A. Supporting Information for Purpose and Need

This appendix supplements information in Chapter 1 pertaining to the Project Participants' Purpose and Need. It includes a brief overview of Colorado water law as it applies to the proposed SDS Project, and descriptions of the Participants' existing water systems, water conservation programs, and previous water resource planning. Detailed descriptions of the Participants' demand forecasts and water needs also are included.

A.1 Overview of Colorado Water Law

The following broad overview of Colorado water law provides a simple explanation of water law without excessive legal jargon or citations. This section should not be construed as a legal basis for the Participants' Proposed Action, No Action, other Action Alternatives, or their associated water rights.

A.1.1 Introduction

In the 1860s, laws regarding water use and land ownership were established because the demand for water often exceeds the availability of water in most parts of the state. Although they have undergone changes over time, the principles of these laws remain the same and are referred to as the Colorado Doctrine. The principles are (CFWE 2003):

1) All surface and ground water in Colorado is a public resource for beneficial use by public agencies and private persons;
2) A water right is a right to use a portion of the public's water resources;
3) Water rights owners may build facilities on the lands of others to divert, extract, or move water from a stream or aquifer to its place of use; and
4) Water rights owners may use streams and aquifers for the transportation and storage of water.

A.1.2 Prior Appropriation System

The Colorado Constitution mandates the use of the prior appropriation system for the regulation of surface water and tributary ground water in the state. The system lays out an orderly procedure for securing and administering water rights, and includes the following main components:

1) Water users with earlier water rights (or senior water rights) have the priority of use during short supply over those with later water rights (or junior water rights). This is often referred to as "first in time, first in right."
2) Water users appropriate (or take) water when water is put to a beneficial use. The water users must have a plan to divert, store, or otherwise capture, possess, and control the water for beneficial use. Types of beneficial use include but are not limited to irrigation, stock watering, domestic, municipal, industrial, commercial, power generation, instream flows, and recreation.
3) Water rights are adjudicated (or made legal) through the water court system, giving the water user a legal basis for administration of the appropriated water. Adjudication sets the priority

date, amount, point of diversion, type and place of use for the water right. It also confirms that the water right will not injure existing water rights holders. The water court issues a water right "decree" for each adjudicated water right that explains the terms of the adjudication.

4) Water rights are administered according to the terms and priority date in their decree by the Division Engineer. Division Engineers are assigned to each of the seven water divisions in Colorado (generally divided by river basins) and report directly to the State Engineer, which is in the Division of Water Resources, Department of Natural Resources.

A.1.3 Water Rights and Decrees

Two main types of water rights are direct flow rights and storage rights. Direct flow rights make immediate use of the water, while storage rights put water in storage for later use. Subsets of direct flow rights include augmentation, change, exchange, recreational in-channel diversion, and instream flow rights. These are generally defined as follows (CFWE 2003):

- Augmentation Water Rights – Allows a water user to divert water out of priority and replace depletions made to the stream system with other sources. Augmentation water rights are typically used for tributary ground water rights and are required because pumping tributary ground water can cause depletions to nearby surface streams.
- Change of Water Rights Decree – This type of decree changes the use, point of diversion, or place of use of an existing water right while maintaining the original decreed priority date. Typically, changes of water rights are limited to the rights' original consumptive use (that is the amount of water actually consumed by the original water right use), and must maintain historical return flow patterns and other conditions necessary to prevent injury to other water rights.
- Exchange Decree – Allows a water user to divert the water that would usually flow to a downstream diverter at an upstream location. The upstream diverter must then provide a suitable replacement supply of water in amount, timing, and quality at a downstream location. The exchange cannot result in injury to senior water rights.
- Recreational In-Channel Diversion Right – A water right held by local government entities for structures that control the flow of water for rafting and kayaking.
- Instream Flow Water Right – A water right held by the state to protect or improve the water-dependent natural environment.

In addition to the types of water rights, water rights also can be either conditional or absolute. A conditional water right is issued when a water user plans to make use of the water but currently does not have the facilities in place to do so. A conditional water right allows entities to have assurances that a water right can be decreed before constructing facilities. The conditional water right retains the priority from the original decree. Once the facilities are in place, the water right becomes absolute by putting the appropriated water to beneficial use. Until a water right is perfected (i.e., made absolute), the water user must show "due diligence" in progressing toward beneficial use of the water.

Water rights in Colorado are private property rights that are subject to market transactions similar to any other private property right. Water rights may be purchased, sold, leased, rented, and transferred between parties subject to their decrees and the laws of the state.

Water rights are subject to abandonment if the water right is not exercised during a 10-year period or if due-diligence cannot be proven for a conditional water right during a 6-year period. Abandonment is commonly referred to as "use it or lose it."

A.1.4 Administration

Colorado is divided into seven divisions for purposes of water right administration. Water rights are administered by the Division Engineer and Water Commissioners that work within each district in the division. The Arkansas River Basin makes up Division 2, and contains several different districts generally divided by watershed.

Many river basins within the state, including the Arkansas River, are considered to be "overappropriated." This occurs when the amount of water appropriated exceeds the amount of water generally available for diversion. Water use during times when not all adjudicated water rights can be fully met is limited to those entities that have water rights senior to the calling water right. A river call occurs when a water user is unable to divert its full entitlement due to inadequate water availability at the point of diversion. The water user contacts its designated official and "calls" for water. The Water Commissioner then shuts off water to junior water rights until adequate water is available to the senior user. If the call cannot be met with all junior water rights shut off, then the water user cannot divert their full entitlement. The "calling" water right is the water right that is only partially being met; all junior water rights are shut off and all senior water rights are met.

In the Arkansas River Basin, the river is nearly always administered by the calling water right. During extremely wet conditions, there may be a "free river" when all adjudicated water rights are met and any unadjudicated appropriations can divert water.

A.1.5 Transmountain Water Rights and Reusable Water Rights

Transmountain water is water that is diverted from one river basin into another river basin. The most significant transmountain diversion projects in Colorado are those that divert water from the Colorado River Basin to either the South Platte River Basin or the Arkansas River Basin.

For native water rights, or those rights that are used in their original basin of origin, the water right is typically decreed for a single use only. That is, the water user cannot "reuse" that portion of the diverted water that is not fully consumed. However, because transmountain water is not native to the basin in which it is used, the return flows that accrue to the surface water after its initial use typically are not subject to the prior appropriation system and can be reused by the original water right owner. In fact, this water can typically be reused repeatedly until there are no return flows left. This is often referred to as "use to extinction." Water users typically refer to the return flows that can be reused as "reusable return flows."

In addition to transmountain diversions, water rights that are changed to allow a water user to use the consumptive use portion of the original water right are usually allowed to reuse return flows that are generated from the delivery of consumptive water by the new water right owner. This is because the original consumptive use portion was fully removed from the stream system (typically through crop consumption) and never returned back to the stream system. Therefore, any return flows derived from these consumptive use waters under its new use (typically municipal use) would be in excess of what was historically returned to the stream, thus reuse of these return flows would not injure senior water rights holders.

Not all transmountain water or consumptive use water is reusable; each decree contains specific language on if and how the water can be reused.

A.1.6 Arkansas River Compact

Interstate compacts apportion that amount of water that can be used by each state from a particular river system. The water in the Arkansas River is apportioned between Colorado and Kansas according to a 1948 Arkansas River Compact. In general, the Compact divides water in the Arkansas River inflows to John Martin Reservoir between Colorado (60 percent) and Kansas (40 percent). The 1980 Operating Principles provide for storage accounts in John Martin Reservoir and release of water from those accounts for Colorado and Kansas water users. If the reservoir pool is depleted, and Colorado is required to administer priorities below John Martin Reservoir, then Kansas is not entitled to water flowing into the reservoir (CWCB 2002).

Colorado and Kansas have been in litigation regarding the Arkansas River since the early 1900s. Recent decisions by the Supreme Court have lead to the appointment of a “Special Master” and the promulgation of well rules by Colorado that limit the amount of well pumping in the lower Arkansas River Basin to bring Colorado into compliance with the Compact.

A.2 Participants’ Water Systems

This section describes the existing supply of each SDS Participant and the water rights that each Participant would use in the SDS Project. Each Participant’s existing supply, when coupled with its anticipated demand, forms the basis for the need for the SDS Project.

A.2.1 Colorado Springs

Colorado Springs is the largest metropolitan area in southeast Colorado. Colorado Springs Utilities provides electric, water, wastewater, gas, and street light services. Colorado Springs’ water service area includes most of Colorado Springs and some of the surrounding suburban residential areas. The military installations of Fort Carson, Peterson Air Force Base, and the U.S. Air Force Academy receive water, electricity, and gas from Colorado Springs. Peterson Air Force Base also receives wastewater treatment service from Colorado Springs. In 2004, Colorado Springs provided water to about 405,900 people.

A.2.1.1Existing Water Supply

Current Raw Water Supplies

Colorado Springs currently obtains raw water supplies from nine different sources: Local System, Blue River System, Otero (Homestake) System, Twin Lakes System, Fry-Ark Project via the Fountain Valley Authority (FVA) System, Arkansas River Exchanges, Colorado Canal System exchanges, Ground Water System, and Turquoise Lake Colorado Fuel and Iron Corporation (CF&I) Decree (Table A-1). These supplies provide a firm yield of 119,000 ac-ft/yr (about 106 mgd). Delivery of Colorado Springs’ firm yield, however, is constrained by several

Table A-1. Colorado Springs' Current Water Supplies*.

System	Firm Yield‡		SMAD$^{\Psi}$	
	ac-ft/yr	**mgd**	**ac-ft/yr**	**mgd**
Local System - Direct Flow Water Rights	18,800	16.8	38,000	33.9
Local System - Water From Storage†	17,200	15.4	100	0.1
Blue River System	7,800	7.0	8,100	7.2
Otero Delivery System	64,700	57.8	71,500	63.8
Fountain Valley Authority System	8,300	7.4	12,600	11.3
Ground Water System$^{\phi}$	2,200	2.0	1,900	1.7
Total	**119,000**	**106.3**	**132,200**	**118.0**

‡Definitions of Firm Yield and SMAD are found in Chapter 1.

$^{\Psi}$SMAD reflect reusable return flows at 2046 demand.

† Firm system yield is higher than firm hydrologic yield due to the benefits of storage.

$^{\phi}$ Ground water average yield is less than that of firm yield because Denver Basin ground water supplies are used only during dry-year conditions. Otherwise, Denver Basin ground water is not used.

*Existing Conditions do not include Pueblo Flow Management Program. This allows the analysis of the alternatives to consider effects of implementation of the Pueblo Flow Management Program

Source: MWH 2005.

factors, which are discussed in the following *Water System Limitations* section.

Each raw water supply source is conveyed to Colorado Springs' water service area for treatment and distribution using one of four main raw water conveyance systems. The four main conveyance systems are the Local System, Blue River System, Otero System, and FVA System (Table A-2). Raw water supplies are delivered primarily through the facilities shown in Table A-1. These conveyance systems in combination are sized to allow delivery of peak flows. Actual deliveries are constrained by water supplies from various collection systems and demands within the Colorado Springs municipal service area. Ground water is not conveyed through a specific system, but treated at the wells and delivered directly to Colorado Springs' water distribution system.

The water system has raw water storage capacity of about 188,000 ac-ft in 24 reservoirs. All but two of the raw water storage reservoirs (Lake Henry and Lake Meredith) can deliver water directly to the system's treatment plants. Raw water from Lake Henry and Lake Meredith reservoirs is transferred to other storage reservoirs by exchange for subsequent delivery and treatment. Under existing contractual arrangements, Colorado Springs' participation in the Fryingpan-Arkansas Project (Fry-Ark Project), through the FVA, provides about 55,700 ac-ft/yr of additional raw water storage capacity for Fry-Ark Project water in Pueblo Reservoir.

Local System

Colorado Springs began developing water supply systems on the flanks of Pike's Peak in 1871 to streams in the Fountain Creek Basin

Table A-2. Colorado Springs' Water Conveyance Systems Delivery Capacity.

Conveyance System	Existing Delivery Capacity (mgd)	Supplies Delivered by System
Local Delivery System	73.0	Local System waters
Blue River System	20.0	Blue River System waters
Otero Delivery System (Homestake) †	64.6	Twin Lakes, Homestake, Colorado Canal, Exchange, and Turquoise Lake CF&I waters
FVA System	12.8	Fryingpan-Arkansas Project and Exchange waters
Ground Water System	4.5	Ground water Supplies
Total	**174.9**	

† Physical capacity is 68 mgd; however, 3.4 mgd is used to supply water to the City of Woodland Park.

Source: MWH 2005.

that flowed through town. The Local System includes nine subsystems on and around Pike's Peak. These systems have a firm yield of 36,000 ac-ft/yr (about 32.2 mgd), which includes releases of 17,200 ac-ft/yr (about 11.3 mgd) from storage. The SMAD of the Local System is 38,100 ac-ft/yr (about 34.0 mgd). Local System yields include the use of Colorado Springs' local exchange program.

Blue River System

Built in the 1950s, the Blue River System was the first transmountain system operated by Colorado Springs. The Blue River project diverts water from the Blue River and its tributaries above Breckenridge, Colorado. The Blue River is tributary to the Colorado River. Diverted water is conveyed under the Continental Divide to Montgomery Reservoir on the Middle Fork of the South Platte River. At Montgomery Reservoir, Blue River water is combined with a small amount of water diverted from the South Platte River and conveyed to Colorado Springs via the Blue River pipeline. The firm yield of the Blue River System is 7,800 ac-ft/yr (about 7 mgd) and the SMAD is 8,100 ac-ft/yr (about 7.2 mgd).

