No. 18-1004

IN THE UNITED STATES COURT OF APPEALS
FOR THE TENTH CIRCUIT

AUDUBON SOCIETY OF GREATER DENVER,
Petitioner-Appellant,

v.

UNITED STATES ARMY CORPS OF ENGINEERS,
Federal Respondent-Appellee,

and

CASTLE PINES METROPOLITAN DISTRICT, CASTLE PINES NORTH METROPOLITAN DISTRICT, CENTENNIAL WATER AND SANITATION DISTRICT, CENTER OF COLORADO WATER CONSERVANCY DISTRICT, CENTRAL COLORADO WATER CONSERVANCY DISTRICT, TOWN OF CASTLE ROCK, and COLORADO DEPARTMENT OF NATURAL RESOURCES,
Intervenor-Respondents-Appellees.

On Appeal from the U.S. District Court for the District of Colorado,
No. 1:14-CV-20749-PAB (Hon. Philip A. Brimmer)

APPENDIX TO FEDERAL RESPONDENT-APPELLEE'S OPPOSITION TO PETITIONER-APPELLANT'S MOTION FOR INJUNCTION PENDING APPEAL

JEFFREY H. WOOD
Acting Assistant Attorney General

ERIC GRANT
Deputy Assistant Attorney General

JENNIFER S. NEUMANN
DUSTIN J. MAGHAMFAR
SOMMER H. ENGELS
Attorneys, U.S. Dep't of Justice
Env't & Natural Resources Div.
P.O. Box 7415
Washington, DC 20044
(202) 514-1806
dustin.maghamfar@usdoj.gov

Of Counsel:

CATHERINE E. GROW
Office of Counsel
U.S. Army Corps of Engineers,
Omaha District

DANIEL INKELAS
Office of the Chief Counsel
U.S. Army Corps of Engineers

TABLE OF CONTENTS

CHATFIELD RESERVOIR STORAGE REALLOCATION

Final Integrated Feasibility Report

and

Environmental Impact Statement

July 2013

US Army Corps
of Engineers®

TABLE OF CONTENTS

This document is an Integrated Feasibility Report and Environmental Impact Statement. The sections required by the National Environmental Policy Act are starred "* NEPA Required."

This page intentionally left blank.

LIST OF TABLES

This page intentionally left blank.

LIST OF FIGURES

APPENDICES

Appendix A	Dam Safety Evaluation
Appendix B	Water Control Plan
Appendix C	Water Supply Demand Analysis
Appendix D	Ecosystem Restoration Evaluation Report
Appendix E	Wetlands
Appendix F	Species of Mammals, Birds, Reptiles, and Amphibians Known to Occur in the Project Area
Appendix G	Butterfly Species Identified at Denver Botanic Gardens at Chatfield, 1992–2001
Appendix H	USACE Hydrology Report: Chatfield Dam and Reservoir
Appendix I	USACE Hydraulic Analysis
Appendix J	Impacts of Increased Water Supply Storage on Water Quality
Appendix K	Compensatory Mitigation Plan
Appendix L	Real Estate Plan
Appendix M	Recreation Facilities Modification Plan
Appendix N	Chatfield Marina Reallocation Impact Assessment Report
Appendix O	Cost of Reallocation
Appendix P	Public and Agency Scoping Comments
Appendix Q	Avian Point Count Data
Appendix R	Antecedent Flood Study
Appendix S	Compliance with Environmental Statutes
Appendix T	National Economic Development (NED) Recreation Benefit Analysis
Appendix U	Regional Economic Development and Other Social Effects Analyses
Appendix V	Biological Assessment
Appendix W	CWA Section 404 (b)(1) Analysis Dredge and Fill Compliance
Appendix X	FWCA Report
Appendix Y	Project Implementation Costs
Appendix Z	Tree Management Plan
Appendix AA	Summaries of Water Providers' Water Conservation Programs
Appendix BB	Policy Waivers
Appendix CC	Additional Measures Beyond the Federal Project
Appendix DD	Response to Public Comments on the Draft FR/EIS
Appendix EE	Potential Failure Mode Analysis
Appendix FF	Denver Tri-Lakes Projects Chatfield Sediment Depletion Rates –Future Conditions
Appendix GG	Adaptive Management Plan
Appendix HH	Comparative Review of Reservoir Fluctuation Zone Chatfield Reallocation Project

This page intentionally left blank.

EXECUTIVE SUMMARY

1.1 Introduction

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 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, cultural, social, and economic resources affected by the proposed activity are incorporated into planning decisions.

1.1.1 Study Authority and Federal Interest

The Chatfield Dam and Lake project on the South Platte River Basin in Colorado was authorized by the Flood Control Act of 1950 (Public Law (P.L.) 81-516) for flood control purposes. Chatfield Dam is a rolled earthfill dam 13,057 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. Construction began in 1967 and was completed in August 1973. Ultimately, the project was operated for flood control (P.L. 81-516, P.L. 99-662) and other purposes: Recreation (P.L. 89-72, P.L. 99-662, P.L. 93-251); Fish/Wildlife (P.L. 99-662) and Water Supply (P.L. 99-662). By authority provided under Section 808 of the Water Resources Development Act (WRDA) of 1986 (P.L. 99-622), as amended by Section 3042 of the WRDA 2007 (P.L. 110-114), the Secretary of the Army, upon request of and in coordination with, the Colorado Department of Natural Resources (CDNR), and upon the Chief of Engineers' finding of feasibility and economic justification, may reassign a portion of the flood control 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. The reallocation was conditioned upon the appropriate non-federal interests agreeing 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. The payments would go to the United States Treasury. 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 cost shared pursuant to that section.

Section 116 of the Omnibus Appropriations Act of 2009 (P.L. 111-8) authorized the CDNR to perform modifications of the Chatfield Reservoir and any required mitigation which results from implementation of the project. In a letter, dated February 10, 2012, the Colorado Water Conservation Board, a division of CDNR, proposed to accomplish through its agencies and non-federal project partners, the water providers, all the modification and mitigation work for the

project. In addition, Section 116 directed the Secretary to collaborate with the CDNR and local interests to determine costs to be repaid for reallocated storage (as determined under Section 808, as amended) that reflect the limited reliability of the resource and the capability of non-federal interests to make use of the reallocated storage space.

This report presents the integrated Feasibility Study and EIS and economic justification required by Section 808, as amended, which the Secretary will consider prior to deciding whether to reassign a portion of the flood control storage space to joint flood control-conservation purposes.

1.1.2 Background

The CWCB requested that the Corps consider reallocating space within Chatfield Reservoir for water supply purposes, on behalf of a group of 12 water users (or water providers) in the Denver metropolitan area. While water supply remains primarily a non-federal responsibility, based on current federal authorities (described in Section 1.4), the Federal Government should participate and cooperate with states and local interests in developing such water supplies in connection with multi-purpose projects. The federally-owned Chatfield Reservoir provides an opportunity to help local communities in the Denver metropolitan (Metro) area to meet a growing demand for water. Therefore, it is the purpose of this study to identify alternatives, compare those alternatives, and select the best alternative for meeting the needs based on solid planning principles.

With the main problem being defined as increasing water demand in the Denver Metro area that exceeds available water supplies, 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 primary objective of the reallocation is to help enable water providers to supply water to local users, mainly for municipal, industrial, and agricultural needs, in response to rapidly increasing demand. Chatfield Reservoir is well placed to help meet this objective for the following reasons: 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.

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 flood protection function is still critically important today and cannot be compromised.

With approximately 1.5 million visitor days annually, Chatfield State Park is one of the most heavily utilized parks, and one of the most vital components, of the Colorado State Parks system. Given its close proximity to both the Denver Metro area and the foothills, Chatfield State Park provides a valuable and unique opportunity for the public to connect to the natural world through camping,

boating, hiking, fishing, biking, horseback riding, and wildlife viewing. Colorado Parks and Wildlife[1] works to protect and enhance fish and wildlife habitat at and around Chatfield State Park.

1.1.3 Project Location

Chatfield Reservoir is located southwest of Denver, at the confluence of the South Platte River and Plum Creek within the South Platte River Basin. The study area encompasses the area in the immediate vicinity of Chatfield Reservoir and extends downstream to where the river intersects the Adams/Weld county line. The reservoir's location is directly on the South Platte River, or "on-channel."

1.1.4 Study Sponsor

The Chatfield Reservoir storage reallocation study is being conducted jointly between USACE and the local sponsor, the CWCB. The study costs for the project were divided evenly between these two agencies.

1.1.5 Cooperating Agencies

There are a number of entities that have been invited by the Corps to participate in the Chatfield Reservoir storage reallocation study as Cooperating Agencies and Special Technical Advisors. These include selected federal, state, and local government entities, the project participants (i.e., water providers), and several environmental groups. The Cooperating Agencies and Special Technical Advisors were given the opportunity to participate in project meetings and review and comment on the Preliminary Draft chapters of the Feasibility Report/Environmental Impact Statement (FR/EIS). Coordination with agencies and compliance with environmental statutes and regulations are described in Appendix S, including coordination letters.

1.2 Study Objectives

1.2.1 Problems and Opportunities

The water resource problem to be addressed is the inadequate supply of water to meet increasing water supply demand in the Denver Metro area over the next 50 years due to the combined effects of population growth, depletion of nonrenewable groundwater sources, and agricultural water providers' need for augmentation water for alluvial wells.

Problems

1. Population growth resulting in increased M&I water demands:

   The CWCB's "Statewide Water Supply Initiative" (SWSI) estimates the state's population will be between 8.6 and 10.3 million in 2050 compared to a 2010 population of 5.0 million. The SWSI includes several "Identified Projects and Processes" (IPPs), including the Chatfield Reallocation Project, to meet the needs of the Denver Metro area. Even with the IPPs, it is expected that a significant gap in water supply availability would remain (potentially 262,700 to 435,000 acre-feet).

[1]On July 1, 2011, Colorado State Parks and the Colorado Division of Wildlife merged to form Colorado Parks and Wildlife.

The 12 prospective recipients of reallocated storage space in Chatfield Reservoir (i.e., water providers) each have immediate and future water needs which will extend beyond current supplies. The water providers project their demand to increase from 249,597 acre-feet in 2010 to at least 365,601 acre-feet in 2050.

2. Reliance of some municipal water providers on nonrenewable Denver Basin groundwater:

   The use of Denver Basin groundwater for municipal water supplies has been determined to be an unacceptable long-term supply due to severely increasing costs and the problems of currently reduced water availability and reliability that will continue to worsen in the future (Black & Veatch et al., 2003).

3. Agricultural water providers need augmentation water for alluvial wells:

   The agricultural water providers seeking Chatfield storage space are also facing an urgent water supply situation. Numerous agricultural water wells of these users are located in the alluvium adjacent to the South Platte River. These wells generally have junior water rights and when owners of senior water rights downstream place a call (or request water) during the irrigation season the agricultural usage from the wells is curtailed or completely halted under Colorado water law unless so-called "augmentation water" is available for release to the river to cover the out-of-priority depletions from the well pumping. Currently, well pumping from approximately 450 alluvial water wells has been curtailed completely and pumping from another approximately 2,000 wells has been partially reduced by court order until necessary augmentation water is secured. These wells supply water to 25,000 to 30,000 irrigated acres and divert approximately 25,000 acre-feet of water per year. The drought of 2002 to 2007, considered the worst drought in the last 300 years, exacerbated the situation. The well pumping curtailment is severely impacting well users and adversely impacting local economies.

Opportunities

1. Expanding the use of an existing storage facility to provide additional water supplies:

   Storage projects capture water during high-flow years and seasons to be used during low-flow periods, a function that is critical to providing reliable water supplies in a semiarid climate such as Colorado's where the hydrologic events are highly variable.

2. Chatfield Reservoir's on-channel location:

   The "on-channel location of the reservoir is a significant advantage over off-channel reservoirs that are limited by the design capacity of diversion and delivery facilities. Additionally, this location provides for the reservoir immediately capturing all available flows that can be legally stored.

3. Chatfield Reservoir's location at a relatively high elevation within the basin:

   Chatfield Reservoir's location and relatively high elevation within the watershed provides the opportunity to deliver water by gravity flow. Since some water providers already receive water

deliveries from Chatfield Reservoir, the need to construct new conveyances (e.g., ditches, pump stations, and pipelines) is less since an existing structure would be used for storage.

4 Ability to store augmentation water for future use:

The Chatfield Reservoir storage reallocation project would give agricultural water providers additional ability to store augmentation water for later release, thereby giving some relief from the well pumping curtailment situation.

1.2.2 Planning Objectives and Constraints

Planning objectives are the intended purposes of the planning process. Constraints are restrictions that limit the extent of the planning process. Constraints can be legal, policy related or study specific.

Planning Objectives

- Increase availability and reliability of water supply by providing an additional average annual yield of up to 8,500 acre-feet of M & I water, sustainable over a 50-year period, to contribute towards meeting a water supply shortfall projected to be 100,000 acre-feet per year by 2050 for the service area of the 12 water providers.
- Provide, over the 50-year planning period, water supply of equivalent quality as currently supplied to the Denver Metro region.
- Maintain adequate levels of downstream flood control, specifically in the Denver Metro area, over the 50-year period of analysis.
- Ensure the provision of in-kind recreation facilities and experiences, to the extent possible, during the 50-year period of analysis.
- Ensure maintenance of environmental benefits by minimizing environmental impacts, fully mitigating unavoidable significant impacts, monitoring to evaluate the level of success and utilizing adaptive management if needed.
- Become less reliant on non-renewable groundwater by utilizing renewable water supplies, thus extending the availability and life of these critical aquifers for use by future generations.
- Be consistent with the USACE Environmental Operating Principles (EOP).
- Be consistent with the USACE Campaign Plan goals.
- Find collaborative solutions to future Denver Metro area water supply needs.

Planning Constraints

- The project must be completed in a reasonable timeframe.
- Financial capability of sponsoring water providers may be constraining because they are responsible for 100 percent of the costs involved in implementing any alternative.

- The project should minimize the use of others' land or, to the extent possible, the availability or capability of other projects.

- Maintain the conservation pool in Chatfield between 5,423 feet msl and 5,432 feet msl consistent with the contract between the Corps of Engineers and the state of Colorado (March 1, 1979). The state of Colorado signed an agreement with Denver Water granting them the exclusive right to store water in Chatfield in the conservation pool. Storage below 5,432 feet msl cannot be reallocated because of the in-place contract and agreement.

- Reallocation of storage above elevation 5,444 feet msl could adversely impact the flood risk management (FRM) purposes of Chatfield, Cherry Creek, and Bear Creek Reservoirs as described in Appendix B – Tri-Lakes Water Control Plans, as documented in the Corps' Chatfield Antecedent Flood Study (Appendix R). Modifications of project structures that would allow additional storage to be reallocated to avoid affecting Chatfield's FRM functions would require additional Congressional authorization.

- Reallocation of storage less than 7,700 acre-feet was considered by the water providers to provide too little water supply benefits for the costs involved.

- Water providers would need to hold existing or newly acquired water rights and existing, new, or change-case water storage rights in order to store water in Chatfield Reservoir, another reservoir, or in gravel pits.

- The water rights of the sponsoring water providers are relatively junior in seniority, and the sponsors would be able to store water only when their water rights were "in priority", or during "run of the river" high river flows. Consequently, the average year yield is low compared to the water storage volume.

- Water providers desiring to install any infrastructure associated with on- or off-channel water storage or water distribution systems on Corps project lands must apply to the Corps for a land availability determination. If Corps project lands are determined to be available for the proposed infrastructure, the water providers must acquire the appropriate real estate easements and pay any Corps charges in accordance with Corps real estate regulations.

- Unavoidable impacts to environmental resources that are considered significant would need to be fully mitigated. This includes impacts to the federally listed threatened Preble's meadow jumping mouse habitat, migratory bird habitat, and wetlands. Costs of mitigation maintenance and monitoring costs, and any increase in Corps operation costs of an Alternative would be borne 100 percent by the non-federal entities receiving storage.

- The project must comply with the Clean Water Act and other applicable environmental laws and regulations.

- For any recreational facilities and areas that would be impacted by higher pool levels with reallocation, recreation modifications are required in-kind (the same type and amount of facilities) within the boundaries of Chatfield State Park prior to utilization of the reallocated storage. The cost of recreation modifications must be borne 100 percent by the non-federal

entities receiving storage, and are included in the total cost of the project included in Table 5-10.

- Design, materials, and elevations of recreation modification structures need to comply with the provisions of the Northwest Division (NWD) Regulation 1110-2-5, Land Development Guidance at Corps Reservoir Projects, as coordinated with USACE, Omaha District staff.

- If reallocation is implemented, losses of income to Colorado Parks and Wildlife and concessionaires at Chatfield State Park during the construction period for recreation modifications and environmental mitigation will be reimbursed by the non-federal entities receiving storage.

- Water resource infrastructure operations, water sources, including storage and conveyance components, should comprise of proven operational and management practices to minimize risk of failure to provide required yield.

- Any storage expansion or reallocation scenario within an existing reservoir that negatively affects the flood risk management function of the reservoir should be avoided. The Alternatives cannot impact dam safety.

1.3 Alternatives

1.3.1 Development of Alternatives/Screening

One of the key aspects of the NEPA process is the assessment of how various alternatives that meet the purpose and need could affect the environment. NEPA requires, at a minimum, that a "proposed action" be compared to a "no action" alternative. The No Action Alternative represents the most likely baseline conditions that would occur if the proposed project were not to move forward. The "action alternatives" are then compared to the No Action Alternative in order to determine the extent and severity of potential impacts. In addition to the procedures and requirements set forth in NEPA, Corps guidance requires an in-depth analysis following procedures outlined in the "Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies," also known as the Principles and Guidelines (P&G's)) as part of the evaluation. As a test of financial feasibility, the governing annual cost of storage is compared to the annual cost of the most likely, least costly alternative that would provide an equivalent quality and quantity of water that the non-federal interest would undertake in the absence of using the proposed federal project. The action alternatives identified and evaluated in the FR/EIS are designed to determine the best and highest use of Chatfield Reservoir. To reach these selected action alternatives, an initial screening of concepts was conducted using a defined set of criteria.

Prior to selecting the four main alternatives considered in detail, other potential alternatives were rigorously explored and evaluated. The alternatives identified for initial screening were evaluated with four general criteria described in the P&Gs: completeness, efficiency, effectiveness, and acceptability. These initial screening criteria definitions were developed based on the planning objectives and constraints identified and summarized in Chapter 2 (Section 2.2). In general terms, these four criteria would encompass the following considerations: 1) Ability to meet purpose and need; 2) Cost; 3) Logistics and technology (including water rights/water availability, land availability, permitting and mitigation feasibility, design and construction feasibility, and operational feasibility);

and 4) Environmental impacts (including significance and ability to mitigate). Furthermore, in keeping with Corps guidance, the development of alternatives considered the Corps' EOP and Campaign Plan goals. The broader view of all alternatives to increase the water supplies for the South Platte River Basin is given in SWSI, Sections 8 and 10, which is included as Appendix C of this report. In general, the alternatives considered fell within the categories of the following concepts: (1) increased storage, (2) importation of water, (3) conversion from agricultural use to municipal use, (4) increased non-tributary ground water (NTGW) use, and (5) increased water conservation.

The initial screening process demonstrates that alternatives for the importation of water or agricultural conversion have vastly higher expense and increased environmental impacts compared to the other alternatives. Importation and agricultural water conversion projects are very complex, high-impact projects that are feasible only if large volumes of yield are realized. They generally include new storage reservoirs, hundreds of miles of pipelines, and multiple pump stations. They are not realistic alternatives to a project yielding 8,539 acre-feet per year and therefore have been eliminated from further alternative consideration. As such, storage options, NTGW, and water conservation were the main considerations in the analysis found in this report.

1.3.2 Alternatives Considered in Detail

As mentioned above, several concepts were initially developed and screened using the Corps' planning process. While many alternatives were eliminated from further detailed evaluation, the screening process did lead to the refinement of four main alternatives. The alternatives considered in detail in the FR/EIS are:

1. No Action—Penley Reservoir combined with Gravel Pit Storage. Under the No Action Alternative flood control storage space within Chatfield Reservoir would not be reallocated to joint flood control-conservation storage (hereafter referred to as conservation or water supply storage/pool), and the operation of the reservoir would remain the same. For this alternative it was assumed the water providers would use Penley Reservoir and gravel pit storage to meet their future water needs. The water providers would newly construct Penley Reservoir and would install the infrastructure needed to convert existing gravel pits for water storage.

2. Least Cost Alternative to Chatfield Reservoir storage reallocation—NTGW combined with Gravel Pit Storage. Normally the No Action Alternative is also the Least Cost Alternative. However, the water providers participating in the Chatfield Reservoir reallocation study are opposed to long-term use of NTGW due to water supply management strategies of becoming less dependent on non-renewable water supplies. For this study, it is assumed that NTGW could provide water to a significant part of upstream water providers through the 50-year planning period, and downstream water providers would be served by the development of gravel pits for water storage.

3. Reallocation to allow an additional 20,600 acre-feet of Water Supply Storage. The 20,600 Acre-Foot Reallocation Alternative would reallocate storage from the flood control pool to the conservation pool. The additional storage would be used for M&I water supply, agriculture, recreation, and fishery habitat protection and enhancement purposes. Under this alternative, the base elevation of the flood control pool would be raised from 5,432 to 5,444 feet msl but the

reallocation of storage for this proposal involves only the volume between 5,432 and 5,444 feet msl.

4. Reallocation to allow an additional 7,700 acre-feet of Water Supply Storage combined with NTGW and Gravel Pit Storage. The 7,700 Acre-Foot Reallocation Alternative, like Alternative 3, would reallocate storage from the flood control pool to the conservation pool for multiple purposes. Again, the additional storage would be used for M&I water supply, agriculture, recreation and fishery habitat protection and enhancement purposes. Because the average year yield from Chatfield Reservoir storage reallocation for Alternative 4 is less than the average year yield for Alternative 3, additional water supply sources (NTGW and downstream gravel pit storage) are also included in Alternative 4 so that the total average year yield equals 8,539 acre-feet, but the reallocation of storage for this proposal involves only the volume between 5,432 and 5,437 feet msl.

For consistent comparison purposes, each alternative was designed to provide an average year yield of 8,539 acre-feet, which corresponds with the yield under the maximum (20,600 acre-feet) reallocation alternative (Alternative 3). Alternatives 1 and 2 do not reallocate storage in Chatfield Reservoir, and as such, the current operations and water levels would remain unchanged with the base elevation of the flood control pool at 5432 feet msl. Alternatives 3 and 4 both consider reallocating storage from the flood control pool to the conservation pool, which would result in changes to the reservoir operations and would raise the base elevation of the flood control pool in the reservoir to 5,444 feet msl (Alternative 3) and 5,437 feet msl (Alternative 4). The Corps considers Alternative 3 the preferred alternative. The alternatives are discussed in detail in Chapter 2 of the FR/EIS.

1.3.3 Comparison of Alternatives

Alternatives 1, 2, 3 and 4 are summarized and compared in the following sections.

1.3.3.1 Financial Comparison

Table ES-1 compares the alternative costs needed to provide (yield) 8,539 acre-feet of equivalent quality water to the water providers. The present value of costs to develop, treat, deliver the water, and to operate, maintain, repair, rehabilitate, and replace (OMRR&R) the required facilities for 50 years are included in order to do the comparison of total financial costs of the alternatives.

Table ES-1
Cost of the Alternatives in Millions

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Cost of Chatfield Storage	$0.0	$0.0	$16.0	6.0
Infrastructure Costs	244.9	146.1	0.78	85.0
Environmental Mitigation	$0.0	$0.0	$58.5	$21.9
Recreation Modification	$0.0	$0.0	$47.3	$23.5
Present Valued OMRR&R	$38.48	$39.99	$56.04	$43.70
Total	$283.4	$186.1	$178.7	$180.2

1.3.3.2 Environmental Comparison

Section 2.8 and summary Table 2-9 of the main report compare the potential environmental impacts of the alternatives. It is difficult to say what the exact new condition of the environmental resources at Chatfield would be for Alternatives 3 and 4 due to the expected but unpredictably high level of fluctuation of water levels associated with these alternatives. For example, it is difficult to say exactly what the impacts to water dependent habitat might be (e.g., cottonwood trees or wetlands) if there is substantial uncertainty in knowing exactly where water surface elevations might be on an annual or seasonal basis. As such, a conservative approach to the impact analysis was taken to reflect the maximum potential impacts that might be associated with the inundation of environmental resources. This worst-case scenario approach was taken to ensure adequate mitigation could be planned and subsequently reasonably attained for any potential impacts that may develop. The table also provides a synopsis of actions to avoid and/or reduce potential impacts. Environmental impacts associated with each alternative are discussed in detail in Chapter 4. In addition, impacts to federally-listed threatened, endangered, and candidate species (T&E species), and their critical habitat, from the preferred alternative (i.e., Alternative 3) are described in the Biological Assessment (Appendix V).

