2018 Water Efficiency Plan

City of Fountain

El Paso County, Colorado

Prepared for:

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Introduction

On August 30, 2001 the City of Fountain (hereafter referred to as the City), adopted a water efficiency plan in accordance with the Water Conservation Act of 1991. Since then, the City's Water Efficiency Plan has been revised in 2006, 2009 and the current document detailing the 2018 revision.

In 2006, the City's baseline demand was 1,057,541,400 gallons a year. As of December 2016, it has reduced its average system-wide demand by 14.6%. This level of savings, equivalent to 475 acre-feet per year, demonstrates the City's dedication to water conservation and accomplishments within the last decade.

The City's 2009 Water Master Plan (Master Plan) defined the integral role of water conservation in Fountain's overall water supply planning, and it became necessary to update the Water Conservation Plan to achieve additional water savings. This report has been prepared to update the City's 2009 Water Conservation Plan by documenting all of the City's present and proposed water conservation activities. The updated plan includes the water efficiency measures and programs from the City's initial plan, and it summarizes the water conservation activities that have been implemented after the initial plan was adopted. In addition, the updated plan incorporates the water conservation measures and programs that the City has proposed for future implementation. Changes to the City's water supply system and water rights operations (since development of the initial plan) were also included in the updated plan.

The City has had a full time Conservation and Sustainability Programs Manager since 2009. The Conservation and Sustainability Programs Manager is responsible for the implementation, monitoring, review, and revision of the Water Efficiency Plan. This plan encompasses a variety of initiatives associated with capital improvements, educational outreach, regulatory enhancements and incentive based programs to achieve its efficiency goals.

This Conservation Plan projects savings over a 10 year period from 2018-2028. If the City's population growth continues at 2.30% annually as predicted by ESRI Business Analyst Online (ESRI Business Analyst Online, U.S. Census Bureau, Census 2010 Summary File 1. Esri forecasts for 2017 and 2022 Esri converted Census 2000 data into 2010 geography), in 2028 it's population is estimated to reach 36,925. If buildout is reached, the City is predicted to provide water service to approximately 60,000 people. Baseline water demand in 2016 was 902,950,000 gallons or 2,771 acre-feet (AF). The City estimated that the water efficiency measures identified within this plan will reduce annual water demand by approximately 71 AF each year through 2028. This implies a cumulative savings of 781 AF over the ten year period. These goals will be re-evaluated every 5 to 7 years as required by state standards.

The development of this document and its contents were established and assembled in accordance with the recommendations stated within the Colorado Water Conservation Board's *Municipal Water Efficiency Plan Guidance Document*. This plan is complementary to the City's Water Master Plan as they two documents contain overlying goals.

1.0 Profile of Existing Water Supply System

1.1 Overview

The City of Fountain is located in South Central Colorado in El Paso County. Fountain Utilities provides treated water services to a 10 square mile service area with approximately 28,753 people. The City supplies over 2,850 AF of water per year to both residential and commercial entities. This has decreased 153 AF since 2008. The City's water distribution system is supplied from Fryingpan-Arkansas (Fry-Ark) Project water and other fully consumable water delivered through the Fountain Valley Authority (FVA) Pipeline and from four (4) wells located in the alluvial aquifer of Fountain Creek. The City also utilizes wells outside of its distribution system to meet the demands of selected customers, as well as groundwater pumped from the Widefield Aquifer. The City stores its water supplies in Pueblo Reservoir and in its distribution system tanks. Historically, it has satisfied its water demand needs using approximately 70% surface water supplies and 30% ground water.

The following maps can be found in Appendix A:

- Fountain's existing and future service area
- Well locations
- Reservoirs and Water Sources
- Water Main Distribution Zones

Wastewater Treatment: Wastewater from Fountain's municipal water system is collected and treated by the Fountain Sanitation District, except for a small area that is provided sewer service by Widefield Water and Sanitation District through both the Fountain Sanitation District Plant and the Lower Fountain Water Treatment Plant. Treated wastewater is subsequently released into Fountain Creek. The district has two treatment plants including the Harold D. Thompson and Richard J. Christian Treatment Plant.
A wastewater treatment facility with a capacity of 1.5 million gallons per day (2.56 MGD peak) was placed in operation in August 1998. The Lower Fountain Plant with a capacity of 2.5 MGD began treatment operations in 2013.

The Fountain Sanitation facility uses an extended aerator activated sludge process to treat its water. It consists of the following processes:

1. **Preliminary Treatment:** This step includes waste water screening, removal of grit and measurement of influent flows.
2. **Secondary Treatment:** This step includes extended aeration activated sludge treatment, sedimentation removal, sludge removal and scum pumping.
3. **Post-Secondary Treatment:** Sludge is sent to a concrete basin for aerobic digestion and later dewatered.

Fountains potable supply (surface water) is treated by the Fountain Valley Authority Treatment Plant just south of the city.

Historical Deliveries: The following table summarizes total water deliveries for the past five years along with the estimated population of its service area.

Table 1: Water Delivery and Population

Water Deliveries and Service Area Population		
Year	**Water Delivery (acre-ft)**	**Estimated Population**
2013	2,870	27,535
2014	2,856	27,627
2015	2,761	28,164
2016	2,771	28,459
2017	2,865	28,753
Average	2,825	28,295

The water deliveries listed above equal the total gross diversions into the City's distribution system and include system losses. Approximately 14% of these deliveries account for water loss. The population estimates demonstrated in Table 1 are provided by the Census Bureau 2010 report via ESRI Business Analyst Online.

1.2 Water Supply Reliability

The City's water distribution system is supplied from Fryingpan-Arkansas (Fry-Ark) Project or other fully consumable water delivered through the Fountain Valley Authority (FVA) Pipeline, four wells located in the alluvial aquifer of Fountain Creek, and from groundwater pumped from the Widefield Aquifer. Fry-Ark Project and other fully consumable water is stored in Pueblo Reservoir and pumped to Fountain through the FVA Pipeline. The City receives a contractual delivery of approximately 2,000 acre-feet per year through the pipeline. This water is used directly in the City's water system for municipal purposes as a base-load supply. Water is delivered throughout the year, but at a somewhat higher delivery rate during summer than in winter.

Wells

The four municipal wells in the Fountain Creek alluvial aquifer have a total combined capacity of about 2.8 MGD. The City also receives water pumped from the Widefield Aquifer pursuant its lease of the Venetucci wells and water rights. The deliveries from this source are limited under the terms of the lease agreement and the Widefield Aquifer Stipulation that governs municipal pumping within the Widefield Aquifer. As of December 31st 2016, deliveries to the City are limited to approximately 130 AF per year, but future deliveries may be reduced based on the use of the Venetucci wells by other parties to the lease. Fountain, Security Water District, and Widefield Water and Sanitation District have jointly re-drilled the Venetucci wells and agreed to improve their water distribution infrastructure to maximize the yield from this water supply source.

Southern Delivery System

The City participated in the development of the Southern Delivery System (SDS) Pipeline. Construction of the pipeline began in 2010 and was completed in 2016. The pipeline delivers additional water from Pueblo Reservoir to the distribution systems of Colorado Springs, Security, and Fountain. The City's SDS participation provides pipeline capacity for an annual delivery of 2,500 acre-feet per year, thus improving system reliability. This regional project includes 50 miles of pipeline.

The City also utilizes wells outside of its distribution system to meet the demands of selected customers in its service area. The City owns two existing wells that provide a water supply to Pikes Peak

International Speedway. Under an agreement with Fountain-Fort Carson School District No. 8, the City provides augmentation water to support pumping of the Aragon Well that irrigates grounds at the Aragon Elementary School.

Storage

The City stores its water supply in Pueblo Reservoir and four storage tanks. Fountain has 9,500 acre-feet of storage available in Pueblo Reservoir pursuant to Fountain's Fry-Ark Project allocation. In the past, the City had also entered into annual contracts for Excess Capacity storage in Pueblo Reservoir but ceased in 2017 due to additional long term storage contacts. Storage within the City's distribution system totals 7 acre-feet. Through the City's ownership of Fountain Mutual Ditch shares, it previously held approximately 435 acre-feet of storage through Big Johnson Reservoir. Drainage of this reservoir began in the summer of 2016 in preparation for repair to three outlet dates. The city does not anticipate having any storage capacity through Big Johnson Reservoir again until 2019 at the earliest. The City's total available storage capacity is approximately 9,533 acre-feet at the present time.

While Keeton Reservoir, Big Johnson Reservoir, Holbrook Reservoir and Lake Meredith do not serve as a source or storage, they are used for augmentation water. Keeton Reservoir currently (2017) provides 17 AF of storage to Fountain. The City has, on occasion, exchanged surface water with agricultural users in the Arkansas Basin. Normally these waters would be used to augment well depletions but ceased following discovery of PFC contamination to the ground water supply.

1.3 Supply-Side Limitations & Future Needs

PFC Groundwater Contamination

In January of 2016, the City discovered a presence of perfluorinated compounds in its groundwater supply which exceeded health advisory level. This pollution is a result of training activity at Peterson Air Force Base just 13 miles north of Fountain. The training included the use of aqueous film-forming foam to extinguish fuel based fires. This discovery led the City to cease use of its groundwater sources and rely solely on surface water to meet demand. In considering that groundwater satisfies 30% of the City's water supply, this event resulted in significant loss to the city's water supply portfolio. This loss is critical as groundwater is far less affected by drought as surface water supply. A map detailing the impacted area is included in Appendix A.

Carbon Filtration System

Since event discovery, the Air Force has provided two pairs of granular activated carbon filtration systems to aid in PFC removal. Each two part filter has a treatment capacity of 500 gallons per minute (GPM), totaling a 1,440,000 gallon or 4.5 AF daily treatment capacity. With the help of these carbon filters, the City plans to utilize 25% of its groundwater resources by the summer of 2018. The City continues to work directly with the Air Force on environmental service agreements and funding to assist in groundwater treatment. Aside from this, the City has contracted additional supply since 2016 and has the ability to continue this contract as needed. The City plans to expand groundwater treatment processes by installing two additional carbon filters by 2020. This is still in the design process.

Best Management Practices

In an effort to lower demand, the City has amended its water curtailment plan and incorporated a fee structure for non-compliance as of 2017.

Table 2: Supply Limitations and Future Needs

Supply-Side Limitations and Future Needs				
Future Need/Challenge	**Yes**	**No**	**Comments on Limitation/Future Need**	**How is Limited/Future Need Being addressed**
System is in a designated critical water supply shortage area		X		
System experiences frequent water supply shortages and/or emergencies		X		
System has substantial real or apparent water losses.		X		
Experiencing high rates of population and demand growth		X		
Planning substantial improvements or additions	X		Legacy systems require repair	Pursuing grants to complete repair to system.
Increases to wastewater system capacity anticipated		X		
Need additional drought reserves		X		
Drinking Water Quality Issues	X		PFC contaminated ground water supply	Installation of carbon filters
Aging Infrastructure		X		
Issues with water pressure in portions of distribution system.	X		Additional distribution lines needed in southwest portion of the service area to improve reliability and pressure.	Install of two additional pipelines have been proposed.

Water Supply Alternatives

In the 2006 Water Master Plan, Black and Veatch evaluated three water supply alternatives and one sub-alternative that would meet the City's demands. The three scenarios are differentiated by the diversion, storage, and treatment of water pumped from the City's well field. All three scenarios assume the City will receive deliveries from Pueblo Reservoir through the FVA pipeline and the SDS delivery pipeline. Schematics of these three alternatives are included in the 2006 Water Master Plan executive summary as Figures ES-2 through ES-4 in Appendix E.

Alternatives 1 through 3 were studied using the City's projected demands without water conservation. To incorporate water conservation savings into the Master Plan, Black and Veatch evaluated Alternative 3a. This sub-alternative is the same as Alternative 3, except that the City's average day and maximum day demands (without conservation) were reduced by 20 percent throughout the entire study period. As described previously, this demand reduction was assumed to be achieved under the City's existing and future water conservation activities.

Evaluation of Water Supply Alternatives

Tables ES-9 and ES-10 in the executive summary of the Master Plan compare the capital and operation and maintenance (O&M) cost opinions for each of the alternatives. On the basis of these costs, Black and Veatch recommended that the City implement Alternative 3a, which is the sub-alternative to Alternative 3 that includes a water conservation element.

Alternative 3 and Alternative 3a both have lower capital and O&M costs than Alternatives 1 and 2. The capital cost opinion for Alternative 3a equals $175,967,000, which is approximately $31,087,000 less than the estimated cost of $207,054,000 without water conservation (Alternative 3). Similarly, the total O&M costs for Alternative 3a were estimated to equal $159,877,000. This total cost is 45,758,000 less than the total O&M cost of 205,635,000 for Alternative 3. Based on these estimates, the City will save $76,845,000 ($31,087,000 + $45,758,000) during years 2006 through 2046 by achieving the level of water conservation recommended in the Master Plan.

Capital Improvements Plan

Black and Veatch recommended improvements to Fountain's distribution system. The capital and O&M costs associated with Alternative 3a and the distribution system improvements were then combined to develop the capital improvements plan, which is presented in Table ES-12 of the 2006 Water Master Plan executive summary.

2.0 Water Demands & Historical Demand Management

The City of Fountain's Customer Service Department is the billing and accounting agency within the City Utilities that tracks all metered water usage. The current tracking system divides customers into the following five categories: Residential; Commercial/Industrial/Institutional; Construction Water; Farmer's Hydrant; and Municipal. The definition of each Sector is as follows:

Residential: The Residential Sector is by far the largest Sector in both number of customers and amount of water delivered, with approximately 94% of the total number of customers and up to 75% of the total amount of water billed. This Sector sums all forms of customers in residences, including the city housing as well as private housing, with both rental and owner-occupied dwellings in both single-family and multi-family configurations.

Commercial/Industrial/Institutional: The actual differences between the uses within this Sector are not tracked differentially by the Customer Service Department, so the uses range from traditional Commercial uses (stores, gas stations, restaurants) to Industrial customers (metal fabrication, wooden truss assembly plant) to Institutional (School District 8, School District 3, Fountain Sanitation District). The City has 45 additional customer taps, so these are not included in the compilation under the Commercial/Industrial/Institutional Sector but under Municipal.

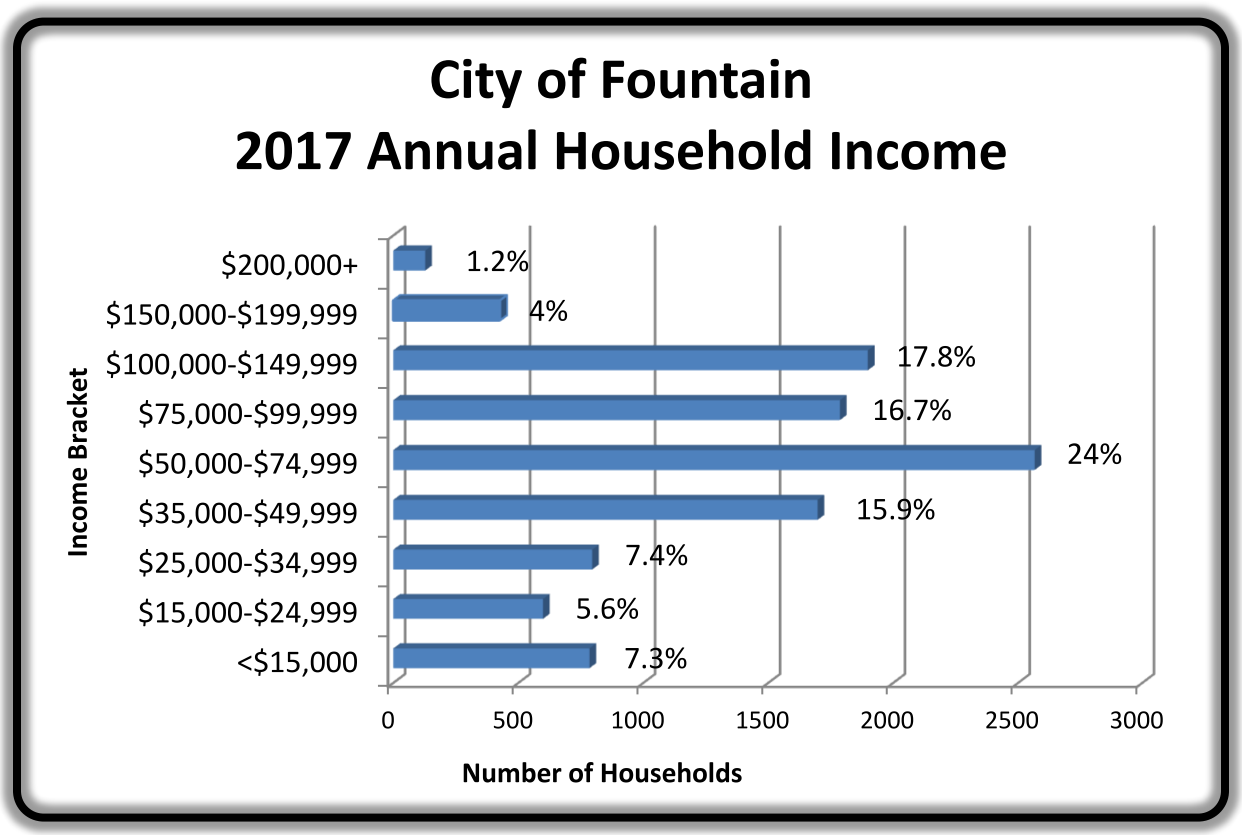
Construction Water: The City sells Construction Water to Contractors using hydrant meters. This usage varies with the intensity of the construction activities. These activities include using the water as a dust palliative and as water for compaction of engineered soils in road bases. The number of Customers is the combines the maximum number of Construction Water Customers during any single month in that calendar year.

Farmer's Hydrant: the City sells water from a metered tap near City Hall to residents of the city who do not have access to the water distribution system. This usage and the number of customers (currently 5) have steadily been declining as the water distribution network continues to expand.

Municipal Use: The City maintains 45 connections for the municipal buildings, parks and irrigation for landscaped streetscapes. These include municipal buildings such as City Hall, Customer Service, Police and Fire Stations and the Public Works Campus buildings. City of Fountain Housing Authority buildings are not included in this accounting; they are combined with all other Residential buildings in the Residential Sector.

2.1 Demographics & Service Area Characteristics

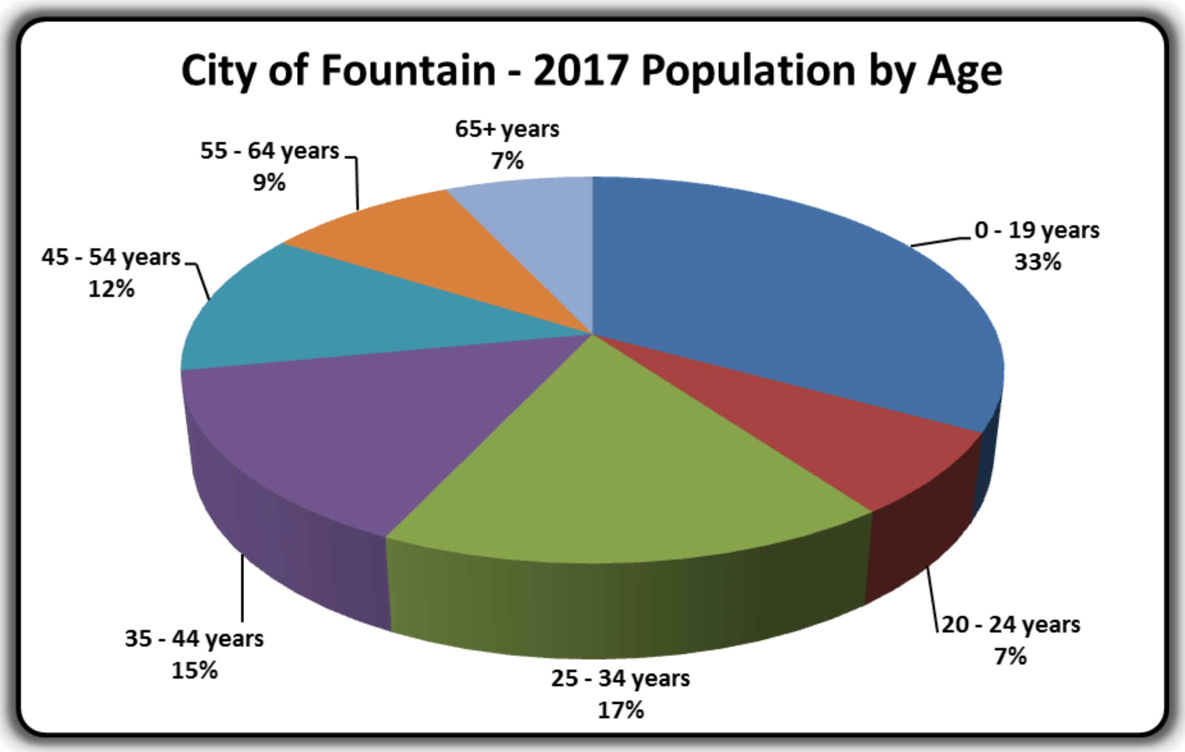
Customer base demographics will play a vital role in establishing effective outreach campaigns as well as determining likely participation rates. Some program requirements and fees may vary based on household income. For that reason, income details are provided below.



Source: ESRI Business Analyst Online (Source: U.S. Census Bureau, Census 2010 Summary File 1. Esri converted Census 2000 data into 2010 geography)

Figure 1: Annual Household Income

Age will continue to play a vital role in determining effective outreach campaigns. The City will need to utilize a variety of methods including social media, hard copy newsletter, event attendance and more in an effort to reach all customer types.

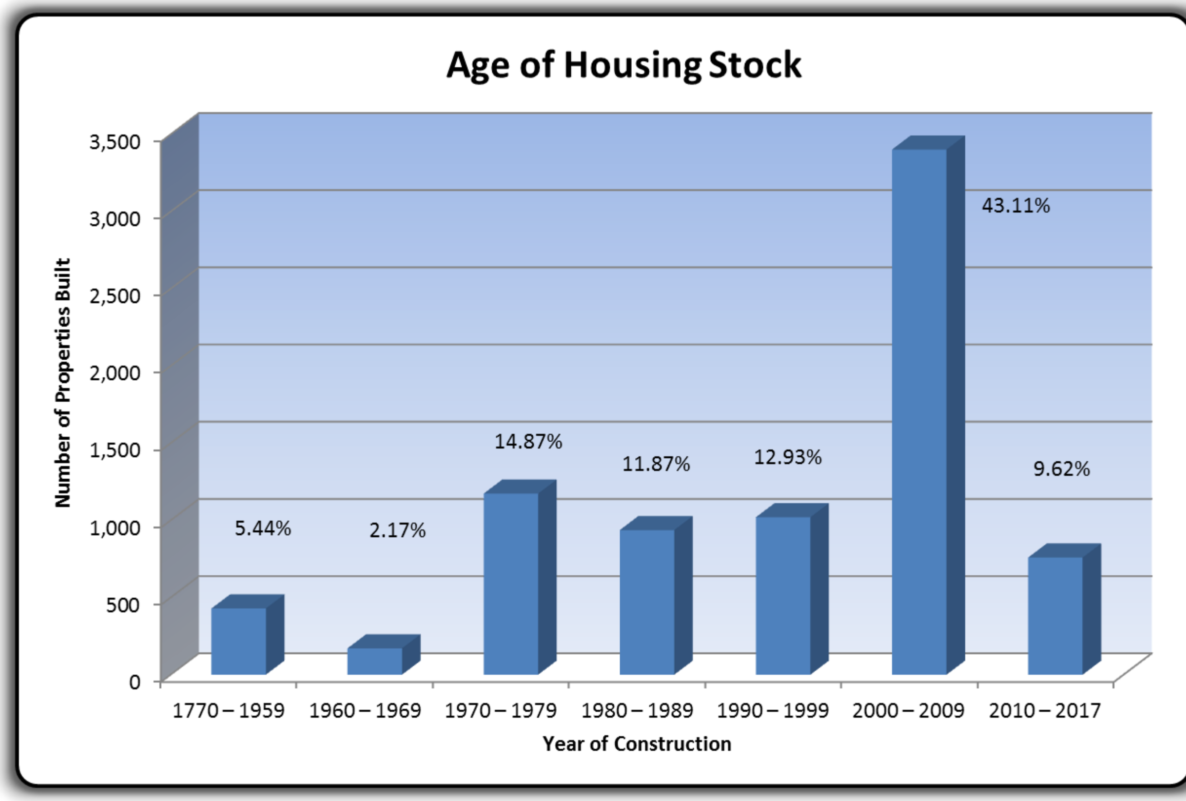


Source: ESRI Business Analyst Online (U.S. Census Bureau, Census 2010 Summary File 1. Esri converted Census 2000 data into 2010 geography)

Figure 2: Population by Age

In 2010, ESRI Business Analyst Online predicted that the average Fountain household size would reach 3.31 in 2017. It also estimates the City of Fountain’s daytime population to consist of 6,502 workers and 17,063 residents, totaling 23,565 during 2017.

Owner or Renter Occupied: According to the ESRI Business Analyst Online, 73% of Fountain residences are owner occupied, 27% are renter occupied. This is likely due to high population of active military residing within the community. This information is important in considering program guidelines and anticipating participation rates if owner occupancy coincides with eligibility.



Source: ESRI Business Analyst Online (Source: U.S. Census Bureau, Census 2010 Summary File 1. Esri converted Census 2000 data into 2010 geography)

Figure 3: Age of Housing Stock

Housing Stock: Recognizing the age of residential properties will assist in determining how many customers are eligible to participate in incentives such as rebates. In some cases, rebates require that the newly purchased appliance is replacing one of a certain age. Assuming that the manufacture date of the water fixture being replaced, matches the age of the property, the City can more accurately predict annual water savings and overall benefit of the program. Acknowledgement of evolving plumbing standards over the decades has assisted in determining accurate projected savings as identified in this plan.

Infrastructure: Most of the City's distribution system is less than 30 years old and repairs are conducted as needed.

2.2 Historical Water Demands

According to Black and Veatch, the purpose of the Master Plan is to "assist the City of Fountain with the long-range planning of its water supply, treatment and distribution systems". The intent of this plan is to provide an assessment of the City's water supply needs through the year 2046. In addition, this plan identifies water supplies and treatment, as well as improvements to the distribution system to meet existing and future demands based on anticipated growth within the current service areas and surrounding areas that are likely to be served by the City in the future. For this reason, the Efficiency Plan will continue to reference various initiatives described within the 2006 Master Plan as the goals frequently overlap or at the least, complement one another.

The following data tables demonstrate the past five years of water demand data including treated deliveries, non-potable deliveries, losses, number of customer accounts within each category and annual consumption for that category. As displayed in the graphs to follow, residential customers account for the majority of water demand, followed by Commercial, Industrial, Institutional (CII) customers. The usage of Residential, CII and Municipal customers consistently rises during the warmer months due to irrigation although fluctuates slightly alongside climatic conditions.

Table 3: System Wide Demand Data Including Losses

System Wide Demand Data			
Year	Total Annual Distributed Treated Water in gallons	Total Annual Raw Distributed Non-Potable and Reclaimed Water	Total Annual Non-Revenue Water
2013	935,193,600	9,637,500	160,393,987
2014	930,631,680	8,495,800	143,910,181
2015	899,675,794	8,302,900	177,330,589
2016	902,934,309	8,065,000	144,510,690
2017	933,659,570	9,086,200	197,900,527

Table 4: Annual Water Demand History by Customer Category

Annual Water Demand History by Customer Category					
Year	**Residential Customers & Use**	**Commercial, Industrial, Institutional & Use**	**Construction Customers & Use**	**Farmers Hydrant & Use**	**Municipal Customers & Use**
2013	7,358 580,491,828	278 192,229,910	13 2,064,375	8 84,000	46 14,027,530
2014	7,509 581,525,339	346 201,572,170	11 3,515,490	7 237,500	49 19,371,690
2015	7,572 542,905,535	328 177,121,670	16 2,234,400	8 162,500	48 13,293,790
2016	7,834 579,887,854	330 175,729,765	9 2,673,200	7 204,200	45 15,820,966
2017	7,922 555,378,190	344 177,309,503	7 2,021,292	8 187,000	45 31,233,569

Figure 4: Annual Water Demand History by Customer Category

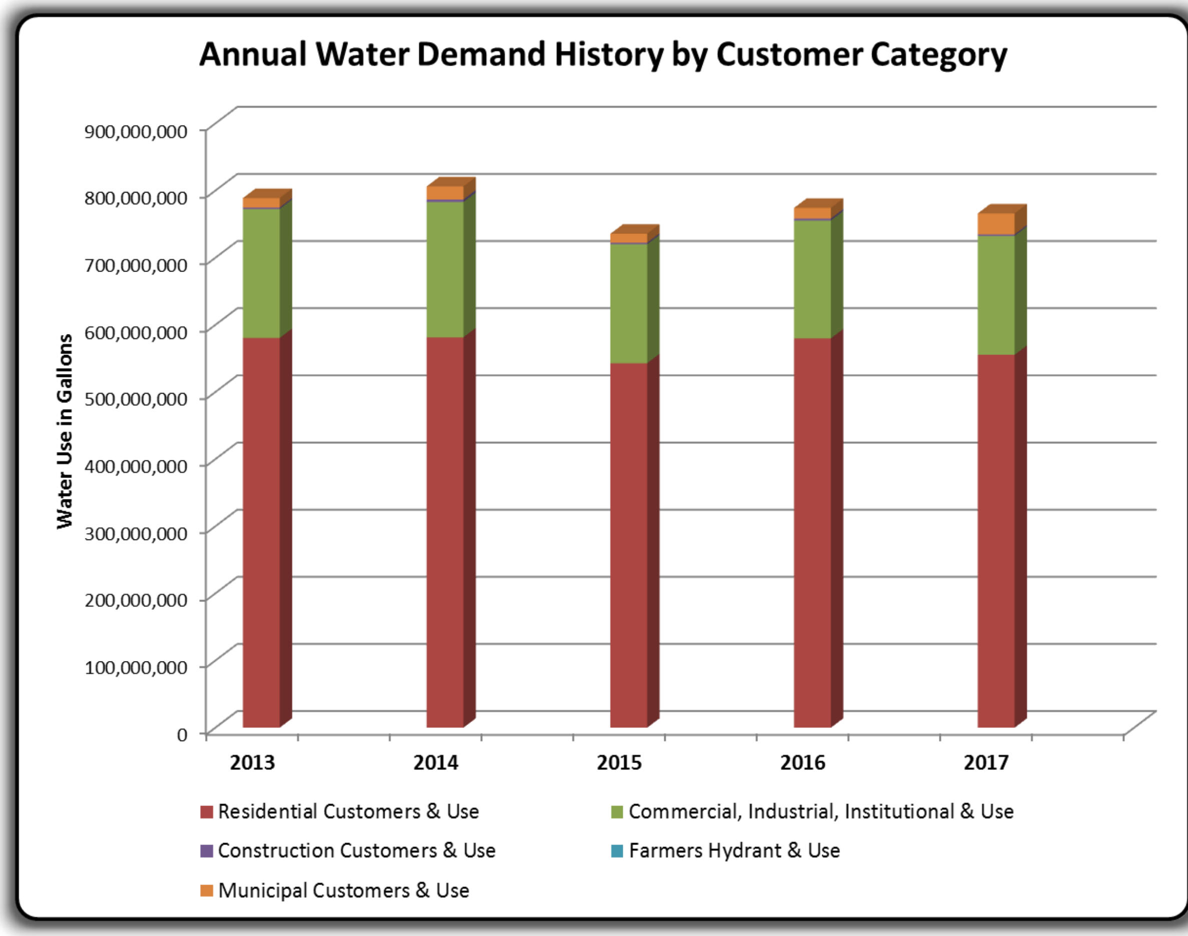


Table 5: 2016 Monthly Water Demand by Customer Category

2016 Monthly Water Demand by Customer Category					
Month	**Residential**	**CII**	**Construction**	**Farmers Hyd**	**Muni**
January	35,533,680	6,132,567	159,600	14,200	718,432
February	33,895,540	6,326,086	15,100	14,800	489,310
March	35,275,180	6,110,667	40,200	15,900	118,420
April	38,856,856	9,220,240	106,400	17,100	1,114,990
May	49,453,258	13,885,210	87,800	18,500	1,749,650
June	61,943,120	22,261,160	256,770	19,600	2,832,690
July	66,730,900	28,935,777	54,300	19,000	2,298,150
August	60,333,350	22,657,167	261,700	18,900	2,112,340
September	57,180,760	18,582,683	134,060	18,600	2,334,452
October	60,680,290	22,588,339	279,500	16,300	1,813,992
November	44,667,490	12,839,744	132,600	15,800	718,432
December	35,337,430	6,190,125	1,145,170	15,500	108,770

System Water Losses

The City experiences an annual water loss of approximately 14%. It is estimated that the majority of the real losses resulting from leakage or theft account for the majority of overall water loss. The remaining are apparent losses are due to meter malfunction resulting in an underestimate of actual usage. Current water loss is estimated by comparing the amount produced to that which was sold. The city does not have plans to use the AWWA M36 Methodology during the scope of this plan.

Annual Peak Day Demands

The City's peak day demand in 2017 was on June 27th, reaching 6,205,000 gallons. Comparably, June was the highest use month this same year, totaling 162,161,000 gallons. July 30th 2016 reached peak demand at 4,245,000 gallons while the month of July totaled 113,959,000 gallons. Historically July and August remain our highest use months due to irrigation and newly installed landscapes. Average daily distribution in 2016 was 2,473,835 gallons or 7.6 acre-feet. Water used for irrigation remains a dominating factor in developing the water efficiency goals as detailed in the plan below.

W. W. Wheeler and Associates had performed an analysis of the City's water use during the period from 1991 through 1996, as documented in the 1996 report, *City of Fountain Water Supply Analysis*. The City had not implemented any significant water conservation measures during the 1991 through 1996 period. The City's annual municipal well production and Fry-Ark water deliveries (through the Fountain Valley Authority Pipeline) during this time averaged 1,629 acre-feet per year. This amount represented the City's average annual water usage through its distribution system (including system losses). In the 1996 report, Wheeler also estimated the service area population to be approximately 10,000 people at that time. Consequently, the average per capital use equaled approximately 145 gallons per capita per day (gpcd). The 2009 Water Conservation Plan revealed the gpcd had been reduced to 128 with a population of 17,875 people.

From 2003-2007, the City's deliveries through its distribution system averaged 2,569 acre-feet per year. As with the 1991 through 1996 data, this amount equals well diversions and FVA Pipeline deliveries into the city's distribution system and includes system losses. The average population of the City's service area during this time was estimated to be approximately 17,875 people. As a result, the corresponding average per capita use was equal to approximately 128 gpcd.

The following per capita demands were calculated based on total production, divided by the current population and number of days in a year. This includes system losses. This information demonstrates the success of the City's demand management activities as well as the community's response to water conservation programs.

Figure 5: System Wide Gallons Per Capita per Day

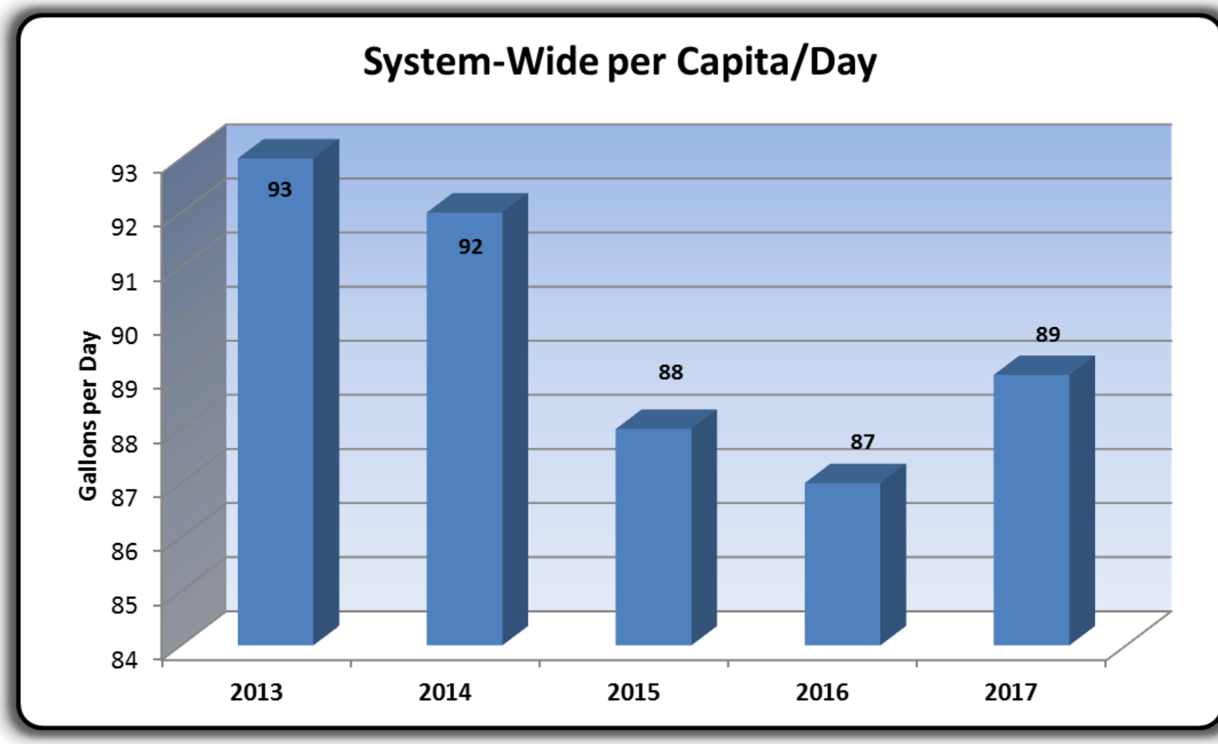


Figure 6 below displays daily and monthly water use of Fountain community members based on 2016 averages.

Table 6: Gallons Per Capita per Day Excluding System Losses

2016 Average Water Use		
Household Size	**Average Gallons per Day**	**Average Gallons per Month**
1	73	2,190
2	146	4,380
3	219	6,570
4	292	8,760
5	365	10,950
6	438	13,140
7	511	15,330
8	584	17,520

2.3 Past & Current Demand Management Activities

The Master Plan confirmed that water conservation will allow the City to minimize the water rights purchases and infrastructure development required to accommodate projected growth in its service area. To meet the Master Plan recommendations, the Water Conservation Plan must produce savings of at least 20 percent of its projected demands (without water conservation). The Master Plan applied the 20-percent demand reduction throughout the entire 2006 through 2046 study period (see Appendix E). With this amount of savings in mind, the 2009 Efficiency Plan determined the incentives and projected savings in Table 7.

Achievements to Date

The 2009 Water Efficiency Plan revision projected the following participation rates and savings. Individual program calculations for the previous plan's savings are included under the table below.

Table 7: Anticipated Savings According to 2009 Water Efficiency Plan

Incentives Savings (Projected)

YEAR	FAUCETS REPLACED	SHOWERHEADS REPLACED	TOILETS REPLACED	IRR. CONTROLLERS INSTALLED	ESTIMATED TOTAL VOLUME SAVED (Gal/Year)	CUMULATIVE VOLUME SAVED (Gal/Year)
2009	30	30	10	10	427,000	427,000
2010	50	50	30	20	811,000	M9 1,238,000
2011	75	75	45	30	1,216,500	2,454,500
2012	100	75	45	30	1,254,000	3,708,500
2013	125	75	45	30	1,291,500	5,000,000
5-Year TOTALS	380 Total Faucets Replaced 2009-13	305 Total Showerheads Replaced 2009-13	175 Total Toilets Replaced 2009-13	120 Total Controllers Installed 2009-13	5,000,000 Total Savings 2009-2013	12,828,000 Gallons Saved Saved 2009-13

Faucet Replacement Calculations: Residential application was targeted, with replacement of existing units that allow over 3.0 gallons per minute with current 2.2 GPM units. Each series of faucets replaced in a household is estimated to (conservatively) save 1,000 to 2,000 gallons per year (reference: Vicker, Table 2.15, 2009 Water Efficiency Plan). For this estimate, 1,500 GPY is incorporated into the table above. For this estimate, each household will replace three faucets.

Showerhead Replacement Calculations: Residential application was targeted for this incentive option during its initial implementation. The AWWA publication The Water Conservation Manager's Guide to Residential Retrofit presents the following algorithm:

(Sa-Sb) X M X C =D
Sa: Existing Showerhead Flow Rate in gallons per minute (GPM)
Sb: Replacement Showerhead Flow Rate in GPM
M: Average Number of Minutes per Shower
C: Average Number of Showers per Year. For this estimate, Sa will be 4.0 GPM, Sb will be 2.5 GPM, M will equal 5 minutes and C will be 700.

Washer Replacement Calculations: The savings measured below assume that an EnergyStar certified washing machine which uses 13 GPL or less is replacing a 23 GPL device and approximately 400 loads of laundry per household each year. This means that a single washer replacement is equivalent to 4,000 gallons saved annually per participating household. According to the Alliance for Water Efficiency, clothes washers manufactured prior to 2010 used 30-45 gallons per load (Alliance for Water Efficiency, 2016). Due to the high population of active military, it is unlikely that pre 2010 washing machines will be replaced with each rebate. For that reason, the GPL of the replacement device has been lowered appropriately.

Toilet Replacement Calculations: The savings estimate for this application assumes that incentives will address residential toilet replacement and that the replacement fixtures will be more efficient that the code-mandated 1.6 gallons per flush (GPF) units. Dual flush or early closure devices will be the target retrofit devices, only using 1.0 GPF and replacing toilets that use (on average) 4.5 GPF. The per unit savings (per year) estimate is based on 300 flush cycles per year. This means that one toilet replacement per participating household will equate to 1,050 gallons.

Irrigation Controller Calculations: As with the other three potential incentive elements, this addresses residential landscape irrigation. Assuming that single family residential homes 1. Average 3,500 square feet of irrigated turf; 2. Water a minimum of 1.5" (1 gallon) per square foot, once a week, for 20 weeks a year and 3. Fountain maintains 15" of annual precipitation. It is estimated that a 20% reduction in outdoor water use resulted from rain sensor install. The savings for this incentive was generated using the recommended water consumption for Kentucky Blue Grass as demonstrated in the Lawn Watering Guide for Southeastern Colorado.

Square Footage X 1 gallon X 20 weeks / .20% = Annual savings per single family residence

3,500 X 1 X 20 = 70,000 / .20 = 14,000 gallons saved per residence per year

The calculations for each year below include passive savings from previous year's program participants.

Table 8: Actual Savings Based on Goals Listed in 2009 Water Efficiency Plan

Actual Savings 2012-2017					
Year	Showerheads Replaced & gallons saved	Faucet Replacements & gallons saved	Washers Replaced & gallons saved	Toilets Replaced & gallons saved	Irrigation Controllers Installed & gallons saved
2012	0	30 15,000	111 444,000	35 36,750	150 2,100,000
2013	0	50 40,000	67 712,000	30 68,250	176 4,564,000
2014	164 861,000	75 77,500	54 928,000	31 100,800	131 6,398,000
2015	211 1,968,750	100 127,500	40 1,088,000	17 118,650	115 8,008,000
2016	294 3,512,250	125 190,000	31 1,212,000	10 324,450	129 9,814,000
Total 5 year cumulative savings	669 6,342,000	380 450,000	203 4,384,000	123 648,900	701 30,884,000

Tracking for the incentive programs detailed above did not begin until 2012. Assuming that participation rates initially remained consistent due to available funding and eventually steady declined, participation was likely abundant from 2009-2011.

Showerhead Replacement

Beginning in 2014, this program continues to far exceed projected savings as it continues to nearly double anticipated participation.

Faucet Replacement

This program was not tracked and therefore it is assumed that these metrics were met.

Washers Replaced

This incentive was not included in the 2009 revision but continues to be a successful offering to the community. It has been in place since 2009.

Toilets Replaced

This program was originally introduced in 2009. Participation has steadily declined and fallen below expectations since 2011. Moving forward, this program will target CII users while implementing a more robust outreach program and housing data demonstrates that we have not yet saturated the market. Due to the City's high population of rental properties, there has likely been less incentive to participate.

Additionally, program requirements have promoted toilets using 1.28 GPF or less, slightly skewing the projected savings which anticipated replacements using 1.00 GPF or less.

Irrigation Controllers

Irrigation controllers are installed at all new build properties. Fountain's steady population growth confirms that this metric has been achieved.

High Bill Investigations

The City continues to respond to reports of high bills by customer request and proactive data analysis of high users. Once an appointment is scheduled, a field technician performs an indoor and outdoor investigation of the properties water use as well as inspection of the meter. Moving forward, the field technicians will provide water conserving and leak detection tools. These can include high efficiency showerheads and aerators, leak detecting dye tabs, flow rate bags, dish scrapers and educational handouts which empower the client with information to help them reduce their water consumption. While this practice was in place prior to creation of the Water Efficiency Plan, it has and will continue to evolve over time with the goal of customer empowerment. Water savings for this program are not measureable.

Voluntary Restrictions

The City has promoted voluntary water restrictions annually since 2009. As a voluntary program, it is difficult to track water savings.

Billing Systems

In October of 2017 the Utilities Department regrouped its billing cycles in an effort to evenly disperse customer inquiries and payments both in person and via phone call. Although some customers experienced a bill date change, the frequency of billing has remained the same, occurring monthly. Implementing this change has improved the City's ability to provide excellent customer service by reducing wait times and allowing for more time to be spent answering customer inquiries, performing high bill investigations and promoting conservation related programming. Below is a table which lists the current amount of accounts per billing cycle.

Table 9: Billing Cycles and Number of Accounts per Cycle

Billing Cycles & Account Totals			
Cycle 1	**Cycle 2**	**Cycle 3 Commercial only**	**Cycle 4**
1,666 accounts	354 accounts	3,482 accounts	2,767 accounts

Demand Data

The demand data available through the billing system includes historical usage that may be separated by customer category or meter size. Data may be displayed over months or years. Demand data is also available for customers. The customer portal uses graphs available to property owners demonstrating their individual usage over the past twelve months.

Water Returns Class

Beginning in 2007, two Water Returns workshops were held annually, attracting an average of 20 participants each year. During this class, participants are educated in low water landscaping install, management and benefits. Water savings for this program cannot be measured.

Water Wise Demonstration Gardens

Beginning in 2014, water wise demonstration gardens have been installed at the following city properties:

- Customer Service: 101 N. Main St
- Water Department: 301 E Iowa
- Well House 3: 230 S. Main St
- City Hall: 116 S. Main St

Preexisting demonstration gardens are located at the Electric Department, Hibbard Park, Fountain Valley Museum and the Library. Not only do these gardens demonstrate the City's commitment to low water landscape, but they inspire the community with creative ideas to reduce their outdoor water use while beautifying the community. A map of the newly installed demonstration garden locations throughout the city can be found in Appendix A. Water savings for these garden beds cannot be measured.

UtiliNews

The Utilities Customer Service Center provides a monthly water bill newsletter known as UtiliNews to all customers. This newsletter includes promotion of energy and water saving tips, conservation campaigns, rebates and events. Approximately 16,000 hard copy newsletters and 2,000 electronic versions are mailed each month. Water savings for this method cannot be measured.

Social Media Campaigns

The City utilizes Facebook, Twitter and YouTube to educate and inspire the community regarding efficient water use through a variety of campaigns. Water savings associated with this program cannot be measured.

Distribution System Leak ID and Repair

The 2009 Water Efficiency Plan continued the City's large scale saddle tap and fire hydrant replacement program. Progress averaged 10-20 fire hydrants and 20-60 tap saddles each year until all were completed. As explained in the 2009 plan, many of the saddle taps and fire hydrants that required replacement were due to highly corrosive soils. On site assessment of devices revealed that one of every five saddle taps exhibited a leakage rate of 15 GPD. Similarly, one in every three fire hydrants exhibited a 10 GPD loss. Collectively, this replacement project saved 815,000 gallons over a six year period. Since 2017, the program has become reactive, only replacing fixtures following routine leak detection. In 2017, three tap saddles and zero fire hydrants required replacement. Field technicians estimate an annual savings of 16,425 gallons based on an average leak rate of 15 gallons per day.

Lessons Learned: Program participation depends greatly on constant and effective outreach which caters to the City's diverse community. The resources and incentive programs have continued to receive recognition from the community but require constant reminders due to the high percentage of rental properties and self-renewing population.

