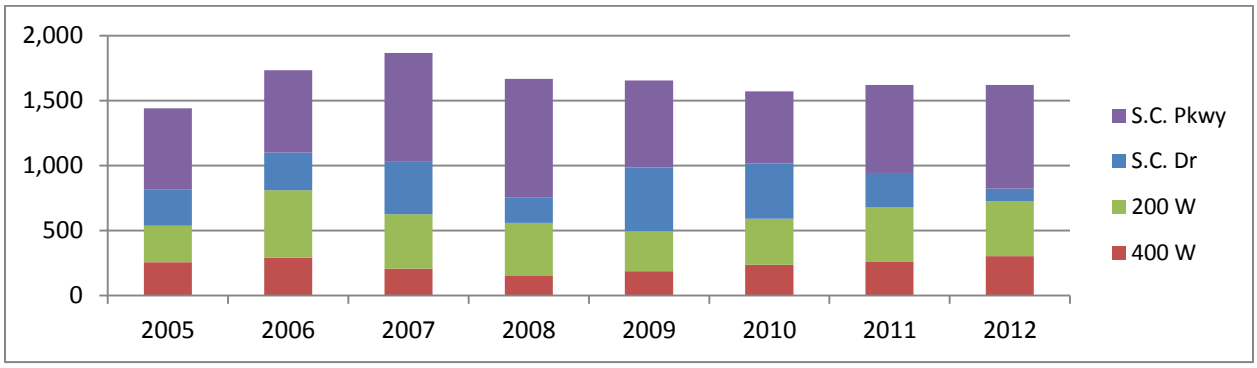


TABLE 17. PEAK DAY DELIVERIES TO IVINS CITY CATEGORIZED BY LOCATION OF DELIVERY POINT 2005 – 2012

	Peak Day Use (gpm)*							
	2005	2006	2007	2008	2009	2010	2011	2012
Snow Canyon Drive Tap	366	308	405	408	500	406	401	179
Snow Canyon Parkway Tap	793	708	800	1247	957	600	733	757
200 West Tap	472	933	561	767	404	676	687	688
400 West Tap	270	536	323	405	263	435	370	469
Ence Wells	0	0	0	0	0	0	0	0
Total	1,719	2,086	1,936	1,977	2,102	1,936	1,858	1,881

*Peak month demand x 1.1

As currently configured, it appears that it may be difficult for the Snow Canyon taps to produce much more than 1,750 gpm unless the City of St. George could reduce its usage in the system. The 200 West and 400 West taps are probably unable to supply much more than 2,400 gpm as currently configured.

Source requirements are as follows:

1. Supply capacity meets peak day demand with largest source out of service.
2. Supply capacity will refill fire storage portion of tank storage in 24 hours.
3. Supply capacity will completely refill storage tanks in three days with all sources in service.

The capacities for each tap, as considered for this analysis, if considered as its own source, are provided in the following table.

TABLE 18. LIST OF EXISTING SOURCE CONNECTION CAPACITIES

Snow Canyon Drive:	500 gpm
Snow Canyon Parkway:	1,250gpm
200 West Tap:	1,100 gpm
400 West Tap:	1,300 gpm
Ence Well:	600 gpm
Total Source:	4,750 gpm
Minus Largest Source:	-1,300 gpm
Total Reliable Source:	**3,450 gpm**

The existing total reliable source of water to Ivins has a capacity of 3,450 gpm. The future buildout source supply requirement (with a secondary irrigation system as planned) is 4,900 gpm peak day demand plus 400 gpm for fire storage replacement flow and 1100 gpm for total storage replacement flow.

This capacity should be adequate until year 2017 without any conversion to a secondary irrigation system. If all irrigation demands could be converted to a secondary system, this connection configuration would be adequate until year 2030, assuming that the current water sources are unchanged.

WATER CONSERVATION

Ivins City prepares a Water Conservation plan every five years as required by Utah Law. The last plan was prepared and adopted in September 2013. The plan is provided in Appendix C. The City has already implemented several water conservation measures and has plans to implement more.

The Washington County Water Conservancy District also has a water conservation plan which was dated May 21, 1996 and recently revised on December 31, 2010. The plan is available at the district's website: http://wcwcd.state.ut.us. The District has set the goal to reduce water demands by 25 percent by the year 2050. This would mean a reduction in the water use from 0.89 AF/Y per ERU to 0.67 AF/Y per ERU.

WATER QUALITY CONSIDERATIONS

The following Table 19 shows some of the significant water quality parameters of each of the water sources. Total dissolved solids (TDS) is typically a good measure of overall water quality for aesthetic effects such as taste, odor or color. The EPA requires that TDS be less than 1,000 ppm as a primary maximum contaminant level (MCL) standard and recommends that the levels be kept below 500 ppm as a secondary non-enforceable standard. The Gunlock Wells are shown to have the lowest TDS concentrations, however, based on actual sampling, the Snow Canyon Wells tend to be the best for good taste.

TABLE 19. SIGNIFICANT WATER QUALITY PARAMETERS FOR EACH IVINS CITY WATER SOURCE

	TDS (ppm)	Arsenic (ppb)	Hardness (ppm as CaCO3)	Nitrates (ppm as N)	Sulfates (ppm)
Regional Water (Quail Creek WTP)[a,b]	585	1.0	350	0.1	250
Snow Canyon Wells[a]	480	11.0	85 to 300	0.3	200
Gunlock Wells[a]	299	9.0	280	0.3	23
Ence Wells[b]	600 to 900	6.8 to 9.0	*	0.2	170

[a]Source: St. George City 2007 Water Quality Report
[b]Source: 2010 WCWCD Consumer Confidence Reports
*No data

The water from the Quail Creek WTP meets EPA primary standards but has fairly high TDS and sulfate concentrations. There have been some taste and odor problems from the WTP in the

summer months when algae production in Quail Creek Reservoir can be difficult to control. The water district has, for the past two years, aggressively controlled the algae problem with copper sulfide lake treatments as well as changing the powdered activated carbon brand to a higher quality brand which seems to have corrected the problems. The District does indicate that eventually ozone treatment of the water may be necessary in the future to best remove the taste and odors. If this treatment process is added, the cost of water could increase by $0.10 to $0.15 per 1000 gallons.

The MCL for arsenic are 10 ppb. As shown above, the Snow Canyon Wells exceed this standard, but after blending with treated water from the WTP, the levels are within EPA minimum requirements. Some Gunlock Wells have been pulled from production by the City of St. George due to arsenic levels that exceed the MCL. Until arsenic treatment can be utilized or a feasible option of blending water can be provided, these wells will remain out of production for culinary purposes.

The Ence Wells have been discontinued for water deliveries into the Ivins City Municipal system for now due to taste and odor complaints. However, the wells are the sole source of the KWU private water system that serves Kayenta. It may be necessary in the future to use this water in the municipal system, although the WCWCD has discussed replacing this water with a different higher quality source and using this water instead for irrigation uses.

FUTURE SOURCES

As indicated in the demand analysis section in Table 12, the future peak day demand for the Ivins City Municipal Water system is 4,900 gpm. The sourcing standards are as follows:

With the WCWCD Regional Water Supply Agreement, the District will be responsible to provide a water source supply for all future demands of Ivins City. Table 20 provides a list of all of the current sources of water currently available and could potentially be expanded to its full capacity to help Ivins City satisfy its future needs. As indicated in the evaluation of existing sources, the Ivins City system needs to consider the expansion of the culinary system to be able to supply an additional 1,500 gpm.

TABLE 20. CURRENT SOURCES OF WATER WITH EXISTING CAPACITY

	Annual Delivery Capacity (acre-feet/year)	Peak Delivery Capacity (gpm)	Currently Delivers to:
Quail Lake WTP – 24" Regional Pipeline	5,600	7,000	Ivins, St. George, Santa Clara
Snow Canyon Wells	2,400	3,000	Ivins, St. George, Santa Clara
Gunlock Wells	3,200	4,000	Ivins, Shivwitz and St. George
Ence Wells	1,000	800	KWU and Ivins
Gunlock Reservoir 30" Pipeline (non-potable)	8,000	11,500	Ivins Irrigation Co., Ivins Reservoir, and Other Irrigation Companies
Reuse 24" Pipeline (non-potable)	5,600	7,000	Shivwitz, Ivins Reservoir, Other Irrigation Companies in other cities

As shown in the above list, a significant amount of water flows near or through Ivins City as water is delivered east and west through the region. It is outside of the scope of this analysis to determine if the existing water source facilities could possibly meet Ivins City's future needs along with the other communities in the local region. This makes it a challenge for Ivins to plan for future capital facilities to accommodate the future source which are uncertain.

The following list is provided as an indication of what future sources may be developed whether it be completely new development or improvement of an existing water source:

- **Wastewater Scalping Plant for Reuse Water** (irrigation) – Ivins City's current indoor use is estimated at 740 acre-feet per year (not including KWU). Indoor water use is typically 5% depletion (per Utah Division of Water Resources) indicating that 700 acre-feet of sewer water could be scalped for a production of an estimated 350 acre-feet. At future build-out, this production could be 3 to 4 times as high for a production of 1,000 to 1,400 acre-feet. This would require a 0.8 to 1.2 MGD plant.
- **Beaver Dam Wash Water Development** – The WCWCD 2006 Capital Facilities Plan has indicated that a reservoir in the Beaver Dam Wash and a pipeline into the Santa Clara River system could supply up to an additional 4,000 gpm or 6,500 acre-feet annually.
- **Gunlock Reservoir Surface Water Treatment Plant** – The WCWCD could consider converting the non-potable water system into a potable system with a surface water treatment plant. Such a project would not increase the water supply to the region but it may be necessary to improve potable water supply systems, however, it is currently not in the WCWCD capital facilities plan but may be considered in the future.
- **Gunlock Wells Improvements** – The arsenic levels in the Gunlock wells has provided the City of St. George with a dilemma. The City could consider a blending project, an arsenic treatment plant, or a conversion into irrigation water. For this reason it would be useful for Ivins City to fully develop its secondary water system plans so that the irrigation option could be more feasible.
- **Upsizing Pipeline Capacity from Quail Lake WTP** – With the Lake Powell Pipeline on the horizon, there may be more water becoming available from the east and it may make sense for additional regional water to be piped into Ivins City. This may be from an upsizing of the existing 24-inch pipeline or from a new pipeline.
- **New Well Development** – Ivins City has some applications for water rights that are unapproved, yet since water rights in the Virgin River drainage is considered to be fully appropriated by the State, it is unlikely that these applications will be approved.
- **New Reservoir Development** – The City of St. George has considered development of dams in both the Graveyard Wash and the Kayenta Wash within Ivins City. Either project could provide additional water sources to Ivins City. However, these projects seem to be less likely with the plans for development of the Lake Powell pipeline and Warner Valley Reservoir.

In discussions with the City of St. George and WCWCD, it seems that future sources are most likely to come through either the existing regional pipeline or through some treatment plant with a water supply from the Gunlock Reservoir or the Gunlock wells.

If a treatment plant were to be implemented, it is likely to deliver water to a point near the Ivins Reservoir. This capital facilities plan should include a new pumping station and pipeline from this area feeding into the 3290 Zone tanks. Ivins City should also plan to enhance its ability to obtain

water from the regional pipeline with a pumping station system. Table 21 provides a summary of these recommendations.