Although a worst-case scenario approach was taken to ensure adequate mitigation would be planned and implemented, it is unlikely that all vegetation and wildlife habitat will be lost below the new reservoir high water line with reallocation (i.e., 5,444 feet msl for Alternative 3) so an adaptive management approach to implementation will be used. Chapter 4 describes the more likely scenario. For example, for Alternative 3 the lower limit of persistent vegetation is estimated to be 5,438 feet msl with losses of upland vegetation and gains of wetland and riparian vegetation between 5,438 feet msl and 5,444 feet msl. The Tree Management Plan (Appendix Z) calls for retaining trees above 5,439 feet msl and using a monitoring and an adaptive management approach to subsequently remove trees between 5,439 feet msl and 5,444 feet msl on an as-needed basis to eliminate potential risks to visitors and dam safety and operations.

1.3.3.3 Environmental Operating Principles (EOP)

The Environmental Operating Principles (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. Chapter 2, Section 2.8.3 Consistency of Alternatives with the EOP, includes an assessment of the consistency of each of the alternatives with the seven EOP.

1.3.3.4 Trade-off Analysis

A detailed trade-off analysis is presented in Chapter 5. It should be noted, with Alternative 3, the costs are less than with the other alternatives, it provides storage for renewable surface water in an existing reservoir, and because it is located on the South Platte River it can capture flows associated with water providers' junior water rights more efficiently than the other alternatives. Additionally, Alternative 3 would use surface water, a renewable source, rather than NTGW that is not renewable.

1.3.3.5 Key Risks and Uncertainties

The study includes analyses of impacts and costs, and there are uncertainties associated with the assumptions used in these analyses. The key risks and uncertainties include modeling of elevations and downstream flows, mitigation and modification plans, and impacts of flood control benefits.

Chapter 5 includes a discussion of the main sources of uncertainty, such as the modeling of the reservoir pool elevations and downstream flows. Standard models and conservative assumptions were used in the study in order to reduce the uncertainties. While mitigation and modification plans have been developed (including an adaptive management component) in coordination with resource agencies, there is still a level of concern that implementing a reallocation could lead to a somewhat different condition for which environmental mitigation or recreational facility modification has not been designed appropriately. In order to relieve these concerns, the water providers are working closely with resource agencies to reach consensus on potential projects and/or project features that might be implemented that would provide additional benefits where the mitigation and modification plans leave off. These projects would be implemented as a part of the non-federal requirements that lie outside of the federal interest.

1.3.3.6 Impacts to Flood Control

Evaluation of the impacts of reallocation on flood control benefits included evaluation of impacts at Chatfield Reservoir, as well as impacts at Bear Creek Reservoir and Cherry Creek Reservoir, and on the South Platte River from Chatfield Reservoir to Julesburg, Colorado. Impacts on flood control benefits were evaluated through use of a hydrologic model to simulate the operations at Chatfield, Cherry Creek, and Bear Creek Reservoirs for the historical period of record. An adjustment was made in the model to historic streamflows to account for current urbanization through the study reach, and the model was used to develop flow and elevation duration and probability relationships for the reservoirs and for the South Platte River downstream of the reservoirs for with and without project conditions. Reallocation would not impact the primary flood risk management purpose of Chatfield Reservoir. During Tri-Lakes system flood control storage evacuation for Level I (small flood events), as defined in Appendix B – Tri-Lakes Water Control Plans, the reallocation of flood control storage at Chatfield slightly increases releases and affects the timing and duration of releases made from Cherry Creek and Bear Creek Reservoirs though the primary flood risk management purpose for Cherry Creek and Bear Creek Reservoirs is not affected. Reference Appendix B – Tri-Lakes Water Control Plans for an example of how the release magnitudes are affected. There is no change to system flood control storage evacuation releases during Level II (large flood events), as defined in Appendix B – Tri-Lakes Water Control Plans. The target flow past the South Platte River at Denver, Colorado stream gage of 5,000 cfs is unchanged, thus there is no net effect past Henderson and Julesburg, Colorado.

Because the period of record does not include extremely large flood events, the impacts of reallocation on the Reservoir Design Flood and Inflow Design Flood were also evaluated. The Reservoir Design Flood is the size of flood a reservoir is designed to store with minimal or no releases from the reservoir, and this flood normally produces a reservoir pool elevation near the spillway crest. With reallocation, the Reservoir Design Flood could still be controlled with a shorter release shutdown period of three days following that event. The original Reservoir Design Flood was based on a release shutdown period of five days. The Inflow Design Flood (or Spillway Design Flood) is used to determine the size of the spillway and height of the dam embankment. The evaluation of the Inflow Design Flood included a more detailed analysis of the antecedent flooding conditions. With the proposed reallocation, and use of an antecedent flood of 40 percent of the Probable Maximum Flood, the resulting maximum pool elevation in the reservoir was 5520.9 feet msl, as compared to the original maximum pool elevation of 5521.6 feet msl.

1.3.3.7 Choosing the Selected Plan

The Chatfield reallocation alternative with 20,600 acre-feet of reallocated storage is the Selected Plan. This plan is the least cost alternative, the locally-preferred plan and would provide $8.42 million in annual National Economic Development (NED) benefits. The total annual NED project cost would be $7.92 million. The adverse impacts to recreation and the environment are mitigable and would be mitigated to the most sustainable alternative to below a level of significance. The Recreation Modification Plan (Appendix M) provides a detailed plan for addressing recreation impacts at Chatfield State Park. A Compensatory Mitigation Plan (CMP), Appendix K, was developed to address environmental impacts associated with Alternative 3.

The water providers continue to work with Colorado Parks and Wildlife (formerly Colorado State Parks and Colorado Division of Wildlife) staff to identify the additional features that will enhance the recreational experience and provide ecological benefits beyond required modification and mitigation plans. The water providers have developed a preliminary list of these additional measures, based on input from Colorado Parks and Wildlife staff and other non-governmental organizations and the general public. See Chapter 6, Section 6.2.3.

1.3.4 Selected Plan

1.3.4.1 Plan Components

The Selected Plan would reallocate 20,600 acre-feet of Chatfield's flood control storage to water supply storage. Environmental mitigation and recreation modifications are significant components of the plan, as they are required to address the adverse impacts caused by changing the operation of the reservoir, which would involve a significant change in how water levels fluctuate within the reservoir. In addition, adaptive management is an integral component of the overall plan, which will help in addressing issues that may arise post-decision.

1.3.4.2 Design/Construction Considerations

The water providers would construct facilities required to collect, transfer, treat, and distribute the additional water reallocated from Chatfield Reservoir. The water providers would finance all environmental mitigation and recreation modifications. The Corps of Engineers, U.S. Fish and Wildlife Service, and state of Colorado would review the design and monitor the construction of mitigation and modification measures.

1.3.4.3 Operation and Maintenance Considerations

The water providers would be responsible for the operation, maintenance, and repair of infrastructure, treatment, and distribution facilities associated with the additional water. They would also provide their share of the Chatfield Project operation, maintenance, repair, rehabilitation, and replacement (OMRR&R) costs. The water providers would be responsible for monitoring the mitigation sites for five years following development and managing the mitigation sites over the period of analysis.

1.3.4.4 Financial Feasibility Considerations

Financial feasibility of the Selected Plan is established by comparing the alternatives from two standpoints: NED costs and financial costs, which are presented in detail in Chapter 5 and

Appendix O. Tables ES-1 and ES-2 show the total implementation and OMRR&R financial costs and the annual financial costs, respectively, for the alternatives.

The financial cost comparison identifies the alternative that minimizes the costs the water providers would expend implementing each alternative. To develop comparable alternatives, for both the financial analysis and the NED analysis the costs were adjusted to the same price level taking into consideration that water must be supplied at the same rate over time (benefits) for all alternatives. The costs are adjusted to a base year that is two years after project approval to allow for construction activities (environmental mitigation and recreation modifications) to be completed prior to implementing the reallocation and raising the conservation pool elevation. Identical water supply increments were assumed for development over an 11-year period after approval, in accordance with Tables 13 and 14 in the CMP. Implementation costs for each alternative were then compared by aggregating each alternative's cost over the 50-year planning period into a revised first cost (present value). As shown in Table ES-2, Alternative 3 is identified as having the lowest annual financial costs for the water providers to implement and has the lowest annual financial costs per acre-foot of average year water yield.

Table ES-2
Annual Financial Costs of the Alternatives

	User Costs in $Millions			
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 4**
Annualized Initial/Implement. Costs	$10.92	$6.51	$5.47	$6.08
Annual OMRR&R Costs	$1.72	$1.78	$2.50	$1.95
Total Annual Costs	$12.64	$8.29	$7.97	$8.03
Annual Implementation Cost/acre-foot	$1,278	$763	$640	$712
Annual OMRR&R Cost/acre-foot	$201	$209	$292	$228
Total Annual Cost/acre-foot	$1,479	$971	$933	$940

The NED comparison identifies the alternative that maximizes net benefits by comparing the first cost and annual costs of each alternative to the least costly no action alternative (Alternative 2). NED costs differ from financial costs in that they include interest during construction (IDC) and NED benefits foregone but do not include the cost of storage. The NED Selected Plan is Alternative 3, which has a lower investment cost (first cost plus IDC) and lower annual cost than Alternative 2 by $38,922,400and $493,400, respectively. More details of the Selected Plan are provided in Section 1.3.4.5.

1.3.4.5 Plan Accomplishments

The Selected Plan meets all federal NED goals providing $8.4million in annual NED benefits to total annual NED project costs of $7.92 million. It meets Corps of Engineers goals, and all required environmental mitigation and recreation modifications are reasonably attainable. It provides an average year yield of 8,539 acre-feet at less cost than other alternatives for water supply. From a regional economic perspective, the Selected Plan will provide benefits of 2,257 person-years of employment over a 50-year period in the study area and approximately $318 million in economic output estimated in the region. Although the Selected Plan will require significant modification of existing recreational facilities to offset impacts of the reallocation, the replacement of roads and facilities that are currently over 30 years old can be viewed as a positive aspect of the project. In addition, while the Selected Plan will require mitigation to offset impacts to mainly terrestrial based effects (wetland and riparian habitats, including Preble's meadow jumping mouse critical habitat), there will be positive environmental effects to the fisheries supported by the reservoir. Namely, the inundation of terrestrial habitats will result in increased habitat structure for use by fish and other

aquatic life. In addition, increased primary productivity as a result of increased shoreline inundation will increase productivity at virtually every trophic level in the aquatic food web.

Finally, a payment for the cost of storage estimated to be $16,046,300 at FY2013 price levels will be made to the U.S. Treasury over 30 years at the applicable federal water supply interest rates.

1.3.4.6 Implementation

The Colorado Department of Natural Resources, through its agencies and non-federal project partners will complete 100 percent of the integral work at no cost to the Federal Government per the 1958 Water Supply Act for this reallocation. Said work will involve every phase of design and construction including but 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

The work tasks identified above are further described in Chapter 6, and Appendices K and M. This work is integral in order to ensure in-kind replacement of facilities and to mitigate environmental impacts.

Agreements between the Federal Government, the state of Colorado and the water providers will be executed prior to the reallocation of storage at Chatfield. The water providers would also construct the infrastructure needed to deliver their water for final use. The water providers would be responsible for any specific construction and/or operational costs associated with the reallocation action, environmental mitigation costs, and recreational modification costs. Prior to entering into storage agreements with the Federal Government, the water providers may need to reach separate agreements with the Colorado State Parks Board and/or the Colorado Wildlife Commission related to the Chatfield project, in accordance with Colorado State Law. The Corps continues to have discussions with the state and the water providers to further refine the legal relationship between the entities.

1.3.5 Public Involvement, Review, and Consultation

As the lead agency for the project, USACE developed a public involvement plan to ensure open communications from the beginning of the NEPA process. Specifically, the public involvement program objectives were to:

- Ensure that affected/interested parties receive accurate, timely information throughout the project by mailing the Scoping Notice and Draft FR/EIS Notice of Availability to parties recorded on the mailing list.
- Provide opportunities for affected/interested parties to convey their concerns and opinions and to ask questions as part of the NEPA process and FR public involvement requirements.
- Comply with NEPA, other applicable laws, and USACE regulations.

Chapter 8, Table 8-1 presents a summary of NEPA public involvement performed by USACE for the Chatfield Reservoir storage reallocation study.

On June 8, 2012, the Notice of Availability of the Draft FR/EIS was posted in the Federal Register. The comment period was open from June 8, 2012 to September 6, 2012. A total of 903 comment letters were received on the Draft FR/EIS during the public comment period. All of the comments were reviewed and categorized based on the topic of the comment. Categories with the most comments (in descending order) were mitigation, alternatives, economics, recreation, water rights, NEPA, downstream flow, planning process, and water quality. The Draft FR/EIS has been revised to incorporate responses to substantive public comments, as appropriate. Appendix DD includes a list of all commenters, the consolidated comments, and the Corps of Engineers' responses to the comments on the Draft FR/EIS. Appendix DD also includes copies of the agency comment letters.

This page intentionally left blank.

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[1] (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 a 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.

[1] 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, 80th Congress, 2nd 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.

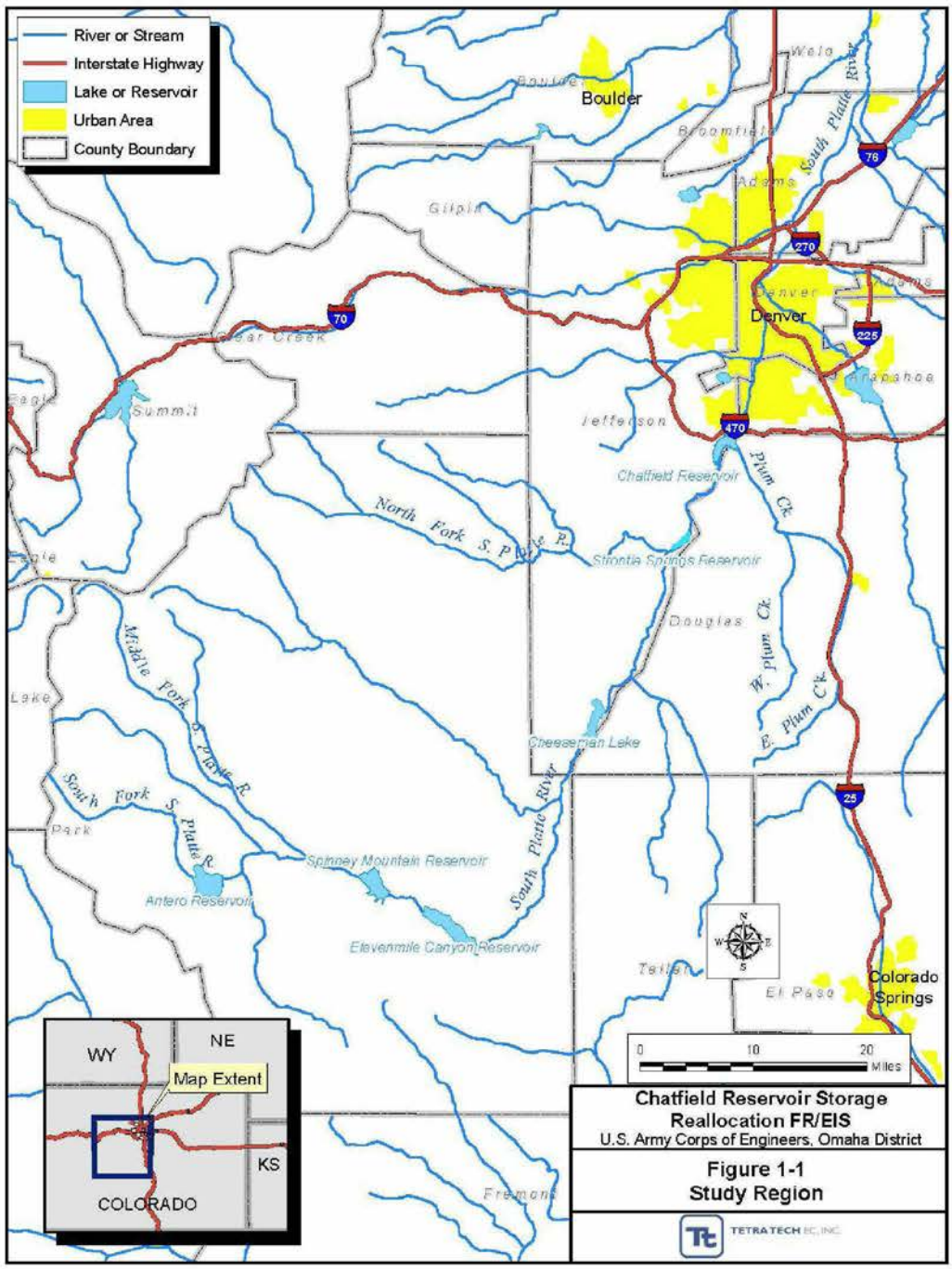
1.4 Study and Implementation Authorities

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:

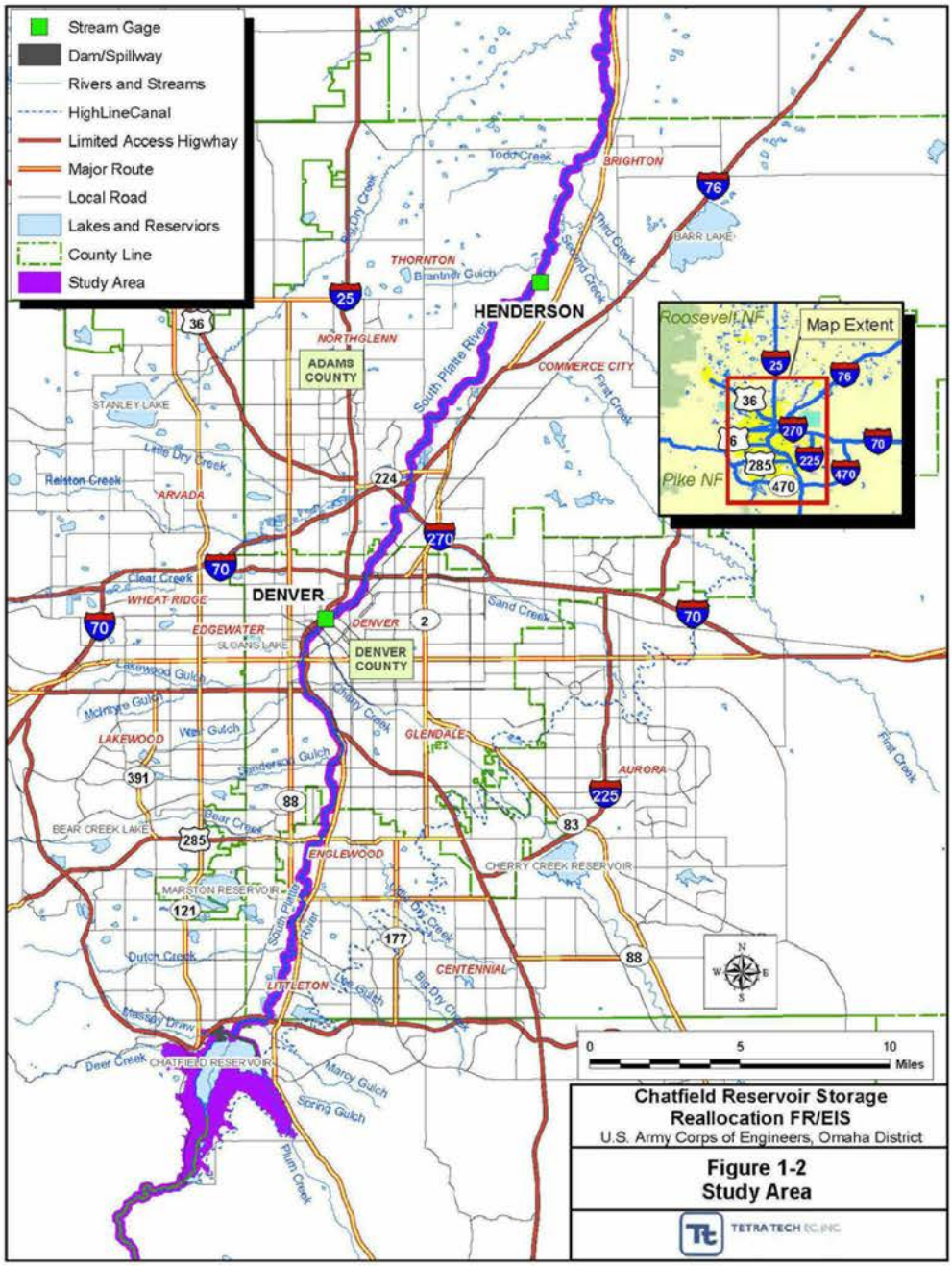
> The Project for flood control and other purposes on the South Platte River Basin in Colorado, authorized by the Flood Control Act of 1950 (64 Statute 175) is modified to authorize the Secretary, upon request of and in coordination with the Colorado Department of Natural Resources and upon the Chief 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



This page intentionally left blank.

Figure 1-2
Study Area



This page intentionally left blank.

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.

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
Downstream Water Providers				
Unassigned[1]	TBD	Unassigned	3,561	17.3
Central Colorado Water Conservancy District (WCD)	Agricultural	Agricultural[8]	2,849	13.8
Colorado Parks and Wildlife[6,7]	Governmental: State Agency	Recreation	1,000	4.9
Denver Botanic Gardens at Chatfield	Governmental: City and County of Denver	Recreation and Agriculture[8]	40	0.2
Western Mutual Ditch Company	Agricultural	Agricultural[8]	1,425	6.9
Upstream Water Providers				
Unassigned[1]	TBD	Unassigned	564	2.7
Castle Pines Metropolitan District (MD)[3]	Local government serving Denver suburban area	Municipal and Industrial[2]	785.6	3.8
Castle Pines North Metropolitan District (MD)[3]	Local government serving Denver suburban area	Municipal and Industrial[2]	941.5	4.6
Town of Castle Rock[3]	Municipality	Municipal and Industrial[2]	1013.1	4.9
Centennial Water and Sanitation District (WSD)[3]	Local government serving Denver suburban area	Municipal and Industrial[2]	6434.9	31.2
Center of Colorado Water Conservancy District (WCD)	Governmental: Park County	Municipal and Industrial[2]	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[2]	400	1.9
South Metro Water Supply Authority (SMWSA)[3]	Local governments providing water supplies to Denver suburbs	Municipal and Industrial[2]	1354.3	6.6
Includes storage for the following entities[4]:				
Arapahoe County Water and Wastewater Authority			121.6	0.59
Castle Pines North MD			64.3	0.31

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 [5]			64.3	0.31
Stonegate Village MD			64.3	0.31
Town of Castle Rock			487.2	2.37
Total			**20,600**	**100%**

[1]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.

[2]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.

[3]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.

[4]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.

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

[7]On July 1, 2011, Colorado State Parks and the Colorado Division of Wildlife merged to form Colorado Parks and Wildlife.

[8] 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

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 discharge-damage 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 long-term 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

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 basin-by-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.

Table 1-2
Demand in Acre-Feet

	Water Demand	Supplies other than NTGW	NTGW Supplies	Unmet	Projected Future Demand[1]			
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[2]	15	15	0	0	815	1,015	1,036	1,036
Other SMWSA[3]	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

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

2. ALTERNATIVES

The CEQ regulations for implementing NEPA require that an EIS "rigorously explore and objectively evaluate all reasonable alternatives" including the No Action Alternative [40 CFR 1502.14(a) and (d)]. In determining the scope of alternatives to be considered for meeting the purpose and need, the CEQ guidance states: "reasonable alternatives include those that are practical or feasible from the technical and economic standpoint using common sense" (CEQ, 1978). The Corps' regulations in 33 CFR 320.4(a)(2)(ii) require an evaluation that considers "the practicability of using reasonable alternative locations and methods to accomplish the objective of the proposed structure or work." Thus, under NEPA, an EIS provides for full disclosure of potential effects of a proposed federal action and of all reasonable alternatives to that proposal to allow for an informed decision made in the public's interest.