Otero Delivery System

The Otero Delivery System consists of the Otero Pump Station, the Twin Rock Pump Station, and the Upper and Lower Homestake pipelines. The system typically delivers water to Colorado Springs from the Homestake, Twin Lakes, Arkansas River Exchange, Colorado Canal, and Turquoise Lake CF&I Systems. These projects are briefly described in the following sections. The firm yield delivered from the Otero Delivery System is 64,700 ac-ft/yr (about 57.8 mgd), which includes releases from storage. The SMAD for the Otero Delivery System is 71,500 ac-ft/yr (about 63.8 mgd). With a delivery capacity of 64.6 mgd, this system operates near maximum capacity to provide a SMAD of 64 mgd.

Figure A-1. Colorado Springs' Water Supply and Conveyance Systems.

Homestake Project
The Homestake Project is a transmountain project that diverts water from the headwaters of Homestake Creek and its tributaries. Homestake Creek is a tributary of the Eagle River, which is a tributary of the Colorado River. Diverted water is stored in Homestake Reservoir, and is conveyed to Turquoise Lake via the Homestake Tunnel and Lake Fork Creek. Water is conveyed to Colorado Springs via the Homestake Pipeline and the Otero Pump Station. The yield from the Homestake System is shared equally between Colorado Springs and the City of Aurora.

Twin Lakes System
The Twin Lakes System conveys trans-mountain diversions from the Roaring Fork River and its tributaries, and from Lake Creek, which is a tributary of the Arkansas River. It was built in two phases; the Twin Lakes were built in the 1890s and the Twin Lakes Transmountain Diversion System was built in the 1930s. Flows diverted from the Roaring Fork River and its tributaries are stored in Grizzly Reservoir and conveyed under the Continental Divide through Twin Lakes Tunnel No. 1, then into Lake Creek and Twin Lakes. Twin Lakes is on Lake Creek, where Lake Creek diversions provide additional water. From Twin Lakes, water is conveyed to Colorado Springs via the Homestake System. The Twin Lakes System is owned and operated by the Twin Lakes and Canal Company, a Colorado mutual ditch and reservoir company. Colorado Springs owns 54.7 percent of stock in the company.

Arkansas River Exchange
Many of Colorado Springs' water supplies are reusable sources, and its Arkansas River Exchange Program allows it to exchange its reusable wastewater effluent (return flows) flowing into Fountain Creek with various diversions in the upper Arkansas River Basin. Part of Colorado Springs' reusable water supply is discharged into Fountain Creek and ultimately the Arkansas River through wastewater effluent discharges. Another portion of Colorado Springs' reusable water supply is returned to Fountain Creek through irrigation return flows. These flows are the portion of irrigation water that is not used by growing plants or lost to evaporation. Eventually, these return flows enter Fountain Creek either through surface or subsurface flows. Effluent discharge and irrigation return flow derived from imported water can be stored, used, and exchanged by the importer. As population in the Colorado Springs' water service area increases, so will the opportunity for Arkansas River Exchanges. Additional exchanges will be possible because of additional use and reuse of transmountain imports and consumptive use water. Between 1990 and 2003, the average annual yield of exchanges into Pueblo Reservoir (including reusable return flows from Fountain Creek and the Colorado Canal system) was approximately 22,300 ac-ft/yr (MWH 2005).

Colorado Canal System
The Colorado Canal System, originally an irrigation system but presently used mainly for municipal supply, is north of the Arkansas River and east of Pueblo. It is composed of three Colorado mutual ditch and reservoir companies partially owned by Colorado Springs. The companies and Colorado Springs' ownership percentage of each are the Colorado Canal Company (56.4 percent), the Lake Meredith Reservoir Company (51.9 percent), and the Lake Henry Reservoir Company (77.2 percent). The yield from this system can only be used through exchange upstream to existing delivery systems. The

current yield from the Colorado Canal System is highly variable because of the junior nature of these water rights.

Turquoise Lake Storage and Colorado Fuel and Iron (CF&I) Rights and Storage
Turquoise Lake is on Lake Fork Creek, a tributary of the Arkansas River. Colorado Springs purchased water rights and 17,416 ac-ft/yr of storage space in Turquoise Lake from CF&I Steel Company. Colorado Springs uses the reservoir to regulate Homestake yield and to store water that is part of its Arkansas River Exchange Program.

Fountain Valley Authority System
The Fry-Ark Project was built between 1964 and 1975 and is a multipurpose transmountain water diversion and delivery project in southern and central Colorado. The United States owns and Reclamation operates all facilities associated with the Fry-Ark Project. Under contract with Reclamation, the FVA operates a pipeline that conveys Fry-Ark Project water from an outlet of Pueblo Dam to a water treatment plant about 17 miles southwest of Colorado Springs (Figure A-1). The pipeline is west of I-25 and near Fort Carson. Colorado Springs, Fountain, Security, the Stratmoor Hills Water District, and the Widefield Water and Sanitation District are FVA participants. Colorado Springs' firm yield from the Fry-Ark Project through FVA, including releases from storage, is 8,300 ac-ft/yr (about 7.4 mgd). The SMAD for the FVA System is 12,600 ac-ft/yr (about 11.3 mgd).

Ground Water System
Colorado Springs has developed 2,200 ac-ft/yr (about 2 mgd) of tributary and non-tributary ground water to help supplement existing potable supplies. Non-tributary ground water is water that is not hydrologically connected to a surface water source. It is similar to transmountain water because it is considered reusable. Non-tributary ground water contributes to Colorado Springs' reusable supplies.

Non-Potable Water System
Colorado Springs reuses a portion of its reusable return flows in its non-potable water system. The non-potable water system diverts reusable return flows from local streams and delivers the water to non-potable uses (primarily landscape irrigation) throughout the city, including golf courses, parks, and other landscaped areas. The Non-potable Water Master Plan, a component of the Water Resource Plan (Black & Veatch 1996), was completed in December 2001 (Black & Veatch, 2001a). Several projects identified in the Master Plan have been completed or are currently under development. These projects have approximately doubled the amount of non-potable water use. The Master Plan is being updated to optimize the use of non-potable water. In addition, Colorado Springs is finalizing a non-potable water strategy project with the objective of improving its long-term plan for the development, management, and use of its non-potable water resources.

Raw Water Treatment and Distribution
Colorado Springs' raw water treatment capacity is about 205 mgd (about 630 ac-ft/day) from six raw water treatment facilities; its treated water storage capacity is about 105 million gallons (about 322 ac-ft) using 34 covered reservoirs and tanks. Maximum peak water use in a single day was about 182 million gallons (558 ac-ft) in July 2001 — nearly 90 percent of capacity. Treated water is supplied to five primary pressure zones (geographic areas) mainly by gravity through a system of distribution mains, pressure reducing

valves, and storage reservoirs. These five primary pressure zones (Briargate, Templeton, Northfield, Highline, and Lowline) are divided into numerous secondary service levels (Figure A-2).

Water System Limitations

Delivery capacity is the amount of water available to meet demands through the combination of delivery system components. Because of the interconnected and complex nature of the Colorado Springs water system, and supply and distribution limitations, delivery capacity is not the sum of the firm yields of the individual water systems. Rather, it is the amount of the demand that can be met by the entire water system.

The firm yield of Colorado Springs' supplies (119,000 ac-ft/yr or 106 mgd, shown in Table A-1) is less than the existing infrastructure's delivery capacity (196,100 ac-ft/yr or 174.9 mgd, shown in Table A-2). This difference of 77,100 ac-ft/yr (68.8 mgd) is due to limitations of water supply, timing of those supplies to the conveyance systems, and limited demand in some portions of the distribution system. Major system limitations are described in the following section.

Local Delivery System

The physical pipeline capacity of the Local Delivery System is about 73.0 mgd (81,800 ac-ft/yr), which exceeds the available firm water supply (38,900 ac-ft/yr or 34.7 mgd of yield) by about 38.3 mgd (42,900 ac-ft/yr). Use of the Local System is constrained by a combination of four related factors.

First, the amount of water physically available on an annual basis is less than the instantaneous hydraulic capacity of the collection and delivery systems. These facilities are designed to capture high flows during the peak runoff season. However, these available high flows have a relatively short duration in the spring. During the balance of the year, these facilities are not used to their full capacity because of lower available flow rates.

Second, a large portion of the water that can be collected and delivered through the Local System is diverted under direct flow water rights, which cannot be stored and must be put to immediate use. During peak flow conditions, such as spring runoff, the supply from the local sources far exceeds the demand for water at the time it is available. Colorado Springs historically has sized its direct flow diversion structures and pipelines to capture a large portion of these flows and is implementing improvements to optimize the use of this water. However, because of limited demand, Colorado Springs cannot put the excess portion of these peak flows to use.

Third, the Mesa water treatment plant, which treats the Local System water, serves the two lowest (elevation) pressure zones in the water distribution system (Lowline and Highline shown on Figure A-2), and these pressure zones have a demand that is typically less than the available local water supplies. Elevation differences between the Mesa plant and the higher pressure zones and limitations in the distribution system currently limit delivery of this water to higher service levels.

Lastly, four different delivery systems feed into the Mesa plant pressure zones (Lowline and Highline). These are the Local System, the Blue River System, the FVA System, and a portion of the Ground Water System. These supplies are all available to serve the limited demands available in these service levels, so when demand is low, one or more of these systems are not currently needed to deliver water at their full capacity.

Colorado Springs recently completed construction of a pipeline connecting the Highline and Northfield pressure zones. This project will allow water to be moved from a lower to a higher pressure zone, reducing the latter two limitations.

Blue River System

The delivery capacity of Blue River pipeline is constrained to the amount of water legally available. The physical pipeline capacity of about 22,400 ac-ft/yr (20 mgd) exceeds the firm yield of 7,800 ac-ft/yr (7 mgd) and the SMAD of 8,100 ac-ft/yr (7.2 mgd). Because this system is remotely located and physically isolated, no other developed sources of water can be delivered through this system.

Otero Delivery System

As discussed previously, this system is operated at capacity. A portion of Colorado Springs' water supplies on the Arkansas River cannot be delivered because of the capacity constraints.

FVA System

Demand and distribution system constraints limit this system's capacity. The FVA pipeline provides water to the lowest elevations of Colorado Springs, primarily the Lowline pressure zone. It is anticipated that the Highline to Northfield project will enable Colorado Springs to increase its use of the FVA System.

Ground Water Systems

The Denver Basin Ground Water System delivers water from a confined aquifer, a non-renewable resource, directly to the potable water distribution system. Therefore, this system is limited by pumping capacity of the existing wells and City of Colorado Springs policy that recognizes the non-renewable nature of this supply.

Another well system (Pinello Ranch Wells) supplies the Lowline pressure zone, and is subject to the same demand and distribution constraints discussed previously. Withdrawals of water from the Widefield Aquifer are limited by various agreements. Due to this limitation, Colorado Springs can only make use of about 1,100 ac-ft/yr (1.0 mgd).

Figure A-2. Colorado Springs' Primary Pressure Zones.

A.2.1.2 Existing Water Rights

Colorado Springs' existing water rights portfolio includes numerous decreed water rights on local streams in the Fountain Creek Basin (Local System), decreed exchange rights in the Local System and the Arkansas River, and interests in federal and non-federal water projects that divert water from the Arkansas, Colorado, and South Platte River basins. This diverse water rights portfolio provides Colorado Springs a safe and reliable water supply to its service area. Most of these water rights are used currently by its existing customer base; therefore, only a portion of the water rights portfolio is proposed for use with the SDS Project.

In addition to the direct flow surface water rights, Colorado Springs has the right to make exchanges of water in the Arkansas River Basin and Fountain Creek Basin through its Exchange Program and associated decrees. Several of Colorado Springs' water sources are reusable sources, including all transmountain water and Colorado Canal waters. These waters can be reused in Colorado Springs' non-potable distribution system, used for well augmentation, exchanged upstream in the Fountain Creek Basin or exchanged upstream in the Arkansas River Basin. These exchange water rights are Colorado Springs' primary supplies for the SDS Project.

Exchange decrees require that the quality of the exchange water be sufficient for historical use by downstream users. In general, for Colorado Springs, this means that any reusable return flows released for exchange purposes must be suitable for irrigation. Chapter 3 includes a water quality study that evaluates the effects of the alternatives on water quality.

Priority of Use

Colorado Springs' priority of use of its water rights is dictated primarily by the exercise of water rights in priority as administered by the Colorado Division of Water Resources in Water Divisions 2 and 5 and to a limited extent Division 1. Overall, within the water rights priority system, Colorado Springs' first operational consideration is to maximize the use of the Local System. Other considerations include: 1) maximizing beneficial use of reusable sources by moving water from carryover storage and Arkansas River Basin to local terminal storage systems described previously; and 2) maximizing exchanges to maintain adequate reservoir storage levels. Ground water is used to a limited extent to supplement both the non-potable and potable systems, as well as for emergency use.

Reuse of Imported Water Return Flows

Both direct and exchange reuses are employed by Colorado Springs. Direct reuse involves using reclaimed wastewater or similar return flows for beneficial uses such as turf watering. Exchange reuse involves discharging treated wastewater into the Arkansas River via Fountain Creek to replace raw water delivered from the Arkansas River higher in the watershed (Figure A-3). Exchange reuse also includes replacing diversions in local watersheds, and augmenting well pumping.

The amount of water available for reuse depends on the amount of reusable water delivered to the system and the consumptive use within the distribution system. Based on present projections, the total return flow available in 2046 for reuse, either directly or by exchange, is expected to be about 82,900 ac-ft/yr when all reusable water sources to which Colorado Springs currently has rights are developed. These return flows can then be reused until all reusable water is used to extinction.