2.4 Demand Forecast

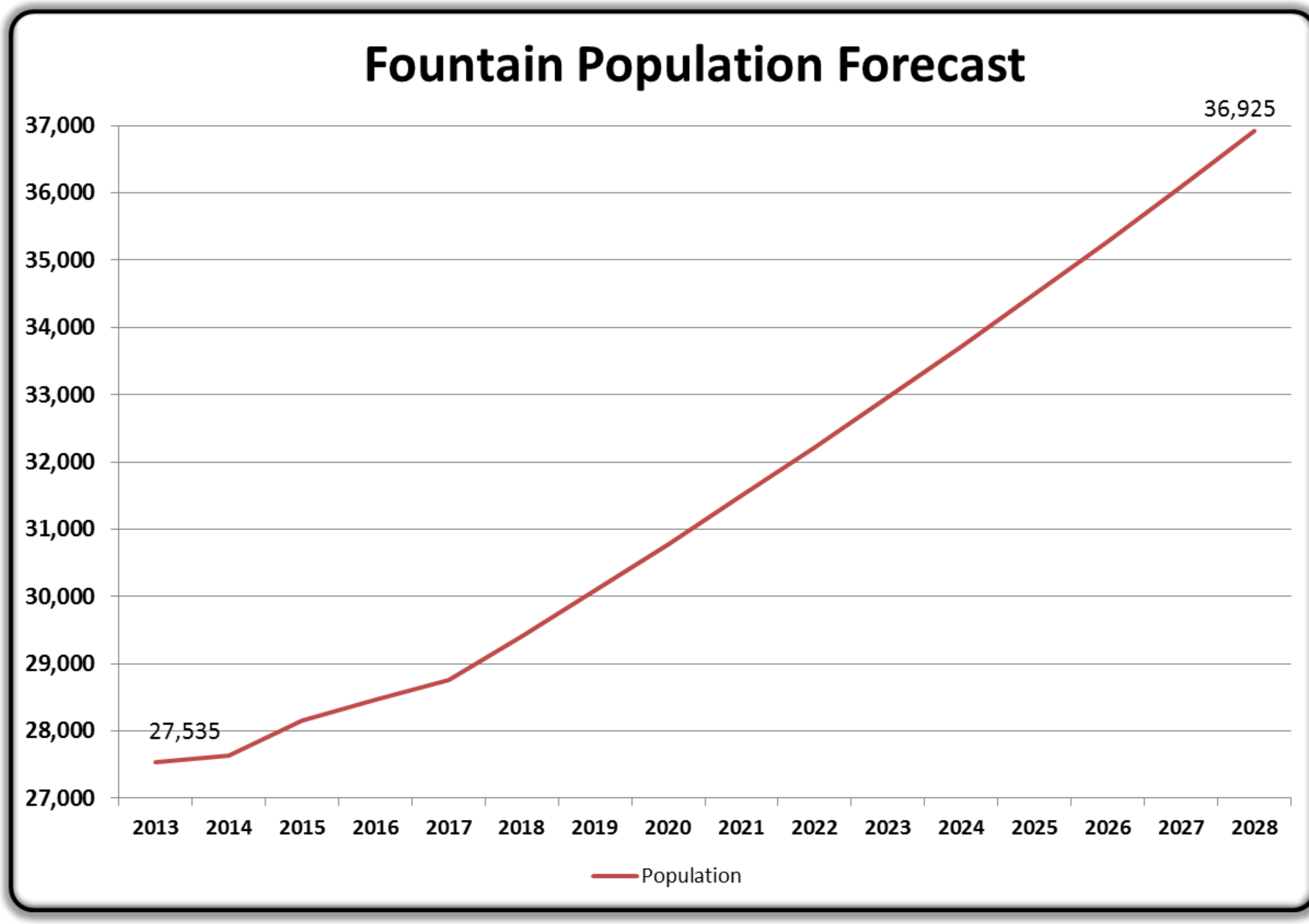
Appendix E includes two tables that summarize the annual water demand projections from the 2006 Master Plan. As shown on the tables, demands were projected without and with water conservation. The demands without water conservation do not include savings realized under the City's existing water conservation measures and programs. In other words, these projections do not account for the demand reductions observed under Fountain's 2009 Water Conservation Plan.

The projected demands with water conservation were developed by assuming the City would continue its existing water conservation activities and implement additional measures and programs to reduce its projected demands by approximately 20 percent. This percentage is cumulative and includes savings that have already been realized through the City's existing water conservation activities. It was assumed that this level of savings would be maintained throughout the entire study period.

As shown in Appendix E, Fountain's year 2046 water demand would be approximately 16,488 acre-feet per year without any existing or future water conservation measures. This demand would represent a 595% increase from the City's present demand of approximately 2,771 acre-feet per year. By reducing its demands 20 percent through water conservation, the City's 2046 water demand would decrease to approximately 13,191 acre-feet per year. This projected demand is still a 476% increase from the City's annual demand at the present time.

Figure 6 below displays the City's historical population and predicted growth of 2.30% annually.

Figure 6: Ten Year Population Forecast



2.30% Population increase (ESRI Business Analyst Population Growth Rate Prediction for 2017-2022)

3.0 Integrated Planning and Water Efficiency Benefits & Goals

3.1 Water Efficiency & Water Supply Planning

Water efficiency plays a major role in water supply planning. The following information examines the City's water supply planning efforts, future capital improvements and how these plans complement our water efficiency goals.

Black and Veatch identified three water supply alternatives and their associated capital improvements plan in the City's 2006 Water Master Plan. This information can be found in Appendix E beginning on page 8-1 of the Water Master Plan. Aside from water supply alternatives, the City has identified the following capital improvement projects which would result in significant demand reductions.

Legacy System Repair

The City recognizes five high usage legacy systems, over which the City currently has no control beyond the master meter. These five properties demonstrate substantial metered water loss throughout their distribution systems. As special districts these properties qualify for various funding opportunities. Achieved primarily through outside funding, the City will assist in upgrading the infrastructure and thus assume control of these legacy systems. These upgrades will 1. Significantly reduce demand; 2. Reduce cost to the customers residing within these communities; and 3. Enable the City to maintain proactive control over future distribution concerns within these areas. Beginning in 2019, the City aims to replace one of these legacy systems every three years. The five properties include Chancellors Mobile Home Park, Credit Mobile Estates, Mountain Shadows Mobile Home Park, Fountain Ridge Apartments and Riverside Mobile Home Park. In assuming at least a 20% reduction in annual water consumption, completion of all five property upgrades will result in an annual water savings of 17,526,670 gallons or 54 AF. This plan includes savings estimates for a single legacy system in recognizing that only one will be completed within this planning period. This savings equates to 10.8 AF annually beginning in 2023.

Promote Raw Water for Irrigation

The City currently sells potable water for non-potable uses, including construction water for soil compaction and as a dust palliative. The water is conveyed through temporary meters mounted on fire hydrants. This is not an efficient use of a costly commodity. In 2016, the City sold 2,673,200 gallons of water for construction purposes. While this demonstrates drastic savings in comparison to 2006 which sold over 50,000,000 gallons of water for construction purposes, the City recognizes that this will be on ongoing effort to promote raw water as appropriate.

By substituting non-potable water, the high quality water can be used more efficiently for domestic, commercial and industrial uses that require potable water, while construction water application can use a lower water quality commodity.

The Cumberland Green Metro District recently concluded an IGA with the City to augment the depletions of the Pullara Well, replacing the water tap with raw water. This system will be completed before irrigation season begins in 2018. Maps of the irrigated area can be found in Appendix A. The same offer to covert potable irrigation to a raw source was provided to Ventana developers but was declined. This conversion will remain an option should they choose to pursue this option.

Construction Water

The City shall continually track the non-potable water sold for construction uses and estimate the annual reduction in potable demand under this goal. A non-potable rate structure should also be considered during Fountain's annual reviews of its water rates and tap fees. All non-potable water shall be metered sales.

Revised Demand Forecast

Figure 8 demonstrates the City's baseline demand and anticipated demand with the additional conservation measures detailed in this plan. Again, this assumes that Fountain maintains a 2.30% growth rate while averaging 71 AF saved annually. The 71 AF annual savings was calculated by averaging savings from the following quantifiable programs. This assumes that collectively, educational activities equate an average savings of 5 AF each year.

Baseline demand was calculated based on the City's annual distribution totals during 2013-2017. During this five year period, the City's distribution total averaged 2,825 AF while its population averaged 28,295. This implies an 89 gpcd without further conservation measures. Demand with conservation considered the City's current 89 gpcd, anticipated growth rate and cumulative savings averaging a reduction of 71 AF annually.

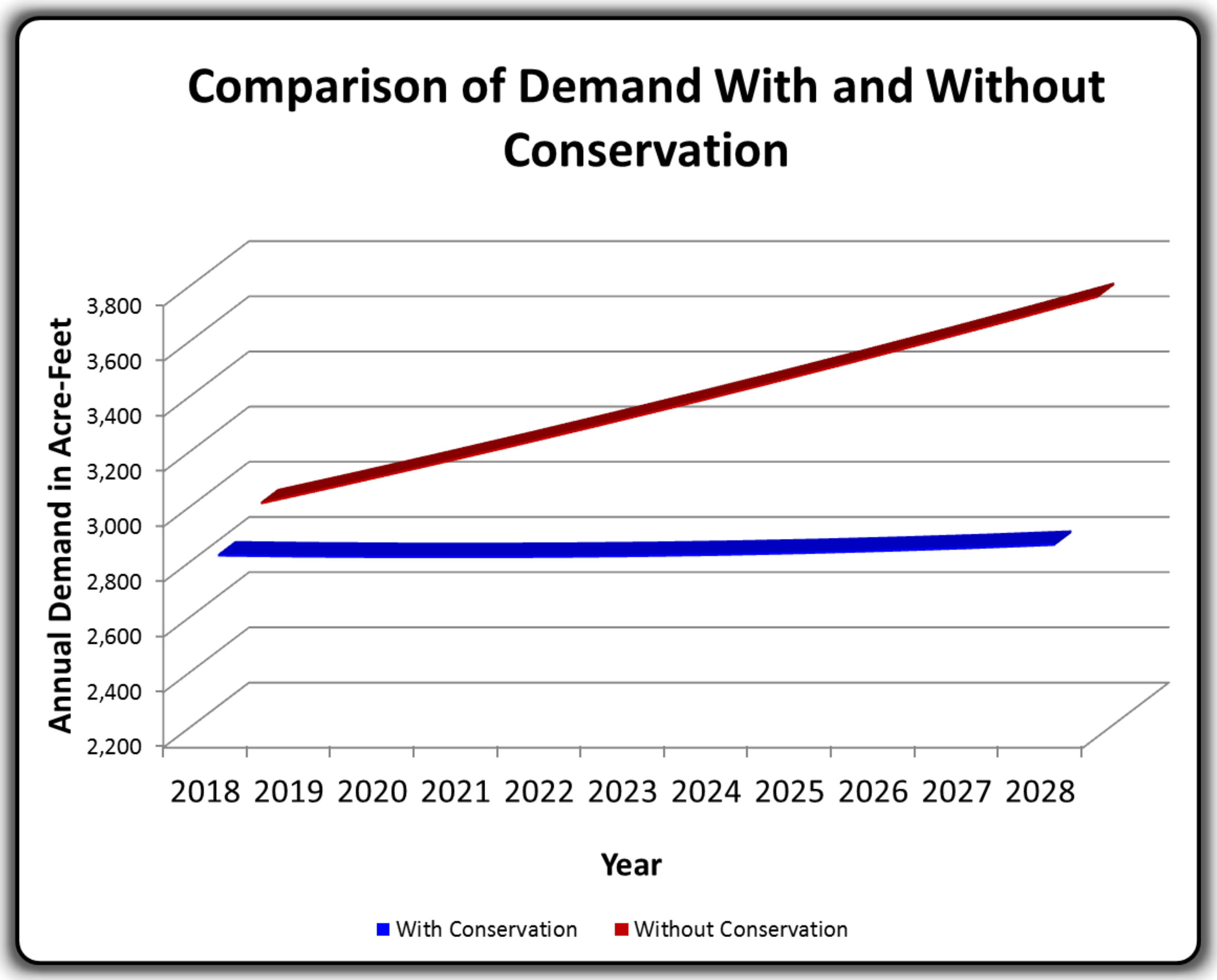


Figure 8: Projected Water Demand With and Without Conservation

3.2 Water Efficiency Goals

The City aims to reduce its baseline forecast by 71 AF annually over the next ten years through the methods detailed within this plan. This equates 781 cumulative AF saved from 2018-2028. While the overall demand reduction is substantial, it is useful to also recognize these savings at the utility customer level.

The amount of water that the City has saved since adopting the initial Water Conservation Plan has been estimated by comparing its present water use with its use prior to implementation of water conservation activities. Prior to the City's adoption of its first Water Efficiency Plan in 2001, the average gpcd was 172. The City's present water conservation measures have reduced its average gross demand to approximately 90 gpcd (2013 through 2017), a savings of 82 gpcd or 47%. This also represents a 38 gpcd reduction (29% savings) when compared to the 128 gpcd identified in the 2009 Water Efficiency

Plan. These statistics display steady success resulting from the methods detailed throughout the City's progressive efficiency plans.

As described under each program selected for implementation, the savings attributable to each goal associated with the updated plan's measures and programs was estimated. Savings estimates were performed for a 5-year planning horizon, which includes years 2018 through 2023. The annual estimates do not include savings that have already been achieved in prior years.

Educational activities selected for implementation will undoubtedly result in savings, but are difficult to estimate. These goals are important to the overall effectiveness of the Water Conservation Plan, but the associated savings cannot be separated from savings under other measures and programs. For example, it would be impossible to estimate the savings attributable to the City's goals for dissemination of information because there are several other water conservation elements that contribute the reductions in use. Additionally, the City will rely on customer satisfaction surveys to determine if behavior changes or equipment upgrades have occurred as a result of information received.

Table 11: Water Efficiency Goals

Water Efficiency Goals		
Goal	**Method**	**Metric**
Reduce indoor water use among CII and Single Family Residential users	• **Rebates for water saving retrofits** • **Improved educational handouts and social media campaigns** • **Offer online and in person classes which promote conservation, empower and educate clients on water use reduction.** • **Offer indoor water assessments**	• **Number of rebate participants** • **Monitor water consumption through billing data** • **Measure water use per capita** • **Reduce High Bill Investigations** • **Lower Winter Quarterly Average** • **Number of class attendees**
Reduce outdoor water use among CII and Single Family Residential users	• **Rebates for rain sensors and/or smart controllers** • **Classes promoting low water landscapes** • **Low Water Landscape demonstration gardens** • **Offer outdoor water assessments** • **Reassess landscape requirements to promote low water use**	• **Number of rebate participants** • **Number of class attendees** • **Number of visitors to demonstration areas** • **Square footage of xeric landscape compared to turf water use.**
Reduce potable water use	• **Transition to non-**	• **Identify square footage**

where non potable may be supplemented	**potable water use for large property irrigation** • **Encourage non-potable water be used for construction purposes.**	**of irrigated turf within the city.** • **Measure potable and non-potable use for irrigated areas.** • **Track conversions** • **List converted city parks**
Promote awareness of programs & the city's role in conservation	• **Scheduled educational social media campaigns with participant incentives** • **Improved presence at community events – host booth** • **Install highly visibly low water landscape demonstration gardens** • **Establish a Sustainability Center with community resources.**	• **Number of website visitors** • **Number of campaign participants/comments**
Public involvement	• **Create surveys to determine community interests, response to conservation programs and resource needs** • **Improve educational literature regarding opportunities and methods of lowering water use and saving money.** • **Improved presence at community events.** • **Implement interactive incentive programs**	• **Gather qualitative and quantitative feedback** • **Track number of participants and visitors.**
Target high water users	• **Contact high water users and provide resources for resolution.**	• **Analyze billing data to identify high users by customer category.**
Improve Monitoring	• **Use newly implemented CIS to improve tracking success of programs and incentives**	• **Monitor before and after consumption of program participants** • **Quantify all conservation related participant activity.**
Foster supporting relationships	• **Improve presence as a leader in water efficiency methods**	• **Serve as board member on a relatable, regional board.**

	throughout the region.	• **List attended trainings, workshops and conferences which assist in water efficiency goals.**
Implement innovative means of achieving water efficiency goals	• **Determine new means of providing resources, information and inspiring change in the community**	• **Attain CWCB grant funding to implement goals.**

Development & Comparability: The programming, incentives and initiatives explored below, pursue water efficiency. Moving forward, the City will expand its water conserving programs and incentives to encourage efficiency among single family residential, multi-family residential, and CII users. While in the past, CII users were considered on a case-by-case basis, they were not targeted to participate in various programs. Additionally the City will continue to promote water efficiency equally among new build and pre-existing properties. Other objectives include promotion of non-potable water for irrigation among CII users. These goals are comparable to the City's previous goals as they continue to develop a more robust campaign for indoor water savings but recognize that outdoor water use requires more attention to produce long term, substantial savings. Comparably the City's CII users manage a sizeable portion of outdoor landscaping and their water use reduction will be essential in achieving future conservation goals.

4.0 Selection of Water Efficiency Activities

4.1 Summary of the Selection Process

The City analyzed a variety of previously implemented conservation programs state wide before finalizing of its own efficiency activities. Specific providers investigated included Colorado Springs Utilities, Denver Water, Aurora Water, City of Fort Collins, City of Westminster, City of Greeley, City of Brighton and the Southeastern Colorado Water Conservancy District.

The City utilized the Guidance Documents created by the CWCB to ensure a well-informed conclusion of activities is implemented into the Efficiency Plan. Additionally, a team of Fountain City Staff assessed the proposed efficiency activities utilizing the following metrics:

- Probable interest within the Fountain community
- Cost-benefit analysis
- Staff and resource feasibility
- Likelihood of significant success
- Anticipated water savings

A summary of the evaluation of these activities is located in Appendix C among Tables D, E, F, G and H.

4.2 Demand Management Activities

As a result of this analysis, the City decided to pursue the proposals that follow. Savings projected in Table 11 take into account the data demonstrated within the Demographic section of this plan. It considers property age, past participation rates, population growth, dedicated funds and success rates of other Colorado based utilities.

4.2.1 Foundational Activities

Metering

Past & Planned Metering Programs

The City continues to test meters as needed when inaccuracy is suspected. Since 2014 the City has replaced approximately 1,500 Circa 1993-5 meters with improved AMR data logging meters. Although the enhanced AMR meters do not directly result in water savings, the technology is vital to tracking the success of other conservation related programming. For example, the new AMR meters hold 96 days of hourly interval data, which is especially valuable during high bill investigations. The City continues to replace malfunctioning meters upon discovery with the improved AMR data logging meters. In spring of 2018, the City will begin a full scale meter replacement, exchanging the remaining 5,500 meters with the updated technology. Discussion is in place to determine the strategy and length of time to complete the project. If we perform the project with internal staffing, the anticipated completion date will be the end of 2021. If we outsource with a temporary workforce, the project could be completed within a year's timeframe.

Random meter testing was performed during the initial replacement of the 1,500 Circa 1993-5 meters. This assessment did not reveal any inaccuracies in metering at the customer location outside of their normal precision.

Although not implemented as a result of the efficiency planning process, the upcoming city wide meter replacement and its corresponding improved technology will undoubtedly result in substantial water savings. These data logging meters will allow the City to more efficiency communicate abnormal spikes in consumption among users. Upon identification of high consumption, high bill investigations will be carried out to communicate resources and solutions to property owners in hopes of education and resolution. Data logging gives the consumer a visual representation, down the hour to help identify dates and times that leaks or high consumption occurred. The City estimates a 25% reduced in outdoor water use as a result of this newly installed technology.

Sub metering

The City has on occasion recommended and installed sub meters to larger properties on a case by case basis. This has been useful for potable CII accounts that use significant water towards irrigation. The City will continue to reach out to these clients as needed.

Unmetered Water Use & Loss

In the past the City has not metered fire connections to buildings. Over the next five years, it plans to install meters on the remaining 200 unmetered fire connections. This project is scheduled for completion in 2023. Once all devices are metered, an accurate estimate of annual losses and savings moving forward will be calculated.

Area of Irrigated Lands in Service Area

The City's GIS Department is currently working on mapping out the amount of irrigated land within its service area. This project will begin in 2019 and scheduled for completion at the end of 2020. While this does not immediately result in water savings, it provides data that is invaluable to the City's conservation efforts. Upon completion, this information will improve our water use analysis moving forward.

Demand Data Collection & Billing Systems

In summer of 2018, The City is transitioning between Customer Information Systems. While it has used BillMaster for over 20 years to fulfill its billing needs, the City is excited to transition to NorthStar. This decision was largely based off of ease of access for the customer. With NorthStar, the client will be able to start, stop and transfer services independently. Northstar provides historical usage graphs that are more aesthetically appealing and easily interpreted by the client. These graphs will promote water conservation through improved delivery of information. Water savings associated with this program are difficult to estimate.

Data Analysis

Northstar allows the operator to target specific customer categories with messages or announcements relevant to their use and needs. This could include rebates, classes, water restrictions or tips for savings. This new software is field accessible, allowing representatives to analyze historical consumption and activity participation remotely. Lastly, this system will drastically improve means for tracking rebates and estimating water savings following participation.

Water Efficiency Oriented Rates

In June of 2001, the City implemented its inclining block arrangement designed to promote water conservation. Prior to this, the city had a flat rate structure based on meter size. In accordance with C.R.S. 37-60-126 (4), our water rate structure encourages efficient use of water and were last fully evaluated in 2012 when a 7th tier was added. Prior to the change, Block 1 held a minimum charge for 0-3000 gallons of use. In an effort to award and promote water conservation, this block was separated into two. The new rate structure changed Block 1 to include 0-1500 gallons while lowering the minimum charge. The current Water Rates are demonstrated below. Information regarding other associated fees can be found in Appendix B. Water savings for this program are not measureable although historically, the city continues to steadily reduce its water demand each year.

The City's water rates are broken down into blocks based on the size of the tap at each building's location and based on the amount of water being used (in gallons), which is reflected below in each block section. The principle of usage is based on the more water used after the initial 1,500 gallons (which includes fixed costs to cover water operations), is charged at a higher price for total water usage. This method or principle is based on the tier factor as a means of water conservation; residents who use less water receive a lower price on the gallons used below 1,500 per month. The higher the use of water, the higher the cost for water used. These water rates are based on ***City Ordinance No*. *1692:***

Table 12: Water Rates

Water Rates – ¾" Residential Tap		
Block 1	0 – 1,500 gallons	$36.57 minimum charge
Block 2	1,501 – 3,000 gallons	$5.87 per 1,000 gallons
Block 3	3,001 – 6,000 gallons	$6.08 per 1,000 gallons
Block 4	6,001 – 10,000 gallons	$7.43 per 1,000 gallons
Block 5	10,001 – 15,000 gallons	$8.20 per 1,000 gallons
Block 6	15,001 – 21,000 gallons	$9.32 per 1,000 gallons
Block 7	➢ 21,000 gallons	$10.35 per 1,000 gallons
Water Rates – 3/4" Commercial Tap		
Block 1	0 – 3,000 gallons	$45.41
Block 2	3,001 – 6,000 gallons	6.08 per 1,000 gallons
Block 3	6,001 – 10,000 gallons	$7.43 per 1,000 gallons
Block 4	10,001 – 15,000 gallons	$8.20 per 1,000 gallons
Block 5	15,001 – 21,000 gallons	$9.32 per 1,000 gallons
Block 6	➢ 21,000 gallons	$10.35 per 1,000 gallons

Table 13: Water Rates for Taps Greater than ¾"

Greater than ¾" Tap Water Rate Block Volume Definitions (gallons)						
Tap Size	First Block Minimum Charge	Second Block $7.26 per 1k gallons	Third Block $8.66 per 1k gallons	Fourth Block $9.54 per 1k gallons	Fifth Block $10.89 per 1k gallons	Sixth Block $11.99 per 1k gallons
1"	0 – 6,000 $94.59	6,000 – 12,000	12,001 – 20,000	20,001 – 30,000	30,001 – 42,000	>42,000
1.5"	0 – 13,500 $210.87	13,501 – 27,000	27,001 – 45,000	45,001 – 67,500	67,501 – 94,500	>94,500
2"	0 – 24,000 $379.55	24,001 – 48,000	48,001 – 80,000	80,001 – 120,000	120,001 – 168,000	>168,000
3"	0 – 52,500 831.37	52-501 – 105,000	105,001 – 175,500	175,001 – 262,500	262,501 – 367,500	>367,500
4"	0 – 90,000 $1,418.74	90,001 – 180,000	180,001 – 300,000	300,001 – 450,000	450,001 – 630,000	>630,000
Above 4" For any tap larger than 4" the water rates are to be established by the contract between the user and the City of Fountain.						

Review and Revision: The City routinely reviews water rates and tap fees, implementing rate changes when required. It utilizes the following six principles to assess the water rate structure:

1. Water System should be financially self-supporting
2. Water rates and tap fees should be fair and equitable
3. Water rates should promote conservation
4. Water quality must meet health standards
5. System investment needed to properly plan for growth
6. New customers should pay for costs they generate

Yearly budget workshops and hearings are conducted at the senior staff level and are presented as recommendations from the Utilities Management to the City Council for adoption. Utilities Management conducts a bi-annual review of the water rates, tap fees and any recommended revisions to the current tap fee schedule. This is then presented to City Council for adoption.

Water Efficiency Oriented Tap Fees

The tap fee and rate structures detailed below satisfy the requirement C.R.S 37-60-126 (4.5). The City annually performs a review of its water rates and tap fees, implementing rate changes when required.

The City charges a one-time water tap fee to all contractors/builders, property owners or annexed entities (residential or commercial) wanting to tap into the water infrastructure system. This tap fee charge is based on the size of the meter to be used. Most residential users have a ¾" meter, which is considered the standard size. The chart listed below reflects the current water tap fee rates based on the size of meter installation:

Table 14: Water Tap Fees

Water Tap Fees			
Tap Size	Infrastructure Fee	Water Acquisition	Total Connection Fee
¾”	$10,824	$6,500	$17,324
1”	$19,279	$11,577	$30,856
1.5”	$42,530	$25,539	$68,070
2”	$47,433	$28,483	$75,916
3”	$110,819	$66,545	$177,364
4”	$193,740	$116,341	$310,081
¾” Each Unit Multifamily	$6,173	$3,640	$9,813
Above 4” For larger than 4” water rates are to be via contract between user and City of Fountain.			

Water Conserving Tap Fee Incentive: The City has issued a water conservation incentive for ¾” metered residential lots reflecting ***City Ordinance No. 1626.*** Introduced in 2013, this program awards new build properties a lowered tap fee in exchange for their commitment to water conservation through a low water use landscape. In order to receive a lowered tap fee, builders were provided the option to limit the amount of turf installed at a property to either 30% or 50% of the pervious area. Traditional homes typically install turf throughout the entirety of their pervious surface. In considering that 40% of household water is used towards irrigation, this incentive provides substantial savings to the customer, while reducing demand. The savings resulting from the lowered tap fee are then passed along to the home buyer in the purchase of their new home, as well as all occupants thereafter. Incentive levels vary dependent upon lot size but every lot size is eligible.

Table 15: Lowered Tap Fee Incentive

Lowered Tap Fee Incentive			
Lot Size Square Footage	Water Acquisition Fee	Water Acquisition Fee with Conservation Incentive: 50% or Less Irrigated Area	Water Acquisition Fee with Conservation Incentive 30% or Less Irrigated Area
< 9,000 sq. ft.	$4,875	$2,438	$1,024
9,001 – 13,000 sq. ft.	$5,688	$2,844	$1,706
Greater than 13,001 sq. ft. or larger	$6,500	$3,250	$1,950

The estimated savings below assume that 1,750 square footage of turf was otherwise avoided at each new build property. This metric was determined following analysis of pervious square footage on single family residential homes constructed after 2009. The savings also assume that these properties water a minimum of 1.5” (1 gallon) per square foot, once a week, for 20 weeks a year.

Recommended water consumption for Kentucky Blue Grass as demonstrated in the Lawn Watering Guide for Southeastern Colorado.

Square Footage X 1 gallon X 20 weeks = annual gallons saved by incentive per property

1,750 X 1 X 20 = 35,000 annual gallons saved per single family residence

Table 16: Historical Participation in Tap Fee Incentive

Historical Participation - Tap Fee Conservation Incentive			
Year	**Number of New Builds**	**Number of Participants**	**Savings assuming 50% incentive**
2013	176	5 (3%)	175,000 gallons
2014	134	9 (7%)	490,000 gallons
2015	115	43 (38%)	1,995,000 gallons
2016	128	72 (57%)	4,515,000 gallons
2017	163	127 (78%)	8,960,000 gallons
Five Year Total	**716**	**256**	49.5 Acre Feet

The table above demonstrates that since program implementation, 36% of new build properties participated in the lowered tap fee incentive for water conserving landscapes. In 2017 alone, 78% of new builds received a discounted tap fee for committing to a low turf option.

Assuming that new build properties continue at a rate of 143 a year based on the five year average from 2013-2017, and maintain a 78% participation rate (based on 2017), it is estimated that 112 properties will participate annually. This implies an average annual savings of 3,920,000 gallons.

Water Efficiency and Land Use Planning

The City of Fountain 2005 Comprehensive Development Plan address several means for managing land use in ways that promote the efficient use of water. These measures ensure the growth and development of Fountain while enhancing quality of life for present and future citizens. The Comprehensive Plan supports best management practices for water demand management and water efficiency through the following methods:

- Requirement that new residential development include low water use landscaping. This is achieved through the lowered acquisition fee incentive.

- Encourages clustered residential development to more efficiently utilize land and public services, create additional useable open space, and to mitigate adverse environmental effects. Clustering residential development reduces turf areas.
- The City encourages the use of non-potable water for irrigation of lawns, parks and open spaces.
- The City encourages that all newly developed parking lots be installed with drought tolerant vegetation – both trees and shrubs within the islands.
- New developments result in a sustainable land development pattern meaning that it can be maintained in the long term, without consuming or destroying finite resources.
- Avoids unnecessary damage to the natural environment evidenced by minimizing cut and fill and vegetation removal
- Celebrate Fountain Creek and Jimmy Camp Creek Corridors as unique resources and provide for site conservation and enhancement.

Source: Comprehensive City Development Plan 2005, 21-41.

Reuse System

The City does not have a water reuse system and does not plan to incorporate one within the timeline of this plan due to financial and staffing feasibility.

System Water Loss Management & Control

Distribution System Leak Identification

From 2007 – 2012, the City performed system wide auditory leak detection during which repairs were made as needed. As most of the City's distribution system is less than 30 years old, its water losses are primarily attributed to water theft and unmetered losses from the supply line to the meter. The City continues to investigate and repair system breaks as needed. Additionally, some areas in need of repair function under a private main followed by sub meters. The water counts towards revenue but is ultimately unused. System maintenance and estimated losses prior to repair is recorded by the Water Department following each leak detection analysis.

Tracking Water Use of High Users

The City continues to track and compile a report of its CII water users. The information is collected and assembled by the Utilities Department Data Analyst.

Water Conservation Coordinator

The City has had a full time Conservation and Sustainability Program Manager since 2009.

4.2.2 Targeted Technical Assistance and Incentives

This section explores the targeted technical assistance and incentive programs that will be offered to customers as well as performed internally in an effort to improve water efficiency. Such programs include install of high efficiency retrofits, appliance replacement and promotion of low water landscaping. These programs are extended to single family residential and CII customers.

Level 1 Utility/Municipal Facility Water Efficiency

The following water efficiency activities are under direct control of the City and have been selected for implementation.

Smart Irrigation Controllers

In 2016 the City installed one WeatherTrak smart controller at Fairview Cemetery which encompasses three acres of turf. This smart controller notifies City staff of unusual spikes in consumption which allows issues concerning irrigation breaks or stuck zones to be addressed in a timely manner. Additionally, watering schedules may be adjusted remotely while rain sensors prevent over watering during times that substantial precipitation has been received. In 2018, three additional controllers will be installed at Fountain Mesa Park (2) and Conley Park (1). Fountain Mesa Park contains approximately 43 acres of open space, 15 of which are irrigated. Conley Park contains one acre of irrigated space. The City anticipates a 25-30% reduction in water use as a result of this upgrade. Average annual water savings will be assessed approximately three years following each date of install.

Funding permitted, the City plans to install WeatherTrak controllers at its entire City maintained parks system and common areas by the end of 2019. Each controller cost varies dependent upon supply line size and number of zones. It is estimated that each WeatherTrak Controller will cost between $1,000 and $3,100. The project encompasses the following parks:

WeatherTrak Sites			
Site	**Acreage**	**2016 Annual Water Use**	**Projected Savings assuming 25% reduction**
Fairview Cemetery	3	2,438,900 gallons	609,725 gallons
Fountain Mesa Park	15	4,452,700 gallons	1,113,175 gallons
Conley Park	1	288,630 gallons	72,158 gallons
Metcalfe Park (non-potable)	41.44	8,065,000 gallons	2,016,250 gallons
Aga Park	11.83	648,639 gallons	162,160 gallons
Heritage Park	2.63	37,100 gallons	9,275 gallons
Hibbard Park	4.80	1,080,400 gallons	1,080,400 gallons
Mayor / Veterans	.38	171,089 gallons	42,772 gallons
Total	**80.08**	**17,182,458 gallons**	**5,105,915 gallons**

Table 17: WeatherTrak Use and Projected Savings

These installments will demonstrate the City's commitment to efficient outdoor water use and as a result, promote participation in the rain sensor rebate program among customers. Water usage to these areas will be monitored and evaluated for savings for the first five years following install. This data will be tracked by the Utilities Analyst and savings identified by the Parks Superintendent. This will occur within the first quarter of the following year for five years.

Irrigation Assessments

Fountain's entire City maintained irrigation system is audited monthly. Internal staff performs this evaluation which encompasses backflow compliance, line breaks, malfunctioning heads and agreeable soil moisture content. Updates to watering schedules and repair are performed as needed.

Level 2 & 3 Management of Largest and Remaining Customer Demands

The City is expanding the scope of its rebate incentive program to encompass a broader variety of water and energy saving devices. Estimated participation rates and predicted savings are explored in the table and figures below. The number of program participants, demand data, estimated savings, relevant public feedback and program costs will be monitored by the Conservation Program Manager on a monthly basis and evaluated during the first quarter of each following year.

Projected Incentive Participation Rates & Savings					
Year	Washing Machines Replaced / Gallons saved	EnergyStar Dishwashers Replaced/ Gallons saved	Showerheads Replaced / Gallons saved	Toilets Replaced / Gallons saved	Weather-Based Irrigation Controller/ Gallons saved
2018	60 240,000	50 52,250	50 897,900	50 1,389,920	50 700,000
2019	50 440,000	50 104,500	50 1,795,800	50 2,779,840	50 1,400,000
2020	40 600,000	50 156,750	50 2,693,700	40 3,891,776	50 2,100,000
2021	30 720,000	45 203,775	50 3,591,600	30 4,725,728	45 2,730,000
2022	20 800,000	40 245,575	50 4,489,500	30 5,559,680	40 3,290,000
Total savings over 5 years	**200 appliances 2,800,000 gallons saved**	**235 appliances 762,850 gallons saved**	**375 fixtures 13,468,500 gallons saved**	**200 devices 18,346,944 gallons saved**	**235 sensors 10,220,000 gallons saved**

Table 18: Projected Incentive Participation Rates and Savings

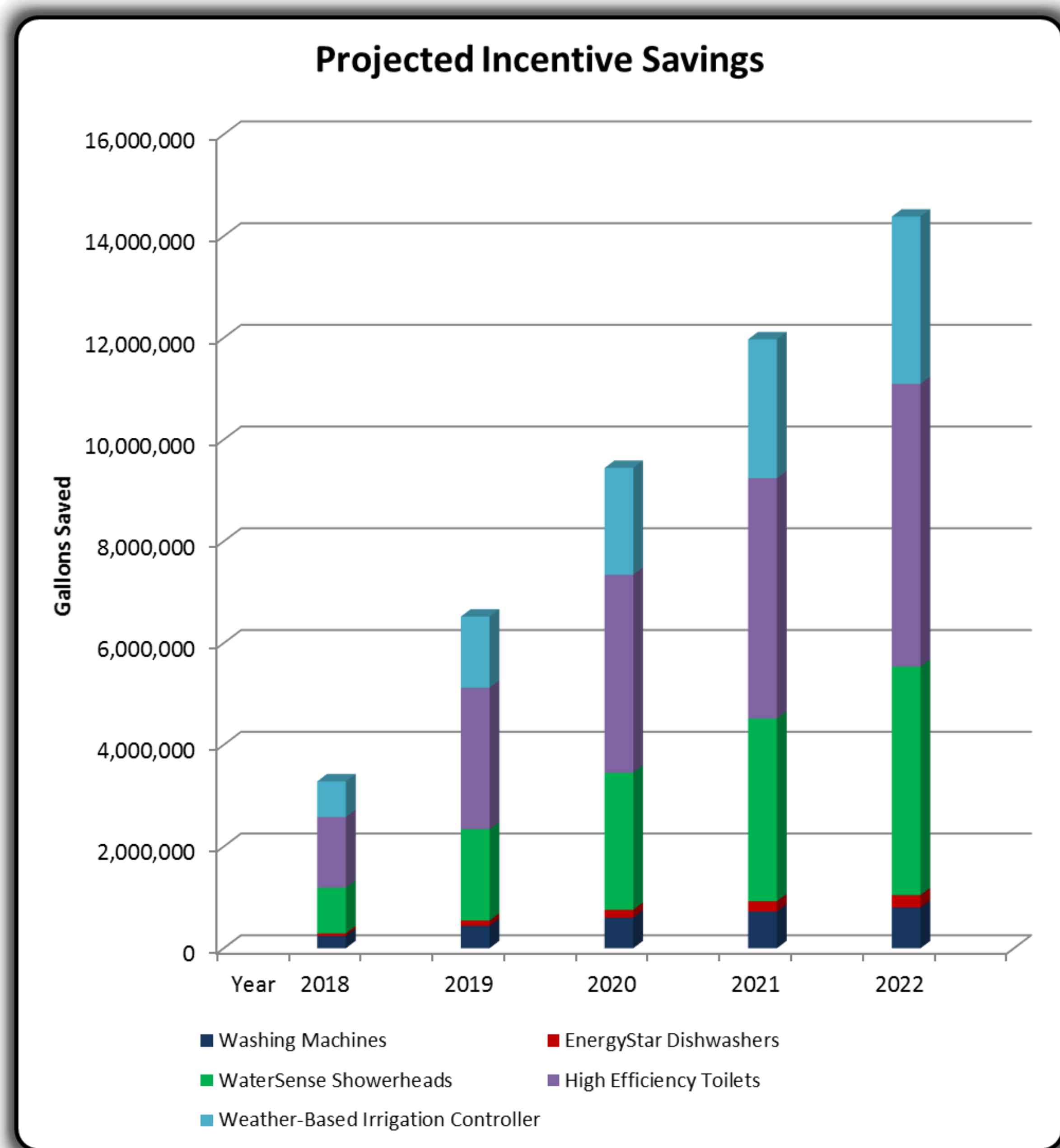


Figure 9: Projected Savings per Incentive Category

WaterSense Toilets

This program began in 2009 and is currently offered to residential customers and commercial customers on a case-by-case basis. By replacing a toilet that was manufactured in 1994 or earlier with a 1.28 GPF WaterSense certified toilet, customers are eligible for up to a $100.00 rebate per fixture. Maximum rebate is for no more than two toilets per household. The calculations demonstrated in the Table 18 and Figure 9 assume that two 1.28 GPF or less toilets are replacing two 4.0 GPF toilet in a four person household. According to the table located under the Demographics section of this report, 40.81% of residential properties were built prior to 1994. This data combined with our rebates issued to date, demonstrates that there is still significant savings opportunities associated with this incentive. Similar to other incentive programs, participation has steadily declined since 2012. The Conservation Manager will continue to test new means of promoting this incentive and gaining participation. Specifically it will expand outreach to commercial property owners. The projected savings in the table below assumes that the average four person household is flushing 28 times a day.

Number of flushes a day X Water savings of retrofit X days in a year = Annual savings

28 X 2.72 X 365 = 27,798.4 gallons saved annually.

Showerheads

This program began in 2014 and as of November of 2017 has had 1,042 retrofits exchanged and approximately 51,267 gallons saved. In October of 2017, the Conservation Manager executed an aggressive showerhead exchange program promoting via newsletter, social media, flier and monitors in City Hall and the Customer Service Lobby. In an effort to improve program participation, both the Fountain Recycling Center and the Customer Service Lobby were established as exchange locations. This approach encouraged visits to both locations and face to face customer interaction with clients that typically do not visit these locations. Moving forward, CII customers will be targeted. The calculations demonstrated in the table 18 above assume that three, 1.5 GPM or less showerheads are replacing three, 3.0 GPM showerheads in a four person household with the average shower lasting 8.2 minutes.

Savings of retrofit X household size X average shower length X days in a year = annual gallons saved per household

1.5 X 4 X 8.2 X 365 = 17,958 annual gallons saved per household.

EnergyStar Washing Machines

This program began in 2009 and is offered to residential customers and commercial customers on a case-by-case basis. By purchasing a brand new EnergyStar washing machine, utility customers are eligible for up to a $100.00 rebate per residence in a lifetime. The savings predicted in the table below assume that an EnergyStar certified washing machine which uses 13 GPL or less is replacing a 23 GPL device and approximately 400 loads of laundry per household each year. In consideration of age of housing stock, the GPL of the fixture being replaced could be higher. This was adjusted to 23 GPL assuming that this appliance is less likely to stay with the property in comparison to refrigerators or automatic dishwashers. Due to fluctuating outreach efforts, participation in this program has steadily declined since 2012, losing approximately 10 participants annually. In consideration of census data and age of housing, it is unlikely that we have saturated the market and therefore will continue to offer this program until 2023 with an improved outreach campaign. The program will be reevaluated at this time.

Energy Star Clothes Dryers

This program's implementation is scheduled to occur in 2018. Program details and eligibility requirements will be similar to those required for the EnergyStar washing machines. Although this device is specific to energy savings, the incentive will encourage a holistic approach to sustainability while promoting the connections between water and energy conservation.

WaterSense Automatic Dishwasher

The Conservation Manager will determine program eligibility requirements, establish dedicated funds, and finalize the rebate application and process by the end of 2018. According to the Alliance for Water Efficiency, the average US household averages 110 dish loads annually (Alliance for Water Efficiency, 2017). Dishwashers manufactured prior to 1994 average 10-15 gallons per load while current EnergyStar certified dishwashers use 5.5 GPL or less (Alliance for Water Efficiency, 2017).

Assuming that an EnergyStar certified dishwasher using 5.5 GPL is replacing a standard machine using 15 GPL at 110 cycles per year, average household savings equates 1,045 GPY. The housing stock information detailed in the demographics section of this report identifies 41% of Fountain properties as having been built prior to 1994. This presents a significant water and energy savings opportunity among residential and CII customers.

Additionally, the energy and water savings associated with this appliance demonstrates the City's holistic approach to sustainable initiatives. The promotion of automatic dishwashers will encourage a behavioral shift away from inefficient hand washing. The Conservation Manager will be responsible for tracking number of participants and water savings.

Weather-Based Irrigation Controller

This program's implementation is anticipated to occur in 2018. Program details and eligibility requirements are yet to be determined. In Fountain, 40% of our potable water is used for irrigation. As a primary use for the City's water supply, this incentive will achieve substantial savings for its customer base. In considering that smart controllers are not required for new build properties; it is predicted that less than 5% of our single family residences have this device. For this reason, the City anticipates a high participation rate in this incentive program. It is likely to exhaust its allotted funding for the first three years following its introduction.

Assuming that single family residential homes 1. Average 3,500 square feet of irrigated turf; 2. Water a minimum of 1.5" (1 gallon) per square foot, once a week, for 20 weeks a year and 3. Fountain maintains 15" of annual precipitation.

Recommended water consumption for Kentucky Blue Grass as demonstrated in the Lawn Watering Guide for Southeastern Colorado.

Square Footage X 1 gallon X 20 weeks = annual gallons used towards irrigation per single family residence.

3,500 X 1 X 20 = 70,000 annual gallons used towards irrigation per single family residence

Consider that Fountain receives an average of 15” of precipitation each year. In recognizing that precipitation will not always be received in an amount adequate enough to override a scheduled watering event, the data detailed below assumes a 20% (14,000 gallons per single family residence) savings as a result of smart controller/rain sensor install. Assuming program funds are exhausted in their entirety for the first three years of program implementation and steadily decline in the years to follow, it is predicted that 235 smart controllers will be installed by the end of 2022, saving 10,220,000 gallons over five years. There is some variability within this estimate as customers may install new irrigation systems where they did not have a preexisting one. This implies that although the client is now watering smarter, they could be using more water that before.

Cost estimates for this program are yet to be determined. For this reason, the number of potential annual rebates may be limited to less than the amount predicted in this plan.

4.2.3 Ordinances & Regulations

This section describes the City’s ordinances and regulations regarding local policies which support the efficient use of water. Worksheet F from the CWCBs guidance documents was used to evaluate and present the City’s regulatory activities in accordance with C.R.S. 37-60-126 (4). This is demonstrated as Table F in Appendix C.

Level 1: Existing Service Area

The following ordinance and regulation goals are monitored by the Conservation Program Manager on an annual basis and evaluated during the first quarter of the following year. This includes demand data, estimated savings, public feedback and implementation costs.

Voluntary Water Restrictions

In 2009 Fountain City Council adopted resolution encouraging voluntary water restrictions between June and September each year thereafter. In a further effort to control demand, occupants are encouraged to limit outdoor watering to three days a week. Similarly, all community members are encouraged to limit outdoor watering to between 10:00 pm and 7:00 am to reduce water lost to evaporation and maintain healthy lawns. These water saving practices apply to all customer category types. They are promoted through the monthly water bill newsletter, LED signs throughout the city, the city website, social media and hard copy handouts.

By recommending limited watering schedules, property owners are promoting deep root growth of their plant material and therefore its resiliency. This effort promotes beautification of the Fountain Community, efficient water use and steadies demand. Moving forward, the City aims to improve its educational efforts by incorporating water waste reduction into this campaign as well as overspray limitations. Estimated savings of this goal is difficult to quantify.

Water Waste Ordinance

The City does not have a specific rule, regulation or ordinance that prohibits or punishes water waste. The City assembled all of the ordinances and rules for the Water Utility in the area of the City Code known as the Utility Code, which consists of Chapter 3.16 in the Municipal Code. There are measures regulating and prohibiting theft or tampering with meters, but there is no specific prohibition or definition of waste. Preparation and introduction of a Water Waste Ordinance to be presented to the City Council for consideration will be included as part of the Goals and Objectives of the Water Department in calendar year 2019. Adoption requires the consent and approval of a majority of the City Council. Implementation of a Water Waste Ordinance presupposes approval by the City Council. If this Ordinance is not approved by Council, it will not be implemented or enacted.

Unless and until such an Ordinance is approved and implemented, there will be no water savings quantified as a result of this Goal. Even when such an Ordinance is in place the consistent and repeatable savings is difficult, to predict. While it is recognized that incident-related water curtailments are occasionally necessary (and that these instances are direct response to timely supply constraints), a consistent savings is not predicted as a result of implementing such a regulation.

Upon implementation of such a regulation, the Conservation and Sustainability Program Manager will review the effectiveness of the water waste rule on a regular basis (not to exceed once every two years) to assess the viability and the actual water savings of the ordinance.

Level 2: New Construction Regulations

Landscape Requirements

The City enforces minimum standards for landscaping and site design. The City encourages developers and landowners to exceed minimum standards whenever possible. All lots in all zoning districts not covered by impervious materials shall be landscaped to prevent land erosion, improper drainage, and damage to properties and unsightliness. All undeveloped building areas within partially developed commercial or industrial uses shall be landscaped with a ground cover to control dust and erosion.

- **Approved Landscape Materials:** Selection of plant materials shall be based upon Fountain's climate and soils. Native vegetation or low water usage vegetation on water conserving design concepts shall be used whenever possible. Minimum sizes and other requirements for plant material shall be as follows:
    1. Deciduous trees: Two and one half inch (2 ½") caliper.
    2. Evergreen trees: Six feet (6'). Shrubs: Five (5) gallon containers.
    3. Ground cover/perennial sizes shall be selected according to growth rate, spacing and the area to be covered,
    4. Thorne plant material shall not be located adjacent to public walks.
    5. Clear space above public walks shall be nine feet (9') or greater.
    6. Artificial plants shall not be used to comply with the requirements of this section.
    7. No more than fifty percent (50%) of an area can be covered by non-living landscaping material.
    8. The planting of any trees of the Ulmus genus (elm) is prohibited.

The review process for CII properties is codified but the use of low water requiring plants is not mandatory for single family dwellings by City Code. The City strongly encourages the installation of low water plants among all customer categories. By changing the type of plants used in landscaping, the City can eventually realize substantial water savings over typically landscape scenarios. The City aims to further promote low water landscape conversion through classes and demonstration beds. Classes will allow community members to attend seminars addressing water saving landscape design methods.

Currently, the City Code Title 17, Chapter 17.37 (Landscaping, Fencing and Screening), Section 17.370 (Landscaping Requirements) requires an intense level of site landscaping. In commercial and industrial settings, this has required development to install a water service for land uses that otherwise have no reason to use municipal water. Although these regulations are stated to be a minimum requirement and even though some language in this section addresses low water use plantings, the preamble to this section states, “The City encourages developers and landowners to exceed these minimums whenever possible.” This goal is to adopt a zoning regulation for site landscaping that respects the water conservation goals of the City while maintaining the visual, aesthetic and screening aspects of the spirit of the land use regulations.

The measure of effectiveness in attaining this goal will be the City adopting a change in the City Code that addresses sustainable landscaping as a land use regulation. Initiation of this Goal is anticipated to occur in calendar 2018, with completion of the adoption of revised developmental regulations in the various City of Fountain land use codes to address required water use reduction to be adopted in late 2019 or early 2020.

The effect of accomplishing this goal will not immediately be seen, since this addresses development and construction projects from the adoption of the appropriate regulations forward. The projected water savings realized by implementing a mandatory sustainable landscaping ordinance or regulation will be estimated by first determining the number of new CII sites and residential lots in subdivisions that incorporate low water demand landscaping. Pending approval and specifications demonstrated through the ordinance, projected new builds and their corresponding square footage will be used to determine savings at the time of incorporation.

After adoption of the revised City Code, the City shall continue to assess the effectiveness of the water conservation provisions under the revised City Code. This assessment shall include a comparison of Fountain’s total per capita use rates before and after the City Code change. This review shall be performed every year.

Low Water Turf

For applications that require turf grass, the City encourages the use of fine-bladed, turf type, tall fescue, fine fescue, or other similar type of turf grass for general and lawn use. By using the turf grasses mentioned above, the irrigation requirement for the lawn will be reduced. Both the tall and fine fescues are more drought resistant than Kentucky bluegrass cultivars. This is not a codified standard or ordinance but a voluntary standard. The City will continue to encourage this aspect of landscaping, which can include upwards of 12 CII sites annually.

Moving forward, we will work with City Council and the HBA towards establishing improved landscape standards for new build properties to promote low water landscapes that beautify the community as well as reduce demand through efficient irrigation. These conversations will begin in 2018. Once standards are determined, estimated water savings will be calculated.