This chapter discusses the problems and opportunities that surround the issue of reallocating storage in Chatfield Reservoir. Considering the complexity of water use and water rights in Colorado, the chapter provides some background information to set the stage for describing the components of the alternatives as well as the impact analysis discussions presented in Chapter 4. Readers are referred to the Water Supply Demand Analysis in Appendix C for additional information on the technical and legal framework for water use. This chapter provides a description of the alternative selection process, including the initial screening of alternatives from a large group of potential water supply concepts. This chapter also provides a detailed description of each of the alternatives and their various components for addressing the purpose and need of the project; gives a description of the methodologies used to evaluate the different alternatives; assesses potential economic and environmental impacts; and, lastly, provides a brief summary of the findings detailed in the alternatives' impact analysis presented in Chapter 4.

2.1 Problems and Opportunities

The first step in the planning process, per USACE regulations, is the identification of problems (i.e., undesirable conditions to be solved) and opportunities (positive conditions to be improved) that the planning team seeks to address (ER 1105-2-100, Appendix E, p. E-2). Problems and opportunities encompass current as well as future conditions and are defined in terms of their nature, cause, location, dimensions, origin, timeframe, and importance. The water resource problem to be addressed is the inadequate supply of water to meet increasing water supply demand in the Denver Metro area over the next 50 years due to the combined effects of population growth, depletion of nonrenewable groundwater sources, and agricultural water providers' need for augmentation water for alluvial wells.

Problems

1. Population growth has resulted in increased M&I water demands:

   In the past, the Colorado water picture has been difficult to bring into focus given the multitude of individual water users and providers, the voluminous information available, and the complexity of developing water supply solutions. As a means to address the collective water communities' desire to understand its water supply situation, the CWCB undertook, at the direction of the Colorado General Assembly, the SWSI in 2003-2004 and 2009 to identify water

supply needs now and in the future and inventory current and future projects and processes that local and regional entities are planning to fulfill the water supply needs.

The SWSI report first looked at the predicted increase in the state's population. Colorado's population is projected to double between the years 2000 and 2050 (CWCB, 2009). Similar growth rates are expected during the same time period within the South Platte River Basin, which includes the Denver Metro area (CWCB, 2004, 2009). Based upon the rates of growth, expected per capita M&I water use, and a specified level of long-term water conservation by the area's M&I water providers, SWSI predicted that the South Platte River Basin would require about 1.2 million acre-feet of water by 2050 for M&I purposes (medium scenario demand projection, CWCB, 2009). This volume represents a 409,000 acre-foot increase over current (i.e., 2000) water supplies in the basin. Local and regional projects and processes, as reported in SWSI, are predicted to provide for about 78 percent of the identified M&I water supply gap, leaving approximately 90,000 acre-feet of unmet needs.

The 12 prospective recipients of storage space in Chatfield Reservoir (i.e., "water providers") each have immediate and future water needs influencing their actions to acquire new Chatfield storage space. The municipal water providers must supply water to the growing metropolitan area population and are therefore stretched beyond current supplies by the water provider's growth projections referenced above. The water providers project their demand to increase from 250,000 acre-feet in 2010 to at least 340,000 acre-feet in 2050. The drought of 2002 to 2007 emphasized to water providers that, despite increased levels of water conservation measures, their existing water supplies have a greater vulnerability to periods of water scarcity than previously realized and that additional water development activities, including expanding existing surface water storage facilities, are urgently needed to provide adequate water for the growing population during future droughts.

2. Water need has resulted in the reliance of some municipal water providers on nonrenewable Denver Basin groundwater:

   Ten municipal water providers seeking Chatfield storage space, collectively serving over 200,000 residents and businesses in the south portion of the Denver Metro area, are presently using a high percentage of nonrenewable Denver Basin groundwater supplies as their primary water source until more reliable surface water supplies can be developed. The use of Denver Basin groundwater for municipal water supplies has been determined in a recent study to be an unacceptable long-term supply, a path of severely increasing costs and currently reduced water availability and reliability that will continue to worsen in the future (Black & Veatch et al., 2003). The water providers who are now using Denver Basin groundwater have a need to reduce their dependency on this nonrenewable water source if the long-term availability of these sources during periods of drought is to be preserved. This water is legally reusable; however, the practical ability to reuse usually involves recapture (either downstream or upstream by exchange) and storage of effluent after discharge to a stream.

3. Agricultural water providers need augmentation water for alluvial wells:

   The agricultural water providers seeking Chatfield storage space are also facing an urgent water supply situation. Numerous agricultural water wells of these providers are located in the alluvium adjacent to the South Platte River. These wells generally were constructed in the 1950s or later and have relatively junior water rights. Owners of senior water rights downstream from the well users normally place a call (or request water) during the irrigation season. The agricultural water well pumping causes a delayed depletive impact to the river system and, if a senior water right is calling for water, the depletion caused from well pumping is considered "out-of-priority." Colorado water law allows this out-of-priority pumping effect only if so-called "augmentation water" is available for release to the river to cover the out-of-priority depletions from the well pumping. Currently, well pumping from approximately 450 alluvial water wells has been curtailed completely and pumping from another approximately 2,000 wells has been partially reduced by court order until necessary augmentation water is secured. These wells supply water to 25,000 to 30,000 irrigated acres and divert approximately 25,000 acre-feet of water per year. The drought of 2002 to 2007, considered the worst drought in the last 300 years, exacerbated the situation. The well pumping curtailment is severely impacting well users as well as adversely impacting local economies. The Chatfield Reservoir storage reallocation project would give agricultural water providers additional ability to store augmentation water for later release, thereby giving some relief from this critical well shutdown situation.

Opportunities

1. There is an opportunity to expand the use of an existing storage facility (Chatfield Reservoir) to provide additional water supply:

   To address the water shortages resulting from population growth, Colorado water providers have the options of either stretching existing supplies, developing new supplies, or, most likely, both. SWSI identifies several broad strategies for meeting the South Platte River Basin's future water needs including: development of additional storage, M&I reuse, agricultural water transfers, conjunctive use of surface and groundwater, and additional water conservation (SWSI, Section 8, p 8-1). Developing additional storage is further described as either utilizing new storage projects or expanding the use of existing storage facilities. The reallocation of storage space in Chatfield Reservoir is a project that fits into the strategy of expanding the use of existing storage facilities.

   Storage projects capture water during high-flow years and seasons to be used during low-flow periods, a function that is critical to providing reliable water supplies in a semiarid climate such as Colorado's where the hydrologic events are highly variable. SWSI concludes that "new storage and enlargement of existing reservoirs will be major components in meeting 2030 demands" (SWSI, Section 10.1.9.1, page 10-41). The major opportunity offered, of course, by reallocation of storage space in Chatfield Reservoir is that new storage space is made available in an existing structure without the costly and more environmentally impacting action of constructing new storage facilities.

2. Chatfield Reservoir's on-channel location provides the opportunity to logistically and cost-effectively capture available flow:

   The reservoir's location directly on the South Platte River, or "on-channel," allows-the reservoir to always immediately capture all available flows that can be legally stored. This is a significant advantage over off-channel reservoirs that are limited by the design capacity of diversion and delivery facilities. In addition, upstream storage at Chatfield Reservoir could be operated in conjunction with existing off-channel storage facilities further downstream to allow certain water providers to maximize the capture of their junior water rights and free river water. For several of the upstream water providers, Chatfield Reservoir is downstream of their wastewater treatment plant outfalls and provides an opportunity for recapture of reusable water for indirect reuse.

3. Chatfield Reservoir's location at a relatively high elevation within the basin provides opportunity to deliver water by gravity flow:

   Chatfield Reservoir's location and relatively high elevation within the watershed provides the opportunity to deliver water by gravity flow. Since some water providers already receive water deliveries from Chatfield Reservoir, there is less need for the construction of new conveyances (e.g., ditches, pump stations, and pipelines) than there would be from new storage facilities.

4. Ability to store augmentation water for future use:

   The Chatfield Reservoir storage reallocation project would give agricultural water providers additional ability to store augmentation water for later release, thereby giving some relief from the well pumping curtailment situation.

2.2 Planning Objectives and Constraints

The end of the first step in the planning process, per USACE regulations, is to identify planning objectives and constraints. Planning objectives are the intended purposes of the planning process, specifically an asserting of what the alternative should try to achieve. Constraints are restrictions that limit the extent of the planning process.

2.2.1 Planning Objectives

The purpose and need is to increase availability and reliability of water supply by providing an additional average year yield (or "average annual yield"; which is defined as the average annual amount of water expected to result from the storage of available water rights with the largest Chatfield reallocation alternative) of up to approximately 8,539 acre-feet of M&I water, sustainable over a 50-year period, to contribute towards meeting a water supply shortfall projected to be 90,000 acre-feet per year by 2050 for the service area of the 12 water providers. The planning objectives for this project are listed below.

- Provide, over the 50-year planning period, water supply of equivalent quality as currently supplied to the Denver Metro region.

- Maintain the authorized purposes of the Chatfield Reservoir as they currently exist which includes maintaining adequate levels of downstream flood control over the 50-year period of analysis.

- Ensure the provision of in-kind recreation facilities and experiences, to the extent possible, during the 50-year period of analysis.
- Ensure maintenance of environmental benefits by minimizing environmental impacts, fully mitigating unavoidable significant impacts, monitoring to evaluate the level of success, and implementing an adaptive management strategy involving input from several agencies.
- Become less reliant on non-renewable groundwater by utilizing renewable water supplies, thus extending the availability and life of these critical aquifers.
- Be consistent with USACE Environmental Operating Principles (EOP) and USACE Campaign Plan goals including robust design, risk management and communication, reliability and adaptability to future change.
- Find collaborative solutions to future Denver Metro area water supply needs.

2.2.2 Constraints

The regulations describe planning constraints as "restrictions that limit the planning process…including resource constraints and legal and policy constraints" (ER 1105-2-100, p. 2-3). Resource constraints are those associated with limits on knowledge, expertise, experience, ability, data, information, money, and time. Legal and policy constraints are those "defined by law, Corps policy and guidance." Planning constraints also include study-specific constraints. Planning studies can evaluate alternatives that would require further authorization or even changes to existing laws and policies to implement.

For efficiency purposes and to save time and money, the study utilizes several recent and relevant water planning studies as cited throughout this FR/EIS. Particularly the analysis focuses on previous South Platte River Basin storage projects as a source of useful information. Data also considered in this analysis were collected from involved water providers to determine the near-term need for water that could be provided by up to a 20,600 acre-foot reallocation at Chatfield Reservoir.

Although the storage reallocation opportunity at Chatfield Reservoir is clearly a favorable water supply option for the various local water providers, the proposed reallocation of storage space does not come without potential conflicts and impacts relating to the existing uses of the reservoir and the land in the immediate vicinity. Reallocation would not impact the primary flood risk management purpose of Chatfield Reservoir. During Tri-Lakes system flood control storage evacuation for Level I (small flood events), as defined in Appendix B – Tri-Lakes Water Control Plans, the reallocation of flood control storage at Chatfield Reservoir slightly increases releases and affects the timing and duration of releases made from Cherry Creek and Bear Creek Reservoirs though the primary flood risk management purpose for Cherry Creek and Bear Creek Reservoirs is not affected. Reference Appendix B – Tri-Lakes Water Control Plans for an example of how the release magnitudes are affected. There is no change to system flood control storage evacuation releases during Level II (large flood events), as defined in Appendix B – Tri-Lakes Water Control Plans. As discussed in Chapter 1, however, Chatfield Reservoir is one of the Colorado State Park's chief attractions. Open space within the park and its environs provide habitat for numerous species of interest including the federally-listed Preble's meadow jumping mouse. Increasing the pool elevation and increasing the magnitude of water level fluctuations within the reservoir would affect

recreational uses and environmental resources within the area. Significant environmental impacts must be mitigated. Recreation modifications can be accomplished within the boundaries of Chatfield State Park, but availability of local lands for environmental mitigation is a constraint. Sufficient lands would be needed onsite and offsite to mitigate environmental impacts from the project.

Legal and policy constraints include compliance with county, state, and federal permitting or other requirements. The project must also comply with the Clean Water Act and other pertinent environmental laws and regulations. A summary of environmental compliance is described in Appendix S.

Study-specific constraints are restrictions unique to the project that alternative plans should avoid. They are designed to avoid undesirable changes between without- and with-plan conditions. Study-specific constraints for this project include:

- The project must be completed in a reasonable timeframe.
- Financial capability of sponsoring water providers may be constraining because they are responsible for 100 percent of the costs involved in implementing any alternative.
- The project should minimize the use of others' land or, to the extent possible, the availability or capability of other projects.
- Maintain the conservation pool in Chatfield between 5,423 feet msl and 5,432 feet msl consistent with the contract between the Corps of Engineers and the state of Colorado (March 1, 1979). The state of Colorado signed an agreement with Denver Water granting them the exclusive right to store water in Chatfield in the conservation pool. Storage below 5,432 feet msl cannot be reallocated because of the in-place contract and agreement.
- Reallocation of storage above elevation 5,444 feet msl could adversely impact the flood risk management (FRM) purposes of Chatfield, Cherry Creek, and Bear Creek Reservoirs as described in Appendix B – Tri-Lakes Water Control Plans, as documented in the Corps' Chatfield Antecedent Flood Study (Appendix R). Modifications of project structures that would allow additional storage to be reallocated to avoid affecting Chatfield's FRM functions would require additional Congressional authorization.
- Reallocation of storage less than 7,700 acre-feet was considered by the water providers to provide too little water supply benefits for the costs involved.
- Water providers would need to hold existing or newly acquired water rights and existing, new, or change-case water storage rights in order to store water in Chatfield Reservoir, another reservoir, or in gravel pits.
- The water rights of the sponsoring water providers are relatively junior in seniority, and the sponsors would be able to store water only when their water rights were "in priority", or during "run of the river" high river flows. Consequently, the average year yield is low compared to the water storage volume.

- Water providers desiring to install any infrastructure associated with on- or off-channel water storage or water distribution systems on Corps project lands must apply to the Corps for a land availability determination. If Corps project lands are determined to be available for the proposed infrastructure, the water providers must acquire the appropriate real estate easements and pay any Corps charges in accordance with Corps real estate regulations.

- Unavoidable impacts to environmental resources that are considered significant would need to be fully mitigated. This includes impacts to the federally listed threatened Preble's meadow jumping mouse habitat, migratory bird habitat, and wetlands. Costs of mitigation maintenance and monitoring costs, and any increase in Corps operation costs of an Alternative would be borne 100 percent by the non-federal entities receiving storage.

- The project must comply with the Clean Water Act and other applicable environmental laws and regulations.

- For any recreational facilities and areas that would be impacted by higher pool levels with reallocation, recreation modifications are required in-kind (the same type and amount of facilities) within the boundaries of Chatfield State Park prior to utilization of the reallocated storage. The cost of recreation modifications must be borne 100 percent by the non-federal entities receiving storage, and are included in the total cost of the project included in Table 5-10.

- Design, materials, and elevations of recreation modification structures need to comply with the provisions of the Northwest Division (NWD) Regulation 1110-2-5, Land Development Guidance at Corps Reservoir Projects, as coordinated with USACE, Omaha District staff.

- If reallocation is implemented, losses of income to Colorado Parks and Wildlife and concessionaires at Chatfield State Park during the construction period for recreation modifications and environmental mitigation will be reimbursed by the non-federal entities receiving storage.

- Water resource infrastructure operations, water sources, including storage and conveyance components, should comprise of proven operational and management practices to minimize risk of failure to provide required yield.

- Any storage expansion or reallocation scenario within an existing reservoir that negatively affects the flood risk management function of the reservoir should be avoided. The Alternatives cannot impact dam safety.

2.3 Development of Alternatives

One of the key aspects of the NEPA process is the assessment of how various alternatives that meet the purpose and need could affect the environment. 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.

NEPA requires, at a minimum, that a "proposed action" be compared to a "no action" alternative. The No Action Alternative represents the most likely baseline conditions that would occur if the proposed project were not to move forward. The "action alternatives" are developed and screened from a broad range of concepts identified based on problems and opportunities, and then are compared to the No Action Alternative in order to determine the extent and significance of potential impacts. An action alternative (proposed action) is developed to describe the various aspects of the proposal by the lead agency (in this case, the Corps' proposal to reallocate up to 20,600 acre-feet of storage). Other action alternatives may also be developed that reduce the extent of impacts to resource areas while still meeting the purpose and need.

Corps guidance requires an economic analysis as part of the evaluation. As a test of financial feasibility, the governing annual cost of storage is compared to the annual cost of the most likely, least costly alternative that would provide an equivalent quality and quantity of water that the non-federal interest would undertake in the absence of using the federal projects. Normally the No Action Alternative (the one most likely to be implemented if Chatfield Reservoir storage is not reallocated) is also the Least Cost Alternative to the proposed action alternative (that is the least costly financial alternative, but not necessarily least costly in terms of NED). However, in this instance due to the understandable reluctance of area water providers to depend on NTGW as a viable long-term alternative to storage, a separate Least Cost Alternative including this source, referred to as the NTGW/Downstream Gravel Pits Alternative, was developed for the 50-year period of analysis in addition to the No Action Alternative.

History of the Chatfield Reservoir Storage Reallocation Study

Shortly after Chatfield Reservoir was constructed in 1973, local water providers began various individual planning processes with the hope that additional storage space in Chatfield Reservoir might be reallocated. In 1977, Denver Water filed for a conditional storage water right that included reallocated storage space in Chatfield Reservoir, and by 1985 five other entities had filed their own claims for conditional storage water rights in Chatfield Reservoir. In 1986, the authorization for the Chatfield Reservoir storage reallocation study was secured by Congressional action in Section 808 of the Water Resources Development Act. Section 808 authorizes the Secretary of the Army to implement a reallocation of existing storage at Chatfield Reservoir to any of several named purposes if the CDNR requests and coordinates the reallocation, and if the Chief of Engineers finds the reallocation feasible and economically justified. Section 116 of the Omnibus Appropriations Act of 2009 authorizes CDNR to perform facility modifications and mitigation for the project, if 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.

The planning efforts intensified with the occurrence of the MWSI, a study process initiated by Colorado Governor Roy Romer and the Colorado General Assembly in 1993. The goal of MWSI was to explore cooperative solutions to future Denver Metro area water supply needs (Hydrosphere Resource Consultants, 1999). A MWSI subcommittee on Chatfield Reservoir storage reallocation was formed in 1994 by a consortium of water providers led by the CWCB as project sponsor, per the Section 808 authorization. The MWSI subcommittee held regular meetings with representatives of the Corps and began the formal process requesting the reallocation of Chatfield Reservoir storage space. In the 905(b) Reconnaissance Report (USACE, 1996), a preliminary analysis was made of the recreational impacts to Chatfield Reservoir of storing various water quantities and determined that

large increases in expenses for recreation facility modifications occurred at elevation levels of 5,435 feet msl; 5,438 feet msl; and 5,445 feet msl. From this work, the initial alternatives to be analyzed were determined to be at elevation levels of 5,434 feet msl (2,900 acre-feet of storage); 5,437 feet msl (7,700 acre-feet of storage); and 5,444 feet msl (20,600 acre-feet of storage). Intermediate storage levels were not evaluated because the costs of recreation modifications for a 5,444-foot-msl pool elevation were believed to be similar to those for a 5,438-foot-msl-pool elevation, resulting in economies of scale that were maximized for the 5,444-foot-msl alternative. Ultimately the group determined that within Chatfield Reservoir, 20,600 acre-feet (at 5,444 feet msl) would be the volume of storage that could be reallocated without major incremental costs or jeopardizing the flood risk management function of the reservoir. This fact was further supported by the Chatfield Antecedent Flood Study (Appendix R), which passed an independent external technical review by the Bureau of Reclamation (BOR) and was approved by the Corps Headquarters in February 2006. The Chatfield Antecedent Flood Study showed that a pool raised 12 feet for water supply (with an adjustment of the reservoir flood control operating criteria) would provide the necessary freeboard without any structural modifications. Such a raise was considered to be a reasonable maximum reallocation alternative.

Thus, the proposed action of the Chatfield Reservoir storage reallocation study is to reallocate 20,600 acre-feet of storage space from flood risk management (flood control) to conservation. As further described below, the other action alternative is reallocation of 7,700 acre-feet of storage space, the third alternative is the No Action Alternative, and the fourth alternative is the NTGW/Downstream Gravel Pits Alternative (Least Cost Alternative to Chatfield Reallocation). The explanations below describe how the process was used to develop these alternatives and eliminate other alternatives.

2.3.1 Alternative Selection Process

The action alternatives identified and evaluated in the FR/EIS are designed to meet project objectives (purpose and need). To reach these selected action alternatives, an initial screening of water supply concepts was conducted using a defined set of criteria. This initial set of concepts was identified based on problems and opportunities identified in Section 2.1. The broader view of all concepts to increase the water supplies for the South Platte River Basin is given in SWSI (CWCB, 2004), Sections 8 and 10, which are contained in Appendix C. In general, the concepts are grouped in five categories: (1) increased storage, (2) importation of water, (3) conversion from agricultural use to municipal use, (4) increased NTGW use, or (5) increased water conservation.

Concepts identified for initial screening were evaluated with four general criteria described in the P&Gs: completeness, efficiency, effectiveness, and acceptability. These are specifically detailed in Section 2.6 "Evaluation Criteria." In general terms, these four criteria would encompass the following considerations:

- Ability to meet purpose and need of the action
- Cost
- Logistics and technology

  - Water rights/water availability
  - Land availability/Land use
  - Permitting and mitigation feasibility
  - Design and construction feasibility
  - Operational feasibility

- Environmental impacts

  - Significance
  - Ability to Mitigate

These initial screening criteria definitions were developed based on planning objectives and constraints identified and summarized in Section 2.2. Initial screening criteria and associated rationale for eliminating an alternative or screening it forward, are summarized in Table 2-1.

Table 2-1
Criteria for Preliminary Screening of Alternatives

Criterion Description	Rationale for Screening Criterion
Purpose and Need	
PN1- The purpose and need is to increase availability of water, sustainable over the 50-year period of analysis, in the greater Denver area so that a larger proportion of existing and future (increasing) water needs can be met.	To advance, a concept must be capable of assisting in providing the water providers with a common regional solution, able to provide a reasonably sufficient portion of the total requested average year yield of approximately 8,539 acre-feet (AF), and not be held up in extensive litigation, extensive permitting, or other timeliness issues.
Cost	
C1- The cost of the project must be affordable The cost of a concept includes a broad estimate of land and water rights acquisition, design and permitting, construction and operation. At this early stage in the analysis, a qualitative estimation of costs was employed because detailed information on costs was not available or could not be estimated within the current scope of the project.	To advance, an alternative must not be unreasonably costly relative to other concepts. A reasonable cost considers whether the concept has a reasonable size relative to cost, and is substantially less (i.e., order of magnitude) than the costs associated with other water supply projects in the Colorado Front Range.
Logistics and Technology	
LT1- Water Rights/Water Availability	To advance, concepts would not require the acquisition of water rights through new filings or by purchasing and transferring existing water rights from current water providers in an unreasonably foreseeable time frame. Sites that are already fully subscribed would be eliminated because the water providers do not have the authority to acquire water or storage or it would take agreements not yet in place and unable to achieve. Preference would be given to sites with on-channel location.
LT2- Land Availability/ Land use	To advance, water sources or infrastructure components must not lie in areas that clearly would not be available for purchase or create a significant obstacle for development.
LT3- Permitting and Mitigation Feasibility	To advance, water sources should have acceptable mitigation and permitting requirements.
LT4- Design and Construction Feasibility	To advance, water sources, including storage and conveyance components, should comprise of proven technological methods to minimize risk of failure to provide the required yield. Physical conditions resulting in high risk or requiring unusual engineering solutions would be eliminated.
LT5- Operational Feasibility	To advance, water sources, including storage and conveyance components, should comprise proven operational and management practices to minimize risk of failure to provide required yield. Also, it would

Table 2-1
Criteria for Preliminary Screening of Alternatives

Criterion Description	Rationale for Screening Criterion
	not be practical to operate multiple storage facilities, pipelines or treatment facilities to meet the required yield. Advanced treatment, such as reverse osmosis systems, would not be feasible.
Environmental Impacts	
EC1- Significance –direct, indirect and cumulative impacts to wetlands and perennial streams	To advance, a concept should avoid and minimize impacts to aquatic ecosystems.
EC2- Ability to Mitigate	If significant impacts to wetlands or perennial streams are identified, then a commensurate ability to mitigate must also be identified in order to have the concept advance for further evaluation.