Ground Water Rights
Colorado Springs estimates it could develop a limited amount of ground water from several aquifers in the northern and northeastern parts of Colorado Springs. These aquifers are part of the Denver Basin Ground Water System and are considered non-tributary and non-renewable (Colorado Division of Water Resources n.d.). Colorado Springs' policy limits water use from the Dawson, Denver, Arapahoe, Laramie-Fox Hills, and Dakota aquifers to emergency situations and limited irrigation purposes (Colorado Springs City Council Resolution 233-86). Colorado Springs is considering modifying this policy to allow limited, non-emergency use and use of ground water in firm yield estimates.

Colorado Springs also has a blanket augmentation plan (Division 2, case number 89CW036) that allows for the limited development of shallow, tributary ground water within the decreed augmentation plan area. Development of this source is limited by decree and local alluvial geology. Use of this water also requires full replacement of depletions to the stream system from other sources; therefore, this shallow ground water system does not add any yield to the total Colorado Springs water system.

A.2.1.3 Fountain
The City of Fountain is located in the south central Front Range of Colorado in the

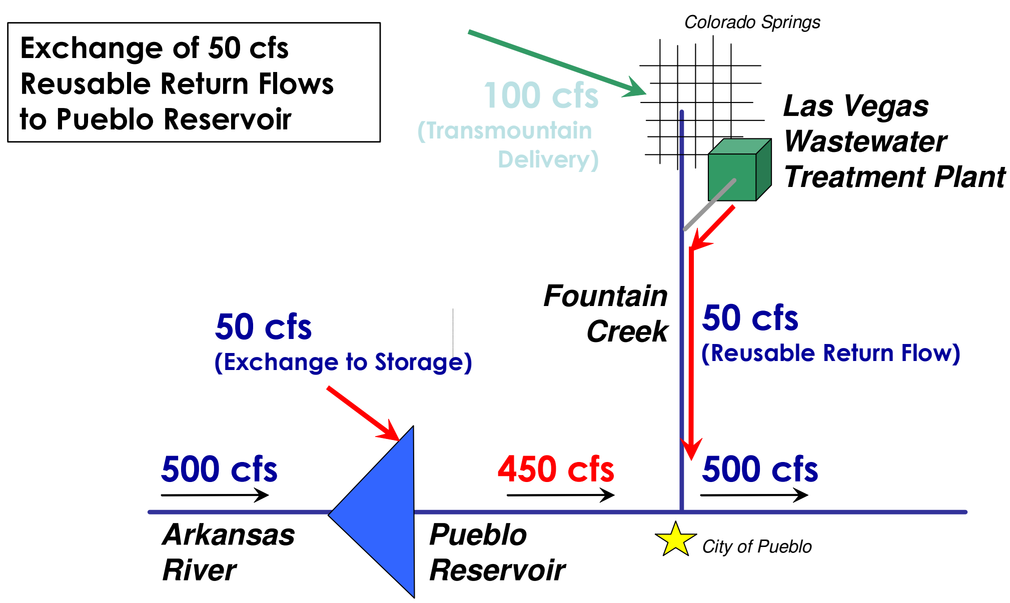

Figure A-3. Hypothetical Example of an Exchange.

Fountain Valley (Figure A-4). The City has a population of about 15,000 people (Bureau of Census 2000). The City provides electric and water service. The water service area includes most of Fountain, but some residents obtain water from other sources. No water is imported or exported from the City's water system to other cities or water districts. Fountain's water system served about 13,370 people in 2000, representing about 88 percent of the City's population; Widefield and Security serve the City's remaining population. Fountain owns wells, storage reservoirs, pumps, regulating valves, and a network of distribution mains.

Existing Water Supply

The water supply for Fountain is from two sources: the Ground Water System and Fry-Ark Project through the FVA System (Table A-3). Existing water supplies are capable of providing a firm yield of 5,500 ac-ft/yr (4.9 mgd) and a SMAD of 6,700 ac-ft/yr (6 mgd) from surface water and ground water sources.

Fountain's share of the water conveyed through the FVA System provides Fountain with a firm yield and SMAD of 1,900 ac- ft/yr (1.7 mgd).

The Fountain Creek Alluvial Wellfield System is a collection of five wells that withdraw ground water from a shallow alluvial aquifer. The portion of the Fountain Creek Alluvial Wellfield used by Fountain generally is located between Fountain Creek and the Union Pacific Railroad near Fountain (Figure A-4). Fountain's wells are used during high demand periods primarily to supplement supplies. The current firm yield from this system is about 3,600 ac-ft/yr (3.2 mgd) and the SMAD (also the maximum yield) is 4,800 ac-ft/yr (4.3 mgd).

An additional 3.0 mgd of water may be obtained through a water exchange agreement with Widefield and Security.

Existing Water Rights

Fountain's existing water rights portfolio includes numerous decreed water rights on local streams in the Fountain Creek Basin, Fountain Creek alluvial aquifer rights, decreed exchange rights in the Arkansas River, and interests in federal and non-federal water projects that divert water from the Arkansas and Colorado River basins. Many of Fountain's water rights are used for augmentation of Fountain Creek alluvial aquifer withdrawals. Because most of Fountain's water rights are currently diverted with existing infrastructure to supply its existing customer base, only a portion of Fountain's existing water rights portfolio is proposed for use with the SDS Project.

Table A-3. Fountain's Current Water Supplies.

Source	Firm Yield		SMAD	
	ac-ft/yr	mgd	ac-ft/yr	mgd
Fountain Valley Authority System	1,900	1.7	1,900	1.7
Fountain Creek Alluvial Wellfield System†	3,600	3.2	4,800	4.3
Total	**5,500**	**4.9**	**6,700**	**6.0**

† SMAD and maximum yield are equal for ground water systems that are not affected by weather conditions.

Source: Black & Veatch 2004a, 2005, 2007.

Figure A-4. Fountain's and Security's Fountain Creek Alluvial Wellfield, Widefield Aquifer, and Windmill Gulch Aquifer Systems.

A.2.1.4Security Water District

The Security Water District is a public water district that is organized as a special district in the State of Colorado. Security supplies municipal water to properties inside its district boundary. The service area includes the community of Security and the surrounding area between the services areas of Colorado Springs and Fountain (Figure A-4). Located in the south central Front Range of Colorado in the Fountain Valley, Security serves about 18,000 people.

Existing Water Supply

Security's water supply is from four sources: Widefield Aquifer, Fry-Ark Project, Windmill Gulch Aquifer, and leased water (Table A-4). These supplies provide Security with a firm yield and SMAD of 4,614 ac-ft/yr (4.1 mgd).

Table A-4. Security's Current Water Supplies.

Source	Firm Yield and SMAD	
	ac-ft/yr	mgd
Widefield Aquifer	2,228	2.0
Fountain Valley Authority	1,546	1.4
Windmill Gulch Aquifer	240	0.2
Clear Springs Ranch lease[†]	600	0.5
Total	**4,614**	**4.1**

[†]Security leases water from Colorado Springs; lease expires in 2012.

Source: Security Water District 2003.

Widefield Aquifer System

Security's Widefield Aquifer System is a collection of wells that withdraw ground water from a shallow aquifer. The portion of the Widefield Aquifer used by Security generally parallels Fountain Creek near the communities of Security and Widefield (Figure A-4). Security's use of the Widefield Aquifer is governed by stipulations and the Widefield Aquifer Management Plan. Under the most recent (2004) stipulations (Case No. W-116, District Court, Water Division 2, Colorado), Security has the right to use about 2,228 ac-ft/yr (2 mgd) from the Widefield Aquifer (Table A-4). It also has the right to an additional 670 ac-ft/yr (0.6 mgd) of the aquifer if adequate recharge is provided. The additional 670 ac-ft/yr is not shown in Table A-4 because Security will need to develop effective recharge capability before it could be used. Security has entered into a lease of an additional Widefield Aquifer allocation of approximately 600 ac-ft/yr (0.5 mgd) beginning in 2012 that will replace the 600 ac-ft/yr (0.5 mgd) of Clear Springs Ranch water when the lease expires in 2012. Security's Widefield Aquifer water is treated at each well and piped to the distribution system.

Fryingpan-Arkansas Project

Security also participates in the Fry-Ark Project. Security's water from the project is received through its participation in the FVA, which provides a firm yield and SMAD of 1,546 ac-ft/yr (1.4 mgd)/yr.

Clear Springs Ranch Lease

Security's Clear Springs Ranch lease is a water supply agreement with Colorado Springs, which owns and operates the Clear Springs Ranch wells. This agreement provides Security up to 600 ac-ft/yr (0.5 mgd) of untreated water through 2012. The water is pumped from three wells on Pinello Ranch to a receiving pit and pump station. The water is then treated and pumped to the distribution system in Security. Availability of 600 ac-ft/yr after expiration of this lease is uncertain.

Windmill Gulch Aquifer
Security uses three wells in the Windmill Gulch Aquifer. The water is treated and pumped to the distribution system in Security. Additional wells may be developed. The yield for this aquifer is estimated to be 240 ac-ft/yr (0.2 mgd).

Existing Water Rights
Security's existing water rights portfolio includes numerous decreed water rights on local streams in the Fountain Creek Basin, Widefield and Windmill Gulch aquifers rights, decreed exchange rights in the Arkansas River, and interest in the Fry-Ark Project. Many of Security's water rights are used for augmentation of Widefield Aquifer withdrawals. Because a majority of Security's water rights are currently diverted with existing infrastructure to supply its existing customer base, only a portion of the water rights portfolio is proposed for use with the SDS Project.

A portion of Security's FVA return flows currently used to augment depletions associated with Widefield Aquifer withdrawals would be used in the SDS Project through exchanges. Security likely would obtain about 600 ac-ft/yr of local ditch shares to replace this augmentation water.

A.2.1.5Pueblo West

Pueblo West is a community about 10 miles west of Pueblo, Colorado (Figure A-5). Pueblo West is a Metropolitan District that provides water, sewer and fire protection services, as well as maintenance of streets and parks to about 17,000 people.

Existing Water Supply
Pueblo West relies on one main water delivery system, which delivers a portion of it's surface water rights. The remaining surface water rights would be delivered either through the SDS Project or a new pipeline from the Arkansas River. The existing delivery system consists of a pipeline originating at Pueblo Dam and terminating at Pueblo West's existing water treatment plant. A parallel pipeline was built in 2005 to provide redundant conveyance capacity. Pueblo West's existing water supply provides a firm yield of about 5,900 ac-ft/yr (5.3 mgd) and SMAD of 10,800 ac-ft/yr (9.6 mgd) from several water rights.

Six wells south of Highway 50 are currently used to supplement non-potable irrigation water to Pueblo West's golf course. Historical use of these wells was up to 894 ac-ft/yr (WRC Engineering 1998).

Existing Water Rights
Pueblo West's existing water rights portfolio includes a mixture of surface, ground water, and exchange rights. Surface water from the western slope of Colorado is diverted to Pueblo West through its ownership in the Twin Lakes and Canal Company. Non-tributary ground water is available to Pueblo West through 18 wells located throughout the district. Arkansas River Basin supplies include Pueblo West's partial ownership in Twin Lakes and Canal Company, Wheel Ranch Ditch right, and Colorado Canal water rights. The Wheel Ranch Ditch right and Colorado Canal water rights provide no firm yield. Reusable sewered return flows have been decreed to Pueblo West.

Figure A-5. Pueblo West Service Area and Conveyance System.

A.3 Participants' Conservation Programs

This section describes the water conservation programs for Colorado Springs, Fountain, Security, and Pueblo West. Conservation and reuse are common to all of the alternatives and is being implemented independently of the SDS Project.

A.3.1 Colorado Springs Water Conservation Programs

On December 31, 2007, Colorado Springs submitted an updated water conservation plan to the Colorado Water Conservation Board (CWCB) for review and approval (CSU 2007). The plan was approved by the CWCB on January 30, 2008. The 2008-2012 Water Conservation Plan complies with the Water Conservation Act of 2004 and follows the Water Conservation Plan Development Guidance Document and Model Plan established by the CWCB to assist water providers in developing water conservation plans. The draft plan was made available for public review and comment from November 15, 2007 through December 15, 2007.

The scope of the 2008-2012 Water Conservation Plan includes a statement of water conservation goals, followed by an analysis and description of selected programs. In addition, the plan addresses the process by which Colorado Springs identified, screened and selected programs for implementation. The plan further describes how Colorado Springs will implement and monitor individual programs. Copies of the plan are available on Colorado Springs' web site at www.csu.org.

The conservation goals identified in the 2008-2012 Water Conservation Plan include:

- Maintain low residential use per capita, already among the lowest in Colorado and the Southwest
- Gain a better understanding of how commercial customers use water in order to reduce commercial use per customer
- Reduce peak day demand, specifically in geographic areas with high residential use per capita and high peaking factors
- Develop and maintain collaborative relationships that encourage water conservation and efficient water use throughout the region
- Establish a reputation as a national leader in water conservation and efficient water use by implementing programs that are sustainable.

The implementation strategies identified in the 2008-2012 Water Conservation Plan include:

- Continue a strong focus on education
- Continue to encourage conservation through block rates for residential customers and seasonal rates for commercial customers
- Introduce a residential new construction program that includes education, incentives and regulations
- Introduce a commercial and industrial program that includes indoor and outdoor water use audits, efficiency incentives plus access to automated meter reading data
- Partner with large water users (i.e., parks, schools, military) to improve water efficiency

While developing the 2008-2012 Water Conservation Plan, Colorado Springs evaluated conservation measures by category (i.e., education, rates, rebates, audits, and regulations) and by market (i.e., indoor vs. outdoor, residential vs. commercial, new vs. existing construction). Final programs were selected based on water savings, cost-effectiveness, social acceptance, likelihood of success, and business and system impacts.