Irrigation Requirements

As mentioned previously, approximately 40% of Fountain's potable water is used towards irrigation. For this reason is it vital to establish irrigation standards for new building stock to promote efficient water use. The City will work with the HBA to determine appropriate standards. Together they will assess needs and requirements of items such as but not limited to irrigation heads, check valves and smart controllers/rain sensors. These conversations will begin in 2018. Once standards are established, projected water savings will be assessed.

Level 3: Point of Sales Ordinances on Existing Building Stock

Regulations covering existing building stock were not carried through to evaluation. See Table F in Appendix C for details.

4.2.4 Education Activities

This section explores the education and outreach programs used to promote water efficient habits throughout the community. It includes classes, informational handouts, interactive resources and activities which empower the community with the tools and knowledge to improve water efficiency at home or at their business. In accordance with C.R.S 37-60-126 (4) the proposed education activities were fully evaluated. These activities were evaluated using Worksheet G, provided by the CWCB guidance document. This can be found as Table G in Appendix C. Activities selected for implementation are detailed below.

For a majority of the education activities selected it is difficult to quantify savings. Those participating in an online class or in person workshop will be requested to complete a survey. Included in this will be specific questions inquiring if 1. The participant changed their water use habits as a result of the course; 2. Observed water savings through their bill; 3. Completed fixture or equipment upgrades as a result of the class.

Level 1 One-Way Education Activities

The City will use a variety of outreach methods to promote its programs and participation rates.

Conservation & Sustainability Website

The City has maintained a page dedicated to Conservation and Sustainability prior to last Water Efficiency Plan Revision in 2009. In October 2017, the City completed a website revision which improved navigability, aesthetics and overall content.

This page contains:

- Rebate applications for water saving appliances and retrofits
- Water and Energy saving tips
- Links to online tools used to assess indoor and outdoor water use
- Recommended outdoor watering schedule
- The Water Efficiency Plan
- Websites visits will be tracked by the City's Community Engagement Manager on an annual basis.

Educational Materials

Promotional conservation handouts such as pamphlets, brochures and guides will be made available to the public through the Customer Service Center, events, newsletters, mailers and by request. These publications will include facts, tools and program details that will empower recipients to conserve water and save money. In 2017, The City became a WaterSense partner, gaining access to their pre-generated educational materials. With limited Conservation staff, these resources will prove invaluable to the utility provider in promoting water efficiency. These materials will encourage efficient indoor and outdoor use, targeting all customer types. Newsletter topics and mailer themes will be tracked, while deliveries are quantified. The Conservation Manager will perform update tracking on a monthly basis.

Level 2 One-Way Education with Feedback

Social Media

In an effort to expand participant base - events, promotional campaigns and all incentive programs will continue to be promoted via the City's shared social media outlets including Facebook, Twitter and YouTube. Fountain Utilities has a page dedicated to sustainability, energy and water conservation programs. These campaigns will target all customer types. The Conservation Program Manager will track views, comments and clicks as a measure of success.

Events

The Conservation & Sustainability Program Manager will participate in at least 6 outreach events a year. During these events, she will distribute resources, promote programs and answer questions regarding conservation efforts and otherwise. The audience attending events will likely consist of residential and CII customer types. Materials provided for these events will cater to these customer categories. The Conservation Manager will track events attended, number of booth visitors and giveaways awarded at each activity as a measurement of success.

Online Classes

The City will incorporate an educational page to its website. This page will exhibit a variety of online classes and activities for both youth and adult audiences. The classes will be targeted towards residential and CII customers. Classes relevant to water conservation will cover topics such as:

- Perform your own home indoor water assessment
- Low Water Landscapes
- Rain Harvesting
- Composting to promote soil health

By offering online classes, the City will broaden its participation rates in conservation related programming as well as expand its efforts to a customer base not previously reached due to limited accessibility. The Conservation and Sustainability Program Manager will research software and applications suitable in meeting this need. A public survey will determine primary topics of interest among the community. From here, research and course development will be carried out. Success will be measured by survey following class participation and number of website visits. Additional metrics may be available once a software program is selected. Software assessment will begin in 2019. Assuming that suitable software has been identified and agreed upon, an interest survey will be issued during spring of 2020.

Water Returns Class

In previous years, the City partnered with the Water Returns Project. Through this partnership, a series of classes were provided at no cost to the community. These classes addressed water-saving landscape design methods, recommended plant material and irrigation revisions. Attendees received expert assistance in planning and implementing a water-saving landscape project at their homes. Clients may be asked to participate in water use monitoring following landscape changes, but are not required. Savings cannot be predicted due to varying project goals and lots sizes. Historically two classes are hosted each year, totaling 20 annual participants. This metric will continue to be tracked by the Conservation Manager.

Level 3 Two-Way Education

Housing and Building Association Meetings

Each month, senior staff of the city meets with the housing and Building Association of Colorado Springs, the utilities committee, builders, developers and design professionals whom are active in the Fountain area. These meetings are utilized to discuss regulatory affairs, upcoming city initiatives, conflict resolution and general topics between stakeholders. These conversations will continue as successful demand reduction relies heavily on structural conservation methodologies in new build properties.

Conservation & Sustainability Center

The successes of the programs detailed within this plan require a high level of customer service and improved accessibility of information. The City recognizes the growing importance of water conservation and sustainability as a whole as its community continues to grow. For these reasons, it is the goal of the City to have an office dedicated to promoting sustainability within its community. Ideally this center will exhibit various water saving methods and tools in addition to routinely hosting conservation related classes and events. Completion of this project will be highly dependent upon sufficient grant and other funding. For this reason a timeline has not been generated. If achieved, this center may promote conservation through the following methods:

Low Water Landscape

- Showcase a variety of low water landscape demonstration gardens and themes.
- Display low water irrigation options, irrigation head types, recommended clock schedules and rain sensors.

This landscape will be maintained by the Conservation & Sustainability Program Manager, interns, volunteers and community service workers. It will be accessible by the public for scheduled or self-guided tours. It will include educational signage that will identify the various plant and irrigation related installments.

Incorporating this outdoor experience will encourage community participation in the following water efficiency programs:

- Low Water Landscape conversion
- Irrigation conversion
- Smart Controller Rebates

Water Conserving Fixtures & Appliances

The center may showcase the following WaterSense and/or EnergyStar appliances and devices

- Clothes washing machine and dryer
- Dishwashing machine
- Toilet
- Faucet aerators and spray nozzles
- Showerheads
- Refrigerator

If achieved, this center will be highly interactive for visitors, allowing them to observe the benefits of installing WaterSense certified devices. It will include educational signage which quantifies water, energy and dollar savings as well as estimated return on investment.

This demonstration of indoor water and energy savings will encourage participation in the following water efficiency programs and habits:

- High Efficiency Toilet Rebate
- Showerhead Exchange Program
- Dish Washer Rebate
- Fix-a-Leak week
- Retrofitting fixtures with HE spray nozzles and aerators

If implemented, number of visitors, number of classes and quantitative feedback will be collected and evaluated by the Conservation Manager on an annual basis.

Water Use Assessments

The City plans to offer indoor and outdoor water use assessments. This will be achieved by either partnering with a local agency that provides such services or by implementing an internship program. These services will be utilized as an opportunity to promote other conservation programs and initiatives such as rebates or classes. A Water Use Assessment will be provided following customer request or recommendation by a utility representative. High bill investigations will be prioritized.

The Conservation Manager will identify potential service providers and assess feasibility of hiring and training additional staff to administer the program by spring of 2018. Following identification of estimated cost per assessment, the Conservation Program Manager will determine budgeting for this program. This will also identify how many assessments may be offered within one year. The City hopes to provide the indoor service by summer of 2018 and outdoor use assessments by summer of 2019. Depending on program implementation costs and level of interest, the City may rely on outside grant funding opportunities to satisfy this need.

Participation rates, participant feedback and water savings will be tracked and evaluated by the Conservation Program Manager on an annual basis.

Indoor Water Assessment

During an indoor assessment a representative will measure all water using fixtures in the property, while checking for leaks and rate of water loss if applicable. The representative will also record water use habits as described by the occupant. Following the assessment, the client will receive a detailed water report which identifies how much water is typically used per fixture, opportunities for savings following repair or upgrade and estimated return on investment. Participants will also be awarded water saving retrofits such as showerheads, kitchen and bath aerators based on need. Other water saving resources such as dish scrapers or leak detection dye tabs will also be provided in exchange for program participation.

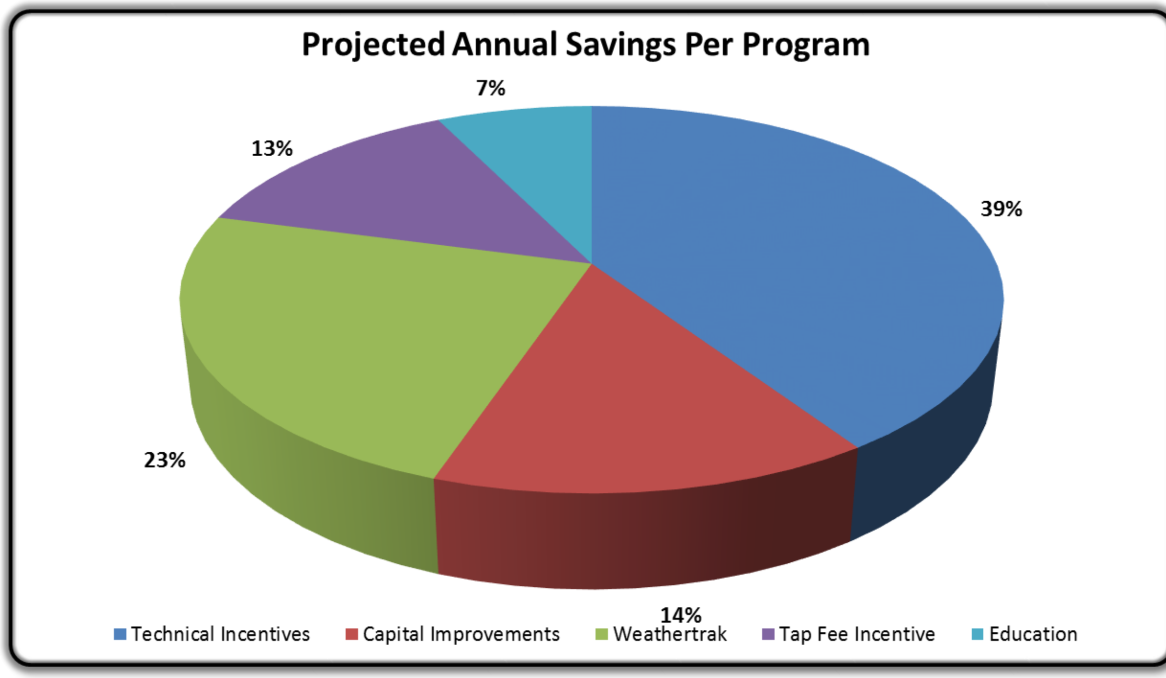
Outdoor Water Assessment

This service will allow a representative to test run the irrigation zones of a property while assessing the system for leaks, breaks or inefficiencies. The customer will receive a detailed report including recommendations for repair or upgrade to reduce water consumption.

Projected Annual Savings per Measure

The following chart and table display anticipated water savings attributed to each program category of those selected for implementation.

Figure 7: Projected Annual Savings per Measure



Projected Annual Savings per Measure

Projected Annual Savings	
Method	**Annual Savings (Acre-Feet)**
Technical Incentives	**28**
Capital Improvements	**10**
WeatherTrak	**16**
Tap Fee Incentive	**12**
Education	**5**
Total	**71**

5.0 Implementation & Monitoring Plan

5.1 Implementation Plan

As required by C.R.S. 37-60-126(4), each selected activity above has been assigned a period of implementation, actions required, milestone deadlines and staff responsible for program implementation which is detailed in its description.

The City strives to promote the efficient use of water. It aims to do so through methods such as educational outreach, incentive programs, repair/replacement programs, and equipment, landscape and building standards. These methods are not necessarily meant to limit water use but promote smart use, maintain sufficient water supplies and stable revenue. In an effort to maintain revenue stability, these programs will continue to be assessed annually with limited dedicated funds to each activity.

5.2 Monitoring Plan

In order to measure the achievements of the of the water efficiency plan, data collection and analysis must occur regularly. Templates provided in the CWCB Municipal Water Efficiency Guidance Document were used to collect and present the information required to satisfy C.R.S. 37-60-126 (4.5). Table K located in Appendix C details the list of demand data to be collected during the monitoring process and the same data that will be reported to the CWCB on an annual basis.

The Conservation and Sustainability Program Manager will compile an annual report in January of each year, summarizing the previous year's results and accomplishments. The Program Manager will meet with the Utilities Director, Water Superintendent and Customer Service Manager to review, evaluate and reassess programs at this time.

6.0 Adoption, Public Review, and Approval of Water Efficiency Plan

6.1 Adoption of New Policy

No new policies have been adopted as a result of this plan revision.

6.2 Public Review Process

A public review process is required for all State approved plans per C.R.S. 37-60-126 (5). The updated plan was made available for public review and comment via the city website over a 60 day period. This period began February 14th 2018 and ended on April 14th 2018. Two open houses were held in the Community Room at the Fountain Library on February 15th and March 14th. The open houses along with promotion of the public review and comment period were advertised through public ad in the Fountain Valley Newspaper, bill insert in the February Utilinews letter, social media posts on Facebook and flyers provided through the Customer Service Lobby. These ads can be found in section D of the Appendix. A total of 14 visitors attended the open house events. While no comments were received during the review period, visitors at the open house events expressed interest and excitement over the programs and changes proposed within this plan.

6.3 Local Adoption and State Approval Process

Local Approval

The Plan Draft was presented to the Mayor and City Council on February 13th 2018. The plan was approved by Council on May 8th 2018. A copy of the City Council Resolution can be found in Appendix D.

CWCB Approval

The Water Efficiency Plan was submitted to the Colorado Water Conservation Board for review and approval on May 9th 2018.

6.4 Periodic Plan Review and Update

Review and Revision

The City will review and update the Water Efficiency Plan every 7 years. The next review date will begin in January of 2024. All goals detailed within this plan will be monitored, reviewed and revised as appropriate as circumstances, feasibly, need and public interests continue to evolve. These periodic evaluations along with annual monitoring of the City's water demand will facilitate development of future plan updates. These goals may be discontinued or made more robust as a result of these variables as well as data monitoring and other relevant methods of measurement. If savings prove insignificant, the program will be reevaluated. The Conservation and Sustainability Program Manager is responsible for initiating and carrying out all plan updates as well as annual reporting of all previously mentioned data collection to the CWCB.

Monitoring

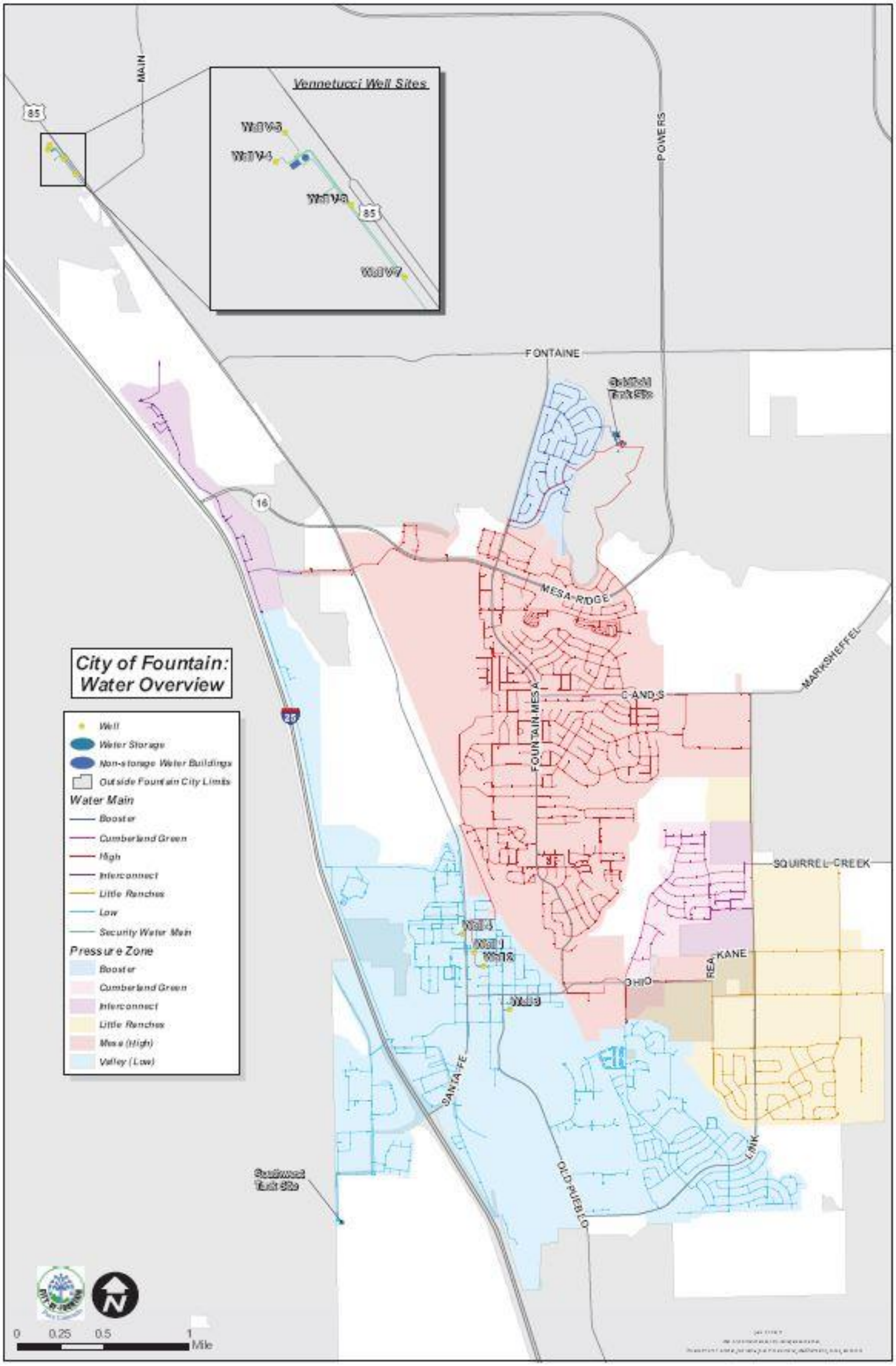
Water demands, losses and per capita use in each customer category are tracked and monitored on a quarterly basis. This overall evaluation shall be conducted on an annual basis, which will allow comparisons between years and months of similar climatic conditions. All reviews and updates of the Water Conservation Plan will be a primary assignment of the City's Conservation and Sustainability Manager with assistance from the Utilities Analyst, GIS Department and Community Engagement Specialist. Assignments and a detailed monitoring schedule can be found in Appendix C on Table K.

Appendix A

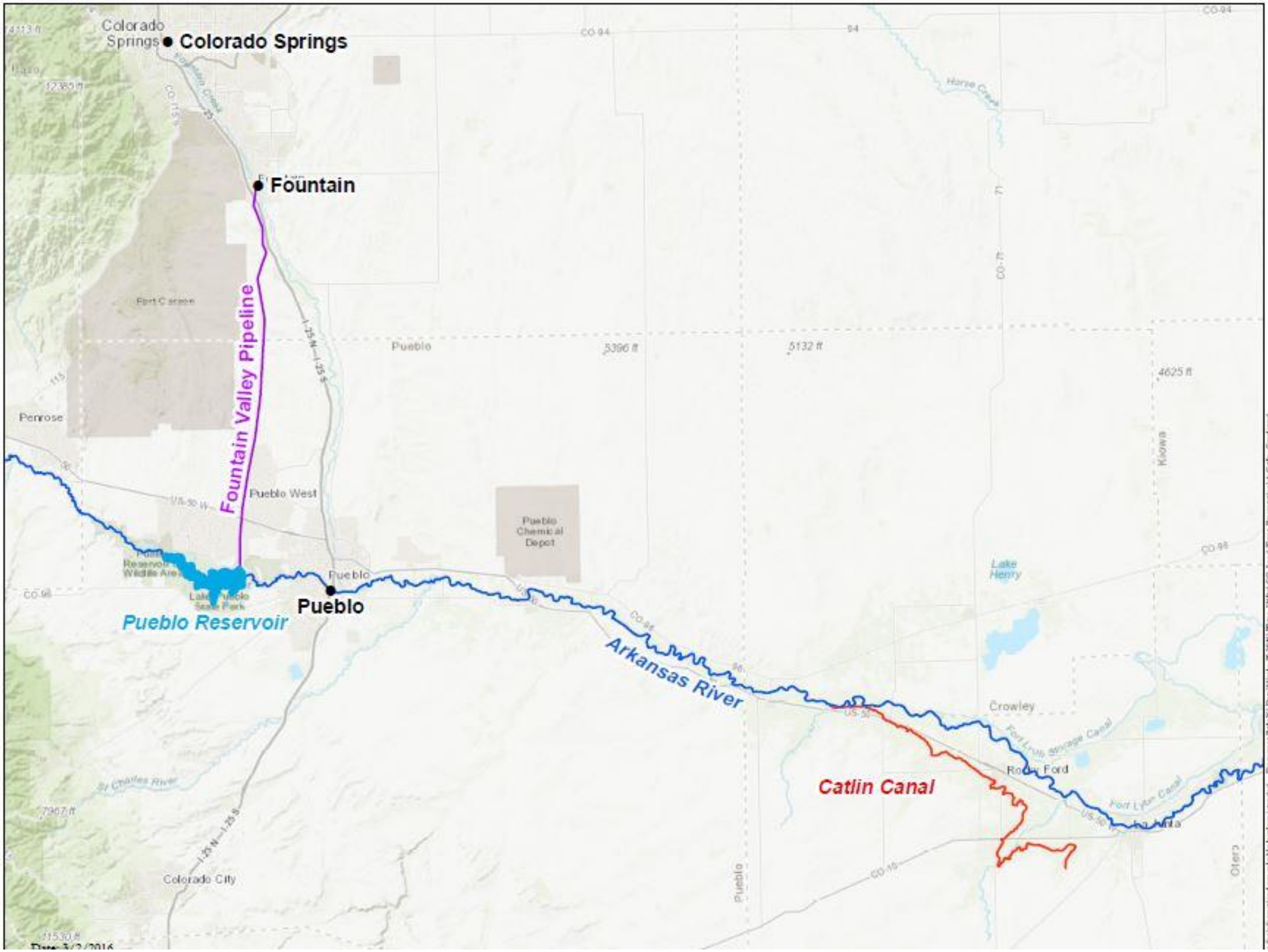
Maps

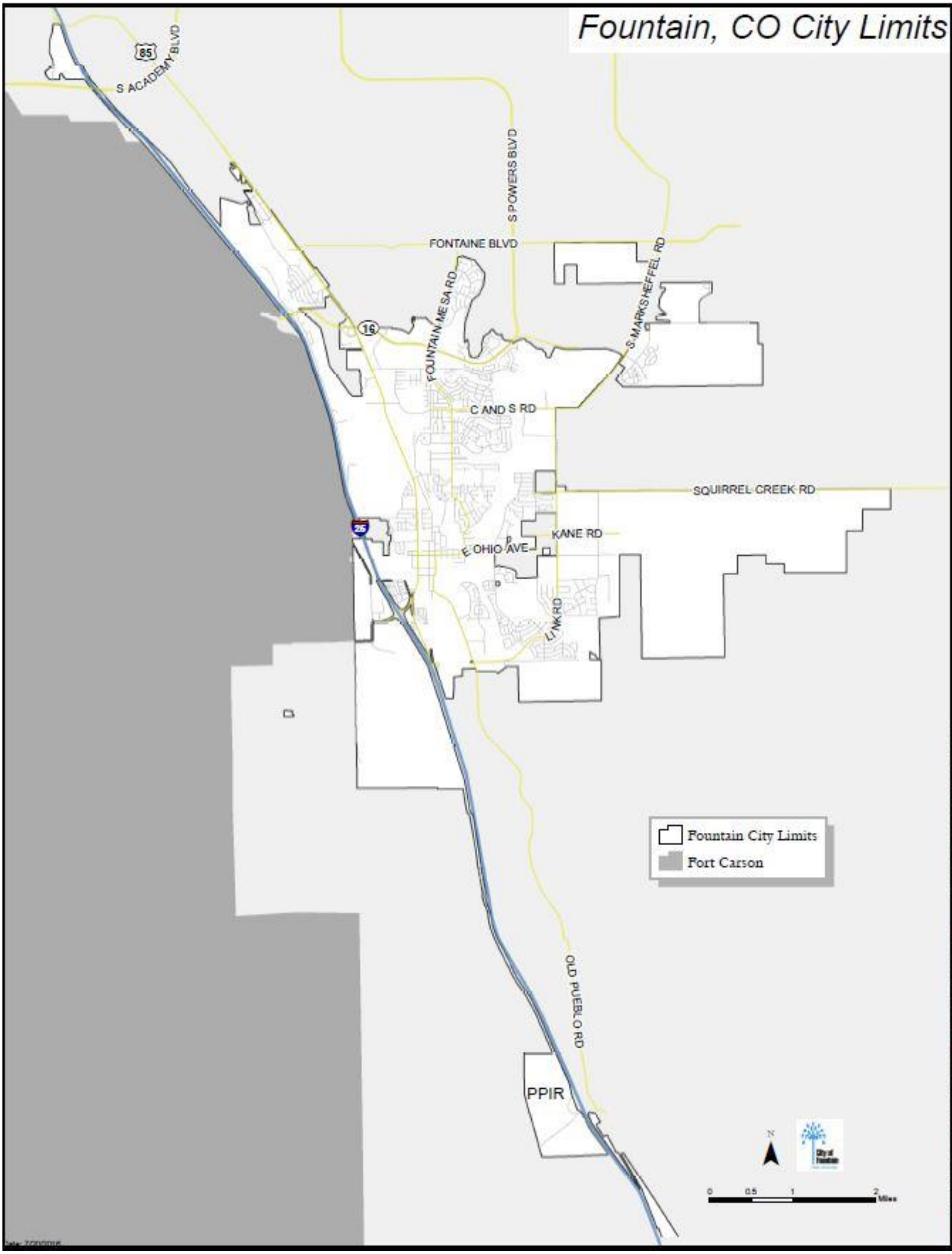
City of Fountain: Xeriscape Gardens

Map for informational purpose only. No legal use intended.

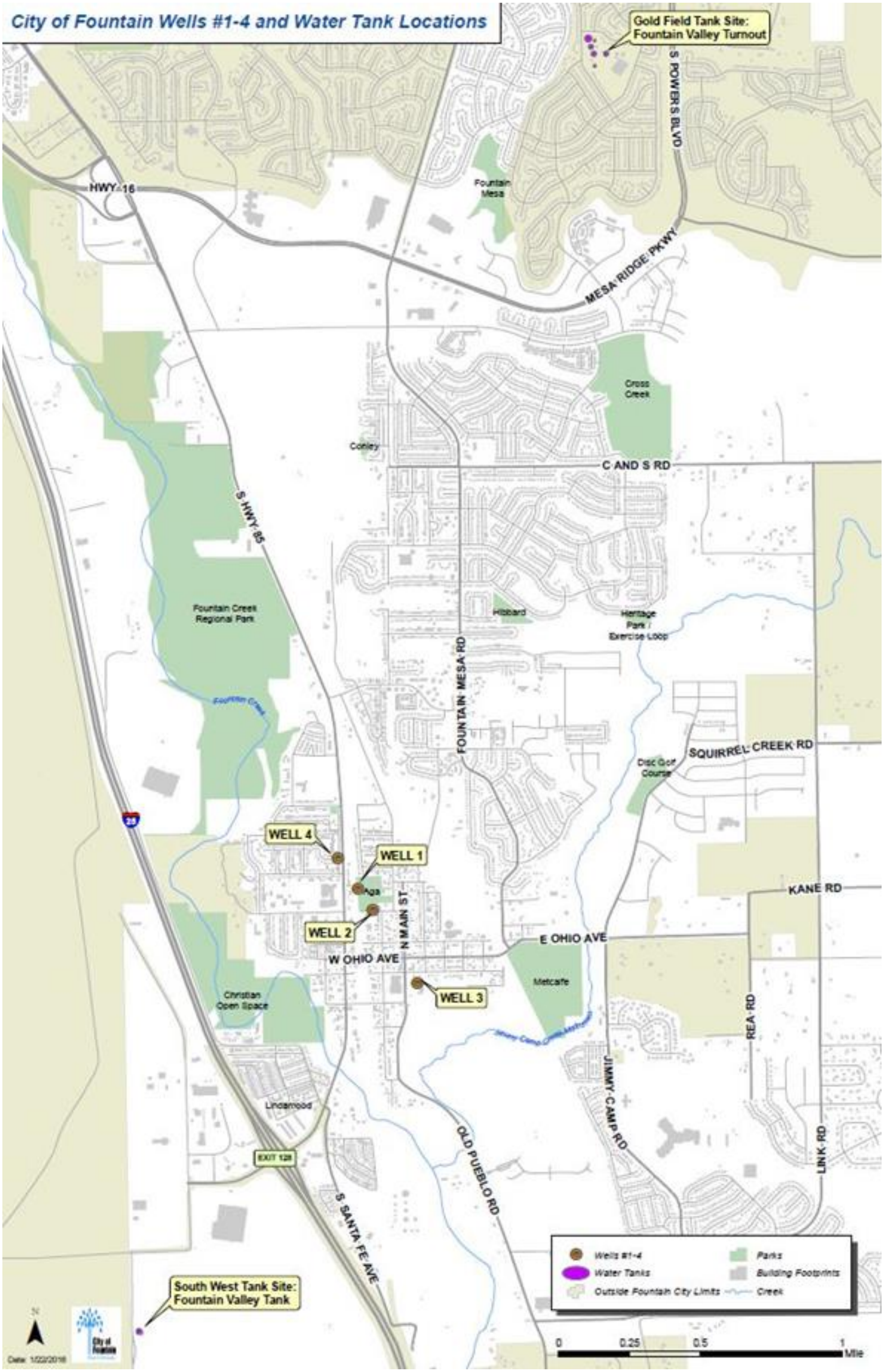


City of Fountain:
Water Overview
Vennetucci Well Sites
85
MAIN
POWERS
FONTAINE
16
MESA RIDGE
MARKSHEFFEL
C AND S
FOUNTAIN MESA
25
SQUIRREL CREEK
KANE
REA
OHIO
SANTA FE
LINK
OLD PUEBLO
Well
Water Storage
Non-storage Water Buildings
Outside Fountain City Limits
Water Main
Booster
Cumberland Green
High
Interconnect
Little Ranches
Low
Security Water Main
Pressure Zone
Booster
Cumberland Green
Interconnect
Little Ranches
Mesa (High)
Valley (Low)
0
0.25
0.5
1
Mile

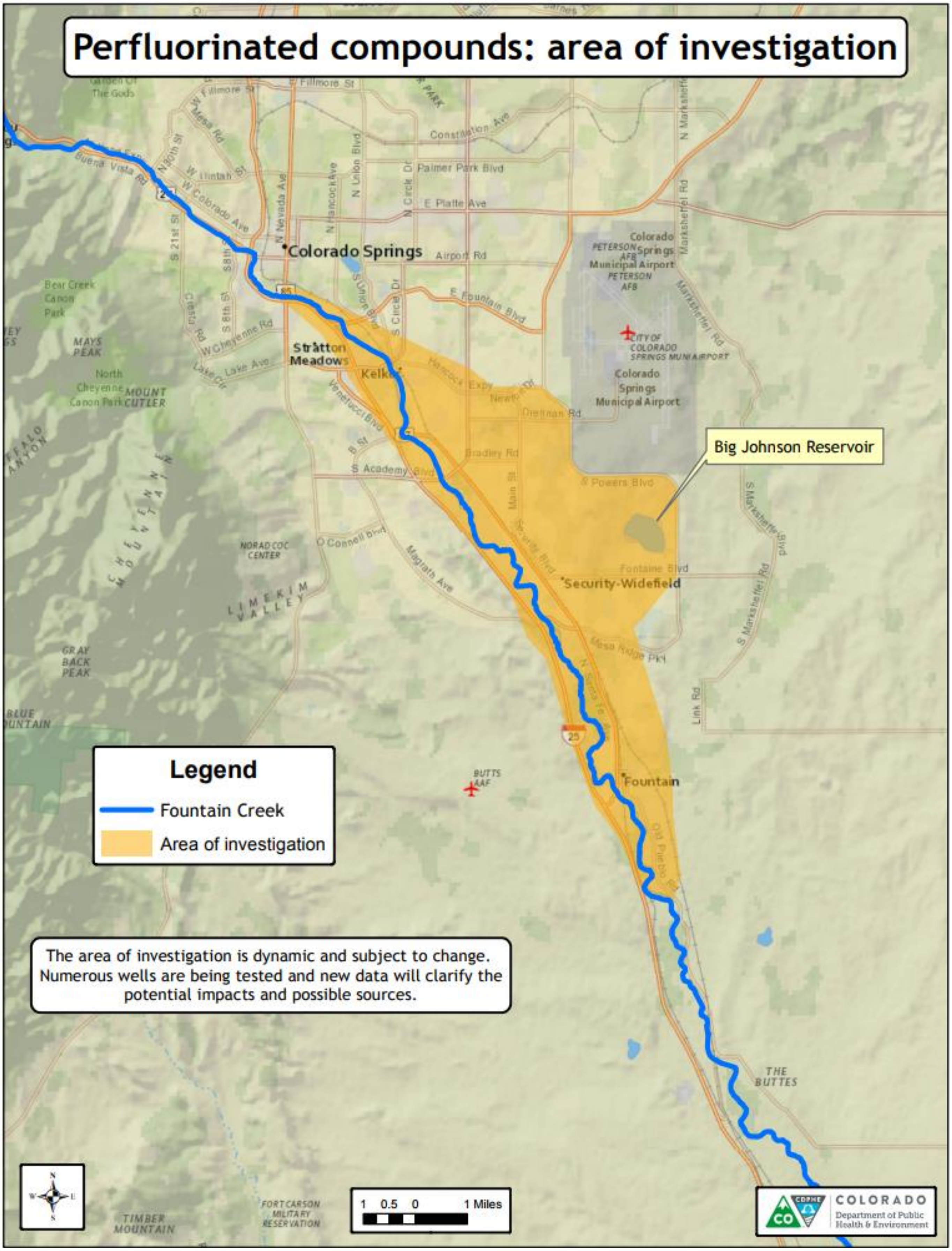

Colorado Springs
Fountain
Fountain Valley Pipeline
Pueblo West
Pueblo
Pueblo Reservoir
Pueblo Chemical Depot
Arkansas River
Crowley
Rocky Ford
Catlin Canal
Lake Henry
Colorado City
Penrose
Fort Carson
St Charles River
Horse Creek
Fort Lyon Storage Canal
Fort Lyon Canal
Kiowa
Otero
5396 ft
5132 ft
4625 ft



Fountain, CO City Limits
S ACADEMY BLVD
85
S POWERS BLVD
FONTAINE BLVD
FOUNTAIN MESA RD
S MARKSHEFFEL RD
16
C AND S RD
SQUIRREL CREEK RD
25
KANE RD
E OHIO AVE
LINK RD
OLD PUEBLO RD
PPIR
Fountain City Limits
Fort Carson
N
0
0.5
1
2
Miles



City of Fountain Wells #1-4 and Water Tank Locations
Gold Field Tank Site: Fountain Valley Turnout
S POWERS BLVD
HWY 16
Fountain Mesa
MESA RIDGE PKWY
Cross Creek
Conley
C AND S RD
S HWY 85
Fountain Creek Regional Park
Hibbard
Heritage Park / Exercise Loop
FOUNTAIN MESA RD
Fountain Creek
SQUIRREL CREEK RD
Disc Golf Course
WELL 4
WELL 1
Aga
N MAIN ST
WELL 2
KANE RD
E OHIO AVE
W OHIO AVE
Metcalfe
WELL 3
Christian Open Space
REA RD
JIMMY CAMP RD
Lindamood
OLD PUEBLO RD
EXIT 128
LINK RD
S SANTA FE AVE
Wells #1-4
Water Tanks
Outside Fountain City Limits
Parks
Building Footprints
Creek
South West Tank Site: Fountain Valley Tank
0
0.25
0.5
1
Mile
N



Colorado Department of Public Health & the Environment. *Area of Investigation,* 2017. Accessed November 15, 2017. https://www.colorado.gov/pacific/cdphe/PFCs/maps-and-data

N

Exhibit B – Irrigated Park and Open Space Areas

Feet

Map for informational purpose only. No legal use intended.

Appendix B

Water Rates, Fees and Schedules

WATER TAP FEES & WATER RATES
May 1, 2017 thru March 31, 2018

The City charges a one-time water tap fee to all contractors/builders, property owners or annexed entities (residential or commercial) wanting to tap into the City's water infrastructure system. This tap fee charge is based on the size of the meter to be used. Most residential users have a ¾" meter, which is considered the standard size. The chart listed below reflects the current water tap fee rates based on the size of meter installation:

Water Tap Fees & Water Rates			
Tap Size	Infrastructure Fee	Water Acquisition	Total Connection Fee
¾"	$10,824	$6,500	$17,324
1"	$19,279	$11,577	$30,856
1.5"	$42,530	$25,539	$68,070
2"	$47,433	$28,483	$75,916
3"	$110,819	$66,545	$177,364
4"	$193,740	$116,341	$310,081
¾" Each Unit Multifamily	$6,173	$3,640	$9,813
Above 4" For larger than 4" water rates are to be via contract between user and City of Fountain.			

The City has issued a water conservation incentive for ¾" metered residential lots reflecting ***City Ordinance No. 1626*** for the following lot sizes:

Lowered Tap Fee Incentive			
Lot Size Square Footage	Water Acquisition Fee	Water Acquisition Fee with Conservation Incentive: 50% or Less Irrigated Area	Water Acquisition Fee with Conservation Incentive 30% or Less Irrigated Area
< 9,000 sq. ft.	$4,875	$2,438	$1,024
9,001 – 13,000 sq. ft.	$5,688	$2,844	$1,706
Greater than 13,001 sq. ft. or larger	$6,500	$3,250	$1,950

The City’s water rates are broken down into blocks based on the size of the tap at each building's location and based on the amount of water being used (in gallons), which is reflected below in each block section. The principle of usage is based on the more water used after the initial 1,500 gallons, is charged at a higher price for total water usage. This method or principle is based on the tier factor as a means of water conservation; residents who use less water receive a lower price on the gallons used below 1,500 per month. The higher the use of water, the higher the cost for water used. These water rates are based on ***City Ordinance No*. *1692:***

Water Rates – ¾” Residential Tap		
Block 1	0 – 1,500 gallons	$36.57 minimum charge
Block 2	1,501 – 3,000 gallons	$5.87 per 1,000 gallons
Block 3	3,001 – 6,000 gallons	$6.08 per 1,000 gallons
Block 4	6,001 – 10,000 gallons	$7.43 per 1,000 gallons
Block 5	10,001 – 15,000 gallons	$8.20 per 1,000 gallons
Block 6	15,001 – 21,000 gallons	$9.32 per 1,000 gallons
Block 7	➢ 21,000 gallons	$10.35 per 1,000 gallons
Water Rates – 3/4” Commercial Tap		
Block 1	0 – 3,000 gallons	$45.41
Block 2	3,001 – 6,000 gallons	6.08 per 1,000 gallons
Block 3	6,001 – 10,000 gallons	$7.43 per 1,000 gallons
Block 4	10,001 – 15,000 gallons	$8.20 per 1,000 gallons
Block 5	15,001 – 21,000 gallons	$9.32 per 1,000 gallons
Block 6	➢ 21,000 gallons	$10.35 per 1,000 gallons

Greater than ¾” Tap Water Rate Block Volume Definitions (gallons)						
Tap Size	First Block Minimum Charge	Second Block $7.26 per 1k gallons	Third Block $8.66 per 1k gallons	Fourth Block $9.54 per 1k gallons	Fifth Block $10.89 per 1k gallons	Sixth Block $11.99 per 1k gallons
1”	0 – 6,000 $94.59	6,000 – 12,000	12,001 – 20,000	20,001 – 30,000	30,001 – 42,000	>42,000
1.5”	0 – 13,500 $210.87	13,501 – 27,000	27,001 – 45,000	45,001 – 67,500	67,501 – 94,500	>94,500
2”	0 – 24,000 $379.55	24,001 – 48,000	48,001 – 80,000	80,001 – 120,000	120,001 – 168,000	>168,000
3”	0 – 52,500 831.37	52-501 – 105,000	105,001 – 175,500	175,001 – 262,500	262,501 – 367,500	>367,500
4”	0 – 90,000 $1,418.74	90,001 – 180,000	180,001 – 300,000	300,001 – 450,000	450,001 – 630,000	>630,000
Above 4” For any tap larger than 4” the water rates are to be established by the contract between the user and the City of Fountain.						

Fee Schedule

The following charges shall apply to all rate classes receiving electric, water or administrative services from Fountain Utilities.

After Hours Non-Emergency Service Charge $ 50.00

<u>Customer Requested Meter Test</u>
Certified Water Meter Test $ 100.00
Electric Meter Test $ 100.00

<u>Customer Requested Water Meter Removal and Installation</u>
Meter Removed $ 75.00
Meter Installed $ 75.00

Deposits

A. Residential

Initial Deposits
Electric $ 150.00
Water $ 50.00
Waste Water $ 50.00

Additional Deposits

An additional deposit at a level of double the initial deposit will be required if the credit evaluation received by Utilities from its third party credit vendor recommends a double deposit.

Supplemental Deposits

If required (as provided in Customer Service Regulations), an amount equal to an actual 90 days' bills of the customer within the immediately preceding calendar quarter, or an amount based on an estimate of 90 days' bills, whichever is greater. If the customer does not have 90 day history with Utilities, a minimum supplemental deposit of $350 is required.

B. Non-Residential

<u>Initial Deposits</u>
An amount equal to an estimated ninety days' bills for such customer or $300, whichever is greater.

<u>Additional Deposits</u>
The dollar amount equal to the customer's highest actual consumption for 90 consecutive days in the immediately preceding six months.
<u>Supplemental Deposits</u>

If required (as provided in Customer Service Regulations), an amount equal to an actual 90 days' bills of such customer within the immediately preceding calendar quarter, or an amount based on an estimate of 90 days' bills, whichever is greater.

Diversion Fee $500.00+ repair, administrative & investigative costs, and unbilled consumption

Water Inactive Account Customer Charge, per month $ 12.50

Missed Appointment Fee (24 hour notice not given) $ 35.00

Lien

Electronic Lien Processing $ 2.00
Per Page $ 11.00

Payment

Dishonored Payment $ 40.00
Late Payment $ 10.00

Collection Fee 20% of bill

Reconnection

Regular Hours $ 40.00
After Hours $ 95.00

Trip Fee $ 35.00

Water Hydrant Deposit and Fees – Inside City Use Only

Hydrant Water Usage and Meter Deposit $ 1,300.00
Per Day Service Charge on the Meter $ 10.00
For the First 3,000 Gallons per 30 day period $ 80.00
Each Additional 1,000 Gallons $ 7.00
Non Returned Water Meter Fee (10 business days) $ 1,500.00

Appendix C

Tables

TABLE D: IDENTIFICATION AND SCREENING OF FOUNDATIONAL ACTIVITIES

Water Efficiency Activities for Screening	State Statute Requirement	Identification: Existing/ Potential Activity	Identification: Targeted Customer Category	Qualitative Screening: Public Acceptance	Qualitative Screening: Staff & Resource Feasibility	Qualitative Screening: Cost Effective	Qualitative Screening: Likelihood of Success	Qualitative Screening: Notes	Carry to Evaluation	Reason for Elimination
Metering (BP1)	V, VII									
Automatic Meter Reading Installation and Operations		E	Res, CII, Muni,	X	X	X	X			
Submetering for Large Users (Indoor and Outdoor)		E	CII	X	X	X	X			
Meter Testing and Replacement		E	Res, CII, Muni,	X	X	X	X			
Meter Upgrades		E	Res, CII, Muni,	X	X	X	X			
Identify Unmetered/Unbilled Treated Water Uses		E	All	X	X	X	X			
Data Collection - Monitoring and Verification (BP2)										
Frequency of Meter Reading		E	All	X	X	X	X			
Tracking Water Use by Customer Type		E	All	X	X	X	X			
Upgrade Billing System to Track Use by Customer Types		E	All	X	X	X	X			
Tracking Water Use for Large Customers		E	CII	X	X	X	X			
Area of Irrigated Lands in Service Area (e.g. acres)		E	All	X	X	X	X			
Water Use Efficiency Oriented Rates & Tap Fees (BP1)	VII, VIII									
Volumetric Billing		E	All	X	X	X	X			
Water Rate Adjustments		E	All	X	X	X	X			
Frequency of Billing		E	All	X	X	X	X			
Inclining/Tiered Rates		E	All	X	X	X	X			
Tap Fees with Water Use Efficiency Incentives		E	Res	X	X	X	X			
System Water Loss Management & Control (BP3)	V									
System Wide Water Audits		E	All	X	X	X	X			
Control of Apparent Losses (with Metering)		P	All	X			X			Staffing feasibility
Leak Detection and Repair		E	All	X	X	X	X			
Water Line Replacement Program		E	All	X	X	X	X			
Planning (BP2)										
Master Plans/Water Supply Plans		E	All	X	X	X	X			
Capital Improvement Plans		E	All	X	X	X	X			
Staff (BP4)										

Table E: Identification and Screening of Targeted Technical Assistance Incentives

Water Efficiency Activities for Screening	State Statute Requirement	Identification: Existing/ Potential Activity	SWSI Framework Levels: Level 1 Municipal Uses	SWSI Framework Levels: Level 2 Customers with the Largest Water Use	SWSI Framework Levels: Level 3 Customer Type(s) in Service Area	Targeted Customer Category	Qualitative Screening: Public Acceptance	Qualitative Screening: Staff and Resource Feasibility	Qualitative Screening: Cost effective	Qualitative Screening: Likelihood of Success	Notes on Additional Pros/Cons to Consider	Carry to Evaluation	Reason for Elimination
Installation of Water Efficient Fixtures and	I												
Indoor Assessments		P		X	X	CII, Res	X		X	X		X	
Toilet Retrofits		E	X	X	X	CII, Res	X	X	X	X			
Urinal Retrofits		P	X	X	X	CII	X	X		X			Not a significant amount of savings due to low participation
Showerhead Retrofits		E	X	X	X	Res, CII	X	X	X	X			
Faucet Retrofits (e.g. aerator installation)		E	X	X	X	CII, Res	X	X	X	X			
Water Efficient Washing Machines		E		X	X	CII, Res	X	X	X	X			
Water Efficient Dishwashers		P	X	X	X	CII, Res	X	X	X	X		X	
Low Water Use Landscapes	II												
Drought Resistant Vegetation Demonstration Garden		E/P	X	X	X	CII, Res	X	X	X			X	
Removal of Phreatophytes		E	X	X	X	CII, Res							
Irrigation Assessments		P	X	X	X	CII, Res	X		X	X		X	
Outdoor Irrigation Smart Controllers		P	X	X	X	CII, Res	X	X	X	X		X	
Residential Outdoor Meter Installations		P		X		CII, Res			X				Staffing and resource feasability
Low Water Use Landscape Demonstration Gardens		E/P	X	X	X	CII, Res, Muni	X		X			X	
Irrigation Equipment Retrofits		P		X	X	CII, Res	X	X	X			X	Feasible to campaign and provide demo only, will reevaluate following community interest survey
Water- Efficient Industrial & Commercial	III												
Specialized Nonresidential Surveys, Audits and Equipment Efficiency Improvements		P		X		CII	X		X				Staffing and resource feasibility
Commercial Indoor Fixture and Appliance Rebates/Retrofits		E		X		CII	X	X	X				
Restaurant equipment		P		X		CII	X						Staff and resource feasibility, small audience
Incentives	X												
Toilet Rebates		E		X	X	CII, Res	X	X	X	X			
Urinal Rebates		P		X		CII		X	X				Not a significant savings opportunity due to low participation
Showerhead Exchange		E		X	X	CII, Res	X	X	X	X			
Water Efficient Faucet or Aerator Rebates		E		X	X	CII, Res	X	X	X				Will be provided as a give away for high bill concerns, not a rebate
Water Efficient Washing Machine Rebates		E		X	X	CII, Res	X	X	X	X			
Water Efficient Dishwasher Rebates		P		X	X	CII, Res	X	X	X	X		X	
Efficient Irrigation Equipment Rebates		P		X	X	CII, Res	X		X	X			Irrigation rebates should not be awarded without first completing an outdoor water use assessment if property has prexisting system. This will be reevaluated once outdoor assessments are in place.
Landscape Water Budgets Information and Customer Feedback		P		X	X	CII, Res	X		X	X			This program will be far more successful in regards to participation and cost/benefit if offered alongside low water landscape rebates. It will be reevaluated if landscape rebates become available.
Turf Replacement Programs/Xeriscape Incentives		P		X	X	CII, Res	X		X	X			Xeriscape incentives will require pre and post inspections, precise guidelines and approved landscape design. It is not feasible at this time.
Give-aways		E				Res	X	X	X	X			

Table F: Identification & Screening of Ordinances & Regulations

Water Efficiency Activities for Screening	State Statute Requirement	Existing/ Potential Activity	Identification – SWSI Framework Levels: Level 1: Customer Type(s) within the Existing	Level 2: New Development	Level 3: Point of Sales on Existing	Targeted Customer Category	Qualitative Screening: Community Acceptance	Staff & Resource Feasibility	Cost Effective	Likelihood of Success	Notes	Carry to Evaluation	Reason for Elimination
General Water Use Regulations	IX												
Water Waste Ordinance (BP 5)		P	X			All	X		X			X	
Time of Day Watering Restriction		E	X			All			X				
Day of Week Watering Restriction		E	X			All			X				
Water Overspray Limitations		P	X			All	X		X			X	
Landscape Design/Installation Rules and Regulations	IX												
Rules and Regulations for Landscape Design/Installation (BP 9)		E		X		Res, CII		X	X	X			
Landscaper Training and Certification (BP 8)		P		X		Res, CII	X			X			This will not be cost effective until additional landscape requirements are in place. This will be reevaluated following success of landscape requirements
Irrigation System Installer Training and Certification (BP 8)		P		X		Res, CII	X			X			This will not be relevant until irrigation requirements, outdoor assessments an rebates are in place and evaluated
Soil Amendment Requirements (BP 9)		P		X		Res, CII		X	X	X			Will be reevaluated once standard landscape requirements are improved.
Turf Restrictions (BP 9)		E	X	X		Res,CII			X				
Irrigation Equipment Requirements		P		X		Res, CII		X	X	X		X	
Irrigation Efficiency Regulations (BP 10)		P	X			Res, CII	X		X	X		X	
Outdoor Green Building Construction (BP 8,9)		P		X		Res, CII							This initiative should begin following adaptation and assessment of improved irrigation requirements, outdoor assessments and evaluation of these programs. This will be reevaluated at that time.
Indoor and Commercial Regulations	IX												
High Efficiency Fixture and Appliance Replacement (BP 12)		P	X			Res, CII	X	X	X	X			Staff feasibility
Commercial Cooling and Process Water Requirements (BP 14)		P	X			CII	X			X			Staff and resource feasibility
Green Building Construction (BP 12)		P		X			X		X				Staff and resource feasibility
Indoor Plumbing Requirements (BP 12)		E		X		All	X	X	X	X			
City Facility Requirements (BP 12)		E	X			Muni	X	X	X	X			
Indoor Residential Audits (BP 13)		P	X			Res, CII	X					X	
Indoor Commercial Water Assessments (BP 14)		P	X			Res, CII						X	
Commercial Water Wise Use Regulations (Car Washes, Restaurants, etc.)		P	X			CII							Staff and resource feasibility

Table G: Identification & Screening of Education Activities

Water Efficiency Activities for Screening	State Statute Requirement	Existing/ Potential Activity	Level 1 One-Way	Level 2 One-Way with Feedback	Level 3 Two-way communication	Targeted Customer Category	Community Acceptance	Staff/Resource Feasibility	Cost Effective	Likelihood of Success	Notes on Additional Pros/Cons to Consider	Carry to Evaluation	Reason for Elimination
		Identification	SWSI Framework Levels				Qualitative Screening						
Customer Education (BP6)	VI												
Bill Stuffers		E	X			All	X	X	X	X			
Newsletter		E	X			All	X	X	X	X			
Newspaper Articles		E	X			All	X	X	X	X			
Mass Mailings		P	X			Res, CII	X	X	X	X		X	
Web Pages		E		X		All	X	X	X	X			
Water Fairs		P			X	Res, CII	X						Staff/resource feasibility
K-12 Teacher and Classroom Education Programs		E			X	CII	X	X	X				
Message Development/Campaign		E		X		Res, CII	X	X	X				
Interactive Websites		E		X		Res, CII	X	X	X				
Social Networking (e.g Facebook)		E		X		Res, CII	X	X	X				
Customer Surveys		P		X		Res, CII	X	X	X			X	
Technical Assistance	VI												
Customer Water Use Workshops (Water Returns)		E			X	Res, CII	**X**		**X**				
Landscape Design and Maintenance Workshops		E			X	Res, CII	**X**		**X**	**X**	Must partner with local landscaper		
Xeriscape Demonstration Garden		E	X		X	Res, CII	**X**		**X**		Requires dedicated volunteers to maintain		
Water Conservation Expert Available		E			X	All	**X**	**X**	**X**	**X**			

Table K: Selection of Monitoring Demand Data for Monitoring Plan

Monitoring Data	Annual	Monthly	Entity/Staff Responsible for Data Collection and Evaluation	Schedule/Timing of Monitoring	Comments
Total Water Use					
Total treated water produced (metered at WTP discharge)	X		Utilities Analyst; Conservation Mgr	First quarter of the year	
Total treated water delivered (sum of customer meters)	**X**		Utilities Analyst; Conservation Mgr	First quarter of the year	
Raw non-potable deliveries	X	X	Watre Foreman; Conservation Mgr	First quarter of the year	
Per capita water use	X		Utilities Analyst; Conservation Mgr	First quarter of the year	Calculated based on total treated water deliveries and estimated population
Indoor and outdoor treated water deliveries		X	Utilities Analyst; Conservation Mgr	First quarter of the year	Indoor calculated based on winter month average treated deliveries
Treated water peak day produced	X		Water Foreman; Conservation Mgr	First quarter of the year	
Raw water peak day produced/delivered			Water Foreman; Conservation Mgr	First quarter of the year	
Non-revenue water	**X**		Water Foreman; Conservation Mgr	First quarter of the year	
Water Use by Customer Type					
Treated water delivered		**X**	Utilities Analyst; Conservation Mgr	Completed first quarter of following year	
Residential per capita water use	X		Utilities Analyst; Conservation Mgr	Completed first quarter of following year	Calculated based on number of residential accounts and corressponding total annual treated water delivery.
Other Demand Related Data					
Irrigated landscape (By acre foot)	X		GIS Department; Conservation Mgr	Collection is ongoing, evaluation to occur during first quarter of the following year.	Calculations based on total irrigaiton land within the service area.
Population	X		Conservation Mgr	Completed first quarter of following year	Data provided by ESRI
New taps	X		Utilities Analyst; Conservation Mgr	Completed first quarter of following year	
Lowered Tap Fee Incentive Participants	X		Deputy City Clerk; Conservation Mgr	Completed first quarter of following year	

Appendix D

Public Review, Comment and Approval

Bill Insert: Front

Bill Insert: Back

Water Efficiency Plan Open for Public Comment

The City of Fountain has updated its Water Efficiency Plan. This document details a seven-year strategic plan, including enhanced programming in an effort to promote water efficiency throughout the Fountain community.