Screening criteria were applied to 38 project concepts. A project concept is defined as a source of water available to meet a substantial portion of the Chatfield Water Provider's requests. Each concept may include various components (e.g., storage facilities, conveyances) that could be independently used, or combined with other components, to make viable alternatives. A description of each concept evaluated in the initial screening process is presented in a summary table (Table 2-2) with a general discussion of the screening process and outcomes provided in the following sections.

Table 2-2
Concepts Considered in Preliminary Screening of Alternatives

	Concept	Description
1.0	**Increased Water Conservation**	
1.1	Chatfield Water Providers M&I Conservation Programs	Comprehensive and aggressive water conservation (or demand management) programs implemented by the Chatfield water providers group. Key facets include progressive inclining block rate structures, regulatory ordinances, conservation incentive programs, and supply-side efficiency measures.
1.2.	Central Colorado Water Conservancy District Efficiency Program	This program supplies ultra-efficient irrigation equipment to farmers, and provides outreach seminars and in-field conservation services.
2.0	**Agricultural Transfers**	
2.1	Lower Arkansas River Concept	Delivers water from the lower Arkansas River (near Avondale or La Junta) to the Rueter-Hess Reservoir. Water pumped 96 to 133 miles with static pumping requirement of 3,100 to 3,600 feet. Firming storage required. Reverse osmosis or advanced water treatment would be required.
2.2	Middle & Lower South Platte River Concept	Delivers water from the South Platte River (near Greeley or Sterling) to Brighton. Requires purchase of South Plate River water rights. Water pumped 36 to 84 miles with static pumping requirement of 700 to 1,300 feet. Firming storage required. Reverse osmosis or advanced water treatment would be required.
2.3	Rocky Ford Highline Canal Concept	Delivers water from the Arkansas River Basin to the South Platte River Basin. The project is in a conceptual state with no identified buyer participants nor details on the conveyance route. Requires purchase of water rights and treatment of water.
2.4	South Platte River/ Farmers Reservoir and Irrigation Company (FRICO) Concept	Delivers water from Weld County to East Cherry Creek Valley via the FRICO Ditch. Agricultural water rights are being converted to municipal use, but have not been adjudicated. Treatment would be required.
2.5	Interruptible Agricultural Transfers	Alternative water resource management approaches to traditional purchase and transfer of water from irrigated lands. Example approaches include interruptible water supply agreements, long- and short-term rotational fallowing, water banks, reduced crop consumptive use, multi-year leases, spot market leases and purchase and lease-back arrangements. Principle goal is to provide some water to other uses while maintaining irrigated agricultural practices.

Table 2-2
Concepts Considered in Preliminary Screening of Alternatives

	Concept	Description
3.0	**Water Importation**	
3.1	Flaming Gorge Reservoir Concept	Delivers water from the Green River to Denver area. A contract with Bureau of Reclamation (BOR) for water from the Flaming Gorge marketable pool would be required. Compact call and legal availability and administration of depletions in Wyoming for use in Colorado would need to be resolved. Conveyance would be 357 to 442 miles of pipeline to the south Denver metropolitan area with static pumping requirements of 1,400 to 3,100 feet. Constructible and permittable West Slope diversion, storage sites, and pipeline routes would need to be evaluated. Estimated yield is 200,000 AF/year. Estimated cost is $3 to $4 Billion.
3.2	Yampa River New Supply Concept	Delivers water from the Yampa River (near Craig) to Denver area. New water rights appropriation required, and Compact call and legal availability related to endangered fish would need to be resolved for a new appropriation. Would require approximately 250 miles of pipeline, with static pumping requirement of 5,000 feet. Constructible and permittable West Slope diversion, storage sites, and pipeline routes would need to be evaluated. Estimated yield is 300,000 AF/year. Estimated cost is $3.2 Billion.
3.3	Green Mountain New Supply Concept	Delivers water from the Blue River to the Denver area via the South Platte River. Water pumped 22 miles with static pumping requirement of 1,000 feet. Requires joint use of Denver Water conveyance system. Estimated yield is 200,000 AF/year. Estimated cost is $700 Million.
3.4	Colorado River Return Concept	Delivers water from the Colorado River, downstream of Grand Junction, to the Denver area. New water rights appropriation required, and Compact call and legal availability related to endangered fish would need to be resolved for a new appropriation. West Slope storage would not be required but East Slope storage would be required. Conveyance on East Slope would be via South Platte and Arkansas Rivers. Water pumped 179 miles with static pumping requirement of 7,000 feet. Reverse osmosis or advanced water treatment would be required. Estimated yield is 250,000 AF/year. Estimated cost is $3.7 Billion.
3.5	Gunnison River Concept	Delivers water from the Gunnison River, and possibly the Blue Mesa Reservoir, to the Denver area. New water rights appropriation required, and Compact call and legal availability would need to be resolved for a new appropriation. Would require approximately 75 miles of tunnels and conduits. Constructible and permittable Western Slope diversion, pumping stations, storage, and pipeline routes would need to be evaluated.
3.6	San Luis Valley Concept	Delivers water from the Arkansas River Basin to the South Platte River Basin via pipeline. The project is in a conceptual state with no identified water rights nor details on the conveyance route. Requires purchase of water rights.
4.0	**Additional Storage within the South Platte River Basin**	
4.1	New Storage Reservoirs	
4.1.1	Penley Reservoir Site	A potential off-channel reservoir located approximately 11 miles south of Chatfield Reservoir adjacent to Colorado's foothills mountain range. The reservoir site would be created by construction of two embankments approximately 160 feet high with a total length of 3,500 feet, producing approximately 12,725 acre-feet of usable storage space. Delivery of water from the South Platte River includes a 15-mile-long gravity tunnel near Deckers or a 7.5-mile-long tunnel and pump station near Eagle Rock. Water would be delivered into the Penley Reservoir from the South Platte River at the downstream end of Waterton Canyon near the Platte Canyon Reservoir and High Line Canal.
4.1.2	Willow Creek Reservoir	A potential reservoir site located on Willow Creek, a tributary to the South Platte River located approximately one mile south of Chatfield Reservoir, in Douglas County. The property site is owned by the Colorado State Board of Land Commissioners. Planned storage capacity is approximately 4,400 AF.
4.1.3	Hritz Plum Creek Reservoir Site	A privately-owned potential reservoir site located off-channel, on Plum Creek, south of Kellytown in Douglas County and approximately 1.75 miles south of Chatfield Reservoir. A two –reservoir system was envisioned, with a planned storage capacity of approximately 2,300 AF.

Table 2-2
Concepts Considered in Preliminary Screening of Alternatives

	Concept	Description
4.1.4	Highland Ranch Reservoir Series (Reservoir Nos. 6, 7, 8, 10, 11 and 12)	Six new reservoir locations are being considered for potential reservoir sites, and all are located in Douglas County. The reservoir sites are being considered for other projects. These reservoirs are part of the current water system development plans of the Centennial Water and Sanitation District. The concept would require purchasing and transferring existing water rights from a current user. Each of the gravel pit reservoirs would require diversions to/from the South Platte River to the reservoir. The distance from the South Platte River is substantial. Total potential storage capacity is approximately 33,000 AF.
4.1.5	Upstream Local Gravel Pit Reservoirs	Three local gravel pits have been identified as potential South Platte River raw water. These sites, and their potential storage capacity include the Titan ARS Reservoir (4,500 AF), Walker Pit (540 AF), and McLean Pit (450 AF). These are located less than one mile south of Chatfield Reservoir. Each of the gravel pit reservoirs would require diversions to/from the South Platte River to the reservoir.
4.1.6	Lower South Platte River Gravel Pits	Three new gravel pits have been identified to contain 7,835 acre-feet of storage volume and includes Central Colorado WCD Gravel Pit, Western Mutual Ditch Company Gravel Pit, and one unassigned gravel pit. Each of the gravel pit reservoirs would require diversions from the South Platte River to/from the reservoir.
4.2	Storage Expansion of Chatfield Reservoir	
4.2.1	Reallocation of 2,900 AF to Storage	Reallocate storage from the flood control pool to the conservation pool. The base elevation of the exclusive flood control pool would be raised from 5,432 to 5,434 feet msl. Water providers downstream of Chatfield Reservoir would be able to use existing infrastructure to divert their portion of the stored water into their water systems. Some of the downstream water providers would need to construct new delivery facilities to deliver their new water supplies from Chatfield Reservoir. At this level, there is limited wetland inundation and most recreation features can be mitigated without relocation of structures.
4.2.2	Reallocation of 4,500 AF to Storage	Reallocate storage from the flood control pool to the conservation pool. The base elevation of the exclusive flood control pool would be raised from 5,432 to approximately 5,435 feet msl. At this level, some wetlands would be inundated, requiring mitigation. Some recreation facilities would be inundated, requiring relocation.
4.2.3	Reallocation of 7,700 AF to Storage	Reallocate storage from the flood control pool to the conservation pool. The base elevation of the exclusive flood control pool would be raised from 5,432 to 5,437 feet msl, but the reallocation of storage for this project only involves the volume between 5,432 and 5,437 feet msl. At this level, wetlands would be inundated, requiring mitigation. Many recreation facilities would be inundated, requiring relocation.
4.2.4	Reallocation of 20,600 AF to Storage	Reallocate storage from the flood control pool to the conservation pool. The base elevation of the exclusive flood control pool would be raised from 5,432 to 5,444 feet msl, but the reallocation of storage for this project only involves the volume between 5,432 and 5,444 feet msl. At this level, wetlands would be inundated, requiring mitigation. Most recreation facilities would be inundated, requiring relocation. The flood risk management functions of each of the Tri-Lakes projects would be impacted as described in Appendix B – Tri-Lakes Water Control Plans.
4.2.5	Reallocation of Greater Than 20,600 AF to Storage	Reallocate storage from the flood control pool to the conservation pool. The base elevation of the exclusive flood control pool would be raised from 5,432 to as high as 5,450 feet msl. At this level, the footprint of the park is severely affected with associated large impacts to wetlands, recreational facilities, park roadways, and local highways. The flood risk management function of the reservoir would be impacted. The flood risk management functions of each of the Tri-Lakes projects would be impacted.
4.2.6	Reallocate in the existing conservation pool (i.e., below 5,432 feet msl) for large and/or small amounts	Reallocates some of the storage space below elevation 5,432 feet msl now controlled by Denver Water to the Chatfield water providers. Requires acquisition of the storage space in the existing conservation pool from Denver Water. Would result in sufficient yield with little or no increase in reservoir level and consequential impact to recreation facilities and wetlands.

Table 2-2
Concepts Considered in Preliminary Screening of Alternatives

	Concept	Description
4.2.7	Reallocate some water in the conservation pool and some in the flood control pool in proportions that would seek to minimize ecosystem habitat flooded and effects on recreation facilities	Reallocates water from Denver Water to the Chatfield water providers. Could result in sufficient yield with little or no increase in reservoir level and consequential impact to recreation facilities and wetlands.
4.2.8	Deepening the Reservoir	Increase the storage capacity by deepening the reservoir. Requires excavation of both alluvial sediments and bedrock. The upstream side of the outlet works is at a fixed elevation. Could result in a larger "dead pool" with no access to the water without pumping.
4.3	Storage Expansion or Reallocation of Other Existing Reservoirs	
4.3.1	Rueter-Hess Reservoir	An off-stream reservoir, located approximately 9.5 miles south of Chatfield Reservoir, which will rely on surface water from nearby Cherry Creek and Newlin Gulch; and groundwater which may be alluvial groundwater or bedrock aquifer groundwater from the Denver Basin. Owned and operated by the Parker Water and Sanitation District (PWSD). The town of Castle Rock, Castle Pines North Metropolitan District and Stonegate Village Metropolitan District own the storage capacity. Water allocation subscribed and permitted under a separate planning action with the USACE. With the completed expansion, reservoir storage is approximately 72,000 AF.
4.3.2	South Platte Reservoir	A working gravel mine converted into a water storage reservoir in 2007. Located north of the Chatfield Reservoir in Arapahoe and Jefferson Counties. The Centennial Water and Sanitation District owns the site. Raw South Platte River water would be pumped to this reservoir, then to McLellan Reservoir for use within Highlands Ranch. Storage capacity is 6,400 AF.
4.3.3	McLellan Reservoir	An existing reservoir located on Dad's Clark Gulch, a tributary of the South Platte River in Arapahoe and Douglas Counties located less than one mile northeast of Chatfield Reservoir. Owned by the city of Englewood and leased to the Centennial Water and Sanitation District (CWSD). Reservoir capacity is approximately 5,000 AF. Would require diversions from the South Platte River to the reservoir.
4.3.4	Platte Canyon Reservoir	An existing reservoir located on the South Platte River at the mouth of Waterton Canyon in Douglas County, approximately 2 miles south of Chatfield Reservoir. Owned by Denver Water. Water supplied by Highline Canal. Reservoir capacity is approximately 910 AF.
4.3.5	Bear Creek Reservoir	Bear Creek Dam, the last of three dams built to protect the Denver region from floods, is located on the southwest edge of suburban Lakewood at the confluence of Bear Creek and Turkey Creek. Located off-channel, would require diversions to/from the South Platte River to the reservoir. Reservoir capacity is approximately 2,000 AF. During Tri-Lakes system flood control storage evacuation for Level I (small flood events), as defined in Appendix B – Tri-Lakes Water Control Plans, the reallocation of flood control storage at Chatfield slightly increases releases and affects the timing and duration of releases made from Bear Creek though the primary flood risk management purpose for Bear Creek is not affected.
4.3.6	Cherry Creek Reservoir	An existing reservoir on Cherry Creek located approximately 10 miles northeast of Chatfield Reservoir. The first of three dams built to protect the Denver region from floods. Owned and operated by the USACE. Located off channel, would require diversions to/from the South Platte River to the reservoir. Reservoir capacity is approximately 14,000 AF. During Tri-Lakes system flood control storage evacuation for Level I (small flood events), as defined in Appendix B – Tri-Lakes Water Control Plans, the reallocation of flood control storage at Chatfield slightly increases releases and affects the timing and duration of releases made from Cherry Creek though the primary flood risk management purpose for Cherry Creek is not affected.

Table 2-2
Concepts Considered in Preliminary Screening of Alternatives

	Concept	Description
5.0	**Conjunctive Use of Surface and Groundwater**	
5.1	Additional NTGW with Local Gravel Pit Storage	Further acquisition of non-tributary groundwater (NTGW) from the Denver Basin, with storage in local gravel pits. Requires acquisition of water rights, development of groundwater withdrawal wells, development of gravel pit storage reservoir, and accompanying water conveyance facilities.
5.2	Bedrock Aquifer Conjunctive Use	Involves capturing and using surplus South Platte River surface water supplies and injecting into bedrock aquifer for storage. Requires identification and development of subsurface groundwater storage reservoir and development of surface water collection and injection facilities. A large-scale groundwater pumping and storage concept was informally presented to Douglas County water interests, but never developed into a viable project due primarily to unreasonably high costs and a lack of surface water.
5.3	Alluvial Aquifer Conjunctive Use	Involves capturing and using surplus South Platte River surface water supplies and recharging the alluvial aquifer for storage. Requires the development of surface water collection and injection facilities. No specific projects have been identified.
6.0	**Water Reuse**	
6.1	Chatfield Water Providers Local Reuse Programs	Various forms of reuse or recapture are currently being employed, or planned to be employed, by those water providers who have reusable water.
6.2	Regional Reuse- WISE Partnership	The WISE Partnership is a proposed regional project between Denver Water ("Denver"), Aurora Water ("Aurora") and the South Metro Water Supply Authority. The Project is looking at the concept of more efficiently using reusable water supplies from Denver and Aurora municipal return flows, while maximizing the use of existing pipeline and pump station infrastructure principally owned by Aurora and the East Cherry Creek Valley Water and Sanitation District. The Partnership Project is currently in the planning stages.

2.3.2 Concepts of Agriculture Transfers and Importation of Water

The initial screening process, which has utilized SWSI and other recent, relevant planning studies (for example, The Colorado River Return Reconnaissance Study Summary Report [Boyle Engineering Corporation, 2003]) identified a number of concepts for the importation of water or permanent agricultural conversion. These concepts are listed in Table 2-2. The initial screening process concluded that these concepts have vastly higher expense, difficulties in obtaining water rights and legal agreements for out-of-basin transfers, and increased environmental impacts compared to the other alternatives.

Permanent Agricultural Transfers

Agricultural uses account for greater than 80 percent of the water diverted and consumed in Colorado (CWCB, 2009). Many agricultural users hold senior water rights that potentially can be converted to provide M&I water supply. In agricultural transfers, the permanent water right is acquired and uncertainty over future water supply is reduced. Permitting may be simpler for such transfers than for development of new supplies since the agricultural water to be acquired has already been diverted from the stream system and a portion consumed. The associated farmland generally is no longer irrigated and therefore not available for agricultural use in the future. Once the water rights are transferred and the land no longer irrigated, the assessed value is reduced significantly. This results in a significant loss of tax base for local governments and school districts.

Four generally known permanent agricultural transfer concepts were considered in the initial screening process: Lower Arkansas River, Middle and Lower South Platte River, Rocky Ford Highline Canal and South Platte River/Farmers Reservoir and Irrigation Company (FRICO). These

Table 4-1
Summary of Adaptive Management Measures to Address Potential Impacts and Uncertainty

Resource	Potential Impact	Uncertainty	Required Adaptive Management
Hydrology	Under Alternatives 3 and 4 pool elevations would fluctuate more than under Alternatives 1 and 2.	Climate change may result in more floods and more or longer periods of drought, which cannot be accurately predicted now. Annual average streamflow volumes in the South Platte could decrease with climate change (Water Research Foundation, 2012). The Corps model uses inflows during the 1942–2000 POR, which tend to be greater on average than predicted for future conditions for all alternatives. This results in a greater probability of adequate mitigation for all types of inundation-related environmental impacts.	In terms of hydrology, potential changes in pool fluctuations would be difficult to minimize under Alternatives 3 or 4. The effects of those fluctuations on other resources (e.g., target environmental resources, tree clearing, weed control, water quality, and aquatic life and fisheries) and ways to reduce effects through adaptive management are discussed under those resources.
Water Quality	Under Alternatives 3 and 4, increases in total phosphorus are expected. Removal of vegetation prior to inundation could reduce nutrients released, but concentrations could exceed Alternative 1 because of hypolimnion increase and nutrient release from inundated soils.	• Water quality analysis shows there may be uncertainty regarding internal nutrient (i.e., phosphorus) loading from increased hypoxic conditions and associated anaerobic sediments. • Water quality could be adversely affected by shoreline erosion associated with increased water level fluctuations. • The hypoxic area could expand and potentially increase the release of reduced contaminants from anaerobic sediments and increase methylation of mercury within the reservoir. • Vegetation establishment within the fluctuation zone that would eventually be inundated could increase internal nutrient loading.	• Water quality monitoring would be implemented at Chatfield Reservoir to allow for the initial and ongoing application of a dynamic water quality model and assessment of reservoir water quality conditions for compliance with water quality standards. Dynamic water quality modeling would require the appropriate monitoring of reservoir, inflow, and outflow water quality conditions. Appropriate water quality data will be collected in Chatfield Reservoir to assess compliance with promulgated water quality standards criteria. This information will be used to help determine if mitigation actions need to be taken. • Remove vegetation below 5,439 ft msl to minimize the introduction of nutrients associated with inundation, as discussed under Tree Management within the Fluctuation Zone. • Control weeds within the fluctuation zone that could increase nutrient levels when inundated. • Monitor the establishment of vegetation within the fluctuation zone that could increase nutrient levels when inundated. • Water Quality Modeling. An initial application of a dynamic water quality model could be attempted using historic water quality, meteorological, pool level, and flow data. Annual dynamic water quality models would be developed where historical data allow. If sufficient historical data are lacking, an initial application of a dynamic water quality model would be based on newly collected data. Once initially developed, a dynamic water quality model would be applied annually on an ongoing basis. Water quality, meteorological, pool level, and flow data for the past year would be used to develop a specific dynamic water quality model for the year. As the annual dynamic water quality models are developed, they could be used to conduct scenario testing of possible water quality management measures. If core objectives are threatened, a

Table 4-1
Summary of Adaptive Management Measures to Address Potential Impacts and Uncertainty

Resource	Potential Impact	Uncertainty	Required Adaptive Management
			dynamic water quality model could be used to scope out the water quality concern, and, if appropriate, identify mitigation actions to manage water quality conditions. • Determine if mitigation actions need to be taken based on an assessment of collected water quality data and findings of the dynamic water quality modeling. • If mitigation actions are needed, use dynamic water quality modeling to identify effective and reasonable actions that can be implemented. • Properly implement selected water quality mitigation actions. • Assess implemented water quality mitigation actions for effectiveness. • As necessary, adjust implemented mitigation actions or implement new mitigation actions as determined by effectiveness assessments. • Continue water quality monitoring and mitigation actions as needed.
Aquatic Life and Fisheries	Fluctuating pool levels during fish spawning and embryo development could impact reproductive success of walleye broodstock in the reservoir. Low flows and higher temperatures could increase stressors on the aquatic community downstream of the reservoir.	Adaptive management will be used to address uncertainties associated with the effects of operations of the reallocated storage related to the walleye broodstock program and to the aquatic life and fisheries in the South Platte River below Chatfield Reservoir. The uncertainties associated with operations related to aquatic life and fisheries include: • How the provisions of a coordinated reservoir operations plan relating to aquatic life and fisheries would affect project yield of the Chatfield water providers. • Factors other than reservoir operations that could adversely affect the success of the walleye broodstock program or the health of the walleye populations within Chatfield Reservoir. • Factors other than releases from Chatfield Reservoir that could adversely affect the aquatic life and fisheries of the South Platte River below Chatfield Reservoir such as alterations in flow from changes in water use by others, climate change, threats to aquatic life such as disease or invasive species, flood events, toxic spills, and increased public use. • How frequently the Chatfield water providers will be able to meet the objectives of an operations plan that includes downstream releases designed to minimize adverse	The following iterative process will be used to address uncertainties associated with aquatic life and fisheries: • The operations plan includes multiple regularly scheduled meetings involving the CPW, Chatfield water providers, and others where the current conditions relating to operations will be discussed and future operational actions will be forecasted. • Monitoring the status of the aquatic life and fisheries both within and downstream of Chatfield Reservoir are part of the regular activities conducted by CPW. CPW will share this information with the Chatfield water providers at the periodic operations meetings. • CPW will be given the opportunity at the operations meetings to discuss the status and make recommendations for improvements of operations at Chatfield Reservoir relating to both the walleye broodstock program and the fishery in the South Platte River downstream of Chatfield Reservoir. • Any alterations to the operations plan related to aquatic life and fisheries can be proposed, discussed, and mutually agreed upon by the CPW, Chatfield water providers, and Corps as part of the regular business of the operations meetings.

