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# 1. PURPOSE OF AND NEED FOR ACTION

This report on the Chatfield Reservoir Storage Reallocation integrates the National Environmental Policy Act (NEPA) process with the Feasibility Study into a single document. Consistent with the U.S. Army Corps of Engineers' (USACE; the Corps) six-step planning process, NEPA also requires the evaluation and comparison of alternatives. It compares the impacts of the alternatives to the ecological, cultural, and aesthetic resources identified and investigated. The NEPA process documents compliance with applicable environmental statutes, such as the Endangered Species Act, the Clean Air Act, the Clean Water Act, the Fish and Wildlife Coordination Act, and the National Historic Preservation Act, among others. The integration of the Feasibility Study and the Environmental Impact Statement (EIS) is intended to reduce process overlap and duplication. The integrated process helps assure that well-defined study conditions and well-researched, thorough assessments of the environmental, social, and economic resources affected by the proposed activity are incorporated into planning decisions.

#### 1.1 Chatfield Project History

Chatfield Reservoir, in conjunction with the Cherry Creek and Bear Creek reservoirs (i.e., Tri-Lakes), are managed to protect the Denver Metro area from catastrophic floods that devastated the area periodically, as reported for more than 100 years. Construction of Cherry Creek Dam began in 1948 and was completed in 1950. Chatfield Dam was the second dam to be built; construction began in 1967 and dam closure was made in August 1973 (USACE, 2002b). Finally, Bear Creek Dam was the last of the three dams to be built; construction was authorized in 1968 and completed in 1982.

Chatfield Reservoir flood control storage space was designed to store flood flows within the reservoir and to release stored water at a maximum rate of 5,000 cubic feet per second (cfs). During flood inflow periods and/or rising pool levels, Chatfield, Bear Creek, and Cherry Creek Reservoirs are normally regulated and operated individually of each other (USACE, 1973). To provide the best downstream flood risk management, operational procedures call for reduced releases if flooding is occurring downstream of the reservoirs. The control point for operation of the reservoirs is the South Platte River at Denver stream gage, with a target maximum flow rate of 5,000 cfs, which would be made up of combined releases from Chatfield, Cherry Creek, and Bear Creek Reservoirs, and the runoff from the drainage area downstream of the reservoirs. During a flood event when the Chatfield Reservoir pool level rises into the flood control zone, releases are increased at a rate of 500 cfs per day up to a level that resulted in a maximum flow of 5,000 cfs at the South Platte River at Denver stream gage. Coordinated regulation of the three projects in parallel is necessary only after flood flows and during flood storage evacuation. USACE revised the reservoir regulation manuals (also known as water control manuals) containing the operating plans for each of the Tri-Lakes reservoirs under existing conditions. The final operating plan (also known as the Water Control Plan) for Chatfield Reservoir based on changes in conservation regulation and flood risk management regulation for the conservation pool (the joint flood control-conservation storage zone) proposed under Alternative 3 is provided in Appendix B.

Chatfield Dam is a rolled earthfill dam 13,136 feet long with a top width of 30 feet, an ungated concrete spillway 500 feet wide located in the left abutment, and a gated concrete outlet works located in the right abutment. The net annual benefits of the dam and reservoir were estimated at

over 17.7 million dollars, based on July 1974 price levels. Approximately 90.5 percent of the net annual benefits were for flood risk management and the remaining 9.5 percent were for recreation (USACE, 2002a).

Section 4 of the Flood Control Act of 1944 authorized USACE to construct, maintain, and operate public park and recreation facilities at Corps reservoirs. The Preliminary Master Plan for Chatfield Dam and Reservoir was approved in June 1966. This plan stated that USACE would construct basic initial facilities for public use and access. Initial development included roads, parking areas, boat ramps, boat docks, camping facilities, shade shelters, picnic facilities, overlook development, a bathing beach, change house, fish cleaning stations, sanitary facilities and disposal systems, electric distribution, water supply, signs, tree planting, seeding, landscaping, fencing, and cleanup of existing building sites (USACE, 2002a). The Colorado Department of Game Fish and Parks, now the Colorado Department of Natural Resources (CDNR) was responsible for obtaining water rights to maintain the conservation pool and contracted with the city and county of Denver in 1979 to provide this water. As described in Section 1.5, the existing multipurpose-conservation pool contains water storage rights held by the Denver Water Department (Denver Water).

In July 1974, USACE leased 5,378 acres of land and water to the state of Colorado for the use and benefit of the CDNR and Division of Parks and Outdoor Recreation, also known as Colorado State Parks, for what is now known as Chatfield State Park. On December 31, 1981, USACE, CDNR, Colorado Division of Wildlife<sup>1</sup> (CDOW), and Colorado State Parks were signatories to a sublease of CDNR-leased lands on the downstream side of Chatfield Dam to CDOW for development of fish production and rearing area development including water supply lines, drain lines, ponds, raceways, roads, and parking areas (USACE, 2002a). The Chatfield State Fish Unit (SFU), also known as the Chatfield Fish Planting Base, is located on the leased lands below Chatfield Dam and receives its water supply from Chatfield Reservoir via 24-inch diameter pipeline that is supplied by a 54-inch diameter water supply pipe that also feeds City Ditch and Nevada Ditch. Another water supply pipe that is 48 inches in diameter extends downstream of Chatfield Dam to feed the Last Chance Ditch.

The Metropolitan Water Supply Investigation (MWSI) began in 1993 to explore a cooperative approach to meeting future water supply needs of the Denver Metro area. The investigation focused on opportunities to increase water supply without the development of significant amounts of new infrastructure. The study identified Chatfield Reservoir as an important potential source of water storage, highlighting its location on the mainstem of the South Platte River, its capacity compared to the upstream reservoirs, and its proximity to metropolitan area supply systems (Hydrosphere Resource Consultants, 1999). The Chatfield Work Group formed within the framework of MWSI and worked with the Colorado Water Conservation Board (CWCB) and USACE to further investigate the possibilities of either reallocating flood storage or recreation storage. This Chatfield Reservoir storage reallocation project under consideration evolved from an assessment of existing contractual agreements, regulatory requirements, operational constraints, and additional studies and investigations.

<sup>&</sup>lt;sup>1</sup> On July 1, 2011, Colorado State Parks and the Colorado Division of Wildlife merged to form Colorado Parks and Wildlife.

### **1.2 Chatfield Project Authorization**

Due to large flood events that occurred along the South Platte River prior to 1974, Chatfield Dam, Chatfield Reservoir, and downstream channel improvements were authorized for flood risk management and related purposes under Section 204 of the Flood Control Act of 1950 (Public Law (P.L.) 81-516). This authorization was in accordance with the recommendation of the Chief of Engineers in House Document [HD] Number 669, 80<sup>th</sup> Congress, 2<sup>nd</sup> Session (HD 80-669). The major part of HD 80-669 was a *Survey Report on Flood Control of the South Platte River and Its Tributaries, Colorado, Wyoming, and Nebraska*, USACE 1945, which states:

The District Engineer recommends the construction of a flood and silt-control dam and reservoir at the Chatfield site on the South Platte River about 8 miles upstream from Denver, Colorado...

Based on this report and subsequent letters, on May 7, 1948, the Secretary of the Army issued his concurrence with this recommendation. The subsequent authorization under Section 204 of the Flood Control Act of 1950 is as follows:

The projects for flood control and related purposes in the South Platte River Basin in Colorado are hereby authorized substantially in accordance with the recommendations of the Chief of Engineers in House Document Numbered 669, Eightieth Congress, second session, and there is authorized to be appropriated the sum of \$26,300,000 for partial accomplishment of the work.

According to the 2002 Chatfield Lake Master Plan (USACE, 2002a), all of the South Platte River projects authorized under the Flood Control Act of 1950 were to be designed for multiple uses, if feasible, to maximize benefits. The original authorized purposes of the Chatfield Dam and Lake Project were flood and silt control. The Master Plan states:

These purposes were later expanded to include recreation, and fish and wildlife... The Department of the Interior recommended that the recreational potential of the proposed projects be studied cooperatively by the National Park Service and the Corps and also that the Fish and Wildlife Service investigate the conclusion of additional provisions for fish and wildlife in connection with the Definite Project Report. Water supply was added later as a project purpose.

Section 808 of the Water Resources Development Act (WRDA) of 1986, as amended by Section 3042 of the Water Resources Development Act of 2007, authorized the Secretary of the Army, "to reassign, a portion of the storage space in the Chatfield Lake project to joint flood-control-conservation purposes, including storage for municipal and industrial water supply, agriculture, environmental restoration, and recreation and fishery habitat protection and enhancement."

Chatfield Dam is currently classified as Dam Safety Action Classification IV; therefore, the reallocation can be permitted per U.S. Army Corps of Engineers Engineer Regulation 1110-2-1156 paragraph 3.6.