TABLE 21. LIST OF FUTURE SOURCE CAPACITIES

Source Name	Existing Capacity (gpm)	Future Buildout Capacity (gpm)	Notes
Snow Canyon Drive Tap	500	500	No Change
Snow Canyon Parkway Tap	1,250	1,250	No Change
200 West Tap	1,100	**1,350**	**Add Pumping Station on 200 West to ensure reliability and increase delivery**
400 West Tap	1,300	1,300	No Change except **add back up pump** to existing pumping station
Ence Wells	600	0	Due to taste and odor issues these wells are planned to become irrigation sources.
Ivins Reservoir Pumping Station		**1,600**	**Pumping station near Ivins Reservoir pumping to the Cliff Rose 1MG/ 2MG tank site.**
Total Source	4,750	6,000	
Demands	2,100	4,900	
Tank Storage Replacement Flow	900	1,100	
Total Requirement	3,000	6,000	

PUMPING STATION & TRANSMISSION ANALYSIS

In reviewing the pumping stations and transmission, this analysis reviews capacities of the existing system in comparison with existing and future requirements in accordance with the service standards provided in the beginning of this plan (Table 1, Page 8).

The following table provides an analysis of the existing pumping stations and transmission pipelines:

TABLE 22. EXISTING PUMPING STATION/TRANSMISSION PIPELINES

Pumping Station/ Tans-mission Pipe Name	# Pu-mps	Flow Capa-city	Total Head	Capa-city with one pump out of service	Exist-ing PDD (calcu-lated)	Exist-ing PDD (meas-ured)	Fill Fire Storage in 24 hours	Fill Tank from empty in 72 hours	Exist-ing Req-uired Capa-city	Trans-mis-sion Pipe Dia-meter	Velo-city
		gpm	ft	gpm	gpm	gpm	gpm	gpm	gpm	in	fps
Taviawk	2	240	175	125	208	116	146	113	262	8	1.5
Tuacahn	1	270	60	0	69	21	167	96	188	10	1.1
400 W	1	1300	20	1100	3260	1740	406	694	2696*	10	5.3
200 W	0	1100	0	1100						10	4.5
Snow Canyon Dr	0	500	0	500						10	2.0
Snow Canyon Pkwy	0	1250	0	1250						10	5.1

*Includes required flow to Taviawk pumping station

In review of the piping, the two 10-inch lines that provide water to the 3290 tanks appear to be sufficient for the existing capacities. The piping from the Taviawk and Tuacahn tanks are more than sufficient for pumping purposes; however, the existing sizing is necessary for distribution since these transmission lines serve a dual purpose.

The current system meets the standard of providing peak day demand plus the flow required to fill fire storage in 24 hours or fill an empty tank in 72 hours with the exception of the Taviawk Pumping Station that appears to be substandard and needs to be upsized. **The pumping station needs to be upsized immediately as City operators have already started to experience problems in maintaining Taviawk tank levels.** Upsizing the pumping station will require three-phase power which will add significant cost. The next table provides the analysis of the future transmission system.

TABLE 23. FUTURE PUMPING STATION/TRANSMISSION PIPELINES

Pumping Station/ Tans-mission Pipe Name	# Pu-mps	Flow Capa-city	Total Head	Capa-city with one pump out of service	Future PDD (calcu-lated)	Fill Fire Storage in 24 hours	Fill Tank from empty in 72 hours	Future Req-uired Capa-city	Trans-mis-sion Pipe Dia-meter	Velo-city
		gpm	ft	gpm	gpm	gpm	gpm	gpm	in	fps
Taviawk	2	**850**	**185**	**480**	**328**	146	113	**474**	8	**3.1**
Tuacahn	**2**	**600**	**70**	**315**	**155**	167	96	**312**	10	**1.3**
400 W	**2**	1300	20	**1300**					10	5.3
200 W	**2**	**1350**	**20**	**1350**					10	**5.5**
Snow Canyon Dr	0	500	0	500	**4323**	406	**926**	**5723***	10	2.0
Snow Canyon Pkwy	0	1250	0	1250					10	5.1
Ivins Reser-voir	**3**	**2300**	**175**	**1600**					**12**	**4.5**

*Includes required flow to Taviawk pumping station
Changes from existing system shown in **bold**.

In addition to the Ivins Reservoir Pumping Station with the 12-inch pipeline, there are additional recommendations to bolster the transmission system, mostly bolstering existing pumping stations and adding another pumping station to the 200 W transmission line.

The recommended improvements can be summarized as follows:

- Increase capacity for Taviawk Pumping Station to 480 gpm.
- Upgrade Tuacahn Pumping Station with a double pump system with alternating lead pumping.
- Upgrade pumping station to 400 West transmission line to ensure 1,300 gpm capacity.
- Upgrade 200 West tap by adding a pumping station to include a double pump system with alternating lead.
- Install pumping station at Ivins Reservoir to provide 1,600 gpm from area to the Cliff Rose 1MG and 2MG tanks. (In the future there will be a single 4MG tank per tank analysis in following section.)

CHAPTER 5: WATER STORAGE ANALYSIS

Water storage is essential to a municipal water system. The storage allows for equalization of flow as the demand varies throughout the day. Also the storage provides water for emergencies such as fires and power outages. The introduction section of this master plan provides the service standards for the water storage which is given as follows:

- Equalization Storage:
  - Indoor: Minimum 400 gallons per ERU
  - Outdoor: 4,964 gallons per irrigated acre
- Fire Suppression Storage: Meet need of individual buildings per International Fire Code (IFC) Appendix B.
- Emergency Storage: None unless source supplies are unable to meet supply source standards as provided above.

The following table provides the geometric data for each storage tank:

TABLE 24. STORAGE TANK GEOMETRIC DATA

Tank Name	Capacity (gallons)	Elevation (ft)		Height (ft)	Inside Diameter (ft)	Zone Supply via Gravity	Zone Supply via PRV	Type
		Base	Overflow					
Snow Canyon 1*	237,500	3292.0	3312.0	20.0	160.0	3312 Snow Canyon	3275 Reserve	Concrete Buried Cylinder
Snow Canyon 2*	237,500	3292.0	3312.0	20.0	160.0	3312 Snow Canyon	3275 Reserve	Concrete Buried Cylinder
Tuacahn	407,000	3315.0	3352.5	37.5	43.0	3350 Tuacahn	None	Painted Steel Cylinder
Cliff Rose 1MG	1,034,000	3270.0	3290.8	20.8	92.0	3290 Zones	3275 South PRV	Painted Steel Cylinder
Cliff Rose 2MG	1,946,000	3269.5	3292.5	23.0	120.0	3290 Zones	3275 South PRV	Painted Steel Cylinder
Taviawk	486,000	3440.0	3460.0	23.0	60.0	3460 Taviawk	3390 Taviawk PRV	Painted Steel Cylinder

*Snow Canyon Tanks are owned by the Snow Canyon Compact which is shared by Ivins, St. George and Santa Clara. Ivins is entitled to 7.9% of the 3MG of storage in each tank.

The age of each tank operated by Ivins City is given as follows:

- Cliff Rose 1 MG – Constructed 1994 – Age 19 years
- Tuacahn 0.4MG – Constructed 1995 – Age 18 years
- Taviawk 0.5 MG – Constructed 1999 – Age 14 years
- Cliff Rose 2 MG – Constructed 2002 – Age 11 years

All of these tanks are refurbished and repurposed tanks from the oil and gas industry. We are unaware of the true age of these facilities.

FIRE STORAGE

Fire storage requirements are governed by the City adopted IFC 2012. In Appendix B, Section B105, fire flow requirements for residential one- and two- family dwellings no larger than 3,600 sq. ft. (all floors including basements and garage) is 1,000 gpm. For residential buildings larger than 3,600 sq. ft. fire flows must be in accordance with Table B105.1 which lists fire flows based on building size and construction type. For the typical non-fire resistant residential construction, homes larger than 3,600 sq.ft. must have the following fire flows shown in Table 25 (excerpted from the full Table B105.1).

TABLE 25. EXCERPT FROM IFC TABLE B105.1 MINIMUM REQUIRED FIRE FLOW FOR BUILDINGS

Fire Flow Calculation Area for Type V-B Construction (sq. ft.)	Required Fire-Flow (gpm)	Fire Flow Duration (hrs)	Fire Storage Required (gallons)
3,601 – 4,800	1,750	2	210,000
4,800 – 6,200	2,000	2	240,000
6,201- 7,700	2,250	2	270,000
7,701 – 9,400	2,500	2	300,000
9,401 – 11,300	2,750	2	330,000

Most of the older medium and high density single family units are small enough for the 1,000 gpm requirement; however, all of the tank service areas encompass areas with structures that would require more than the minimum. The following table provides a summary of the analysis that was conducted across the service areas.

TABLE 26. SUMMARY OF EXISTING BUILDINGS FIRE FLOW REQUIREMENTS

Area/Building	Maximum Fire Area (Sq. Ft.)	Building Type	Required Fire Flow (gpm)	Duration (hours)	Required Fire Storage (gallons)	Tank
Taviawk Subdivision	6,000	V-B	2,000	2	240,000	Taviawk
Tuacahn Center for the Arts	39,163 (sprinkled)	II-A or III-A	2000	2	240,000	Tuacahn
Citadel Subdivision	8,500	V-B	2500	2	300,000	Snow Canyon
The Reserve Subdivision	11,000	V-B	2750	2	330,000	Snow Canyon
Snow Canyon Medical Clinic	22,600 (sprinkled)	V-A	2000	2	240,000	Snow Canyon
Church at Center Street/600 East	19,150 (sprinkled)	V-A	2000	2	240,000	Snow Canyon
Church at Center/Main	23,000	V-A	2750	2	330,000	Cliff Rose 1 & 2 MG
200 East Commercial Area	7,950	V-B	2500	2	330,000	Cliff Rose 1 & 2 MG
Stake Center at 250 E 1060 S	28,000 (sprinkled)	V-A	2250	2	270,000	Cliff Rose 1 & 2 MG
Heritage Church at 200 E 1060 S	17,500	V-A	2250	2	270,000	Cliff Rose 1 & 2 MG
Red Mountain Spa	50,000	V-A	2500	2	300,000	Snow Canyon
Red Mountain Elementary	50,000	V-A	3000	3	540,000	Cliff Rose 1 & 2 MG
Vista School	57,000 (sprinkled)	V-B	3250	3	585,000	Snow Canyon
Fitness Ridge Spa	31,000 (sprinkled)	V-A	2500	2	300,000	Cliff Rose 1 & 2 MG
Posovi Subdivision	6,800	V-B	2250	2	270,000	KWU Upper

The building with the highest fire storage requirement is Vista School with a fire storage requirement of 585,000 gallons. This impacts the storage in the 3290/3312 Pressure Zones which are served by the 1 & 2 MG tanks. The Taviawk and Tuacahn fire storage requirement is 240,000 gallons.

EXISTING STORAGE ANALYSIS

The following tables show the existing storage for the Ivins City municipal system and the KWU system.