To view the draft plan and provide feedback, please visit FountainColorado.org or attend an Open House event located at the Fountain Library (230 South Main Street):

Thursday, February 15, 2018 **or** **Wednesday, March 14, 2018**
5:00pm - 7:00pm **4:00pm - 7:00pm**

The draft plan will be available for public comment beginning February 14, 2018 through April 14, 2018.
Please submit comments to conserve@fountainutilities.org, or in writing to 101 North Main Street, Fountain, CO 80817.

Ad in Fountain Valley Newspaper

Water Efficiency Plan
Open for Public Comment

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Proof of Publication

THE EL PASO COUNTY ADVERTISER AND NEWS,
FOUNTAIN, COLORADO 80817
STATE OF COLORADO

ss.

COUNTY OF EL PASO

I, Karen M. Johnson, do solemnly swear that I am General Manager of the El Paso County Advertiser and News, that the same is a weekly newspaper printed, in whole or in part, and published in the County of El Paso, state of Colorado, and has a general circulation therein; that said newspaper has been published continuously and uninterruptedly in said county of El Paso for a period of more than 52 weeks next prior to the first publication of the annexed notice and that said newspaper is a weekly newspaper duly qualified for publishing legal notices and advertisements within the meaning of the laws of the State of Colorado.

That copies of each number of said paper in which said notice and list were published were delivered by carriers or transmitted by mail to each of the subscribers of said paper for a period of _**1**_ consecutive insertions, once each week, and on the same day of each week; and that first publication of said notice was in the issue of said newspaper dated **Feb. 7** , A.D. **2018** and that the last publication of said notice was in the issue of said newspaper dated **Feb. 7** ,A.D. **2018**.

Karen M Johnson

Karen M. Johnson
General Manager

Subscribed and sworn to before me, a notary public in and for the County of El Paso, State of Colorado, this **7th** day of **Feb.** A.D. **2018.**

Marianne M McBride

Marianne McBride
Notary Public

MARIANNE MCBRIDE
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 20084034113
MY COMMISSION EXPIRES SEPTEMBER 30, 2020

THE EL PASO COUNTY ADVERTISER AND NEWS,
FOUNTAIN, COLORADO 80817
STATE OF COLORADO

ss.

COUNTY OF EL PASO

I, Karen M. Johnson, do solemnly swear that I am General Manager of the El Paso County Advertiser and News, that the same is a weekly newspaper printed, in whole or in part, and published in the County of El Paso, state of Colorado, and has a general circulation therein; that said newspaper has been published continuously and uninterruptedly in said county of El Paso for a period of more than 52 weeks next prior to the first publication of the annexed notice and that said newspaper is a weekly newspaper duly qualified for publishing legal notices and advertisements within the meaning of the laws of the State of Colorado.

That copies of each number of said paper in which said notice and list were published were delivered by carriers or transmitted by mail to each of the subscribers of said paper for a period of _**1**_ consecutive insertions, once each week, and on the same day of each week; and that first publication of said notice was in the issue of said newspaper dated **March 7** , A.D. **2018** and that the last publication of said notice was in the issue of said newspaper dated **March. 7** ,A.D. **2018**.

Karen M Johnson

Karen M. Johnson
General Manager

Subscribed and sworn to before me, a notary public in and for the County of El Paso, State of Colorado, this **7th** day of **March** A.D. **2018.**

Marianne M Bride

Marianne McBride
Notary Public

MARIANNE MCBRIDE
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 20084034113
MY COMMISSION EXPIRES SEPTEMBER 30, 2020

RESOLUTON 18-024

A RESOLUTION AUTHORIZING ADOPTION OF THE 2018 WATER EFFICIENCY PLAN.

WHEREAS, the City of Fountain, Colorado, through its Electric, Water and Wastewater utility Enterprise (the "Utility Enterprise") adopted its initial Water Efficiency Plan on August 30, 2001, in accordance with the Water Conservation Act of 1991, and the plan was last updated in 2009; and

WHEREAS, the 2006 Water Master Plan confirmed the importance of water conservation to the City's future and identified the need to update the Water Efficiency Plan to achieve ongoing and additional water savings; and

WHEREAS, the City provided public notices and received public comment on the Water Efficiency Plan for sixty days; and

WHEREAS, the City and its utility enterprise has received and considered comments received by the public before submitting a final Water Efficiency Plan to the City Council for adoption; and

WHEREAS, the City Council of the City of Fountain desires to approve the 2018 Water Efficiency Plan.

NOW, THEREFORE, BE IT RESOLVED by the City Council of the City of Fountain, Colorado, as follows:

1. Approves and adopts the 2018 Water Efficiency Plan.

Done this 8th day of May 2018.

Gabriel P. Ortega, Mayor

ATTEST:

Silvia Huffman, City Clerk

CITY OF FOUNTAIN EL PASO SEAL COUNTY COLORADO

Appendix E

2006 Water Master Plan

2006 Water Master Plan

Prepared for:
City of Fountain
116 South Main Street
Fountain, Colorado 80817

Prepared by:
Black & Veatch Corporation
6300 South Syracuse Way
Suite 300
Centennial, Colorado 80111

Project 143418.200
March 2007

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Abbreviations

ac-ft	acre feet
ac-ft/yr	are-feet per year
AD	average day
B&V	Black & Veatch
CIP	Capital Improvements Plan
City	City of Fountain
EPS	extended period simulation
Fountain	City of Fountain
Fry-Ark	Fryingpan Arkansas Project
FVA	Fountain Valley Authority
gpcd	gallons per capita per day
gpm	gallons per minute
hp	horsepower
ISO	Insurance Services Office
Master Plan	City of Fountain Water Master Plan
MD	maximum day
MF	microfiltration
MG	million gallons
mgd	million gallons per day
MH	maximum hour
O&M	operation and maintenance
PPACG	Pike's Peak Area Council of Governments
PRV	pressure reducing valve
psi	pounds per square inch
PVC	polyvinyl chloride
RO	reverse osmosis
rpm	revolutions per minute
SDS	Southern Delivery System
TDS	total dissolved solids
WS	water supply
WTP	water treatment plant
ZLD	zero liquid discharge

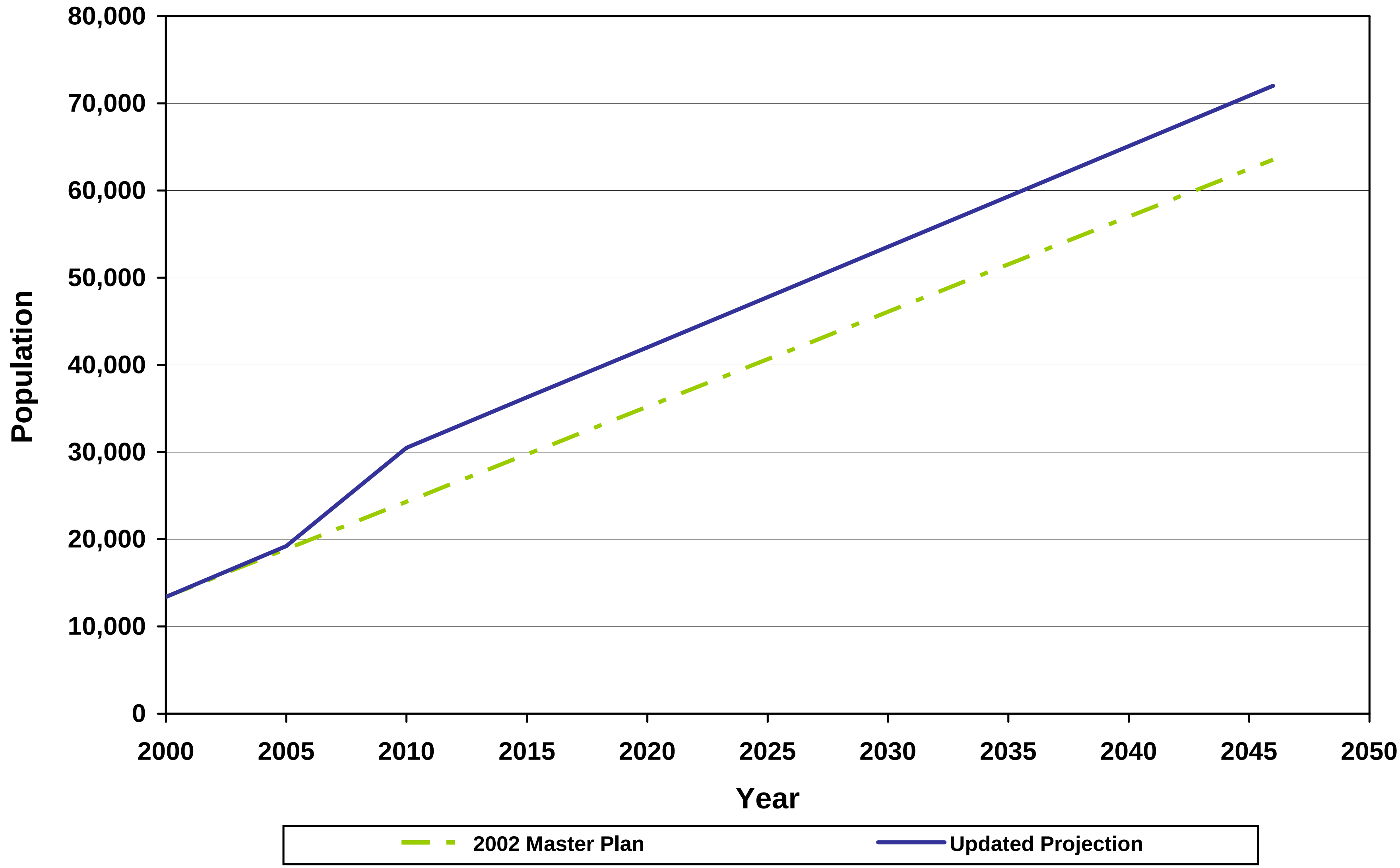
Executive Summary

This Water Master Plan (Master Plan) has been developed to assist the City of Fountain (City, Fountain) with the long-range planning of its water supply, treatment and distribution systems. The intent of this plan is to provide an assessment of the City's water supply needs through the year 2046. In addition, this plan identifies water supplies and treatment, as well as improvements to the distribution system to meet existing and future demands based on anticipated growth within the current service areas and surrounding areas that are likely to be served by the City in the future. This summary is organized by the following sections:

A. Population Projections
B. Future Water Requirements
C. Existing Water Supplies
D. SDS Participation Evaluation
E. Local Water Supply Alternatives
F. Distribution System Analyses
G. Recommended Capital Improvements Plan
H. Reduced Levels of Service
I. Next Steps

A. Population Projections

Development of an effective Master Plan begins with an evaluation of the historic population trends and projected growth patterns within the service area. Table ES-1 provides a summary of the population projections previously presented in the 2002 Water System Master Plan report and the adjustments made as a result of a report published in 2004 by Crowley Consulting and the announcement made by the United States government to station additional personnel at Fort Carson. Table ES-1 also shows the service area population projections that were used in this Master Plan to determine future water requirements within the City's service area. Both sets of projections are shown graphically on Figure ES-1.



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City of Fountain, Colorado – Water Supply Plan

Population Projections

Figure ES-1

Table ES-1

Service Area Population Projections

Year	City of Fountain		Adjustments		Water Service Area	
	2002 Master Plan	Crowley Consulting(1)	Baseline Revision(2)	Fort Carson(3)	2002 Master Plan(4)	Updated Projection(5)
2000	15,197	15,197	0	0	13,370	13,370
2005	20,650	21,000	350	0	18,850	19,200
2010	26,096	26,800	704	5,500	24,300	30,500
2015	31,548	32,591	1,043	5,500	29,750	36,300
2020	37,000	38,382	1,382	5,500	35,200	42,000
2046	65,350	68,495	3,145	5,500	63,540	72,000

(1) Year 2015 value from Oct 2004 Crowley report; other values interpolated and extrapolated accordingly.
(2) Difference between updated projection by Crowley Consulting and the 2002 Water System Master Plan value.
(3) Anticipated number of Fort Carson personnel and family members who will reside in Fountain.
(4) City of Fountain population minus residents receiving water service from Widefield or Security.
(5) 2002 Water System Master Plan projection adjusted to reflect baseline revision and Fort Carson effect.

B. Future Water Requirements

Although a 20-year planning period is generally adequate for sizing most water system facilities, it is often considered prudent to look more than 20 years into the future when planning major components such as water supply and treatment facilities, principal pumping stations and reservoirs, and large-diameter transmission mains. This longer-range view helps to ensure that the water supply will be adequate for the foreseeable future and also serves to minimize the possibility that major water system facilities will have to be duplicated or paralleled within a few years of their construction.

Table ES-2 presents water demand projections based on historic water usage through the year 2046. However, due to recent efforts by the City to encourage water conservation through public education and an inclining rate structure, current demands are lower than anticipated. The City also intends to implement additional measures in the near future to encourage water conservation. Based on this information, water demand projections were developed that consider the impact of current and future conservation. These projections are shown in Table ES-3 and assume a reduction in residential average day water demands of approximately 20 percent.

Table ES-2

Annual Water Demand Projections through 2046 (without Conservation)

Year	Annual Average Day		Maximum Day
	(ac-ft/yr)	(mgd)	(mgd)
2006	4,139	3.7	9.5
2011	6,594	5.9	15.1
2016	8,116	7.2	18.5
2021	9,540	8.5	21.8
2026	11,002	9.8	25.2
2031	12,464	11.1	28.5
2036	13,925	12.4	31.9
2041	15,327	13.7	35.1
2046	16,488	14.7	37.8

Table ES-3

Annual Water Demand Projections through 2046 (with Conservation)

Year	Annual Average		Maximum Day
	(ac-ft/yr)	(mgd)	(mgd)
2006	3,311	3.0	7.6
2011	5,276	4.7	12.1
2016	6,493	5.8	14.8
2021	7,632	6.8	17.5
2026	8,802	7.9	20.1
2031	9,971	8.9	22.8
2036	11,140	9.9	25.5
2041	12,262	10.9	28.1
2046	13,191	11.8	30.2

C. Existing Water Supplies

Water for the City's potable water system comes from two main sources; surface water and well water. In general, surface water is used as the City's primary supply, and the well water is used to supplement during periods of higher demand.

Surface water is obtained through participation in the Fountain Valley Authority (FVA) system. On an annual basis, this supply accounts for the majority (approximately 75 percent) of the City's water. Because the FVA water supply is not sufficient to meet all of Fountain's water needs, the City routinely supplements with water pumped from wells. The City owns and operates five wells located in the downtown area. In general, these wells are relatively small with capacities ranging from 350 to 750 gallons per minute (gpm). This is equivalent to a total pumping capacity of 4.3 mgd and a firm pumping capacity (largest well offline) of 3.2 mgd. However, in recent years, the City has experienced reduced yield from these wells due to lower groundwater levels. Water from these wells is disinfected before being pumped directly into the distribution system.

D. SDS Participation Evaluation

Previous studies have focused on the use of water from the proposed Southern Delivery System (SDS) to meet long-term projected increases in water demand. As currently envisioned, Fountain's level of participation in the SDS project will be 2,500 ac-ft per year, which is equivalent to an annual average delivery rate of 2.2 mgd. However, Fountain may be able to obtain up to 5.6 mgd of SDS water during periods of high demand.

Several studies to develop and evaluate water supply scenarios that utilize SDS water have been completed. Since the City's participation in and timing of SDS is uncertain, two scenarios (C and D) were carried forward for consideration in the report, as described below:

- **Scenario C:** Future water demands would be met by utilizing 2,500 ac-ft/yr of SDS water. The remaining demand would be met with local supplies (wells).

- **Scenario D:** Future water demands would be met by utilizing local supplies (wells). Under this scenario, the City would not participate in SDS.

An evaluation was completed to determine the financial impact of the City's participation in SDS versus developing additional local supplies. For this evaluation, it was assumed that if the City does not participate in SDS, it will need to develop 2.2 mgd of water with similar treated water quality utilizing local groundwater. This water will require treatment due to high total dissolved solids (TDS) concentrations. Costs for 2 mgd of additional reverse osmosis (RO) treatment and brine disposal were also included in the evaluation, which assumes low quality wells and therefore, a low RO bypass ratio. Three alternatives were developed for brine disposal. These alternatives include:

- Drying beds. Brine would be sent to lined drying beds for evaporation.
- Zero liquid discharge (ZLD) located near a power plant. Brine would be sent to concentrators to evaporate the water. The heat required for this process would be provided by the waste heat produced by the power plant. The concentrated salt would be sent to a landfill for disposal.
- ZLD not located near a power plant. Brine would be sent to concentrators to evaporate the water. The heat required for this process would be provided by electricity. The concentrated salt would be sent to a landfill for disposal.

Table ES-4 shows the cost comparison for the City's participation in SDS versus no participation for the years 2015 (when SDS is expected to come online) through 2046.

Table ES-4

Evaluation of City's Participation in SDS versus Developing Local Supplies

Cost Component	Cost for 2.2 mgd of Treated Water			
	SDS Participation	Wells/RO Treatment w/ Drying Beds	Wells/RO Treatment w/ ZLD Near Power Plant	Wells/RO Treatment w/ ZLD Not Near Power Plant
Capital cost opinion	\$26,000,000	\$20,000,000	\$20,000,000	\$20,000,000
O&M cost opinion[(1)]	\$29,000,000	\$28,000,000	\$38,000,000	\$69,000,000
Total cost opinion	\$56,000,000	\$48,000,000	\$58,000,000	\$88,000,000

[(1)]Total O&M for years 2015 – 2046.

The cost opinion for the City's participation in SDS is of the same order of magnitude as that for developing wells and RO treatment utilizing either drying beds or ZLD near a power plant for brine treatment. Therefore, it is recommended that the City continue to pursue participation in SDS and budget accordingly. If the SDS project does not move forward, the City can use those funds to develop additional local supplies.

E. Local Water Supply Alternatives

Three water supply alternatives and one sub-alternative were developed to meet interim and ultimate water demands. The alternatives developed as part of this Master Plan focus on utilizing additional wells to meet future water demands in addition to existing FVA and well supplies, and water from SDS.

It is recommended that the City acquire existing wells with demonstrated yields and re-drill them as necessary to meet municipal requirements. The northern part of the City has relatively high water quality wells that can be chlorinated and pumped directly into the distribution system without additional treatment. It is recommended that the City acquire and develop some of these northern wells, as identified below.

Since the number of wells required to meet future demands exceeds the expected supply associated with the available northern wells, it is recommended that the City acquire and/or develop additional wells in the southern part of the City. The quality of the well water in the southern portion of the City is poor with respect to TDS (average 700 to 1,500 mg/L). Consequently, these alternatives include treatment of the groundwater.

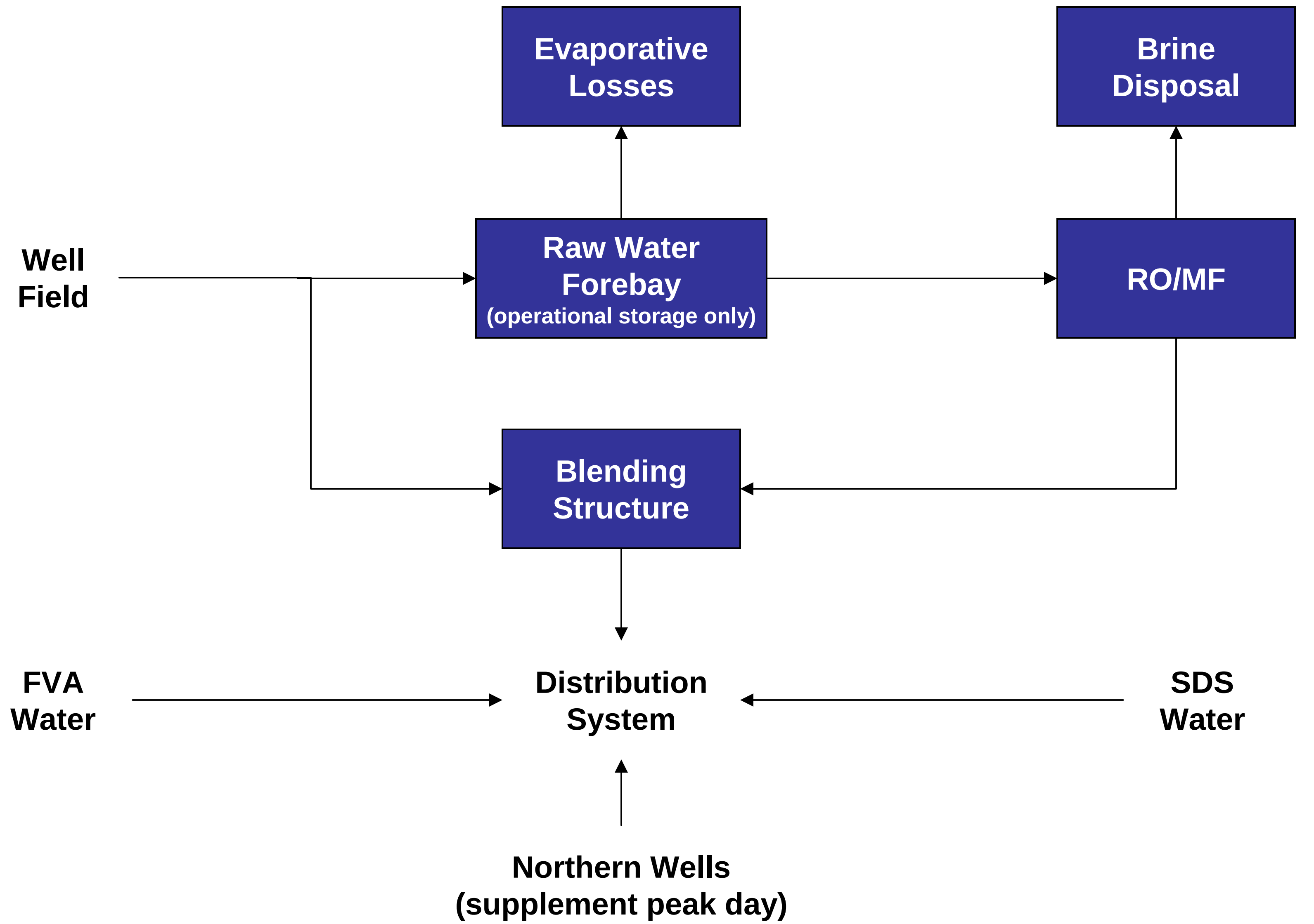
1. Alternative 1 – Pump Wells to Meet Maximum Day Demands

Under Alternative 1, as summarized in Table ES-5, the City would utilize wells and reverse osmosis/microfiltration (RO/MF) treatment to meet maximum day demands. Figure ES-2 shows a schematic representation of Alternative 1.

Table ES-5

Alternative 1 Components

Year	Project Description
2007	Develop 4 northern wells and 1 southern well
2008	Develop 2 northern wells and 4 southern wells 1.5 mgd temporary RO/MF treatment facility online
2009	Develop 1 northern well and 1 southern well
2010	Develop 2 southern wells
2011	Develop 1 southern well 10 mgd permanent RO/MF treatment facility online Decommission temporary RO/MF treatment facility
2012	Develop 1 southern well
2013	Develop 3 southern wells Augmentation reservoir online
2014	Develop 1 southern well Turn over two Ventucci wells to Widefield and Security
2015	SDS online WTP forebay online
2019	Develop 3 southern wells
2021	Expand RO/MF treatment facility to 15 mgd
2022 – 2031	Develop 10 southern wells
2032	Expand RO/MF treatment facility to 20 mgd
2033 – 2046	Develop 13 southern wells



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City of Fountain, Colorado – Water Supply Plan

Alternative 1 Schematic – Pump Wells to Meet Maximum Day Demands

Figure ES-2

2. Alternative 2 – Pump Wells to Meet Average Day Demands and Provide Single Pass Treatment

Under Alternative 2, as summarized in Table ES-6, the City would pump wells at a constant rate equal to the annual average day demand and utilize storage and RO/MF treatment to meet maximum day demands. Figure ES-3 shows a schematic representation of Alternative 2.

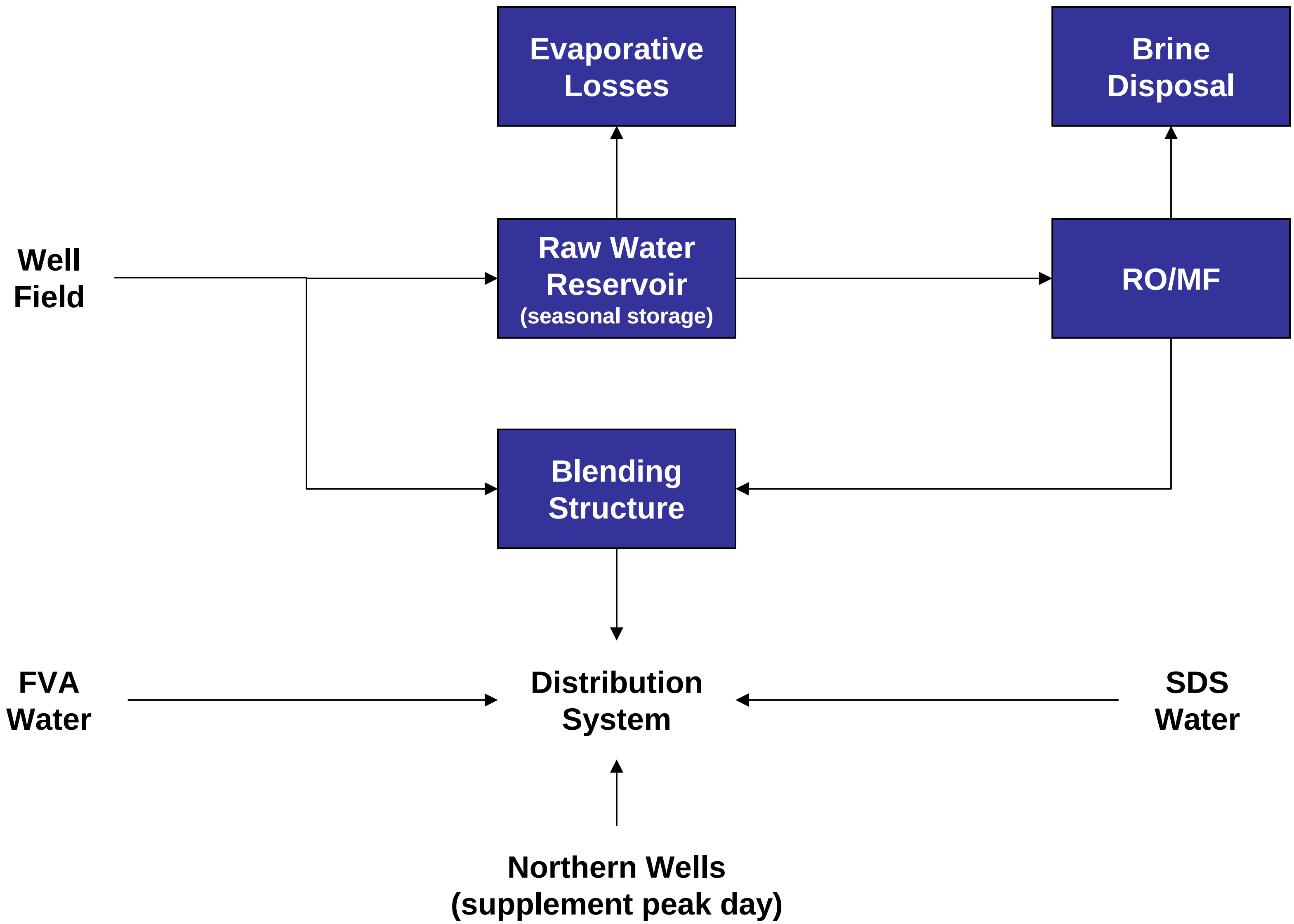
Table ES-6

Alternative 2 Components

Year	Project Description
2007	Develop 4 northern wells and 1 southern well
2008	Develop 2 northern wells and 4 southern wells 1.5 mgd temporary RO/MF treatment facility online
2009	Develop 1 northern well and 1 southern well
2010	Develop 2 southern wells
2011	Develop 1 southern well 10 mgd permanent RO/MF treatment facility online Decommission temporary RO/MF treatment facility
2012	Develop 1 southern well
2013	Develop 3 southern wells Augmentation reservoir online
2014	Develop 1 southern well Turn over two Ventucci wells to Widefield and Security
2015	SDS online Raw water storage reservoir online
2021	Expand RO/MF treatment facility to 15 mgd
2032	Expand RO/MF treatment facility to 20 mgd

3. Alternatives 3 and 3a – Pump Wells to Meet Average Day Demands and Provide Single Pass Treatment

Under Alternative 3, as summarized in Table ES-7, the City would pump wells and utilize RO/MF, all at a constant rate equal to the annual average day demand and utilize storage and additional microfiltration (MF) treatment to meet maximum day demands.



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City of Fountain, Colorado – Water Supply Plan

Alternative 2 Schematic – Pump Wells to Meet Average Day Demands and Provide Single Pass Treatment

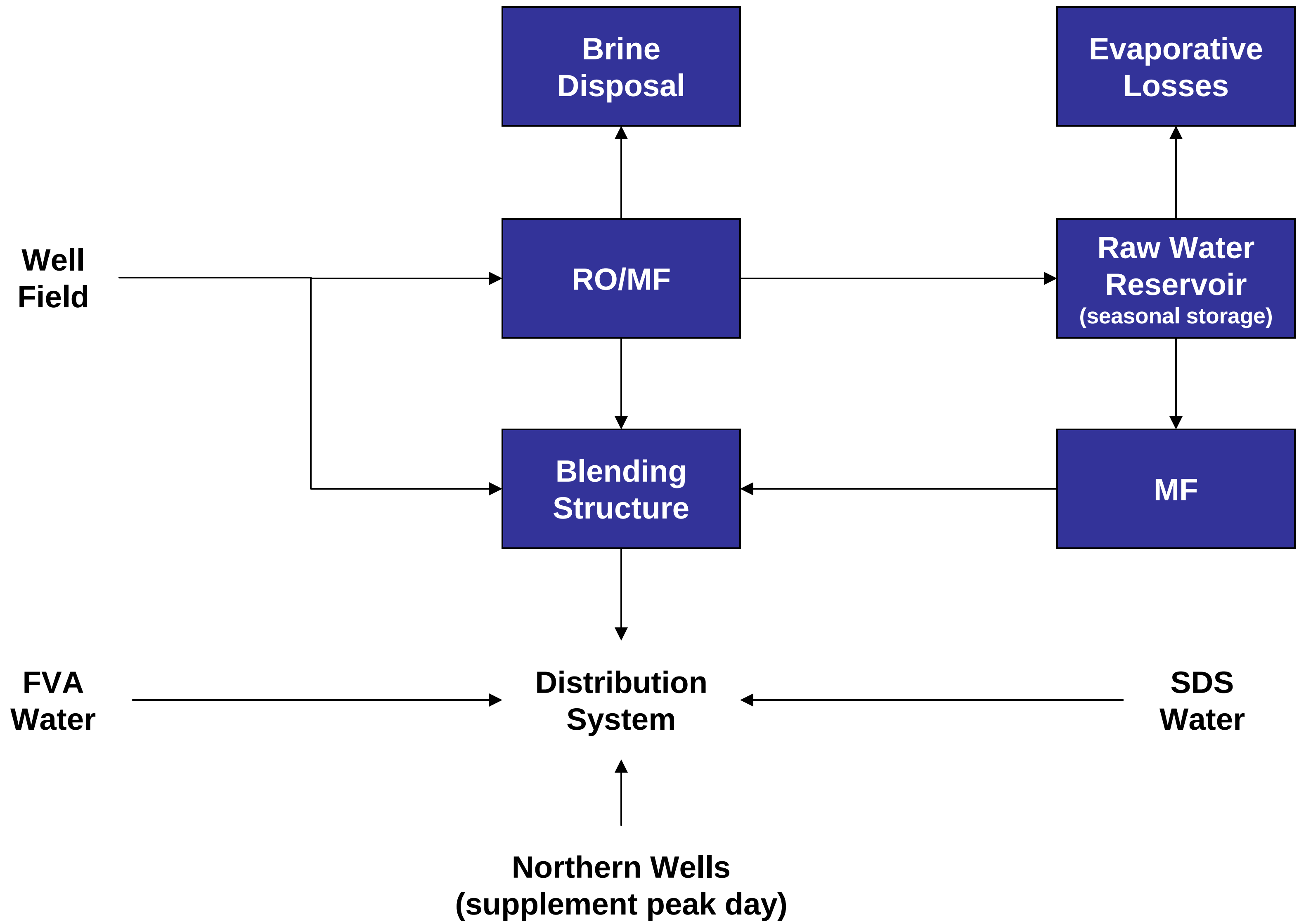
Figure ES-3

Table ES-7

Alternative 3 Components

Year	Project Description
2007	Develop 4 northern wells and 1 southern well
2008	Develop 2 northern wells and 4 southern wells 1.5 mgd temporary RO/MF treatment facility online
2009	Develop 1 northern well and 1 southern well
2010	Develop 2 southern wells
2011	Develop 1 southern well 4.0 mgd permanent RO/MF treatment facility online
2012	Develop 1 southern well
2013	Develop 3 southern wells Augmentation reservoir online
2014	Develop 1 southern well Turn over two Ventucci wells to Widefield and Security
2015	SDS online Raw water storage reservoir online
2018	15 mgd MF treatment facility online Decommission temporary RO/MF treatment facility
2029	Expand RO/MF treatment facility to 6.5 mgd
2031	Expand MF treatment facility to 20 mgd

A sub-alternative of Alternative 3 was also developed. This alternative has the same components as Alternative 3, but considers the impact of conservation on average day and maximum day demand projections. If the City opts to implement conservation measures, it can downsize the capacity of some water supply and treatment infrastructure. A reduction of 20 percent in average day and maximum day demands was assumed in developing this alternative. Table ES-8 provides a summary of the components associated with Alternative 3a. Figure ES-4 shows a schematic representation of Alternatives 3 and 3a.



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City of Fountain, Colorado – Water Supply Plan

Alternatives 3 and 3a Schematic – Pump Wells to Meet Average Day Demands and Provide Double Pass Treatment

Figure ES-4

Table ES-8 Alternative 3a Components	
Year	**Project Description**
2007	Develop 4 northern wells and 1 southern well
2008	Develop 2 northern wells and 4 southern wells 1.5 mgd temporary RO/MF treatment facility online
2009	Develop 1 northern well and 1 southern well
2010	Develop 2 southern wells
2011	Develop 1 southern well 4.0 mgd permanent RO/MF treatment facility online
2012	Develop 1 southern well
2013	Augmentation reservoir online
2014	Turn over two Ventucci wells to Widefield and Security
2015	SDS online Raw water storage reservoir online
2018	Expand RO/MF treatment facility to 5.0 mgd 10 mgd MF treatment facility online Decommission temporary RO/MF treatment facility
2029	Expand MF treatment facility to 15 mgd

4. Evaluation of Water Supply Alternatives

Unit costs were utilized to develop both capital and operation and maintenance (O&M) cost opinions for each alternative. Capital costs associated with each of the alternatives were divided into the following categories:

- Wells and Pump Stations
- Wellfield Pipelines
- Storage Reservoirs
- Water Rights
- Water Treatment
- SDS Participation

Table ES-9 provides a side-by-side comparison of the capital cost opinions for each water supply alternative.

Table ES-9

Capital Cost Comparison of the Proposed Water Supply Alternatives

Component	Capital Cost Opinion			
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 3a**
Wells and Pump Stations	$21,884,000	$11,484,000	$11,484,000	$9,884,000
Wellfield Pipelines	$21,170,000	$10,400,000	$10,400,000	$10,400,000
Storage Reservoirs	$6,750,000	$21,112,000	$21,112,000	$21,112,000
Augmentation Water Rights	$63,000,000	$53,600,000	$53,600,000	$42,900,000
Water Treatment and Brine Handling	$117,312,000	$117,312,000	$84,011,000	$65,224,000
SDS Participation	$26,447,000	$26,447,000	$26,447,000	$26,447,000
Total Capital Cost Opinion	**$256,563,000**	**$240,355,000**	**$207,054,000**	**$175,967,000**

O&M cost opinions were developed for each water supply alternative for the planning period 2006 through 2046. It is important to note that these costs are above and beyond the O&M costs that the City is currently experiencing. These costs have been developed based on the following categories:

- SDS
- Well Electricity
- Raw Water Pump Station Electricity and Maintenance
- Water Treatment and Brine Handling
- Pipeline Maintenance
- Storage Reservoir Maintenance

Table ES-10 summarizes the total O&M costs for years 2006 through 2046 associated with each of the alternatives. Annual O&M costs vary by year and generally increase with the addition of new facilities.

Table ES-10

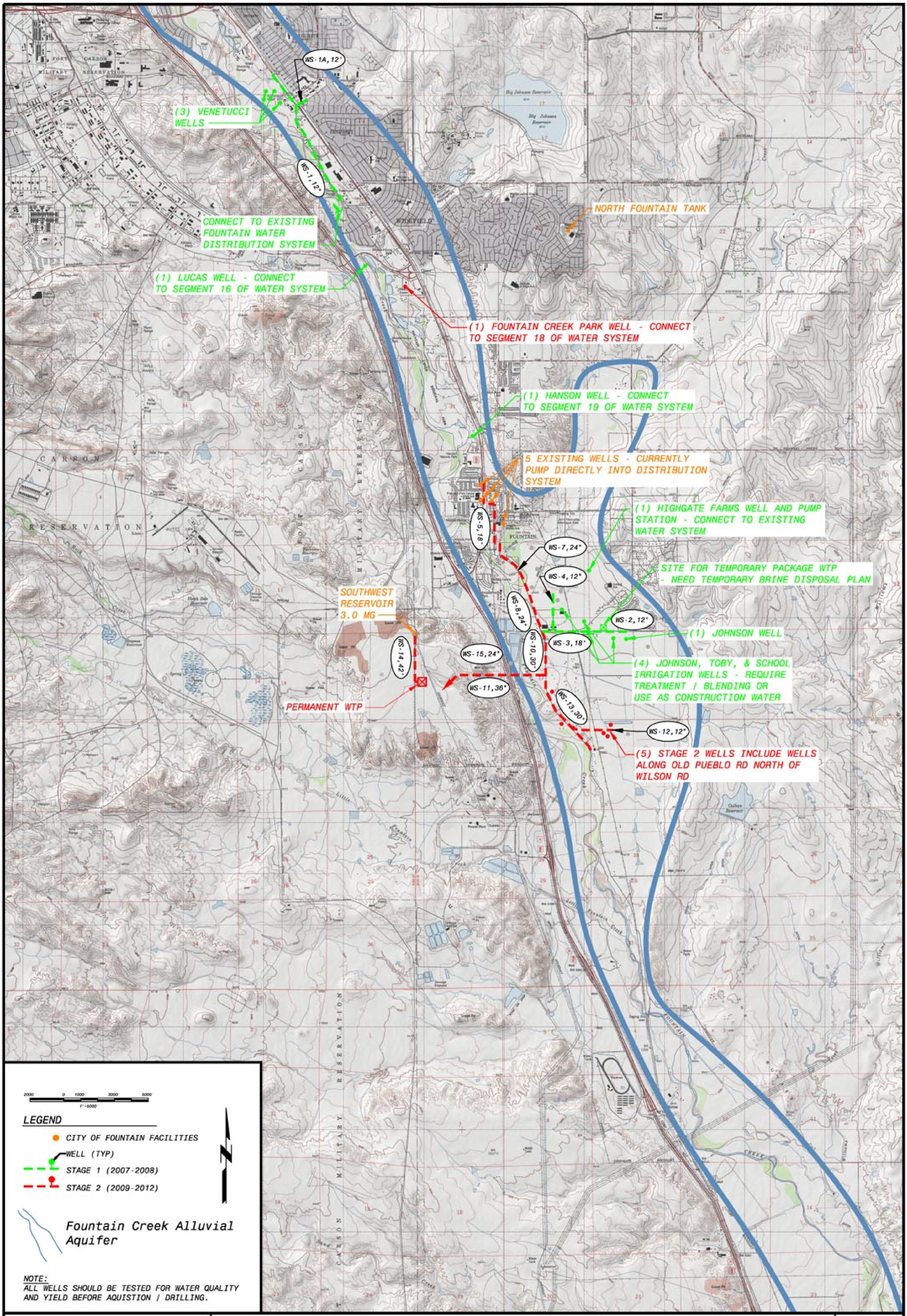
O&M Cost Comparison of the Proposed Water Supply Alternatives

Category	Total Cost (Years 2006 – 2046)			
	Alternative 1	Alternative 2	Alternative 3	Alternative 3a
SDS	$29,466,000	$29,466,000	$29,466,000	$29,466,000
Well Electricity	$19,481,000	$18,416,000	$18,907,000	$14,170,000
Pump Station Electricity and Maintenance	$25,627,000	$23,124,000	$13,596,000	$10,795,000
Water Treatment and Brine Handling	$244,659,000	$246,039,000	$142,028,000	$103,808,000
Pipeline Maintenance	$1,287,000	$767,000	$767,000	$767,000
Storage Reservoir Maintenance	$338,000	$871,000	$871,000	$871,000
Total	**$320,858,000**	**$318,683,000**	**$205,635,000**	**$159,877,000**

Based on the financial evaluation, it is recommended that the City implement Alternative 3a. Alternative 3a has the lowest capital cost opinion as well as the lowest projected O&M costs. Under this alternative, the City would implement conservation measures to reduce future water demands. The City would pump wells and utilize RO/MF at a constant rate equal to the annual average day demand and utilize storage and additional MF treatment to meet maximum day demands. Infrastructure improvements associated with Alternative 3a are shown on Figure ES-5.

F. Distribution System Analyses

In addition to evaluating the City's water supply, a hydraulic model was developed to analyze and evaluate the performance of the water distribution network under various demand and operating conditions. A series of analyses were conducted to identify potential deficiencies in the Fountain distribution



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City of Fountain, Colorado - Water Supply Plan

Infrastructure Improvements Associated with Alternatives 3a

Figure ES-5

system, evaluate various combinations of improvements and modifications, and establish a recommended long-range capital improvement program to reinforce and expand the system as necessary to meet projected water demands and enhance operational flexibility. Deficiencies within the distribution system were identified, and a recommended long-range capital improvement program was developed, as described below and shown on Figure ES-6.

1. Pressure Zones

The existing pressure zones within the Fountain distribution system should be expanded as necessary to accommodate the projected growth areas. It is recommended that the operating gradient within the Little Ranches Zone be increased to about 5,820 feet so that it will be more nearly at the midpoint between the High and Low Zone gradients.

2. Storage Facilities

The existing storage facilities are adequate to meet the future requirements within the Low, High, and Booster pressure zones through the year 2020. It is recommended that a new 3.0 million gallon (MG) reservoir with an overflow elevation of 5,820 feet be constructed to serve the Little Ranches Zone. This reservoir should be located on the high ground near the intersection of Kane Road and the proposed Powers Boulevard extension. It is recommended that the reservoir be constructed by 2010 to provide peaking and emergency storage for customers in the Little Ranches Zone.

3. Pumping Stations

It is recommended that two new pumping stations be constructed; one along Wilson Road and one at the site of the proposed Kane Ranch Reservoir. These stations will be essential for transferring water from the proposed WTP into the higher service areas.

The proposed Wilson Road pumping station should be constructed by year 2011 at the boundary between the Low Zone and the Little Ranches Zone. Although the station should be designed to have an ultimate firm pumping capacity of about 16 mgd, it can initially be constructed with a capacity of about 6 mgd. The proposed Kane Ranch pumping station should be constructed by year 2017, and should be with a firm pumping capacity of about 11 mgd.