Using 1999 as the baseline year, Colorado Springs expects to save 30 billion gallons of water by 2017, which represents approximately 7.6 percent of the water demand forecast.

In total, Colorado Springs plans to develop and manage a portfolio of twenty-three conservation programs. Implementation of new programs identified in the 2008-2012 Water Conservation Plan will begin as early as 2008. For each individual program, a detailed implementation plan will be developed. Colorado Springs will involve the public through customer surveys and working groups in the development of individual programs. The following new programs are planned for implementation in the 2008-2012 timeframe:

- Builder Incentive Program
- Commercial Car Wash Certification
- Commercial High-Efficiency Toilet Rebate
- Commercial High-Efficiency Urinal Rebate
- Commercial Indoor Audit Program
- Commercial Indoor Efficiency Incentives
- Commercial Outdoor Audit Program
- Commercial Outdoor Efficiency Incentives
- Commercial Smart (ET) Controller Rebate
- Landscape Establishment Permits
- Pre-Rinse Spray Nozzle Retrofit
- Residential Smart Irrigation Rebate
- Residential Sprinkler Check Program
- Water Waste Ordinance

In addition to the new programs identified in the 2008-2012 Water Conservation Plan, Colorado Springs will continue to support existing conservation programs that are consistent with state regulations, operational needs, and community values. These include:

<u>Conservation Education.</u> Colorado Springs has a comprehensive education program, which includes a Xeriscape Demonstration Garden and a Conservation and Environmental Center that is free and open to the public. Educational materials are distributed through the Conservation and Environmental Center, customer newsletters, schools, community events, the web site and local media. Free classes, tours, and speakers are offered to students, homeowners, and civic and business groups. The school program features curriculum that is developed in partnership with local educators. Colorado Springs also co-sponsors the annual Peak to Prairie Landscape Symposium, which draws 200 to 400 attendees interested in water-wise landscaping in the semi-arid west.

<u>Residential Block Rates.</u> Increasing rate structures, or tiered rate structures, encourage conservation by increasing the cost of water with increasing use. Inclining block rates were introduced to residential customers in 2002. In 2006, the block rates were changed from seasonal to year-round. The block rates provide an affordable rate for essential indoor use, a moderate rate for typical outdoor use and an aggressive rate for excess use.

<u>Commercial Seasonal Rates.</u> Seasonal rates were introduced to the largest water users in 1994. In 1999, the remaining commercial and industrial customers were added to the seasonal rate. In 2002, all master-metered residential customers were added to the

seasonal rate. The commercial seasonal rates encourage conservation during the summer months when the greatest demands are placed on the water system.

Commercial Landscape Code and Policy. In 1998, Colorado Springs adopted a Landscape Code requiring water-efficient landscaping for newly developed commercial, industrial, and multi-family sites. Colorado Springs plans to update the Landscape Code and Policy in the coming years. Given recent advancements in irrigation technology and changing customer expectations, the existing code needs review. Elements under consideration include stricter enforcement procedures and smart (ET) controller requirements. Colorado Springs will engage key stakeholders in the code review process.

Residential Rebates. Colorado Springs began offering rebates in 2002, when the community first entered mandatory water restrictions. From 2002 through 2006, Colorado Springs issued just over 10,000 rebates for the purchase of ENERGY STAR™ clothes washers. Colorado Springs also offers rebates for high-efficiency toilets. For outdoor use, Colorado Springs offers rebates to residential customers for installing efficient irrigation equipment, including irrigation controllers, rain sensors, spray heads with check valves and rotating multi-stream nozzles.

Other programs include Online Water Efficiency Profiles and the Home Efficiency Assistance Program (HEAP).

A.3.2 Fountain Water Conservation Program

Fountain adopted a Water Conservation Plan (Fountain 2001) that includes the use of water-efficient fixtures and appliances, installation of low-water-use landscapes, efficient irrigation, and development of water-efficient industrial and commercial processes. Fountain established a leak detection and repair protocol, xeriscape demonstration gardens, and a public education program. Voluntary water restrictions were implemented in 2004 and will be continued as a component of Fountain's conservation program.

Fountain is fully metered and has implemented a tiered rate structure. Residential and commercial customers are charged according to an increasing block rate structure. Residential and commercial customers have a five-tiered rate that increases with increasing water use. Additionally, rates differ by tap diameter. For typical residential customers, the first tier is a minimum rate of $15.70 for up to 3,000 gallons. Rates for tiers two through five are applied for additional increments of 3,000 to 5,000 gallons and increase by 12 to 13 percent with each tier.

Non-potable ground water is used for landscape irrigation at several locations and opportunities for expansion of this program are being evaluated. Fountain's conservation program is being implemented independent of the SDS Project. Fountain intends to implement additional measures in the near future to encourage water conservation. The effects of these conservation efforts are reflected in Fountain's future water use projections.

A.3.3 Security Water Conservation Program

Security's water conservation program is described in its Water Conservation Plan (Security Water District 2004). Security became fully metered in 2003 and has implemented a tiered rate structure. Residential and commercial customers have a four-tiered rate that increases with increasing water use. For residential customers, the first tier is a minimum rate of $7.50 for up to 7,500 gallons for residential customers and $10.00 for commercial customers. Rates for tiers two through four are applied on a per 1,000-gallon basis and increase by 18 to 25 percent with each tier. Security is investigating development of a water reuse program involving recharge of the Widefield Aquifer, described previously. Security anticipates about 450 ac-ft/yr (0.4mgd) of its future demand will be fulfilled through conservation.

A.3.4 Pueblo West Water Conservation Program

In 1999, Pueblo West adopted a Community Plan (PWMD 1999) that outlined water conservation goals. Pueblo West developed a xeriscape demonstration garden and offers free seminars, demonstrations, and counseling. A tiered rate structure was developed to charge residential and commercial customers according to an increasing block rate structure.

Pueblo West also has a water conservation and drought contingency plan (PWMD 1987) that provides water conservation measures in each of five stages of drought. Conservation measures include voluntary and mandatory watering restrictions, increased water rates, and restrictive use of hydrants and car washes. Violators can be issued a warning, or fined up to $500 and have their water service discontinued.

A.4 Participants' Previous Water Resource Planning

A.4.1 Colorado Springs

Colorado Springs conducted numerous studies since the late 1980s regarding alternatives for increasing water supplies to its service area (Black & Veatch 1989, 1994). These studies culminated in the 1996 Water Resource Plan (Black & Veatch 1996). An early version of the SDS Project was included as one of these initial alternatives. In addition, improvements to existing facilities were considered for increasing deliveries via the existing systems.

In 1996, Colorado Springs prepared a Water Resource Plan (Black & Veatch 1996) to define a water supply planning and management strategy through 2040. The 1996 Water Resource Plan identified raw water conveyance system limitations and included recommendations for improvements to existing raw water conveyance systems and recommendations regarding long-term major regional water supply projects. The 1996 Water Resource Plan concluded that Colorado Springs' firm yield from its various existing supply sources exceeded its ability to convey these flows into Colorado Springs for treatment and distribution. Accordingly, several improvements to the raw water conveyance systems were considered and recommended for implementation. These improvements were completed by 2004, and increased the overall raw water delivery capacity by about 20 mgd.

The 1996 Water Resource Plan determined that available water supply exceeds delivery capacity and that projected future demand would exceed available supply and existing delivery capacity. The Plan identified that a new delivery system from the Arkansas River to Colorado Springs is necessary.

Several projects have been implemented or are currently being implemented to increase the use of existing supplies. Some of these projects include distribution system improvements and transfer pipelines to increase the use of local water supplies. Projects for increasing existing systems are not described in this DEIS. The increased yield and capacity from these projects is reflected in Table A-1.

The 1996 Water Resource Plan evaluated seven new major water delivery system alternatives. These alternatives included three projects in the mountains west of Colorado Springs, two southern projects, and two wastewater reclamation projects. The Water Resource Plan also described the public involvement process used in identifying a recommended plan. The public involvement process included a series of public and agency meetings, focus groups, telephone surveys, questionnaires, and interviews. Public meetings were held at multiple locations throughout the Arkansas River Basin. The recommended alternative was the SDS Project with local terminal storage at Jimmy Camp Creek Reservoir augmented by Pueblo Reservoir storage and exchange storage at Williams Creek Reservoir. Key factors in selecting the recommended alternative were favorable environmental characteristics, public consent, and low cost (Black & Veatch 1996).

In 2001, the configuration and details of the SDS Project were re-evaluated to incorporate information developed after the 1996 Water Resource Plan, to include regional partners (Fountain and Security) in the system, and to update project costs (Black & Veatch 2001b). In 2002, a supplemental alternatives analysis was conducted to verify the cost effectiveness of the recommended system (Black & Veatch 2002a). The 2002 alternatives analysis compared five alternatives and one subalternative. These alternatives were all variations of the southern delivery alternative and the wastewater reclamation alternatives described in the 1996 Water Resource Plan. Colorado Springs planned the SDS Project because of its comparatively low cost and superior non-cost characteristics.

After the 2002 alternatives analysis, Colorado Springs began detailed planning for the SDS Project. More detailed assessments of the project relative to actual site conditions and more detailed hydraulic analyses were conducted. These efforts were used to further refine the estimated project costs and configuration. Because these analyses resulted in higher estimated costs, Colorado Springs performed a final verification of the alternatives analysis in early 2003 (CH2M HILL 2003).

A.4.2 Fountain

Black & Veatch completed a Water System Master Plan for the City of Fountain in 2006 (Black & Veatch 2007). The Master Plan provided Fountain with a plan through 2046 for improvement and expansion of its water distribution system to meet water demands from anticipated population growth and commercial development within Fountain's service area. Using Fountain's (1999) Comprehensive Development Plan, and PPACG growth projections, the Plan forecast a 2020 population of 42,000 and a 2046 population of 72,000 in Fountain's service area. Average day demand in the Plan was projected to increase from 2 mgd in 2000, to 8.3 mgd in 2020. The maximum day demand was projected to increase from its 2000 level of 5.2 mgd to 21.2 mgd in 2020. The Plan anticipated the SDS Project would meet this increased demand.

In 2004, Fountain completed a Water Resource Study to evaluate alternatives to supply water from Fountain's water rights in Fountain Creek and the Arkansas River (Black & Veatch 2004a). The study provided Fountain with information to assist it in determining its participation in the SDS Project. In 2006, Fountain completed a Water Master Plan (Black & Veatch 2007), which reaffirmed Fountain's participation in the SDS Project. This plan projected an average day demand of 11.8 mgd in 2046, and a maximum day demand of 30.2 mgd. Potential sources to supply the additional demand were ground water wells along Fountain Creek, the SDS Project, and other smaller supplies. Fountain decided to meet future demands with 2.25 mgd from the SDS Project, with the remainder from Fountain Creek ground water.

A.4.3 Security Water District

The Security Water District-Water System Master Plan was prepared by Security Water District and GMS, Inc. (2001). The Plan describes actual system demands from 1997 through 2001, and projected system demands from 2002 to 2022. Developable sites within the District were identified, and anticipated demands for each site estimated. Security assumed each single-family equivalent would use 0.5 ac-ft/yr. The analysis also projected demand for wet, average, and dry years. Wet and dry years varied from average years by 15 percent. The plan identified a future demand of 6,486 ac-ft/yr during dry years. Security uses projected dry year demands in planning its infrastructure and supply needs.

A.4.4 Pueblo West

The Pueblo West Metropolitan District Water Supply Analysis (WRC Engineering 1998) evaluated options to meet future water demands for Pueblo West. The analysis determined that existing supplies at that time were not sufficient to meet the projected water demand at build-out. Ground water development and acquisition of shares in two canal companies were compared. Acquisition of Colorado Canal/Lake Meredith shares and obtaining raw water storage at or near Pueblo Reservoir were recommended.

In 2003, Reclamation completed an Environmental Assessment for the Pueblo West Pipeline and Pumping Station Project (Reclamation 2003). Reclamation issued a Finding of No Significant Impacts (FONSI) in the same year. The project includes construction, operation and maintenance of River Pump Station No. 2, a 36-inch raw water pipeline, diversion and river intake structure and generator. As discussed previously, the 36-inch raw water pipeline was constructed in 2005. The balance of the proposed project is now Pueblo West's No Action Alternative in this DEIS.

Because this project has already been approved by Reclamation, Pueblo West is a conditional participant in the SDS Project. Should Reclamation select an alternative that does not meet Pueblo West's purpose and need, Pueblo West would likely proceed with development of the project approved by Reclamation in 2003.

A.5 Demand Forecasts

A.5.1 Colorado Springs

A.5.1.1 Approach

Colorado Springs uses a model that forecasts water demands based on population growth, historical use trends, price, economic activity, weather, and seasonal factors. Colorado Springs uses this model for a variety of purposes including sales and revenue forecasting, and capital planning. The primary model variable is the population projection by the Colorado State Demographer for El Paso County. Colorado Springs periodically updates its forecast to ensure it accurately represents anticipated future conditions.

Colorado Springs developed a forecast for use in this DEIS in 2005 covering the period 2005 to 2027. The forecast supersedes previous forecasts and is used in all planning studies (Colorado Springs Utilities 2005a). Colorado

Springs extended this forecast to 2046 using a stabilized growth rate at the end of the 2005 to 2027 forecast.

To assist in planning for future demands, Colorado Springs developed two demand scenarios: the “revenue forecast” scenario; and the “planning forecast” (Figure A-6). These two forecasts serve distinctly different purposes.