TABLE 27. IVINS CITY EXISTING WATER STORAGE ANALYSIS

Tank Service Area	Tanks	Available Storage (gallons)	Fire Storage (gallons)	Equalization		**Excess Storage (gallons)**
				Indoor (gallons)	Outdoor (gallons)	
3290/3312 Zones 3175 PRV Zones	Cliff Rose 1MG Cliff Rose 2MG Snow Canyon	1,034,000 1,946,000 475,000 3,455,000	585,000	1,020,000	1,846,000	**-25,000**
3460 Taviawk	Taviawk	486,000	240,000	64,000	113,000	**69,000**
3350 Tuacahn	Tuacahn	413,000	240,000	13,000	52,000	**108,000**

TABLE 28. IVINS CITY ANALYSIS OF EXISTING EXCESS ERUS

Tank Service Area	Tanks	ERUs Serviced	**Excess ERUs**	Vacant Lots	**Remaining ERUs**
3290/3312 Zones 3175 PRV Zones	Cliff Rose 1MG Cliff Rose 2MG SnowCanyon	2,550	**-23**	599	**-622**
3460 Taviawk	Taviawk	159.5	**89**	110	**-47**
3350 Tuacahn	Tuacahn	32	**120**	0	**120**

TABLE 29. KWU EXISTING WATER STORAGE ANALYSIS

Tank Service Area	Tanks	Available Storage (gallons)	Fire Storage (gallons)	Equalization		**Excess Storage (gallons)**
Kayenta Upper	Indian Hills Posovi	250,000 500,000 750,000	270,000	57,000	71,000	**352,000**
Kayenta Mid/Lower	Poson	1,200,000	240,000	71,000	90,000	**799,000**

TABLE 30. KWU ANALYSIS OF EXISTING EXCESS ERUS

Tank Service Area	Tanks	ERUs Serviced	**Excess ERUs**	Vacant Lots	**Remaining ERUs**
Kayenta Upper	North Posovi	143	**426**	71	**355**
Kayenta Mid/Lower	Poson	178	**668**	77	**591**

The KWU system has ample storage capacity to meet current demands including the buildout of existing vacant lots. The municipal system storage, however, is deficient in the 3290/3312 Zones, especially with a buildout of existing vacant lots. **It is recommended that additional storage be constructed immediately with a recommendation to add another 1 million gallons of storage to the system.**

FUTURE STORAGE

TABLE 31. FUTURE TANK STORAGE EVALUATION

Tank Service Area	Tanks	Available Storage (gallons)	Fire Storage (gallons)	Equalization		**Excess Storage (gallons)**	**Excess Storage with Irr. System (gallons)**
				Indoor (gallons)	Outdoor (gallons)		
3290/3312 Zones 3165 PRV Zones	**Cliff Rose 4MG** Snow Canyon	4,000,000 475,000 4,475,000	585,000	2,770,000	4,530,000*	**-2,294,000**	**1,100,000**
3460 Taviawk 3390 Taviawk PRV	Taviawk	486,000	240,000	163,000	102,000 158,000*	**-113,000**	**-16,000**
3350 Tuacahn	Tuacahn	413,000	240,000	39,000	102,000	**32,000**	**32,000**
3310 Comanche Cliffs		0	240,000	18,000	31,000	**-289,000**	**-289,000**
Kayenta Upper	Indian Hills Posovi	250,000 500,000 750,000	240,000	192,000	239,000	**79,000**	**79,000**
Kayenta Mid/Lower	Poson	1,200,000	240,000	409,000	334,000	**17,000**	**17,000**

* Outdoor Storage to be not required with full implementation of a future separated irrigation system.

Conversion of the system separating out the irrigation would theoretically eliminate need for more storage in the 3312/3290/3165(PRV) pressure zones. However, since the system is currently deficient on storage and since complete conversion of the entire city may require 10 to 20 years of transition, **it is recommended that an additional 1 MG of storage be provided to this service area to address immediate needs for additional storage.** The additional storage will improve the reliability of the system in time of shortage or power outage and help stretch water supplies over a longer period of time.

Taviawk Tank shows a 113,000 gallon deficiency in storage for future buildout. However, 56 percent of the outdoor demand is in the 3390 Taviawk PRV pressure zone which would be theoretically eliminated with full implementation of the separate irrigation system. Until the irrigation system is in place, each subdivision or other site developments must be carefully considered. As per the section on pumping station analysis, the future Taviawk pumping station will have an additional 146 gpm capacity for the refilling of the storage in a 72 hour period. This may also be considered as emergency fire flow for the deficient amount of fire flow of 16,000 gallons, as the extra 146 gpm over a two hour period would provide 17,500 gallons into the Taviawk system.

The Comanche Cliffs zone may possibly be included in the 3290 Zone depending on options taken by the developer as described in one of the following sections of this report for Distribution Pipe Sizing. If included with the 3290 Zone, the storage would be satisfactory to meet the need. If the developer decides to utilize a tap from the St. George pipeline in Highway 91, storage would be provided by the City of St. George at the 3 MG Shivwits Tank.

CONCRETE STORAGE TANKS VERSUS STEEL TANKS

Any municipality, when considering new water storage, must consider the advantages of concrete versus steel. Currently all of Ivins City tanks are steel tanks that have been refurbished from the oil and gas industry and repurposed for culinary water use. This type of product has enabled Ivins to provide a large amount of water storage at low initial cost. According to the steel tank manufacturers, this should not be a cause for concern, because steel tanks that are regularly inspected and the protective coatings are repaired or replaced as needed possibly could last indefinitely. On the other hand, steel tanks are expensive to maintain requiring scuba divers and/or robotic equipment for the periodic inspections and recoatings can be a major expense. It may also be necessary to install and operate a cathodic protection system to ensure that the tank does not corrode and deteriorate.

Concrete tanks, in contrast, are more expensive to construct than steel tanks but are generally maintenance free for many decades. Lately, water agencies in this area have been building more concrete tanks than steel. The largest disadvantage with concrete tanks is controlling cracking and the resulting leakage. Steel tanks can also be problematic with leakage on the floor since the bottom of the floor is not accessible for recoatings when there are problems. There are several technologies that reduce this risk and increase service life in concrete tanks. These technologies include additives to the concrete mix to reduce permeability and encourage self healing of cracks as well as pre- or post-tensioning of the reinforcement. A significant advantage of concrete tanks over steel tanks is the better control of water temperature. The thick concrete walls and the ability to bury concrete tanks provide the ability to insulate the system water from temperature rise. Higher temperature water is usually less appreciated by customers. Another advantage of concrete tanks over steel is the flexibility in design to engineer the structure to withstand a rock fall, which is a significant concern for all of our current tank sites.

TABLE 32. CONCRETE TANK VS STEEL TANK SUMMARY OF ADVANTAGES

Concrete Tank Advantages	Steel Tank Advantages
• Low maintenance cost and less accompanying disruption to water system. • Water temperature rise control during summer months • Ability to engineer structure to better withstand rockfall • Less chance of leakage problems in floor	• Low construction cost • Less chance of leakage problem in walls

If life cycle cost is the most important factor in the decision between the two styles of tanks, then the crux of the matter is the life of the structure. According to an IRS bulletin[1] published in 1942 (although reiterated in several publications since), the useful life of a concrete tank is 50 years and a steel tank is 40 years. These estimates are based on averages and may not be applicable to specific projects. Also, it is not clear whether these figures account for structure maintenance practices. As

[1] Income Tax Depreciation and Obsolescence, Estimated Useful Lives and Depreciation Rates, *U.S. Bur. Internal Revenue Bull*. F, 1942. See also "Depreciation Guidelines and Rules," Pub. 456, rev. ed., Internal Revenue Service, August 1964. See also *Water Resources Engineering*, Linsey et. al, 1992, p.445

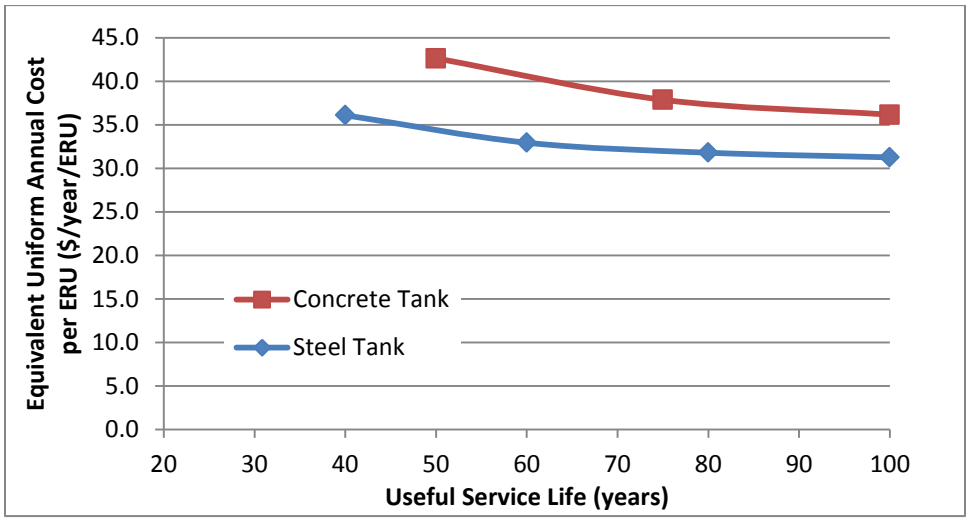
stated above, the steel tank industry specialists promote an indefinite life. Concrete industry specialists indicate that the life of concrete structures will range between 50 to 100 years and recommends using an average of 75 years for life estimates, however, with proper specifications and careful construction the life could arguably be ensured to 100 years.

A simple analysis of life cycle costs for steel and concrete tanks was performed to aid in this discussion. The following assumptions were made for each structure.

TABLE 33. SUMMARY OF ASSUMPTIONS FOR CONCRETE VERSUS STEEL LIFE CYCLE ANALYSIS

Concrete 1 MG tank	Steel 1 MG tank
$750,000 design and construction cost (tank only) Maintenance: Periodic Inspections and Cleanings (not considered since expense common to both types of construction) Life Cycle Senstivity Analysis: 50 years 75 years 100 years	$500,000 Design and Construction Cost (tank only) Maintenance: $120,000 full interior recoating every 20 years $20,000 exterior recoating every 30 years $10,000 misc. corrosion repairs every 5 years starting in year 25 Life Cycle Senstivity Analysis: 40 years 60 years 80 years 100 years
3.5% Interest Rate (Current Market Borrowing Rate) 750 ERU (equivalent residential units) served by a 1 MG Tank	

FIGURE 13. LIFE CYCLE COST ANALYSIS OF STEEL VERSUS CONCRETE (1 MG TANK)



As shown above, the steel tank appears to have a lower life cycle cost in comparison to the concrete tank, especially if steel tanks have a useful service life of 100 years or more. If steel tanks have a useful service life of 40 years as compared to an average service life of concrete of 75 years, then steel is still more cost effective although the margin if very slim $36.10/yr/ERU versus

$37.90/yr/ERU which is a 5% increase. This analysis does not take into account the improved service qualities of the concrete, such as lower water temperatures and less disruption of system due to maintenance. Even if both structures are considered to have the same useful service life of 100 years, the cost difference is small, $4.90 per year per ERU or 16%. Despite the increased cost of concrete, due to consideration of the additional benefits of buried concrete storage, we are recommending that steel tanks be converted to concrete over time.

It seems imprudent to assume that Ivins' refurbished steel water tanks will last indefinitely. It is recommended that an effort should be made to make the tanks last as long as possible if not indefinitely, but as these tanks become more expensive to maintain, to look seriously at converting the tanks to concrete structures. For planning purposes we recommend expecting a 40 year useful service life from the date construction.

ALTERNATIVES FOR ADDITIONAL STORAGE RECOMMENDATION

The next question that is of issue in this plan is the recommendation for 1 million gallons of additional storage should be constructed in the 3290 Zone. There are three alternatives to achieve this storage in reference to the concrete versus steel tank dilemma. These are given as follows:

1. Demolish the existing 3290 Zone Cliff Rose 1 and 2 million gallon steel tanks and replace with a single buried concrete 4 million gallon tank.
2. Demolish the existing 3290 Zone Cliff Rose 1 million gallon tank (18 years old) and replace with a buried concrete 2 million gallon tank.
3. Keep both existing structures and install a new 1 million gallon tank.

The estimated costs and advantages of the three alternatives are given as follows:

Alternative 1 Demolish 1 and 2 MG and install 4 MG concrete tank	Alternative 2 Demolish 1 MG and replace with buried 2 MG tank	Alternative 3 Keep both existing structures and install a new 1 MG gallon tank
Cost Estimate: $3,960,000	Cost Estimate: $2,290,000	Cost Estimate: $2,040,000
• Improvement in water temperatures during summer months. • Low maintenance concrete. • Buried tanks more aesthetic to environment • Can be engineered for rock fall	• Partial improvement in water temperatures during summer months. • Partial low maintenance concrete. • With one tank concrete, better rock fall protection.	• Lowest construction cost alternative. • Higher maintenance costs. • Need to purchase more land. • More complicated operation of system.