Table 4-1
Summary of Adaptive Management Measures to Address Potential Impacts and Uncertainty

Resource	Potential Impact	Uncertainty	Required Adaptive Management
		impacts and/or benefit aquatic life and recreation? • Changes in the Chatfield water providers' water systems that could affect operations. • Changes made to the physical habitat of the South Platte River from habitat, drainage, or flood improvement projects. • Future water demands unrelated to this project, which could change flow patterns in the South Platte River and impact aquatic life.	
Tree Clearing Within the Fluctuation Zone	A Tree Management Plan (TMP) was developed to address the removal of trees that would be inundated under Alternative 3 or 4 (FR/EIS, Appendix Z). Under Alternative 3, as proposed in the TMP, the majority of trees between 5,432 ft msl (the current high water elevation) and 5,439 ft msl would be removed prior to raising the pool elevation.	The following are uncertainties that could require adjustments to the methods used to implement the TMP: • The degree of tree survival below the new high water elevation of 5,444 ft msl; • The exact area and location of trees to be cleared; • Locations and size of tree stands to be retained below 5,439 ft msl; • Locations of where downed trees will be used for aquatic habitat enhancement; • Locations of where downed trees will be used for Preble's habitat enhancement; and • The degree of new tree establishment in the upper portions of the new fluctuation zone.	The following will be used to adaptively manage uncertainties that can affect implementation of the TMP: • Monitor the trees between 5,439 and 5,444 ft msl, and any trees retained below 5,439 ft msl, for signs of severe stress and mortality, and remove unhealthy and dead trees from this area on an as-needed basis when they pose a significant risk to visitor, boater or dam safety. • Monitor the trees between 5,439 and 5,444 ft msl, and any trees retained below 5,439 ft msl, to determine if adjustments to impact estimates and mitigation are needed. • The Corps and CPW will work together to identify areas where trees will need to be removed prior to storing water in the reallocated conservation pool to eliminate significant risks to visitor, boater or dam safety. • The Corps and CPW will work together to identify areas where removed trees will be placed to enhance aquatic habitat prior to storing water in the reallocated conservation pool. Methods to secure the trees and eliminate significant risks to visitor, boater or dam safety will also be determined. • The Corps, CPW, and FWS will work together to identify areas where removed trees will be placed to enhance Preble's habitat. The Corps and CPW will evaluate trees within the reallocated pool after water has been stored and trees have been inundated, and based on their evaluation will notify the Chatfield Reservoir Mitigation Company of the trees that need to be removed based on significant risks to visitor, boater, or dam safety/operations. • Monitor the establishment of cottonwoods and willows above and below the new high water line of 5,444 ft msl.

Table 4-1
Summary of Adaptive Management Measures to Address Potential Impacts and Uncertainty

Resource	Potential Impact	Uncertainty	Required Adaptive Management
Target Environmental Resources (wetlands, Preble's and birds)	The adverse impacts estimated for the target environmental resources are a conservative maximum estimate of the impacts. The impact estimate assumes that all of the target environmental resources below the maximum pool elevation of 5,444 feet mean sea level (ft msl) would be lost. As a practical matter, this may not be the case, and will be addressed through monitoring and adaptive management. Implementation of the CMP is expected to produce quantitative and qualitative benefits for the target environmental resources. The quantitative benefits will be measured by monitoring the ecological functional units (EFUs) gained.	The following are uncertainties that could require adjustments to the methods used to achieve objectives in the CMP as currently proposed. • All of the compensatory mitigation measures may not be completely successful; • Some compensatory mitigation activities may provide more benefit than currently estimated; • Impacts associated with inundation may be less than have been conservatively estimated for the CMP; • Not all private property owners targeted for land protection may be willing to enter into agreements to protect their property or portions of their property at a fair market price; and • Other opportunities may become available to provide mitigation determined to be of value to the target environmental resources.	The following strategies will be used to adaptively manage issues and events that adversely affect or limit proposed compensatory mitigation. • Broaden the geographic scope of the target off-site mitigation area identified in the CMP to increase the potential for protection of private lands or enhancement of public lands; • Employ corrective actions to unsuccessful mitigation activities (e.g., grade adjustments, reseeding, replanting, increased weed control, fencing, and temporary irrigation); • Reconsider the use of approved wetland mitigation banks; • Investigate opportunities to partner on future regional conservation and mitigation projects; • Adjust operations by Chatfield water providers in either the storage or release of water without adversely affecting the yield of the Chatfield water providers as identified in this reallocation project; • Investigate incentives or other options for private land owners who are unwilling to enter into agreements to protect their property or portions of their property at fair market rates; • Adjust impact assessment and mitigation based on monitoring associated with the tree management plan; and • Other measures agreed upon by the Project Coordination Team and the Chatfield water providers that are appropriate to address mitigation issues.
Weed Control Within the Fluctuation Zone	The proposed reallocation of storage at Chatfield Reservoir is predicted to result in a greater magnitude and frequency of reservoir level fluctuations compared to historical reservoir operations. When exposed, the expanded fluctuation zone provides potential habitat for the establishment of weeds.	Adaptive management will be used to address uncertainties associated with the establishment and control of weeds within the fluctuation zone. Monitoring will determine which weeds invade the fluctuation zone, their distribution, and methods that prove effective in their eradication and control. The following are uncertainties that could require adjustments to weed control in the fluctuation zone. • It is currently unknown if weeds will invade the fluctuation zone; • It is currently unknown which weeds may in become established in the fluctuation zone; • It is currently unknown which methods will prove most effective for controlling or eradicating a specific weed species; • Weed species, not currently known to the region, could	The following iterative process will be used to address uncertainties associated with controlling weeds within the fluctuation zone and will need to be incorporated into a weed control program: 1. Monitoring the fluctuation zone annually for weeds; 2. Identifying areas requiring weed control or eradication; 3. Selecting the appropriate treatment for control or eradication; 4. Properly implementing the selected treatment for control or eradication; 5. Post-treatment monitoring to determine the effectiveness of control or eradication methods; 6. Adjusting treatment as required; and 7. Continuing monitoring and treating as needed.

Table 4-1
Summary of Adaptive Management Measures to Address Potential Impacts and Uncertainty

Resource	Potential Impact	Uncertainty	Required Adaptive Management
		invade the fluctuation zone in the future; and • New methods of weed control and eradication may become available in the future and could be effective in controlling and eradicating weed species found in the fluctuation zone.	
Operations	Operation of storage in the reallocated space in Chatfield Reservoir can affect the environmental and recreation resources. It may be possible to operate the reallocated storage in a manner that will reduce the estimated impacts.	Adaptive management will be used to address uncertainties associated with the effects of inundation and operations of the reallocated storage. The uncertainties associated with the effects of inundation are discussed in the previous sections on the Target Environmental Resources and the Tree Management Plan. The uncertainties associated with operations include: • How a coordinated operations plan could affect project yield. • If a target elevation range for water surface elevations and a schedule for water storage and releases for the reallocated space can be identified that could benefit the target environmental resources and recreation. • How frequently the Chatfield water providers are able to meet the objectives of an operations plan designed to minimize adverse impacts and/or benefit the target environmental resources and recreation. • Changes in water law or water administration. • Changes in water availability due to climate change or other phenomena. • Changes in the Chatfield water providers. • Changes in the Chatfield water providers' needs or relative allocations of storage. • Changes in the Chatfield water providers' water systems, which could affect operations. • Results from monitoring that provide ongoing information on the effects of inundation on the target environmental resources. • Effects on other resources that need to be considered in reservoir operations (e.g., weeds, water quality, and downstream aquatic habitat).	The Project Coordination Team and the Chatfield Reservoir Mitigation Company will explore ways to adjust their management and operation of the reallocated storage to further minimize impacts on the target environmental resources considering system constraints and project yield. The ability to minimize these impacts may be opportunistic and/or programmatic. However, these opportunities also may be limited by water rights, costs, or other constraints. Opportunistic operations to minimize impacts associated with inundation that will be explored by the Chatfield Reservoir Mitigation Company include: • Reducing water elevations at Chatfield Reservoir to a targeted elevation range during the growing and recreation season; • Moving water from Chatfield Reservoir to other facilities when water levels are above a targeted elevation range during the growing and recreation season; and • Developing an agreement and an accounting system among the Chatfield water providers and other Chatfield Reservoir users (e.g., Denver Water) that would allow storage exchanges in other facilities to be repaid at Chatfield Reservoir outside of the growing season when water elevations at the reservoir are above a targeted elevation range during the growing and recreation season. Adaptive management will be used to address uncertainties associated with the effects of inundation and operations of the reallocated storage.

The town of Castle Rock, the Castle Pines Metropolitan District, and the Castle Pines North Metropolitan District participated in the Water Resources Optimization Study (WROS). The results of the WROS were incorporated in the Water Resources Implementation Plan (CDM, 2008), a joint project undertaken to establish a plan to fully utilize water supplies and return flows that are currently unused or under-utilized. These entities rely primarily on NTGW supplies to meet the water needs of their respective service areas. Looking towards development of sustainable water supplies, these entities are planning for development of a regional approach to using the local renewable supplies.

The Citizen's Guide to Denver Basin Groundwater describes that although the Denver Basin contains about 200 million acre-feet of recoverable water in storage, water levels are declining at rates of one inch per day (30 feet per year). Water level trends in the dominant municipal water supply aquifers (the Arapahoe and Laramie-Fox Hills) are not favorable. Between 1990 and 2000, development in the south Denver Metro area resulted in localized declines up to 40 feet per year in the Arapahoe Aquifer. The future prospects for this aquifer are of great concern to water managers. The Laramie-Fox Hills Aquifer, used for municipal water supply in the southeast Denver Metro area, has experienced localized water-level declines of up to 125 feet in the past decade. Furthermore, much of the estimated recoverable water is spread across the eastern part of the basin, where demand is minimal and the cost of extraction and conveyance is presently prohibitive. It is likely that economics will prevent the Denver Basin aquifers from being completely exhausted. Over time, large-capacity pumping may become so expensive that it simply becomes too costly to drill more wells or keep pumping existing wells with diminishing returns. Drilling more wells is not necessarily a viable long-term solution because of well-to-well interference, particularly in areas with high demand. Some well users on the western margin of the Denver Basin in Douglas County already have been forced to deepen their wells or pumps in an attempt to find more water.

"Aquifers of the Denver Basin, Colorado," is a peer-reviewed article that describes that available water reserves in the Denver Basin may be one-third less than previously estimated. There is no legal protection for pressure levels in the aquifer, and water managers are becoming increasingly concerned about the rapid water level declines (30 feet per year). Approximately 33,700 wells of record have been completed in the sedimentary rock aquifers of the Denver Basin for municipal, industrial, agricultural, and domestic purposes. The volume of annual withdrawal appears to indicate a significant acceleration in groundwater withdrawal from the Denver Basin aquifers between 1985 and 1995.

4.3.3 Alternative 3—20,600 Acre-Foot Reallocation

Alternative 3 would reallocate storage from the flood control pool to the conservation pool. Under this alternative, the elevation of the conservation pool would be raised from 5,432 feet msl (under Alternative 1) to 5,444 feet msl, but the reallocation of storage for this project only involves the volume between 5,432 and 5,444 feet msl. The average annual yield under Alternative 3 is estimated at 8,539 acre-feet. The "average annual yield" is the average annual amount of water expected to result from the storage of available water rights. The pool elevation of 5,444 feet msl would not be achieved every year due to fluctuations in the amount of runoff available on an annual basis.

The mean annual outflow from the reservoir into the South Platte River under Alternative 3 would range from 54.2 to 759.3 cfs, based on the output from the HEC-5 model. Of the alternatives, mean

annual outflows into the South Platte River would be smallest under this alternative (Figure 4-5) because more water would be maintained in the conservation pool to reach the targeted 5,444 feet msl pool elevation. However, the magnitude of difference in outflows between the alternatives is small. The reduced flows in the South Platte River would be most noticeable in the months of May and June when incoming runoff is retained to fill the reservoir (Figures 4-7 and 4-8). The small magnitude of differences between alternatives appears constant at the Chatfield Reservoir outflow, the Denver gage downstream, and the Henderson gage further downstream.

Following the review of the draft FR/EIS, the city of Brighton, a downstream user, withdrew from the project. Brighton had an allocated storage amount of 1,425 acre-feet. Its shares were picked up by upstream users in the following amounts: Centennial (1,181 acre-feet), Castle Pines Metro (125 acre-feet), and Castle Pines North (119 acre-feet). Brighton's withdrawal from the project will change the with-project flows presented in the FR/EIS slightly but would be a small change to an insignificant impact. It should be noted that 1425 acre-feet of storage would yield less than 500 acre-feet per year or less than one cfs spread over the year. This amount of change would not have a measurable impact on streamflow along the South Platte River.

Peak flows would not be significantly different under Alternative 3 than under Alternatives 1 or 2. The USACE modeled 500-year streamflows (Q_{500}) under each Alternative (see Appendix I for results). The alternatives would not substantially alter the frequency of Q_{500}. The magnitude of Q_{500} along the South Platte River downstream of the reservoir would change by ±2 percent under Alternative 3 compared with Alternatives 1 and 2.

The largest observable difference between alternatives appears to be the magnitude of pool elevation fluctuations. Under Alternative 3, elevations would fluctuate up to 21 feet (from the historical low elevation of 5,423 feet msl to the maximum elevation under Alternative 3 of 5,444 feet msl) (Table 4-7). The demand on the additional water storage rights would change the volume and pattern of the discharge from that observed under Alternative 1, allowing the pool level to fluctuate more widely under Alternative 3 than under Alternative 1. The maximum conservation pool elevation (5,444 feet msl) would not be reached in approximately 82 percent of the days in the POR (Table 4-7). Several of the following sections address the potential impacts of pool fluctuations on habitat of the shoreline and aquatic wildlife and vegetation, as well as recreational users. Losses of water through evaporation of the conservation pool would be the largest under Alternative 3 because the surface area of the reservoir would be the largest.

4.3.4 Alternative 4—7,700 Acre-Foot Reallocation/NTGW/Downstream Gravel Pits

Alternative 4 would also reallocate storage from the flood control pool to the conservation pool. In this case, the pool containing conservation storage would be raised from 5,432 to 5,437 feet msl, but the reallocation of storage for this project only involves the volume between 5,432 and 5,437 feet msl. The average annual yield would be approximately 3,160 acre-feet. Under Alternative 4, the additional 5,379 acre-feet would be obtained from NTGW and downstream gravel pits. The impacts on hydrology related to the use of downstream gravel pits would be less than those described under Alternative 1. Under Alternative 4, the remaining water storage would be obtained from NTGW. Those impacts are described under Alternative 2.

The mean outflow from the reservoir into the South Platte River under Alternative 4 would range from 55.4 to 772.5 cfs, based on the output from the HEC-5 model. Outflows into the South Platte River under Alternative 4 would fall between the other two alternatives because water would be maintained in the pool containing conservation storage at a level between the other two alternatives (Figure 4-5). However, the magnitude of the differences would be small. The difference in flows in the South Platte River would be most noticeable in the months of May and June when incoming runoff is retained to fill the reservoir (Figures 4-7 and 4-8).

Peak flows would not be significantly different under Alternative 4 than under Alternatives 1 or 2. The magnitude of Q_{500} along the South Platte River downstream of the reservoir would change by ±1 percent under Alternative 4 compared with Alternatives 1 and 2 (Appendix I).

Because the pool containing conservation storage would increase only to an elevation of 5,437 feet msl, the degree of fluctuation (approximately 14 feet) within the reservoir would be greater than under Alternative 1 and less than under Alternative 3. The target pool elevation (5,437 feet msl) would not be reached in approximately 75 percent of the days in the POR (Table 4-7). Losses of water through evaporation of the conservation pool would fall between Alternatives 1 and 3 because the surface area of the reservoir would fall between the two.

4.3.5 Reduction of Potential Impacts

Climate change will result in greater variability in climate. There may be more floods and more or longer periods of drought, which cannot be accurately predicted at this time (Ray et al., 2008). The Corps model uses inflows during the 1942–2000 POR, which tend to be greater on average than predicted for future conditions for all alternatives. This results in a greater probability of adequate mitigation for all types of inundation-related environmental impacts. Reduced streamflow volumes in the South Platte River from climate change also could result in fewer years when usable water storage would occur in Chatfield Reservoir's conservation pool, but the same lack of water storage would occur under Alternatives 1, 2 (for gravel pit storage), 3 and 4, or other water supply projects involving surface water sources. Surface water projects satisfy one component of the project's purpose and need (described in Chapter 1, Section 1.6), which is to reduce dependence on nonrenewable NTGW use in the Front Range.

Alternative 2 could contribute to the loss of production in the Arapahoe Aquifer over the Denver Metro area. As a regional problem, this issue would cause a significant adverse impact on hydrology. This impact would be difficult to reduce without decreasing the reliance on NTGW required under Alternative 2.

The largest potential impact on hydrology under Alternatives 3 and 4 compared to Alternative 1 would be the amount of fluctuations in pool elevations. In terms of hydrology, potential changes in pool fluctuations would be difficult to minimize. The effects of those fluctuations on other resources (e.g., the target environmental resources, tree removal and weed control within the fluctuation zone, water quality and fisheries and downstream aquatic habitat) and ways to reduce fluctuations and their effects through adaptive management are discussed under those resources and in the Adaptive Management Plan (Appendix GG). Adaptive management by an established group would be used to implement operation strategies to minimize impacts once reallocation begins. The

Chatfield water providers will pursue development of an operations plan to minimize impacts as discussed in the AMP (Appendix GG).

4.4 Water Quality

4.4.1 Chatfield Reservoir

Interested parties were invited to participate in a water quality workgroup to determine the scope of the water quality modeling necessary for this FR/EIS. Participants included representatives from the Chatfield Watershed Authority, Colorado State Parks, CDOW, the water providers, the Corps, and Tetra Tech (who assisted the Corps in preparing the FR/EIS). Four workgroup meetings were held between April and September 2005. The workgroup reviewed, evaluated, and considered scoping comments on water quality; identified the water quality parameters of greatest concern; and developed the following approach for addressing water quality concerns associated with storage reallocation at Chatfield Reservoir.

Three broad categories were identified as the primary water quality issues associated with the proposed alternatives: changes in nutrient levels, metals concentrations, and bacteria counts. Available physical, chemical, and biological data for the reservoir were evaluated, and the proposed conditions under each alternative were modeled. A detailed description of the approach is presented in the complete water quality impacts report in Appendix J. The analysis provided a simplified, representative assessment of potential impacts on water quality under each alternative. As discussed in Section 4.3, the average pool levels reflected in the reallocation alternatives would likely be lower than the Corps model predicts. Because the water quality model includes average lake levels, water quality impacts may vary from those predicted. Because simple models generally do not represent fully the dynamic, time-variable nature of a system, they involve a high level of uncertainty. Potential sources of uncertainty are disclosed in Appendix J. Despite some limitations, simple modeling approaches can be useful analytical tools. The water quality workgroup considered more complex modeling approaches but ultimately determined that the approach documented in Appendix J was adequate and reasonable to evaluate the potential impacts associated with the proposed project.

During the public comment period on the Draft FR/EIS, the U.S. Environmental Protection Agency commented on Appendix J, requesting that the Corps evaluate additional water quality data collected at Chatfield Reservoir since 2009. Earlier water quality sampling characterized the top approximately 33 feet (10 meters) of the reservoir, while more recent sampling characterizes the entire approximately 59-foot (18-meter) water column. The recent data indicate that Chatfield Reservoir stratifies strongly throughout the summer at relatively deep levels. As part of the stratification process, reservoirs develop pronounced thermal barriers (thermoclines) and hypoxic zones (less than 2.0 mg/L dissolved oxygen) in the summer, and "turnover" or mix during the fall. In Chatfield Reservoir, the upper limit of the deep hypoxic zone migrates up from the bottom to a maximum elevation in July and then migrates down again in September until dissipating during the fall turnover (Appendix J). During a meeting following the public comment period, EPA and the Corps agreed that the Corps would revise the phosphorus loading analysis presented in the Draft FR/EIS to incorporate recent water quality data. Output from the revised model is summarized in this section and described in greater detail in Appendix J.

Potential impacts on water quality from the proposed Penley Reservoir, pipeline areas, and gravel pit reservoirs are also discussed below, as applicable, by alternative.

Nutrients. A detailed, localized nutrient analysis was conducted to address the uncertainty regarding possible increases in anaerobic and inundated vegetation nutrient fluxes from total phosphorus and internal phosphorus loading. This assessment of the potential long-term impacts on nutrients of the alternatives focused on potential changes in the number of hypoxic layers (based on 1-meter depth increments) and volume of the hypolimnion (i.e., cold bottom layer of water in the reservoir, characterized by low dissolved oxygen conditions) and the resulting effects on nutrient loading and concentrations in Chatfield Reservoir. Excessive nutrients stimulate plant growth (e.g., algae, weeds). When that plant material dies, the decomposition process reduces the amount of dissolved oxygen in the hypolimnion. Water with a low concentration of dissolved oxygen is called hypoxic; water with no dissolved oxygen is anoxic. These conditions can limit aquatic life and mobilize sediment-bound nutrients (including phosphorus) through oxidation-reduction processes that would not occur to the same extent under more oxygen-rich conditions. Releasing additional phosphorus can further increase eutrophication in the reservoir.

As described in Chapter 3, the TMAL for nutrients (19,600 pounds total phosphorus per year under a median inflow of 100,860 acre-feet per year) for Chatfield Reservoir was developed to protect Chatfield Reservoir against increasing eutrophication and exceedances of standards for total phosphorus and chlorophyll-a (a measure of eutrophication). The phosphorus standard is 0.030 mg/L and the chlorophyll-a standard is 0.010 µg/L. These standards are attained when the assessment criteria for total phosphorus (0.035 mg/L) and chlorophyll-a (11.2 µg/L) are met, as measured through the collection of samples that are representative of the mixed layer during summer months (July, August, and September) and with a maximum allowable exceedance frequency of once in five years. The modeled changes under each alternative are compared with these standards to determine the impacts of each alternative on nutrients.

Metals. The evaluation of the potential impacts of the proposed alternatives on metals concentrations considered that increasing the bottom surface area of the reservoir could lead to greater releases of metals bound to bottom sediments. A simple model was used to compare the predicted metals releases under each alternative. The fluxes of sediment-based metals to and from the water column were estimated for the reservoir bottom. Fluxes depended on environmental conditions and varied by orders of magnitude. Only four metals (copper, iron, mercury, and manganese) exceeded water quality standards historically in the reservoir. The exceedances occurred in 2004 and likely resulted from accelerated sedimentation from burn areas associated with the Hayman fire. Metals considered in the water quality impacts analysis were copper, lead, mercury, cadmium, selenium, and arsenic. There were limited sediment data for these metals (one data point during August every year), but they were sufficient to perform simple analysis calculations. The estimated metals concentrations under the alternatives were compared with the copper, mercury, lead, cadmium, selenium, and arsenic water quality standards of 15.3 mg/L, 1.4 mg/L, 75 mg/L, 4.96 mg/L, 18.4 mg/L, and 50 mg/L, respectively (assessed water quality standard is based on a hardness value of 111 mg/L).

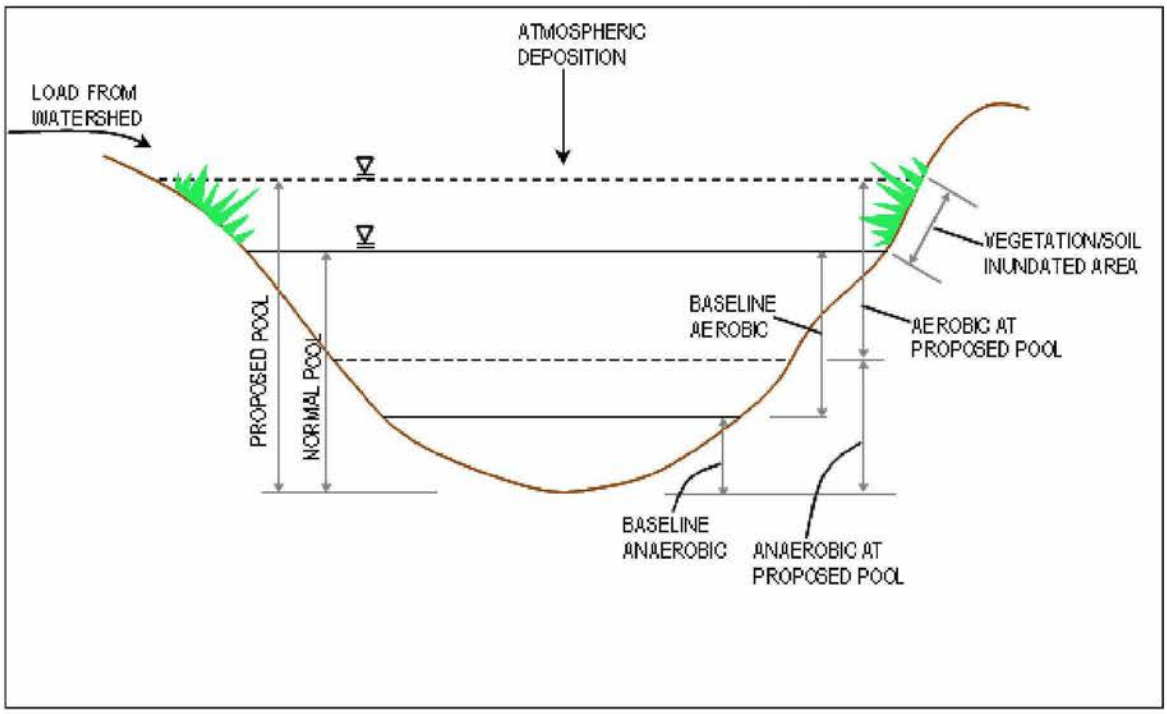
Bacteria. The assessment of the potential effects of the proposed alternatives on bacteria focused on the swim beach and surrounding areas where changes would be most likely to occur. Waterfowl and shorebird usage of the reservoir could increase with increasing shoreline area. With increasing usage, additional bacteria loading would be expected, which would affect bacteria levels at the swim beach. The water quality impacts analysis considered the relationship among the surface area and

volume of the beach, the amount of use by birds and humans (especially children), and the potential E. coli bacteria concentration. Further discussion of E. coli is included in Appendix J.