The revenue forecast is a median forecast with equal probability of being high or low. It is used to predict future utility income, and provides a basis with which to plan future budgets and customer rates. Because the revenue forecast is used for these purposes, assumptions are made for median water use and revenue generated on average. For this reason, the revenue forecast assumes average weather conditions.

The planning forecast is used to ensure reliable water service and timing of major projects. The planning forecast is based on the revenue forecast. The planning forecast represents a water demand forecast for which actual water demands will be at or below the forecast at least 95 percent of the time. In terms of annual water demand, the planning forecast is higher than the revenue forecast because it reflects historical variation in weather and economic growth. Colorado Springs uses the planning forecast to estimate the likely water demand in each year.

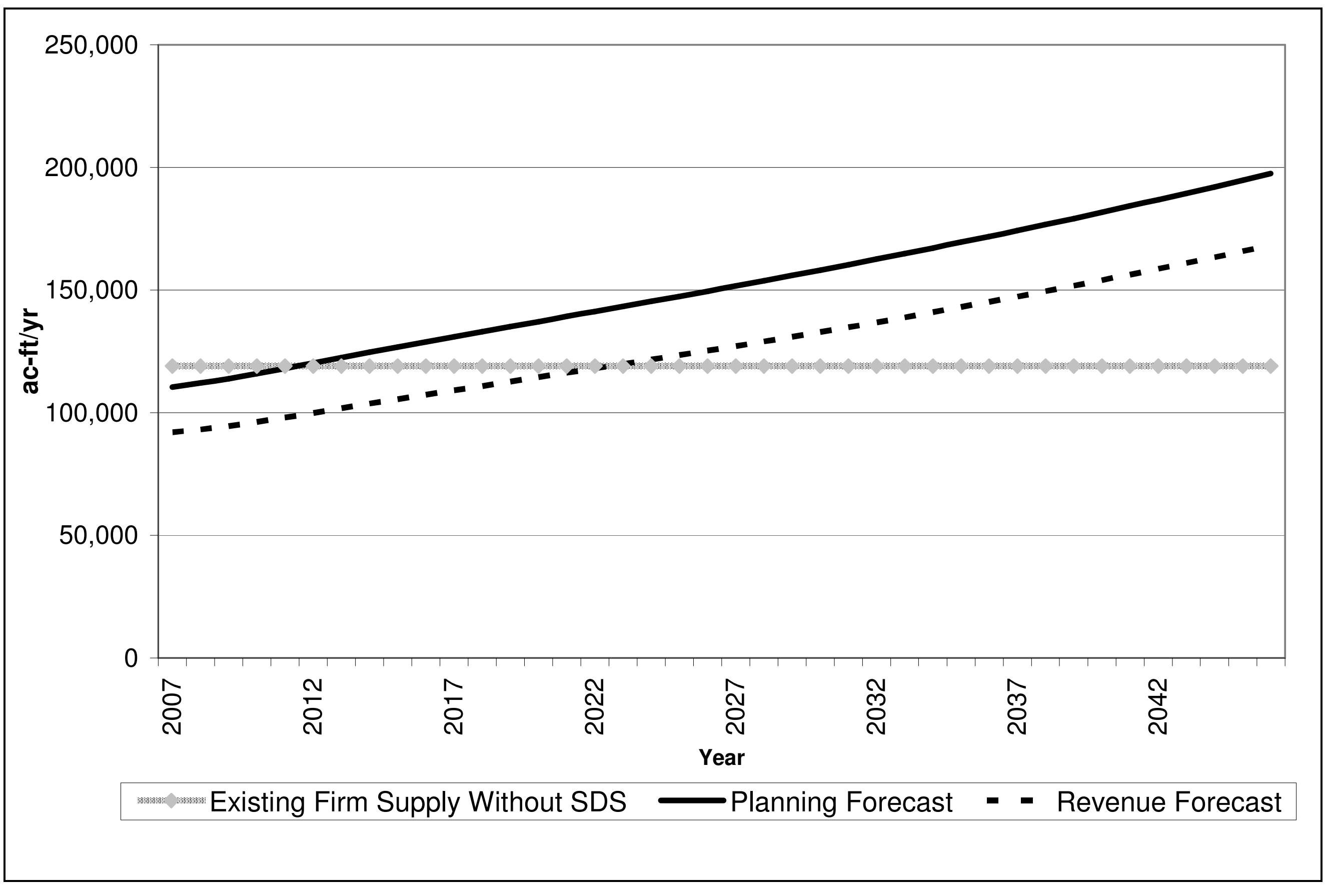

Figure A-6. Colorado Springs’ Future Water Demands.

Source: Colorado Springs Utilities 2005a.

A.5.1.2 Revenue Forecast

The revenue forecast uses the 2004 Colorado State Demographer population projection and incorporates an 8 percent average annual growth in water rates from 2005 to 2013. Rate increases are based on anticipated future capital expenditures and expenses reflected in Colorado Springs Utilities' financial model. Water rates for 2013 to 2027 are assumed to grow at the same rate as the rate of inflation, which is about 2.6 percent per year. This is known as a "zero real" price forecast and results in price having no influence on the forecast, either up or down. The revenue forecast projections use the State Demographer's growth rate of 1.4 percent for El Paso County population through 2027. Weather conditions, such as precipitation and temperature, are assumed to be normal for the period of 1971 to 2000.

In 2002, Colorado Springs started water restrictions for residential and commercial customers in response to the widespread drought in the western United States. Water-use restrictions have reduced water consumption significantly since 2002, and are an important consideration in the first several years of these forecasts. In both forecasts, two-day per week water restrictions are assumed to remain in place through 2005. No water restrictions are assumed after the spring of 2006 (Colorado Springs Utilities 2005b). Although the total water demand increases over time, the revenue forecast assumes there will be reductions in water use per customer because of the drought and watering restrictions. This is referred to as the "drought shadow" and is estimated to reduce use per customer about 5 percent below where it would have been. Other important assumptions in the revenue forecast are:

- Annual residential customer growth averaging 1.9 percent for the 2005 to 2014 period
- No new semi-conductor manufacturing, beyond the 2005 expansion of the Intel plant
- Water restrictions in 2005 and not thereafter

A.5.1.3 Planning Forecast

The planning interval forecast is developed from the statistical uncertainty in the regression equations used to develop the revenue forecast. The variation due to weather implicitly reflects hot, dry weather. The variation in economic growth is also reflected in the range provided by the planning interval forecast.

A.5.1.4 Single Family Residential Water Use

Water demand is sometimes examined and compared in terms of gallons per capita-day (gpcd). These projections assume that each Colorado Springs single family residential water customer will serve 2.83 people (Bureau of Census 1990, 2000). The approach and results are comparable with the Smart Water study by Western Resource Advocates (2003) (Figure A-7). The revenue forecast estimates residential water usage level of 111 gpcd.

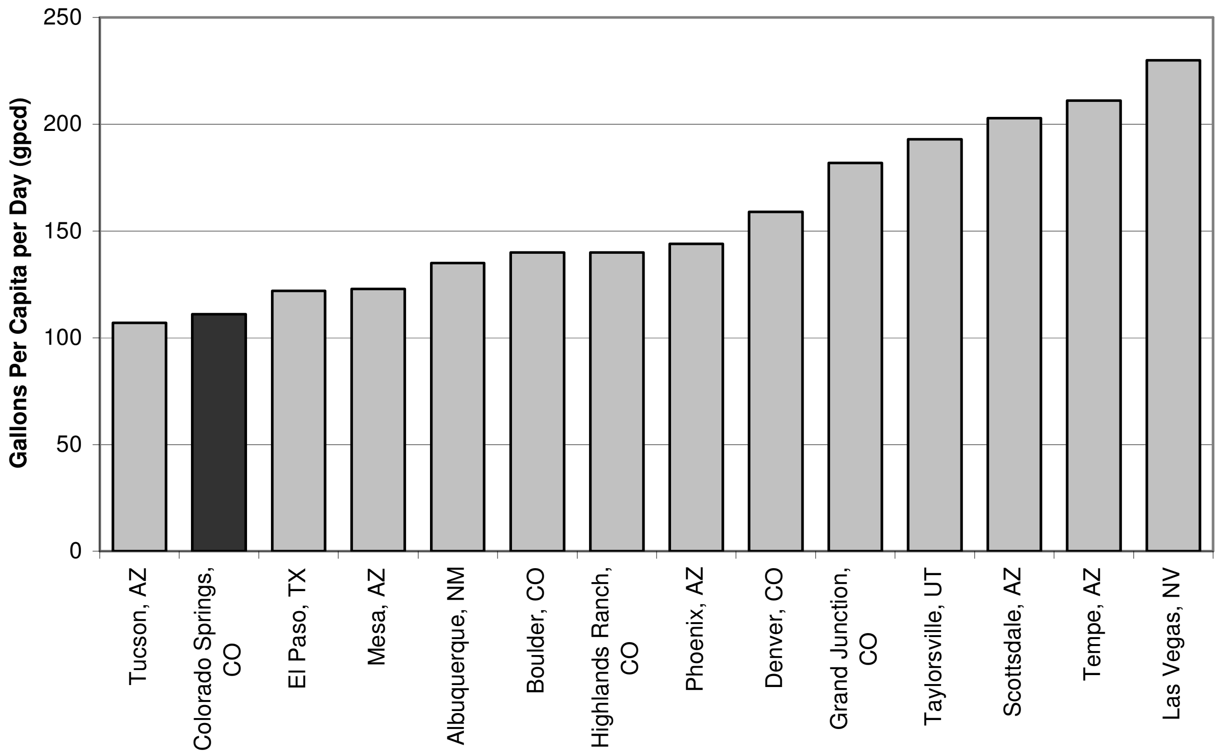

Figure A-7. Comparison of Single Family Residential Water Use.
Source: Western Resource Advocates 2003; Colorado Springs Utilities 2005a

A.5.2 Fountain

Like Colorado Springs, Fountain needs additional water to supply future population growth. Fountain uses revenue forecast and planning forecast scenarios. The planning forecast is similar to Colorado Springs' 95 percent confidence interval forecast. It is used for raw water capacity planning purposes to ensure that adequate water infrastructure is in place to meet consumer demand. Both scenarios use PPACG population forecasts. Fountain estimates its population, excluding existing and future residents served by Widefield Water District, will increase from 15,200 in 2000 to 44,665 in 2046 using the revenue forecast. Estimated population in 2046 using the planning forecast is 66,700, excluding existing and future residents served by Widefield Water District (Black & Veatch 2004b).

Based on the number and magnitude of development plans submitted to the City of Fountain, Fountain is basing future water demands on the planning forecast. The projected populations were used in conjunction with historical water use characteristics to estimate future water requirements. Using the planning forecast, Fountain's annual demand will increase from 3,880 ac-ft/yr in 2006 to 15,600 ac-ft/yr in 2046 (Table A-6). The SDS Project would provide Fountain 2,500 ac-ft/yr, meeting all of Fountain's average demands through 2020. The balance of the annual demand would be met by development of local ground water supplies. Fountain's maximum day raw water demand is 2.6 times the average day demand (Black & Veatch 2002b). Thus, Fountain's maximum day demand supplied by the SDS Project would be 17.8 ac-ft/day. The balance of Fountain's 110-ac-ft maximum day demand will be met through other water supplies.

Table A-6. Fountain's Water Demand and Existing Supplies.

Year	Existing Supplies (ac-ft/yr)	Demands (ac-ft/yr)	Unmet Demand (ac-ft/yr)
2006	5,600	3,880	0
2016	5,600	6,870	1,270
2026	5,600	9,800	4,200
2036	5,600	12,700	7,100
2046	5,600	15,600	10,000

Source: Black & Veatch 2004b.

A.5.3 Security Water District

Similar to other Participants, Security needs additional water to supply future population growth. Security has prepared demand forecasts using wet, dry, and average years. The average year forecast is similar to the other Participants' revenue forecasts and the dry year forecast is similar to the other Participants' planning and 95 percent confidence interval forecasts.

Security estimates annual water demand based on single family equivalents (SFEs) and an assumed water demand of 0.5 ac-ft/yr per SFE for average years and 0.575 ac-ft/yr per SFE for dry years. Using the dry year forecast, Security's demand will increase from 5,353 ac-ft/yr in 2006 to 6,486 ac-ft/yr in 2022. At build-out, in 2025, Security will have an unmet demand of 2,472 ac-ft/yr (Table A-5).

Security anticipates needing the SDS Project to meet demands by about 2009 The SDS Project would provide 1,395 ac-ft/yr; 407 ac-ft/yr will come from conservation, and the remaining 670 ac-ft/yr will be supplied by a future water project. Security would use the SDS Project to meet average demand only; peak demand will be met through other water supplies.

Security has entered into a lease of an additional Widefield Aquifer allocation of approximately 600 ac-ft/yr (0.5 mgd) beginning in 2012 that will replace the 600 ac-ft/yr of Clear Springs Ranch water in case that lease is not renewed when it expires in 2012. If the Clear Springs lease is renewed, then the additional allocation that has been acquired will be used for peak demand. Under the most recent stipulation regarding the Widefield Aquifer management plan, Security can with draw up to an additional 670 ac-ft/yr from the aquifer if it provides effective recharge. Security is currently evaluating a Widefield Aquifer recharge project, which would provide additional water for peak demand.

Table A-5. Security's Water Demand and Existing Supplies.

Year	Existing Supplies (ac-ft/yr)	Demands (ac-ft/yr)	Unmet Demand (ac-ft/yr)
2006	4,614	5,353	739
2009	4,614	5,827	1,213
2015	4,014	6,388	2,374
2020	4,014	6,480	2,466
2025	4,014	6,486	2,472
2046	4,014	6,486	2,472

Source: Security and GMS, Inc. 2001.