Based on this analysis, alternative 3 appears the least appealing. Even though it is the lowest cost alternative, the solution would impact private property, increase maintenance costs and unnecessarily increase complexity of the system, yet is not excessively less expensive than alternative 2. Alternative 1 is not necessarily eliminated, however, as there is a benefit to accelerating the conversion of the water storage to concrete tanks. It is recommended that the user rate and impact fee analysis consider both alternatives.

CHAPTER 6: DISTRIBUTION PIPING SYSTEM ANALYSIS

This section discusses the existing facilities and analyzes the ability of the existing piping system to handle the current demands and identifies the required facilities to handle future demands. From this analysis deficiencies will be identified for which capital improvements will be recommended.

INTRODUCTION

The Ivins City existing distribution piping system is extensive comprising of 61.5 miles as shown in the table summarizing the pipe lengths by size as follows:

TABLE 34. SUMMARY OF PIPING SYSTEM LENGTHS

Pipe Diameter (inches)	Distribution Pipe Length (miles)	Transmission Pipe Length (miles)	Total Pipe Length (miles)
2	0.8	0.0	0.8
4	1.2	0.0	1.2
6	18.9	0.0	18.9
8	30.6	0.0	30.6
10	6.7	1.4	8.1
12	2.1	2.3	4.4
14	1.1	0.0	1.1
Totals:	61.5	3.8	65.3

The system analysis is mostly reliant on a computer based hydraulic model which analyzes a distribution of demands over a network of pipelines and determines the resultant flows in each individual pipe and resultant pressures at each node of the network. The model will also evaluate the available fire flow at each node based on the service standards defined in the introduction section of this report (see Table 1, page 8).

The following models were evaluated as part of this master plan:

- **Scenario E1-PMD: Existing Peak Month Demand for July 2010** – The demands were based on true meter data with an added 7% (for leakage losses).
- **Scenario E2-PID: Existing Peak Instant Demand for July 2010 –** The demands were based on the July 2010 Peak Month as calculated in the previously listed scenario multiplied by a factor of 1.5.
- **Scenario E3-PDD: Existing Peak Day Demand (PDD) with Fire Flow analysis** – The demands were based on State Requirements which have been incorporated into the City service standards.
- **Scenario E4-PDD+: Existing plus Vacant Lots and Bellagio/Comanche Cliffs PDD with Fire Flow Analysis** – This model was to ensure that enough capacity was available for all vacant lots in the City plus the anticipated development of the Villas at Bellagio and Comanche Cliffs subdivisions located on the south side of Highway 91. These two subdivisions are considered as imminent to be developed, perhaps within the next 5 years.

- **Scenario E5-PID: Existing Peak Instantaneous Demand (PID)** – These are based on Peak Day Demand (based on City service standards) multiplied by 1.5.
- **Scenario F1-PDD: Future Buildout PDD with Fire Flow Analysis** – This scenario assumed that irrigation demands within the irrigation service area would be provided by a separate irrigation system. The demands were based on the City service standards.
- **Scenario F2-PID: Future Buildout PID** – This scenario also assumed that irrigation demands in the irrigation service area are separated out. The demands were based on PDD multiplied by 1.5.

Ivins City used Bentley® WaterGEMS® V8i as the hydraulic modeling software with a capability of modeling a network of up to 1,000 pipes. The model was updated from the model created by Alpha Engineering in 2006 as part of the Ivins City Culinary Water Capital Facilities Plan. The model is a network of 999 pipes, 794 junctions, 5 tanks, 2 pumps, and 7 PRVs.

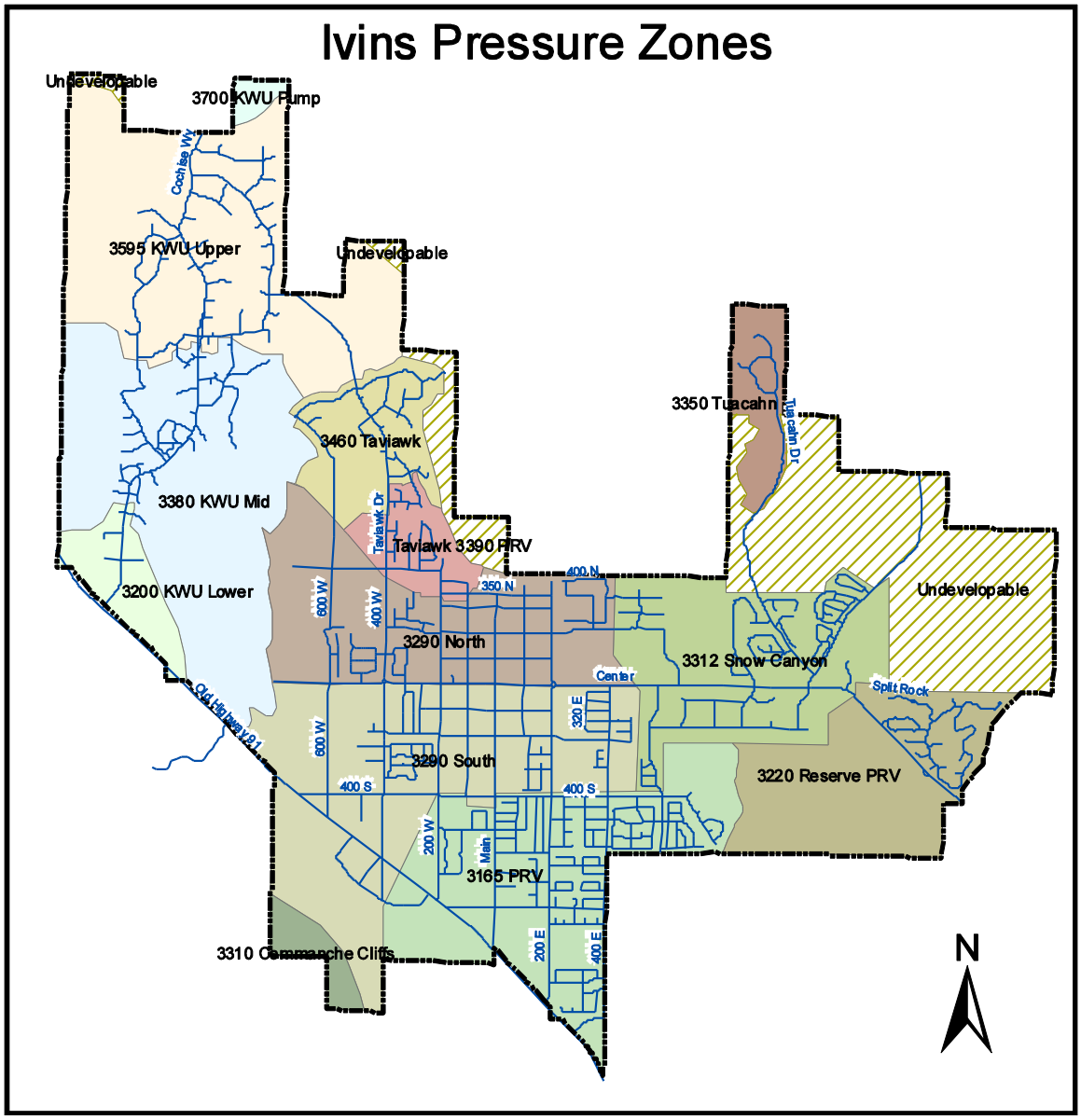
Hydraulic modeling of the water system is a recent requirement by the State of Utah per Utah Administrative Code Rule R309-511. The modeling performed for this master plan meets the requirements of this rule and this master plan document meets the reporting requirements and will be submitted to the Division of Drinking Water for review.

The model includes all distribution and transmission pipelines of all sizes except for dead end pipelines less than 6 inches, not connected to a hydrant and not in a pressure problem area. The model does not include service lateral piping. All the evaluated scenarios were steady state models and assumed that the tanks were at a 25 percent full level.

PRESSURE ANALYSIS

The pressure zones are shown on the map in Figure 14 as follows. This figure shows the KWU system pressure zones in light pastels and the Ivins municipal system in darker pastels. Undevelopable zones are identified with a cross hatch. The KWU system pressure zones are shown here but not analyzed sufficiently to identify any recommended capital improvements.

FIGURE 14. IVINS CITY EXISTING PRESSURE ZONES



The municipal system has been divided into nine pressure zones as follows:

Connecting to the Taviawk Tank are:

- 3460 Taviawk Zone
- 3390 Taviawk PRV Zone

Interconnecting to the Cliff Rose 1MG/2MG and the Snow Canyon Tanks are:

- 3290 North Zone
- 3290 South Zone

- 3312 Snow Canyon Zone
- 3165 PRV Zone
- 3220 Reserve PRV Zone

Connecting to the Tuacahn Tank is:

- 3350 Tuacahn Zone

The final zone is undeveloped but potentially unserviceable by the current tanks in Ivins City:

- 3310 Comanche Cliffs Zone

The static pressures of each of the pressure zones can be summarized by the following table.

TABLE 35. STATIC PRESSURE ANALYSIS OF PRESSURE ZONES PER EXISTING CONDITIONS

	Tank/PRV HGL (feet)			Zone Elevation (feet)		Static Pressure Range (psi)	
Zone	High	Low	25% Full	High	Low	High	Low
3460 Taviawk	3460	3440	3445	3415	3160	130	13
3390 Taviawk PRV	3390	3390	3390	3220	3150	104	74
3350 Tuacahn	3352.5	3315	3324	3230	3150	88	41
3312 Snow Canyon	3312	3270	3281	3170	2990	140	48
3290 North/South	3292.5	3270	3276	3180	3000	127	42
3220 Reserve PRV	3220	3220	3220	3030	2940	121	82
3165 South PRV	3165	3165	3165	3010	2940	97	67

High Static Pressure = Pressure at Low Elevation with High Tank HGL
Low Static Pressure = Pressure at High Elevation with 25% Full Tank HGL

In review of the table above, the pressure problem in the 3460 Taviawk zone is apparent. In the upper area of the zone there is a residence that uses a booster pump/pressure vessel to obtain the necessary pressure. The fire hydrant is located within the requisite distance and actually meets the fire flow requirements of 20 psi since the hydrant sits at a lower elevation than the residence. It is not feasible for the City to correct this problem in any cost efficient manner therefore **there is no recommendation to repair this system deficiency**.

The 3312 Snow Canyon Zone shows static pressures at 140 psi which is 10 psi above the maximum per the Ivins Service Standard. These pressures occur mostly near the Puerto Drive PRV on the upstream side of the valve. The high pressures may cause additional leakage and potential problems to users where the house PRV is not properly working. It is not feasible for the City to correct this problem in any cost efficient manner therefore **there is no recommendation to repair this system deficiency**.

In review of the current pressure zones, it appears that there is a benefit to combine the 3165 South PRV zone with the 3220 Reserve PRV zone in the future. The two zones appear to be serviceable under a single HGL of 3175. The benefits of combining the zones is the redundancy that could be provided to the Reserve zone since it is serviced by a single PRV. There have been instances where the City has had to shut down the whole zone to work on the PRV or a leak on the feed pipeline. Table 35 shows the resulting static pressures for the combination.