4.4.1.1 Alternative 1—No Action

Nutrients. A localized analysis to address the uncertainty regarding possible increases in anaerobic and inundated vegetation nutrient fluxes due to total phosphorus was evaluated for Alternative 1. A baseline condition was evaluated for Alternative 1. Baseline reflects Chatfield Reservoir while the reservoir is stratified between May and September under normal pool conditions. The epilimnion and hypolimnion were defined by estimating the hypolimnetic depth for each month based on the number of anoxic layers (1-meter depth increments), which ranged from a minimum of two layers in May and September to a maximum of nine layers in July. The analysis considered separate components of the total load from several sources, including the South Platte River and Plum Creek watersheds upstream of the reservoir, atmospheric deposition, and the internal load from the reservoir (Figure 4-10). The anaerobic depth shown in Figure 4-10 corresponds to the depth of the hypolimnion. The proposed condition in this figure refers to Alternative 3. Alternative 1 would not involve periodic increases in water levels above 5,432 feet msl, as would Alternatives 3 and 4. As such, the evaluation of nutrient loading under Alternative 1 did not address inundated soil and vegetation above 5,432 feet msl. Sediment nutrient fluxes were estimated using a sediment flux model developed by DiToro (2001) (see Appendix J for details).

Figure 4-10
Phosphorus Sources to the Chatfield Reservoir Considered in the Nutrient Analysis



The localized analysis showed that there may be water quality concerns regarding internal loading from increased anaerobic conditions due to increases in reservoir pool levels and inundated vegetation in Alternative 3 or 4 compared to Alternative 1. The model predicted average total

phosphorus concentrations in the epilimnion from July to September of approximately 0.023 mg/L, less than the current phosphorus standard (0.030 mg/L) for the mixed layer and the mean summer assessment criteria of 0.035 mg/L.

Metals. Metal loads for copper, lead, mercury, cadmium, selenium, and arsenic from the watershed and from internal loads were evaluated under Alternative 1. The analysis indicated that metals concentrations in the reservoir under the maximum pool elevations (i.e., 5,432 feet msl for Alternative 1) would be higher under Alternative 1 than under Alternative 3 or 4. The concentrations of copper, mercury, lead, cadmium, selenium, and arsenic were estimated at 6.75, 0.63, 0.15, 0.022, 0.0005, and 0.123 µg/L, respectively, under Alternative 1. The standards for all these metals except mercury and arsenic are table value standards, which means that the standard is computed based on site-specific hardness values. Table value standards were calculated using representative hardness values in the reservoir (Chatfield Watershed Authority, 2006). None of the predicted metals concentrations exceeds the applicable standard. According to the Chatfield Watershed report, a maximum concentration of 68.8 µg/L for copper was reported in 2006, which exceeded the acute copper standard, a table value standard dependent on water hardness (as presented in Chapter 3). Mercury, measured in the dissolved form, has also exceeded the total mercury standard of 0.01 µg/L in the reservoir. None of the other metals were reported as exceeding standards in 2006.

E. coli. Changes in the number of birds using the swim beach area or in the number of recreational users could affect E. coli concentrations. Under Alternative 1, the swim beach and nearby areas would not be modified. As a result, the shoreline and beach areas are not expected to change, and E. coli concentrations would not be affected.

Penley Reservoir, Pipeline Areas, and Downstream Gravel Pits. The potential effects on water quality of constructing Penley Reservoir and associated pipelines under Alternative 1 would be limited to the amount of sedimentation or potential spills that occurred during and immediately following construction activities. Ground disturbance could lead to soil erosion and transport of sediments to water bodies, which could result in short-term increases in turbidity. With effective construction BMPs and successful implementation of stormwater, erosion control, and spill prevention plans, the long-term adverse impact of these activities on water quality likely would be minor. Similarly, the construction of slurry walls in downstream gravel pits could result in localized, short-term increases in sedimentation that could reach the nearby South Platte River. BMPs and implementation of stormwater, erosion control, and spill prevention plans would reduce the potential for adverse impacts on water quality. These impacts on water quality would not be significant.

4.4.1.2 Alternative 2—NTGW/Downstream Gravel Pits

NTGW. No direct impacts are anticipated to water quality from using NTGW. Short-term indirect adverse impacts could occur if many additional wells were constructed to meet water demands. Ground disturbances could lead to short-term increases in turbidity at nearby water bodies, and the use of drilling rigs and related construction equipment could increase the potential for spills. With proper BMPs, these impacts are not anticipated to be significant.

Downstream Gravel Pits. The potential impacts on water quality from the conversion of downstream gravel pits to water storage reservoirs would not be significant, as explained above under Alternative 1.

4.4.1.3 Alternative 3—20,600 Acre-Foot Reallocation

Nutrients. In reviewing the water quality analysis, it is important to consider that Chatfield Reservoir does not contribute phosphorus and would not under the proposed alternatives. Instead, phosphorus inputs from the watershed upstream of Chatfield Reservoir influence concentrations in the reservoir. Changing the operation of Chatfield Reservoir could influence the reactivity of those minerals. Internal loading is not currently a concern in Chatfield Reservoir, as described in Regulation No. 38 (page 191): "Chatfield Reservoir presently has good water quality and uses are being attained… The data record amassed through more than 20 years of water quality monitoring shows that trophic condition has remained stable... The Commission believes that eutrophication of Chatfield Reservoir has been averted through the control of phosphorus loads from the watershed."

The evaluation of nutrients for Alternative 3 used a site-specific phosphorus loading model to assess water quality conditions.

This analysis assumed that increased depth and reduced outflow under increased storage maintained summer thermal stratification and resulted in expanded hypoxic conditions in the hypolimnion that would increase internal phosphorus loading from bottom sediments. As under Alternative 1, nutrient loads (including the watershed, atmospheric deposition, and internal loads) for phosphorus were evaluated under Alternative 3. The internal phosphorus loading from the reservoir was estimated based on expansion of the anaerobic hypolimnion and the resulting increase in sediment phosphorus fluxes. Baseline conditions and two "with-project" scenarios were evaluated. The "with-project" scenarios assumed the elevation to the top of the hypolimnion increased by the same amount as the increase in pool elevation. The two "with-project" scenarios evaluated were: 1) a typical condition which includes an increase in hypolimnetic elevation and anaerobic volume based on the monthly increase in summer pool elevation, and 2) a maximum impact condition which includes an increase in hypolimnetic elevation and anaerobic volume based on a maximum 12 ft increase in summer pool elevation. The 12 ft increase in the hypolimnion elevation condition provides an upper bound for the phosphorus concentrations that can be expected, while the typical scenario provides an average typical summer condition case based on proposed pool elevation conditions.

Under Alternative 3, water would inundate periodically the soil and vegetation between 5,432 and 5,444 feet msl that would not be inundated under Alternative 1. This inundation would occur only during relatively high flows. The nutrient model considered the short-term additional phosphorus load that would result from the initial inundation of the soils and vegetation. The model evaluated the magnitude of internal phosphorus loading from vegetation and sediment that would be inundated with increased pool elevations in Chatfield Reservoir (Appendix J). Most of the phosphorus release is expected to occur in the first year after inundation and to decrease substantially with time.

The upper bound model of the 12-foot hypolimnion elevation increase indicates that the reservoir would experience an increase in total phosphorus concentrations under Alternative 3 above those

modeled under Alternative 1. This conservative modeling approach predicts 0.057 mg/L of total phosphorus in the epilimnion (the layer where the 0.035 mg/L water quality assessment criteria are evaluated), as phosphorus is released from the newly inundated soil and vegetation. However, most of the phosphorus would be released in the first year after inundation (see Appendix J for details). Over the longer term, concentrations of total phosphorus under this conservative scenario would reach approximately 0.025 mg/L, about a 9 percent increase over Alternative 1 and below the water quality standard. Again, the conditions that were modeled represent that conservative scenario, which would not necessarily occur under Alternative 3 and would be unlikely to occur every year. In the unlikely event the hypolimnion elevation did increase by 12 feet in one year, it would not likely persist at that size throughout the growing season. This modeled prediction is useful because it provides an upper bound for the phosphorus concentrations that could be expected under Alternative 3.

Phosphorus concentrations were also modeled based on the more typical pool elevations expected under Alternative 3. Mean increases in pool elevations range from 8.47 to 9.61 feet between May and September (Appendix J). The model varied the size of the anaerobic hypolimnion during this critical period (when stratification occurs). Similar to the upper bound scenario, the elevation of the top of the hypolimnion was assumed to increase by the same amount as the mean monthly increase in pool elevation. Based on modeling, total phosphorus concentrations in the epilimnion would be expected to be approximately 0.048 mg/L in the short term and 0.023 mg/L after the first year of inundation. The long-term total phosphorus concentrations in the epilimnion modeled for Alternative 3 under typical conditions is similar to total phosphorus concentrations under Alternative 1.

The total phosphorus standard (0.030 mg/L) is evaluated based on the assessment criteria of 0.035 mg/L, as measured through the collection of samples that are representative of the mixed layer during summer months (July, August, and September). The localized phosphorus loading model predicted that the average concentration would be less than the phosphorus assessment criteria (and the standard). However, this result reflects the low phosphorus concentrations in the epilimnion during July, August, and early September when the hypolimnion is isolated and when dilution from the increase pool levels occurs in the epilimnion. The internal phosphorus loading in Chatfield Reservoir would increase under Alternative 3. The increased loading would not affect the total phosphorus concentrations in the epilimnion until late summer because internal loading from the anaerobic sediment would not be available during the stratified period (when the epilimnion and hypolimnion do not mix). The increased phosphorus concentrations in the hypolimnion would become available during the fall turnover. The localized phosphorus loading model shows a corresponding increase in total phosphorus in the water column during late September for the mixed condition (Appendix J). As a result, implementation of Alternative 3 could trigger a need to implement adaptive management measures.

Metals. As with Alternative 1, metal loads for copper, lead, mercury, cadmium, selenium, and arsenic from the watershed and from internal loads also were evaluated under Alternative 3. The analysis indicated that metals concentrations in the reservoir under the maximum pool elevations (i.e., 5,444 feet msl for Alternative 3) would be lower under Alternative 3 than under either Alternative 1 or 4. A conservative analysis of metals resulted in an estimated decrease in metals concentrations in Chatfield Reservoir under Alternative 3. The predicted increase in volume at the

maximum pool elevation would provide sufficient dilution to offset the decreased outflow (i.e., longer hydraulic retention time) and increased metals loading from the newly inundated areas. The concentrations of copper, mercury, lead, cadmium, selenium, and arsenic were estimated at 6.29, 0.53, 0.13, 0.021, 0.0004, and 0.120 µg/L, respectively, under Alternative 3. These correspond with decreases that range from approximately 2 percent (for arsenic) to 20 percent (for selenium) compared with concentrations predicted under Alternative 1. These predicted concentrations are estimates based on estimated diffusive fluxes and could change if sediment core sampling were performed to more precisely estimate the site-specific sediment metal fluxes.

E. coli. As with Alternative 1, possible changes in the number of birds in the immediate vicinity of the swim beach or in the number of recreational users using the swim beach were considered during the evaluation of the potential effects of Alternative 3 on *E. coli* concentrations. Under Alternative 3, the swim beach and nearby areas would be modified as described in Appendix M. To meet the goal of replacing affected facilities and use areas "in-kind", the relocation plan is based on maintaining current walking distances at the swim beach. Under this conceptual design, the beach area would be graded to minimize the distance between swim beach facilities and the water's edge at low water conditions. As a result, the configuration of the shoreline near the beach area and the overall dimensions of the swim beach would be similar to current conditions. Given this proposed modification to the swim beach, changes in *E. coli* concentrations are not expected under Alternative 3.

Colorado's 2012 Integrated Water Quality Report identifies the South Platte River downstream from Chatfield Dam to its confluence with Big Dry Creek as non-supporting of recreation due to *E. coli*. Segment 14 (South Platte River from Chatfield Dam to the Burlington Ditch) has a TMDL in place for *E. coli* and thus is not listed for *E. coli* on Colorado's 2012 303(d) list of impaired waters. The *E. coli* TMDL for Segment 14 states that significant E. coli contributions to this segment are conveyed through urban stormwater collection systems during storm events and dry weather conditions. Contributions from Chatfield Reservoir are not identified as a source of *E. coli*, and Alternative 3 is not expected to contribute *E. coli* to the South Platte River downstream of Chatfield Dam.

Pipeline Areas. Alternative 3 would not involve constructing pipelines to transport water from Chatfield Reservoir thus there would be no impacts to water quality from construction of infrastructure under this alternative.

4.4.1.4 Alternative 4—7,700 Acre-Foot Reallocation/NTGW/Downstream Gravel Pits

Nutrients. The likely water pool elevations and depths of the hypolimnion under Alternative 4 would be intermediate between Alternatives 1 and 3. As a result, the predicted nutrient concentrations also would be intermediate between the concentrations predicted for those alternatives. The maximum elevation of the conservation pool under Alternative 4 would be 5,437 feet msl. As described under Alternative 3, this condition would occur only during relatively high flows (see Section 4.3 for more information) and would not last throughout the entire growing season. The correlated increase in the depth of the hypolimnion could range from little to the entire 5 feet. Similar to Alternative 3, under Alternative 4 water would periodically inundate the soil and vegetation between 5,432 and 5,437 feet msl that would not be inundated under Alternative 1. The 5,437-foot msl elevation would be reached only during relatively high flows. The predicted total

phosphorus concentrations would be expected to be lower than those reported under Alternative 3 and higher than those reported under Alternative 1.

As in Alternative 3, increasing the hypolimnion elevation and expanding hypoxic conditions could affect nutrient concentrations and could alter water quality in Chatfield Reservoir, particularly during the first years after inundation. However, the hypolimnion is not likely to change as much as modeled under Alternative 3. The internal phosphorus loading in Chatfield Reservoir would increase under Alternative 4, but to a lower extent than under Alternative 3. Total phosphorus concentrations in the water column would be expected to increase during late September during turnover under Alternative 4, which could trigger a need to implement adaptive management measures. The contribution of phosphorus from inundated vegetation and soil would likely increase nutrients in the short term, but would likely decrease substantially with time.

Metals. Metal concentrations in the reservoir at the target pool elevation (i.e., 5,437 feet msl for Alternative 4) would be intermediate between concentrations under Alternatives 1 and 3. As in Alternative 3, the predicted increase in volume at the target pool elevation would provide sufficient dilution to offset the decreased outflow (i.e., longer hydraulic retention time) and increased metals loading from the newly inundated areas. The magnitude of the decrease would be expected to be lower than under Alternative 3 because the volume increase would be lower.

E. coli. Like Alternative 3, changes in *E. coli* concentrations are not expected under Alternative 4, given the proposed modification to the swim beach area (described in Appendix 5 of Appendix M). Under the conceptual design, the beach would be graded to minimize the distance between the swim beach facilities and the water's edge at low water conditions. As a result, the configuration of the shoreline and the dimensions of the swim beach would be similar to current conditions, and *E. coli* concentrations would not be affected.

Pipeline Areas. Alternative 4 would not involve constructing pipelines to transport water from Chatfield Reservoir thus there would be no impacts to water quality from construction of infrastructure under this alternative.

NTGW and Downstream Gravel Pits. An additional 5,348 acre-feet would be obtained from use of NTGW and downstream gravel pits. The potential effects on water quality from conversion of downstream gravel pits to water storage reservoirs and use of NTGW are disclosed under Alternatives 1 and 2, respectively. Fewer and/or smaller gravel pit reservoirs would be needed under Alternative 4 than under Alternative 1 or 2. These impacts on water quality would not be significant.

4.4.1.5 Reduction of Potential Impacts

Increases in total phosphorus in the short term are expected under Alternatives 3 and 4. Under Alternative 1, using an upper bound scenario, modeled concentrations of total phosphorus reach 0.023 mg/L and are not expected to exceed the standard of 0.030 mg/L, which is measured as the July-September average. The upper bound scenario under Alternative 3 was modeled with a total phosphorus concentration of 0.057 mg/L. Removal of vegetation prior to inundation could reduce the amount of phosphorus released under Alternatives 3 or 4, but the short-term concentrations would still be greater than those predicted under Alternative 1 because of the increased release of phosphorus from anoxic sediments and inundated soils.

The nutrient analysis shows that there may be water quality uncertainty regarding internal phosphorus loading from inundated vegetation and expanded anaerobic conditions due to increases in reservoir pool levels. Adaptive management would be used to address this uncertainty should the proposed Chatfield Reservoir storage reallocation project be implemented (Appendix GG). Water quality monitoring will be conducted on an on-going basis to identify any water quality impacts and evaluate their level of significance. The following approach using a dynamic water quality model could be executed to adaptively manage water quality uncertainties:

- Water Quality Monitoring and Assessment. Water quality monitoring would be implemented at Chatfield Reservoir to allow for the initial and ongoing application of a dynamic water quality model and assessment of reservoir water quality conditions for compliance with water quality standards. Dynamic water quality modeling would require the appropriate monitoring of reservoir, inflow, and outflow water quality conditions. Appropriate water quality data will be collected in Chatfield Reservoir to assess compliance with promulgated water quality standards criteria. This information will be used to help determine if mitigation actions need to be taken.

- Inundated Vegetation.

  - Remove vegetation below 5,439 ft msl to minimize the introduction of nutrients associated with inundation, as discussed under Tree Management within the Fluctuation Zone.

  - Control weeds within the fluctuation zone that could increase nutrient levels when inundated.

  - Monitor the establishment of vegetation within the fluctuation zone that could increase nutrient levels when inundated.

- Water Quality Modeling. An initial application of a dynamic water quality model could be attempted using historic water quality, meteorological, pool level, and flow data. Annual dynamic water quality models would be developed where historical data allow. If sufficient historical data are lacking, an initial application of a dynamic water quality model would be based on newly collected data. Once initially developed, a dynamic water quality model would be applied annually on an ongoing basis. Water quality, meteorological, pool level, and flow data for the past year would be used to develop a specific dynamic water quality model for the year. As the annual dynamic water quality models are developed, they could be used to conduct scenario testing of possible water quality management measures. If core objectives are threatened, a dynamic water quality model could be used to scope out the water quality concern, and, if appropriate, identify mitigation actions to manage water quality conditions.

- Feedback and Learning.

  - Determine if mitigation actions need to be taken based on an assessment of collected water quality data and findings of the dynamic water quality modeling.

- If mitigation actions are needed, use dynamic water quality modeling to identify effective and reasonable actions that can be implemented.
- Properly implement selected water quality mitigation actions.
- Assess implemented water quality mitigation actions for effectiveness.
- As necessary, adjust implemented mitigation actions or implement new mitigation actions as determined by effectiveness assessments.
- Continue water quality monitoring and mitigation actions as needed.

As described in Section 4.1.1, adaptive management planning will involve an iterative process of cycling through several steps: problem assessment, design, implementation, monitoring, evaluation, adjustment, and continued cycling through earlier steps (Barnes, 2009). Adaptive management will involve structured decision making, with an emphasis on incorporating water quality monitoring results into decision-making to minimize potential impacts to water quality. The project participants will coordinate their adaptive management work related to water quality with the Chatfield Watershed Authority, because they are working to maintain and improve the water quality of Chatfield Reservoir. Water providers will use adaptive management (including increased water quality monitoring) to address state concerns that water quality could be impacted by shoreline erosion caused by increased water level fluctuations. Monitoring and adaptive management will also be used to address the state's concern that under an upper bound scenario, dissolved oxygen levels could decrease, releasing mercury from the sediments and potentially accumulate in aquatic species in Chatfield Reservoir. Water quality modeling conducted as part of this analysis suggests that mercury levels would decrease under the reallocation alternatives.

4.4.2 South Platte River Immediately Downstream of Chatfield Reservoir

Comments on the Draft FR/EIS, and subsequent discussions with the EPA, identified the possible reduction of flows in the South Platte River downstream of Chatfield Dam as a water quality concern. Average annual outflow from Chatfield Dam over the 1942 to 2000 period would have been reduced by 4.4 percent under the proposed conditions for storage reallocation (Table 2-1, Appendix J). As noted in the FR/EIS, the Chatfield storage reallocation project would not result in the direct discharge of pollutants to the South Platte River. The project would likely reduce flows somewhat in the river downstream of Chatfield Dam. The reduction of flows could reduce the available pollution assimilative capacity of the South Platte River. Water Quality, TMDLs, and permitted dischargers could be adversely impacted by a reduced assimilative capacity to dilute pollutants discharged to the river downstream of Chatfield Dam during critical low flow periods. If water quality impacts were to occur, TMDLs and water quality-based permits may need to be recalculated. This concern is further evaluated in (Appendix J).

Under Alternative 3, the proposed Chatfield storage reallocation could potentially reduce critical low flows in the South Platte River immediately downstream of Chatfield Dam by storing 19 acre-feet of water annually instead of releasing the water to the river during critical low flow periods. Critical low flows have been identified for the South Platte River immediately downstream of Chatfield Dam to support implementation of a Nitrate TMDL. As part of the FR/EIS, the occurrence of days below the identified water quality critical low flows during the 10-year period 1991 through 2000 was

determined for baseline and with-project (Alternative 3) conditions (Table 4-8). It may be possible to adjust the timing of Chatfield Dam releases in order to meet the currently identified critical low flows in the South Platte River immediately downstream of Chatfield Dam. Only the South Platte River immediately downstream of the Chatfield Dam outlet would seemingly be impacted as extensive diversions and discharges to and from the river occur in the Metro Denver area. See Appendix J for further discussion.

Table 4-8. Monthly Occurrence of Days below Water Quality Critical Low Flows in the South Platte River immediately downstream of Chatfield Dam during the 10-Year Period 1991 through 2000 under Baseline and With-Project (Alternative 3) Conditions .

Condition	Number of Days by Month												Total Days
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Baseline	11	11	4	0	0	0	0	1	3	0	1	12	43
With-Project	32	42	64	38	5	2	1	2	6	0	11	7	210

4.5 Aquatic Life and Fisheries

4.5.1 Alternative 1—No Action

Under Alternative 1, Chatfield Reservoir would continue under baseline conditions with a top of multipurpose pool elevation of 5,432 feet msl (Figure 4-1 and Table 4-2). Adverse impacts on aquatic biota in the Chatfield Reservoir study area would not occur. Water levels would continue to fluctuate with the current maximum 9-foot annual range in water level goal and therefore no augmentation would be required regarding Chatfield Reservoir's current management of sport fish, forage fish, or any native species present. Pool fluctuation shows how many feet, on average, the pool elevation ranges (between highest and lowest elevations) in a given month. Even Alternative 1 fluctuates because the inflow to Chatfield Reservoir does not necessarily match the outflow from Chatfield Reservoir; the pool fluctuates up or down depending on which flow is higher.

Alternative 1 would not change the current fluctuations in flow in the South Platte River and thus would not change the impacts on the aquatic biota present. The river would continue to fluctuate by the controlled release from Chatfield Reservoir and therefore would not affect the South Platte River's cool- or warm-water fish species present.