A.5.4 Pueblo West

Similar to other Participants, Pueblo West needs additional water to supply future population growth. Pueblo West prepared both planning and revenue forecasts (PWMD 2004). Pueblo West estimates an increase in water taps served based on historical growth. The planning forecast assumes 700 taps added per year, and the revenue forecast assumes the 553 taps added per year, which was the average amount added between 2000 and 2004. Population is estimated based on a correction for commercial taps (about 8 percent of all water taps in Pueblo West) and assumes an average household size of 2.8 persons per household (Bureau of Census 2000).

Using the planning forecast, Pueblo West's demand will increase from 6,062 ac-ft/yr in 2006 to about 10,525 ac-ft/yr in 2018. At build-out in 2018, Pueblo West will be able to meet demand on an annual basis (Table A-7). However, Pueblo West will have an unmet peak-day demand of about 13 mgd (40 ac-ft/day) (Table A-7). Peak day demand of Pueblo West's water system is 1.4 times the average day demand (10-year average of annual maximum daily rate). Pueblo West's peak day demand supplied by the SDS Project would be 18 mgd. Pueblo West estimates that the cumulative annual firm yield from the SDS Project would be 450 ac-ft/yr and the average yield from the SDS Project would be 1,100 ac-ft/yr (Higgins 2005).

Pueblo West anticipates needing the SDS Project to meet peak day demands by about 2009. Peak day shortfalls occurring prior to 2009 would be managed using water stored in tanks within Pueblo West's existing water distribution system.

Table A-7. Pueblo West's Peak Water Demand and Existing Capacity.

Year	Existing Capacity (mgd)	Peak Demands (mgd)	Unmet Peak Demand (mgd)
2006	12	14	2
2016	12	23	11
2026	12	25	13
2036	12	25	13
2046	12	25	13

Source: PWMD 2004.

A.6 References

Black & Veatch Corp. 1989. Raw Water Delivery Study for Colorado Springs, Colorado.

Black & Veatch Corp. 1994. Update to Raw Water Delivery Study for Colorado Springs Utilities.

Black & Veatch Corp. 1996. Water Resource Plan for Colorado Springs Utilities. Water Resources Department.

Black & Veatch Corp. 2001a. Nonpotable Master Plan. Black & Veatch Project No. 97271-0100. December 6.

Black & Veatch Corp. 2001b. Southern Delivery System Update for Colorado Springs Utilities.

Black & Veatch Corp. 2002a. Supplemental Evaluations for Regional Water Infrastructure Authority.

Black & Veatch Corp. 2002b. Water System Master Plan for Fountain, Colorado.

Black & Veatch Corp. 2004a. Water Resource Study for Fountain, Colorado.

Black & Veatch Corp. 2004b. Appendix A to Water Resource Study for Fountain, Colorado.

Black & Veatch Corp. 2005. Fountain Responses to EIS – Firm and Average Yields. Memorandum to Larry Patterson, City of Fountain.

Black & Veatch Corp. 2007. 2006 Water Master Plan. Prepared for City of Fountain. March.

Bureau of Census. 1990. <http://factfinder.census.gov>.

Bureau of Census. 2000. <http://factfinder.census.gov>.

Bureau of Reclamation (Reclamation). 2003. Final Environmental Assessment for the Pueblo West Pipeline and Pumping Station Project, EC-1300-03-01. Reclamation, Eastern Colorado Area Office, Loveland, CO.

CH2M HILL, Inc. 2003. Water Reclamation Assessment Cost Update for Colorado Springs Utilities.

City of Fountain (Fountain). 1999. City of Fountain Comprehensive Development Plan.

City of Fountain (Fountain). 2001. Water Conservation Plan.

Colorado Division of Water Resources. n.d. Adjudication of Denver Basin Ground Water Rights. <http://water.state.co.us/groundwater/DenBasin_FAQ.asp>.

Colorado Foundation for Water Education (CFWE). 2003. Citizen's Guide to Colorado Water Law.

Colorado Springs Utilities. 2007. 2008-2012 Water Conservation Plan. Water Services Division, Water Supply Department, Water Conservation Section. Submitted to Colorado Water Conservation Board. December.

Colorado Springs Utilities. 2005a. Sales and Load Forecast 2005-2027.

Colorado Springs Utilities. 2005b. E-mail from Keith Riley to Bill Van Derveer (MWH) regarding comparison of Colorado Springs Utilities single family water use to Smart Water Report by Western Resource Advocates. 11 February.

Colorado Water Conservation Board (CWCB). 2002. Arkansas River Basin Facts.

Higgins, D. (Treatment Supervisor, Pueblo West Metropolitan District). 2005. "RE: Southern Delivery System Environmental Impact Statement - Information Request". E-mail to Bill Van Derveer (MWH Americas, Inc.). August 9.

MWH. 2005. Raw Water Yield Study. Prepared for Colorado Springs Utilities.

Pueblo West Metropolitan District (PWMD). 1987. Article 12. Water Conservation and Drought Contingency Plan, Title 4 Water and Sewer, Rules and Regulations of Pueblo West Metropolitan District.

Pueblo West Metropolitan District (PWMD). 1999. Community Plan.

Pueblo West Metropolitan District (PWMD). 2004. Water Consumption Analysis.

Security Water District. 2003. Purpose and Need Questionnaire: Proposed Southern Delivery System.

Security Water District. 2004. Water Conservation Plan.

Security Water District and GMS, Inc. 2001. Security Water District: Water System Master Plan.

Western Resource Advocates. 2003. Smart Water: A Comparative Study of Urban Water Use Efficiency Across the Southwest. Western Resource Advocates, Boulder, CO.

WRC Engineering, Inc. 1998. Pueblo West Metropolitan District Water Supply Analysis of Twin Lakes and Colorado Canal/Lake Meredith Water Rights. Prepared for Pueblo West Metropolitan District.

B. Operations

Some tables in this appendix use the following numbers to identify the alternatives:

- Alternative 1 (No Action Alternative)
- Alternative 2 (Participants' Proposed Action)
- Alternative 3 (Wetland Alternative)
- Alternative 4 (Arkansas River Alternative)
- Alternative 5 (Fountain Creek Alternative)
- Alternative 6 (Downstream Intake Alternative)
- Alternative 7 (Highway 115 Alternative)

B.1 Water Supplies

As discussed in Chapter 1 and Appendix A, the primary water supplies for the SDS Project would include water currently owned by the Participants in the Colorado Canal System (or other former agricultural systems) and reusable return flows, which result from existing transmountain water supplies.

Water rights owned in the Colorado Canal System would be delivered to either regulating storage, upper Arkansas River Basin storage or diversion facilities or to the untreated water intake by exchange. Depending on the alternative, reusable return flows would be delivered to either regulating storage, upper Arkansas River Basin storage or diversion facilities or to the untreated water intake by exchange or direct diversion.

B.1.1 Surface Water Diversions

Water would be delivered to the untreated water intake from regulating storage in Pueblo Reservoir by direct release for the Participants' Proposed Action, Wetland, Arkansas River, and Downstream Intake alternatives, or water stored in Twin Lakes previously used to fill the Homestake pipeline would be released to the Arkansas River for diversion at the Highway 115 Intake and new exchanges would be made to an upgraded Ark-Otero Intake on the Arkansas River to fill the Homestake pipeline for the No Action and Highway 115 alternatives. In the Highway 115 Alternative, Fountain and Security would trade water and/or conveyance space in the SDS pipeline with Colorado Springs to account for deliveries to those entities from Colorado Springs' Twin Lakes account.

Mean annual SDS Project water supplies by water supply type are presented in Table B-1. For example, in the Participants' Proposed Action, 49,200 ac-ft per year of Colorado Springs' SDS Project water would come from regulating storage. Reusable return flows are exchanged from Fountain Creek, return flow storage or Colorado Canal into regulating storage prior to being diverted into the raw water intake. Direct deliveries of reusable return flows would occur only for those alternatives that have a point of diversion downstream of the reusable return flow accrual point (the Wetland, Arkansas River, and Downstream Intake alternatives). For the Wetland and Arkansas River alternatives, reusable return flows would be released from the return flow pipeline at Colorado 115 and would be stored in regulating storage before being introduced into the SDS intake; thus, the source of water for these alternatives is shown as regulating storage. For the remaining alternatives, reusable return flows would be delivered out of regulating storage. Pueblo West would not participate in SDS infrastructure if the Arkansas River, Downstream Intake, or Highway115 alternative is selected; thus, no surface water diversions are shown for these alternatives.

Table B-1. Mean Annual SDS Project Arkansas River Diversion Sources.

Location	Alt 1 (ac-ft)	Alt 2 (ac-ft)	Alt 3 (ac-ft)	Alt 4 (ac-ft)	Alt 5 (ac-ft)	Alt 6 (ac-ft)	Alt 7 (ac-ft)
Colorado Springs							
Reusable Return Flow Direct Diversion	0	0	0	0	0	54,800	0
Regulating Storage	0	49,200	54,400	54,300	49,700	0	0
Twin Lakes Tunnel	3,900	4,300	5,300	5,300	4,500	900	600
Twin Lakes Storage	48,200	6,100	800	900	5,600	4,700	56,800
Sub-Total†	52,100	59,600	60,500	60,500	59,800	60,400	57,400
Security							
Reusable Return Flow Direct Diversion	0	0	0	0	0	1,400	0
Regulating Storage	0	700	800	800	700	0	1,300
Sub-Total†	0	700	800	800	700	1,400	1,300
Fountain							
Reusable Return Flow Direct Diversion	0	0	0	0	0	2,100	0
Regulating Storage	0	2,200	2,200	2,300	2,200	0	2,000
Sub-Total†	0	2,200	2,200	2,300	2,200	2,100	2,000
Pueblo West							
Regulating Storage	0	2,800	2,800	0	2,800	0	0
Sub-Total	0	2,800	2,800	0	2,800	0	0
Total†	52,100	65,300	66,300	63,600	65,500	63,900	60,700

† Total supplies may not exactly equal total conveyed through SDS due to rounding.

Source: MWH 2007.

Pueblo West would, however, still store water in Pueblo Reservoir under these alternatives.

B.1.2 Exchanges

Exchanges are the primary means by which Colorado Springs, Fountain, and Security would maximize their use of reusable return flows in the No Action, Participants' Proposed Action, Fountain Creek, Downstream Intake, and Highway 115 alternatives. Colorado Springs, Fountain, and Pueblo West have additional exchanges with the Colorado Canal System. Additional exchanges would be made by Colorado Springs from Pueblo Reservoir to Twin Lakes to supplement the transmountain water sources diverted through the Otero Pump Station (discussed below).

Mean annual simulated river exchanges into Pueblo Reservoir for the SDS Participants are presented in Table B-2. Mean annual exchanges into storage facilities or intake locations above Pueblo Reservoir are shown in Table B-3. Colorado Springs is the only

Participant that would make exchanges to the upper Arkansas River Basin.

Mean annual contract exchanges for Colorado Springs and Fountain, the only Participants that would use contract exchanges, are presented in Table B-4. Contract exchanges also would be used to exchange water from restoration of yield (ROY) storage into Pueblo Reservoir. Colorado Springs' use of ROY storage and, consequently, ROY contract exchanges would vary among alternatives. No contract exchanges are shown for the No Action Alternative because there would be no excess capacity storage in Pueblo Reservoir under the No Action Alternative. No ROY contract exchanges are shown for Fountain because the SDS Project daily hydrologic model is constructed to allow Fountain to make river exchanges first. Consequently, most water stored in ROY storage by Fountain would be moved to Pueblo Reservoir via river exchange rather than contract exchange.

Table B-2. Mean Annual SDS Project River Exchange to Pueblo Reservoir.

Location	Alt 1 (ac-ft)	Alt 2 (ac-ft)	Alt 3 (ac-ft)	Alt 4 (ac-ft)	Alt 5 (ac-ft)	Alt 6 (ac-ft)	Alt 7 (ac-ft)
Colorado Springs							
Fountain Creek	41,200	40,300	200	300	40,700	13,100	56,900
Return Flow Storage	8,700	19,400	0	0	19,200	1,400	6,600
Colorado Canal System	18,900	19,700	21,600	22,500	19,400	18,800	22,000
ROY Storage	700	300	0	0	200	0	200
Sub-Total	69,500	79,700	21,800	22,800	79,500	33,300	85,700
Security							
Fountain Creek	0	700	800	800	700	200	800
Sub-Total	0	700	800	800	700	200	800
Fountain							
Fountain Creek	0	1,200	1,300	1,400	1,200	100	1,300
Colorado Canal System	0	500	500	500	500	500	500
ROY Storage	0	100	200	100	100	100	100
Sub-Total	0	1,800	2,000	2,000	1,800	700	1,900
Pueblo West							
Wild Horse Creek	100	0	0	200	0	100	100
Colorado Canal System	300	300	300	300	300	300	300
Sub-Total	400	300	300	500	300	400	400
Total	69,900	82,500	24,900	26,100	82,300	34,600	88,800

Source: MWH 2007.

Table B-3. Mean Annual SDS Project River Exchange to Upper Arkansas River Basin.

Location	Alt 1 (ac-ft)	Alt 2 (ac-ft)	Alt 3 (ac-ft)	Alt 4 (ac-ft)	Alt 5 (ac-ft)	Alt 6 (ac-ft)	Alt 7 (ac-ft)
Colorado Springs							
Turquoise Lake	7,400	5,700	3,900	4,000	5,900	4,700	2,900
Twin Lakes	18,200	18,800	18,300	18,100	18,100	19,800	17,000
Ark-Otero Intake	46,900	0	0	0	0	0	57,400
Total	72,500	24,500	22,200	22,100	24,000	24,500	77,300

Source: MWH 2007.