TABLE 36. STATIC PRESSURE ANALYSIS OF FUTURE COMBINED ZONES

Zone	Tank/PRV HGL (feet)			Zone Elevation (feet)		Static Pressure Range (psi)	
	High	Low	25% Full	High	Low	High	Low
3220 Reserve PRV	3175	3175	3175	3030	2940	102	63
3165 South PRV	3175	3175	3175	3010	2940	102	71

For the existing 3165 South PRV Zone, this would cause a 5 psi rise in pressure. For the 3220 Zone this would be a 19 psi drop in pressure. However, pressure should be sufficient still to provide the service standards of the City. **Based on this analysis, it is recommended that the two zones be combined with a single HGL of 3175.**

DISTRIBUTION PIPE SIZING (DYNAMIC PRESSURE & FIRE FLOW ANALYSIS)

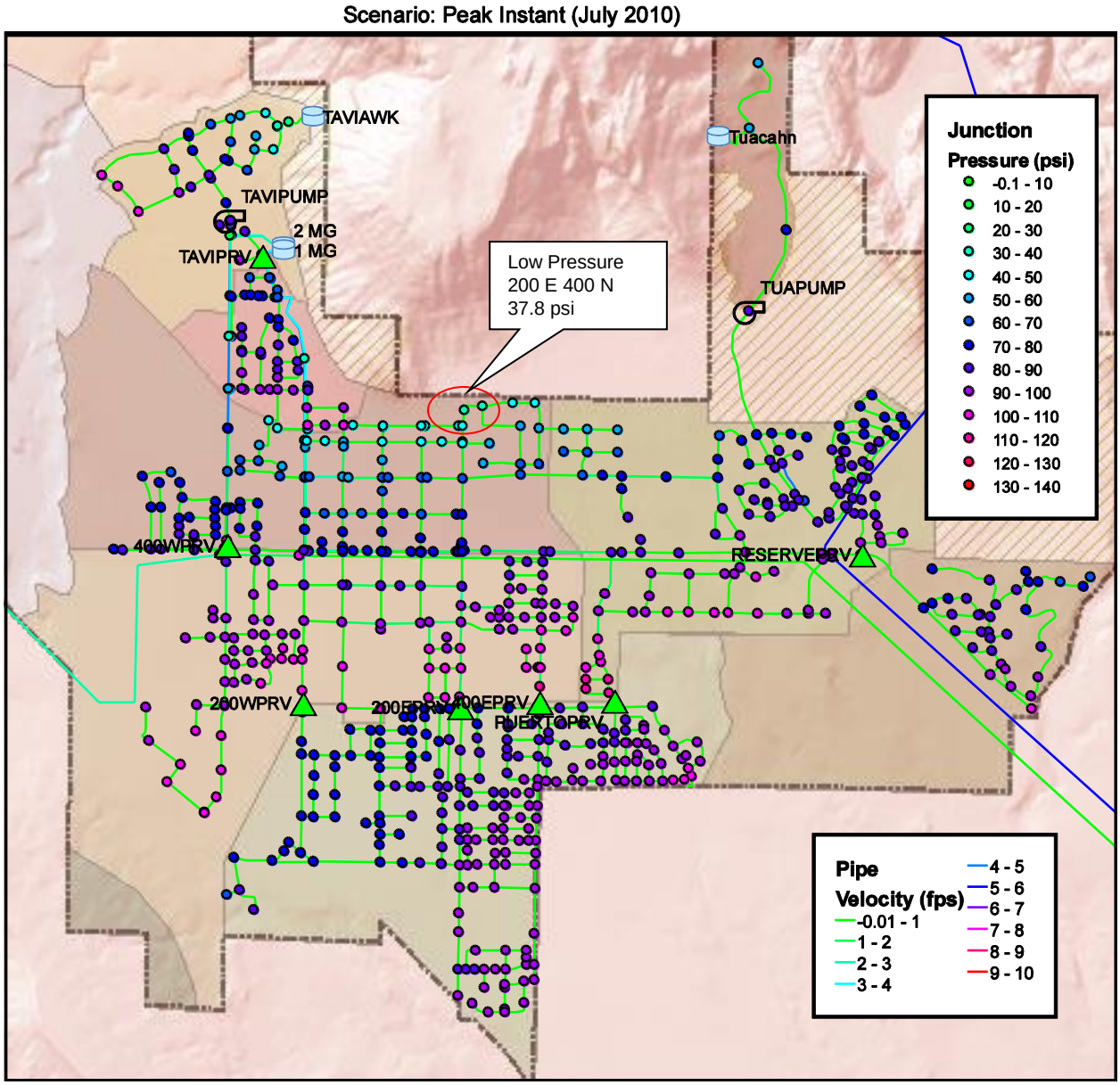
Distribution piping is the facilities that deliver water from the tanks to the customer and is characterized by redundancy through a looping pipe network, such that during repairs, minimal interruptions occur to the customers. The sizing of distribution pipe is generally sized based on the criteria of first, maintaining 30 psi in the system under a peak instantaneous condition, and second, maintaining 20 psi in the system under a peak day demand condition while providing needed fire flow at any one point throughout the city.

EXISTING DISTRIBUTION PIPING

Figure 15 as follows shows the output from the computer hydraulic model of Peak Instantaneous flows as estimated for the summer of 2010. The figure shows color codes for nodal pressures and color codes for pipeline velocities.

The lowest pressures other than those already defined in the static pressure analysis are at 200 East 400 North where the pressure is 37.8 psi. This meets the City service standards of 30 psi minimum at peak instant flows however, when evaluating the Existing PDD Model including vacant lots, Bellagio, and Comanche cliffs (Scenario E4-PDD+) this pressure drops further to 34.5 psi and being that this is a peak day demand scenario with a service standard of 40 psi, this pressure area becomes an existing deficiency. The reason for the low pressures is the high velocities and resulting headlosses exiting the feed lines from the Cliff Rose 1 MG and 2 MG reservoirs which currently feed water into the 3290 zones through an 8 inch pipe (from the 1 MG tank) and a 14-inch pipe (from the 2 MG tank).

FIGURE 15. HYDRAULIC MODELING RESULTS FOR PEAK INSTANT DEMANDS (JULY 2010)



This condition makes it more apparent that **the 14-inch feed to the 2 MG tank should be tied into the 3290 Zone at 200 West/300 North** where a 12-inch distribution pipeline could feed more efficiently through the north end of the pressure zone. This improvement is recommended as part of this master plan. Also, if the currently inactive **PRV at 400 West should be activated with a set HGL at 3270 feet** this would prevent the pressure at 200 East/400 North from dropping below the 40 psi in the Scenario E4-PDD+.

The model has also looked at the existing fire flow conditions for the City. Fire flow requirements are governed by the City adopted IFC 2012. In Appendix B, Section B105, fire flow requirements for residential one- and two- family dwellings no larger than 3,600 sq. ft. (including all floors and garage) is 1000 gpm. For residential building larger than 3,600 sq. ft. fire flows must be in accordance with Table B105.1 which lists fire flows based on building size and construction type.

For the typical non-fire resistant residential construction, homes larger than 3,600 sq.ft. must have the following fire flows shown in Table 36 (excerpted from the full Table B105.1).

TABLE 37. EXCERPT FROM IFC TABLE B105.1 MINIMUM REQUIRED FIRE FLOW FOR BUILDINGS

Fire Flow Calculation Area for Type V-B Construction (sq. ft.)	Required Fire-Flow (gpm)
3,601 – 4,800	1,750
4,800 – 6,200	2,000
6,201- 7,700	2,250
7,701 – 9,400	2,500
9,401 – 11,300	2,750

Essentially, any area with less than 1,750 gpm needs to be reviewed to see if buildings exist or may exist in the future with fire flow calculation areas greater than 3,600 sq. ft. It may also be necessary to review areas where there are buildings known to be larger than 4,800 sq. ft. that might need 2,000 gpm or more. Figure 16 shows the calculated fire flow from the existing conditions model. The yellow, orange, and red color coded nodal fire flows indicate areas that might be substandard per current standards.

The map identifies several areas where fire flow is less than 1,750 gpm but greater than 1,000 gpm, yet are still considered to meet the standard since the structures in the area are less than 3,600 sq. ft. There are other areas identified where the fire flow should be higher based on the structure sizes that are served.

In 2010, the Insurance Services Office (ISO) conducted a comprehensive analysis of the City's fire suppression system. This analysis was used in helping to calibrate the model to match existing conditions; however, there were some discrepancies between the model and the field data that could not be resolved through modification of calibration parameters. Table 37 is provided showing fire flow problem areas identified by the ISO but also showing the discrepancies in some of these areas between the modeling data and the field data.

There are also discrepancies shown in this table in interpretation of "Needed Fire Flow". It is not entirely clear whether the ISO was following the IFC Table in Appendix B or some other standard. In the Reserve, ISO shows no problem, while per the IFC table there appears to be a deficiency. For the purposes of making recommendations, this study shall consider the IFC table as the standard.

The areas where the field data matched fairly close with the model were in areas such as the Tuacahn Arts Center and The Reserve and other areas that are not shown in this table. Other areas appear to have physical issues with the system where it appears that there may be a closed valve, or other type of problem disconnecting the network to cause the reduced flows. The comments in the table indicate rationale on which problem should be addressed by the Capital Facilities Plan.

FIGURE 16. EXISTING FIRE FLOW CAPACITIES (JULY 2010 PEAK MONTH WITH FIRE FLOW ANALYSIS)