Joint Storage Reservoir
4.0 Mil Gal
Overflow Elev = 5,930 ft
Joint Elevated Tank
0.75 Mil Gal
Overflow Elev = 6,023 ft
Booster Pumping Station
Fountain Terminal Tank
2.5 Mil Gal
Overflow Elev = 5,930 ft
Inset A
Jointly owned with
City of Widefield
Well #4
Well #5
Well #1
Well #2
Well #3
High Gate Pump
High Gate Well
Proposed Reservoir
3.0 Mil Gal
Overflow Elev = 5,820 ft
Inset B
Proposed
Pumping Station
Proposed
Pumping Station
Southwest Reservoir
3.0 Mil Gal
Overflow Elev = 5,740 ft
Future Water
Treatment Plant
N
1,300 650 0 1,300 2,600
Feet
Legend
Existing Facilities
Water Mains and Diameter (inches)
Low Zone
Little Ranches Zone
High Zone
Booster Zone
Other Facilites
Storage Reservoir
Pumping Station
Well
Pressure Reducing Valve
Proposed Facilities
Phase I Mains and Diameter (inches)
Low Zone
Little Ranches Zone
High Zone
Phase II Mains and Diameter (inches)
Low Zone
Little Ranches Zone
High Zone
Other Facilites
Water Treatment Plant
Storage Reservoir
Pumping Station
Well
Pressure Reducing Valve
Normally Closed Gate Valve
Flow Meter
City of Fountain
Fountain, Colorado
Water System Master Plan
Recommended Distribution
System Improvements
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Corporation
2006
Figure ES-6

4. Distribution Mains

In order to facilitate the budgeting and planning process, the recommended distribution system facilities have been grouped into two phases. Phase 1 facilities are recommended for construction by 2015 and Phase 2 facilities are recommended for construction after 2015.

The Phase 1 Improvements include major transmission mains in the Low Zone and a number of additional mains to reinforce the existing distribution network and to extend service into future growth areas. The Phase 1 transmission mains are needed to enhance the ability to convey water from the Southwest Reservoir to existing and future customers in future growth areas. The principle proposed Phase 1 transmission main is the 36-inch main in the Low Zone between the Southwest Reservoir and the site of the future booster pumping station along Wilson Road.

The Phase 2 Improvements include a number of mains to reinforce the existing distribution network and extend service to projected growth areas. It is recommended that a 30-inch main be constructed in the Little Ranches Zone along Wilson Road and the Powers Boulevard corridor between the Wilson Road booster pumping station and the Kane reservoir. In the High Zone, it is recommended that a 24-inch transmission main along the Powers Boulevard corridor be constructed between the Kane Ranch pumping station and C&S Road. These improvements will complete the sequence of mains needed to convey water from the proposed WTP into the Little Ranches and High Zones.

Because it is not possible to accurately predict the layout of the numerous local distribution mains within future developments and subdivisions, local main improvements were not identified as part of this study. However, in order to assist the City in sizing and laying out the local distribution mains within future developments, the following guidelines are provided:

- Install 12-inch mains as a minimum size on a mile grid.
- Use a minimum pipe size of 8-inches for any main extending more than 500 feet without cross-ties.
- Use minimum pipe sizes of 8 inches in commercial areas and 6-inches in residential areas.

- Wherever possible, eliminate dead-end mains to provide a more reliable looped network.

5. Fire Flow Considerations

A comprehensive fire protection evaluation was not included as part of this study. However, fire flow requirements were considered while performing the hydraulic analyses and the recommended distribution system facilities were sized to provide a reasonable degree of fire protection. Fire flow rates greater than 1,000 gpm will be generally obtainable throughout the distribution network, with significantly higher fire flow rates being available along the primary development corridors, where the larger-diameter distribution mains are located.

6. Capital Cost Opinion

Table ES-11 provides a summary of probable costs for the proposed Phase 1 and Phase 2 recommended distribution system improvements, including water mains, storage reservoirs, and flow control valves.

Table ES-11

Summary of Probable Costs for Distribution System Improvements

Phase	Recommended Improvements	Probable Cost ($)
Phase 1 (by 2015)	Water Transmission and Distribution Mains	13,370,000
	Fire Protection Upgrade (Upsize Ohio Ave with 8 inch main)	200,000
	Wilson Road Pumping Station	1,200,000
	3.0 mil gal ground storage reservoir	2,000,000
	PRVs and Flow control valves	350,000
	Phase 1 Total	**$ 17,120,000**
Phase 2 (after 2015)	Water Transmission and Distribution Mains	11,370,000
	Wilson Road Pumping Station Expansion	500,000
	Kane Ranch Pumping Station	1,000,000
	PRVs and Flow control valves	230,000
	Phase 2 Total	**$ 13,100,000**

G. Recommended Capital Improvements Plan

The capital and O&M costs associated with the recommended water supply and distribution system improvements were used to develop a staged CIP, as shown in Table ES-12.

Table ES-12

Staged CIP for the City's Recommended Water System Improvements[(1)]

Year	Capital Cost	O&M Cost[(2)]
2006	$4,885,000	$0
2007	$11,998,000	$93,000
2008	$13,577,000	$1,227,000
2009	$37,926,000	$1,319,000
2010	$16,995,000	$1,371,000
2011	$15,848,000	$2,644,000
2012	$13,386,000	$2,907,000
2013	$14,773,000	$3,172,000
2014	$3,601,000	$4,314,000
2015	$6,044,000	$4,862,000
2006 - 2015 Subtotal	**$139,033,000**	**$21,909,000**
2016 - 2020	$39,950,000	$19,458,000
2021 - 2030	$22,153,000	$38,072,000
2031 - 2046	$9,073,000	$85,615,000
2016 - 2046 Subtotal	**$71,176,000**	**$143,145,000**
Total	**$210,209,000**	**$165,054,000**

[(1)]Cost reflect 20 percent reduction in average and maximum day demand due to conservation.
[(2)]O&M costs are in addition to the City's current O&M costs.

H. Reduced Levels of Service

The recommended plan described above provides the City with a reliable water system capable of meeting anticipated water demands through the planning period. However, these recommendations require over 60 percent of the total capital improvements to be funded and constructed between 2007 and

2015 and the financial impacts may not be acceptable to the City. If the City cannot implement these recommendations due to financial limitations, reduced level of service alternatives could be considered.

The reduced level of service alternatives (Alternatives 3b and 3c) presented herein are based on the following criteria:

- Sufficient water supplies are provided to meet the same estimated maximum day water demands as for Alterative 3a.
- Water treatment facilities provided under the reduced level of service will enable the City to produce a blended water quality in the distribution system of less than 750 mg/L for TDS, instead of the Environmental Protection Agency (EPA) Secondary Guideline (recommended by not required) value of 500 mg/L.
- The blended water quality of 750 mg/L or less for TDS will be met for all demands equal to or less than 80 percent of the projected maximum day demand condition. During the highest demand periods, additional wells would be operated but the water treatment facilities would be by-passed resulting in slightly poorer water quality. Alternatively, water curtailment measures could be implemented to reduce the peak demands associated with dry summer days and meet the water quality target of 750 mg/L.
- After year 2020, facilities will be in place to meet the recommended target service levels (Alternative 3a).

Alternative 3b includes a revised implementation plan for water treatment and brine handling facilities assuming SDS participation. Alternative 3c includes a revised implementation plan for water treatment and brine handling facilities assuming no participation in SDS. Alternative 3c requires approximately $19.5 million in treatment between years 2006 and Years 2015.

Tables ES-13 and ES-14 provide a comparison of capital and O&M costs associated with the reduced service level alternatives compared to the recommended alternative, respectively.

Table ES-13

Comparison of Capital Costs For Recommended and Reduced Service Level Alternatives

Year	Alternative 3a	Alternative 3b	Alternative 3c
2006	$4,885,000	$4,885,000	$4,885,000
2007	$11,998,000	$9,875,000	$9,875,000
2008	$13,577,000	$13,070,000	$12,534,000
2009	$37,926,000	$13,308,000	$11,866,000
2010	$16,995,000	$14,791,000	$14,136,000
2011	$15,848,000	$14,528,000	$9,790,000
2012	$13,386,000	$13,386,000	$3,267,000
2013	$13,023,000	$14,773,000	$8,253,000
2014	$1,851,000	$3,601,000	$2,814,000
2015	$4,044,000	$6,044,000	$13,544,000
2006 - 2015 Subtotal	**$133,533,000**	**$108,261,000**	**$90,964,000**
2016 - 2020	$39,950,000	$53,405,000	$49,738,000
2021 - 2030	$22,153,000	$32,503,000	$47,803,000
2031 - 2046	$9,073,000	$9,073,000	$9,073,000
2016 - 2046 Subtotal	**$71,176,000**	**$94,981,000**	**$106,614,000**
Total	**$210,209,000**	**$203,242,000**	**$197,578,000**

Comments:

1. Alternative 3a provides a robust system that meets recommended EPA guidelines.
2. Alternative 3b provides reduced levels of service while Fountain continues to participate in SDS.
3. Alternative 3c provides reduced levels of service and no SDS participation.

Table ES-14

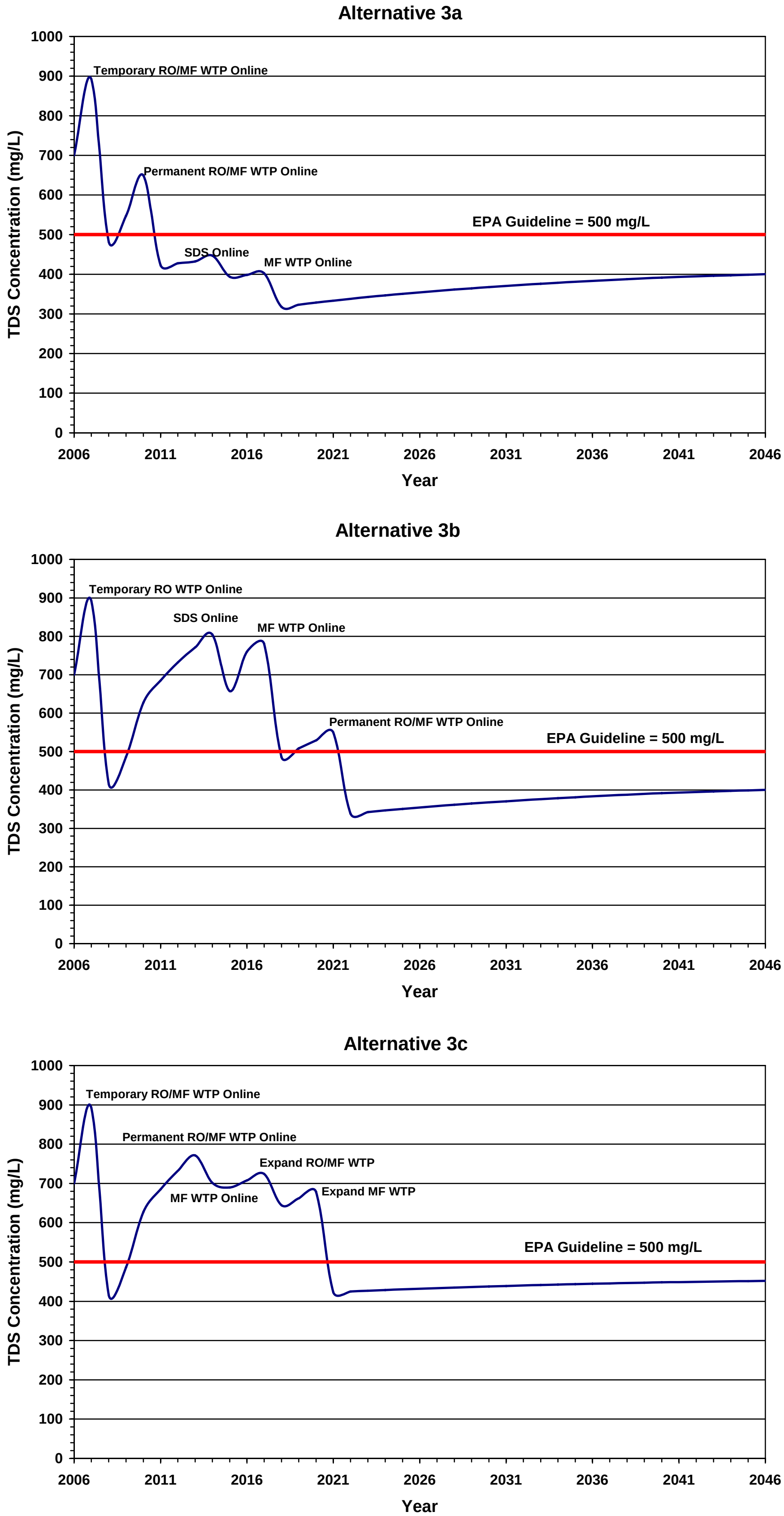
Comparison of O&M Costs For Recommended and Reduced Service Level Alternatives[(1)]

Year	Alternative 3a	Alternative 3b	Alternative 3c
2006	$0	$0	$0
2007	$93,000	$93,000	$93,000
2008	$1,227,000	$712,000	$712,000
2009	$1,319,000	$799,000	$799,000
2010	$1,371,000	$846,000	$846,000
2011	$2,644,000	$985,000	$985,000
2012	$2,907,000	$1,013,000	$1,013,000
2013	$3,172,000	$1,042,000	$1,042,000
2014	$4,314,000	$946,000	$1,403,000
2015	$4,862,000	$2,139,000	$2,011,000
2006 - 2015 Subtotal	**$21,909,000**	**$8,575,000**	**$8,904,000**
2016 - 2020	$19,458,000	$12,010,000	$12,034,000
2021 - 2030	$38,072,000	$37,199,000	$40,106,000
2031 - 2046	$85,615,000	$85,615,000	$88,869,000
2016 - 2046 Subtotal	**$143,145,000**	**$134,824,000**	**$141,009,000**
Total	**$165,054,000**	**$143,399,000**	**$149,913,000**

[(1)] O&M costs are in addition to the City's current O&M costs.

Table ES-14 shows that the O&M costs for Alternatives 3b and 3c are lower that 3a in early years. However, after year 2020, Alternative 3c has the highest O&M cost because it does not realize the benefits of the high quality SDS water.

Figure ES-7 shows the predicted distribution system water quality with respect to TDS concentrations throughout the planning period for Alternatives 3a, 3b, and 3c, respectively. For Alternative 3a, once the permanent RO/MF WTP is online, finished water TDS concentrations are expected to stay below EPA's Guideline of 500 mg/L. For Alternatives 3b and 3c, finished water TDS



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Predicted TDS Concentrations in the Distribution System for Alternatives 3a, 3b and 3c

Figure ES-7

concentrations are not expected to drop below EPA's Guideline of 500 mg/L until after 2020.

I. Next Steps

Assuming conservation measures are implemented, Fountain may utilize groundwater to meet as much as 90 percent of maximum day demands and 65 percent of annual demands by 2020 if the City does not participate in SDS. If the City elects to participate in SDS, its reliance on groundwater could still be as much as 77 percent during maximum day demand periods and 41 percent during average day demand periods. Therefore, it is imperative that an alluvium study be performed to confirm sufficient water is available to meet groundwater demands. In the fall of 2006, Harvey Economics evaluated the City's ability to fund the water plans presented herein and recommended the City implement Alternative 3b.

As discussed previously, RO treatment of the groundwater is required in order to meet water quality standards. RO treatment produces a brine stream that must be disposed of. The Colorado Department of Public Health and Environment requires the development of a Brine Management Plan to evaluate options for brine disposal prior to permitting. In addition, the brine handling costs discussed in this Master Plan are rough order-of-magnitude costs and should be defined further. Therefore, it is recommended that the City perform a treatability/brine handling study. These studies are scheduled to be completed the first half of 2007.

Chapter 1
Introduction and Background

This chapter discusses the purpose and need for this Water Master Plan (Master Plan) and provides pertinent background information.

A. Purpose

This Master Plan has been developed to assist the City of Fountain (City, Fountain) with the long-range planning of its water supply, treatment and distribution systems. In 2004, a comprehensive Water Resource Study was completed for the City by Black & Veatch (B&V). Since that time, new information has come to light regarding population projections as well as changes to the proposed Southern Delivery System (SDS) water supply project. These aspects could have a significant impact on the City's water supply portfolio and infrastructure requirements, and as a result, it is appropriate to reevaluate the City's long-term planning based on this new information.

Therefore, the intent of this plan is to provide an assessment of the City's water supply needs through the year 2046. In addition, this plan identifies water supplies and treatment, as well as improvements to the distribution system to meet existing and future demands based on anticipated growth within the current service areas and surrounding areas that are likely to be served by the City in the future. The recommendations described in this report are designed to provide the City with an adequate and dependable water system.

B. Scope

The principal tasks of this study include the following:

- Evaluate historic trends of population growth, development, and water use.
- Prepare projections of future service area population and water requirements.
- Evaluate the adequacy of existing water supply, storage, and distribution facilities.

- Develop alternatives to provide the City with an adequate supply of water of sufficient quality to meet future demands.

- Evaluate water supply alternatives and develop a phased capital improvements program (CIP) for the recommended facilities.

- Develop a distribution system hydraulic model and perform hydraulic analyses to determine the ability of the distribution system to meet present and future water demands.

- Identify water distribution system improvements and develop a phased CIP with opinions of probable cost.

Chapter 2
Population

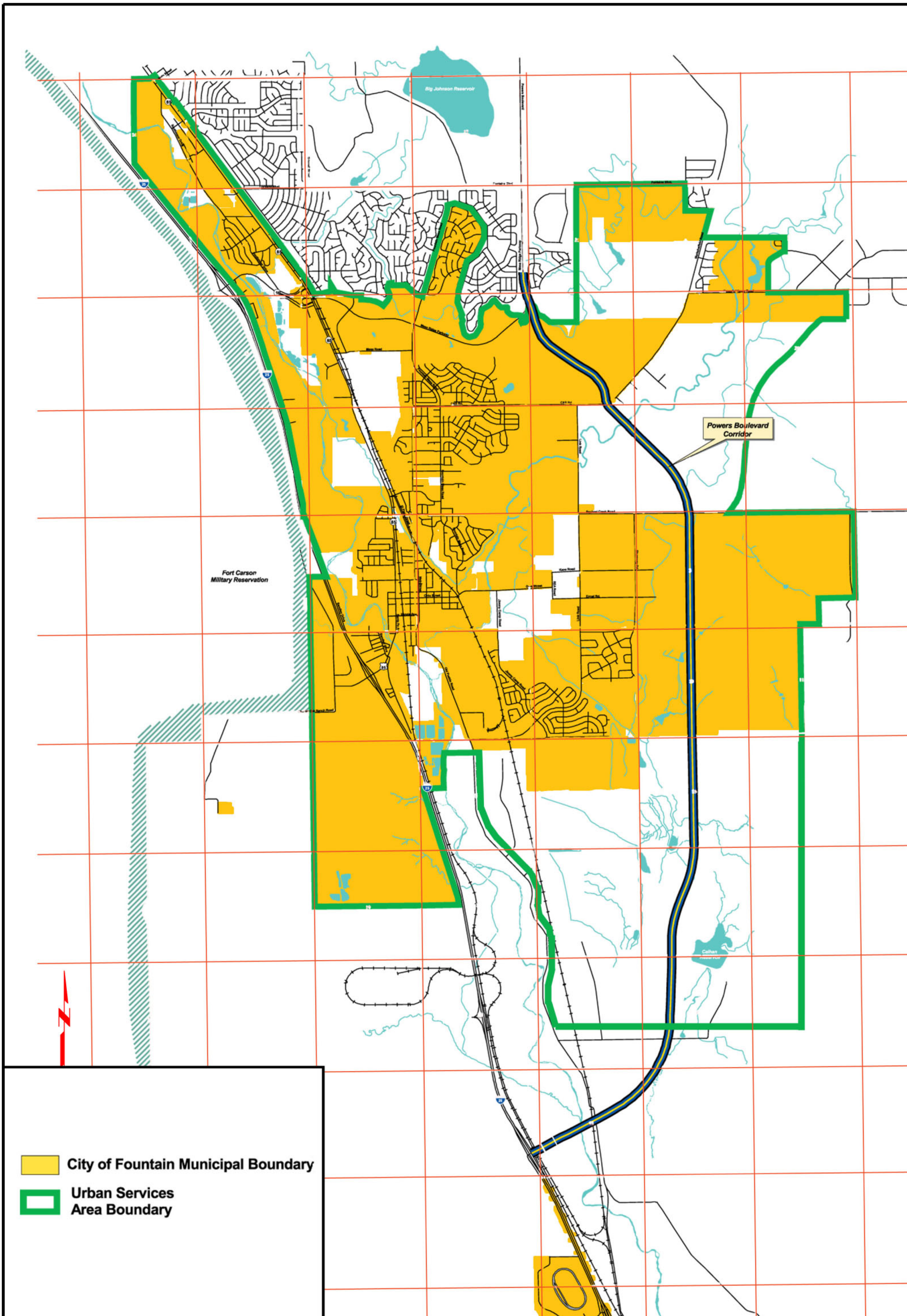
Development of an effective Master Plan begins with an evaluation of the historic population trends and projected growth patterns within the service area. Figure 2-1 presents the planning boundary of the City's water service area.

A. Historic Population

Population projections were developed for the City's previous master plans using population data for El Paso County and the City of Fountain, obtained from the United States Bureau of the Census. Table 2-1 shows the year 2000 population for the City of Fountain and for the City's service area as presented in the 2002 Master Plan.

As shown in Table 2-1, the year 2000 census population for the City of Fountain was 15,197, and about 13,370 of these people were obtaining water from the Fountain water system. The majority of the approximately 1,800 residents not being served by the City receive water from the Widefield Water and Sanitation District, in particular those living in the area north of State Highway 16 and west of U.S. Highway 85. Additionally, a small number of residents in outlying areas of the City currently obtain water from private wells on individual properties.

As indicated in Table 2-1, the area served by the Widefield water system includes block group 3 of tract 45.01 and block group 1 of tract 45.08. It is also worth noting that the small population numbers within census tracts 44, 45.06, 45.07, and 46 can be attributed primarily to the fact that these areas of the city were relatively undeveloped in year 2000.



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Fountain Water Service Planning Boundary

Figure 2-1

Table 2-1

Year 2000 Population

Census Tract	Block Group	City of Fountain	Water Service Area
44	9	6	6
45.01	3[1]	755	0
45.03	1	253	181
	2	823	823
	3	882	882
45.06	3	0	0
45.07	3	14	14
45.08	1[1]	921	0
	2	1,741	1,741
	3	1,964	1,952
	4	1,200	1,192
45.09	1	2,760	2,746
	2	927	927
	3	2,906	2,906
46	2	45	0
Total		**15,197**	**13,370**

[1]Served by other water utilities (Widefield and Security).

B. Future Population

At the time that the 2002 Water System Master Plan study was completed, population projections for the City of Fountain were available from the City's Comprehensive Development Plan and from a document prepared by the Pike's Peak Area Council of Governments (PPACG). Each of these documents contained three scenarios for population representing various assumptions regarding potential growth and development within the City. Based on an evaluation of recent increases in the number of residential service connections, it was decided that the High Level population forecast developed by the PPACG would be the most appropriate to use for projecting Fountain's future water requirements.

In October of 2004, Crowley Consulting published a report that contained updated population projections for the City of Fountain. The Crowley report contained a baseline set of projections that included the Mesa Ridge property, as well as a modified set of projections excluding Mesa Ridge. Even under the assumption that Fountain will not provide water service to the Mesa Ridge area, the population projections in the Crowley report were greater than those utilized in the 2002 Water System Master Plan.

After the 2004 Crowley report was published, the US government announced plans to station approximately 10,000 additional personnel at Fort Carson. It has been estimated that approximately 4,000 of these new personnel will live off base and that 25 to 50 percent of the off-base personnel will likely reside in the City of Fountain. Assuming that about 37 percent of the off-base personnel choose to live in Fountain and assuming an average of 3.7 people per military household, the resulting population increase for the City of Fountain is projected to be about 5,500 people (4,000 x 0.37 x 3.7).

Table 2-2 provides a summary of the population projections previously presented in the 2002 Water System Master Plan report and the adjustments made as a result of the Crowley report and expected Fort Carson impact. Table 2-2 also shows the service area population projections that will be used in this Master Plan to determine future water requirements within the City's service area. These projections are also shown graphically on Figure 2-2.

Table 2-2

Service Area Population Projections

Year	City of Fountain		Adjustments		Water Service Area	
	2002 Master Plan	Crowley Consulting[(1)]	Baseline Revision[(2)]	Fort Carson[(3)]	2002 Master Plan[(4)]	Updated Projection[(5)]
2000	15,197	15,197	0	0	13,370	13,370
2005	20,650	21,000	350	0	18,850	19,200
2010	26,096	26,800	704	5,500	24,300	30,500
2015	31,548	32,591	1,043	5,500	29,750	36,300
2020	37,000	38,382	1,382	5,500	35,200	42,000
2046	65,350	68,495	3,145	5,500	63,540	72,000

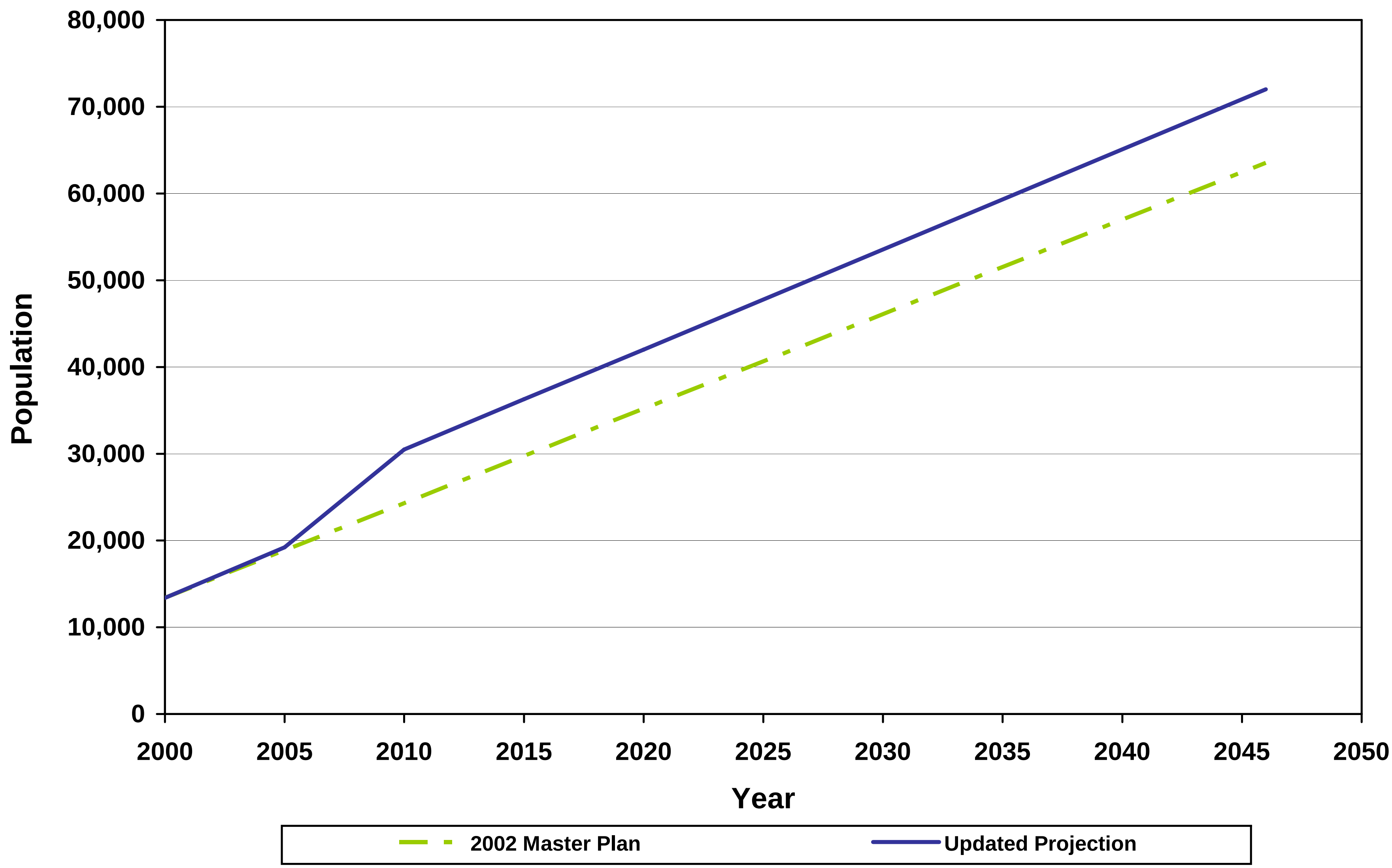
[(6)] Year 2015 value from Oct 2004 Crowley report; other values interpolated and extrapolated accordingly.

[(7)] Difference between updated projection by Crowley Consulting and the 2002 Water System Master Plan value.

[(8)] Anticipated number of Fort Carson personnel and family members who will reside in Fountain.

[(9)] City of Fountain population minus residents receiving water service from Widefield or Security.

[(10)] 2002 Water System Master Plan projection adjusted to reflect baseline revision and Fort Carson effect.



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City of Fountain, Colorado – Water Supply Plan	Figure 2-2
Population Projections	

Chapter 3
Water Demands

Water demands can fluctuate over a wide range based on annual, daily and hourly variations. Water use is typically higher during dry years and hot months, when more water is used for irrigation. Additionally, water use typically follows a daily diurnal pattern, being low at night and peaking in the early morning and late afternoon. As a result, a water utility must be able to supply water at rates to meet these demands. Rates most important to the design and operation of a water system are average day (AD), maximum day (MD), and maximum hour (MH) demand.

Average day use is the total annual water use divided by the number of days in the year. Maximum day use is the maximum quantity of water used on any one day of the year. The maximum day demand is used to size water supply and treatment facilities to ensure that these facilities are capable of providing an adequate quantity of treated water every day of the year.

The greatest demands on a water system are generally experienced for short periods of time during the maximum demand day. These peak demands are referred to as maximum hour demands because they seldom extend over a period of more than a few hours. Although the duration of these extreme demands is relatively short, the rate of consumption during the maximum hour period often taxes the capabilities of the pumping facilities, distribution mains, and system storage. These demands are met by providing storage within the distribution system. The use of storage minimizes the required capacity of transmission mains and permits a more uniform and economical operation of supply and pumping facilities.

A. Historic Water Use

Fountain currently obtains water from the Fryingpan-Arkansas (Fry-Ark) Project and from wells located within the city limits. The City's annual allocation of Fry-Ark water is limited to 2,000 acre-feet (ac-ft). Accounting for a 5 percent evaporative loss charge, the City's usable allotment is 1,900 ac-ft, which is equivalent to approximately 1.7 million gallons per day (mgd). Because the Fry-Ark water supply is not sufficient to meet all of Fountain's water needs (particularly during the summer months), the City routinely supplements with water pumped from five City-owned wells.

Table 3-1 provides a summary of annual Fry-Ark water purchases and city well production for the past 10 years. Total annual water use within the Fountain system was determined by adding the volume of water pumped from the City wells to the annual Fry-Ark water purchases.

Table 3-1

Fry-Ark Water Purchases and City Well Production

Year	Fry-Ark[1]		City Wells		Total Use (MG)	Average Day (mgd)	Max Day (mgd)	MD/AD Ratio
	MG	percent	MG	percent				
1996	438.5	75	148.3	25	586.8	1.61	3.8	2.3
1997	468.4	72	179.6	28	648.0	1.78	4.2	2.4
1998	501.6	72	191.6	28	693.2	1.90	5.2	2.7
1999	536.6	82	115.9	18	652.5	1.79	3.6	2.0
2000	565.4	76	180.8	24	746.2	2.04	4.9	2.4
2001	558.7	74	197.4	26	756.1	2.07	5.1	2.5
2002	728.7	80	187.7	20	916.4	2.51	5.6	2.2
2003	662.3	77	195.8	23	858.1	2.37	5.4	2.3
2004	586.2	77	172.6	23	758.8	2.07	4.5	2.2

(1)Fountain has an annual allocation of approximately 620 million gallons (MG) per year of Fry-Ark water. In recent years, the City has exceeded this allocation by making short-term water exchanges.

The maximum day water demands shown in Table 3-1 were calculated from the daily meter readings for the Fry-Ark turnouts and the City's daily well production records. During the past 10 years, the maximum day water demand within the City's system has ranged from a low of 3.6 mgd to a high of 5.6 mgd, and the ratio of maximum day water use to average day water use (MD/AD) has ranged from 2.0 to 2.7, averaging about 2.4.

For planning purposes, it is common engineering practice to select a design demand ratio that is greater than the historic average ratio but less than the maximum ratio that has been experienced. If the historic average ratio were used for future planning, it would mean that, during approximately half of the future years, the City may not be able to meet system demands on one or more of the highest demand days.

Conversely, selecting a design demand ratio equal to the historic maximum ratio would mean that the full capacity of the City's system may only be utilized once during a ten-year or longer period. Designing and constructing facilities with sufficient capacity to meet this possible demand is not always economically justifiable. However, most utilities agree that being able to meet maximum day demands in nine out of ten years is a reasonable goal. By utilizing this criteria, utilities accept the fact that, during any given ten-year period, there may be a few days during which certain water facilities may have to be operated beyond their normal capacities or during which some form of water use restrictions may need to be imposed.

Therefore, a MD/AD design demand ratio of 2.6 was used to project Fountain's future maximum day water demands. This ratio is consistent with the design demand ratios being utilized by other front range water utilities including Denver, Colorado Springs, Pueblo, and Trinidad.

Since hourly water use data for the Fountain system was not readily available, actual maximum hour demand rates and MH/AD ratios could not be easily calculated for the Fountain system. Consequently, an assumed MH/AD ratio of 3.8 was utilized for projecting Fountain's future maximum hour demands. The assumed 3.8 MH/AD design demand ratio is based primarily on experience with the other front-range water utilities identified above.

Table 3-1 also shows that, during the past 10 years, the City has obtained between 72 and 82 percent of its annual water supply from the Fry-Ark project, with the remainder of the water obtained from the City's wells. An evaluation of the monthly water production and purchase records indicates that Fry-Ark water purchase volumes do not vary significantly throughout the year while well pumpage tends to be considerably higher during the summer months. In other words, to the extent possible, the Fry-Ark supply is being utilized as a base supply, and the wells are being used primarily as a supplemental source of supply to help meet the higher summer-time water demands.

B. Metered Sales

For any water utility, the volume of water entering the distribution system is typically greater than the volume of water that is ultimately sold to the customers. The difference between the volume of water entering the system and the volume of water sold is referred to as unaccounted-for water use. A portion of the unaccounted-for water use may be attributed to legitimate water uses that are not metered or billed, including water used for flushing mains and hydrants, water used for irrigating parks and city landscaping. The remainder of the unaccounted-for water may be attributed to other factors such as leakage from the distribution system, unauthorized water taps, under-registration by customer meters, and inaccuracies in supply and well meters.

An evaluation of water production versus metered sales performed during the 2002 Water System Master Plan study indicated that unaccounted-for water use in the Fountain system averaged 14 percent. To help reduce this level, the City has implemented a meter replacement program and is also planning to improve the tracking of non-billed City water uses such as park irrigation. Additionally, as the Fountain water system grows, the newer portions of the distribution system will probably have a lower percentage of leakage, thereby resulting in a further reduction in the overall percentage of unaccounted-for water use. As a result of all these factors, it is anticipated that the level of unaccounted-for water use within the Fountain system will gradually decline from 14 percent to 10 percent by year 2020. Achieving an unaccounted-for water use percentage of 10 percent or less is considered a reasonable goal within the water industry.

An evaluation of metered sales data performed as part of the 2002 Water System Master Plan study indicated that residential water usage accounts for 78 percent of the total annual water sales, and commercial usage accounts for the remaining 22 percent. Residential sales include single family homes, duplexes, apartments, and trailers. Commercial sales include office buildings, shopping malls, hotels, public buildings, schools, churches, hospitals, industries, and similar institutions.

As the City of Fountain grows and matures, it is anticipated that an increasing number of businesses and industries will locate within the city, thereby resulting in an increase in the percentage of water being sold to commercial customers. Consequently, for projecting future water demands, it is assumed that the percentage of commercial water use in the Fountain system will gradually increase from the current level of 22 percent to a future level of 35 percent by year 2020. By way of comparison, commercial water use represents about 32 percent of retail sales in Colorado Springs and 35 percent in Pueblo.

Based on the annual residential water usage and the estimated service area population, the average residential water demand in the Fountain system is approximately 100 gallons per capita per day (gpcd). Residential per capita water use can vary widely depending upon the age of the homes, size of the lots, economic status of the residents, and other intangible factors. Historically, per capita water use has been higher within newer subdivisions than it is in older, established areas. One of the reasons for this has been that newer homes are generally equipped with more water-using appliances than older homes. Additionally, newer homes are generally located on larger lots equipped with larger irrigation areas. Therefore, unless conservation measures are implemented by the City, the overall residential per capita water use could gradually increase from its current level of 100 gpcd to 115 gpcd by year 2020. Alternatively, conservation measures could be implemented by the City to keep residential per capita water use at or slightly less than the current rate.

C. Future Water Requirements

Future annual average day water demands were determined considering the preceding evaluations of population, residential per capita water use, metered sales apportionment, and unaccounted-for water use. Future maximum day and maximum hour water demands were determined by applying the previously discussed design ratios to the projected annual average day use.

Table 3-2 provides a summary of the design criteria values utilized in calculating the future water demands for the City of Fountain.

Table 3-2

Future Water Use Criteria

Design Year	**2010**	**2020**
Service Area Population	30,500	42,000
Average Residential Use, gpcd	110	115
Metered Sales Apportionment		
Percent Residential	68	65
Percent Commercial	32	35
Percent Unaccounted-for Water Use	11	10
Demand Ratios		
Maximum Day / Average Day	2.6	2.6
Maximum Hour / Average Day	3.8	3.8

Future water demands were projected using the values listed in Table 3-2, as shown in Table 3-3. As shown in Table 3-3, annual average day water use is projected to increase from its current level of 2.5 mgd to a level of 8.3 mgd by year 2020. The maximum day demand is projected to increase from its current level of 5.5 mgd to a level of 21.2 mgd by year 2020.

Table 3-3

Future Water Demands

Design Year	**2010**	**2020**
Average Day, mgd		
Residential	3.38	4.83
Commercial	1.61	2.60
Subtotal	4.99	7.43
Unaccounted-for	0.62	0.83
Total	5.61	8.26
Maximum Day, mgd	14.4	21.2
Maximum Hour, mgd	21.2	31.0

Although a 20-year planning period is generally adequate for sizing most water system facilities, it is often considered prudent to look more than 20 years into the future when planning major components such as water supply and treatment facilities, principal pumping stations and reservoirs, and large-diameter transmission mains. This longer-range view helps to ensure that the water supply will be adequate for the foreseeable future and also serves to minimize the possibility that major water system facilities will have to be duplicated or paralleled within a few years of their construction.

A review of the numerous development plans that have been submitted to the City of Fountain's planning department during the past year indicates that a considerable amount of the vacant land in the immediate vicinity of the City is already being targeted for development. If all of these plans come to fruition, and if the intermediate areas subsequently develop, population and resulting water demands within the Fountain service area could increase at the high projected rate well beyond the year 2020. Based on this long-range growth assumption, the City's average day and maximum day water demands were projected out to the year 2046, as shown in Table 3-4.

Table 3-4 presents water demand projections based on historic water usage. However, due to recent efforts by the City to encourage water conservation through public education and an inclining rate structure, current demands are lower than anticipated. The City also intends to implement additional measures in the near future to encourage water conservation. Based on this information, water demand projections were developed that consider the impact of current and future conservation. These projections are shown in Table 3-5 and assume a reduction in residential average day water demands of approximately 20 percent.

Table 3-4

Annual Water Demand Projections through 2046 (without Conservation)

Year	Annual Average Day (ac-ft/yr)	Annual Average Day (mgd)	Maximum Day (mgd)
2006	4,139	3.7	9.5
2007	4,675	4.2	10.7
2008	5,212	4.7	11.9
2009	5,748	5.1	13.2
2010	6,285	5.6	14.4
2011	6,594	5.9	15.1
2012	6,904	6.2	15.8
2013	7,214	6.4	16.5
2014	7,523	6.7	17.1
2015	7,833	7.0	17.8
2016	8,116	7.2	18.5
2017	8,399	7.5	19.2
2018	8,682	7.8	19.8
2019	8,965	8.0	20.5
2020	9,248	8.3	21.2
2021	9,540	8.5	21.8
2022	9,832	8.8	22.5
2023	10,125	9.0	23.2
2024	10,417	9.3	23.8
2025	10,710	9.6	24.5
2026	11,002	9.8	25.2
2027	11,294	10.1	25.9
2028	11,587	10.3	26.5
2029	11,879	10.6	27.2
2030	12,171	10.9	27.9
2031	12,464	11.1	28.5
2032	12,756	11.4	29.2
2033	13,048	11.6	29.9
2034	13,341	11.9	30.5
2035	13,633	12.2	31.2
2036	13,925	12.4	31.9
2037	14,218	12.7	32.6
2038	14,510	13.0	33.2
2039	14,803	13.2	33.9
2040	15,095	13.5	34.6
2041	15,327	13.7	35.1
2042	15,559	13.9	35.6
2043	15,792	14.1	36.2
2044	16,024	14.3	36.7
2045	16,256	14.5	37.2
2046	16,488	14.7	37.8

Table 3-5

Annual Water Demand Projections through 2046 (with Conservation)

Year	Annual Average		Maximum Day
	(ac-ft/yr)	(mgd)	(mgd)
2006	3,311	3.0	7.6
2007	3,740	3.3	8.6
2008	4,170	3.7	9.6
2009	4,599	4.1	10.5
2010	5,028	4.5	11.5
2011	5,276	4.7	12.1
2012	5,523	4.9	12.6
2013	5,771	5.2	13.2
2014	6,019	5.4	13.7
2015	6,266	5.6	14.3
2016	6,493	5.8	14.8
2017	6,719	6.0	15.3
2018	6,946	6.2	15.9
2019	7,172	6.4	16.4
2020	7,398	6.6	16.9
2021	7,632	6.8	17.5
2022	7,866	7.0	18.0
2023	8,100	7.2	18.5
2024	8,334	7.4	19.1
2025	8,568	7.6	19.6
2026	8,802	7.9	20.1
2027	9,035	8.1	20.7
2028	9,269	8.3	21.2
2029	9,503	8.5	21.8
2030	9,737	8.7	22.3
2031	9,971	8.9	22.8
2032	10,205	9.1	23.4
2033	10,439	9.3	23.9
2034	10,673	9.5	24.4
2035	10,907	9.7	25.0
2036	11,140	9.9	25.5
2037	11,374	10.2	26.0
2038	11,608	10.4	26.6
2039	11,842	10.6	27.1
2040	12,076	10.8	27.6
2041	12,262	10.9	28.1
2042	12,448	11.1	28.5
2043	12,633	11.3	28.9
2044	12,819	11.4	29.3
2045	13,005	11.6	29.8
2046	13,191	11.8	30.2

Chapter 4
Existing Facilities

The City of Fountain's water system includes wells, storage reservoirs, pumps, regulating valves, and a network of distribution mains. A map of the existing system (excluding FVA facilities) is shown on Figure 4-1. Water is obtained from a regional water supply system and from several city-owned wells. The Fountain distribution system is divided into two major pressure zones as well as one booster zone and one regulated zone that is supplied through pressure reducing valves. The following paragraphs discuss the City's water supply and distribution facilities in more detail.

A. Water Supply

Water for the City's potable water system comes from two main sources; surface water and well water. These sources are described in more detail below. In general, surface water is used as the City's primary supply, and the well water is used to supplement during periods of higher demand.

1. FVA Water

Surface water is obtained through participation in the Fountain Valley Authority (FVA) system. On an annual basis, this supply accounts for the majority (approximately 75 percent) of the City's water. Raw water from the Fryingpan-Arkansas Project is pumped from Pueblo Reservoir through the Fountain Valley Conduit to the Fountain Valley Water Treatment Plant (WTP). The water is then treated before being delivered via finished water pumping stations to the cities and towns of Fountain, Widefield, Security, Stratmoor Hills, and Colorado Springs, which comprise the FVA. These facilities were designed to supply a total annual volume of 20,100 acre-feet (ac-ft) of treated water to the participating municipalities at a constant rate throughout the year. The City's annual allocation of water is 2,000 ac-ft. Accounting for a 5 percent evaporative loss charge, the City's usable allotment is 1,900 ac-ft, which is equivalent to approximately 1.7 mgd.

A series of pumping stations and reservoirs along the length of the Fountain Valley Conduit are required to facilitate the flow of water through the


Joint Storage Reservoir
4.0 Mil Gal
Overflow Elev = 5,930 ft
Joint Elevated Tank
0.75 Mil Gal
Overflow Elev = 6,023 ft
Booster Pumping Station
Fountain Terminal Tank
2.5 Mil Gal
Overflow Elev = 5,930 ft
Inset A
Well #4
Well #5
Well #1
Well #2
Well #3
Southwest Reservoir
3.0 Mil Gal
Overflow Elev = 5,740 ft
Legend
Existing Facilities
Water Mains and Diameter (inches)
Low Zone
Little Ranches Zone
High Zone
Booster Zone
Other Facilites
Storage Reservoir
Pumping Station
Well
Pressure Reducing Valve
1,300 650 0 1,300 2,600
Feet
City of Fountain
Pure Colorado
Fountain, Colorado
Existing Water
System Facilities
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2006
Figure 4-1

transmission main. The water surface elevation in the Pueblo Reservoir is normally about 4,881 feet. Raw water from the Pueblo Reservoir is initially pumped by Pumping Plant No. 1 through about 12 miles of 42-inch main to Forebay Tank No. 2, which has an overflow elevation of 5,177 feet. Pumping Plant No. 2 pumps raw water from Forebay No. 2 through 16 miles of 39-inch pipe to the Clear Springs Regulating Tank, which has an overflow elevation of 5,622 feet. The Clear Springs Regulating Tank is located on the Fountain Valley Water Purification Plant site, and raw water flows by gravity from the regulating tank to the treatment facility.

Following treatment, the finished water flows from the plant into an adjacent clearwell. Pumping Plant No. 3 pumps water from the clearwell through 5 miles of 39-inch pipe to Forebay Tank No. 4, which is located just west of Fountain and has an overflow elevation of 5,767 feet. Pumping Plant No. 4 pumps water from Forebay No. 4 through 5 miles of 33-inch pipe to the Stratmoor Hills Terminal Tank, which is located on the south side of Colorado Springs and has an overflow elevation of 5,983 feet.

FVA finished water is delivered to the City at two locations. A turnout on the section of the Fountain Valley Conduit leading to Forebay Tank No. 4 allows water from the conduit into the City's Southwest Reservoir, a 3.0 million gallon (MG) ground storage reservoir located in the southwest part of the distribution system. The City's Southwest Reservoir has an overflow elevation of 5,740 feet, which is 27 feet lower than Forebay Tank No. 4. Because the overflow elevation of the Southwest Reservoir is below the normal operating gradient in this section of the Fountain Valley Conduit, water can flow from the conduit through a regulating valve into the City's reservoir. The water then flows by gravity from the City's Southwest Reservoir into the Low Zone distribution system.

As previously indicated, FVA Pumping Plant No. 4 takes suction from Forebay Tank No. 4 and discharges into a transmission main that conveys water northward to the Stratmoor Hills Terminal Tank. On the discharge side of Pumping Plant No. 4, a 24-inch diameter transmission main, referred to as the Fountain Valley Lateral, branches off from the Fountain Valley Conduit and heads northeast about 3 miles to the Widefield Regulating Tank, which is located at the Fountain/Widefield tank site along Goldfield Drive. Thus, some of the water that is pumped by Pumping Plant No. 4 flows through the Fountain Valley Lateral to the Widefield Regulating Tank, which has an overflow elevation of

5,942 feet. From there water flows by gravity to the Widefield Terminal Tank, the North Fountain Tank and the Joint Fountain/Widefield Storage Reservoir. From these reservoirs, water can either enter Fountain's High Zone distribution network or be pumped to the Joint Fountain/Widefield Elevated Tank, which serves the City's Booster Zone and the Widefield distribution system.

About one-third of the water that is delivered to the Widefield Regulating Tank is subsequently pumped through the 16-inch diameter Security Lateral to the Security Terminal Tanks. Thus, the Fountain Valley Lateral conveys water for Fountain, Widefield, and Security.

2. Well Water

Because the FVA water supply is not sufficient to meet all of Fountain's water needs, the City routinely supplements with water pumped from wells. The City owns and operates five wells located in the downtown area between Fountain Creek and the Union Pacific Railroad tracks. Wells No. 3, 4, and 5 discharge to the Low Zone distribution network. Wells No. 1 and 2 normally discharge to the High Zone distribution network, but during emergencies or unusual demand conditions they can be valved to temporarily discharge into the Low Zone.

A description of the well locations and capacities is given in Table 4-1. In general, these wells are relatively small with capacities ranging from 350 to 750 gallons per minute (gpm). This is equivalent to a total pumping capacity of 4.3 mgd and a firm pumping capacity (largest well offline) of 3.2 mgd. However, it should be noted that in recent years, the City has experienced reduced yield from these wells due to lower groundwater levels.

Table 4-1

Locations and Capacities of the City's Potable Wells

Well Number	Pressure Zone Served	General Location	Pumping Capacity (gpm)
1	High	Santa Fe Avenue and Hanover Street	750
2	High	Alabama Avenue and Race Street	650
3	Low	Main Street and Missouri Avenue	550
4	Low	Santa Fe Avenue and Linda Vista Drive	350
5	Low	Near Fountain-Fort Carson High School	660

The wells are generally only operated during periods of higher water demand, usually during the summertime, and account for approximately 25 percent of the total potable water delivered by the City annually. Water from these wells is disinfected before being pumped directly into the distribution system. As a result, FVA water and well water are not blended prior to reaching the City's customers. Therefore, customers located within the zone of influence of the wells primarily receive well water during the summer months while other customers continue to receive higher quality FVA water. Table 4-2 provides a comparison of the water qualities of the different water sources.