## 1.3 Chatfield Location and Study Area

Chatfield Reservoir is located at the confluence of the South Platte River and Plum Creek within the South Platte River Basin. The reservoir itself is located southwest of Denver in Douglas, Jefferson, and Arapahoe Counties (see Figure 1-1). The drainage area for the South Platte River Basin upstream of the reservoir encompasses 3,018 square miles and originates at the headwaters of the North Fork of the South Platte River and the South Fork of the South Platte River in Park County, Colorado. The U.S. Forest Service (USFS) manages most of the lands along the mainstem of the South Platte River upstream of the reservoir. Plum Creek, the second largest of the reservoir's tributaries, flows through a mixture of rangelands and suburban areas. The Buffalo Creek fire (1996) and the Hayman fire (2002) burned large areas within the South Platte River Watershed, resulting in the deposition of sediments and other pollutants into the South Platte River drainage. Reservoirs located upstream of Chatfield Reservoir include Strontia Springs (completed in 1983), Cheesman Lake (1905), Elevenmile Canyon (1932), Spinney Mountain (1981), and Antero (1909) Reservoirs. Downstream, the South Platte River joins with the North Platte River in western Nebraska to form the Platte River. The Platte River ultimately joins the Missouri River at the Nebraska/Iowa border. The study area (Figure 1-2) encompasses the immediate vicinity of Chatfield Reservoir and extends downstream to where the river intersects the Adams/Weld county line.

## 1.4 Study and Implementation Authorities

Congress authorized USACE to conduct a reallocation study and reassignment of storage in Chatfield Lake project to joint flood risk management (flood control)- conservation purposes, including storage for municipal and industrial (M & I ) water supply, agriculture, environmental restoration, and recreation and fishery habitat protection and enhancement under Section 808 of the Water Resources Development Act of 1986 (P.L. 99-662), as amended by Section 3042 of the Water Resources Development Act of 2007 (P.L. 110-114). Policies and plan formulation, economic justification and project implementation developed for use under the general authority for M & I water supply in the Water Supply Act of 1958 are applicable and used in this Chatfield Reallocation Report. The recreation modifications and environmental mitigation work are additionally authorized by Section 103(c)(2) WRDA 1986, requiring non-federal payment of 100 percent of the costs of municipal and industrial water supply projects, and this work will be paid entirely to the sponsor as described by that section.

The specific legislative language authorizing this work under Section 808 WRDA 1986, as amended by Section 3042 WRDA 2007, states:

The Project for flood control and other purposes on the South Platte River Basin in Colorado, authorized by the Flood Control Act of 1950 (64 Statute 175) is modified to authorize the Secretary, upon request of and in coordination with the Colorado Department of Natural Resources and upon the Chief of Engineers' finding of feasibility and economic justification, to reassign a portion of the storage space in the Chatfield Lake project to joint flood control-conservation purposes, including storage for M&I water supply, agriculture, environmental restoration, and recreation and fishery habitat protection and enhancement. Appropriate non-federal interests shall agree to repay the cost allocated to such storage in accordance with the provisions of the Water Supply Act of 1958, the Federal Water Project Recreation Act, and such other Federal laws as the Secretary determines appropriate (33 United States Code [USC] Section [§] 2201 et seq.; Public Law 99-662; 100 Statute 4082).

#### Figure 1-1 Study Location



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#### Figure 1-2 Study Area



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Section 808, as amended, authorizes the Secretary of the Army to implement a reallocation of existing storage at Chatfield Reservoir to any of several named purposes upon meeting two conditions. First, CDNR must request and coordinate the reallocation. Second, the Chief of Engineers must find the reallocation to be feasible and economically justified. If these conditions are met, the Secretary can approve reallocation without obtaining additional authority from Congress. This Feasibility Report (FR)/EIS has been prepared under the Section 808 project authorization to document the study, its findings, and the recommendation of a Selected Plan and conduct the analyses required to support the Chief of Engineer's findings (ER1105-2-100, page 4-2).

Section 116 of the Omnibus Appropriations Act of 2009 (P.L. 111-8) authorizes CDNR to perform facility modifications and mitigation for the project, provided that the Secretary of the Army collaborates with CDNR and local interests to determine storage cost repayments that reflect the limited reliability of the reallocated storage space. In accordance with implementation guidance for Section 116 of the Omnibus Appropriations Act of 2009, the Secretary must make a determination whether the in-kind credits that would be afforded to CDNR are integral to the reallocation project. On January 31, 2012 the CDNR reconfirmed interest in the project and on February 10, 2012, through its office the CWCB, identified work that is important for project implementation. Specifically, CWCB identified that work integral to the project to be completed after execution of the Water Storage Agreement (WSA) at 100 percent non-federal cost includes but is not limited to: 1) on-site and off-site environmental mitigation; 2) modification/re-construction of all impacted recreation facilities; 3) utility relocations; 4) earthwork and shoreline contouring; 5) road, bridge and parking lot construction; 6) demolition, clearing, and grubbing; and 7) vegetation management. Both letters from CDNR are located in Chapter 5 and Appendix DD.

## 1.5 Project Allocation

Reservoir water levels vary with the amount and timing of inflows and of releases for flood risk management or water rights. Chatfield Reservoir currently consists of four storage layers referred to as pools (i.e., inactive, multipurpose-conservation, flood control, and maximum surcharge/spillway design flood) that are used for different purposes. These pools are discussed in detail in Chapter 2. The existing multipurpose-conservation pool, which extends from 5,385 to 5,432 feet above mean sea level (msl), contains existing water storage rights of storage space between elevation 5,432 msl and 5,423 msl held by Denver Water (USACE, 2005a). Denver Water considers its use of this pool to be a vital and permanent component of its water supply system. Denver Water uses water stored in Chatfield Reservoir primarily for exchange to its upstream reservoirs, such as Strontia Springs and Cheesman. Water is released from Chatfield Reservoir to supply a senior water right downstream of Chatfield, in exchange for allowing Denver Water to divert a like amount of water at its upstream reservoirs with more junior water rights. Filling these upstream reservoirs allows Denver Water to deliver water to treatment plants. In addition, Denver Water uses the available space in Chatfield Reservoir to provide bypass flows in the South Platte River between Strontia Springs Dam and Chatfield Reservoir that maintain the trout fishery in Waterton Canyon. Without the storage space in Chatfield Reservoir and the subsequent exchange operations, these flows would be lost from the Denver Water system. Because the 1979 Agreement granting Denver Water the exclusive right to store water in Chatfield Reservoir is only modifiable by mutual agreement, Denver Water considers any alternatives that would decrease the amount of its storage capacity in Chatfield to be unacceptable. As a result, water below 5,432 feet msl is not available for reallocation and cannot be

redefined as an integrated pool with other water providers. The reallocation will only occur between 5,432 feet msl and 5,444 feet msl.

The reallocated storage space in the conservation pool would be filled using water rights belonging to a consortium of 12 water providers listed in Table 1-1. This reallocation would enable the providers to better manage existing and future water supplies to be used for municipal, industrial, agricultural, recreational, and fish and wildlife needs in response to population growth in the Denver Metro area. The maximum reallocation under consideration for this Chatfield Reservoir storage reallocation study is 20,600 acre-feet, representing an increase in the permanent pool to 5,444 feet msl, an increase of 12 feet. The Corps will not assure refill of joint use space released downstream for flood control purposes. Flooding and damages caused by flooding, will not be the responsibility of the Corps.

Entity Pogyasting Storage	Noturo of Entity	Purpose of Use of	Maximum Storage Reallocation	Percent of Costs and Storage	
Entity Requesting Storage     Nature of Entity     Storage     (acre-feet)     Realloc       Downstream Water Providers					
Unassigned <sup>1</sup>	TBD	Unassigned	3,561	17.3	
Central Colorado Water Conservancy District (WCD)	Agricultural	Agricultural <sup>8</sup>	2,849	13.8	
Colorado Parks and Wildlife <sup>6,7</sup>	Governmental: State Agency	Recreation	1,000	4.9	
Denver Botanic Gardens at Chatfield	Governmental: City and Recreation and Agriculture <sup>8</sup> County of Denver		40	0.2	
Western Mutual Ditch Company	Agricultural Agricultural <sup>8</sup>		1,425	6.9	
Upstream Water Providers					
Unassigned <sup>1</sup>	TBD	Unassigned	564	2.7	
Castle Pines Metropolitan District (MD) <sup>3</sup>	Local government serving Denver suburban area	Municipal and Industrial <sup>2</sup>	785.6	3.8	
Castle Pines North Metropolitan District (MD) <sup>3</sup>	Local government serving Denver suburban area	Municipal and Industrial <sup>2</sup>	941.5	4.6	
Town of Castle Rock <sup>3</sup>	Municipality	Municipal and Industrial <sup>2</sup>	1013.1	4.9	
Centennial Water and Sanitation District (WSD) <sup>3</sup>	Local government serving Denver suburban area	Municipal and Industrial <sup>2</sup>	6434.9	31.2	
Center of Colorado Water Conservancy District (WCD)	Governmental: Park County	Municipal and Industrial <sup>2</sup>	131.3	0.6	
Colorado Water Conservation Board	Governmental: State Agency	Recreation	100	0.49	
Mount Carbon Metropolitan District (MD)	Local government serving Denver suburban area	Municipal and Industrial <sup>2</sup>	400	1.9	
South Metro Water Supply Authority (SMWSA) <sup>3</sup> Includes storage for the following entities <sup>4</sup> :	Local governments providing water supplies to Denver suburbs	Municipal and Industrial <sup>2</sup>	1354.3	6.6	
Arapahoe County Water and Wastewater Authority			121.6	0.59	
Castle Pines North MD			64.3	0.31	

Table 1-1 Colorado Water Providers Requesting Storage Space in Chatfield Reservoir

Entity Requesting Storage	Nature of Entity	Purpose of Use of Storage	Maximum Storage Reallocation (acre-feet)	Percent of Costs and Storage Reallocation
Castle Pines MD			1.1	0.005
Centennial WSD			487.2	2.37
Cottonwood WSD			64.3	0.31
Pinery WSD <sup>5</sup>			64.3	0.31
Stonegate Village MD			64.3	0.31
Town of Castle Rock			487.2	2.37
Total			20,600	100%

<sup>1</sup>The City of Aurora and Roxborough WSD are in the process of withdrawing from the Project. Their combined share of the reallocated storage of 4,125.3 acre-feet is designated as unassigned and will be reassigned to one or more of the water providers or others at a future date.