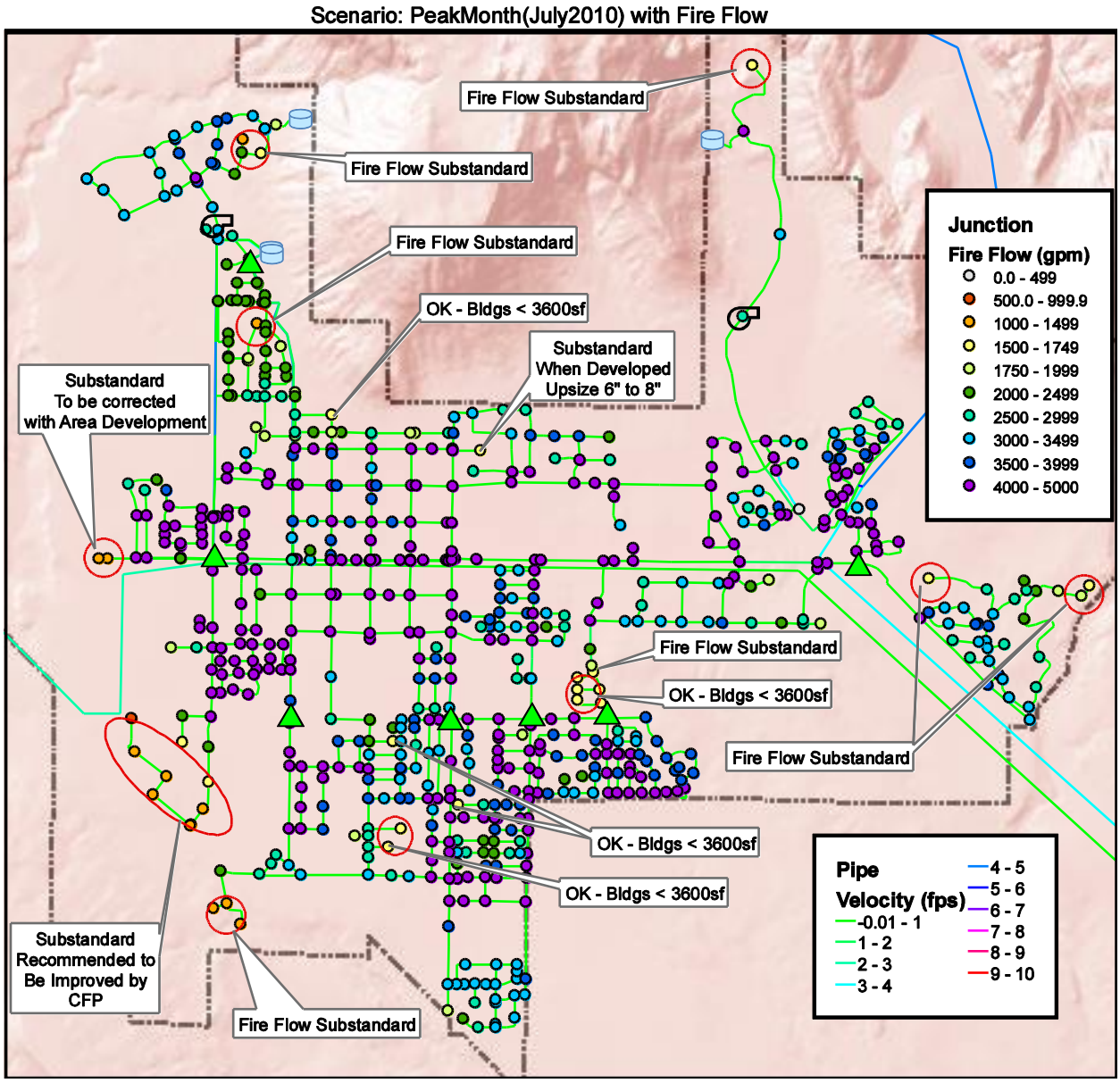


TABLE 38. FIRE FLOW ISO 2010 FIELD DATA VERSUS MODELED FIRE FLOW, PROBLEM AREAS

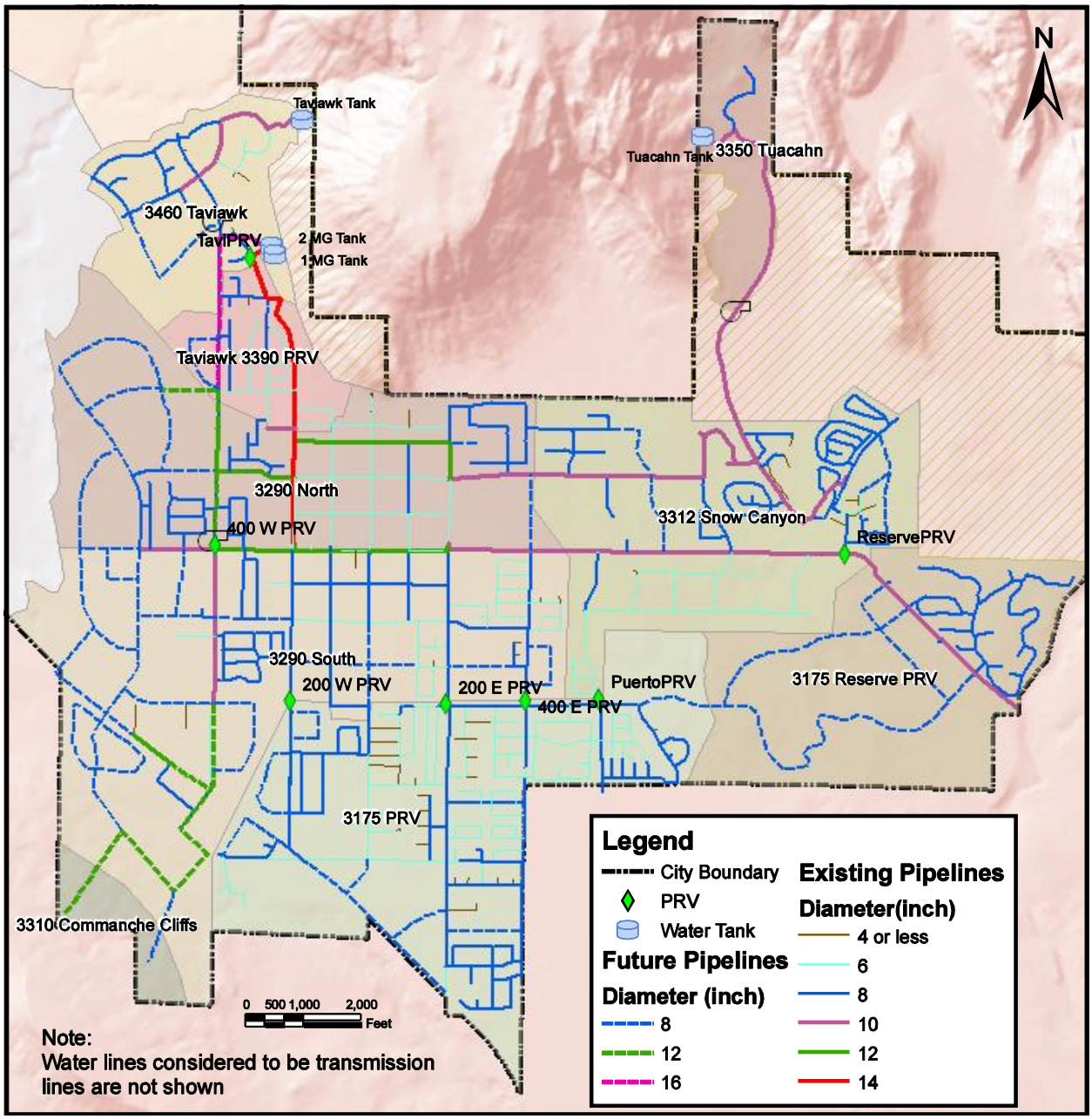
ID	Type	Location	Zone	ISO Needed Flow (gpm)	ISO Tested Avail. Flow (gpm)	IFC Needed Flow (gpm)	Model Flow Avail. (gpm)	Comments
1	Comm	Tuacahn Arts Center	3350 Tuacahn	2000	1500	2000	1697	Difficult to boost fire flow without incurring significant capital expense. Tuacahn should pay to upgrade at its own discretion to improve its insurance rates.
2	Comm	Park Ave. Way (LDS Church)	3312 Snow Canyon	4500	3000	2000	4424	Discrepancy in needed flows from ISO vs. IFC. May need to investigate discrepancy in model vs. test.
3	Comm	263 E 200 S (Red Mountain Elem.)	3290 Zone	3000	1600	3000	2984	Ivins City to investigate possibility of closed valves in the system.
4	Res	100 S 100 W	3290 Zone	2250	1900	2250	5000+	Ivins City has recently upsized 4-inch pipelines to 8-inch. Model reflects the upsizing.
5	Res	570 S 150 E (Mesa View Townhomes)	3165 South PRV	2250	1800	2250	3634	Ivins City to investigate closed valves in the system.
6	Comm.	260 E 1060 S	3165 South PRV	3500	1300	2250	3324	Discrepancy in needed flows from ISO vs. IFC, but also need to investigate possible closed valves in the system.
7	Res	1500 Split Rock (The Reserve)	3140 Reserve PRV	1000	1900	2750	1911	Discrepancy in needed flows. Fire flow increase would be high cost for the benefit of a few houses, may not be necessary.

Insurance Services Office (ISO), Inc. Public Protection Classification Report dated May 20, 2011

FUTURE DISTRIBUTION PIPING

The future distribution piping has also been modeled for the future build-out condition. Based on trial and error modeling, a recommended distribution piping network is shown in the following Figure 17, followed by another two figures: Figure 18 shows the output from the computer hydraulic model of Peak Instantaneous flows as estimated for buildout conditions with this piping network and Figure 19 shows the output for Peak Day Demand with fire flow. In the Peak Instantaneous figure, nodes are shown with color codes for pressure and pipes are shown with color codes for velocity. For the Peak Day Demand figure, nodes are shown with color codes by fire flow available and pipes are shown with color codes for velocity.

FIGURE 17. FUTURE DISTRIBUTION PIPELINE SIZING

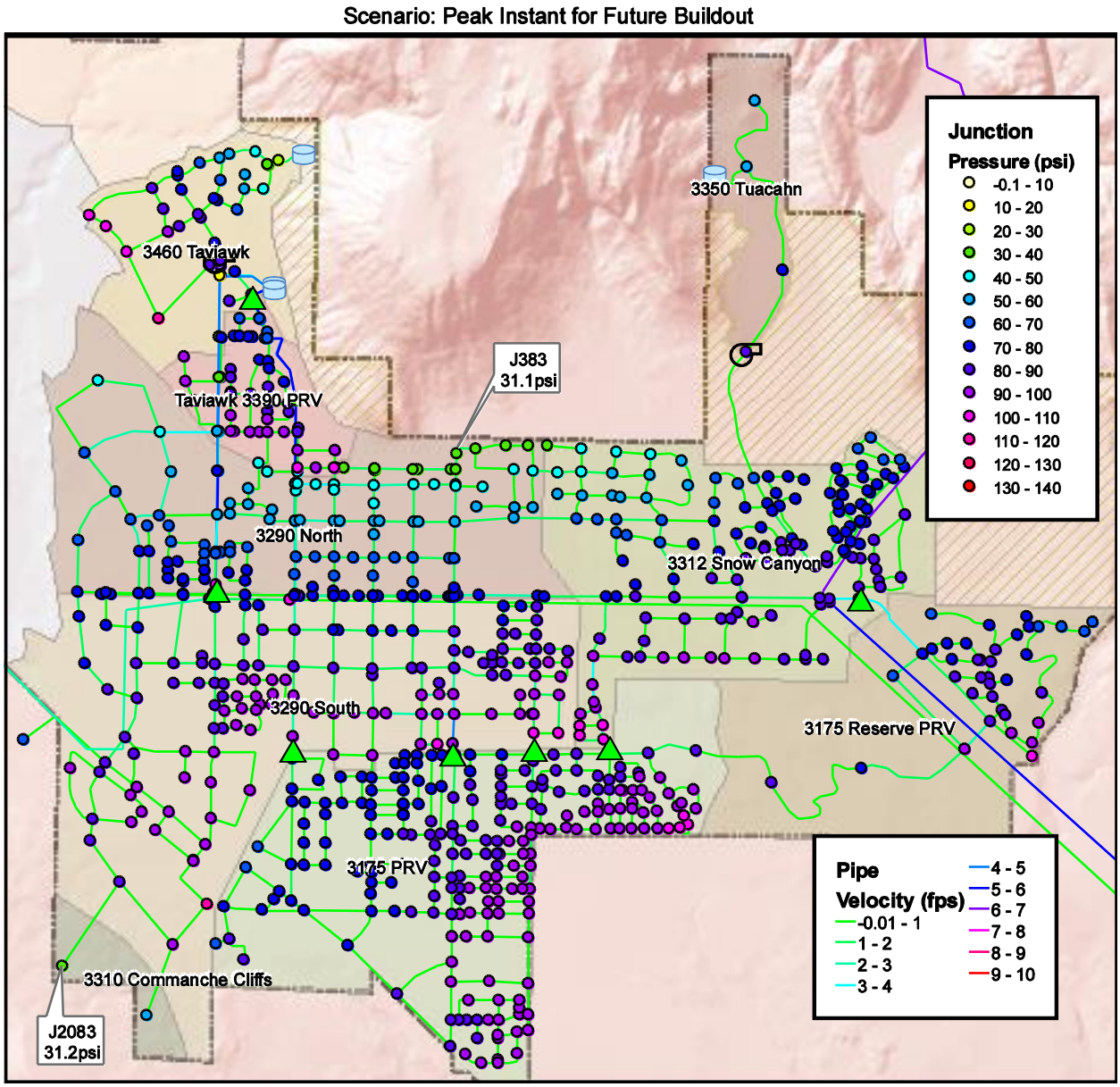


In regards to this figure, the following items are noted:

- Most of the west side network should provide sufficient capacity with the standard minimum size 8-inch diameter pipe.
- More capacity is needed out of the supply pipelines from the Cliff Rose Tanks. This network shows the 8-inch existing pipe in Taviawk Dr. upsized to a 16-inch to 450 N and continues as a 12-inch to Center Street.
- The 300 N/200 W 12-inch distribution line is interconnected with the 14-inch feed line.