Table B-4. Mean Annual SDS Project Contract Exchanges.

Location	Alt 1 (ac-ft)	Alt 2 (ac-ft)	Alt 3 (ac-ft)	Alt 4 (ac-ft)	Alt 5 (ac-ft)	Alt 6 (ac-ft)	Alt 7 (ac-ft)
Colorado Springs							
ROY Storage to Pueblo Reservoir	0	200	0	0	200	0	200
Pueblo Reservoir to Turquoise Lake	0	2,000	2,400	2,400	2,100	2,600	2,300
Pueblo Reservoir to Twin Lakes	0	3,300	3,400	3,600	3,500	3,300	4,100
Fountain							
ROY Storage to Pueblo Reservoir	0	0	0	0	0	0	0

Source: MWH 2007.

B.1.3 Transmountain Imports

Simulated mean annual transmountain imports for each alternative are presented in Table B-5. Project Participants are direct beneficiaries of a portion of the Homestake Tunnel imports, Twin Lakes tunnel imports, and Boustead Tunnel imports. The Busk-Ivanhoe Tunnel imports benefit Aurora and the PBWW. All simulated transmountain imports are made under existing decreed water rights and associated limitations on the West Slope. Mean annual imports would be slightly greater (up to 4 percent) than for Existing Conditions for all alternatives but would not exceed the maximum allowable under existing decreed water rights and associated limitations on the West Slope.

B.2 Regulating Storage

Regulating storage would provide the Participants with the ability to store reusable return flows, changed consumptive use water, and other water that may be available for each Participant. Except for the No Action Alternative, regulating storage would occur as one or more long-term excess capacity storage contracts in Pueblo Reservoir, with Colorado

Table B-5. Simulated Mean Annual Transmountain Imports to Upper Arkansas River Basin.

Entity	Existing Condition (ac-ft)	Maximum Allowable Imports (ac-ft)	Alt 1 (ac-ft)	Alt 2 (ac-ft)	Alt 3 (ac-ft)	Alt 4 (ac-ft)	Alt 5 (ac-ft)	Alt 6 (ac-ft)	Alt 7 (ac-ft)
Homestake Tunnel	28,200	31,800	27,300	29,700	29,200	29,100	29,600	29,400	27,600
Twin Lakes Tunnel	37,500	42,200	42,000	41,500	40,700	40,900	41,500	39,700	41,000
Boustead Tunnel	65,800	65,800	65,800	65,800	65,800	65,800	65,800	65,800	65,800
Busk-Ivanhoe Tunnel	2,300	5,800	3,000	2,600	2,400	2,400	2,500	2,600	2,700
Total	133,800	145,600	138,100	139,600	138,100	138,200	139,400	137,500	137,100

Source: MWH 2007.

† Simulated maximum allowable imports based on estimates by Grand River Consulting Corporation (MWH 2005).

Springs requesting 28,000 ac-ft, Fountain requesting 2,500 ac-ft, Security requesting 1,500 ac-ft, and Pueblo West requesting 10,000 ac-ft. The No Action Alternative would not include any new excess capacity storage in Pueblo Reservoir. Excess capacity contracts would allow the Participants to store non-Fry-Ark Project water in Fry-Ark storage space, provided there is space available after storing Fry-Ark Project water. Non Fry-Ark Project water and the Winter Water Storage Program water stored in excess capacity would be subject to spill in accordance with Article 13 of the SECWCD contract (Section 3.2.10).

Table B-6 presents a summary of mean storage contents and maximum storage contents for each alternative. The mean storage contents would typically be substantially less than the requested capacity for each entity because regulating storage typically would not serve as long-term carryover storage for the Participants. Rather, the storage would be used annually to store water during times of higher flow (when exchanges could be made) and release water to the SDS Project during times of lower flow.

Colorado Springs would be able to fill regulating storage to the maximum account capacity of 28,000 ac-ft during several years in the hydrologic modeling study period (1982 to 2004). With its existing water supplies, Security would be able to fill between 200 and 800 ac-ft of its 1,500-ac-ft regulating storage account capacity. Fountain would be able to fill between 500 and 2,500 ac-ft of its 2,500-ac-ft regulating storage account capacity using existing water supplies. Given its existing water supplies, Pueblo West would use between 4,300 and 4,800 ac-ft of its 10,000-ac-ft regulating storage account capacity.

B.3 Untreated Water Intake and Conveyance

Mean annual diversions for the SDS intakes from the Arkansas River are presented in Table B-7. Mean annual diversions by Pueblo West would be the same among all alternatives for which it is a Participant in SDS infrastructure. Annual diversions for Colorado Springs, Security, and Fountain would vary slightly among Action Alternatives. Annual diversions for the No Action Alternative would be

Table B-6. Mean and Maximum Storage Contents in SDS Project Excess Capacity Accounts.

Location	Alt 1 (ac-ft)	Alt 2 (ac-ft)	Alt 3 (ac-ft)	Alt 4 (ac-ft)	Alt 5 (ac-ft)	Alt 6 (ac-ft)	Alt 7 (ac-ft)
Mean Storage							
Colorado Springs	0	5,400	8,500	8,200	5,600	7,900	6,600
Security	0	0	0	0	0	300	100
Fountain	0	200	200	300	200	1,600	1,000
Pueblo West	200	700	700	500	700	600	600
Total	200	6,300	9,400	9,000	6,500	10,400	8,300
Maximum Storage							
Colorado Springs	0	28,000	28,000	28,000	28,000	27,800	28,000
Security	0	200	200	200	200	800	400
Fountain	0	800	800	900	800	2,500	2,500
Pueblo West	1,000	4,700	4,600	4,300	4,600	4,400	3,800
Total	1,000	33,700	33,600	33,400	33,600	35,500	34,700

Source: MWH 2007.

substantially lower then those for the Action Alternatives for Colorado Springs and would be absent for Security and Fountain.

The mean annual diversion values shown in Table B-7 represent physical diversions by the SDS untreated water intake. These values differ from the SDS SMAPD values shown in Chapter 2. SMAPD for an individual project is the difference between the overall system yield with the project and without the project. System yield accounts for operations of the system as a whole, whereas mean annual SDS Project diversions are simply the average SDS Project diversion, which does not account for evaporative losses in terminal storage or other changes to system operations due to the SDS Project.

Median daily flows through the SDS untreated water intake and conveyance, excluding Pueblo West, would be fairly consistent among the Action Alternatives. In general, flow through the SDS Project under 2046 demands would be at the 78-mgd capacity when either the total demand at the water treatment plant equals or exceeds the SDS Project capacity or when terminal storage is less than reservoir capacity. Water treatment plant demands would typically exceed SDS Project delivery

Table B-7. Mean Annual SDS Project Diversions from the Arkansas River

Location	Alt 1 (ac-ft)	Alt 2 (ac-ft)	Alt 3 (ac-ft)	Alt 4 (ac-ft)	Alt 5 (ac-ft)	Alt 6 (ac-ft)	Alt 7 (ac-ft)
Colorado Springs	52,100	59,600	60,500	60,500	59,800	60,400	57,400
Security	0	700	800	800	700	1,400	1,300
Fountain	0	2,200	2,200	2,300	2,200	2,100	2,000
Pueblo West	0	2,800	2,800	0	2,800	0	0
Total	52,100	65,300	66,300	63,600	65,500	63,900	60,700

Source: MWH 2007.

capacity from about late April through early-October. The SDS Project would be used to fill terminal storage in the fall, typically from early October through December. SDS Project flow would then match water treatment plant demands (between 15 and 60 mgd) from January through late April.

B.4 Terminal Storage

Terminal storage would be used as a forebay reservoir for the proposed water treatment facility. The reservoir would provide temporary storage of water delivered from the Arkansas River before introduction into the water treatment plant. Storage would vary seasonally and daily as water demands are met. Typically, peak day demands during the summer are greater than the maximum capacity of the SDS untreated water conveyance pipeline. Water stored in terminal storage would be used to meet these peak demands. Drawdowns from terminal storage would be replenished by the untreated water conveyance pipeline during low demand portions of the year when demand at the water treatment plant is less than the maximum untreated water conveyance pipeline capacity. Mean monthly simulated terminal storage contents for each alternative are presented in Table B-8.

The terminal storage facilities would be sized to provide emergency storage for Colorado Springs. Emergency storage is reserved for use in case of extreme emergencies, such as delivery system failure, emergency maintenance, or extreme drought conditions. Colorado Springs has set its emergency storage target at 25 percent of annual demand, which represents 3 months of "average" monthly supply (MWH 2005). For the SDS terminal storage, emergency storage at 2046 demands would be about 22,300 ac-ft. Except during extreme drought conditions, such as those in the early 2000s, all alternatives would meet the 22,300-ac-ft minimum target for emergency storage.

Table B-8. Mean Monthly SDS Terminal Storage Contents.

Month	Alt 1 (ac-ft)	Alt 2 (ac-ft)	Alt 3 (ac-ft)	Alt 4 (ac-ft)	Alt 5 (ac-ft)	Alt 6 (ac-ft)	Alt 7 (ac-ft)
Oct	27,300	24,800	26,800	26,800	25,000	26,700	26,200
Nov	29,100	26,600	28,400	28,400	26,700	28,300	28,000
Dec	29,800	28,200	30,100	30,100	28,400	30,100	29,900
Jan	29,900	28,100	30,400	30,400	28,300	30,400	30,300
Feb	29,800	27,900	30,400	30,400	28,200	30,400	30,300
Mar	29,500	27,900	30,400	30,400	28,200	30,400	30,200
Apr	29,000	27,900	30,300	30,300	28,100	30,300	30,000
May	28,200	27,300	29,900	29,900	27,500	29,900	29,300
Jun	27,200	26,000	28,600	28,600	26,300	28,600	27,900
Jul	25,900	24,600	27,100	27,100	24,800	27,100	26,300
Aug	25,200	23,700	26,300	26,300	24,000	26,300	25,300
Sep	25,500	23,700	26,400	26,400	24,000	26,300	25,200
Mean	28,000	26,400	28,800	28,800	26,600	28,700	28,200

Source: MWH 2007.

B.5 Water Treatment Plant and Treated Water Conveyance

The monthly amount of water to be treated at the proposed SDS water treatment plant is developed in Colorado Springs' Operations and Yield Model (MWH 2005). It is converted into daily values and provided to the SDS Project daily hydrologic model as a time-series input that varies by month and year and specifies the daily demand at the proposed SDS water treatment plant for Colorado Springs. For Fountain and Security, because their daily demands consistently exceed their portion of SDS Project capacity and because they are not participating in terminal storage, the daily and annual demand at the water treatment plant is presented as their total SDS Project capacity.

The mean annual amount of water that would be delivered to the water treatment plant for the Project Participants is presented in Table B-9. Annual demands and deliveries to Colorado Springs for the No Action, Participants' Proposed Action, Wetland, Arkansas River, Fountain Creek, Downstream Intake, and Highway 115 alternatives range from about 28,000 to 78,300 ac-ft, with an annual average of about 58,700 ac-ft.

Simulated demands at the water treatment plant would be met for all alternatives during all years.

Annual treated water deliveries for Security under the Participants' Proposed Action, Wetland, Arkansas River, Fountain Creek, Downstream Intake, and Highway 115 alternatives would vary from less than 100 ac-ft to full capacity of 1,400 ac-ft. Because the No Action Alternative for Security does not include water treatment at the proposed water

Table B-9. Annual SDS Water Treatment Plant Deliveries.

Location	Alt 1 (ac-ft)‡	Alt 2 (ac-ft)	Alt 3 (ac-ft)	Alt 4 (ac-ft)	Alt 5 (ac-ft)	Alt 6 (ac-ft)	Alt 7 (ac-ft)
Mean Deliveries							
Colorado Springs	58,500	58,700	58,700	58,700	58,700	58,700	58,500
Security	0	700	800	800	700	1,400	700
Fountain	0	2,200	2,200	2,300	2,200	2,100	2,000
Total†	58,500	61,600	61,700	61,700	61,600	62,200	61,200
Maximum Deliveries							
Colorado Springs	78,300	72,400	72,400	72,400	72,400	72,400	78,300
Security	0	1,100	1,100	1,100	1,100	1,400	1,100
Fountain	0	2,500	2,500	2,500	2,500	2,100	2,500
Total†	78,300	76,000	76,000	76,100	76,000	76,000	81,900
Minimum Deliveries							
Colorado Springs	28,000	28,100	28,100	28,100	28,100	28,100	28,000
Security	0	100	100	100	100	1,300	100
Fountain	0	1,700	1,800	1,800	1,700	2,000	800
Total†	28,000	30,000	30,000	30,000	29,900	31,400	28,900

† Total deliveries may not exactly equal sum of individual Participant deliveries due to rounding.

‡ Simulated demand year is 2046 for all alternatives.

Source: MWH 2007.

treatment plant, no demands are shown for the No Action Alternative.

Annual treated water deliveries for Fountain under the Participants' Proposed Action, Wetland, Arkansas River, Fountain Creek, Downstream Intake, and Highway 115 alternatives would vary from about 800 ac-ft to full capacity of 2,500 ac-ft. Because the No Action Alternative for Fountain does not include water treatment at the proposed water treatment plant, no demands are shown for the No Action Alternative.

Median daily deliveries to the water treatment plant by calendar month for Colorado Springs, Fountain, and Security are presented in Table B-10. The proposed water treatment plant capacity is 109 mgd, while the maximum median daily delivery to the water treatment plant (i.e., the highest median delivery for 365 simulated days) would be between 101 and 104 mgd for the Participants' Proposed Action, Wetland, Arkansas River, Fountain Creek, Downstream Intake, and Highway 115 alternatives, and 100 mgd for the No Action Alternative.