<sup>2</sup>Municipal and Industrial uses may include domestic, mechanical, manufacturing, and industrial uses; power generation; fire protection; sewage treatment; street sprinkling; irrigation of parks, lawns, gardens, and grounds; and augmentation and replacement, recharge, use as a substitute water supply, and exchange for water supplies also dedicated to these types of uses. <sup>3</sup>Note that these entities are requesting their own storage space in Chatfield Reservoir, and are also seeking storage space as members of the South Metro Water Supply Authority. Their portion of SMWSA's storage space would be allotted as described below in note 4.

<sup>4</sup>The South Metro Water Supply Authority is an entity that provides coordination of regional planning efforts to develop renewable water supplies for its members. The SMWSA is requesting storage space in Chatfield Reservoir that would be used by eight of its members: Arapahoe County Water and Wastewater Authority, Castle Pines Metropolitan District, Castle Pines North Metropolitan District, Town of Castle Rock, Centennial WSD, Cottonwood WSD, Stonegate Village Metropolitan District, and Denver Southeast Suburban Water and Sanitation District doing business as Pinery Water and Wastewater District. SMWSA's storage space would be allocated among these eight members as shown in the table. Note that some of these SMWSA members are also seeking storage space as their own entity (i.e., not under SMWSA); these are shown in the table and include Castle Pines MD, Castle Pines North MD, Centennial WSD, and Town of Castle Rock.

<sup>5</sup>The Pinery WSD is also known as Denver Southeast Suburban Water and Sanitation District.<sup>6</sup> The Colorado Water Conservation Board (CWCB) is temporarily holding the shares of Colorado Parks and Wildlife (CPW).

<sup>7</sup>On July 1, 2011, Colorado State Parks and the Colorado Division of Wildlife merged to form Colorado Parks and Wildlife. <sup>8</sup> Although three of the water providers are listed as needing storage for agricultural uses, the municipal and industrial cost sharing contained in the Water Supply Act of 1958 will be used for the full reallocation, as the overall context for the reallocation to the CDNR is the enhancement of municipal and industrial water supply for the Denver region in a manner equitable to all water providers. This context is described further in Section 1.9 of this Report and is recognized by the authorizing statute, Section 808 of the WRDA of 1986, which lists a variety of potential purposes for storage use, including agriculture, but references the Water Supply Act of 1958 as governing the repayment of the storage costs.

MD = Metropolitan District

WSD = Water and Sanitation District

The specific water providers and their CWCB-approved allocations in Table 1-1 were arrived at by consensus of all interested water providers in the following manner. At the request of the Corps and the CWCB, a subcommittee of water providers was formed in June 2004 to determine the allocation among interested water providers of the potentially available 20,600 acre-feet of storage space in Chatfield Reservoir. The subcommittee held 11 meetings over a six-month period to develop a consensus on a fair and equitable storage space allocation. The process emphasized that all potentially interested water providers know of, and have an opportunity to obtain, storage space in Chatfield Reservoir on an equal footing, if such storage space was made available. Extensive efforts were made to have as many potentially interested water providers aware of the process as possible. Thirty water providers participated in the process. Some water providers attended early meetings but then chose not to attend later meetings or otherwise be involved in the process. Sixteen water providers ultimately determined they desired storage space in Chatfield Reservoir and would pay a share of feasibility study costs and cooperate by providing technical information with no guarantee that storage space would be made available. Initially this group, which included municipal,

agricultural, and recreational water providers, collectively expressed its desire to acquire approximately twice the maximum storage space potentially available. During early deliberations, the group established a ground rule that any allocation among the water providers must receive unanimous agreement. Therefore, concessions were required by nearly all water providers before the required consensus could be reached. Part of the eventual compromise included the equal splitting of storage space between upstream water providers and downstream water providers, further reinforcing the equitable aspect of the allocation. Downstream water providers included water providers located within the Chatfield Reservoir storage reallocation study area. At a decisive meeting in November 2004, the group unanimously agreed on the allocation. The decision was formalized by CWCB approval on January 27, 2005. Agreements between the CWCB and the 16 participating water providers were signed in March 2005, completing the allocation process. Although three of the water providers are listed as needing storage for agricultural uses, the municipal and industrial cost sharing contained in the Water Supply Act of 1958 will be used for the full reallocation, as the overall context for the reallocation to the CDNR is the enhancement of municipal and industrial water supply for the Denver region in a manner equitable to all water providers. This context is described further in Section 1.9 of this Report and is recognized by the authorizing statute, Section 808 of the WRDA of 1986, which lists a variety of potential purposes for storage use, including agriculture, but references the Water Supply Act of 1958 as governing the repayment of the storage costs.

The agreements included a mechanism to transfer allocation ownership. In 2007, one of the upstream water providers (Hock Hocking) chose not to pursue its allocated maximum 100 acre-feet of storage. This maximum storage allocation was partitioned among the remaining upstream water providers who wished to acquire additional storage at Chatfield Reservoir, according to the mechanism set forth in these agreements. The resulting allocation among the 15 water providers was approved by the CWCB on July 11, 2007. In 2008 one of these water providers, Parker WSD, opted not to participate in the Chatfield storage reallocation. Mount Carbon Metropolitan District assumed the place of Parker WSD, as presented in Table 1-1. Several of the water providers (Table 1-1), including Centennial WSD, Castle Pines North, Castle Pines Metro, Center of Colorado WCD and Mount Carbon Metropolitan District, received portions of the Parker WSD allocation. In 2011, Perry Park withdrew from the project and its 100 acre-feet of storage were acquired by CWCB (approved November 15, 2011). In 2012, the city of Brighton withdrew from the project and its 1,425 acre-feet of storage were acquired by Centennial WSD (1,181 acre-feet), Castle Pines Metro (125 acre-feet), and Castle Pines North (119 acre-feet) (approved April 23, 2012).

The City of Aurora and Roxborough WSD are in the process of withdrawing from the Project. Aurora's share of the reallocated storage of 3,561 acre-feet (downstream) and Roxborough's share of 564 acre-feet (upstream), are designated as unassigned, as shown in Table 1-1, and will be reassigned to one or more of the water providers or others at a future date.

The goal of this Chatfield Reservoir storage reallocation study is to provide decision-makers and the public with an assessment of the positive and negative impacts that could result from the selection of each of the various alternatives, including the Selected Plan. Any decision, then, can be made with the best available information after objectively weighing the positive and negative effects of each alternative. As described in Section 1.4, this study also has been prepared under the Section 808

project authorization to develop the plan and conduct the analyses required for the Chief of Engineers to determine whether the reallocation is feasible and economically justified.

## 1.6 Purpose and Need Statement

With the main problem being defined as increasing water demand in the Denver Metro area, the next task is to define the project planning objectives, which go hand in hand with a specifically defined purpose and need statement. The statement of purpose and need is important in determining the range of alternatives to be evaluated in this combined FR/EIS as required by NEPA. The purpose and need statement is as follows:

The purpose and need is to increase availability of water, providing an additional average year yield of up to approximately 8,539 acre-feet of municipal and industrial (M&I) water, sustainable over the 50-year period of analysis, in the greater Denver Metro area so that a larger proportion of existing and future water needs can be met. The average year yield is the average amount of water per year that the water providers (not including Hock Hocking or Parker WSD) would have been able to store in Chatfield during the 1942-2000 period of record (POR) if Chatfield Dam had existed during the entire POR. Calculations for each water provider were based on inflows during each year of the POR, the effective date of each water provider's water rights, a maximum total storage for all water providers of 20,600 acre-feet, and whether water providers had effluents (non-natural flows) from water rights upstream that could be recaptured in Chatfield for later re-use. Due to a combination of relatively low inflows in most years and the relatively low seniority of water rights held by the water providers, 20,600 acre-feet would have been able to be stored in Chatfield Reservoir in only 16 of the 59 years in the POR.