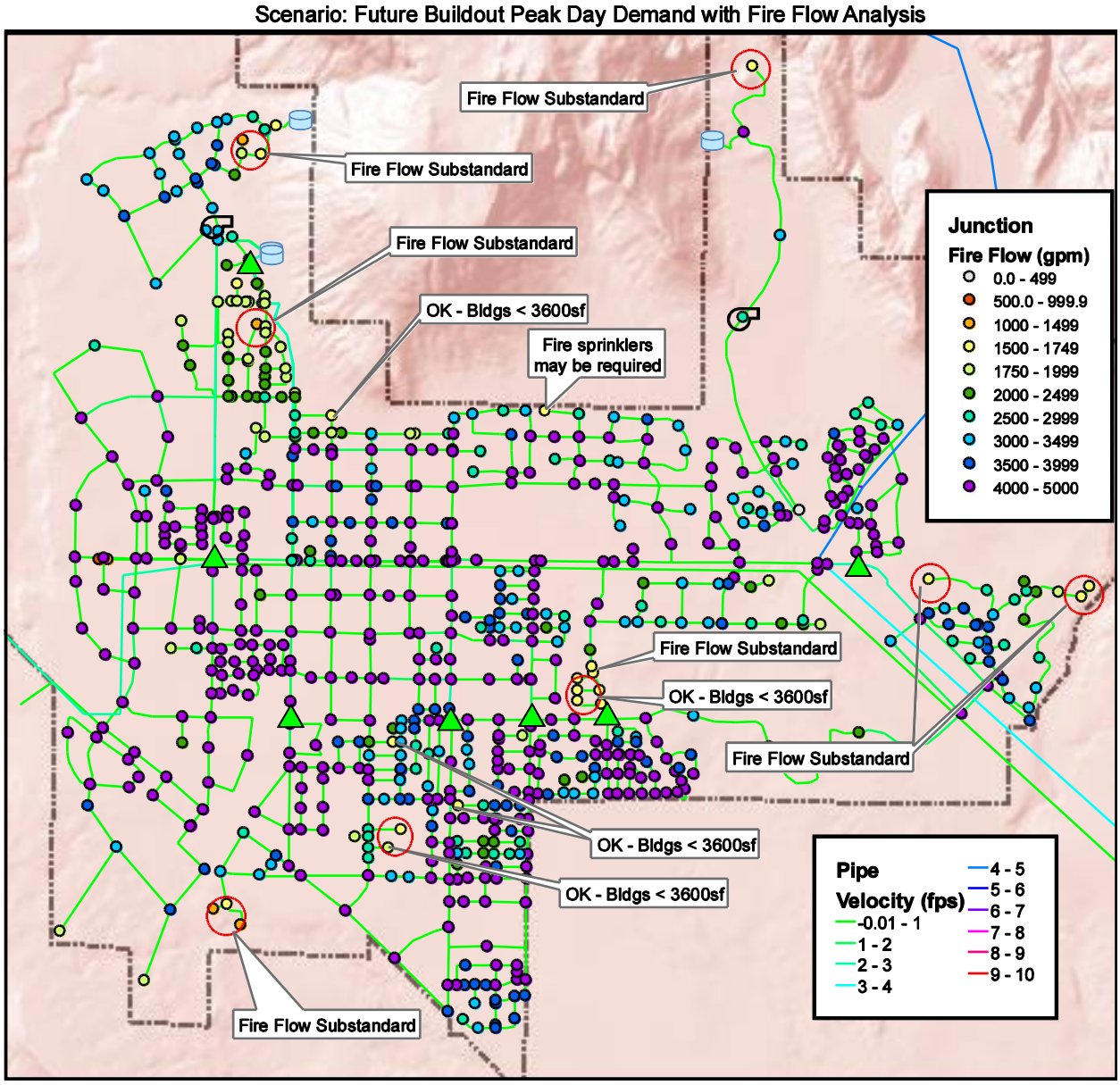
- A 12-inch line is needed in 400 West to service the south side of the pressure zone.
- To deliver fire flows to the upper reaches of the future Comanche Cliffs, a 12-inch line is needed. (See further discussion at the end of this section of the report)

FIGURE 18. HYDRAULIC MODELING RESULTS FOR FUTURE BUILDOUT PEAK INSTANTANEOUS FLOWS



As shown in the peak instantaneous model, there were two critical points that drove the trial and error process for future pipe sizing: junctions J383 and J2083. Junction J383 is located at 200 E and 400 S and represents the highest point in the 3290 Zone. J383 represents a condition where the Comanche Cliffs Zone is served by the 3290 Zone.

FIGURE 19. HYDRAULIC MODELING RESULTS FOR FUTURE BUILDOUT PEAK DAY DEMAND WITH FIRE FLOW ANALYSIS



As shown above, some of the fire flow problems still exist as provided in rationale in the previous section and it does not seem prudent for the City to expend capital funds to improve fire protection on one or two residential structures. The City should **require sprinkler devices on any new residential structure that would be constructed in an area with less than 1,750 gpm when the structure will have a fire flow calculation area larger than 3,600 sq. ft**.

The model identifies the upper elevations of the Comanche Cliffs area could be served by the 3290 Zone but it would require some pipe upsizing beyond Highway 91. T**his cost should not be borne by impact fee funds but should be borne by the developer of Comanche Cliffs with no impact fee credits**. There may be other options that the developer could explore. These options are given as follows:

1. Install a City master meter with a PRV at 600W/Highway 91 off of the 20-inch Gunlock Pipeline to bolster pressure when demands are large enough to cause a pressure drop in the southern end of 3290 Zone, or
2. Install a 12" pipeline from 400W/Highway 91 to the upper fire hydrant and limit house size of these lots to a fire flow area of 4,800 sq. ft. which includes garage and all floors (system will produce 1,750 gpm), or
3. Create isolated pressure zone for upper lots with separate master meter off of the 20-inch Gunlock pipeline to service upper lots.

Developer must hire an engineer to verify that the selected option will meet the water service requirements.

CHAPTER 7: FACILITIES PLAN

The previous sections have discussed the many issues regarding service standards, demands, water storage analysis, water source, transmission, pumping stations, and distribution system piping. In this section, as a result of these master planning efforts, a vision of the future of the City's water system is proposed as a master facilities plan.

The master facilities plan includes three elements:

- List of necessary capital improvements for the required facilities
- Cost of the capital improvements
- Assignment of the capital improvement to either the correction of an existing deficiency, increase in service level, or future growth.
- Evaluation of revenue sources and financing

All improvements assigned to future growth will be included in the Impact Fee Facilities Plan that is prepared to be in accordance with the Utah Impact Fee Act, Utah Code Title 11, Chapter 36a. An impact fee analysis shall then be completed as per the same Act (not a part of the scope of this report but included as appendix F) which will determine the amount to be charged and method of assessment of charge for all future developments.

LIST OF FACILITIES NEEDED

Table 38, as follows provides the list of capital facilities needed per the analysis completed for this master plan. The table breaks down the list into four categories, the first three being based on priorities and the last one being governed by rate of development.

Following the tables are the capital facilities maps, Figures 20 and 21, which identify the location for each of the recommended improvements. There is one map for the transmission system and one map for the distribution system. Storage improvements are shown on both maps. Each project is identified by a Project ID that corresponds with the ID provided in the table.

TABLE 39. LIST OF CAPITAL FACILITY PROJECTS

Project ID	Project Description	Facility Type	Time Frame	Project Cost	Notes	Impact Fee Fund
Priority #1: Current Needs						
IA	Upsize Taviawk Pumping Station to 480 gpm Capacity	Transmission	0-5 years	$60,000	Current Pumping Station is at maximum capacity.	100%
IB	Upsize 6" Waterline to 12" on 400 W from 400 S to Hwy 91	Distribution	0-5 years	$190,000	Provides Fire Flow for Future Development	100%
IB	Install 12" Waterline in Hwy 91 from 400 W to Earl Rd	Distribution	0-5 years	$90,000	Provides Fire Flow for Future Development	100%
IC	Install Check Valves on 1MG & 2MG Tanks	Storage	0-5 years	$15,000	Prevents Snow Canyon Taps from Overflowing Tanks	50%
ID	Remove Check Valves at 50 N 200 E and Red Mountain Spa	Distribution	0-5 years	$10,000	Increase interflow between 3290 Zones	50%
IE	Connect 14" to 12" @ 200 W/300N	Distribution	0-5 years	$20,000	Provides better pressures in higher elevation areas of 3290 zone	100%
IF	Combine 3165 and 3220 Pressure Zones in a 3175 Zone	Distribution	When Developed	Paid by Developer	Adjust the pressures on the PRVs. Connection of system for future pending development.	n/a
IF	Combine 3165 and 3220 Pressure Zones in a 3175 Zone	Distribution	When Developed	Paid by Developer	Adjust the pressures on the PRVs. Connection of system for future pending development.	n/a
Priority #2: Bolster 3290 Zone						
IIA	Add Water Storage to 3290 Zone	Storage	0-5 years	$2,300,000	Replace 1MG steel tank with 2MG concrete tank	100%
IIB	Upsize Outflow Pipeline from 8" to 16" in Taviawk Dr (450 N to Tank)	Distribution	5-15 years	$540,000	Necessary to maintain pressures while accommodating growth	100%
IIB	Upsize Outflow Pipeline from 8" to 12" in 400 W (450 N to 300 N)	Distribution	5-15 years	$70,000	Necessary to maintain pressures while accommodating growth	100%
IIB	Upsize main line from 8" to 12" in 400 W (200 N to Center St)	Distribution	5-15 years	$150,000	Necessary to maintain pressures while accommodating growth	100%
IIC	Separate Irrigation System	Irrigation	0-5 years	Paid by Irrigation Funds	Necessary as system will become undersized without removing the irrigation demand	n/a

TABLE 38, LIST OF CAPITAL FACILITY PROJECTS (CONT.)

Project ID	Project Description	Facility Type	Time Frame	Project Cost	Notes	Impact Fee Fund
Priority #3: Bolster Transmission of Source						
IIIA	Install Pumping Station at 200 W	Transmission	15-25 years	$170,000	As demands increase, necessary to ensure flow capacity	100%
IIIB	Upgrade Pumping Station at 400 W	Transmission	15-25 years	$60,000	As demands increase, reliability of pumping is necessary	50%
IIIC	Pumping Station Transmission Line from Ivins Reservoir	Transmission	15-25 years	$1,360,000	Future Pumping Station & Pipeline from Possible Treated Water Source	100%
IIID	Upgrade Tuacahn Pumping Station	Transmission	5-15 years	$50,000	Install Backup Pump to improve redundancy	100%
Future Priorities Per Development & Major Tank Replacements						
IVA	450 North (400 W to 550 W) 12" Pipe	Distribution	When Developed	$15,000	Impact Fees Fund upsize from 8"	100%
IVB	Guy Lane (Hwy 91 to Fitness Way) Replace 8" with 12"	Distribution	When Developed	Paid by Developer	For Fire flow (see page 61) for more details.	n/a
IVC	400 S (400 W to 480 W) Replace 6" with 8"	Distribution	When Developed	Paid by Developer	6” pipe not viable to handle future flows.	n/a
IVD	Center St (600 W to 750 W) Replace 6" with 8"	Distribution	When Developed	Paid by Developer		n/a
IVE	Upsize Pumping Station at Tuacahn	Transmission	When Developed	Paid by Developer	As necessary for development paid for by development	n/a
IVF	Replace Tuacahn Tank with concrete tank at end of service life	Storage	Year 2035 +/-	$940,000	Lower water temperatures, Reduce maintenance costs	0%
IVG	Replace Taviawk Tank with concrete tank at end of service life	Storage	Year 2039 +/-	$940,000	Lower water temperatures, Reduce maintenance costs	0%
IVH	Replace 2MG Tank with concrete tank at end of service life	Storage	Year 2042 +/-	$2,250,000	Lower water temperatures, Reduce maintenance costs	0%