Table 4-2

Water Quality Comparison of the City's Water Supplies[1]

Water Quality Parameter	Concentration		Comments
	Wells Nos. 1 and 2	FVA Finished Water	
Alkalinity (as $CaCO_3$), mg/L	270 – 290	77 – 129	
Sulfate, mg/L	190 – 320	63 – 152	Federal Secondary Maximum Contaminant Level = 250 mg/L
pH, s.u.	7.6 – 8.2	7.2 – 7.6	
Calcium (as $CaCO_3$), mg/L	310 – 350	105 – 150	
Total Hardness (as $CaCO_3$), mg/L	450 – 500	138 – 228	Well water classified as very hard by USGS
Langlier Index	0.24 – 0.89	-0.28 – -0.90	Negative value may result in corrosion in the distribution system

[1] Based on water quality testing conducted between 1991 and 2001.

In general, water from the City's wells is of lower quality than FVA water, which has resulted in customer complaints, as discussed above. In order to address this issue, the well water must be treated or blended with higher quality water. Alternatives for improving water quality are evaluated in the following chapters.

B. Pressure Zones

In order to accommodate varying ground elevations within the service area without producing excessively low or high system pressures, the City's water distribution system is divided into two major pressure zones (referred to as the Low Zone and the High Zone) as well as one booster zone and one relatively small regulated zone supplied through pressure reducing valves. Table 4-3 provides a summary of the ground elevations and operating gradients within the various pressure zones that makeup the Fountain water system, and the subsequent paragraphs discuss the individual pressure zones in more detail.

Table 4-3 Pressure Zones			
Pressure Zone	**Minimum Ground Elevation (feet)**	**Maximum Ground Elevation (feet)**	**Operating Gradient (feet)**
Low	5,500	5,600	5,740
Little Ranches	5,560	5,700	5,790
High	5,520	5,750	5,930
Booster	5,750	5,880	6,023

1. Low Zone

The Low Zone serves the low-lying ground in the southwest part of the City, generally southwest of the Union Pacific Railroad tracks. Ground elevations within the Low Zone range from about 5,500 feet along Fountain Creek to 5,600 feet along the Union Pacific railroad tracks. The Low Zone operates on a static hydraulic gradient of 5,740 feet as determined by the overflow elevation of the City's 3.0 million gallon Southwest Reservoir.

FVA water is supplied to the City's Low Zone from the Fountain Valley Conduit via a turnout located about 3 miles upstream of Forebay Tank No. 4 into Fountain's Southwest Reservoir and then flows by gravity into the distribution system. Additional water for the Low Zone is obtained from City Wells No. 3 and No. 4. Under unusual demand conditions or emergencies, water can also be supplied to the Low Zone from City Wells No. 1 and No. 2 or through pressure reducing valves located along the boundary between the Low and High zones.

2. High Zone

The High Zone serves most of the higher-lying ground in the northeast part of the City, generally northeast of the Union Pacific Railroad tracks. Ground elevations within the High Zone range from about 5,520 feet along Camp Creek to 5,750 feet in the vicinity of Janitell Junior High School. The High Zone operates on a static hydraulic gradient of 5,930 feet as determined by the overflow elevations of the Fountain Terminal Tank and the Joint Storage Reservoir.

FVA water is supplied to the High Zone through the Fountain Valley Lateral, which conveys water from the Fountain Valley Conduit to the Widefield Regulating Tank. Water flows by gravity from the regulating tank to the North Fountain Tank and Joint Storage Reservoir. From these reservoirs, water can flow by gravity into the High Zone distribution system or be pumped into the Booster Zone. Additional water for the High Zone is obtained from City Wells No. 1 and No. 2.

3. Little Ranches Zone

The Little Ranches Zone serves an area in the southeast part of the City where the ground elevations are too high to be served effectively from the Low Zone but lower than the ground being served from the High Zone. Ground elevations in the Little Ranches Zone range from about 5,560 feet to 5,700 feet. Water is supplied through a pressure reducing valve (PRV) that bleeds water from the High Zone into the regulated zone. Because there are no storage facilities within the Little Ranches Zone, the static hydraulic gradient within the zone is determined by the downstream pressure setting on the pressure reducing valve. The PRV is currently set to maintain an operating gradient of about 5,790 feet within the Little Ranches distribution system.

4. Booster Zone

The Booster Zone serves the high-lying ground in the north part of the City, generally north of Mesa Ridge Parkway. Ground elevations in this zone range from about 5,750 feet to 5,880 feet. The Booster Zone operates on a static hydraulic gradient of 6,023 feet as determined by the overflow elevation of the 750,000 gallon Joint Elevated Tank.

Water is pumped from the Joint Storage Reservoir into the Booster Zone using two pumps located in the base of the Joint Elevated Tank. Each of the pumps has a rated capacity of 1,300 gallons per minute (gpm) at a head of 100 feet, and each is equipped with a 50 horsepower (hp) motor that operates at a speed of 1,750 revolutions per minute (rpm).

C. Storage Facilities

Storage facilities in a distribution system serve a number of purposes, including flow equalization, fire reserve, and emergency supply. Without storage facilities, the supply, treatment, pumping, and transmission facilities would have to be sized to meet instantaneous peak demands within the service area, which would be both impractical and uneconomical. However, by constructing appropriately sized reservoirs at strategic locations throughout the service area, the other major system components can be more economically sized.

Table 4-4 provides a summary of pertinent information concerning the existing storage reservoirs within the City's distribution system. It should be noted that the Joint Storage Reservoir, the Joint Elevated Tank, and the associated booster pumps are all jointly owned and operated by the Cities of Fountain and Widefield.

Table 4-4

Water Storage Facilities

Facility	Volume (MG)	Overflow Elevation (feet)	Sidewater Depth (feet)
Southwest Reservoir	3.0	5,740	39
Fountain Terminal Tank	2.5	5,930	43
Joint Storage Reservoir[(1)]	4.0	5,930	37
Joint Elevated Tank[(1)]	0.75	6,023	30

[(1)]Jointly owned and operated by the Cities of Fountain and Widefield.

D. Distribution Mains

Except for a relatively small amount of 16-inch and 20-inch pipe, the water mains within Fountain's distribution system generally range in diameter from 4-inches to 12-inches. Most of the older pipes within the distribution system are cast iron or ductile iron, with a few asbestos cement pipes. Conversely, most of the newer pipes in the distribution system are polyvinyl chloride (PVC).

Since Fountain's Booster Zone and the northern part of its High Zone are located immediately adjacent to the City of Widefield's service area, the two utilities have established, by mutual agreement, a number of interconnections between the neighboring distribution systems. The valves on these interconnections are typically closed to keep the two systems separated during normal operations. However, in the event of an emergency in either distribution system, the valves on the interconnections could be opened to allow water to flow from one system to the other. Thus, these interconnections provide an additional level of reliability for both the Fountain and Widefield water utilities.

Chapter 5
Water Supply Alternatives

This chapter presents a review of findings from previous studies as well as three water supply alternatives that have been developed as part of this Master Plan.

A. SDS Participation Evaluation

Previous studies have focused on the use of water from the proposed SDS to meet long-term projected increases in water demand. The proposed SDS consists of a system of transmission mains, pumping stations, reservoirs, and treatment facilities designed to bring additional water from Pueblo Reservoir to serve the Pike's Peak area. These facilities are anticipated to be online by 2015.

It was originally assumed that the City's share of the SDS water would be conveyed from the SDS treatment facility to the Fountain service area through a future transmission main extended from the Colorado Springs distribution system. However, due to cost and scheduling issues, the City has recently begun exploring the possibility of an agreement with Colorado Springs to trade SDS water for an equivalent amount of FVA water. Under this potential arrangement, the City would not receive any SDS water from the proposed SDS WTP but would instead receive additional water through the existing Fountain Valley Conduit. Since the amount of water than can be delivered through the FVA system is essentially fixed, the increase water delivery to Fountain would be offset by a corresponding decrease in the delivery of FVA water to Colorado Springs. In exchange, Colorado Springs would retain what would have been Fountain's share of the SDS water being treated at the proposed SDS WTP.

Under the above described arrangement, the increase in delivery of FVA water to Fountain would be equivalent in volume and rate to Fountain's SDS allotment. As currently envisioned, Fountain's level of participation in the SDS project will be 2,500 ac-ft per year, which is equivalent to an annual average delivery rate of 2.2 mgd. However, Fountain may be able to obtain up to 5.6 mgd of SDS water during periods of high demand.

Several studies to develop and evaluate water supply scenarios that utilize SDS water have been completed. These scenarios are briefly described below.

- **Scenario A:** All future water demands would be met with water from the SDS project. This scenario was dismissed due to the high cost of obtaining the required water rights.

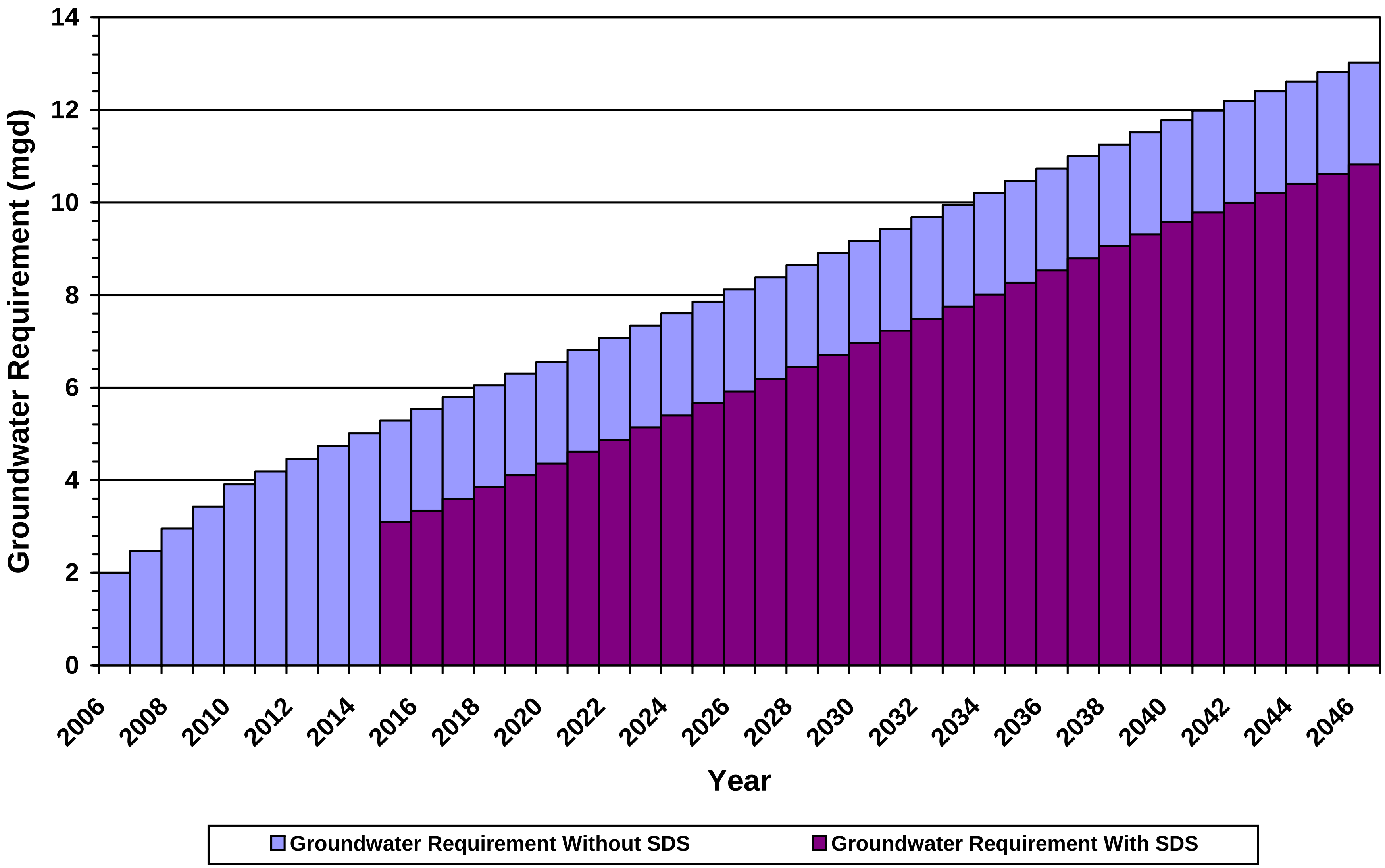
- **Scenario B:** Future water demands would be met by utilizing 5,000 ac-ft/yr of SDS water and the remaining demand would be met with local supplies (wells). This scenario was also dismissed due to the high cost of obtaining the required water rights.

- **Scenario C:** Future water demands would be met by utilizing 2,500 ac-ft/yr of SDS water. The remaining demand would be met with local supplies (wells). Based on the City's existing and future water rights portfolio, this level of participation may be feasible.

- **Scenario D:** Future water demands would be met by utilizing local supplies (wells). Under this scenario, the City would not participate in SDS.

Since the City's participation in and timing of SDS is uncertain, it is prudent to consider both Scenarios C and D have. If the City decides not to participate in SDS, it will need to develop additional local supplies. Figures 5-1 and 5-2 show the groundwater requirements to meet projected average day demands for the years 2006 through 2046. The amount of groundwater required is the City's projected average day demand less FVA water. Figure 5-2 shows the projected average day groundwater requirements if the City was to implement conservation measures. Figures 5-1 and 5-2 show the City's groundwater requirements for two scenarios: SDS participation and no SDS participation.

An evaluation was completed to determine the financial impact of the City's participation in SDS versus developing additional local supplies. For this evaluation, it was assumed that if the City does not participate in SDS, it will need to develop 2.2 mgd of water with similar treated water quality utilizing local groundwater. A yield of 0.75 mgd per well was assumed based on data from existing wells. Therefore, the City will need to develop 5 additional wells, which



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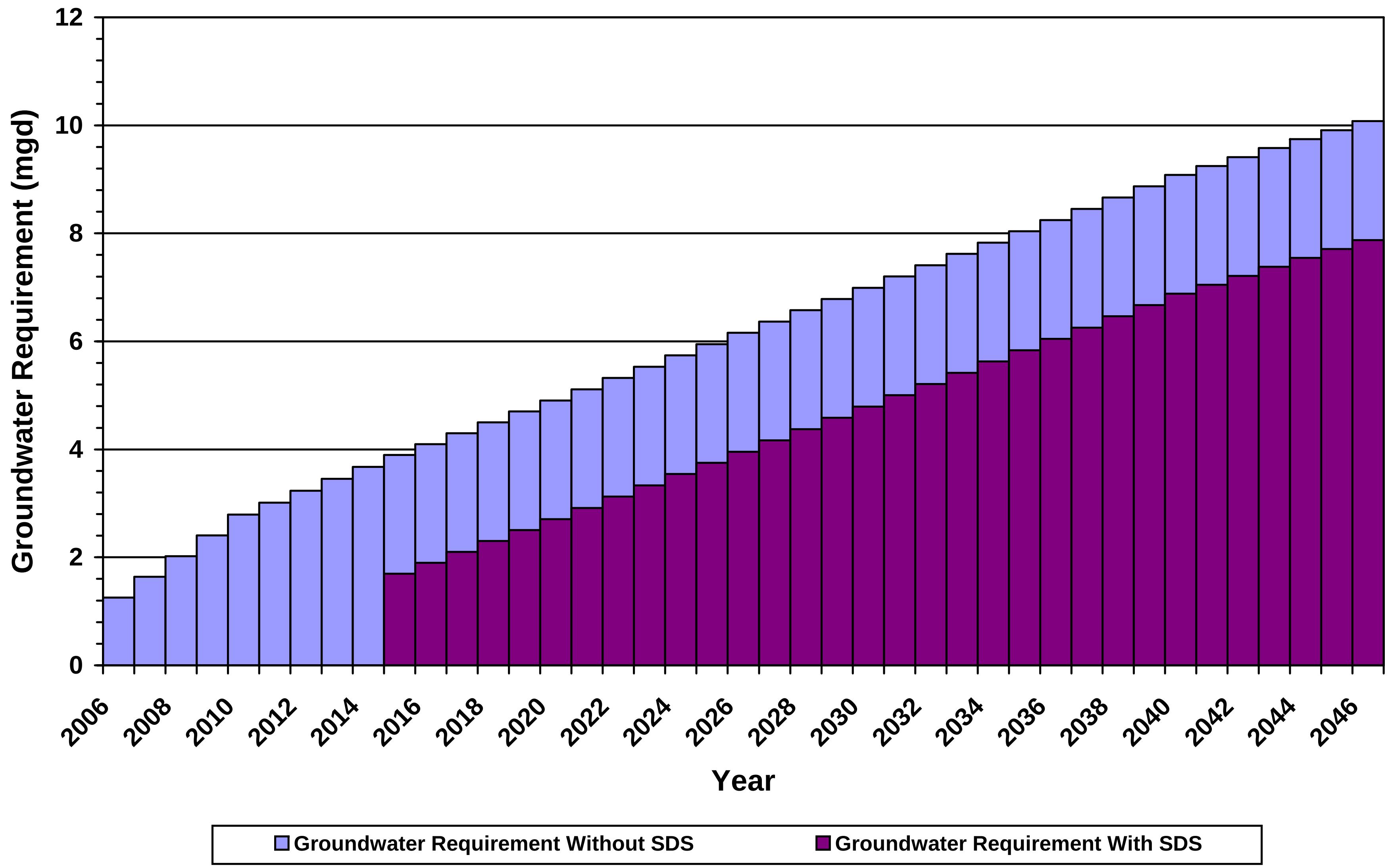
City of Fountain, Colorado – Water Supply Plan

Projected Annual Average Day Groundwater Requirements

Figure 5-1



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City of Fountain, Colorado – Water Supply Plan

Projected Annual Average Day Groundwater Requirements with Conservation

Figure 5-2

includes two stand-by wells. This water will require treatment due to high total dissolved solids (TDS) concentrations. Costs for 2 mgd of additional reverse osmosis (RO) treatment and brine disposal were also included in the evaluation, which assumes low quality wells and therefore, a low RO bypass ratio. Three alternatives were developed for brine disposal. These alternatives include:

- Drying beds. Under this alternative, brine would be sent to lined drying beds for evaporation.
- Zero liquid discharge (ZLD) with the benefit of being located near a power plant. Under this alternative, brine would be sent to concentrators to evaporate the water. The heat required for this process would be provided by the waste heat produced by the power plant. The concentrated salt would then be sent to a landfill for disposal.
- ZLD not located near to a power plant. Under this alternative, brine would be sent to concentrators to evaporate the water. The heat required for this process would be provided by electricity. The concentrated salt would then be sent to a landfill for disposal.

Table 5-1 shows the cost comparison for the City's participation in SDS versus no participation for the years 2015 (when SDS is expected to come online) through 2046.

Table 5-1

Evaluation of City's Participation in SDS versus Developing Local Supplies

Cost Component	Cost for 2.2 mgd of Treated Water			
	SDS Participation	Wells/RO Treatment w/ Drying Beds	Wells/RO Treatment w/ ZLD Near Power Plant	Wells/RO Treatment w/ ZLD Not Near Power Plant
Capital cost opinion	$26,000,000	$20,000,000	$20,000,000	$20,000,000
O&M cost opinion	$29,000,000	$28,000,000	$38,000,000	$69,000,000
Total cost opinion	$56,000,000	$48,000,000	$58,000,000	$88,000,000

The cost opinion for the City's participation in SDS is of the same order of magnitude as that for developing wells and RO treatment utilizing either drying beds or ZLD near a power plant for brine treatment. Therefore, it is recommended that the City continue to pursue participation in SDS and budget accordingly. If the SDS project does not move forward, the City can use those funds to develop additional local supplies.

B. Local Water Supply Alternatives

Three water supply alternatives and one sub-alternative were developed with the goal of meeting interim and ultimate water demands. As discussed previously, prior studies determined that participating in SDS at levels greater than 2,500 ac-ft/yr was not feasible. In addition, implementation of a regional non-potable water system for Fountain was not recommended for the following reasons:

- A cursory investigation concluded that there is insufficient areas with large irrigation demand in a single region of the City of justify a regional non-potable water system.
- When plans for development are submitted to the City, localized non-potable water supplies should be evaluated on a case by case basis to determine if a well can be acquired that would have adequate water quality to be utilized for purposes such as landscape irrigation at parks and schools. However, it should be noted that the majority of the wells on the southern end of the City have TDS concentrations above 1,000 mg/L and would require blending with a higher quality water supply to be suitable for turf irrigation.

Therefore, the alternatives developed as part of this Master Plan focus on utilizing additional wells to meet future water demands in addition to existing FVA and well supplies, and water from SDS.

The State of Colorado does not allow the drilling of new wells within 600 feet of existing wells to avoid negative impacts to existing well owners. Due to the large number of existing wells within the Fountain Creek Basin, finding an acceptable site to drill new wells is challenging. In addition, the Fountain Creek alluvium is braided with a mixture of sands and clays that make locating wells with adequate yield difficult. Therefore, it is recommended that the City acquire existing wells with demonstrated yields and re-drill them as necessary to meet municipal requirements. The northern part of the City has relatively high water quality wells that can be chlorinated and pumped directly into the distribution system without additional treatment. It is recommended that the City acquire and develop some of these northern wells, as identified below.

Since the number of wells required to meet future demands exceeds the expected supply associated with the available northern wells, it is recommended that the City acquire and/or develop additional wells in the southern part of the City. However, as discussed in Chapter 4, the quality of the well water in the southern portion of the City is poor with respect to TDS (average 700 to 1,500 mg/L), and therefore, these alternatives include treatment of the groundwater. Although additional treatment capabilities could potentially be provided at each individual well site, the most practical long-term solution is to construct one treatment facility with sufficient capacity to treat the water from all of the City wells.

The water quality of several existing wells located in and near the City of Fountain is included in the Appendix, prioritized based on the potential to be utilized by the City. Figure 5-3 is a map showing the location of these wells and Figure 5-4 shows the average TDS concentration of each well.

The following assumptions were utilized in developing alternatives:

- New wells were anticipated to yield 0.75 mgd each.
- A minimum of one standby well was provided at all times.

These alternatives are described in detail below.

Aprox. 1 Mile

LEGEND

Existing Well Sites

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Existing Well Sites In and Near the City of Fountain

Figure 5-3

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City of Fountain, Colorado - Water Supply Plan

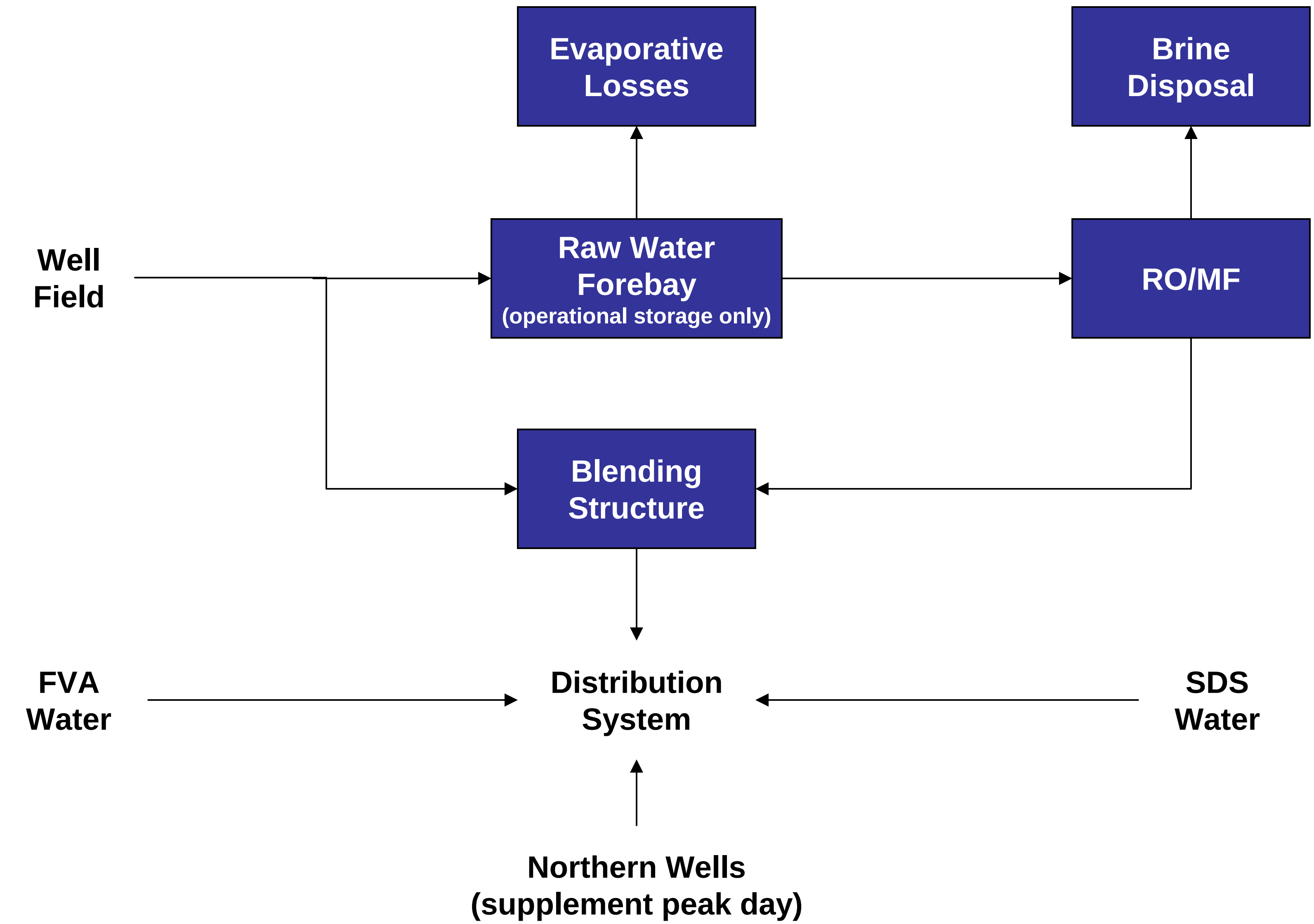
Average Groundwater TDS Concentrations Near Fountain

Figure 5-4

1. Alternative 1

Under Alternative 1, the City would utilize wells and reverse osmosis/microfiltration (RO/MF) treatment to meet maximum day demands. Figure 5-5 shows a schematic representation of Alternative 1. The following is a list of the assumptions associated with Alternative 1:

- The City would continue to utilize its full allotment of FVA water, as well as water from its existing wells.
- The City would develop additional wells as needed to meet maximum day demands. These wells would be developed in areas north and south of the City's existing wells.
- Water from the northern wells would only be used during periods of peak water demands. The water from the northern wells is of higher quality than the southern wells and are not anticipated to require treatment.
- Three northern wells, known as the Venetucci Wells, have been identified as potential well sites. Under a proposed agreement, the City could develop and utilize these three wells until 2014, at which time the City would turn over two of the three wells to the Towns of Widefield and Security.
- A temporary RO/MF WTP would be utilized for treatment of southern wells beginning in 2008 and would be operated while a permanent RO/MF WTP was being constructed. It is recommended that the permanent treatment facility be located just south of the Southwest Reservoir, in the general vicinity of the gravel pits. Once the permanent RO/MF WTP was constructed, the temporary facility would be decommissioned. The permanent RO/MF WTP would be expanded as needed to meet maximum day demands.
- A portion of the water from the existing and southern wells would be treated with RO/MF and blended with untreated well water and FVA and SDS water before entering the distribution system. The treatment goal of the RO/MF facility would be to have a blended water TDS concentration of less than 500 mg/L, which is the Federal Secondary Maximum Contaminant Level.



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City of Fountain, Colorado – Water Supply Plan

Alternative 1 Schematic – Pump Wells to Meet Maximum Day Demands

Figure 5-5

- Brine handling facilities would be constructed. These facilities could be drying beds, ZLD, or deep well injection. For purposes of this study, it was assumed that ZLD located near a power plant would be utilized for brine disposal.

- An augmentation reservoir would be constructed to offset impacts on Fountain Creek due to pumping additional wells, as well as help meet SDS augmentation requirements.

- A raw water reservoir would be constructed as a forebay for the permanent WTP and provide operational storage.

- If available, the City would utilize SDS water beginning in 2015. As discussed in Chapter 1, the City may be able to vary the supply of SDS water based on seasonal demands. However, for purposes of this study, it was assumed that the City would only receive SDS water at a constant rate year-round. SDS participation was assumed since, as discussed previously, the costs for participating in SDS are of the same order of magnitude as those for developing and utilizing local supplies.

Table 5-2 provides a summary of the components associated with Alternative 1 and the anticipated year of implementation for each component. The estimated costs associated with the infrastructure listed in Table 5-2 are presented in Chapter 6.

Table 5-2

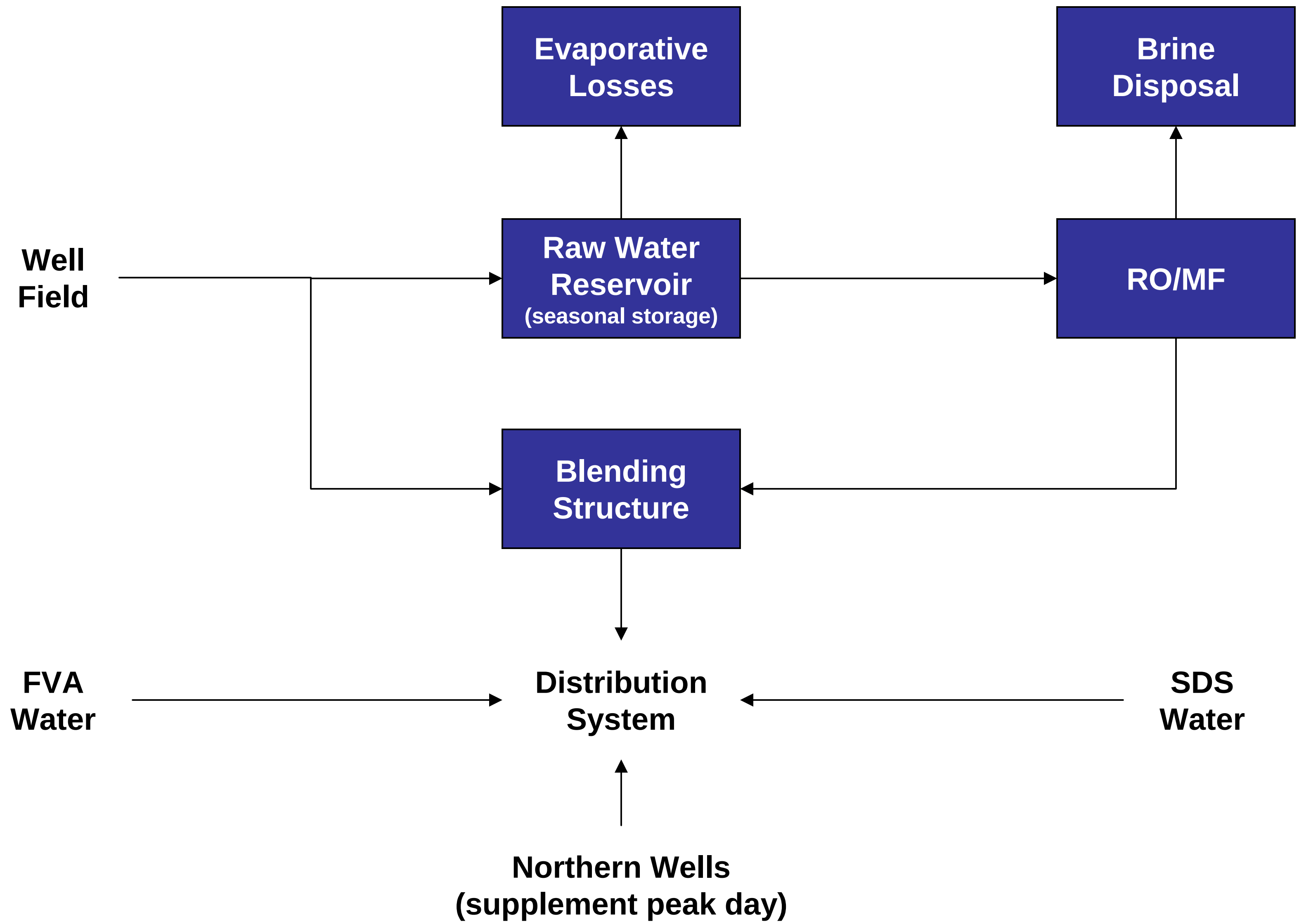
Alternative 1 Components

Year	Project Description
2007	Develop 4 northern wells and 1 southern well
2008	Develop 2 northern wells and 4 southern wells 1.5 mgd temporary RO/MF treatment facility online
2009	Develop 1 northern well and 1 southern well
2010	Develop 2 southern wells
2011	Develop 1 southern well 10 mgd permanent RO/MF treatment facility online Decommission temporary RO/MF treatment facility
2012	Develop 1 southern well
2013	Develop 3 southern wells Augmentation reservoir online
2014	Develop 1 southern well Turn over two Ventucci wells to Widefield and Security
2015	SDS online WTP forebay online
2019	Develop 3 southern wells
2021	Expand RO/MF treatment facility to 15 mgd
2022 – 2031	Develop 10 southern wells
2032	Expand RO/MF treatment facility to 20 mgd
2033 – 2046	Develop 13 southern wells

2. Alternative 2

Under Alternative 2, the City would pump wells at a constant rate equal to the annual average day demand and utilize storage and RO/MF treatment to meet maximum day demands. Figure 5-6 shows a schematic representation of Alternative 2. The following is a list of assumptions associated with Alternative 2:

- The City would continue to utilize its full allotment of FVA water, as well as water from its existing wells.
- The City would develop additional wells as needed to meet maximum day demands until raw water storage was constructed.



City of Fountain, Colorado – Water Supply Plan

Alternative 2 Schematic – Pump Wells to Meet Average Day Demands and Provide Single Pass Treatment

Figure 5-6

These wells would be developed in areas north and south of the City's existing wells. After raw water storage is constructed, wells will only be required to meet average day demands.

- A raw water reservoir would be constructed in two phases. This reservoir would be expanded as needed to ensure water is available for treatment whenever the demand exceeds the supply provided by the wells.

- Once raw water storage is constructed, treated water from the southern wells will be the best quality and therefore, be used as the primary supply. Water from the northern wells would only be used during periods of peak water demands and would not be treated prior to entering the distribution system.

- Three northern wells, known as the Venetucci Wells, have been identified as potential well sites. Under a proposed agreement, the City could develop and utilize these three wells until 2014, at which time the City would turn over two of the three wells to the Towns of Widefield and Security.

- A temporary RO/MF WTP would be utilized for treatment of southern wells beginning in 2008 and would be operated while a permanent RO/MF WTP was being constructed. It is recommended that the permanent treatment facility be located just south of the Southwest Reservoir, in the general vicinity of the gravel pits. Once the permanent RO/MF WTP was constructed, the temporary facility would be decommissioned. The permanent RO/MF WTP would be expanded as needed to meet maximum day demands.

- A portion of the water from the existing and southern wells would be treated with RO/MF and blended with untreated well water and FVA and SDS water before entering the distribution system. The treatment goal of the RO/MF facility would be to have a blended water TDS concentration of less than 500 mg/L, which is the Federal Secondary Maximum Contaminant Level.

- Brine handling facilities would be constructed. These facilities could be drying beds, ZLD, or deep well injection. For purposes of this study, it was assumed that ZLD located near a power plant would be utilized for brine disposal.

- An augmentation reservoir would be constructed to offset impacts on Fountain Creek due to pumping additional wells, as well as help meet SDS augmentation requirements.

- If available, the City would utilize SDS water beginning in 2015. As discussed in Chapter 1, the City may be able to vary the supply of SDS water based on seasonal demands. However, for purposes of this study, it was assumed that the City would only receive SDS water at a constant rate year-round. SDS participation was assumed since, as discussed previously, the costs for participating in SDS are of the same order of magnitude as those for developing and utilizing local supplies.

Table 5-3 provides a summary of the components associated with Alternative 2. The estimated costs associated with the infrastructure listed in Table 5-3 are presented in Chapter 6.

Table 5-3

Alternative 2 Components

Year	Project Description
2007	Develop 4 northern wells and 1 southern well
2008	Develop 2 northern wells and 4 southern wells 1.5 mgd temporary RO/MF treatment facility online
2009	Develop 1 northern well and 1 southern well
2010	Develop 2 southern wells
2011	Develop 1 southern well 10 mgd permanent RO/MF treatment facility online Decommission temporary RO/MF treatment facility
2012	Develop 1 southern well
2013	Develop 3 southern wells Augmentation reservoir online
2014	Develop 1 southern well Turn over two Ventucci wells to Widefield and Security
2015	SDS online Raw water storage reservoir online
2021	Expand RO/MF treatment facility to 15 mgd
2032	Expand RO/MF treatment facility to 20 mgd

3. Alternatives 3 and 3a

Under Alternative 3, the City would pump wells and utilize RO/MF, all at a constant rate equal to the annual average day demand and utilize storage and additional microfiltration (MF) treatment to meet maximum day demands. Figure 5-7 shows a schematic representation of Alternative 3. The following is a list of the assumptions associated with Alternative 3:

- The City would continue to utilize its full allotment of FVA water, as well as water from its existing wells.

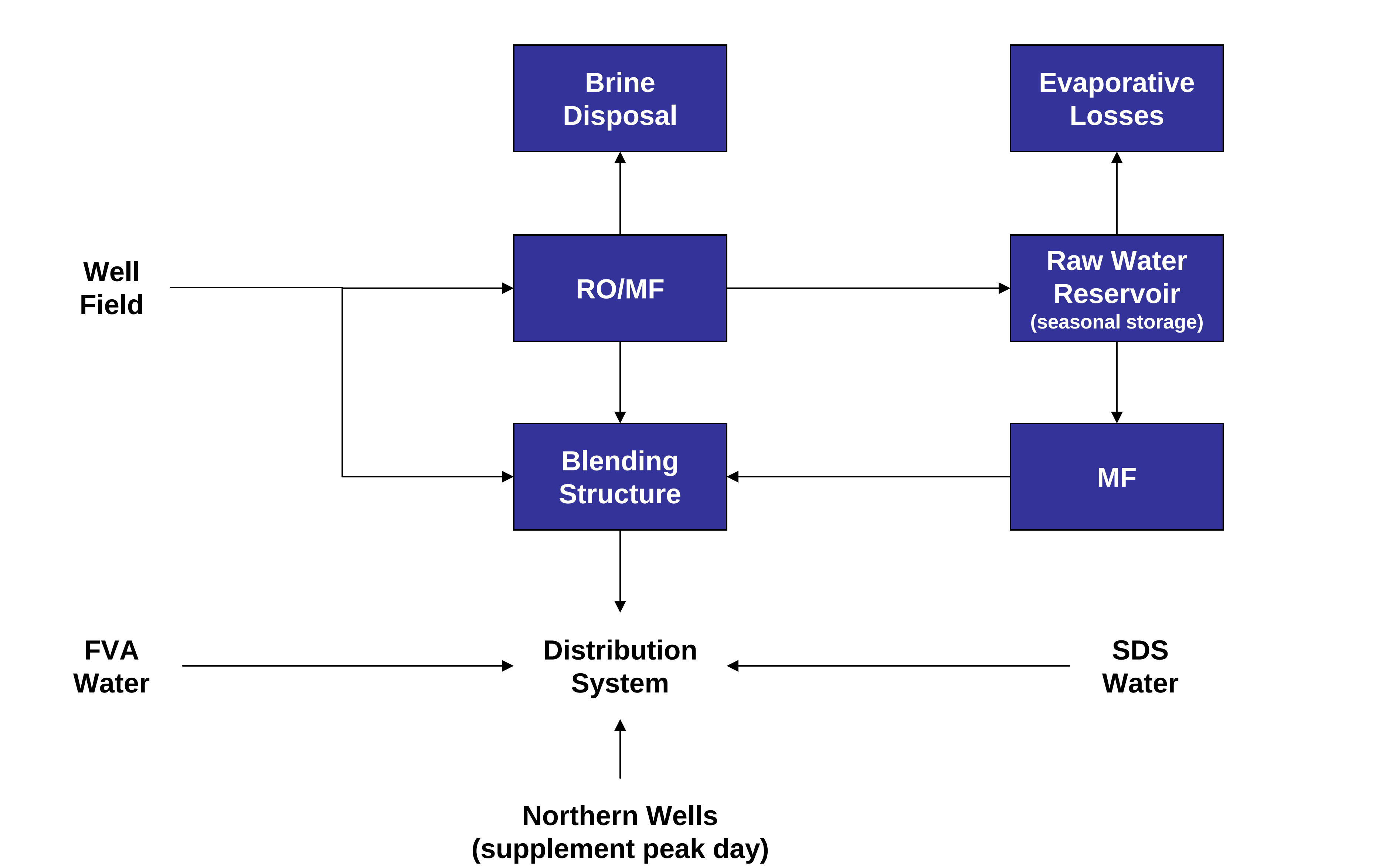
- The City would develop additional wells as needed to meet maximum day demands until raw water storage was constructed. These wells would be developed in areas north and south of the City's existing wells. After raw water storage is constructed, wells will only be required to meet average day demands.

- A raw water reservoir would be constructed in two phases. This reservoir would be expanded as needed to ensure water is available for treatment whenever the demand exceeds the supply provided by the wells.

- Once raw water storage is constructed, treated water from the southern wells will be the best quality and therefore, be used as the primary supply. Water from the northern wells would only be used during periods of peak water demands and would not be treated prior to entering the distribution system.

- Three northern wells, known as the Venetucci Wells, have been identified as potential well sites. Under a proposed agreement, the City could develop and utilize these three wells until 2014, at which time the City would turn over two of the three wells to the Towns of Widefield and Security.

- A temporary RO/MF WTP would be utilized for treatment of southern wells beginning in 2008 and would be operated while a permanent RO/MF WTP was being constructed. It is recommended that the permanent treatment facility be located just south of the Southwest Reservoir, in the general vicinity of the gravel pits. Once the permanent RO/MF WTP was constructed, the temporary facility would be decommissioned. The permanent



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Alternatives 3 and 3a Schematic – Pump Wells to Meet Average Day Demands and Provide Double Pass Treatment

Figure 5-7

RO/MF WTP would be expanded as needed to meet maximum day demands until a MF facility was constructed, as discussed below.

- A portion of the water from the existing and southern wells would be treated with RO/MF and blended with untreated well water and FVA and SDS water before entering the distribution system. The treatment goal of the RO/MF facility would be to have a blended water TDS concentration of less than 500 mg/L, which is the Federal Secondary Maximum Contaminant Level.

- A MF treatment facility would ultimately be constructed adjacent to the RO/MF WTP. Once online, the MF facility would provide peaking treatment capacity and would allow the permanent RO/MF facility to be operated at a constant rate equal to the annual average day demand. During periods of the year when water demands dropped below the annual average day demand, the extra treated RO/MF water would be stored in the raw water reservoir. During periods of the year when water demands exceeded the annual average demand, the MF facility would be utilized to retreat the water from the raw water reservoir before sending it into the distribution system.

- Brine handling facilities would be constructed. These facilities could be drying beds, ZLD, or deep well injection. For purposes of this study, it was assumed that ZLD located near a power plant would be utilized for brine disposal.

- An augmentation reservoir would be constructed to offset impacts on Fountain Creek due to pumping additional wells, as well as help meet SDS augmentation requirements.

- If available, the City would utilize SDS water beginning in 2015. As discussed in Chapter 1, the City may be able to vary the supply of SDS water based on seasonal demands. However, for purposes of this study, it was assumed that the City would only receive SDS water at a constant rate year-round. SDS participation was assumed since, as discussed previously, the costs for participating in SDS are of the same order of magnitude as those for developing and utilizing local supplies.

Table 5-4 provides a summary of the components associated with Alternative 3. The estimated costs associated with the infrastructure listed in Table 5-4 are presented in Chapter 6.

Table 5-4

Alternative 3 Components

Year	Project Description
2007	Develop 4 northern wells and 1 southern well
2008	Develop 2 northern wells and 4 southern wells 1.5 mgd temporary RO/MF treatment facility online
2009	Develop 1 northern well and 1 southern well
2010	Develop 2 southern wells
2011	Develop 1 southern well 4.0 mgd permanent RO/MF treatment facility online
2012	Develop 1 southern well
2013	Develop 3 southern wells Augmentation reservoir online
2014	Develop 1 southern well Turn over two Ventucci wells to Widefield and Security
2015	SDS online Raw water storage reservoir online
2018	15 mgd MF treatment facility online Decommission temporary RO/MF treatment facility
2029	Expand RO/MF treatment facility to 6.5 mgd
2031	Expand MF treatment facility to 20 mgd

A sub-alternative of Alternative 3 was also developed. This alternative has the same components as Alternative 3, but considers the impact of conservation on average day and maximum day demand projections. If the City opts to implement conservation measures, it can downsize the capacity of some water supply and treatment infrastructure. A reduction of 20 percent in average day and maximum day demands was assumed in developing this alternative. Table 5-5 provides a summary of the components associated with Alternative 3a.

Table 5-5

Alternative 3a Components

Year	Project Description
2007	Develop 4 northern wells and 1 southern well
2008	Develop 2 northern wells and 4 southern wells 1.5 mgd temporary RO/MF treatment facility online
2009	Develop 1 northern well and 1 southern well
2010	Develop 2 southern wells
2011	Develop 1 southern well 4.0 mgd permanent RO/MF treatment facility online
2012	Develop 1 southern well
2013	Augmentation reservoir online
2014	Turn over two Ventucci wells to Widefield and Security
2015	SDS online Raw water storage reservoir online
2018	Expand RO/MF treatment facility to 5.0 mgd 10 mgd MF treatment facility online Decommission temporary RO/MF treatment facility
2029	Expand MF treatment facility to 15 mgd

Chapter 6
Evaluation of Water Supply Alternatives

This chapter presents an evaluation of the three water supply alternatives described in Chapter 5.

A. Unit Costs

Unit costs were utilized to develop both capital and operation and maintenance (O&M) cost opinions for each alternative. Table 6-1 lists the unit costs that were utilized in developing capital costs.

Table 6-1

Capital Unit Costs[1]

Component	Cost	Unit
Wells	$400,000	Each
Pipelines	Variable[2]	Inch-diameter per foot
Pump Stations	$4,500	Per horsepower
Fountain Creek Diversion	$3,000,000	Lump sum
RO/MF Water Treatment Plant (WTP)	$3.30	Per gallon per day
RO/MF Temporary WTP	$1.83	Per gallon per day
Brine Handling (Drying Beds)	$23.75[3]	Per gallon per day
Brine Handling (Zero Liquid Discharge)	$23.00	Per gallon per day
MF WTP	$1.50	Per gallon
Gravel Pit Site Acquisition	$1,000	Per acre
Gravel Pit Conversion	$4,500	Per ac-ft

[1]Capital costs include allowances for contingency, engineering, administration and legal.
[2]Pipeline costs were based on construction costs for recent similar projects and vary between $6.00 and $12.00 per linear foot for each inch in diameter.
[3]Assumed 400 acres of drying beds required per mgd of brine at a cost of $58,300 per acre.

Annual O&M costs were developed based on 1) a flat rate per million MG of treated water, and 2) a combination of a labor and maintenance rate (based on a specified percentage of the capital cost) plus electricity for non-treatment related facilities. Table 6-2 lists the unit costs that were utilized in developing O&M costs.

Table 6-2

Annual O&M Unit Costs

Component	Labor and Maintenance (Percent of Capital Cost)	Electricity	Flat-Rate O&M
Wells	1.60	$135/MG	-
Pipelines	0.20	-	-
Pump Stations	1.60	$34/MG	-
Reservoir Maintenance	0.15	-	-
SDS Facilities	-	-	$1,150/MG
MF WTP	-	-	$400/MG
RO/MF WTP	-	-	$1,100/MG
Brine Handling (Drying Beds)	-	-	$1,125/MG
Brine Handling (ZLD Located Near Power Plant)	-	-	$1,500/MG
Brine Handling (ZLD Not Located Near Power Plant)	-	-	$2,700/MG

B. Capital Cost Evaluation

As discussed in Chapter 5, three water supply alternatives and one sub-alternative were developed with the goal of meeting water demand projections through the year 2046. The alternatives developed as part of this Master Plan focus on primarily utilizing additional local wells to meet future water demands. These alternatives are summarized below.

- Alternative 1 – The City would utilize wells and RO/MF treatment to supplement imported water supplies to meet maximum day demands.

- Alternative 2 – The City would pump wells at a constant rate equal to the annual average day demand and utilize RO treatment and storage to meet maximum day demands. With this alternative, substantial raw water storage near the WTP is utilized to reduce the number of required groundwater wells.

- Alternative 3 – The City would pump wells and utilize RO/MF at a constant rate equal to the annual average day demand and utilize storage and additional MF treatment to meet maximum day demands. This alternative may seem counter-intuitive, since water treated by RO/MF is stored in an open reservoir, thereby requiring it to be treated again using MF to meet Safe Drinking Water Act regulations. However, this alternative reduces the size of the RO/MF facilities, which could result in significant capital cost savings.

- Alternative 3a – This sub-alternative has the same components as Alternative 3, but considers the impact of conservation on average day and maximum day demand projections.

A capital cost comparison was developed to compare the above alternatives. Capital costs associated with each of the alternatives were divided into the following categories:

- Wells and Pump Stations
- Wellfield Pipelines
- Storage Reservoirs
- Water Rights
- Water Treatment
- SDS Participation

The following sections summarize the capital cost opinions for the main components of each of the above defined water supply alternatives.

1. Alternative 1

Infrastructure improvements associated with Alternative 1 are shown on Figure 6-1.