The action is a component in the overall effort to meet the water supply needs of the greater Denver Metro area, and it would contribute to meeting a portion of those needs. One alternative considered the reallocated storage space in Chatfield Reservoir would be filled using existing or new water rights, including wastewater return flows and other decreed water rights, belonging to a consortium of water providers. The primary objective of the reallocation is to help enable water providers to supply water to local constituents, mainly for municipal, industrial, and agricultural needs, in response to rapidly increasing demand. Chatfield Reservoir is well placed to help meet this objective, because the reservoir provides a relatively immediate opportunity to increase water supply storage without the development of significant amounts of new infrastructure, it lies directly on the South Platte River (efficient capture of runoff), and it provides an opportunity to gain additional use of an existing federal resource.

As Colorado's population is projected to approximately double by 2050 (CWCB, 2011), there is a significant impact on water planning and management strategies in the Denver Metro area. Some of the water providers in the Denver Metro area (mainly downstream of Chatfield Reservoir) rely mainly on junior surface water rights, surface water exchanges and agricultural transfers, and existing/new gravel lake storage, while others (South Metro providers mainly upstream of Chatfield Reservoir) rely most heavily on nonrenewable, nontributary groundwater (NTGW). Increased reliance on nonrenewable NTGW for permanent water supply brings serious reliability and sustainability concerns. As the NTGW source becomes less reliable, it will become more expensive to obtain. Because its availability is not reliant on weather patterns, NTGW provides a very important supply of water during drought. Because the Chatfield Reservoir storage reallocation

project would help lessen reliance on the finite supply of groundwater, the project would assist not only in helping to meet water supply objectives, but also would help upstream water providers meet their management goals of becoming less reliant on groundwater and of extending the availability and life of these critical aquifers for use by future generations. Thus, development of surface water supplies helps meet supply needs during both wet and dry periods in the future.

Several constraints affect the primary objective of helping to meet water demand. Plans to meet the study objectives must avoid violating the constraints, so they are important considerations in selecting a preferred plan. Three reservoirs, consisting of Chatfield Reservoir, in conjunction with Cherry Creek and Bear Creek Reservoirs (i.e., Tri-Lakes), are managed as a system by the Corps to provide flood protection to the Denver Metro area. This function is still very important today, and cannot be compromised. In addition, other originally authorized purposes of Chatfield Reservoir include recreation and fish and wildlife. With approximately 1.5 million visitor days annually, Chatfield State Park is one of the most important parks in the Colorado State Parks system. Chatfield also holds a diverse array of habitats that are important to many fish and wildlife species, including the federally-protected Preble's meadow jumping mouse. It is very important to ensure that sufficient environmental mitigation and recreational modifications are met upon implementation of a reallocation at Chatfield Reservoir, and the Corps must uphold its responsibility to protect animals and plants (and their critical habitats) protected under the Endangered Species Act (ESA).

In reaffirming its commitment to the environment, USACE formalized a set of seven Environmental Operating Principles (EOP) applicable to all its decision-making and programs. The EOP are identified and explained in Engineer Regulation (ER) 200-1-5, dated October 30, 2003. The EOP and associated doctrine highlight the Corps' roles in, and responsibilities for, sustainability, preservation, stewardship, and restoration of our nation's natural resources. It is an important sub-goal of the Corps to meet these EOP. The EOP are consistent with the stated objectives and sub-objectives of the Chatfield Reservoir storage reallocation study. The EOP were revised in 2012 and can be viewed online at:

http://www.usace.army.mil/Missions/Environmental/EnvironmentalOperatingPrinciples.aspx.

The seven EOP are:

- 1. Foster sustainability as a way of life throughout the organization.
- 2. Proactively consider environmental consequences of all Corps activities and act accordingly.
- 3. Create mutually supporting economic and environmentally sustainable solutions.
- 4. Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the Corps, which may impact human and natural environments.
- 5. Consider the environment in employing a risk management and systems approach throughout the life cycles of projects and programs.
- 6. Leverage scientific, economic and social knowledge to understand the environmental context and effects of Corps actions in a collaborative manner.

7. Employ an open, transparent process that respects views of individuals and groups interested in Corps activities.

## 1.7 National Environmental Policy Act (NEPA)

This section describes NEPA, the scope of the study, the study funding program and sponsors, and the scoping summary.

NEPA of 1969 requires environmental impacts be considered within the federal decision-making process. The Council on Environmental Quality (CEQ) established regulations for implementing NEPA (under Title 40 of the Code of Federal Regulations [CFR] § 1500). USACE has its own supplemental regulations for complying with NEPA (33 CFR 230) for its Civil Works Program. These regulations call for the preparation of an EIS for authorization of any major federal project that could have significant effects on the environment. An authorization for a major project also requires the preparation of a Feasibility Report (FR). The purpose of the FR is to identify, evaluate, and recommend to decision-makers an appropriate coordinated, implementable solution to the identified water resources problems and opportunities (ER 1105-2-100). NEPA (40 CFR §1500.4(o) and §1506.4) and USACE implementing regulations (33 CFR 230.13, and ER 1105-2-100, Paragraph 4-3.b.(3), April 22, 2000) encourage incorporating the EIS into the FR to reduce paperwork. This report constitutes the FR/EIS for the Chatfield Reservoir storage reallocation study.

WRDA 2007 and the Corps' Planning Guidance Notebook (ER 1105-2-100) require that mitigation planning be an integral part of the overall planning process. Under Section 2036(a) of WRDA, the Corps must ensure that any report submitted to Congress for authorization does not select a project alternative without either a specific plan to mitigate fish and wildlife losses or a determination of negligible adverse impacts. Specific mitigation plan components are required, including 1) monitoring until successful, 2) criteria for determining ecological success, 3) a description of available lands for mitigation and the basis for the determination of availability, 4) the development of contingency plans (i.e., adaptive management), 5) identification of the entity responsible for monitoring, and 6) establishing a consultation process with appropriate federal and state agencies in determining the success of mitigation (USACE, 2009a). The Corps defines adaptive management as an organized and documented undertaking of goal-directed actions, while evaluating their results to determine future actions. Simply stated, adaptive management is doing, while learning in the face of uncertain outcomes (Barnes, 2009). According to the National Research Council's 2004 Adaptive Management for Water Resources Project Planning, adaptive management promotes flexible decision-making that can be adjusted in the face of uncertainties, as outcomes from management actions and other events become better understood. The use of adaptive management in the Chatfield Reservoir storage reallocation study is discussed in Section 4.1.1. The water providers and the Corps are dedicated to implementing the adaptive management strategy detailed in Chapter 4 to address any areas of uncertainty in the impact analysis. The adaptive management strategy will involve several agencies and interested parties.

The USACE Omaha District Commander is the responsible official for NEPA actions within the district boundary. Ultimately the decision whether or not to implement the action recommended in this report will be made at the level of USACE Headquarters in Washington, DC. Compliance with other environmental statutes and regulations, including coordination letters with government agencies, are documented in Appendix S.

# 1.7.1 Scope of Study

USACE is authorized to carry out civil works water resources projects for navigation, flood damage reduction, ecosystem restoration, storm damage prevention, hydroelectric power, recreation, and water supply. Planning for these water resource projects is based on the Principles and Guidelines for Water and Land Related Resources Implementation Studies (P&Gs) adopted by the U.S. Water Resources Council (U.S. Water Resources Council 1983). USACE follows a six-step planning process defined in the P&Gs: (1) identify problems and opportunities, (2) inventory and forecast conditions, (3) formulate alternative plans, (4) evaluate alternative plans, (5) compare alternative plans, and (6) select a plan. Civil works studies should be in compliance with state and federal laws. NEPA requires USACE to comply with a process that can include the inventory and assessment of the environmental resources within the study area (ER 1105-2-100).

Reallocation is the reassignment of the use of existing storage space in a reservoir project to another use. A reallocation report is separate from a reallocation action. A report may include future needs, but a reallocation action can only be implemented to satisfy immediate needs. For the alternatives considered, needs are immediate. Whenever a reallocation is contemplated, a reallocation report must be prepared. This report can vary in length depending upon the size of the change and the issues encountered. The purpose of the report and the topics to be discussed are as follows: (1) identify and quantify the new use and user; (2) evaluate the impacts on the project purposes and users; (3) determine environmental effects; (4) determine the price to be charged the new user; and (5) determine appropriate compensation, if any, to existing users/beneficiaries (USACE, 1998). The scope of this Chatfield Reservoir storage reallocation study focuses on natural and cultural resources within, upstream from, and downstream from the existing Chatfield Reservoir and how the proposed action and alternatives could affect those resources. Much of the analysis focuses on the effects of water levels in the reservoir, including the increase in elevation, and the fluctuations associated with regular operations. The potential effects of changes in the amount and timing of releases from the reservoir are also addressed.