B.6 Return Flow Storage

Return flow storage would be used to temporarily store Colorado Springs' reusable return flows that could not be immediately exchanged to Pueblo Reservoir or the upper Arkansas River Basin facilities. The reusable return flows stored in return flow storage would be released during higher flow times when adequate exchange potential exists in the Arkansas River Basin. Because return flow storage is only needed for those alternatives that require exchanges to deliver or store reusable return flows, return flow storage is not included for alternatives that do not require exchanges (the Wetland and Arkansas River alternatives). Return flow storage would not include any emergency storage because water stored in return flow storage would not be directly accessible by the water treatment plant (MWH 2005).

Mean monthly simulated reservoir contents in return flow storage (Williams Creek Reservoir) are presented in Table B-11. A time-series analysis (MWH 2007) indicates that reservoir

Table B-10. Median Monthly and Maximum Median SDS Water Treatment Plant Deliveries.

Month	Alt 1 (mgd)†	Alt 2 (mgd)	Alt 3 (mgd)	Alt 4 (mgd)	Alt 5 (mgd)	Alt 6 (mgd)	Alt 7 (mgd)
Oct	61	64	64	64	64	64	64
Nov	32	35	35	35	35	35	35
Dec	28	33	33	33	33	34	33
Jan	21	29	29	29	29	30	23
Feb	12	15	15	13	15	16	16
Mar	20	20	20	21	20	21	20
Apr	48	51	51	51	51	51	48
May	82	85	85	85	85	85	86
Jun	96	99	97	97	98	99	100
Jul	90	92	91	91	91	92	94
Aug	73	76	76	76	76	75	77
Sep	70	73	73	74	73	73	74
Maximum Median	100	101	101	101	101	102	104

† Simulated demand year is 2046 for all alternatives.
Source: MWH 2007.

Table B-11. Mean Monthly Return Flow Storage.

Month	Alt 1 (ac-ft)	Alt 2 (ac-ft)	Alt 3 (ac-ft)	Alt 4 (ac-ft)	Alt 5 (ac-ft)	Alt 6 (ac-ft)	Alt 7 (ac-ft)
Oct	20,100	6,900	0	0	6,700	2,300	3,000
Nov	21,200	7,900	0	0	7,700	2,300	3,000
Dec	24,500	11,200	0	0	11,000	2,400	3,400
Jan	26,800	14,300	0	0	14,100	2,500	4,300
Feb	27,700	16,600	0	0	16,400	2,900	5,600
Mar	27,700	18,200	0	0	18,000	3,300	7,200
Apr	27,400	17,900	0	0	17,800	3,000	4,400
May	25,200	14,100	0	0	14,600	2,900	3,600
Jun	21,500	8,000	0	0	9,000	2,800	3,300
Jul	19,700	5,500	0	0	5,700	2,600	3,200
Aug	19,000	5,500	0	0	5,400	2,500	3,100
Sep	19,000	5,800	0	0	5,800	2,400	3,100
Mean	23,300	11,000	0	0	11,000	2,700	3,900

Source: MWH 2007.

contents for all alternatives would vary seasonally, with minimum contents typically occurring in summer and maximum contents typically occurring in late spring. In general, the reservoir would fill when there is more return flow than there is exchange potential and would empty when there is more exchange potential than there are return flows.

The No Action Alternative reservoir contents would remain high for all years in the study period because, without storage in Pueblo Reservoir, Williams Creek Reservoir would hold all the return flows that are not immediately exchanged to the upper Arkansas River Basin or passed downstream to Colorado Canal. Because an exchange from Fountain Creek to the upper Arkansas River Basin is more difficult than an exchange from Fountain Creek to Pueblo Reservoir, return flows would be held in Williams Creek for a longer period of time. Simulated reservoir contents in return flow storage would be intermediate for the two alternatives that rely on exchanges from Fountain Creek to Pueblo Reservoir and participate in the Pueblo Flow Management Program (the Participants' Proposed Action and Fountain Creek Alternative). This is because SDS Project could not directly divert reusable return flows; therefore, if they could not be immediately exchanged due to lack of exchange potential or PFMP curtailments, they would be stored in return flow storage.

In the Highway 115 Alternative, which also relies on exchanges from Fountain Creek to Pueblo Reservoir, Colorado Springs would not participate in the Pueblo Flow Management Program because the untreated water intake would not come out of Pueblo Dam. Therefore, it would be easier for exchanges of reusable return flows to be made directly into Pueblo Reservoir, and the reusable return flows would not need to be stored in Williams Creek Reservoir as often as in the Participants' Proposed Action and Fountain Creek Alternative. In the Downstream Intake Alternative, reusable return flows would be delivered directly to the diversion location below the Fountain Creek confluence. However, reusable return flows would still require exchange into Pueblo Reservoir for regulating storage. Consequently, reusable return flows would be stored only in return flow storage if the reusable return flow was greater than either the SDS capacity or the available storage space in terminal storage, and there was no potential in the Arkansas River to exchange water into Pueblo Reservoir. This would result in less storage in the return flow reservoir for the Downstream Intake Alternative than for other similar alternatives. Table B-13 summarizes the percentage of the return flow capacity that would be used on a daily basis under 1982 through 2004 hydrologic conditions. For the No Action Alternative, the reservoir would remain nearly full. About 50 percent of the time, the reservoir would be nearly empty under the Participants' Proposed Action and Fountain Creek Alternative; however, the full capacity would be used nearly 20 percent of the time. For the Downstream Intake Alternative, the reservoir would consistently be less than 25 percent full. Component sizing was not optimized separately for each alternative. Thus, the optimum size of this reservoir may be smaller from some alternatives. Some component optimization may occur during final design of the Preferred Alternative.

B.7 Return Flow Conveyance

The simulated mean annual conveyance of reusable return flows through the return flow conveyance pipelines is shown in Table B-13. The return flow conveyance systems would convey reusable return flows to the Arkansas River for exchange or direct diversion by SDS. One return flow pipeline configuration would convey reusable return flows from the LVSWWTF and the CSRWRF to the Arkansas River at Colorado 115 near Florence. The other return flow pipeline configuration would convey reusable return flows from the CSRWRF and from Fountain Creek return flow storage to the confluence of Fountain Creek and the Arkansas River. The Wetland and Arkansas River alternatives include the first return flow pipeline configuration while the Fountain Creek Alternative includes the second configuration.

The first reusable return flow pipeline configuration would be sized so that most exchangeable reusable return flows could be delivered to the Arkansas River through the pipeline; thus, deliveries would be consistent for the Wetland and Arkansas River alternatives. The mean annual flows through the second return flow pipeline configuration in the Fountain Creek Alternative would be less than the total return flows through the first return flow pipeline configuration in the Wetland and Arkansas River alternatives. This

Table B-12. Daily Usage of Return Flow Reservoir Capacity.

Storage Content	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6†	Alt 7†
0%-25% Full	3%	50%	No Return Flow Reservoir		49%	100%	93%
26%-50% Full	4%	22%			23%	0%	6%
51%-75% Full	18%	9%			11%	0%	1%
76%-100% Full	75%	19%			18%	0%	0%

† Components were not optimized separately for each alternative and were therefore simulated at the same maximum size.

Source: MWH 2007.

Table B-13. Mean Annual SDS Conveyance through Return Flow Pipelines.

Conveyance to Fountain Creek/ Arkansas River	Alt 1 (ac-ft)	Alt 2 (ac-ft)	Alt 3 (ac-ft)	Alt 4 (ac-ft)	Alt 5 (ac-ft)	Alt 6 (ac-ft)	Alt 7 (ac-ft)
Highway 115 Alignment	0	0	69,600	69,600	0	0	0
Fountain Creek Alignment	0	0	0	0	62,800	0	0
Total	0	0	69,600	69,600	62,800	0	0

Source: MWH 2007.

would occur because of transit losses in Fountain Creek and evaporative losses of reusable return flows that are stored in return flow storage.

B.8 General Facilities Operation and Maintenance Procedures

B.8.1 Operations and Control

Under all alternatives, SDS project facilities would be monitored continuously from Colorado Springs Utilities' existing Control Center. A Supervisory Control and Data Acquisition (SCADA) system would control and monitor the SDS facilities. Information on facilities status would be transmitted through fiber optic lines and a redundant microwave communications system linked to computers at the Control Center. The system would be connected to instruments or sensors to monitor pressure, flow, valve position, and other parameters, and would facilitate remote control of critical facilities. The system also would have an alarm system capable of notifying key personnel when emergency situations occur and would store operational data for accounting purposes. Under the No Action Alternative, Fountain, Security, and Pueblo West would monitor and operate their facilities through their individual, existing control centers. Alternatives consisting of multiple reservoirs (the No Action, Participants' Proposed Action, Fountain Creek, Downstream Intake, and Highway 115 alternatives) would require more complex control systems, real-time operational decisions, and labor.

B.8.2 Conveyance Systems Maintenance

Untreated, treated, and return flow conveyance systems would be maintained in a similar manner. Untreated water pipelines would require routine maintenance inspections. This would consist of driving the pipeline alignments semi-annually and visually evaluating site conditions. These inspections would detect evidence of unauthorized excavation activity on or near rights-of-way, erosion and washout areas, areas of sparse vegetation, damage to permanent erosion control devices, exposed pipe, and other potential problems that might affect the safety and operation of the pipeline. In addition, pipeline markers and signs would be inspected and maintained or replaced, as necessary. Repairs to the right-of-way could include regrading and reseeding with appropriate plant materials or installing other soil stabilization measures. Maintenance roads would not be built along the pipelines. However, a permanent access road would be constructed from Squirrel Creek Road south to the Williams Creek Pump Station along the untreated water pipeline route. If a pipeline segment could not be accessed from a main road, a 4-wheel drive vehicle would be used.

Other maintenance operations would include valve maintenance (both air/vacuum and in-line), pipeline cathodic protection testing, pipeline equipment replacement or repair, and pump stations monitoring and maintenance. The air/vacuum valve maintenance would be done annually and would include driving to each valve station, opening and entering the vault access, inspecting and lubricating valves, performing maintenance and replacing broken or failed components. Annual in-line valve maintenance would consist of exercising or turning in-line valves and lubricating components exposed inside valve vaults or manholes.

Pipeline cathodic protection testing would be done annually and consist of driving along the pipeline alignment, testing the system at test stations spaced at roughly 1,500-ft intervals, setting up temporary anodes and the connection to each test station to check continuity and pipe-to-soil potentials (voltages).

Detailed visual surveys would be done every 2 to 3 years, which would require walking the pipeline alignment. Pipeline equipment replacement or repair would be done as needed or once every 10 to 15 years. Maintenance would consist of servicing or replacing failed in-line valves, flow meters, blowoff valves or other major components that require pipe shutdown. This would include draining, refilling, testing, and returning the pipeline to operation. This also would include the discharge of water at adjacent blow-offs (discussed in Chapter 2), pipeline excavation, and backfill and surface restoration.

Daily or weekly maintenance activities would include driving to each pump station to inspect the facility, facility grounds, and equipment and to test the equipment. Pump station maintenance also would include lubricating mechanical equipment and pumps based on manufacturer instructions, checking valves, testing the lighting and controls standby generator, testing the standby overhead crane if furnished and testing alarms and SCADA equipment. Routine maintenance would be performed on a scheduled basis and major overhauls would be likely after 10 to 15 years for each pump and its generator.

Maintenance equipment would consist of combinations of pickup or flatbed trucks, mowers, mechanical blowers, boom-trucks, excavators, loaders, and compactors depending upon the needs of the maintenance activity.

B.8.2.1 Terminal and Return Flow Storage Maintenance

Routine maintenance of the terminal and return flow storage reservoirs would include inspection of all facilities, dam safety inspections, inlet trash rack cleaning, equipment operation, lubrication and replacement. Spillway repairs, erosion protection repairs downstream of discharge point, instrumentation inspection, calibration, and replacement would be performed as needed. General maintenance activities also would include litter removal, culvert cleaning, and mowing of selected areas if required for dam safety.

Maintenance equipment would consist of combinations of pickup or flatbed trucks, mowers, mechanical blowers, boom-trucks, excavators, loaders, and compactors depending upon the needs of the maintenance activity.

B.8.2.2 Water Treatment Plant Maintenance

Maintenance of the water treatment plant would include routine visual inspections, monitoring, equipment replacement, or repair and specialty maintenance. Routine maintenance would consist of observing, monitoring, and inspecting the plant daily. Maintenance activities would include lubricating mechanical equipment, monitoring and testing the alarms on standby equipment.

Equipment replacement or repair would be performed on a scheduled basis and would consist of checking valves and other major components. This activity would include closing valves and isolating the component requiring service, disconnecting header piping, draining the isolated line, and removing the valve or object needing repair or replacement. Specialty maintenance would be necessary for pump impeller, stator, or diaphragm replacement, equipment drive rebuilding and eventual replacement, ozone generation and destruct equipment repairs and replacement and filter media replacement.

Maintenance equipment would consist of combinations of pickup or flatbed trucks, mowers, mechanical blowers, boom-trucks, excavators, loaders, and compactors depending upon the needs of the maintenance activity.

B.9 References

MWH. 2005. Raw Water Yield Study Monthly Model Documentation and Results. Prepared for Colorado Springs. October.

MWH. 2007. Surface Water Hydrology Effects Analysis, Southern Delivery System Environmental Impact Statement. Prepared for U.S. Bureau of Reclamation. December.