Note: All cost estimates are in 2012 dollars

FIGURE 20. CAPITAL FACILITIES MAP FOR TRANSMISSION SYSTEM

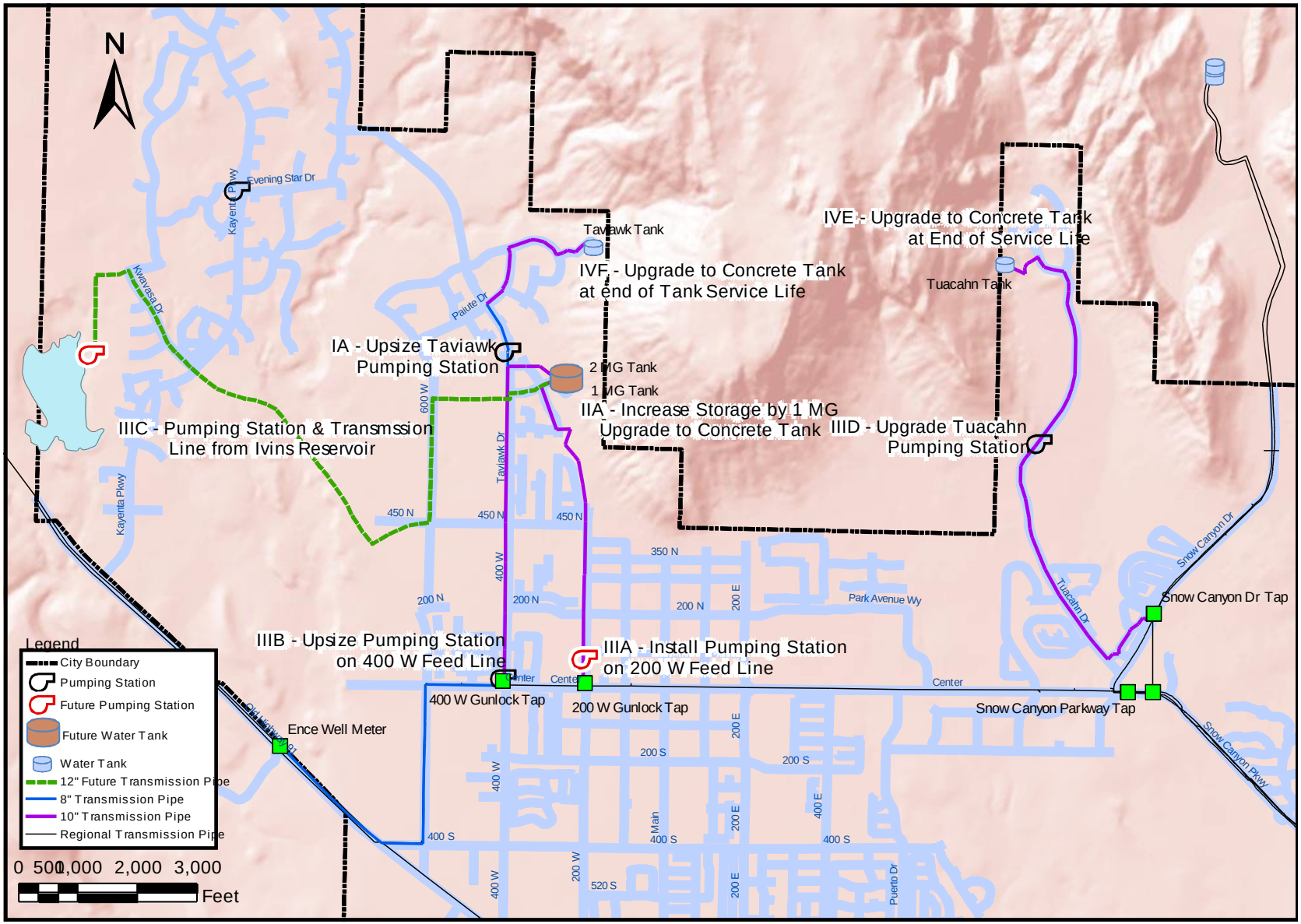
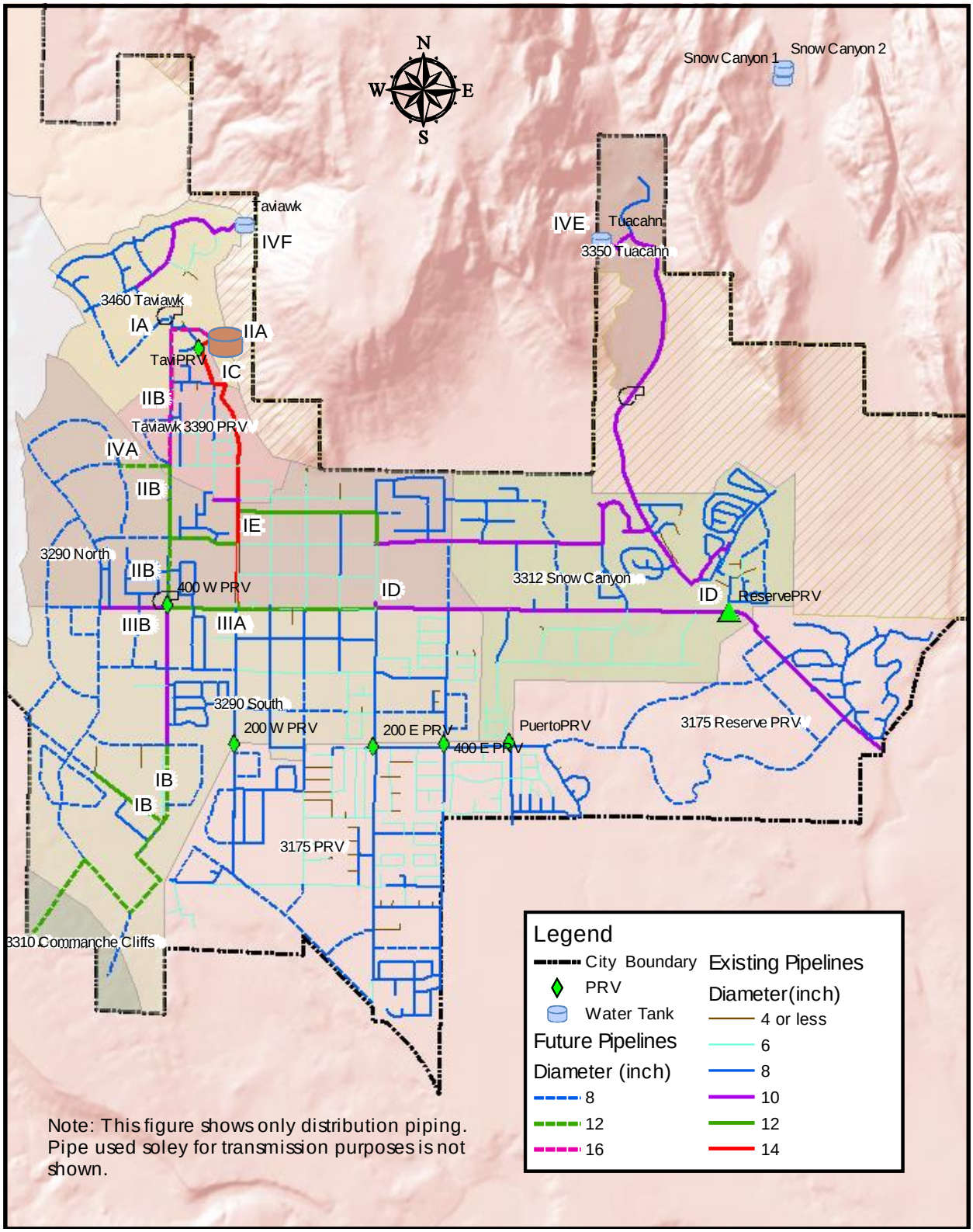


FIGURE 21. CAPITAL FACILITIES MAP FOR DISTRIBUTION SYSTEM



REVENUE SOURCES

There are seven potential revenue sources that should be considered in the impact fee analysis.

- **User Rates** – User rates are the bulk of revenue received for the operation and maintenance of the water utility. This revenue is used to pay utility employee salaries and benefits, purchase costs of water, power costs, supplies, equipment, and maintenance repairs. It may also be used to cover capital projects that are not growth related but rather level of service related including any debt service costs relating to these capital expenses.

- **Impact Fees** – Impact fees are charged in association of the City permitting development that impacts the water system. These fees are authorized in accordance with Utah Code Title 11, Chapter 36a, the Utah Impact Fee Act. The use of these fees must be in accordance with this state law. One of the most important limitations to these funds is that the fee must be expended within six years or otherwise be refunded to the developer (first in, first out).

- **Connection Fees** – These fees are charged at the time of connection. The purpose of this fee is to cover the expense to the City for purchase of the water meter and installation including any administration costs. These fees are not intended to cover any additional expenses unrelated to the physical connection.

- **Reserves** – Ivins tries to maintain reserves no less than 50 percent of the annual operational expenses. If these reserves ever rise above this level, this could be considered a source of revenue for the construction of capital facilities. Impact fees are saved in a separate fund and are not mixed with the utility reserves account.

- **Interest Income** – With reserves, some interest will be received by the City, this income could be a source to fund either operation and maintenance costs or capital costs. Interest income should only be considered a source of revenue when reserves are well above the minimum level. This is a minor revenue source.

- **Dedication of System Improvements** – Developers will dedicate system improvements when these improvements are necessary for the development. Improvements listed in the facilities plan that are expected to be dedicated are identified as "Paid by Developer". A developer would need to install these facilities if it were necessary to make a connection to the system and provide necessary looping redundancy. If a developer needs to install any of the facilities plan improvements that are indicated to be paid for by impact fees, as a requirement of development, a credit towards impact fees shall be granted or developer shall be reimbursed by impact fees.

- **Sale of Assets** – When the utility owns assets that are no longer necessary for the operation of the system, these assets may be sold as a form of revenue. Ivins City has no current plans to sell any assets and therefore this revenue source is negligible.

- **Grants** – There are federal and state grants available for certain qualified projects. All opportunities to obtain such grants will be pursued by Ivins City.

FINANCING

There are essentially three financing methods available for financing the proposed capital facilities. These categories are listed as follows:

- Internal financing for Pay-As-You-Go
- Conventional Long Term Debt Instruments
- Grant Funds and/or Low Interest Governmental Loan Programs

Ivins City will use pay-as-you-go financing as a first preference with long term debt financing as an option as necessary. Grant funds and/or low interest governmental loan programs will always be considered in the pursuit of financing. The following most common sources are listed although there may be other sources that should be considered.

U.S. Department of Agriculture – Rural Development

- Only for municipalities that serve a population of 10,000 or less.
- Loans and grants available.
- $15,000 planning grants available.
- Where median household income is less than $37,369 grants up to 75% of eligible project costs available.
- Where median household income is between $37,369 and $46,711 may receive grant less than 75%.

Utah Community Impact Board

- Project grants and no interest loans are only available to communities impacted by mineral development.
- Planning/Engineering grants available to all.
- Low interest loans available to all communities.

Utah Division of Water Resources

- Low interest and no interest loan money available for projects that conserve, protect, or more efficiently use present water supplies, develop new water or provide flood control.
- Matching funds typically 10 to 30 percent required. In-kind match is allowed.

Utah Division of Drinking Water

- Federal State Revolving Fund Program
- State Revolving Fund Program
- Small grants and low interest loans available

Utah Community Development Block Grants

- All grant money. No grants larger than $150,000 per year. Two years max.
- Must pay Davis Bacon wages for construction projects
- Site specific projects must conduct survey of affected residents. Must be low to moderate income.