The operational plan for the proposed action establishes how water levels within the reservoir would be managed to meet the needs of the water suppliers without interfering with Denver Water's contractual commitments to maintain water levels of at least 5,423 feet msl, and a minimum storage level goal of 20,000 acre-feet during the period May 1 through August 31 of each year, at Chatfield State Park except during periods of severe and protracted drought, as determined by the state of Colorado and endorsed by the Omaha District Engineer, USACE. Much of the analysis focuses on the operational plan because water levels within the reservoir have a direct bearing on the potential to affect most of the resources considered in this study. The analysis of the proposed action and alternatives for this study varies by resource but generally identifies the key concerns identified during the scoping process for each resource. For example, the analysis includes parameters such as the acreage of upland and wetland habitat inundated at the reallocated conservation pool elevation or otherwise impacted, an assessment of the effects on recreational activities (boating and fishing, for example) and facilities (such as boat ramps and picnic tables), and the effects of water levels on water quality and aquatic and wildlife habitat. Socioeconomic resources are considered on a regional basis and include the impact of change to Chatfield State Park, concessions operating within it, and the socioeconomic effects of water storage within and outside of Chatfield Reservoir. The analysis also identifies mitigation measures aimed at avoiding or minimizing impacts to particular resources.

# 1.7.2 Study Funding Program and Sponsors

The Chatfield Reservoir storage reallocation study is being conducted jointly between USACE and CWCB. The study costs for the project will be divided evenly between these two agencies. USACE's share is provided through General Investigation funds. CWCB's share of funding may be distributed among the water provider groups. CWCB is the local sponsor for the Chatfield Reservoir storage reallocation study.

# 1.7.3 Scoping Summary

The regulations for implementing NEPA require USACE to employ scoping as an early and open process to identify significant concerns from the public, organizations, and agencies. The concerns identified during scoping and summarized below focused the analysis within the FR/EIS. USACE published a Notice of Intent (NOI) to prepare this FR/EIS in the Federal Register on September 30, 2004, and hosted scoping meetings for the public on October 26 and 27, 2004. An additional agency scoping meeting was held February 10, 2005. USACE received 29 verbal comments at the meetings, as well as 17 letters containing a total of 160 comments and 11 emails with comments, totaling approximately 200 individual comments.

Comments ranged from broad concerns to very specific positions or recommendations for analysis and provided input on all aspects of the FR/EIS process, including authorizations, alternative analyses, baseline conditions, impact analyses, and mitigation.

One comment suggested that the discussion of purpose and need should describe the multipurpose authorities stated in the enabling legislation (i.e., M&I water supply, recreation, fish and wildlife) and explain how they relate to discharges and the operational model. Other comments indicated that the funding authorized through the Land and Water Conservation Fund Act (LWCF) provided funds for Chatfield State Park and that the discussion of authorizations should include the implications of the LWCF funding.

Comments concerning alternatives requested that USACE consider specific water conservation measures as part of either the No Action Alternative or of one that did not involve the reallocation of additional water storage. Recommended conservation measures included:

- Continuing water rate surcharges all year
- Continuing no-water days for the whole watering season (mandatory)
- Giving rebates year-round for the installation of low-flush toilets
- Placing a water rate surcharge on bluegrass and median grass
- Using outlying reservoirs/off-channel storage
- Promoting the use of water budgeting systems in the metropolitan area
- Conserving and reusing
- Stabilizing the population
- Leasing agricultural water rights

Commenters indicated that it was important to know how the additional storage capacity would be filled and managed. One concern was the effect on operations by junior versus senior water rights among the water providers slated for the increased storage. Commenters also suggested a discussion on the effect reallocation could have on operational changes to other reservoirs in the South Platte River Watershed. The most widely expressed concern about operations surrounded the effects of water level fluctuations on numerous resources, including aquatic resources, wildlife habitat, vegetation (including noxious weed establishment and control), water quality, and recreation (including the use of the beach by swimmers and potential hazards to boaters).

Public sector and agency commenters requested the analysis identify a number of species for consideration, including special status plants and animals, migratory birds, water birds, sport fish, and non-sport fish. Specifically, commenters expressed concern about the loss of habitat as a result of the increased water levels and the negative effects that fluctuating water levels could have on breeding and spawning areas.

Recreation-related comments focused on fluctuating water levels and how they could affect access to boating, fishing, swimming, scuba diving, bird watching (including wildlife viewing), and handicapped fishing access. Boaters additionally expressed concern about the potential hazards that would result from trees and brush being inundated. Concerns were also identified regarding the potential to inundate new roads built within the park and the width of proposed bicycle lanes.

Socioeconomic issues raised in scoping comments included the benefits of relatively low costs for increased storage capacity in the reservoir and concern about the loss of revenues for the park and concessionaires operating within it. One commenter also requested that the FR/EIS address environmental justice (Executive Order 12898).

Some comments on Denver Water's proposal to pump water from below the conservation pool elevation in times of drought suggested including the proposal as part of this FR/EIS, while other commenters pointed out that they are two separate and unrelated projects that should not be considered together. The assessment of cumulative impacts calls for all past, present, and reasonably foreseeable projects to be evaluated, however, and because the pump/drawdown proposal is considered reasonably foreseeable, it is included in the discussion of cumulative effects. Other issues identified as appropriate for cumulative effects include the potential impact on South Platte Park from recreational users displaced from Chatfield State Park, as well as the effects of the Last Chance diversion from the South Platte River with a pump at Kassler (upstream of Chatfield Reservoir and downstream of the High Line Canal headgate) and the temporary pump station near the Fox Run picnic area, which pumps water from Chatfield Reservoir.

Commenters from the public, organizations, and agencies offered suggestions on mitigation. One group suggested that mitigation include regularly updated announcements of changes in the water levels via a phone number or website. Other commenters suggested that any relocated recreation facilities be designed to survive flooding. CDOW offered technical guidance on planting, while the Chatfield Basin Conservation Network, Denver Botanic Gardens at Chatfield, and Douglas County all offered assistance in identifying, developing, and/or maintaining mitigation areas in order to maximize benefits.

### 1.8 Summary of Prior Studies, Reports, and Existing Projects

Over the years, there have been many studies and proposals addressing issues of flood risk management, water storage, recreation, and fish and wildlife habitat. The planning process for this

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project has relied on these past studies to obtain information about the watershed to guide the analysis.

#### 1.8.1 Colorado Department of Public Health and Environment Water Quality Control Commission: Regulation Number 73 Chatfield Reservoir Control Regulation, 1999 and 2006

The Colorado Water Quality Control Commission (CWQCC) adopted a total maximum annual load (TMAL) for phosphorus within the Chatfield Reservoir in 1989. Regulation Number 73 codifies the TMAL and establishes phosphorus wasteload allocations to point and non-point source discharges. The regulation also defines the Chatfield Watershed Authority's responsibility in implementing the TMAL and monitoring water quality within the watershed (CWQCC, 1999). The control regulation was amended in 2005 with an effective date of January 30, 2006 (CWQCC, 2006).

### 1.8.2 Chatfield Watershed and Reservoir: 1986–1995 Historical Data Analysis and Monitoring Program Review, 1997

The Denver Regional Council of Governments (DRCOG) developed this annual report to CWQCC for the Chatfield Watershed Authority. The report supported the development of Regulation Number 73. The report characterizes water quality monitoring results collected between 1986 and 1995 within the Chatfield Watershed. Data collection included specific chemical, physical, and biological parameters. The report also describes the trophic condition of the reservoir over time, related to nutrient concentrations (Chatfield Watershed Authority, 1997).

# 1.8.3 Chatfield Watershed Authority Annual Reports: 1989–2011

The Chatfield Watershed Authority annually monitors Chatfield Reservoir and inputs from the watershed. A generally continuous collection of surface water quality data in the watershed and reservoir began in 1990. Data collection includes specific chemical, physical, and biological parameters. The authority produces an annual report summarizing water quality trends in the reservoir and watershed (Chatfield Watershed Authority 2011). These annual reports and electronic data files track reservoir loading, trophic state, and associated factors affecting water quality management.

#### 1.8.4 Report on Surveys for Preble's Meadow Jumping Mouse and Ute Ladies'-Tresses Orchid, 1998 and Preble's Meadow Jumping Mouse, 2001

The purpose of this report was to define the presence or absence of the Preble's meadow jumping mouse and Ute ladies'-tresses orchid on lands administered by USACE by conducting surveys in the Tri-Lakes project area, which includes the Chatfield Dam and Lake Project area (the area acquired by the USACE near Chatfield Reservoir). The surveys were conducted on the area potentially affected by the flooding of Chatfield Reservoir, including Deer Creek. The survey found the Preble's meadow jumping mouse along the South Platte River above Chatfield Reservoir and along Plum Creek. No Ute ladies'-tresses orchids were found within the Chatfield Dam and Lake Project area (Burns & McDonnell, 1998). Another survey was conducted June 25–29, 2001, along Deer Creek upstream and downstream of the culvert under Colorado Highway 121 in areas with suitable habitat for the Preble's meadow jumping mouse; none were found (Burns & McDonnell, 2001).