In addition, tributaries to Chatfield Reservoir would not be affected under Alternative 1. There would be no further inundation of the tributaries from Chatfield Reservoir. The dam releases at Strontia Springs Reservoir would continue to maintain both minimum winter and summer flows in the South Platte River above Chatfield Reservoir.

Penley Reservoir would be constructed under Alternative 1. Existing aquatic life and fisheries would not be impacted because no significant water resources currently exist in the area that would be inundated by Penley Reservoir. Reservoir construction would create aquatic habitat that could be used for aquatic life and fisheries. Diversion of water to the reservoir may impact fisheries resources downstream by decreasing flows in streams and rivers.

Pipelines associated with Alternative 1 would cross several streams that could support fish populations, including Indian Creek, Rainbow Creek, Willow Creek, and Plum Creek (Figure 2-1). The precise pipeline location is not yet known; therefore, alignment to the various waterways could

change. Temporary adverse impacts on fish populations could result during the construction of underground pipelines, but these impacts can be minimized if proper techniques were used to reduce changes in hydrologic conditions during construction. Culverts at road crossings could alter stream flow and decrease fish movement upstream and downstream. Changes to vegetation and temperature along the stream bank could decrease spawning habitat. If appropriate construction techniques were implemented, the proposed pipelines would have no significant adverse impacts on aquatic life and fisheries.

The downstream gravel pits would not affect existing aquatic life and fisheries because none currently occur in these active gravel pits. Converting the gravel pits to water storage would create aquatic habitat for aquatic life and fisheries.

4.5.2 Alternative 2—NTGW/Downstream Gravel Pits

Under Alternative 2, reservoir levels and operations at Chatfield Reservoir would remain unchanged as in Alternative 1. As in Alternative 1, aquatic biota in Chatfield Reservoir or downstream in the South Platte River would not be affected. Penley Reservoir would not be constructed because water would be obtained from underground sources (NTGW). Aquatic life would not be impacted by NTGW use. Impacts resulting from converting downstream gravel pits to water reservoirs would be the same as under Alternative 1.

4.5.3 Alternative 3—20,600 Acre-Foot Reallocation

Alternative 3 would generally provide a positive impact to the Chatfield Reservoir aquatic ecosystem as included in the discussion of potential water quality impacts from nutrient loading in Section 4.4.3 and Appendix J. Precise quantification of increases in primary productivity may be difficult to determine between the two reallocation alternatives (Alternatives 3 and 4).

There would be a 587-acre gain in pool area and a 27,748-foot increase in pool perimeter under Alternative 3 (Figure 4-1). On average, the pool area would increase by approximately 49 acres, and the perimeter would increase approximately 2,312 feet, for every 1 foot of pool elevation increase between 5,432 and 5,444 feet msl. There is a net increase of about 20 acres of shallow water (i.e., <4 ft) between the 5,432 and 5,444 feet msl pool levels, but at 5,444 feet msl the proportion of shallow water to the total volume decreases slightly when compared to 5,432 feet msl. Shoreline Development (DL) is a parameter in lake morphometry that "reflects the potential for greater development of littoral communities in proportion to the volume of the lake" (Wetzel, 1975). Comparison of the DL values calculated for the 5,432 and 5,444 ft msl pool levels showed there was a slight increase (approximately 15 percent) in shoreline development at 5,444 ft msl compared to 5,432 ft msl. This suggests a slight increase in the littoral zone (the area containing emergent, floating, and rooted aquatic plants) compared to the lake volume, and thus a slight increase in lake productivity relative to volume.

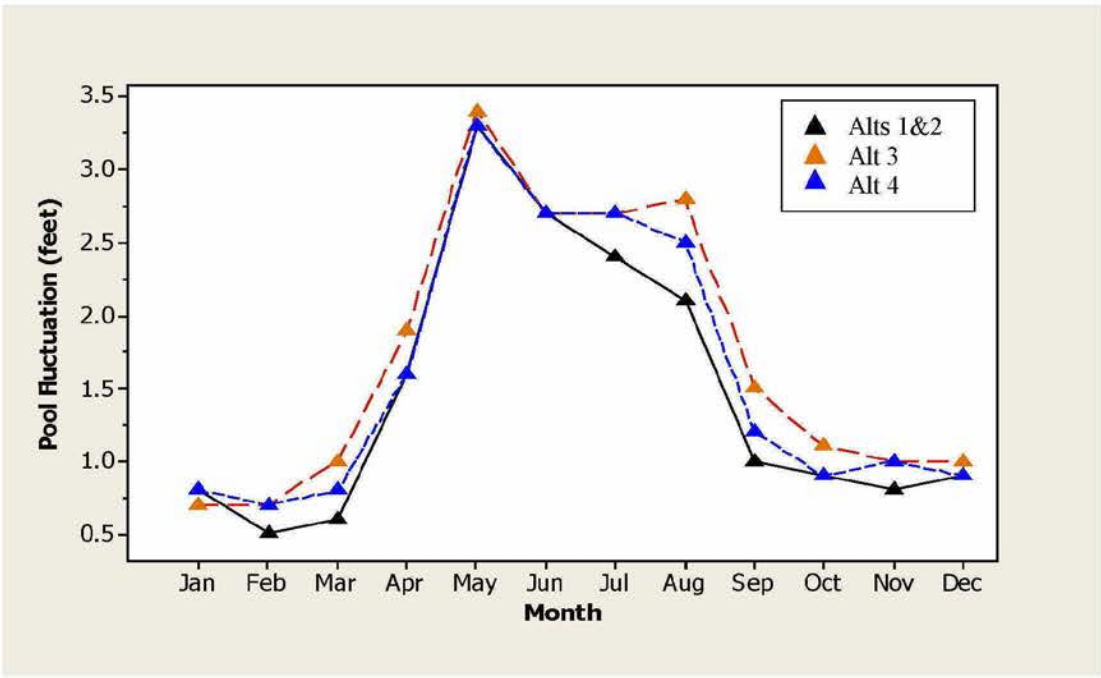
The areas inundated due to this reallocation would essentially be shallow water areas within the reservoir. These shallow water areas would potentially affect several key components of the reservoir's aquatic community. These include impacts on sport fish, forage fish, and native species populations.

Reservoir filling to 5,444 feet msl could potentially influence natural reproduction by cool- and warm-water fish communities in the reservoir. Timeframes for natural reproduction by various cool-water sport fish in Chatfield Reservoir begin in mid-March, when walleye spawn and egg-taking

operations commence. As currently projected, pool elevations would increase during this period, with filling occurring during spring runoff and from seasonal storm events (Figure 4-11). However, based on filling and storage scenarios for Alternative 3, there would not be a negative impact on natural reproduction of these sport fish species in Chatfield Reservoir. Natural reproduction for the primary sport fish of concern would be finished before the decrease in water levels occurs. In addition, populations of walleye, rainbow trout, and channel catfish in Chatfield Reservoir have been and would continue to be maintained by annual stocking (CDOW, 2007a).

Warm-water sport fish spawning occurs from May to mid-June when fish including crappie, bluegill, smallmouth bass, and largemouth bass spawn. Increased pool elevation would create new shallow water habitat areas that these warm-water species require for spawning. However, greatly decreasing pool elevations during their spawning period would have a negative impact on spawning success and, in turn, could impact warm-water fish populations within Chatfield Reservoir. As shown in Figure 4-11, projected water withdrawals would begin in late spring and continue through the summer months. Larger predator fish species could also be negatively impacted by the increase in shallow water zones, creating more habitat and therefore more protection for the forage fish.

Figure 4-11
Average Monthly Pool Fluctuations in Chatfield Reservoir[1]



[1] This figure portrays the average monthly pool fluctuations in Chatfield Reservoir by alternative, based on the modeling described in Appendix H. The water quality modeling (described in Appendix J) evaluates more extreme (and less probable), upper bound pool fluctuations.

As with sport fish, the inundation of new pool areas under Alternative 3 would provide a generally positive impact on forage fish populations in the reservoir. Increases in primary productivity would especially benefit gizzard shad populations, which are dependent on plankton populations as primary food sources. Inundation of new pool areas and the resultant infusion of new nutrients from decay of organic material would enhance plankton populations in the reservoir and provide a positive impact to gizzard shad and other forage fish populations during the period of increased pool elevations. One possible limit to positive impacts is that gizzard shad reproduction occurs from approximately mid-May to mid-June depending on reservoir water temperature. The onset of greatly decreasing water levels under Alternative 3 during reproduction along with slight increases in water temperatures would adversely affect gizzard shad populations.

Crayfish populations would benefit from newly inundated pool areas with a resulting enhancement of forage for smallmouth and largemouth bass populations. Additional forage production consists of young-of-the-year (YOY) of certain game fish, primarily yellow perch and bluegill (Nesler, 2003).

A few native fish species exist within Chatfield Reservoir and include the gizzard shad, western white sucker, and green sunfish. None of these species are recognized as sensitive, threatened, or of special status concern in Colorado and all are likely to be found in many aquatic habitats throughout Colorado. One other native species, Iowa darter, has been sampled in Chatfield Reservoir by CDOW. However, only two individuals have been collected over an 8-year sampling period (CDOW, 2007a). Iowa darters are more commonly found in and associated with a limited number of streams in northeastern Colorado (Woodling, 1985). Consistent with previously discussed impacts, it is anticipated that the higher pool elevations experienced under Alternative 3 would enhance habitat conditions for the native species in Chatfield Reservoir and would not adversely impact them.

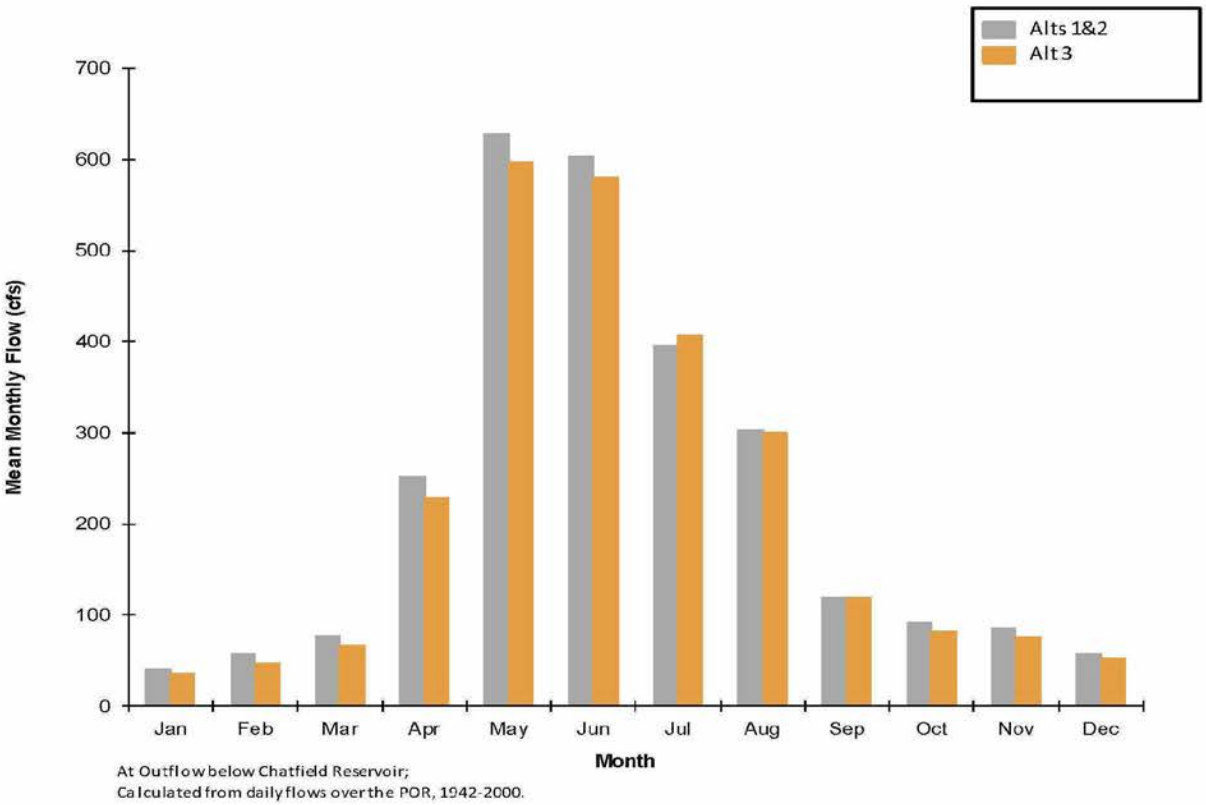
Prolonged low pool levels after drawdown or during drought under Alternative 3 could increase temperatures in the bottom of the reservoir. This creates possible eutrophication and algal issues in Chatfield Reservoir and also in downstream sections of the South Platte River. Because of the potential for stored water to be carried over from prior non-drought years, however, low pool levels would not occur as frequently under Alternative 3 as under Alternative 1.

Another potential impact under Alternative 3 to Chatfield Reservoir is the periodic inundation of two ponds to the south of the reservoir near the inlet of the South Platte River (Figure 4-1). All fish species present in these ponds are currently found in Chatfield Reservoir, so inundation of these areas would not impact the species composition of Chatfield Reservoir (CDOW, 2007a). However, the species composition of the ponds could change, as these ponds will be inundated and become incorporated into the reservoir perimeter.

Under Alternative 3, the South Platte River below Chatfield Reservoir would have minimal changes during base flow conditions and a small increase in flow during the late summer months (Figure 4-12). Figure 4-12 shows that there could be a slight decrease in flows below the reservoir during May and June, when inflows are captured and the reservoir is filling. It is possible that these reduced flows could affect spawning, but the significance of the effect would be very small. Managing the timing, duration, and amount of flow from the Chatfield Reservoir is an important tool in enhancing aquatic biota in the South Platte River. For example, a projected increase in flow during July would have a positive effect on aquatic biota downstream of the reservoir. The current

cool- and warm-water species present experience stress during late summer months from increased water temperatures and decreased flow.

Figure 4-12
Comparison of Flows in the South Platte River
Below Chatfield Reservoir if Alternative 3 Were Implemented



Another critical aquatic stressor is base flow conditions during the winter months. Based on the Corps' modeling results, the projected change during winter base flow conditions would result in a slight decrease that would result in minimal or no impact to aquatic biota present. Appendix D, prepared by Great Western Institute et al., includes additional modeling and evaluation of wintertime flows in the South Platte River under various water release scenarios from Chatfield Reservoir. These analyses indicate that the proper management of outflow from the Chatfield Dam to the South Platte River by maintaining a minimum of 10 cfs could greatly improve the habitat available for fish in this downstream reach.

While sport fish are present in the fish community below Chatfield Reservoir, the population is not actively managed by the CDOW as a sport fishery. Virtually all the sport fish found in this reach of the South Platte River are more typically found in standing water habitats and are actually migrants from Chatfield Reservoir or adjacent pond habitats connected to the river. It is believed that most of these fish are not year-round residents of the river, and size distribution of this population indicates

that most of these fish are YOY to 1-year-old fish with little adult representation of the species (CDOW, 2007a). In addition, none of the sport or non-sport native fish species found in the South Platte River below Chatfield Reservoir are currently recognized as special status, threatened, or endangered species and all are considered common in Colorado (Nesler, 2003).

An increased flow to the South Platte River below Chatfield Reservoir during the warmer months and low-flow periods would help in protecting aquatic biota from poor water quality conditions that currently exist. For example, treated wastewater effluent can account for as much as 100 percent of stream flow downstream from Denver during these months and this effluent was the primary source of nitrate, ammonia, and phosphorus in the South Platte River and adjoining Front Range streams (National Water-Quality Assessment Program [NAWQA], 2002). An addition of cool, flowing water would assist in flushing high nutrient content and lowering instream water temperatures, and thus help prevent possible eutrophication. Much of the downstream water from Chatfield Reservoir is recycled at some point for municipal use, and any increase in flow would be beneficial to all aquatic biota present. The focus of any such flow management would be to improve habitat conditions above those that currently exist, by way of enhancement to the resource rather than required mitigation of adverse effects attributable to reallocation.

Alternative 3 would not have adverse impacts on aquatic life in the tributaries to Chatfield Reservoir. Increases in flow would primarily occur along the South Platte River, which is partially controlled by the release of water from Strontia Springs Reservoir (see Section 3.5). The South Platte River above Chatfield supports cold-water habitats that contain cold-water game fish such as rainbow and brown trout. Also occurring are white sucker, longnose sucker, and longnose dace. The other reservoir tributaries, Plum Creek and Deer Creek, described above, are limited in flows and in quality of game fish habitats (USFWS, 2006).

Under Alternative 3, an approximate 3,643-foot (0.69-mile) reach of the South Platte River directly above Chatfield Reservoir would be intermittently inundated (Figure 4-1). This reach is within the flood control pool of Chatfield Reservoir and has been periodically inundated in the past during large storm events. However, under Alternative 3 the duration of inundation of this reach is expected to be longer than under flood events, and this could result in changes in the aquatic habitat and the composition of species utilizing the habitat. This reach of the South Platte River contains typical cold-water riverine habitat and aquatic biota as well as some occasional warm-water species that migrate from the reservoir. The increased perimeter of Chatfield Reservoir would alter the fish and macroinvertebrate community composition of the inundated tributaries. Fish composition would change from cold- and cool-water species to more warm-water species by increasing the shallow still-water areas along the reservoir perimeter. The macroinvertebrate community in the South Platte River contains many sensitive taxa such as Ephemeroptera, Plecoptera, and Trichoptera (EPT) orders of insects that typically best thrive in cold-water streams. Inundation of this small stretch could alter the species composition of macroinvertebrates by removing or reducing stream-sensitive species and increasing taxa that are tolerant of a larger range of temperature and dissolved oxygen conditions.

4.5.4 Alternative 4—7,700 Acre-Feet Reallocation/NTGW/Downstream Gravel Pits

In addition to the reallocation, another 5,379 acre-feet would be obtained from NTGW and/or other storage downstream gravel pits under Alternative 4. The potential effects on aquatic life from

conversion of downstream gravel pits to water storage reservoirs and use of NTGW are disclosed under Alternatives 1 and 2, respectively. Fewer and/or smaller gravel pit reservoirs would be needed under Alternative 4 than under Alternative 1 or 2.

Alternative 4 would generally provide a positive impact to the Chatfield Reservoir aquatic ecosystem as included in the discussion of potential water quality impacts from nutrient loading in Section 4.4.4 and Appendix J. An overall increase in productivity under Alternative 4 would be less than under Alternative 3. Precise quantification of increases in primary productivity may be difficult to determine between the two reallocation alternatives; however, an index of potential benefits can be gained when comparing increases in pool area and pool perimeter.

There would be a 215-acre gain in pool area and a 2,854-foot increase in pool perimeter between Alternatives 1 and 4 (Figure 4-1). On average, the pool area would increase by approximately 43 acres, and the perimeter would increase approximately 2,854 feet, for every 1 foot of increase in pool elevation. The areas inundated due to the reallocation would essentially be shallow water areas within the reservoir. These shallow water areas would increase overall productivity and could potentially affect several key components of the reservoir's aquatic community. These include impacts on sport fish, forage fish, and native species populations.

Reservoir filling to 5,437 feet msl could potentially influence natural reproduction by cool- and warm-water fish communities in the reservoir. Timeframes for natural reproduction by various cool-water sport fish in Chatfield Reservoir begin in mid-March, when walleye spawn and egg-taking operations commence. As currently projected, pool elevations would increase during this period, with filling occurring during spring runoff and from seasonal storm events (Figure 4-11). However, based on filling and storage scenarios for Alternative 4, there would not be an adverse impact on natural reproduction of these sport fish species in Chatfield Reservoir. Natural reproduction for the primary sport fish of concern would be finished before the decrease in water levels. As mentioned previously, populations of walleye, rainbow trout, and channel catfish in Chatfield Reservoir are and would continue to be maintained by annual stocking (CDOW, 2007a).

Warm-water sport fish spawning occurs in mid-June when fish including crappie, bluegill, smallmouth bass, and largemouth bass spawn. Declining water levels during this time period could have negative impacts on successful natural reproduction for these species and adversely impact their populations within Chatfield Reservoir. As shown in Figure 4-11, projected water withdrawals would begin in late spring and continue through the summer months.

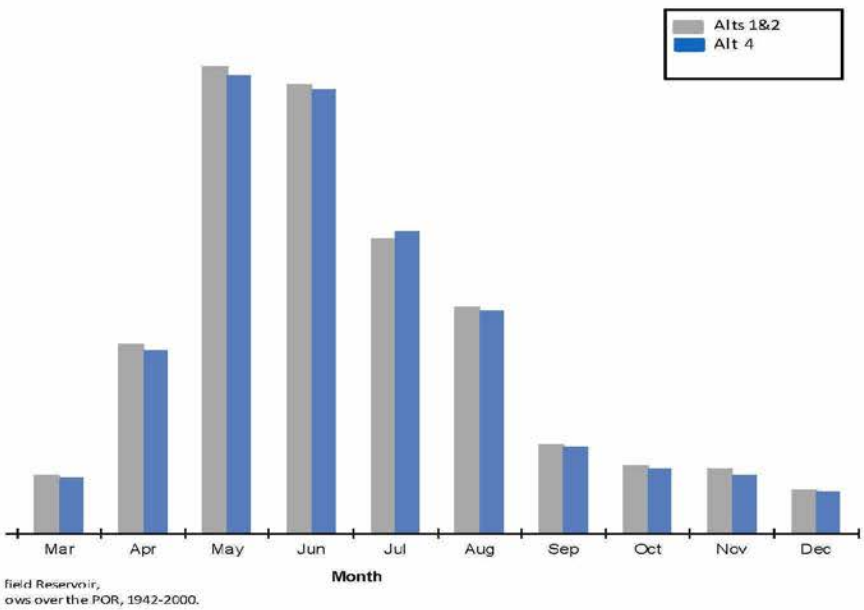
As with sport fish, the inundation of new pool areas under Alternative 4 would provide a generally positive impact on forage fish populations in the reservoir, although not to the same degree as in Alternative 3. Increases in primary productivity would especially benefit gizzard shad populations, which are dependent on plankton populations as primary food sources. Inundation of new pool areas and the resultant infusion of new nutrients from decay of organic material would enhance plankton populations in the reservoir and provide a positive impact to gizzard shad and other forage fish populations during the period of increased pool elevations. One possible limit to positive impacts is gizzard shad reproduction, which occurs from approximately mid-May to mid-June depending on reservoir water temperature. The onset of decreased water levels under reallocation Alternative 4 during reproduction along with slight increases in water temperatures could adversely affect gizzard shad populations.

Crayfish populations would benefit from newly inundated pool areas with a resulting enhancement of forage for smallmouth and largemouth bass populations. Additional forage production consists of YOY of certain game fish, primarily yellow perch and bluegill (Nesler, 2003). As with sport fish, the inundation of new pool areas under Alternative 4 would provide a generally positive impact to forage fish populations in Chatfield Reservoir.

A few native fish species exist within Chatfield Reservoir and include the gizzard shad, western white sucker, and green sunfish. None of these species are recognized as sensitive, threatened, or of special status concern in Colorado, and all are likely to be found in many aquatic habitats throughout Colorado. One other native species, Iowa darter, has been sampled in Chatfield Reservoir by CDOW. However, only two individuals have been collected over an 8-year sampling period (CDOW, 2007a). Iowa darters are more commonly found in and associated with a limited number of streams in northeastern Colorado (Woodling 1985). Consistent with previously discussed impacts, it is anticipated that the higher pool elevations experienced under Alternative 4 would enhance habitat conditions for the native species in Chatfield Reservoir and would not adversely impact them.

Under Alternative 4, similar conditions would exist in the South Platte River below Chatfield Reservoir, with minimal changes during base flow conditions and a very small increase in flow during the late summer months (Figure 4-13). Managing the timing, duration, and amount of flow from the Chatfield Reservoir is an important tool in enhancing aquatic biota in the South Platte River. For example, a projected increase in flow during July would have a positive effect on aquatic biota downstream of the reservoir. The current cool- and warm-water species present experience stress during late summer months from increased water temperatures and decreased flow.