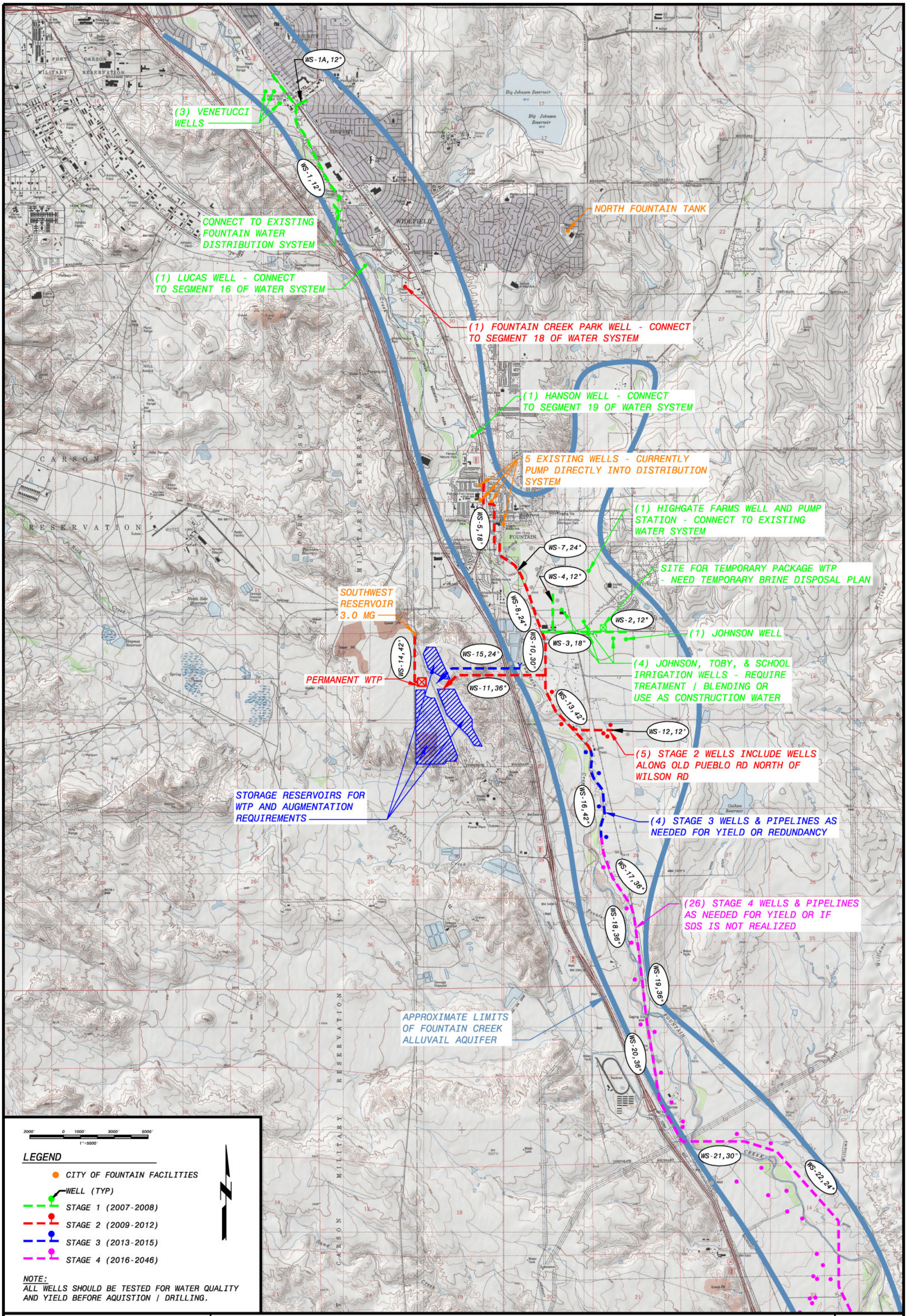
Table 6-3 lists the well and raw water pump station costs associated with Alternative 1. A total of 47 new wells are required under Alternative 1 to meet projected maximum day demands through the year 2046.

Table 6-3

Well and Pump Station Costs Associated with Alternative 1

Year	Component Description	Cost
2007	Highgate Farms Well and Pump Station	$314,000
	3 Venetucci Wells	$1,370,000
	1 South Well (Johnson or Other)	$400,000
2008	1 North Well (Lucas or Other)	$400,000
	1 North Well (Hanson or Other)	$400,000
	1 South Well (Johnson or Other)	$400,000
	3 South Wells (Toby and/or Others)	$1,200,000
2009	1 North Well (Fountain Creek Park or Other)	$400,000
	1 South Well	$400,000
2010	2 South Wells	$800,000
2011	1 South Well	$400,000
	Fountain Creek Diversion Pump Station	$3,000,000
2012	1 South Well	$400,000
2013	3 South Wells	$1,200,000
2014	1 South Well	$400,000
2024 - 2046	26 South Wells	$10,400,000
	Capital Cost Opinion for Wells and Pump Stations	**$21,884,000**

Table 6-4 lists the welfield pipeline costs associated with Alternative 1. These pipelines are required to connect the additional wells to the proposed RO/MF treatment facility and are labeled with the prefix WS (Water Supply) to prevent confusion between these improvements and the distribution system improvements. It is important to note that water from the northern wells is not



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Infrastructure Improvements Associated with Alternative 1

Figure 6-1

expected to require treatment and therefore will be pumped directly into the distribution system.

Table 6-4

Wellfield Pipeline Costs Associated with Alternative 1

Year	No.	Segment Location	Pipe Diameter (inches)	Pipe Length (feet)	Cost
2007	WS-1	Along Fountain Creek from Venetucci Wells	12	8,500	$720,000
	WS-1A	Venetucci Wells to Widefield System	12	1,500	$170,000
	WS-2	Wilson Road East Segment	12	2,500	$220,000
2008	WS-3	Wilson Road West Segment	18	2,500	$260,000
	WS-4	Lateral North of Wilson Road	12	2,200	$190,000
2009	WS-5	Highway 85 to Old Pueblo Road	18	2,300	$250,000
	WS-7	Old Pueblo Road	24	2,000	$300,000
	WS-8	Old Pueblo Road to Wilson Road	24	3,600	$530,000
2010	WS-10	Old Pueblo Road South of Wilson	30	2,700	$490,000
	WS-11	Pipeline to RO/MF WTP	48	6,200	$4,470,000
2011	WS-12	Old Pueblo Road (East Lateral)	12	2,500	$150,000
	WS-13	Old Pueblo Road (North of East Lateral)	42	4,000	$990,000
	WS-14	WTP to Southwest Reservoir	42	3,500	$670,000
	WS-15	Fountain Creek Diversion Pipeline	24	4,300	$1,250,000
2014	WS-16	Old Pueblo Road (South of East Lateral)	42	5,200	$1,140,000
2019	WS-17	Old Pueblo Road (South of WS-14)	36	3,100	$510,000
2022	WS-18	Old Pueblo Road (South of WS-15)	36	3,100	$660,000
2023	WS-19	Old Pueblo Road (South of WS-16)	36	3,100	$810,000
2024	WS-20	Old Pueblo Road (South of WS-16)	36	3,100	$950,000
2025	WS-21	Old Pueblo Road (South of WS-18)	30	10,000	$2,950,000
2026	WS-22	Old Pueblo Road (South of WS-18)	24	12,500	$3,490,000
Capital Cost Opinion for Wellfield Pipelines					**$21,170,000**

Lafarge, Incorporated is currently performing gravel mining operations west of the City. A report completed by the Applegate Group in February 2006 recommended that the City utilize these pits for raw water storage once the gravel mining operations are concluded. Table 6-5 lists the components and costs associated with the augmentation and pretreatment storage reservoirs. As discussed previously, an augmentation reservoir will offset impacts on Fountain Creek due to pumping additional wells and help meet SDS augmentation requirements. Under Alternative 1, only a minimal amount of pretreatment storage is necessary to allow operational flexibility, since the wells will be utilized to meet maximum day demands.

Table 6-5

Storage Reservoir Costs Associated with Alternative 1

Year	Task or Facility	Capacity (ac-ft)	Cost
2007	Purchase Lafarge Site		$620,000
2012	Design Augmentation Reservoir		$357,000
2013	Construct Augmentation Reservoir (Lafarge Area 1)	1,200	$3,573,000
2014	Design Pretreatment Reservoir		$200,000
2015	Construct Pretreatment Reservoir (Lafarge Area 2)	500	$2,000,000
	Capital Cost Opinion for Storage Reservoirs		**$6,750,000**

An analysis was completed by W.W. Wheeler and Associates to determine the amount of augmentation water the City is required to deliver into Fountain Creek or Pueblo Reservoir to offset impacts of pumping wells in the Fountain Creek Alluvium. A copy of the findings is included in the Appendix in a letter dated June 13, 2006 and email correspondence dated July 11, 2006. The W.W. Wheeler report estimated the cost for acquiring water rights at $10,000 per acre foot. Table 6-6 lists the amount of water rights and associated costs to obtain this augmentation water.

It is important to note that water rights accounting of Fountain Creek is calculated monthly. Since Alternative 1 requires groundwater pumping to meet maximum day demands, additional augmentation is required for this alternative.

Table 6-6 Augmentation Water Rights Costs Associated with Alternative 1		
Year	**Volume (ac-ft)**	**Cost**
2006	460	$4,600,000
2007	250	$2,500,000
2008	250	$2,500,000
2009	250	$2,500,000
2010	250	$2,500,000
2011	150	$1,500,000
2012	160	$1,600,000
2013	425	$4,250,000
2014	425	$4,250,000
2015	200	$2,000,000
2016 - 2046	3,480	$34,800,000
Capital Cost Opinion for Augmentation Water Rights		**$63,000,000**

Table 6-7 lists the estimated costs by year associated with the City's participation in SDS. These costs were assumed to be the same for all the alternatives.

Table 6-7 SDS Costs Associated with Alternative 1	
Year	**Cost**
2008	$536,000
2009	$1,442,000
2010	$655,000
2011	$4,738,000
2012	$10,119,000
2013	$8,170,000
2014	$787,000
Capital Cost Opinion for SDS Participation	**$26,447,000**

Table 6-8 lists the components and costs associated with treating the water from the proposed southern wells for Alternative 1.

Table 6-8

Water Treatment Costs Associated with Alternative 1

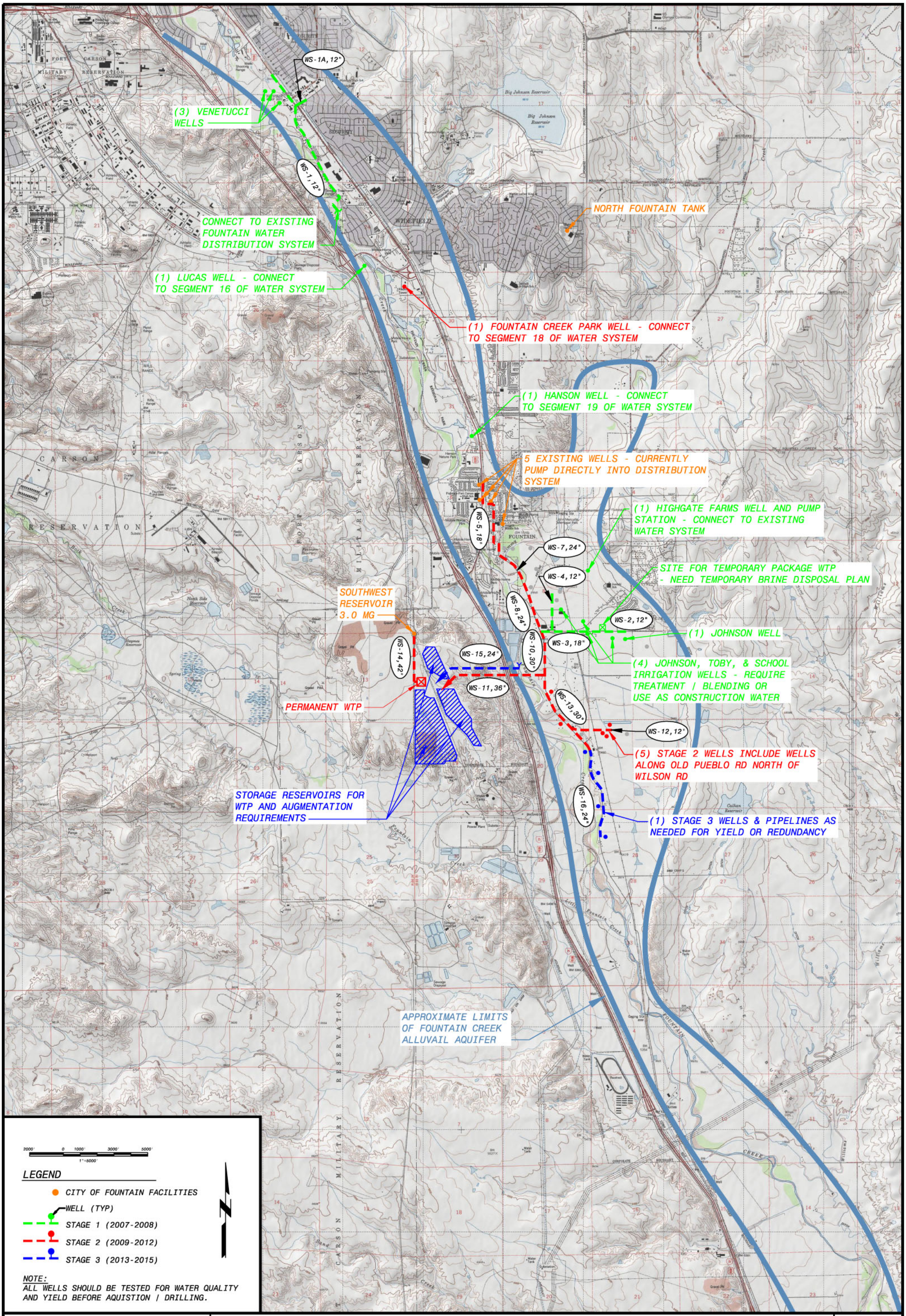
Year	Component	Cost
2006	Alluvium Study	$125,000
	Treatability/Brine Handling Study	$125,000
	Environmental/Permitting Assessment	$35,000
2007	Design and Permit 1.5 mgd Temporary RO/MF WTP	$75,000
	Procure 1.5 mgd Temporary RO/MF WTP	$2,059,000
	Utilize Temporary Brine Handling Facilities	$1,000,000
	Purchase Permanent RO/MF WTP Site	$300,000
	Design 10 mgd Permanent RO/MF WTP (30 Percent)	$2,250,000
2008	Install Temporary RO/MF WTP (Online Summer 2008)	$686,000
	Acquire Permits for Permanent RO/MF WTP	$75,000
	Negotiate Design/Build/Operate Agreement for Permanent RO/MF WTP	$50,000
2009	Construct 10 mgd RO/MF WTP (Online Summer 2011)	$33,000,000
	Construct Brine Handling Facilities	$23,438,000
2021	Expand RO/MF WTP (Additional 5 mgd)	$16,500,000
	Expand Brine Handling Facilities	$21,094,000
2032	Expand RO/MF WTP (Additional 5 mgd)	$16,500,000
	Capital Cost Opinion for Water Treatment	**$117,312,000**

The total estimated capital cost opinion for Alternative 1 is approximately $257 million.

2. Alternative 2

Infrastructure improvements associated with Alternative 2 are shown on Figure 6-2.

Table 6-9 lists the well and raw water pump station costs associated with Alternative 2. A total of 21 new wells are required under Alternative 2 to meet projected maximum day demands through the year 2046.



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Infrastructure Improvements Associated with Alternatives 2 and 3

Figure 6-2

Table 6-9

Well and Pump Station Costs Associated with Alternative 2

Year	Component Description	Cost
2007	Highgate Farms Well and Pump Station	$314,000
	3 Venetucci Wells	$1,370,000
	1 South Well (Johnson or Other)	$400,000
2008	1 North Well (Lucas or Other)	$400,000
	1 North Well (Hanson or Other)	$400,000
	1 South Well (Johnson or Other)	$400,000
	3 South Wells (Toby and/or Others)	$1,200,000
2009	1 North Well (Fountain Creek Park or Other)	$400,000
	1 South Well	$400,000
2010	2 South Wells	$800,000
2011	1 South Well	$400,000
	Fountain Creek Diversion Pump Station	$3,000,000
2012	1 South Well	$400,000
2013	3 South Wells	$1,200,000
2014	1 South Well	$400,000
	Capital Cost Opinion for Wells and Pump Stations	**$11,484,000**

Table 6-10 lists the pipeline segment descriptions and costs associated with Alternative 2. These pipelines are required to connect the additional wells to the proposed RO/MF treatment facility. It is important to note that water from the northern wells is not expected to require treatment and therefore will be pumped directly into the distribution system.

Table 6-10

Wellfield Pipeline Costs Associated with Alternative 2

Year	No.	Segment Location	Pipe Diameter (inches)	Pipe Length (feet)	Cost
2007	WS-1	Along Fountain Creek from Venetucci Wells	12	8,500	$720,000
	WS-1A	Venetucci Wells to Widefield System	12	1,500	$170,000
	WS-2	Wilson Road East Segment	12	2,500	$220,000
2008	WS-3	Wilson Road West Segment	18	2,500	$260,000
	WS-4	Lateral North of Wilson Road	12	2,200	$190,000
2009	WS-5	Highway 85 to Old Pueblo Road	18	2,300	$250,000
	WS-7	Old Pueblo Road	24	2,000	$300,000
	WS-8	Old Pueblo Road to Wilson Road	24	3,600	$530,000
2010	WS-10	Old Pueblo Road South of Wilson	30	2,700	$490,000
	WS-11	Pipeline to RO/MF WTP	36	6,200	$3,830,000
2011	WS-12	Old Pueblo Road (East Lateral)	12	2,500	$150,000
	WS-13	Old Pueblo Road (North of East Lateral)	30	4,000	$710,000
	WS-14	WTP to Southwest Reservoir	42	3,500	$670,000
	WS-15	Fountain Creek Diversion Pipeline	24	4,300	$1,250,000
2014	WS-16	Old Pueblo Road (South of East Lateral)	24	5,200	$660,000
		Capital Cost Opinion for Wellfield Pipelines			**$10,400,000**

As discussed previously, Lafarge, Incorporated, is currently performing gravel mining operations west of the City and the February 2006 Applegate Group report recommended that the City utilize these pits for raw water storage once the gravel mining operations are concluded. Table 6-11 lists the costs associated with the augmentation and pretreatment storage reservoirs. Under Alternative 2, three mined areas with a total storage volume of 4,500 ac-ft will be utilized to meet maximum day demands. This will enable the City to limit the number of additional wells that will be required in the future and also minimize the pipe diameter sizes within the raw water collection system.

Table 6-11

Storage Reservoir Costs Associated with Alternative 2

Year	Task or Facility	Capacity (ac-ft)	Cost
2007	Purchase Lafarge Site		$620,000
2012	Design Augmentation Reservoir		$357,000
2013	Construct Augmentation Reservoir (Lafarge Area 1)	1,200	$3,573,000
2014	Design Pretreatment Reservoir		$404,000
2015	Construct Pretreatment Reservoir (Lafarge Area 2)	1,300	$4,044,000
2020	Develop Lafarge Area 3	1,200	$8,727,000
2033	Expand Lafarge Area 3	800	$3,387,000
Capital Cost Opinion for Storage Reservoirs			**$21,112,000**

Table 6-12 lists the amount of water rights and associated costs to obtain the required augmentation water associated with Alternative 2.

Table 6-12

Augmentation Water Rights Costs Associated with Alternative 2

Year	Volume (ac-ft)	Cost
2006	460	$4,600,000
2007	250	$2,500,000
2008	250	$2,500,000
2009	250	$2,500,000
2010	250	$2,500,000
2011	150	$1,500,000
2012	160	$1,600,000
2013	175	$1,750,000
2014	175	$1,750,000
2015	200	$2,000,000
2016 - 2046	3,040	$30,400,000
Capital Cost Opinion for Augmentation Water Rights		**$53,600,000**

The costs associated with purchasing augmentation water rights are slightly less for Alternative 2 because the maximum pumping rate from the alluvium is reduced from maximum day demands to average day demands.

The costs for participating in SDS were assumed to be the same for each alternative. These costs are shown in Table 6-7. In addition, the costs associated with treating the water from the proposed southern wells are the same for Alternative 2 as Alternative 1. These costs are shown in Table 6-8.

The total estimated capital cost opinion for Alternative 2 is approximately $240 million.

3. Alternative 3

The costs for the wells and raw water pump stations, wellfield pipeline segments, storage reservoirs, and water rights associated with Alternative 3 are the same as those associated with Alternative 2. These improvements are shown on Figure 6-2 and costs for these improvements are shown in Tables 6-9, 6-10, 6-11, and 6-12, respectively. As discussed previously, the costs associated with participating in SDS were assumed to be the same for each alternative. These costs are shown in Tables 6-7.

Table 6-13 lists the costs associated with treating the water from the proposed southern wells for Alternative 3.

Table 6-13

Water Treatment Costs Associated with Alternative 3

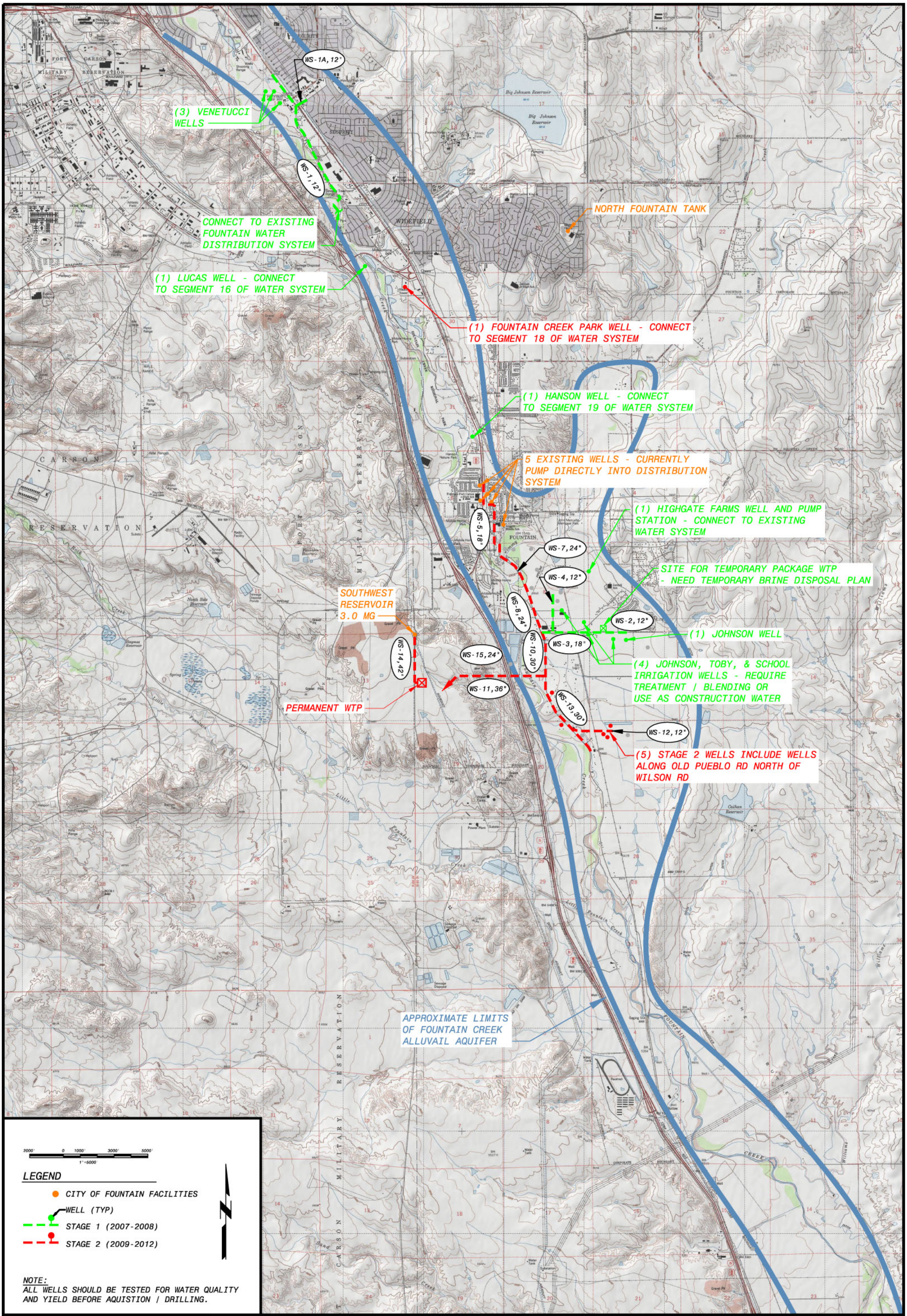
Year	Component	Cost
2006	Alluvium Study	$125,000
	Treatability/Brine Handling Study	$125,000
	Environmental/Permitting Assessment	$35,000
2007	Design and Permit 1.5 mgd Temporary RO/MF WTP	$75,000
	Procure 1.5 mgd Temporary RO/MF WTP	$2,059,000
	Utilize Temporary Brine Handling Facilities	$1,000,000
	Purchase Permanent RO/MF WTP Site	$300,000
	Design 4 mgd Permanent RO/MF WTP (30 Percent)	$2,250,000
2008	Install Temporary RO/MF WTP (Online Summer 2008)	$686,000
	Acquire Permits for Permanent RO/MF WTP	$75,000
	Negotiate Design/Build/Operate Agreement for Permanent RO/MF WTP	$50,000
2009	Construct 4 mgd RO/MF WTP (Online Summer 2011)	$13,200,000
	Construct Brine Handling Facilities	$25,781,000
2018	Design and Construct 15 mgd MF WTP	$22,500,000
2029	Expand RO/MF WTP (Additional 2.5 mgd)	$8,250,000
2031	Expand MF WTP (Additional 5 mgd)	$7,500,000
	Capital Cost Opinion for Water Treatment	**$84,011,000**

The total estimated capital cost opinion for Alternative 3 is approximately $207 million.

4. Alternative 3a

Infrastructure improvements associated with Alternative 3a are shown on Figure 6-3.

Table 6-14 lists the well and raw water pump station costs associated with Alternative 3a. A total of 17 new wells are required under Alternative 3a to meet projected maximum day demands through the year 2046.



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Infrastructure Improvements Associated with Alternatives 3a

Figure 6-3

Table 6-14

Well and Pump Station Costs Associated with Alternative 3a

Year	Component Description	Cost
2007	Highgate Farms Well and Pump Station	$314,000
	3 Venetucci Wells	$1,370,000
	1 South Well (Johnson or Other)	$400,000
2008	1 North Well (Lucas or Other)	$400,000
	1 North Well (Hanson or Other)	$400,000
	1 South Well (Johnson or Other)	$400,000
	3 South Wells (Toby and/or Others)	$1,200,000
2009	1 North Well (Fountain Creek Park or Other)	$400,000
	1 South Well	$400,000
2010	2 South Wells	$800,000
2011	1 South Well	$400,000
	Fountain Creek Diversion Pump Station	$3,000,000
2012	1 South Well	$400,000
	Capital Cost Opinion for Wells and Pump Stations	**$9,884,000**

The costs for the wellfield pipeline segments, and storage reservoirs associated with Alternative 3a are assumed to be the same as those associated with Alternatives 2 and 3. These costs are shown in Tables 6-10 and 6-11, respectively.

As discussed previously, the City is required to deliver augmentation water into Fountain Creek to offset any impact of pumping additional wells. Table 6-15 lists the amount of water rights and associated costs to obtain this augmentation water under Alternative 3a.

Table 6-15

Augmentation Water Rights Costs Associated with Alternative 3a

Year	Volume (ac-ft)	Cost
2006	460	$4,600,000
2007	250	$2,500,000
2008	250	$2,500,000
2009	250	$2,500,000
2010	250	$2,500,000
2011	150	$1,500,000
2012	160	$1,600,000
2013	175	$1,750,000
2014	175	$1,750,000
2015	200	$2,000,000
2016 -2046	1,970	$19,700,000
Capital Cost Opinion for Augmentation Water Rights		**$42,900,000**

As discussed previously, the costs associated with SDS participation were assumed to be the same for each alternative. These costs are shown in Table 6-7.

Table 6-16 lists the costs associated with treating the water from the proposed southern wells for Alternative 3a.

Table 6-16

Water Treatment Costs Associated with Alternative 3a

Year	Component	Cost
2006	Alluvium Study	$125,000
	Treatability/Brine Handling Study	$125,000
	Environmental/Permitting Assessment	$35,000
2007	Design and Permit 1.5 mgd Temporary RO/MF WTP	$75,000
	Procure 1.5 mgd Temporary RO/MF WTP	$2,059,000
	Utilize Temporary Brine Handling Facilities	$1,000,000
	Purchase Permanent RO/MF WTP Site	$300,000
	Design 4 mgd Permanent RO/MF WTP (30 Percent)	$2,250,000
2008	Install Temporary RO/MF WTP (Online Summer 2008)	$686,000
	Acquire Permits for Permanent RO/MF WTP	$75,000
	Negotiate Design/Build/Operate Agreement for Permanent RO/MF WTP	$50,000
2009	Construct 4 mgd RO/MF WTP (Online Summer 2011)	$13,200,000
	Construct Brine Handling Facilities	$21,094,000
2018	Design and Construct 10 mgd MF WTP	$15,000,000
2029	Expand RO/MF WTP (Additional 1.0 mgd)	$1,650,000
2031	Expand MF WTP (Additional 5 mgd)	$7,500,000
	Capital Cost Opinion for Water Treatment	**$65,224,000**

The total estimated capital cost opinion for Alternative 3a is approximately $176 million.

Table 6-17 provides a side-by-side comparison of the capital cost opinions for each water supply alternative.

Table 6-17

Capital Cost Comparison of the Proposed Water Supply Alternatives

Component	Capital Cost Opinion			
	Alternative 1	Alternative 2	Alternative 3	Alternative 3a
Wells and Pump Stations	$21,884,000	$11,484,000	$11,484,000	$9,884,000
Wellfield Pipelines	$21,170,000	$10,400,000	$10,400,000	$10,400,000
Storage Reservoirs	$6,750,000	$21,112,000	$21,112,000	$21,112,000
Augmentation Water Rights	$63,000,000	$53,600,000	$53,600,000	$42,900,000
Water Treatment and Brine Handling	$117,312,000	$117,312,000	$84,011,000	$65,224,000
SDS Participation	$26,447,000	$26,447,000	$26,447,000	$26,447,000
Total Capital Cost Opinion	**$256,563,000**	**$240,355,000**	**$207,054,000**	**$175,967,000**

C. O&M Cost Evaluation

O&M cost opinions were developed for each water supply alternative for the planning period 2006 through 2046. It is important to note that these costs are above and beyond the O&M costs that the City is currently experiencing. These costs have been developed based on the following categories:

- SDS
- Well Electricity
- Raw Water Pump Station Electricity and Maintenance
- Water Treatment and Brine Handling
- Pipeline Maintenance
- Storage Reservoir Maintenance

Table 6-18 summarizes the total O&M costs for years 2006 through 2046 associated with each of the alternatives. Annual O&M costs vary by year and generally increase with the addition of new facilities.

Table 6-18

O&M Cost Comparison of the Proposed Water Supply Alternatives

Category	Total Cost (Years 2006 – 2046)			
	Alternative 1	Alternative 2	Alternative 3	Alternative 3a
SDS	$29,466,000	$29,466,000	$29,466,000	$29,466,000
Well Electricity	$19,481,000	$18,416,000	$18,907,000	$14,170,000
Pump Station Electricity and Maintenance	$25,627,000	$23,124,000	$13,596,000	$10,795,000
Water Treatment and Brine Handling	$244,659,000	$246,039,000	$142,028,000	$103,808,000
Pipeline Maintenance	$1,287,000	$767,000	$767,000	$767,000
Storage Reservoir Maintenance	$338,000	$871,000	$871,000	$871,000
Total	**$320,858,000**	**$318,683,000**	**$205,635,000**	**$159,877,000**

Chapter 7
Distribution System Analyses

A. Hydraulic Model

An important aspect of water system studies is the development of a hydraulic model to analyze and evaluate the performance of the water distribution network under various demand and operating conditions. For this study, a hydraulic model of the City's distribution system was developed using H_2OMAP software, pertinent data regarding existing water system facilities, and information concerning the magnitude and distribution of water demands within the City's service area.

The physical aspects of the distribution system represented in a hydraulic model include storage reservoir elevations and capacities; pump operating characteristics; the diameter, length, and interior roughness of each water main; and the characteristics of various regulating valves. Distribution system maps provided by the City were used to identify the diameter and length of each main in the distribution network and the locations of the various wells, pumps, regulating valves, and storage reservoirs. The operating characteristics of the booster pumps were determined from head-capacity curves, while the capacities and operating characteristics of the five existing wells were determined by evaluating historical pumping records. Additional information concerning reservoir elevations and capacities was obtained from construction drawings. The control settings for the various regulating valves were obtained through discussions with water utility personnel.

In addition to the physical components of the distribution system, the hydraulic model contains information on the water demands within the service area. Current and projected average day water demands were allocated to the network junctions by user class. Residential water use was allocated on a per capita basis, using the current and future population distributions discussed in Chapter 2. Commercial water use was allocated by considering the locations of large users, present commercial land use, and the potential for future development. Unaccounted-for water use was allocated throughout the distribution system, based on the relative density of development.

To calculate flows and pressures, the hydraulic analysis program utilizes engineering equations and mathematical algorithms in an iterative solution process. For each specified scenario, the program calculates the head loss through each water main, the total dynamic head and pumping rate for each pump that is operating, the fill or draft rate at each reservoir, and the flow rate through each regulating valve.

Although there are a number of theoretical and empirical equations available for calculating head losses through pipes, the most commonly used formula within the water distribution industry is the Hazen-Williams equation. This empirical equation expresses head loss as a function of pipe diameter, pipe length, pipe interior roughness, and water flow rate. In the Hazen-Williams equation, interior roughness is represented with a roughness coefficient that is generally referred to as the "C-value". Roughness coefficients are dependent on a number of factors, including pipe material and method of fabrication, type of lining, pipe age, and amount of tuberculation. For the Fountain distribution system hydraulic model, appropriate pipe C-values were assigned based on pipe age and pipe material.

B. Application of Model

Once the hydraulic model had been developed, it was used to analyze the performance of the distribution system under various demand and operational scenarios. A series of analyses were conducted to identify potential deficiencies in the Fountain distribution system, evaluate various combinations of improvements and modifications, and establish a recommended long-range capital improvement program to reinforce and expand the system as necessary to meet projected water demands.

The hydraulic model was set up to perform EPS (extended period simulation) analyses to simulate the performance of the distribution system over a 24-hour period. In these analyses, diurnal demand patterns are utilized in the model to vary the water demands hour-by-hour in order to simulate typical daily water use fluctuations within the distribution system. It was no possible to determine actual diurnal water use patterns within the Fountain system because the operating records were not detailed enough to allow calculations of hourly flow rates at the FVA pipeline turnouts, hourly pumpage at the wells, hourly pumpage at the Goldfield pumping station, and hourly fill/draft rates at the reservoirs. However, by using available data from other utilities with similar characteristics, it was possible to develop representative diurnal patterns suitable for use in the Fountain EPS model.

A series of hydraulic analyses were performed to evaluate system performance for maximum day demand conditions for each design year. An important aspect of these simulations was evaluating the diurnal water level fluctuations within the various distribution system reservoirs. For the maximum day simulations, it was important to ensure that the water levels within the reservoirs did not drop below acceptable emergency reserve levels at any time during the day and that the reservoirs could be adequately replenished during the off-peak periods.

The maximum day analyses were also used to determine the ability of the distribution system facilities to maintain acceptable residual pressures throughout the distribution network during the periods of highest demand. The most critical condition usually occurs near the end of the peak demand period, when reservoir water levels are depressed, but system demands are still relatively high. This condition generally produces the lowest residual pressures within the system. The distribution network is considered to be adequate if residual pressures of at least 30 pounds per square inch (psi) are maintained at all locations within the distribution grid under peak demand conditions.

As part of this study, average day EPS analyses were also set up for each design year in order to evaluate the operation of the distribution system under more typical demand conditions. Other criteria for developing the recommended improvement program included increasing system reliability and enhancing operational flexibility.

C. Pressure Zones

As discussed in Chapter 4, Fountain's water distribution system is divided into four pressure zones: Low, Little Ranches, High, and Booster. The Low Zone serves the low-lying ground in the southwest part of the City, the Little Ranches Zone serves a small area in the southeast part of the system, the High Zone serves most of the higher-lying ground to the northeast, and the Booster Zone serves the highest ground in the northern-most part of the City. A series of closed valves and PRVs form the boundaries between the various zones.

The Low, High and Booster Zones contain storage reservoirs that establish the static operating gradients for those zones. Because there is no reservoir in the Little Ranches Zone, the operating gradient in that zone is established by the downstream setting of the PRV that controls the flow of water from the High Zone into the Little Ranches Zone. Currently, the operating gradient in the Little Ranches Zone is approximately 5,790 feet, or about 50 feet higher than the gradient in the Low Zone.

In order to develop a long-range plan for serving future water customers, it was necessary to layout the probable future boundaries between the four pressure zones. It was assumed that the existing zones will be expanded as necessary to serve adjacent growth areas that have similar ground elevations. Because the Low, High, and Booster Zones contain existing storage reservoirs that establish the static gradients within these pressure zones, no changes are recommended for the operating gradients in these zones, with one exception, as discussed below.

Based on a review of the topography in this part of the service area, it is recommended that the future operating gradient within the Little Ranches Zone be increased to about 5,820 feet so that it is closer to the midpoint between the Low Zone and High Zone gradients. This will result in a relatively modest increase of 13 psi for existing customers within the Little Ranches Zone, which would be beneficial for those customers on the highest ground within the zone who currently have static pressures of less than 40 psi. The proposed 5,820-foot gradient would also make it feasible to construct a ground storage reservoir for the Little Ranches Zone on the high ground near the intersection of Kane Road and the proposed Powers Boulevard extension.

Under this scenario, a small portion of the High Zone system (along Ohio Avenue and R.E.A. Road) will be transferred to the Little Ranches Zone. This means that the small number of existing customers along these roads will experience a decrease in their pressures as a result of the proposed boundary modifications. However, because the ground elevations along these roads are relatively low and system pressures in this area are currently quite high, the customers will still have adequate pressures.

Table 7-1 summarizes current and future operating gradients for the City's pressure zones, as well as the approximate range of ground elevations and static pressures within each zone.

Table 7-1

Pressure Zone Characteristics

Pressure Zone	Current Operating Gradient (feet)	Proposed Operating Gradient (feet)	Approximate Range of Ground Elevations (feet)	Approximate Range of Static Pressures (psi)
Low	5,740	5,740	5,410 to 5,600	61 to 143
Little Ranches	5,790	5,820	5,530 to 5,700	52 to 126[(1)]
High	5,930	5,930	5,540 to 5,780	65 to 169
Booster	6,023	6,023	5,720 to 5,880	62 to 131

[(1)]Based on proposed operating gradient.

Future water demands were determined for each pressure zone based on the proposed pressure zone boundaries, as shown in Table 7-2. A relatively large percentage of the projected demand increase is expected to occur within the High Zone, with smaller amounts of growth occurring in the Low and Little Ranches Zones, and essentially no growth within the Booster Zone.

Table 7-2

Water Demands by Pressure Zone

Design Year	Pressure Zone	Average Day (mgd)	Maximum Day (mgd)	Maximum Hour (mgd)
2010	Booster	0.26	0.7	1.1
	High	2.85	7.3	10.6
	Little Ranches	0.78	2.2	3.5
	Low	1.72	4.2	6.0
2020	Booster	0.26	0.7	1.1
	High	4.26	10.8	15.5
	Little Ranches	1.47	4.1	6.4
	Low	2.27	5.6	8.0

D. Water Supply Facilities

As previously discussed, Fountain currently obtains water from the Fry-Ark Project and from several wells located within the city limits. In recent years, FVA water has been used as the City's primary base supply, while the City wells have been utilized as a supplemental supply on the higher-demand days. Treated FVA water is delivered to the City at two locations. One turnout on the Fountain Valley Conduit allows water to be bled from the FVA pipeline into the City's Southwest Reservoir. Water then flows by gravity into the Low Zone distribution system. A subsequent turnout on the Fountain Valley Conduit allows water to be diverted through a transmission lateral for delivery to the Fountain Terminal Tank and the Joint Fountain/Widefield Storage Reservoir. From these reservoirs, the water can flow by gravity into the City's High Zone or be pumped into the Booster Zone.

For the purposes of the distribution system hydraulic analyses, the following assumptions were utilized:

- Fountain will continue to utilize its allocation of FVA water, which is equivalent to an annual average delivery rate of 1.7 mgd.

- The five existing city wells have a combined capacity of about 4.3 mgd.

- An additional 3.0 mgd of water will be obtained by the summer of 2007 through a water exchange agreement with Widefield and Security. This water will most likely be introduced into the northwest part of Fountain's distribution system in the vicinity of Interstate 25 and Carson Drive.

- An additional 3.0 mgd of water will be available by the summer of 2008 from city-owned wells in the vicinity of Interstate 25 and State Highway 16. Water from these wells would be pumped and disinfected with chlorine. No additional treatment will be provided before entering the distribution system.

- An additional 2.5 mgd of well water will be available in the vicinity of Wilson Road and Jimmy Camp Road in year 2009. Water from these wells would be pumped and disinfected with chlorine. No additional treatment will be provided before entering the distribution system.

- An additional 2.2 mgd of water will be available by 2011, either through participation in SDS or through additional wells.

E. Pumping Stations

Based the assumptions listed above, all future SDS and/or treated well water will be introduced into the existing Southwest Reservoir and then flow by gravity from the reservoir into the Low Zone. Since only a portion of this water will actually be used in the Low Zone, it will be necessary to construct pumping stations to lift some of the water from the Low Zone to the higher-lying zones.

About year 2011, or concurrent with any new water supply being introduced into the Southwest Reservoir, a pumping station should be constructed along Wilson Road to transfer water from the Low Zone into the Little Ranches Zone. It is recommended that this proposed pumping station be designed with an initial capacity of 6 mgd, with the capability to be easily expanded to at least 16 mgd in the future. Although the exact timing of the pumping station expansion should ultimately be coordinated with future expansion(s) of the proposed WTP, it is anticipated that the expansion will occur about year 2017. Additionally, at the same time that the Wilson Road pumping station is expanded, a second pumping station should be constructed to pump water from the Little Ranches Zone into the High Zone. This second station should have a capacity of about 11 mgd and should be located in the vicinity of the future Kane Ranch reservoir (to be discussed later).

F. Storage Facilities

Equalization and emergency storage requirements for the City's water distribution system were evaluated as part of this study. These evaluations are discussed in the subsequent sections.

1. Equalization Storage

The amount of equalization storage needed is a function of an area's demand characteristics and the capacities of the major system components. Supply, treatment, pumping, and transmission facilities are generally sized to meet maximum day demands and equalizing storage is sized to meet demands in excess of this rate. Thus, storage facilities provide water when demands exceed the maximum day rate, and refill when demands are less than the maximum day rate.

Based on assumed diurnal demand patterns, the volume of equalization storage needed on a maximum demand day was calculated. Based on these calculations, a volume of 3 MG is sufficient to meet equalization storage requirements under projected maximum day demand conditions for the next 20 years. However, as will be discussed in the following paragraphs, this does not mean that a total storage volume of 3 million gallons would be sufficient to meet Fountain's future requirements.

2. Emergency Storage

In addition to having sufficient equalization storage, it is also necessary to maintain an appropriate amount of reserve storage in case of a fire or an emergency such as a main break, equipment failure, power outage, contamination of raw water supply, or natural disaster. The amount of emergency storage in a particular water system is generally decided by the utility based on an assessment of risk and the desired degree of reliability. A common engineering design practice is to assume that the total volume of storage within a distribution system should be equal to at least twice the required volume of equalization storage. Thus, for the Fountain system, it would be appropriate to have a total storage volume of 6 million gallons or more.

Typically, a water utility provides sufficient storage to meet the fire flow requirements established by the Insurance Services Office (ISO), which is an organization that grades municipal fire defense capabilities for insurance rating purposes. Part of an ISO evaluation consists of determining needed and available fire flows at various locations throughout a utility's service area. Needed fire flows are calculated based on the size, type of construction, exposure, and occupancy of each building or complex. For fighting a residential fire, a flow rate of 1,000 gpm is generally sufficient, provided that the residential structure is no higher than two stories and is separated from adjacent structures by more than 10 feet. Although necessary fire flow rates can be as high as 12,000 gpm for some commercial or industrial facilities, 3,500 gpm is the maximum fire flow required to be supplied by municipal water systems for ISO insurance rating purposes. Fire flow requirements in excess of 3,500 gpm, if not available through the municipal water system, may affect the rating of an individual building or complex, but will not affect the overall city rating.

The calculated fire flow rate must be sustained for a minimum duration (generally 2 to 3 hours) at a minimum residual pressure of 20 psi. A 3,500 gpm fire flow for a period of 3 hours is equivalent to a volume of 630,000 gallons. Based on the preceding discussion, 6 MG of emergency storage within Fountain's system is more than adequate to provide this volume of fire reserve.

3. Storage Conclusions

As indicated in Chapter 4, Fountain's water distribution system currently contains nearly 8 million gallons of storage (assuming that half of the volume of water in the Joint Storage Reservoir and Joint Elevated Tank belong to the City of Fountain). Thus, based on the preceding discussions, the overall total volume of storage currently within the Fountain system is adequate for meeting projected flow equalization requirements for the next 20 years, as well as satisfying emergency and fire flow requirements.

However, it is important to evaluate how the storage volume is distributed among the various pressure zones within the distribution system. Currently, the Low Zone contains 3.0 MG of storage (the Southwest Reservoir), the High Zone contains 4.5 MG (the Fountain Terminal Tank and half of the Joint Storage Reservoir), the Booster Zone contains 375,000 gallons (half of the Joint Elevated Tank), and the Little Ranches Zone has no storage.

Based on the projected demands by pressure zone, the existing storage within the Low, High, and Booster Zones will be adequate to meet future requirements for the next 20 years or more. However, since the Little Ranches Zone currently has no storage facility, consideration was given to the future construction of a reservoir that could effectively serve this intermediate service level. Based on the projected demands within the Little Ranches Zone, 1.5 MG of storage would be sufficient.

In addition to providing storage, any reservoir constructed to serve the Little Ranches Zone could also serve as a backup storage facility for the adjacent zones. In an emergency, water could be pumped from the Little Ranches Zone into the High Zone or bled from the Little Ranches Zone into the Low Zone. For this reason, it would be advantageous to size the proposed Little Ranches storage reservoir so that it would be capable of meeting emergency needs in the Low, Little Ranches, or High Zones. Therefore, it is recommended the proposed Little Ranches storage reservoir have a volume of 3.0 MG.

G. Transmission Mains

As previously discussed, it is anticipated that SDS and treated well water will be delivered to the Southwest Reservoir. In order to effectively convey water from this location to the City's existing and future distribution grid, it will be necessary to construct a number of key transmission mains within the Fountain water system.

Within the Low Zone, it is recommended that a 36-inch transmission main be constructed from the Southwest Reservoir, across the Low Zone, to the proposed booster pumping station along Wilson Road. Within the Little Ranches Zone, a 30-inch transmission main should be constructed from the discharge side of the Wilson Road pumping station to the site of the proposed Kane Ranch reservoir and pumping station. Within the High Zone, a 24-inch main should be constructed from the discharge side of the Kane Ranch pumping station, north to C&S Road, where it will connect to several future distribution mains within the High Zone.

H. Fire Flow Considerations

A comprehensive fire protection evaluation was not included as part of this study. However, fire flow requirements were considered while performing the hydraulic analyses. In the old downtown area (bounded by Main Street, Iowa Avenue, Hamilton Street, and Missouri Avenue), the available fire flow rates currently range from about 1,600 gpm to 2,100 gpm, which is relatively good considering that all of the east-west distribution mains in this area are 4-inch pipes. Despite the small-diameter mains, fire flow rates of this magnitude are possible in this area primarily because the distribution network is well grided, i.e. there are numerous distribution loops and no dead-end mains.

Additionally, there is also a pressure reducing valve on the east side of the downtown area that allows water to flow from the High Zone into the Low Zone during periods of high demand or during an emergency such as a fire.

I. Control Valves

A number of existing and proposed PRVs will be utilized for transferring water from the higher to lower zones during periods of peak demand or during emergencies. Table 7-3 provides a summary of existing and proposed PRVs within the Fountain distribution system. The maximum flow rates listed in the table are based on the results of hydraulic analyses performed to simulate future demand conditions.

It should be noted that, when the boundary between the High Zone and Little Ranches Zone is modified as previously described, the existing PRV located near the intersection of Link Road and Circle C Road will no longer be needed. Consequently, this PRV will need to be removed or bypassed when the boundary modification is implemented.

Table 7-3

Pressure Reducing Valves

From and To Zones	Valve Status	Maximum Flow (mgd)	Location
High to Little Ranches	Proposed	1.5	Link Road south of Valli Farms Road
	Proposed	1.5	Ohio Avenue at Jimmy Camp Road
	Proposed	1.5	Intersection of Kane Road and Shumway Road
High to Low	Existing	0.4	Ohio Avenue and Hamlin Street
	Existing	1.5	Jimmy Camp Road, south of Ohio Avenue
	Proposed	0.5	U.S. Highway 85, south of Mesa Road
	Proposed	1.5	I-25 Frontage Road
Little Ranches To Low	Existing	1.5	Link Road, south of Falling Star Road

J. Recommended Improvements

As a result of the hydraulic analyses that were conducted as part of this study, deficiencies within the distribution system were identified, and a recommended long-range capital improvement program was developed, as described below and shown on Figure 7-1.