### 1.8.5 Biological Assessment Routine Operation of Chatfield Dam and Reservoir Effects on Preble's Meadow Jumping Mouse, 1999

In 1998, the U.S. Fish and Wildlife Service (USFWS) issued a final rule to list the Preble's meadow jumping mouse as a federal threatened species under the ESA of 1973, as amended (16 USC 1531 et seq.). Consequently, between August 11 and 20, 1998, a survey was conducted for Preble's meadow jumping mouse at Chatfield State Park. The survey located a total of 13 Preble's meadow jumping mice. Four mice were found on the South Platte River upstream of the dam, and nine were found on Plum Creek (Burns & McDonnell, 1999).

## 1.8.6 Draft Existing Conditions Report for Biological Resources, 2000

This report addressed the existing conditions of biological resources, including vegetation, wildlife, wetlands, fisheries, and special status species. Special status plant and wildlife habitat include potential Ute ladies'-tresses orchid habitat in five areas around Chatfield Reservoir. Additionally, four sites at Chatfield State Park were determined to possess potential Preble's meadow jumping mouse habitat (Foster Wheeler, 2000a).

## 1.8.7 Draft Existing Conditions Report for Cultural Resources, 2000

This report addressed the existing conditions of cultural resources within the Chatfield Reservoir storage reallocation study area. The project area included the identification and recordation of 43 cultural resource locations. These include 26 prehistoric archaeological sites, 3 prehistoric isolates (i.e., fewer than five flakes within a restricted area with no associated features), 11 historic archaeological sites, and 3 archaeological sites that contain both prehistoric and historic components. All of these sites have either been destroyed or are outside of the area potentially affected by the 12-foot rise in the reservoir's elevation (Foster Wheeler, 2000b).

#### 1.8.8 Chatfield Lake Project, Colorado: Master Plan Update, Final Environmental Assessment and Finding of No Significant Impact, 2002

This master plan provides direction for project development and use, mainly related to recreation. Its intent is to document policies and analyses that determine appropriate uses and levels of development of project resources, provide a framework to develop and implement the Operational Management Plan and Annual Management Programs, and to establish a basis to evaluate out-grant and recreation development proposals. A finding of no significant impact was based on the environmental assessment of new alternatives proposed in the updated master plan (USACE, 2002a).

## 1.8.9 Chatfield Reallocation Study Storage Use Patterns, 2003

The purpose of this report was to determine the feasibility of diverting water under existing water rights to storage space in Chatfield Reservoir resulting from the proposed reallocation of flood storage to conservation. A spreadsheet model was developed to analyze the potential use of the reallocation pool under 15 potential modes of operation. The results of the modeling indicate that the water rights available to the water providers were sufficient to efficiently use the reallocated reservoir storage space under all pool sizes (CWCB, 2003).

## 1.8.10 Chatfield Reservoir Recreation Facilities Modification Plan, 2010

The 2010 EDAW, Inc. (EDAW) report documents the results of a study to identify opportunities and costs for the modifications of recreation facilities and uses at Chatfield State Park to offset impacts that would result from the reallocation of 20,600 acre-feet of flood control storage to conservation storage in the Chatfield Reservoir. In addition to recreation facility impacts, a portion of the road entrance would need to be realigned and a segment of the main park road would have to be located farther from the lake based on potentially increased water levels. The report also addresses the same issues for the 7,700 acre-foot alternative. The EDAW 2010 report is included as Appendix M in this FR/EIS.

### 1.8.11 Chatfield Storage Reallocation Project Rare Plant Survey for the Ute Ladies'-Tresses Orchid and the Colorado Butterfly Plant, 2005 and 2006

These reports discuss the results of rare plant surveys conducted in 2004 and 2005 at Chatfield State Park for two federally-threatened species, the Ute ladies'-tresses orchid and the Colorado butterfly plant. Six generalized locations where potential habitat may be found in areas possibly impacted by the proposed reallocation project were selected for site reconnaissance prior to the actual survey. Within these six locations, 21 specific potential habitat sites were identified. Some sites possessed characteristics for both species, while other sites included habitat for only one species. Intensive surveys were conducted for both species, but no individuals were found (USACE, 2005b). An additional season of surveys was conducted in 2005, but again, neither of these rare plants was found. The report of the 2005 survey was finalized in 2006 (USACE, 2006).

### 1.8.12 Class III Cultural Resources Survey of Chatfield State Park, Arapahoe, Douglas and Jefferson Counties, Colorado, 2007

An intensive Class III archaeological pedestrian survey was recently completed for the USACE to provide an assessment of site locations and conditions within Chatfield State Park (Dominguez et al. 2007). A total of 3,605 acres was surveyed, with the identification of 25 previously unrecorded archaeological sites, of which two are prehistoric, 21 historic, and two contain historic and prehistoric components. Two prehistoric and two historic sites have been recommended as eligible for listing on the National Register of Historic Places (NRHP). In addition to the documented sites, the survey recorded 18 isolated finds, which are defined as small scatters of five items or fewer. The findings of this report are further discussed in Chapter 3.

### 1.8.13 Tri-Lakes Sedimentation Studies Area-Capacity Report, 2010; Chatfield Portion Updated 2007

Chatfield Reservoir storage depletion rate was originally anticipated to be a loss of storage within the reservoir of 189.5 acre-feet per year. Based on updated information in 2010, the sedimentation is projected to be considerably less with a long term depletion rate of 30 acre-feet per year (see Chatfield Sediment Depletion Rates - Future Conditions study, Appendix FF). The difference in depletion rates is probably due to the available sediment knowledge and limited sediment load measurements from the upper South Platte River basin during project design.

However, the estimated future deposition rate of 30 acre-feet per year should be used with caution since sediment deposition is variable and may respond to climate change, extreme weather events such as drought and thunder storms, and physical events such as forest fires and changes in land use. This value is a practical minimum future depletion rate. The 2002 Hayman Fire would have greatly

increased the sediment deposition rate at Chatfield if the upstream Cheesman Reservoir had not caught all the sediment. Increased sediment yield as a result of the fire was estimated to be 5 to 10 times the normal rate for several years.

It is estimated that in 2110, using the current long-term depletion rate of 30 acre-feet per year, storage capacity in the multi-purpose pool is projected to have 85.4 % capacity remaining (Appendix FF).

### 1.8.14 Metropolitan Water Supply Investigation (MWSI), 1999

The focus of the MWSI (Hydrosphere Resource Consultants, 1999) was on exploring means for enhancing the cooperative use of existing water supply systems to meet the future water demands of the Denver Metro area. The MWSI evaluated four main areas: conjunctive use, effluent management, interruptible supply arrangements, and other system integration opportunities. This report discusses the idea of reallocation of storage at Chatfield Reservoir and the scope of a feasibility study that would be required for reallocation.

## 1.8.15 South Metro Water Supply Study (SMWSS), 2003

The SMWSS investigated water supply options for the south Denver Metro area through the year 2050. The study area included the northern half of Douglas County. The study was authorized by the Douglas County Water Resources Authority (DCWRA), Denver Water, and the Colorado River Water Conservation District. The DCWRA participants included Centennial WSD, Town of Castle Rock, East Cherry Creek Valley WSD, Arapahoe County Water and Wastewater Authority, Cottonwood WSD, Stonegate Metropolitan District, Pinery Water and Wastewater District, Inverness WSD, Meridian Village Metropolitan District, Roxborough WSD, and Castle Pines North WSD. Many of these entities are also participants in the Chatfield Reservoir storage reallocation study. Some excerpts from the study are included in the Water Supply Demand Analysis (Appendix C). The entire document (Black & Veatch et al., 2003) is available online at http://www.crwcd.org/media/uploads/SouthMetroWaterSupplyStudy11-03.pdf.

#### 1.8.16 Statewide Water Supply Initiative (SWSI), 2004 and Colorado's Water Supply Future, SWSI Phase 2, 2007

The SWSI (CWCB, 2004) is a comprehensive study that was started in 2003 by the CWCB. Phase 1 of the study focused on Colorado's existing water supplies and the future water demands, and options for meeting those demands. Phase 1 evaluates the eight major river basins within Colorado, while also taking a statewide perspective. Some excerpts from the study are included in the Water Supply Demand Analysis (Appendix C). Phase 2 of the SWSI (CWCB, 2007a) summarizes the work of Technical Roundtables that were formed to conduct detailed analysis of: (1) Water Conservation and Efficiency (Agricultural and Municipal and Industrial), (2) Alternative Agricultural Water Transfer Methods to Traditional Purchase and Transfer, (3) Delineating and Prioritizing Colorado's Environmental and Recreational Resources and Needs, and (4) Addressing the Water Supply Gap (between Current Supply and Current and Future Water Needs). The overall goal of Phase 2 was to develop a range of solutions to sustainably meet future water needs. The entire Phase 1 and 2 SWSI reports are available online at http://cwcb.state.co.us/public-information/publications/pages/studiesreports.aspx.

### 1.8.17 Facing Our Future: A Balanced Water Solution for Colorado, 2005

This report was prepared in part as a response to the SWSI study. It presents the views of Colorado's major conservation groups on meeting water demands over the next 25 years. It was prepared by Western Resource Advocates, Trout Unlimited, and the Colorado Environmental Coalition, and was endorsed by Audubon Colorado, the Sierra Club, The Wilderness Society and a number of other conservation organizations (Western Resource Advocates et al., 2005). The report's model for meeting water demands emphasizes water conservation and efficient use, and protection of environmental values. The report can be accessed online at http://www.westernresourceadvocates.org/facingourfuture/.

#### 1.8.18 Preliminary Reservoir Regulation Manual for Chatfield Dam and Lake, Colorado, 1973

This document contains pertinent descriptive and historical information regarding the Chatfield Dam and Lake Project and the basin, including stream flow, channel capacities, and dischargedamage relationships; procedures for collection and distribution of hydrologic data and forecasts; and the regulations and procedures by which Chatfield Reservoir is regulated. The USACE Omaha District has prepared an update of the manual (called the Chatfield Water Control Manual), including updated sections on project history and description, regulation of water in the conservation pool, and regulation for flood risk management, based on existing conditions. Chatfield Reservoir is operated as a system with Cherry Creek and Bear Creek Reservoirs, known as the Tri-Lakes, while evacuating flood control storage. If storage is reallocated in Chatfield Reservoir, the Tri-Lakes' Water Control Manuals will be further modified to incorporate the revised Water Control Plans which reflect the change in storage zones, release schedules, and other reservoir regulation procedures.

The Omaha District Water Control and Water Quality Section acquired contingent approval of the Chatfield, Cherry Creek, and Bear Creek Water Control Plans from the Northwestern Division Missouri River Basin Water Management office reflecting Chatfield's potentially reallocated storage under the Selected Plan. Following the Record of Decision and the Water Storage Agreement for the Chatfield Reservoir Reallocation Study, the Omaha District Water Control and Water Quality Section will submit a request for final approval for Chatfield, Cherry Creek, and Bear Creek's active Water Control Plans. The revised Water Control Plans for each of the Tri-Lakes are included as Appendix B. The Chatfield Water Control Plan has not been updated for other alternatives.

#### 1.8.19 Climate change and water resources management—A federal perspective: U.S. Geological Survey Circular 1331, 2009

This report concludes that the best available scientific evidence based on observations from longterm monitoring networks indicates that climate change is occurring, although the effects differ regionally. Potential climate change impacts affecting water availability include changes in precipitation amount, intensity, timing, and form (rain or snow); changes in snowmelt timing; and changes to evapotranspiration. The results from several general circulation models agree that the southwestern United States is likely to experience precipitation and evapotranspiration changes that result in reduced runoff and water availability (Brekke et al., 2009).

#### 1.8.20 Climate Change in Colorado: A Synthesis to Support Water Resources Management and Adaptation, A Report by the Western Water Assessment for the Colorado Water Conservation Board, 2008

Climate models project that Colorado will warm by approximately 2.5°F by 2025 and by approximately 4°F by 2050, relative to 1950 to 1999 baseline temperatures. The projections show summers warming more (+5°F) than winters (+3°F), and suggest that typical summer temperatures in 2050 will be as warm as or warmer than the hottest 10 percent of summers that occurred between 1950 and 1999. Individual models' projections do not agree whether annual mean precipitation will increase or decrease in Colorado by 2050. More mid-winter precipitation throughout the state is predicted, and in some areas, a decrease in late spring and summer precipitation. Regardless of precipitation, the timing of spring runoff is projected to shift earlier in the spring, and late-summer flows may be reduced. The impact of climate change on runoff in the Platte Basin has not been studied extensively.

The consistent projections for a substantial temperature increase over Colorado have important implications for water management (Ray et al., 2009). Increases in temperature imply more evaporation and evapotranspiration leading to higher water demands for agriculture and outdoor watering. Temperature-related changes in the seasonality of streamflows (e.g., earlier runoff) may complicate prior appropriation systems and interstate compact regimes; and modify the interplay among forests, hydrology, wildfires, and pests (e.g., pine beetles). The current state of the science is unable to provide sufficient information to decision makers and stakeholders on a number of crucial scientific issues regarding Colorado's water resources. The wide range of precipitation projections makes it difficult to assess likely changes in annual mean precipitation by mid-21st century. However, a synthesis of findings in this report suggests a reduction in total water supply by then. Furthermore, there is potential for increased drought severity in the region due to higher temperatures alone.

#### 1.8.21 Global Climate Change Impacts in the United States, Regional Climate Impacts: Southwest, 2009

According to this report, water supplies in the southwestern United States are projected to become increasingly scarce, calling for trade-offs among competing uses. Water supplies in some areas of the Southwest are already becoming limited. Groundwater pumping is lowering water tables, while rising temperatures increase water lost to evaporation. Limitations imposed on water supply by projected temperature increases are likely to be made worse by substantial reductions in rain and snowfall in the spring months when precipitation is most needed to fill reservoirs to meet summer demand. The average temperature in the Southwest has already increased roughly 1.5°F compared to a 1960 to 1979 baseline period (Karl et al., 2009). By the end of the century, average annual temperature is projected to rise approximately 4°F to 10°F above the historical baseline, averaged over the Southwest region (Karl et al., 2009).

## 1.8.22 Joint Front Range Climate Change Vulnerability Study, 2012

This report examines the effects of climate change scenarios on several watersheds, including the South Platte. The central objective was to assess potential changes in the timing and volume of hydrologic runoff for the years 2040 and 2070 as compared with 1950-1999. Two hydrologic models were calibrated and implemented, and modeled streamflows were compared to historic streamflows to estimate the sensitivity of water supplies to climate change. Drier basins, including portions of the

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South Platte, experience larger percent reductions in streamflows due to warmer conditions, while wetter basins, including the upper areas of Colorado, show smaller percent reductions. Although the study results indicate broad variability and uncertainty about future streamflows in the South Platte, they suggest that reduced future streamflow volumes are possible above and below Chatfield Reservoir in the future as a result of climate change.

## 1.9 Water Supply and Demand Analysis

In the 1990s, Colorado was the third fastest growing state, surpassed only by Nevada and Arizona. Based on Colorado Department of Local Affairs Demography Division projections, it is estimated that Colorado's population will increase by 65 percent, from more than 4.3 million to approximately 7.1 million, between 2000 and 2030 (CWCB, 2004). The South Platte River Basin's population is expected to increase at the same rate, 1.7 percent annually. This anticipated population growth has a significant impact on water planning and management strategies. As of 2004, groundwater provided approximately 880,000 acre-feet per year in the basin for irrigation, and 100,000 acre-feet per year to meet the M&I demands (CWCB, 2004). Surface water use within the South Platte River Basin has been changing rapidly over the last few years as municipalities make greater use of agricultural water rights. In 1998, 1.1 million acres of agricultural lands were irrigated with approximately 2 million acre-feet of surface water. Within the same time period, municipal uses accounted for an additional 530,000 acre-feet (CWCB, 2004).

In 2003, because of Colorado's population increase and water shortage issues, the Colorado legislature authorized CWCB to implement the SWSI to facilitate understanding of, and preparation for meeting, Colorado's long-term water supply needs. The purpose of the SWSI comprehensive study was to examine existing water supplies and projected water demands in each basin and to identify a range of potential options to meet that demand over the next 25 years. The overall objective of this study was to "help Colorado maintain an adequate water supply for its citizens and the environment" (CWCB, 2004). For purposes of this FR/EIS, the SWSI study is used along with demand projections from water providers requesting storage space for the demand analysis numbers for the South Platte River drainage area. The numbers represented in this study are the most comprehensive and current available for Colorado (CWCB, 2004).

Over half of Colorado's land area and 85 percent of its population (CWCB, 2004) lies in the South Platte and Arkansas River basins, which contribute only about 5 percent of the flows leaving the state. Drought conditions, especially since 2002, have caused concern among residents and political leaders. Calls on senior water rights that had previously never been called out occurred in 2002, and reservoir surface elevations reached unprecedented low levels, bringing about mandatory water use restrictions. Based on this widespread concern, SWSI explored recommendations to find alternative sources of water and develop plans to better conserve Colorado's water. Along with population increases, data from Colorado's 2003 Statewide Comprehensive Outdoor Recreation Plan (SCORP) and the 2001 National Survey of Fishing, Hunting, and Wildlife show that the water-based recreation demand has increased over the past 10 years (as cited in CWCB, 2004). The SCORP reports an increase in water-based recreation participants of 21.5 percent between 1995 and 2003 (Colorado State Parks 2003). The importance of recreation and tourism in the economy has also increased over the past 10 years (CWCB, 2004).