1. Pressure Zones

The existing pressure zones within the Fountain distribution system should be expanded as necessary to accommodate the projected growth areas, as shown on Figure 7-1. As discussed previously, it is recommended that the operating gradient within the Little Ranches Zone be increased to about 5,820


Joint Storage Reservoir
4.0 Mil Gal
Overflow Elev = 5,930 ft
Joint Elevated Tank
0.75 Mil Gal
Overflow Elev = 6,023 ft
Booster Pumping Station
Fountain Terminal Tank
2.5 Mil Gal
Overflow Elev = 5,930 ft
Inset A
Jointly owned with
City of Widefield
Well #4
Well #5
Well #1
Well #2
Well #3
High Gate Pump
High Gate Well
Proposed Reservoir
3.0 Mil Gal
Overflow Elev = 5,820 ft
Inset B
Proposed
Pumping Station
Proposed
Pumping Station
Southwest Reservoir
3.0 Mil Gal
Overflow Elev = 5,740 ft
Future Water
Treatment Plant
1,300 650 0 1,300 2,600
Feet
Legend
Existing Facilities
Water Mains and Diameter (inches)
Low Zone
Little Ranches Zone
High Zone
Booster Zone
Other Facilites
Storage Reservoir
Pumping Station
Well
Pressure Reducing Valve
Proposed Facilities
Phase I Mains and Diameter (inches)
Low Zone
Little Ranches Zone
High Zone
Phase II Mains and Diameter (inches)
Low Zone
Little Ranches Zone
High Zone
Other Facilites
Water Treatment Plant
Storage Reservoir
Pumping Station
Well
Pressure Reducing Valve
Normally Closed Gate Valve
Flow Meter
City of Fountain
Fountain, Colorado
Water System Master Plan
Recommended Distribution
System Improvements
BLACK & VEATCH
Corporation
2006
Figure 7-1

feet so that it will be more nearly at the midpoint between the High and Low Zone gradients.

2. Storage Facilities

The existing storage facilities are adequate to meet the future requirements within the Low, High, and Booster pressure zones through the year 2020. It is recommended that a new 3.0 MG reservoir with an overflow elevation of 5,820 feet be constructed to serve the Little Ranches Zone. This reservoir should be located on the high ground near the intersection of Kane Road and the proposed Powers Boulevard extension. It is recommended that the reservoir be constructed by 2010 to provide peaking and emergency storage for customers in the Little Ranches Zone.

3. Pumping Stations

It is recommended that two new pumping stations be constructed; one along Wilson Road and one at the site of the proposed Kane Ranch Reservoir. These stations will be essential for transferring water from the proposed WTP into the higher service areas.

The proposed Wilson Road pumping station should be constructed by year 2011 at the boundary between the Low Zone and the Little Ranches Zone. The station will take suction from the proposed 36-inch transmission main in the Low Zone and discharge to the future 30-inch transmission main in the Little Ranches Zone. Although the station should be designed to have an ultimate firm pumping capacity of about 16 mgd, it can initially be constructed with a capacity of about 6 mgd.

The proposed Kane Ranch pumping station should be constructed by year 2017, and should be with a firm pumping capacity of about 11 mgd. The station will take suction from the proposed 30-inch transmission main in the Little Ranches Zone and discharge to the proposed 24-inch transmission main in the High Zone.

4. Distribution Mains

Figure 7-1 shows the existing distribution network along with the recommended diameter, alignment, and timing of the proposed distribution mains.

a. Phase 1 and Phase 2 Improvement Mains

In order to facilitate the budgeting and planning process, the recommended distribution system facilities have been grouped into two phases. Phase 1 facilities are recommended for construction by 2015 and Phase 2 facilities are recommended for construction after 2015. The alignments shown on Figure 7-1 are the approximate locations used for the hydraulic analyses. Specific street locations should be determined during the preliminary design and improvements in undeveloped areas may change based on changing growth patterns.

The Phase 1 Improvements include major transmission mains in the Low Zone and a number of additional mains to reinforce the existing distribution network and to extend service into future growth areas. The Phase 1 transmission mains are needed to enhance the ability to convey water from the Southwest Reservoir to existing and future customers in future growth areas. As shown on Figure 7-1, the principle proposed Phase 1 transmission main is the 36-inch main in the Low Zone between the Southwest Reservoir and the site of the future booster pumping station along Wilson Road.

The Phase 2 Improvements include a number of mains to reinforce the existing distribution network and extend service to projected growth areas. It is recommended that a 30-inch main be constructed in the Little Ranches Zone along Wilson Road and the Powers Boulevard corridor between the Wilson Road booster pumping station and the Kane reservoir. In the High Zone, it is recommended that a 24-inch transmission main along the Powers Boulevard corridor be constructed between the Kane Ranch pumping station and C&S Road. These improvements will complete the sequence of mains needed to convey water from the proposed WTP into the Little Ranches and High Zones.

Tables 7-4 and 7-5 summarize the probable costs of the recommended Phase 1 and Phase 2 water main improvements. These costs are planning level estimates that reflect generalized assumptions regarding conditions along the proposed alignments and are intended for budgeting purposes. Once the exact route for a particular main has been determined, the cost estimate should be re-evaluated and, if necessary, adjusted appropriately to reflect actual conditions along the selected route.

All costs are based on current construction prices and include allowances for contingencies and for legal, engineering, and administrative expenses, but do not include allowances for land, right-of-way, or rock excavation. Construction costs are based on conventional open-cut installation within the right-of-way of existing streets and include allowances for removing a section of pavement equal to the width of the trench and subsequently replacing the pavement.

Table 7-4

Probable Costs of Phase 1 Water Mains

Main No.	Pressure Zone	Location	Diameter (inches)	Length (feet)	Probable Cost ($)
1	Low	No existing street	8	800	80,000
2	Low	No existing street	12	2,600	210,000
3	Little Ranches	Ermel Road	12	400	50,000
4	Little Ranches	Ermel Road	8	2,600	220,000
5	Little Ranches	Shumway Road	12	1,300	130,000
6	High	Valli Farms Road	8	1,000	90,000
7	Little Ranches	Link Road	12	4,000	430,000
8	Little Ranches	Squirrel Creek Road	12	1,100	120,000
9	High	Squirrel Creek Road	12	1,600	160,000
10	High	Shumway Road	12	2,600	260,000
11	High	Kane Road	12	2,600	260,000
12	High	I-25 Frontage Road	16	3,800	430,000
13	High	No existing street	12	3,100	300,000
14	High	U.S. Highway 85	12	900	100,000
15	High	Mesa Road	12	3,800	480,000
16	Low	U.S. Highway 85	8	7,500	630,000
17	Low	No existing street	12	1,000	170,000
18	Low	Wilson Road	36	1,500	350,000
19	Low	Jimmy Camp Road	12	700	80,000
20	Little Ranches	Shumway Road	12	1,300	130,000
21	Little Ranches	Link Road	12	1,600	160,000
22	Little Ranches	Link Road	12	1,300	130,000
23	Little Ranches	Link Road	12	2,600	260,000
24	Little Ranches	Kane Road Road	12	2,600	260,000
25	Little Ranches	Kane Road and R.E.A. Road	8	2,100	180,000
26	Little Ranches	No existing street	8	6,600	340,000
27	High	C & S Road	20	2,600	340,000
28	High	Link Road	12	1,300	130,000
29	High	C & S Road	20	1,100	150,000
30	High	Marksheffel Road	16	6,800	820,000
31	High	No existing street	12	900	60,000
32	High	No existing street	16	5,000	400,000
33	Low	Charter Oak Ranch Road	36	5,200	1,030,000
34	Low	No existing street	36	2,800	500,000
35	Low	No existing street	36	1,300	600,000
36	Low	No existing street	36	2,700	860,000
37	Low	Old Pueblo Road	36	1,700	450,000
38	Low	Wilson Road	36	2,000	500,000
39	Low	Wilson Road	36	4,700	1,180,000
40	Little Ranches	No existing street	16	4,200	340,000
Phase 1 Total					**$13,370,000**

Table 7-5

Probable Costs of Phase 2 Water Mains

Main No.	Pressure Zone	Location	Diameter (inches)	Length (feet)	Probable Cost ($)
41	High	No existing street	16	1,400	120,000
42	High	Future Powers Blvd extension	16	5,400	430,000
43	Little Ranches	No existing street	30	2,700	510,000
44	Little Ranches	Future Powers Blvd corridor	30	5,300	790,000
45	Little Ranches	Future Powers Blvd corridor	30	3,000	430,000
46	Little Ranches	No existing street	16	2,600	220,000
47	High	Future Powers Blvd corridor	24	3,000	370,000
48	High	Squirrel Creek Road	12	2,600	260,000
49	High	Future Powers Blvd corridor	24	7,000	820,000
50	Low	Old Pueblo Road	12	3,600	360,000
51	Low	No existing street	8	4,900	240,000
52	Low	No existing street	8	2,000	230,000
53	Low	No existing street	12	2,700	180,000
54	Little Ranches	Future Powers Blvd corridor	12	2,700	180,000
55	Low	Future Powers Blvd corridor	12	1,600	140,000
56	Low	No existing street	16	5,100	410,000
57	High	Pleasant Valley Road	12	5,800	600,000
58	High	No existing street	12	12,700	860,000
59	Low	Future Powers Blvd corridor	16	3,400	270,000
60	Low	No existing street	16	2,900	240,000
61	Low	No existing street	16	2,800	270,000
62	Low	Old Pueblo Road	16	6,400	740,000
63	Low	No existing street	12	5,900	380,000
64	Low	Old Pueblo Road	12	6,200	620,000
65	Low	Future Powers Blvd corridor	12	7,400	490,000
66	Low	Birdsall Road	12	3,400	370,000
67	High	Future Powers Blvd corridor	12	2,600	170,000
68	High	No existing street	12	2,600	170,000
69	Little Ranches	No existing street	12	2,600	170,000
70	Low	No existing street	12	4,900	330,000
Phase 2 Total					**$11,370,000**

The main numbers listed in Tables 7-4 and 7-5 correspond to the numbers shown on Figure 7-1 and are representative of a tentative priority schedule.

However, the actual timetable of distribution main improvements may differ slightly from the proposed schedule. Factors that may accelerate or delay a given improvement include availability of easements, scheduling of street improvements, and construction of other utilities.

b. Local Distribution Mains

Because it is not possible to accurately predict the layout of the numerous local distribution mains within future developments and subdivisions, local main improvements were not identified as part of this study. However, in order to assist the City in sizing and laying out the local distribution mains within future developments, the following guidelines are provided:

- Install 12-inch mains as a minimum size on a mile grid.
- Use a minimum pipe size of 8-inches for any main extending more than 500 feet without cross-ties.
- Use minimum pipe sizes of 8 inches in commercial areas and 6-inches in residential areas.
- Wherever possible, eliminate dead-end mains to provide a more reliable looped network.

c. Fire Flow Considerations

As discussed previously, a comprehensive fire protection evaluation was not included as part of this study. However, fire flow requirements were considered while performing the hydraulic analyses and the recommended distribution system facilities were sized to provide a reasonable degree of fire protection. Fire flow rates greater than 1,000 gpm will be generally obtainable throughout the distribution network, with significantly higher fire flow rates being available along the primary development corridors, where the larger-diameter distribution mains are located.

Since downtown is a commercial area, it may be desirable to have higher available fire flow rates. The most practical way to achieve higher fire flow rates in the downtown area would be to replace the 4-inch main on Ohio Avenue (between Main Street and Hamilton Street) with an 8-inch main. As a result of this main replacement, the range of available fire flow rates in the downtown area would increase to between 2,200 gpm and 4,000 gpm. This main replacement project could be performed at the City's discretion, ideally in conjunction with other street or utility upgrade projects so as to minimize the inconvenience for local businesses and possibly reduce overall costs.

Chapter 8
Recommended Capital Improvements Plan

This chapter presents the recommended water supply alternative and an associated capital improvements plan (CIP). The water system improvements recommended in this report are staged to coincide with anticipated development and to aid the City in planning and financing its CIP.

The sequence and timing of the improvements proposed below are based on the anticipated development patterns within the City's service area. Since actual development may vary somewhat from the projected pattern, it is recommended that the City revisit this Master Plan at regular intervals to ensure that all components of the proposed CIP are still appropriate.

A. Recommended Water Supply Alternative

Based on the financial evaluation completed in Chapter 6, it is recommended that the City implement Alternative 3a. The recommended infrastructure improvements associated with Alternative 3a are listed in Table 8-1 and shown on Figure 6-3.

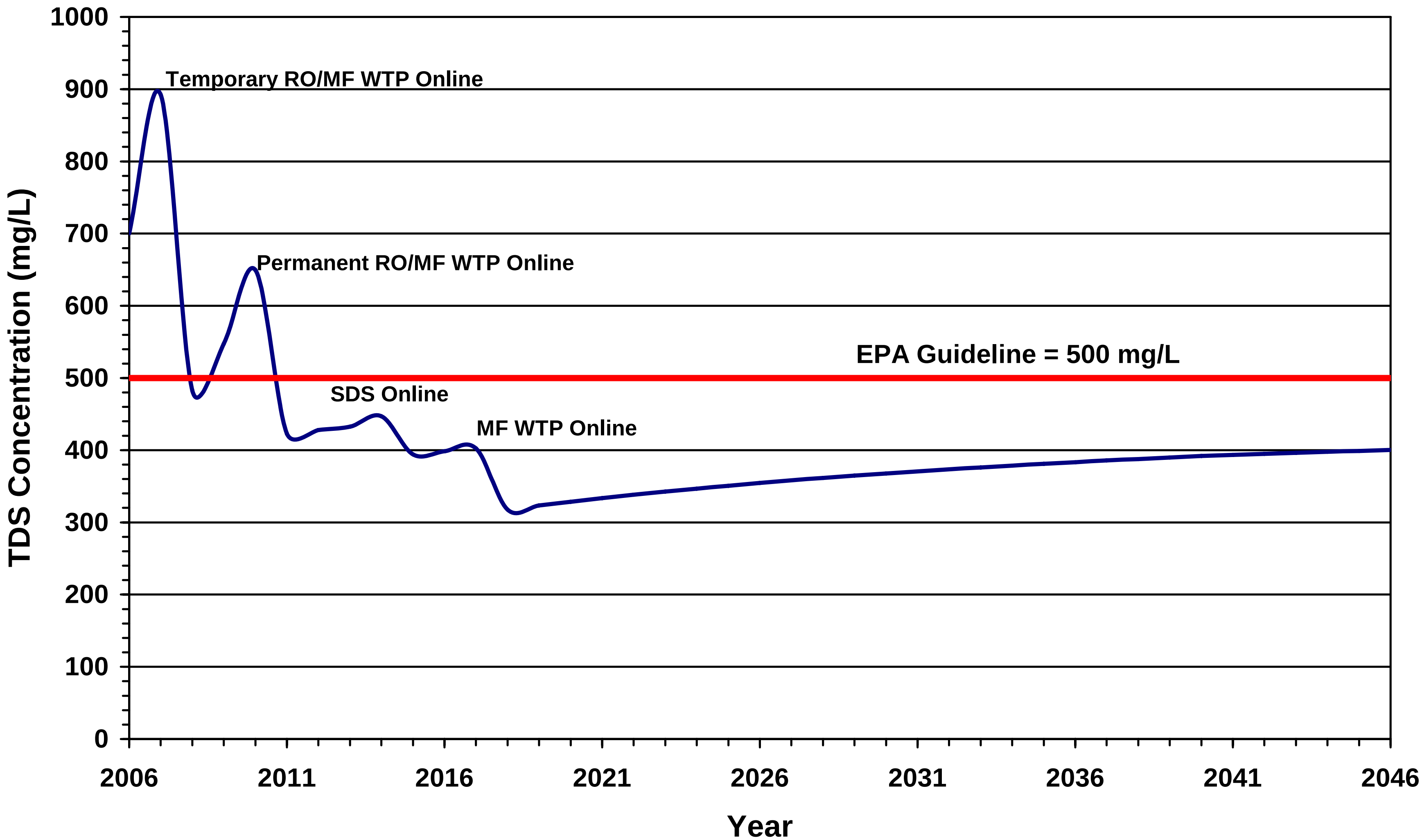
Table 8-1

Alternative 3a Components

Year	Project Description
2007	Develop 4 northern wells and 1 southern well
2008	Develop 2 northern wells and 4 southern wells 1.5 mgd temporary RO/MF treatment facility online
2009	Develop 1 northern well and 1 southern well
2010	Develop 2 southern wells
2011	Develop 1 southern well 4.0 mgd permanent RO/MF treatment facility online
2012	Develop 1 southern well
2013	Augmentation reservoir online
2014	Turn over two Ventucci wells to Widefield and Security
2015	SDS online Raw water storage reservoir online
2018	Expand RO/MF treatment facility to 5.0 mgd 10 mgd MF treatment facility online Decommission temporary RO/MF treatment facility
2029	Expand MF treatment facility to 15 mgd

Alternative 3a has the lowest capital cost opinion as well as the lowest projected O&M costs. Under this alternative, the City would implement conservation measures to reduce future water demands. The City would pump wells and utilize RO/MF at a constant rate equal to the annual average day demand and utilize storage and additional MF treatment to meet maximum day demands.

Figure 8-1 shows the predicted distribution system water quality with respect to TDS concentrations throughout the planning period if Alternative 3a is implemented. As shown on Figure 8-1, once the permanent RO/MF WTP is online, finished water TDS concentrations are expected to stay below EPA's Secondary Standard of 500 mg/L.



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City of Fountain, Colorado – Water Supply Plan

Predicted TDS Concentrations in the Distribution System for Alternative 3a

Figure 8-1

B. Recommended Distribution System Improvements

Table 8-2 provides a summary of probable costs for the proposed Phase 1 and Phase 2 recommended distribution system improvements, including water mains, storage reservoirs, and flow control valves.

Table 8-2

Summary of Probable Costs for Distribution System Improvements

Phase	Recommended Improvements	Probable Cost ($)
Phase 1 (by 2015)	Water Transmission and Distribution Mains	13,370,000
	Fire Protection Upgrade (Replace 4 inch main on Ohio Ave with 8 inch main)	200,000
	Wilson Road Pumping Station	1,200,000
	3.0 mil gal ground storage reservoir	2,000,000
	PRVs and Flow control valves	350,000
	Phase 1 Total	**$ 17,120,000**
Phase 2 (after 2015)	Water Transmission and Distribution Mains	11,370,000
	Wilson Road Pumping Station Expansion	500,000
	Kane Ranch Pumping Station	1,000,000
	PRVs and Flow control valves	230,000
	Phase 2 Total	**$ 13,100,000**

C. Capital Improvements Plan

The capital and O&M costs associated with the recommended water supply and distribution system improvements were used to develop a staged CIP, as shown in Table 8-3.

Table 8-3

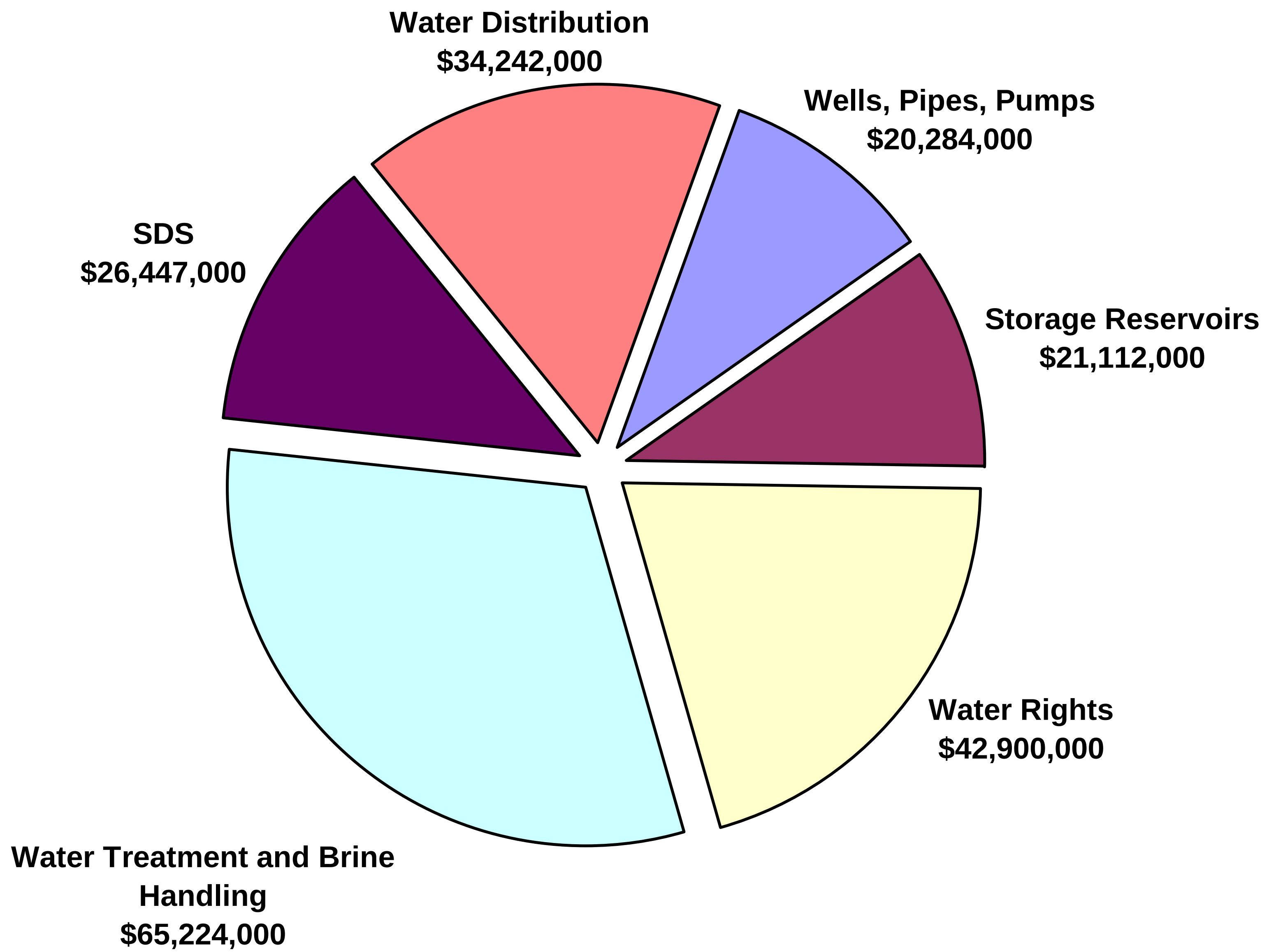
Staged CIP for the City's Recommended Water System Improvements[(1)]

Year	Capital Cost	O&M Cost[(2)]
2006	$4,885,000	$0
2007	$11,998,000	$93,000
2008	$13,577,000	$1,227,000
2009	$37,926,000	$1,319,000
2010	$16,995,000	$1,371,000
2011	$15,848,000	$2,644,000
2012	$13,386,000	$2,907,000
2013	$14,773,000	$3,172,000
2014	$3,601,000	$4,314,000
2015	$6,044,000	$4,862,000
2006 - 2015 Subtotal	**$139,033,000**	**$21,909,000**
2016 - 2020	$39,950,000	$19,458,000
2021 - 2030	$22,153,000	$38,072,000
2031 - 2046	$9,073,000	$85,615,000
2016 - 2046 Subtotal	**$71,176,000**	**$143,145,000**
Total	**$210,209,000**	**$165,054,000**

(1) With conservation projections assume a 20 percent reduction in average and maximum day demand projections.
(2) O&M costs are in addition to the City's current O&M costs.

1. Capital Costs

Figure 8-2 presents graphically the capital cost for the recommended alternative broken out by project component for planning period (2006 through 2046). As shown on Figure 8-2, the largest expenditure is for water treatment and brine handling. As discussed in Chapter 5, three brine handling options were explored as part of this study. A forth option, deep well injection, was identified but not investigated as part of this study. However, it is important to note that substantial savings could potentially be realized if deep well injection is determined to be feasible and a subsequent feasibility study should be performed.



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City of Fountain, Colorado – Water Supply Plan

Capital Cost By Component Assuming Conservation (2006 – 2046)

Figure 8-2

The second largest capital expenditure in the near-term planning horizon is related to participation in SDS. As discussed in Chapter 5, the cost to provide SDS water is comparable to the cost to provide water from additional local supplies. However, local supplies can be developed incrementally as demands are realized and therefore, capital expenditures may be able to be delayed if the City does not participate in SDS.

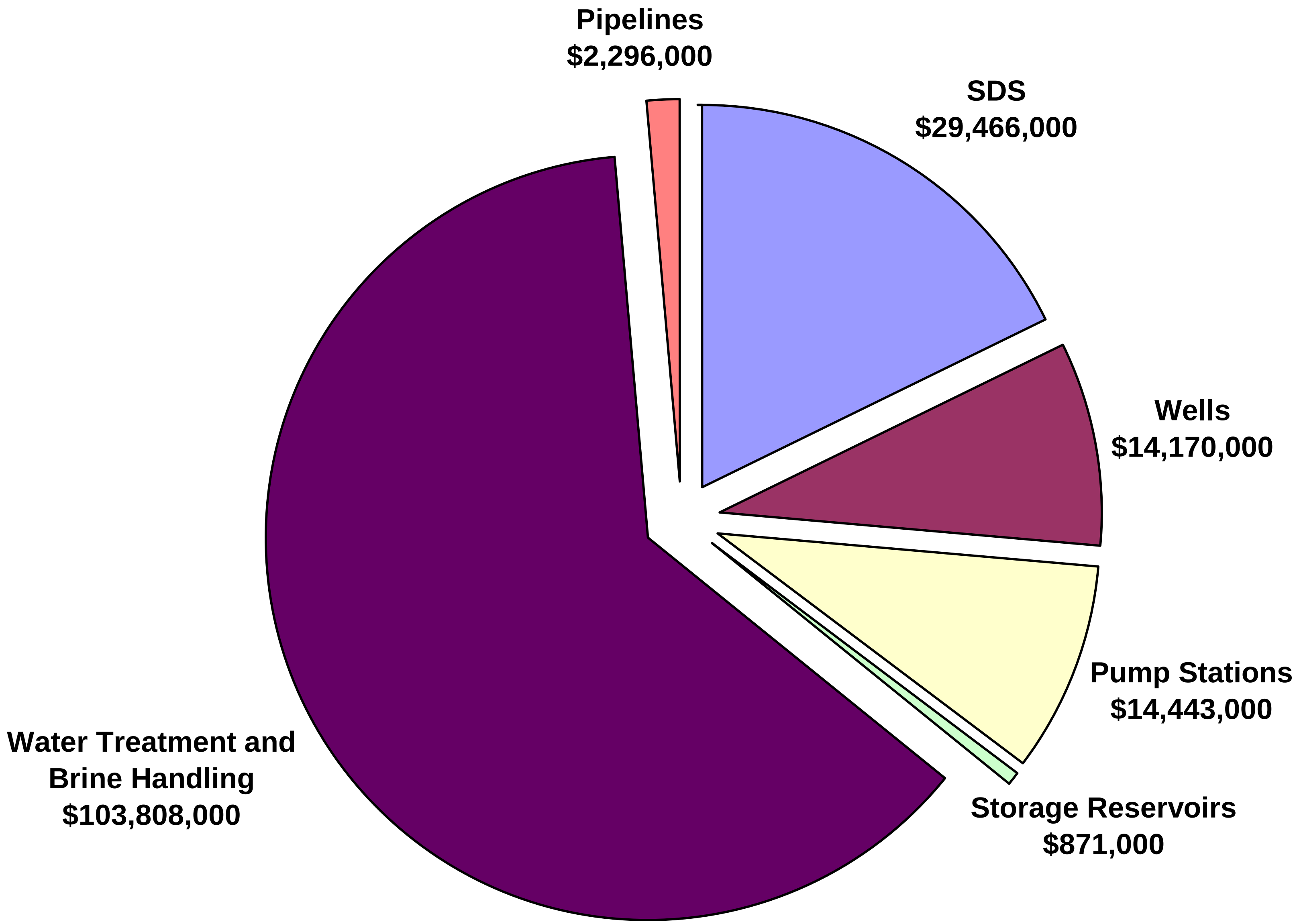
Storage costs account for approximately $21 million dollars of the total capital costs. A savings of approximately $3 million dollars may be realized if water releases from Pueblo Reservoir can be used to meet augmentation requirements. W.W. Wheeler is currently investigating this option.

2. O&M Costs

Figure 8-3 shows the O&M cost for the recommended alternative broken out by project component for the entire planning period and Figure 8-4 shows the annual average O&M cost broken out by component through the entire planning period.

Similar to the capital costs, and as shown on these figures, the largest O&M expenditure is for water treatment and brine handling. It is important to note that the O&M costs associated with brine handling are based on an optimistic assumption that the ZLD facility will be located near a power plant that has sufficient suitable waste heat for the evaporation process. This option was assumed due to the perceived difficulty in obtaining large amounts of land required to utilize drying beds for brine handling. However, it is recommended that the City explore the drying bed option further and, if there is sufficient land available on which to construct drying beds, the City could potentially save approximately $750,000 per year in O&M costs. An additional $2.5 million dollars per year would be required to operate a ZLD facility if waste heat from a power plant is not available.

The second largest O&M expenditure is related to participation in SDS. This estimate is based on costs to deliver water from SDS system at the time this study was prepared. However, both capital and O&M costs are subject to change as the SDS project moves forward, and Fountain should reevaluate the decision to participate as costs are revised.



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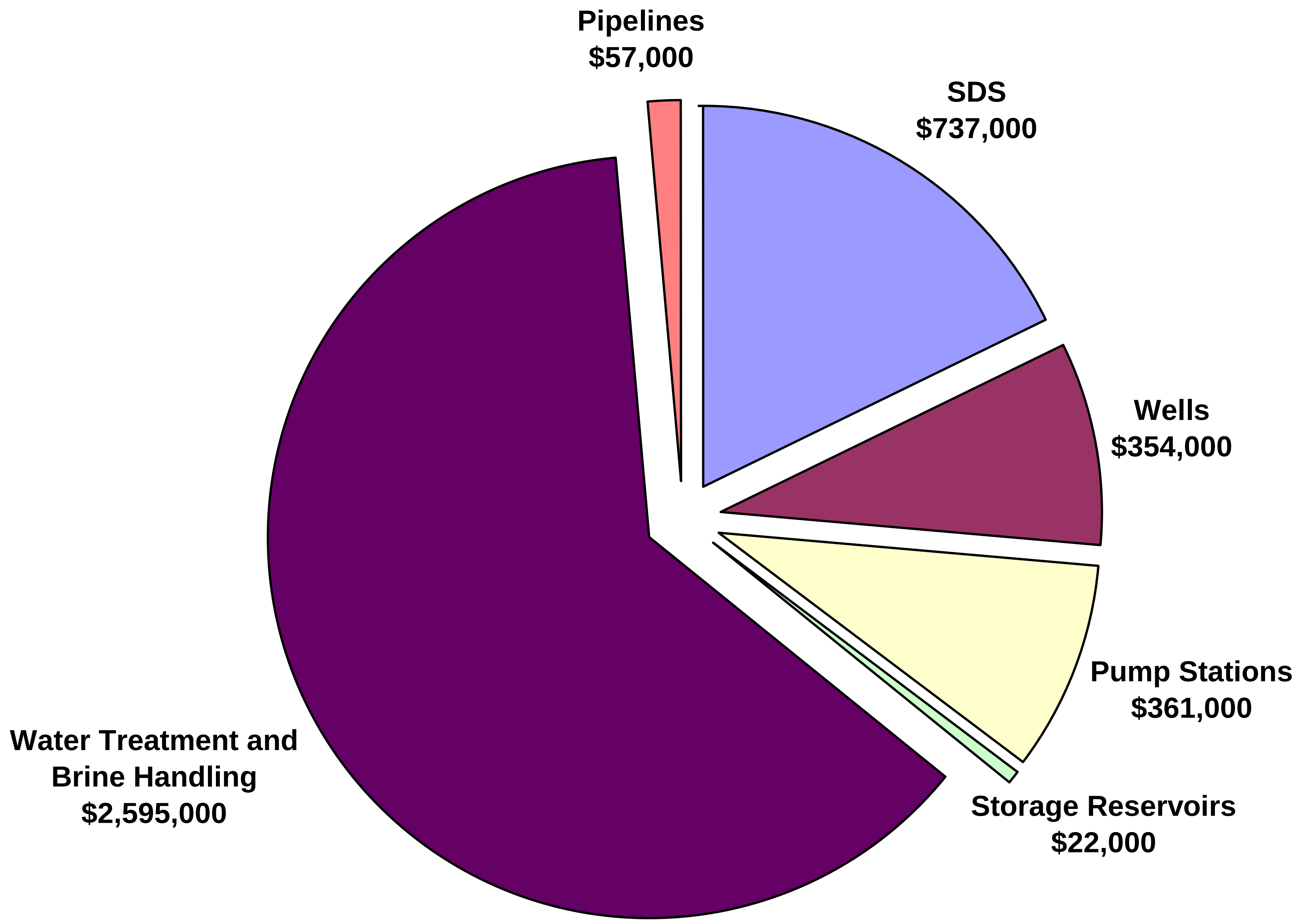
City of Fountain, Colorado – Water Supply Plan

O&M Cost By Component Assuming Conservation (2006 – 2046)

Figure
8-3



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City of Fountain, Colorado – Water Supply Plan

Average Annual O&M Cost By Component
Assuming Conservation (2006 – 2046)

Figure
8-4

D. Reduced Levels of Service

The recommended plan described above provides the City with a reliable water system capable of meeting anticipated water demands through the planning period. However, these recommendations require over 60 percent of the total capital improvements to be funded and constructed between 2007 and 2015 and the financial impacts may not be acceptable to the City. If the City cannot implement these recommendations due to financial limitations, reduced level of service alternatives could be considered.

The reduced level of service alternatives presented herein are based on the following criteria:

- Sufficient water supplies are provided to meet the same estimated maximum day water demands as for Alterative 3a.
- Water treatment facilities provided under the reduced level of service will enable the City to produce a blended water quality in the distribution system of less than 750 mg/L for TDS, instead of the Federal Secondary Guideline value of 500 mg/L.
- The blended water quality of 750 mg/L or less for TDS will be met for all demands equal to or less than 80 percent of the projected maximum day demand condition. During the highest demand periods, additional wells would be operated but the water treatment facilities would be by-passed resulting in slightly poorer water quality. Alternatively, water curtailment measures could be implemented to reduce the peak demands associated with dry summer days and meet the water quality target of 750 mg/L.
- After year 2020, facilities will be in place to meet the recommended target service levels (Alternative 3a).

1. Alternative 3b – Reduced Service with SDS Participation

Alternative 3b includes a revised implementation plan for water treatment and brine handling facilities. Table 8-4 lists the costs associated with treated water for Alternative 3b.

Table 8-4

Water Treatment Costs Associated with Alternative 3b

Year	Component	Cost
2006	Alluvium Study	$125,000
	Treatability/Brine Handling Study	$125,000
	Environmental/Permitting Assessment	$35,000
2007	Design and Permit 0.5 mgd Temporary RO/MF WTP	$75,000
	Procure 0.5 mgd Temporary RO/MF WTP	$686,000
	Utilize Temporary Brine Handling Facilities	$1,000,000
	Purchase Permanent RO/MF WTP Site	$300,000
	Design 3.0 mgd Permanent RO/MF WTP and Brine Handling Facilities	$1,500,000
2008	Install Temporary RO/MF WTP (Online Summer 2008)	$230,000
	Acquire Permits for Permanent RO/MF WTP	$75,000
2009	Construct Brine Handling Facilities (First Year)	$3,076,000
2010	Construct Brine Handling Facilities (Second Year)	$3,076,000
2018	Construct 7.5 mgd MF WTP	$11,250,000
2020	Construct Permanent 3.0 mgd RO/MF WTP	$4,500,000
	Expand Brine Facilities	$14,355,000
2029	Expand MF WTP (Additional 7.5 mgd)	$11,250,000
2030	Expand RO/MF WTP (Additional 2.0 mgd)	$6,600,000
	Capital Cost Opinion for Water Treatment	**$58,257,000**

Alternative 3b requires approximately $10.3 million between years 2006 and Years 2015 as compared to $41.1 million for Alternative 3a. Of this $30.8 million difference, $13.8 million is delayed to later years and $7 million is eliminated entirely from the budget.

2. Alternative 3c – Reduced Service without SDS Participation

Alternative 3c includes a revised implementation plan for water treatment and brine handling facilities. Table 8-5 lists the costs associated with treated water for Alternative 3c.

Table 8-5

Water Treatment Costs Associated with Alternative 3c

Year	Component	Cost
2006	Alluvium Study	$125,000
	Treatability/Brine Handling Study	$125,000
	Environmental/Permitting Assessment	$35,000
2007	Design and Permit 0.5 mgd Temporary RO/MF WTP	$75,000
	Procure 0.5 mgd Temporary RO/MF WTP	$686,000
	Utilize Temporary Brine Handling Facilities	$1,000,000
	Purchase Permanent RO/MF WTP Site	$300,000
	Design 0.5 mgd Permanent RO/MF WTP and Brine Handling Facilities	$1,500,000
2008	Install Temporary RO/MF WTP (Online Summer 2008)	$230,000
	Acquire Permits for Permanent RO/MF WTP	$75,000
2009	Construct Brine Handling Facilities (First Year)	$3,076,000
2010	Construct Brine Handling Facilities (Second Year)	$3,076,000
2013	Construct Permanent 0.5 mgd RO/MF WTP	$1,650,000
2015	Design and Construct 5 mgd MF WTP	$7,500,000
2018	Expand RO/MF WTP (Additional 1.0 mgd) and Abandon Temporary WTP	$3,300,000
2020	Expand Brine Handling Facilities	$20,508,000
2021	Expand MF WTP (Additional 5.0 mgd)	$7,500,000
	Expand RO/MF WTP (Additional 3.0 mgd)	$9,900,000
2029	Expand MF WTP (Additional 5.0 mgd)	$7,500,000
2030	Expand RO/MF WTP (Additional 2.5 mgd)	$9,900,000
	Capital Cost Opinion for Water Treatment	**$76,410,000**

Alternative 3c requires approximately $19.5 million in treatment between years 2006 and Years 2015. To provide the same level of service, Alternative 3a requires $41.1 million in treatment facilities and an additional $26 million in SDS. Of the $47.6 million difference, a total of $35.1 million is delayed to later years and $12.5 million is eliminated entirely from the budget.

3. Comparison of Alternatives 3a, 3b, and 3c

Tables 8-6 and 8-7 provide a comparison of capital and O&M costs associated with the reduced service level alternatives compared to the recommended alternative, respectively.

Table 8-6

Comparison of Capital Costs For Recommended and Reduced Service Level Alternatives

Year	Alternative 3a	Alternative 3b	Alternative 3c
2006	$4,885,000	$4,885,000	$4,885,000
2007	$11,998,000	$9,875,000	$9,875,000
2008	$13,577,000	$13,070,000	$12,534,000
2009	$37,926,000	$13,308,000	$11,866,000
2010	$16,995,000	$14,791,000	$14,136,000
2011	$15,848,000	$14,528,000	$9,790,000
2012	$13,386,000	$13,386,000	$3,267,000
2013	$13,023,000	$14,773,000	$8,253,000
2014	$1,851,000	$3,601,000	$2,814,000
2015	$4,044,000	$6,044,000	$13,544,000
2006 - 2015 Subtotal	**$133,533,000**	**$108,261,000**	**$90,964,000**
2016 - 2020	$39,950,000	$53,405,000	$49,738,000
2021 - 2030	$22,153,000	$32,503,000	$47,803,000
2031 - 2046	$9,073,000	$9,073,000	$9,073,000
2016 - 2046 Subtotal	**$71,176,000**	**$94,981,000**	**$106,614,000**
Total	**$210,209,000**	**$203,242,000**	**$197,578,000**

Comments:

1. Alternative 3a provides a robust system that meets recommended EPA guidelines.
2. Alternative 3b provides reduced levels of service while Fountain continues to participate in SDS.
3. Alternative 3c provides reduced levels of service and no SDS participation.

Table 8-7

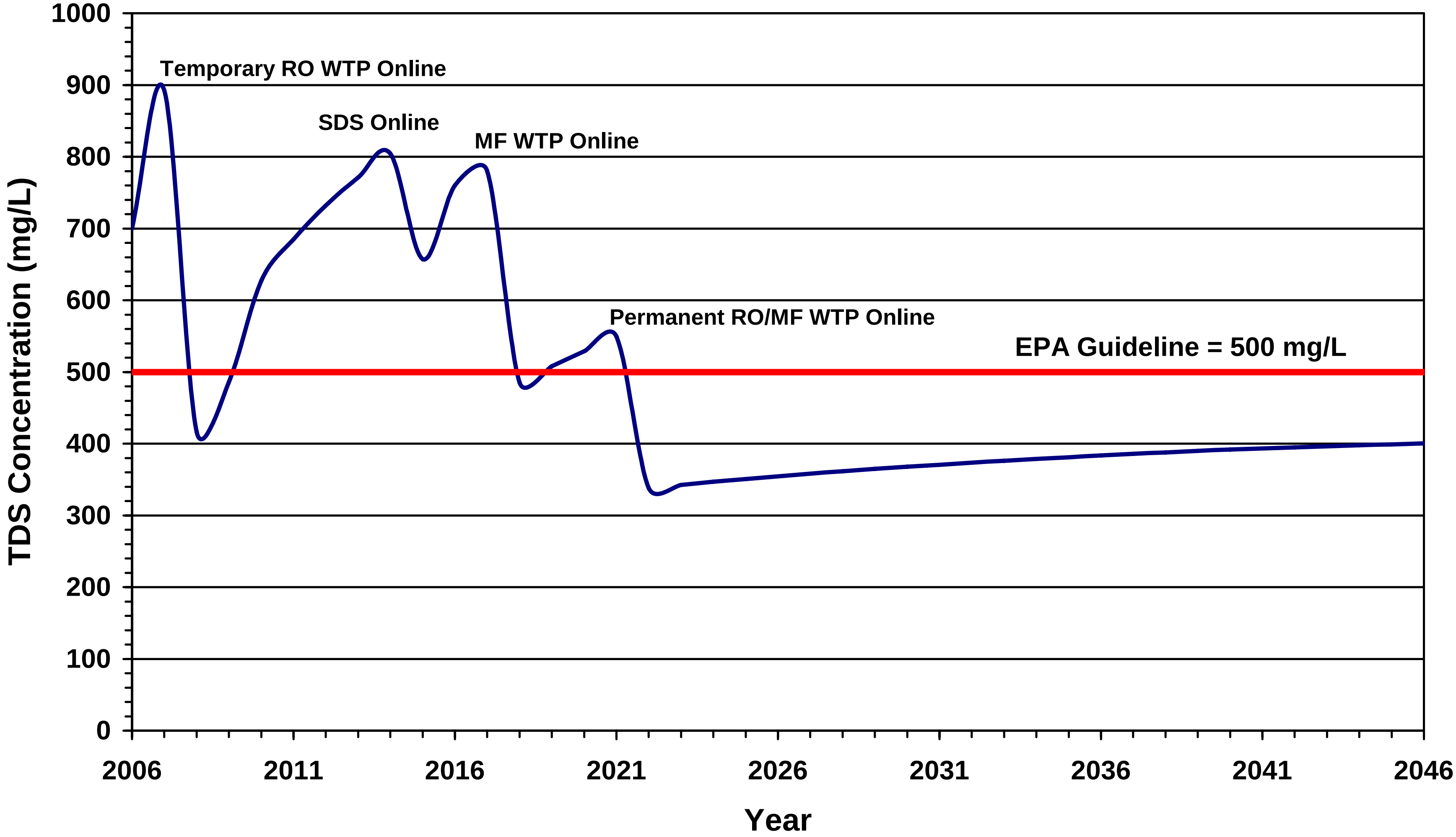
Comparison of O&M Costs For Recommended and Reduced Service Level Alternatives[(1)]

Year	Alternative 3a	Alternative 3b	Alternative 3c
2006	$0	$0	$0
2007	$93,000	$93,000	$93,000
2008	$1,227,000	$712,000	$712,000
2009	$1,319,000	$799,000	$799,000
2010	$1,371,000	$846,000	$846,000
2011	$2,644,000	$985,000	$985,000
2012	$2,907,000	$1,013,000	$1,013,000
2013	$3,172,000	$1,042,000	$1,042,000
2014	$4,314,000	$946,000	$1,403,000
2015	$4,862,000	$2,139,000	$2,011,000
2006 - 2015 Subtotal	**$21,909,000**	**$8,575,000**	**$8,904,000**
2016 - 2020	$19,458,000	$12,010,000	$12,034,000
2021 - 2030	$38,072,000	$37,199,000	$40,106,000
2031 - 2046	$85,615,000	$85,615,000	$88,869,000
2016 - 2046 Subtotal	**$143,145,000**	**$134,824,000**	**$141,009,000**
Total	**$165,054,000**	**$143,399,000**	**$149,913,000**

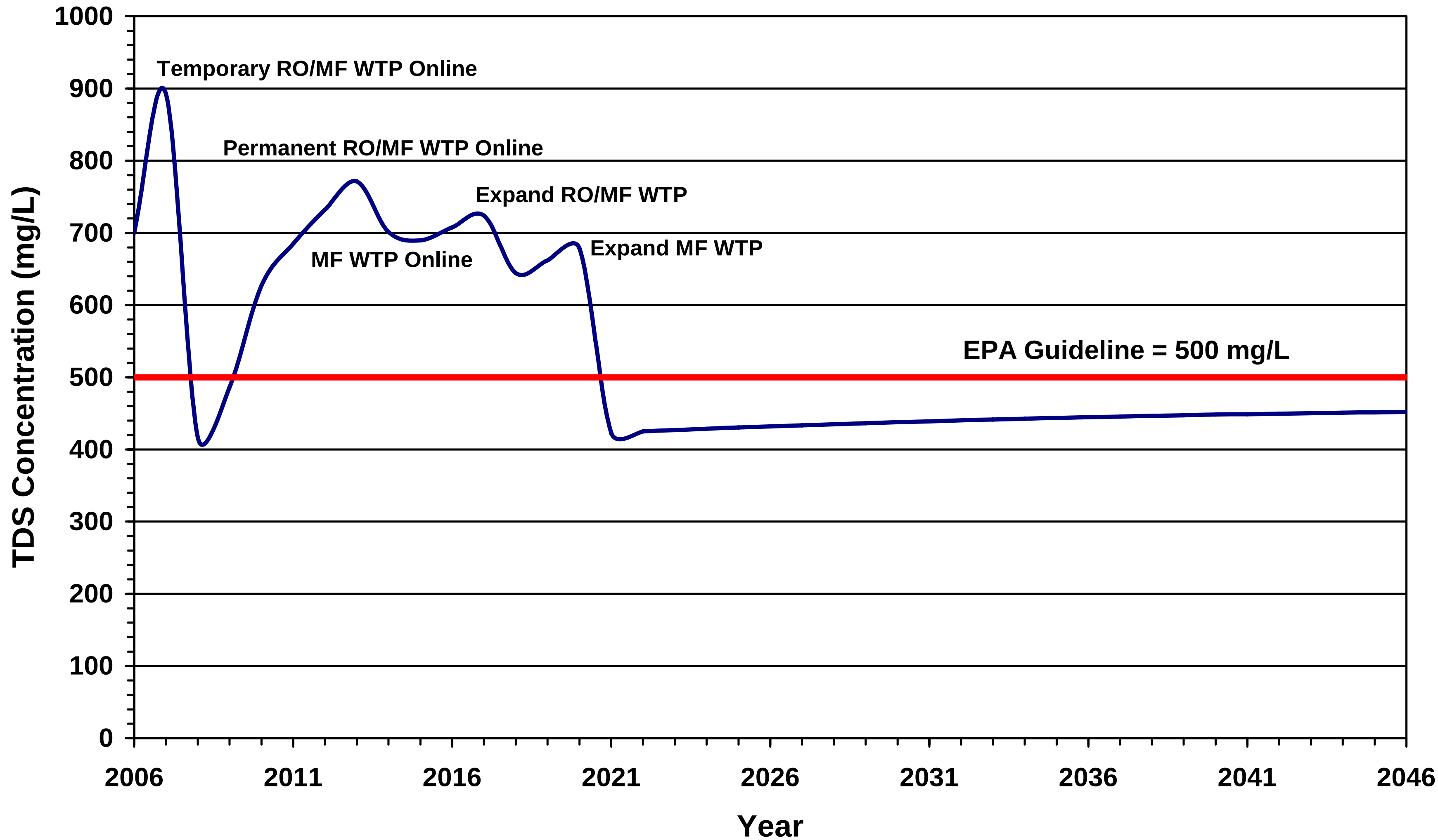
[(1)]O&M costs are in addition to the City's current O&M costs.

Table 8-7 shows that the O&M costs for Alternatives 3b and 3c are lower that 3a in early years. However, after year 2020, Alternative 3c has the highest O&M cost because it does not realize the benefits of the low cost/high quality SDS water.

Figures 8-5 and 8-6 show the predicted distribution system water quality with respect to TDS concentrations throughout the planning period for Alternatives 3b and 3c. As shown on these figures, finished water TDS concentrations are not expected to drop below EPA's Secondary Standard of 500 mg/L until after 2020 for the reduced level of service alternatives.



BLACK & VEATCH building a world of difference ENERGY WATER INFORMATION GOVERNMENT	City of Fountain, Colorado – Water Supply Plan Predicted TDS Concentrations in the Distribution System for Alternative 3b	Figure 8-5



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City of Fountain, Colorado – Water Supply Plan

Predicted TDS Concentrations in the Distribution System for Alternative 3c

Figure 8-6

E. Next Steps

Assuming conservation measures are implemented, Fountain may utilize groundwater to meet as much as 90 percent of maximum day demands and 65 percent of annual demands by 2020 if the City does not participate in SDS. If the City elects to participate in SDS, its reliance on groundwater could still be as much as 77 percent during maximum day demand periods and 41 percent during average day demand periods. Therefore, it is imperative that an alluvium study be performed to confirm sufficient water is available to meet groundwater demands.

As discussed previously, RO treatment of the groundwater is required in order to meet the EPA Secondary Standard for finished water TDS concentrations. RO treatment produces a brine stream that must be disposed of. The Colorado Department of Public Health and Environment requires the development of a Brine Management Plan to evaluate options for brine disposal prior to permitting. In addition, the brine handling costs discussed in this Master Plan are rough order-of-magnitude costs and should be defined further. Therefore, it is recommended that the City perform a treatability/brine handling study.

Budget amounts of $125,000 for each of these studies have been included as part of the recommended CIP.