SWSI explored all aspects of Colorado's water use and development on both a statewide and basinby-basin level. Findings were made available to local providers, citizens, and communities across Colorado to help shape and plan their future water needs. Major findings included the following: (1) a significant increase in population and recreation water use; (2) irrigated agricultural lands will see a greater reduction as M&I water providers seek transfers of water rights if the identified projects and processes are not successfully implemented; (3) there are reliability and sustainability concerns regarding increased reliance on nonrenewable NTGW (i.e., groundwater that is essentially unconnected to surface streams and is an exhaustible resource); (4) in-basin solutions can help solve the gap between M&I supply and demand; (5) water conservation will be a major tool in meeting future M&I demands; and (6) beyond 2030, more aggressive strategies may be required to provide water to Coloradoans (CWCB, 2004). Some examples of conservation efforts that have been used in the Denver Metro area include education, rebates for low-flush toilets and high efficiency washing machines, water use audits, landscape and irrigation system audits, and tiered water rate structures (CWCB, 2004).

Without additional conservation, annual M&I and self-supplied industrial water demands would be projected to increase from 1,194,900 acre-feet in 2000 to 1,926,800 acre-feet by 2030 based on population projections and per capita use rates. However, water conservation that results from the 1992 National Energy Policy Act is projected to reduce the estimated 2030 annual demands by about 101,900 acre-feet. This conservation does not reflect the active measures such as metering, and water rate pricing that are being implemented, planned, or considered by many water providers across the state, and that are considered in SWSI as a future water supply option for meeting demands (CWCB, 2004).

From these major findings, recommendations were made to (1) continue ongoing dialogue among all water providers; (2) track and support identified projects and processes; (3) develop a program to evaluate, quantify, and prioritize environmental and recreational water enhancement goals; (4) find alternative forms of funding for environmental and recreational enhancements; (5) create a common understanding of future water supplies; (6) develop implementation plans towards meeting future needs; (7) assess potential new state roles in implementing solutions; and (8) develop requirements for standardized annual M&I use data reporting (CWCB, 2004).

The future water supply options that water providers are pursuing to meet their needs are termed "identified projects and processes" in the SWSI study. Identified projects and processes to reduce dependence on water and ensure the availability of water through 2030 include water conservation, agricultural transfers, development of additional storage, conjunctive use of surface water and groundwater, M&I reuse, and control of nonnative phreatophytes. Under a best-case scenario, it is estimated that approximately 80 percent of Colorado's statewide future needs can be met by implementation of these options, leaving a 20 percent gap in supply statewide (CWCB, 2004, 2007a).

Average municipal and industrial per capita water use in the South Platte River Basin (measured by taking all M&I demand divided by permanent population) is 206 gallons per capita per day. Some areas of the South Platte River Basin currently rely heavily on nonrenewable groundwater to meet existing demands. Gaps are projected in these areas since its supply is not replenished, and continued groundwater pumping will reduce the yield of existing wells, which will further increase the gap between supply and demand. Mountain areas of the South Platte River Basin have limited

groundwater availability and future development may be limited unless surface water supplies are developed and delivered to these areas to supplement the limited groundwater. Most water providers indicated they would not be able to meet the 2030 demands. Estimated demand in the South Platte River Basin by 2050 is 409,700 acre-feet per year (CWCB, 2009). Estimated demand met by identified projects and processes, as well as additional water conservation, totals 319,100 acre-feet per year (about 78 percent of future needs), leaving a 90,600 acre-foot gap (or 22 percent) in the South Platte River Basin.

The South Platte River Basin is broken into six subbasins, but areas surrounding the project area include Denver Metro and South Metro subbasins. In Adams, Denver, and Jefferson Counties (Denver Metro Subbasin), estimated demand met by identified projects and processes include a total of 108,100 acre-feet per year (using the following conservation measures), leaving a 12,500 acre-foot gap (or 10 percent) of the anticipated 2030 demand of 120,600 acre-feet in the Denver Metro Subbasin. The identified projects and processes are:

- Active water conservation (e.g., metering, increasing water rate pricing, rebates for efficient water using appliances, incentives for reducing high water use landscaping, and restrictions on amount of lawn area).
- Existing supplies.
- Denver Northern Firming (Denver Water's transbasin diversion from Grand County).
- The City of Thornton's agricultural water conversion project with the Water Supply and Storage Company.
- Agricultural transfers.
- New storage (including gravel lakes) and reservoir enlargements.
- Reuse for nonpotable irrigation of parks and golf courses and other landscaping.
- Treating lower quality water sources.

In Arapahoe, Douglas, and Elbert Counties (South Metro Subbasin), estimated demand met by identified projects and processes include a total of 38,300 acre-feet per year (using the following conservation measures), leaving a 50,300 acre-foot gap (or 56 percent) (CWCB 2004). The identified projects and processes are:

- Active water conservation (e.g., metering, increasing water rate pricing, rebates for efficient water using appliances, incentives for reducing high water use landscaping, restrictions on amount of lawn area)
- Implementation of South Metro Conjunctive Use Plan or alternative
- Rueter-Hess Reservoir
- Aurora Long-Range Plan

- East Cherry Creek Plan
- Agricultural transfers and reuse
- Additional NTGW
- Reuse for nonpotable irrigation of parks and golf courses and other landscaping
- Indirect potable reuse by the discharge of reusable effluent to a water body for later recapture
- Blending of high quality and low quality water supplies to achieve the maximum volume of potable water that is of acceptable quality
- Treating lower quality water sources

The information presented in this chapter establishes the context of the analysis within the USACE authorities and the purpose and need for the project. The focus of the Chatfield Reservoir storage reallocation study on particular aspects of physical, natural, and cultural resources in and around the Chatfield Reservoir results from the topics discussed above. The remaining chapters provide details on the proposed action and alternatives, describe existing and future conditions for the various resources, and assess the potential positive and negative effects of implementing the proposed action or alternatives.

# 1.9.1 Water Supply and Demand of the Water Providers

The water providers participating in the Chatfield Reservoir storage reallocation study provided their water demand by decade through 2050. The water demand estimates take into account the water providers' conservation programs that are described in Appendix AA. Table 1-2 shows this demand. Most of the participants were projected to meet their 2010 demand. The Central Colorado WCD and Western Mutual Ditch Company will provide augmentation and irrigation water, respectively. Augmentation is the provision of water to an affected stream to allow out-of-priority diversion from the stream, with the augmented water preventing injury to senior water rights holders on the stream. In this instance, these two agricultural water providers need to augment surface water in order to draw on tributary groundwater that is connected to and depletes surface water. Such augmentations must be approved by the water court. Currently, well pumping from approximately 225 alluvial water wells has been curtailed completely and pumping from another approximately 1,000 wells has been partially reduced by court order until necessary augmentation water is secured. The well pumping curtailment is severely impacting well users as well as adversely impacting local economies. These two water providers are not planning to issue additional shares in the future, so the demand would not change over time. Even as growing municipalities purchase participating farms, their demand is expected to change from agriculture to M&I demand such as for parks, lawns, and golf courses. The Denver Botanic Gardens at Chatfield will have an unmet need of 12 acre-feet that would allow expansion of its operation, but growth beyond 2020 is not anticipated at this time.

Most of the upstream water providers currently use groundwater and will have met their 2010 demand from that source. Center of Colorado WCD expects an increase in demand for augmentation water in Park County by 2010 and does not expect this to increase between 2010 and 2020.

For all water providers, the increase in demand between 2010 and 2050 will need to be met by developing new sources and using existing developed supplies unused in 2010.

	Water Demand	Supplies other than NTGW	NTGW Supplies	Unmet	Projected Future Demand <sup>1</sup>			
Water Provider	2010	2010	2010	2010	2020	2030	2040	2050
Downstream Providers								
Central Colorado WCD	89,000	18,250	0	70,750	89,000	89,000	89,000	89,000
Colorado Parks and Wildlife	3,000	1,200	0	1,800	3,000	5,000	5,000	5,000
Denver Botanic Gardens at Chatfield	40	28	0	12	40	40	40	40
Western Mutual Ditch Company	30,000	15,000	0	15,000	30,000	30,000	30,000	30,000
Upstream Providers								
Castle Pines Metropolitan District	1,467	1,030	437	0	1,620	1,620	1,620	1,620
Castle Pines North Metropolitan District	2,290	0	2,290	0	2,518	2,518	2,518	2,518
Centennial WSD	19,500	9,500	10,000	0	22,500	22,500	22,500	22,500
Center of Colorado WCD	267	70	0	197	267	325	375	425
Mount Carbon Metropolitan District <sup>2</sup>	15	15	0	0	815	1,015	1,036	1,036
Other SMWSA <sup>3</sup>	11,421	5,894	5,527	0	16,738	18,868	22,038	22,038
Town of Castle Rock	8,600	1,841	6,759	0	11,900	15,400	15,400	15,400
Totals	165,600	52,828	25,013	87,759	178,398	186,286	189,527	189,577

Table 1-2 Demand in Acre-Feet

No change in demand projections is predicted after 2050.
Mount Carbon has not projected demand for 2040 or 2050, total demands beyond 2030 are conservative.
Includes Pinery Water and Wastewater District, Arapahoe County Water and Wastewater Authority, Cottonwood WSD, and Stonegate Village Metropolitan District.