Figure 4-13
Comparison of Flows in the South Platte River
Below Chatfield Reservoir if Alternative 4 Were Implemented



Another critical aquatic stressor is base flow conditions during the winter months. Based on the Corp's modeling results, the projected change during winter base flow conditions is a very slight decrease that would have minimal impact on the aquatic biota present. However, this decrease in base flow may impact the Chatfield SFU during the late fall or winter months. Currently, there are no minimum base flows required below Chatfield Dam and senior water right holders can choose to use all available water during the late fall and winter months. This action often leaves the river dry until the next water effluent is reached (likely Marcy Gulch). Therefore, a decrease, however slight, would further decrease water needed for the Chatfield SFU.

For impacts to the sport fish community and to water quality to the South Platte River below Chatfield Reservoir, see Alternative 3. Alternative 4 would not adversely impact aquatic life in the tributaries to Chatfield Reservoir. Increases in flow would primarily occur along the South Platte River, which is partially controlled by the release of water from Strontia Springs Reservoir (see Section 3.5). The South Platte River above Chatfield Reservoir supports cold-water habitats that contain cold water game fish such as rainbow and brown trout. Also occurring are white sucker, longnose sucker, and longnose dace. The other reservoir tributaries, Plum Creek and Deer Creek, described above, are limited in flows and in quality of game fish habitats (USFWS, 2006).

Under Alternative 4, a small portion of the South Platte River above Chatfield Reservoir (slightly smaller than Alternative 3) would be intermittently inundated (Figure 4-1). Impacts to this reach are similar to those described in Alternative 3, although less of the stream reach will be impacted.

4.5.5 Reduction of Potential Impacts

Managing the release of water from Chatfield Reservoir could be an important tool in enhancing all aquatic communities present. If the releases of water from the reservoir were more evenly distributed throughout the year so that appropriate pool levels were maintained during fish spawning and embryo development, there could be less impact on reproductive success of warm-water fish species in the reservoir. Similarly, keeping instream flow rates high on the South Platte River below the reservoir during times of low flow and higher temperature could reduce stressors put on the aquatic community in this reach. However, future water demands would dictate alterations in current flow patterns in the South Platte River regardless of increased storage capacity in Chatfield Reservoir.

Increased habitat structure would be expected to occur with the inundation of trees adjacent to Chatfield Reservoir. As indicated in the Tree Management Plan (Appendix Z), selected trees within the inundated area will be cut and anchored in place for fisheries habitat. This would create positive habitat for fish, aquatic insects, and aquatic flora that inhabit these areas. Visitor and dam safety will take priority in determining where trees can be retained and anchored.

The Corps has conducted coordination and informal consultations with the USFWS regarding potential impacts to fish and wildlife resources and their recommendations for mitigation, including a Planning Aid Report (February 2006) and progress letter (July 2010) (see Appendix X).

Within Chatfield Reservoir, the CPW currently conducts a walleye broodstock program that includes an annual egg-taking process used to populate multiple Colorado reservoirs with the popular game fish. Since an abrupt release of pool levels has been shown in the past to have significant adverse

impacts on walleye reproductive success, the Coordinated Reservoir Operations Plan is expected to include a provision to limit the release of water stored in the reallocated pool during critical seasonal periods. The critical period for the walleye broodstock program is from March 1 to April 15. Monitoring by CPW will be used to verify that the provisions of the Coordinated Reservoir Operations Plan limiting the magnitude of releases from the reallocated pool provide the desired protections from adverse release events or will inform if adjustments to operations are needed to benefit the walleye broodstock program.

The adaptive management process (Appendix GG) will allow the water providers, Corps, and resource agencies to be responsive to issues should they arise. In addition, beyond the mitigation measures that are part of the Selected Plan, the water providers propose to fund stream habitat improvements on up to 0.7 miles of the mainstem of the South Platte River above Chatfield Reservoir. Also, while this analysis does not suggest a significant loss of habitat downstream, to allay CDOW concerns, the water providers have agreed to pursue stream habitat improvement on up to 0.5 miles of the mainstem of the South Platte River downstream of Chatfield Reservoir. The specific sites and project designs for these measures will be selected in coordination with CDOW.

4.6 Vegetation

All types of vegetation are susceptible to the impacts of flooding and inundation. Trees are more susceptible to the impacts of flooding and inundation during the growing season (Kozlowski, 1997), and flooding during the dormant season typically has little impact on trees (Bell & Johnson, 1974). Thus, the analysis of impacts on trees focused on the pool elevations reached during the growing season. This analysis of impacts on trees is also based on the maximum level of inundation for each alternative, or the upper bound scenario. The growing season at the Chatfield study area was estimated from data from the Colorado Climate Center for a weather station at Kassler, Colorado (Doesken, 2006). The boundaries of the growing season were based on the median dates at which 28 degrees Fahrenheit is last reached in the spring and first reached in the fall, based on the years 1975 to 2005. These dates are April 25 and October 11, respectively, and correspond to a growing season of approximately 170 days.

Trees that are tolerant of flooding, including the plains cottonwood, may withstand an entire growing season of inundation. However, they are killed when they are inundated for two consecutive growing seasons (USFS, 1993; Teskey & Hinckley, 1978; Whitlow & Harris, 1979). Some studies indicate that flooding for even one growing season can result in significant mortality in mature cottonwoods (Yin et al. 1994). Saplings are even more susceptible to flooding than mature trees (Yin et al., 1994).

The reservoir modeling results were used to calculate the number of days in each growing season that exceeded specific pool elevations. These results were used to estimate at what pool elevations trees are likely to be killed. The analysis focused on the plains cottonwood (*Populus deltoides* var. *occidentalis*) since it is the dominant tree in the area potentially inundated by increased storage in Chatfield Reservoir.

The drawdown zone would be alternately inundated and exposed for variable periods each growing season. The cyclic disturbance would allow invasion of both native and exotic species that must be monitored and managed. Likely invasive species are listed in the following paragraphs and further

identified in Chapter 3 (see Section 3.6). A combination of exotic species control and native species encouragement would be needed to prevent exotic species domination. A complex of factors that control vegetation establishment would vary each year and require an adaptive management approach to achieve the desired goal. Factors that would affect vegetation establishment include the duration and timing of inundation, soil characteristics, water quality, availability of native and exotic species propagules, and proposed treatments.

The duration of inundation, as well as the duration and depth of soil saturation, are the primary factors affecting the establishment of plant species and succession of plant communities on the reservoir margin. Over the short term, changes can be expected to be quite variable since the natural availability of native or exotic weed seed combined with the site-specific conditions can be unpredictable. Over the long term, vegetation management can enhance the establishment of targeted native species and prevent exotics from proliferating by using monitoring data from weed control efforts to develop more effective control procedures.

The highest priority should be the management of weedy perennials such as the woody species tamarisk (*Tamarix ramosissima*), crack willow (*Salix fragilis*), and Russian olive (*Eleagnus angustifolia*), as well as aggressive perennial herbaceous species such as Canada thistle (*Breea arvensis*) and reed canarygrass (*Phalaris arundinacea*) or annuals such as puncturevine (*Tribulus terrestris*). Vegetation management should also include the intentional establishment of native species such as plains cottonwood and sand bar willow (*Salix exigua*) in areas with shorter periods, or lower frequencies, of inundation, and aggressive natives such as foxtail barley (*Critesion jubatum*) in areas that are regularly inundated for longer periods.

The drawdown zone would be in a cycle of disturbance that would limit vegetation establishment to annuals, biennials, and short-lived perennials. It is anticipated that woody species such as plains cottonwood, crack willow, sandbar willow, and potentially tamarisk could become naturally established apart from any intentional vegetation establishment program at the upper extent of the drawdown zone where soil conditions are adequate for germination. However, any natural establishment would be restricted, as mentioned above, by the duration and timing of inundation, precipitation, soil characteristics, water quality, and availability of native and weed species propagules. The necessary convergence of timely precipitation throughout the spring and early summer during the first one or two growing seasons, the presence of live seed of native riparian species, the absence or low competitive pressure from aggressive weedy species, and a high pool elevation to charge the groundwater table make the likelihood of natural establishment very low in the short term, although probable in the long term. Therefore, the short-term uncertainty associated with natural establishment would mean that natural establishment would only serve as a fortunate support system to any intensive, adaptive management program for vegetation establishment at or immediately above the drawdown zone. The next cycle of inundation would be expected to kill those newly established individuals that are submerged. Those individuals above the ordinary high water mark (OHWM) may survive if precipitation and an elevated groundwater level coincide.

A comparison of the fluctuation zones of other reservoirs in the region indicates that it is not very likely that an expanded fluctuation zone at Chatfield will be dominated by mud flats (Appendix HH "Comparative Review of Reservoir Fluctuation Zone Chatfield Reallocation Project"). The potential for weeds to invade the fluctuation zone of Chatfield will need to be monitored and if weeds do

invade, controlled (Appendix GG). A review of other reservoirs in the metro area indicated that they do not appear to have substantial weed issues within their fluctuation zones, although some reservoirs in southeast Colorado do have weed problems within the fluctuation zone. Mud flats were uncommon at these reservoirs, and the substrate for these reservoirs was finer than the course sands and pea gravel that currently comprise the fluctuation zone at Chatfield Reservoir.

A Tree Management Plan (Appendix Z) has been developed to address the removal of trees that would be inundated under Alternatives 3 or 4. In general, under Alternative 3, the majority of trees between 5,432 and 5,439 feet msl would be removed prior to raising the pool elevation. Selected trees in some areas may be retained for fisheries or wildlife habitat. These areas will be determined based on a review by USACE, State Parks, and CDOW. Additionally, implementation of an inundation alternative would be conducted in a step-wise fashion allowing maximum water levels to be achieved only after mitigation for partial inundation was achieved or at least underway. For example, under Alternative 3, the mitigation for an intermediate pool elevation (e.g., 5,440 feet) would be allowed, but the ability to fill to the maximum elevation of 5,444 feet would not be allowed until mitigation was underway for impacts at the intermediate level of 5,440 feet. This phased or step-wise implementation is discussed in the CMP (Appendix K, Section 7.2). Once the selected alternative is fully implemented and use of the maximum pool elevation is approved and established, the tree management plan would monitor trees that are partially inundated to determine if additional trees need to be removed.

Once the annual cycle of the reservoir drawdown has been established for a few years, a successional sequence of vegetation can be expected at the upper end of the drawdown zone. This fringe of vegetation would be closely linked to a gradient of soil moisture conditions. The zone of saturated soils above the OHWM would extend for variable distances from the upper end of the drawdown zone depending on soil texture, slope, and the upgradient conditions including the normal depth of the water table. For each of the alternative pool elevation targets, the successional changes would occur in established uplands, so a complex successional sequence would include competition between established upland and pioneering riparian species. The current vegetation along the reservoir margin may probably be replicated over the long term if weedy species were controlled, and the intentional planting of target native species could accelerate this process. However, these successional changes are dependent on the many variables discussed in the preceding paragraph and long-term successional increases in riparian or wetland communities are not used to temper the estimates of vegetation community losses described in Table 4-8. An assessment of the potential future plant communities is discussed by alternative in the following sections. The potential plant communities described for Alternatives 3 and 4 (Tables 4-8, 4-9, and 4-10) are based on the current distribution of communities on the reservoir margin and an assumption that moisture will be available during the growing season for sufficient duration at or slightly above target pool elevations. This current distribution of plant communities is based on a vegetation map of Chatfield State Park prepared by CDNR in 2001. The exact new condition for each alternative is unknown due to the high fluctuation of the water levels associated with certain alternatives.

has the least cost per acre-foot for annualized implementation and total annual cost. Alternative 1 has the least cost per acre-foot for annual OMRR&R cost.

Table 5-16
Annual Financial Costs of the Alternatives per Acre-Foot of Average Year Yield, FY 2013 Price Levels

	User Costs			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Initial/ Implementation Cost Including Capitalized OMRR&R Cost	$10,916,907	$6,512,696	$5,468,370	$6,082,008
Annual OMRR&R Costs	$1,715,055	$1,782,401	$2,497,273	$1,947,679
Total Annual Costs	$12,631,961	$8,295,097	$7,965,643	$8,029,687
Annualized Implementation Cost/acre-foot	$1,278	$763	$640	$712
Annual OMRR&R Cost/acre-foot	$201	$209	$292	$228
Total Annual Cost/acre-foot	$1,479	$971	$933	$940

Alternatives 1, 2, and 4 use NTGW to some extent (see Table 5-2). This is a nonrenewable source and it is not sustainable over a long period (beyond the 50-year planning period). The upstream water providers would be affected. NTGW would be available during long dry periods possibly at high costs. The downstream water providers would also be affected during extended dry periods because their surface water rights may not yield water. With Alternative 3 surface water rights may not yield water during extended dry periods.

Alternatives 3 and 4 would be able to more effectively capture water during high flows because Chatfield is located on the South Platte River. Storage components (Penley and gravel pits) with the other alternatives would be located on tributaries or adjacent to the South Platte River and therefore they would not be as effective at capturing water during high flows due to the pumping capacity used to collect the flows.

5.4.6 Plan Designations

Alternative 3 maximizes NED benefits and therefore is the designated NED plan. Alternative 3 also is the alternative that best meets the water supply needs of the water providers for the local communities and therefore is designated the Locally Preferred Plan. Alternative 3 is also the Least Environmentally Damaging alternative because: 1) the environmental impacts of Alternative 3 at Chatfield can all be fully mitigated; 2) Alternative 3 does not result in the drying up of any farmland or include the use of non-renewable NTGW; and 3) Alternative 3 is the plan most consistent with the Corps' seven EOP.

5.5 The Selected Plan

5.5.1 Identification of the Selected Plan

The 20,600 Acre-Foot Reallocation Alternative (Alternative 3) is designated as the Selected Plan. It is the NED Plan and the Locally Preferred Plan of the water providers. It is also fully consistent with the Corps' EOP. Alternative 3 is the Selected Plan because it is the alternative that minimizes the cost of supplying water and therefore maximizes net NED benefits. It offers $4.8 million more in net annual benefits than Alternative 1, $0.5 million more net annual benefits than Alternative 2, and $0.5 million more than Alternative 4. Mitigation measures ensure that important environmental resources are preserved and recreation modifications would maintain the recreation experience at

Chatfield Reservoir. A description of the features of the Selected Plan (Alternative 3) is located in Chapter 6.

5.5.2 Determinations Required by Authorizing Legislation

The requirements of several legislative authorizations specific to the reallocation, or the existing Chatfield Lake project, must be met in order to implement the Chatfield Water Supply Reallocation Project. The sections that follow evaluate how the Selected Plan (Alternative 3) meets these requirements. Letters from CDNR, CWCB and the National Park Service regarding the requirements of Section 808, Section 116 and the LWCF Act are included at the end of this section.

5.5.2.1 Section 808 Findings

Section 808 of WRDA 1986, as amended, authorizes the Secretary of the Army to implement a reallocation of existing storage at Chatfield Reservoir, *"…upon request of and in coordination with the Colorado Department of Natural Resources (CDNR) and upon the Chief of Engineers' finding of feasibility and economic justification…"*.

The requirement for CDNR involvement has and continues to be met. The CDNR, in a letter dated January 31, 2012, requested that the Corps consider reallocating space within Chatfield Reservoir for water supply purposes, on behalf of a group of water providers in the Denver metropolitan area. CDNR has participated with the Corps under a Feasibility Cost Share Agreement to cost-share the reallocation study. CDNR continues to support the reallocation project, has coordinated with the Water Providers and the Corps in developing the plan, and will serve as the overall non-federal sponsor signing the WSA with the Corps. The Corps continues to have discussions with the state and the water providers to further refine the legal relationship between the entities.

In regards to the requirement for the Chief of Engineers' finding, the analyses presented in the FR/EIS show that Alternative 3, the Selected Plan, is economically justified and feasible.

The Selected Plan is economically justified. It meets all federal NED goals providing $8.42 million in annual NED benefits to total annual NED project costs of $7.92 million, for a benefit to cost ratio of 1.06. It is the least costly alternative providing an average year yield of 8,539 acre-feet meeting a portion of the demand that is expected to continue to increase. The cost of the Selected Plan is within the financial capabilities of the water providers.

The Selected Plan is feasible, as shown in the FR/EIS evaluations of engineering, environmental and institutional and social considerations. The proposed raise in lake level will meet dam safety requirements and does not impact the primary flood risk management purpose at Chatfield Reservoir. Flood control capabilities at Chatfield Reservoir would not be reduced by the proposed reallocation of flood storage to water supply storage. Reallocation would not impact the primary flood risk management purpose of Chatfield reservoir. During Tri-Lakes system flood control storage evacuation for Level I (small flood events), as defined in Appendix B – Tri-Lakes Water Control Plans, the reallocation of flood control storage at Chatfield slightly increases releases and affects the timing and duration of releases made from Cherry Creek and Bear Creek though the primary flood risk management purpose for Cherry Creek and Bear Creek is not affected. Reference Appendix B – Tri-Lakes Water Control Plans for an example of how the release magnitudes are affected. There is no change to system flood control storage evacuation releases during Level II

(large flood events), as defined in Appendix B – Tri-Lakes Water Control Plans. Adverse effects to recreation facilities and environmental resources will be avoided or off-set by relocations and modifications to recreation facilities, construction of ecosystem restoration features, and preservation and enhancement of off-site habitat. All recreation modifications and environmental mitigation features utilize well-established concepts and practices, and design and construction will follow Corps standards and regulations.

The Selected Plan is environmentally and socially acceptable because environmental mitigation and recreation modifications are included in the plan to avoid or compensate for adverse effects to those resources. Environmental mitigation will be required to offset impacts to terrestrial-based effects (wetland and riparian habitats, including Preble's mouse critical habitat). Positive environmental effects to the fisheries supported by the reservoir include the inundation of terrestrial habitats which will result in increased habitat structure for use by fish and other aquatic life. Additionally, increased primary productivity as a result of increased shoreline inundation will enhance productivity at virtually every trophic level in the aquatic food web. Impacted recreation facilities will be replaced with new facilities. Although the recreation experience may be diminished for current park users due to changed facilities and lake fluctuations from the new operations of the dam, the recreation modifications and maturation of replaced trees and vegetation will provide equivalent recreation opportunities that are expected to be acceptable to the general public.

The Selected Plan will fulfill a portion of the state and regional plans for addressing future water supply sources for the Denver metropolitan area. Population growth within the Denver, Colorado, metropolitan area continues to create a demand on water providers. Colorado's population is projected to be between 8.6 and 10.3 million in 2050. The Statewide Water Supply Initiative (SWSI), commissioned by the State Legislature, estimates that by 2050, Colorado will need between 600,000 and 1 million acre-feet/year of additional municipal and industrial water. This proposed reallocation project will help enable water providers to utilize a surface water supply source to provide water to local users, mainly for municipal, industrial, and agricultural needs, in response to rapidly increasing demand and lessen dependence on non-tributary ground water. Chatfield Reservoir is well placed to help meet this objective for the following reasons: 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. Alternative 3 is most acceptable to the water providers because it is the least costly, reduces NTGW usage, and provides renewable water supply.

Extensive agency and public coordination has occurred. Representatives from federal, state, and local governments, as well as technical advisors from nongovernmental groups such as Sierra Club and Audubon Society, provided extensive input to the development of this FR/EIS. Because of the comprehensive transparent collaboration that has occurred, consideration was given to varying aspects attempting to present a plan that balances numerous interests. The expectation is that the plan presented in this FR/EIS during Draft Pubic Review will be socially and environmentally acceptable (see Appendix DD for a summary of the public comments and the Corps' responses).

5.5.2.2 Section 116

Section 116 of Division C of the Omnibus Appropriations Act of 2009 authorizes the CDNR to perform the work for design and implementation of modifications for Chatfield Reservoir and any required mitigation for the project. It also requires the Secretary to determine a cost of storage that reflects the limited reliability of the resource and user's capability to use the storage space.

The Implementation Guidance for Section 116, dated May 12, 2010, requires that this FR/EIS identify the work items to be performed by CDNR and that the ASA(CW) approval of the report includes the determination of whether the proposed work items are integral to the project. In a letter, dated February 10, 2012 (see end of Section 5.5.2.3), CWCB proposes to accomplish through its agencies and non-federal project partners, the water providers, all the modification and mitigation work for the project. Of the overall total project implementation cost estimated to be $179,000,000, the cost of the CDNR work is estimated to be $123,200,000. The work will consist of design, construction, project management and coordination for all project features, including on-site and off-site environmental mitigation; modification/re-construction of all impacted recreation facilities; utility relocations; earthwork and shoreline contouring; road, bridge and parking lot construction; demolition, clearing, and grubbing; and vegetation management. The Omaha District Corps of Engineers may decide to perform the work related to modification or instrumentation of the dam or other Chatfield Project safety features, as well as modifications to project operating documents and processes. The district would also retain responsibility for oversight of the CDNR work and inherent government responsibilities, including agency approvals and decisions. The Corps work is estimated to cost $1,730,000 and will be funded 100 percent non-federal. The proposed CDNR work is integral to the reallocation project, because all the work and features are essential components of the Selected Plan, would otherwise have been performed by the Corps, are not inherent governmental responsibilities and are not already a task required to be performed by the non-federal sponsor (such as LERRDs). All the work is eligible to be performed by CDNR, because it is within the non-Federal cost-share, which for water supply is 100 percent non-federal. Design and construction of environmental mitigation features and recreation modifications will follow Corps standards and regulations, as well as applicable federal laws governing non-federal construction. All plans will be approved by the Corps. The ASA(CW) approval of this FR/EIS and determination of whether the proposed CDNR work items are integral will identify what CDNR work might be eligible for Section 116 credit. The acceptance of the work and the affording of credit towards the non-federal share will be determined by the Omaha District inspection and certification in accordance with the terms of the WSA. The Corps continues to have discussions with the state and the water providers to further refine the legal relationship between the entities.

The second provision of Section 116 regarding the cost of storage was addressed in the ASA(CW) letter, dated January 22, 2009, which approved a modified method, supported by CDNR, for determining the costs to be repaid by CDNR for storage in Chatfield Lake. This exemption of the policy for determining the updated cost of storage is described in Section 5.3.1.2.

5.5.2.3 Land and Water Conservation Fund Act

Chatfield State Park must remain in outdoor recreation uses pursuant to Section 6(f) of the Land and Water Conservation Fund Act (LWCF), because LWCF assistance was used by the Colorado Division of Parks and Outdoor Recreation to construct the existing recreation facilities at Chatfield Lake. If facilities purchased with LWCF grants are inundated, they will be replaced elsewhere in the

park, and Colorado State Park staff will submit a formal letter to the National Park Service recognizing the changes and stating that the park is not in default. If the facilities are removed and not relocated, then the state would be in default. However, because all recreation facilities are planned to be relocated in-kind under the Selected Plan, the Selected Plan complies with the LWCF Act. As indicated in Section 5.4.4.2, the National Park Service has issued a letter (dated October 4, 2010) concurring with Colorado State Parks that the Chatfield Reservoir Storage Reallocation project will not result in a Section 6(f)(3) conversion. Letters from CDNR, CWCB and the National Park Service regarding the requirements of Section 808, Section 116 and the LWCF Act are included at the end of this section.

5.5.3 Consistency of the Selected Plan with the Corps' Seven Environmental Operating Principles

The Selected Plan is consistent in the following major ways with each of the Corps' seven Environmental Operating Principles (EOP) (see Table 2-11 for additional details).

EOP 1—The Selected Plan fosters sustainability by increasing opportunities to better utilize renewable surface water, including facilitating recapture and reuse of upstream effluents, to complement water conservation efforts already implemented by the water providers (sponsors). The Selected Plan also does not entail any increase in use (mining) of NTGW, thereby promoting the conservation of NTGW for future generations and utilizes an existing federal water storage facility.

EOP 2—The Selected Plan proactively considers the environmental consequences of Corps activities regarding sustainable water resources solutions to the consequences in the near-term and long-term of not having adequate multi-year storage for surface water or not having enough NTGW to weather droughts, which may become more frequent and severe in the future due to climate change. The Selected Plan also considers environmental consequences of the impacts of storage reallocation; avoids and minimizes these consequences to the extent practicable; and provides for full mitigation of all remaining significant environmental impacts (including proactive use of monitoring and adaptive management), giving priority attention to sustained compliance with environmental laws and regulations.

EOP 3—The Selected Plan achieves a mutually supporting economic and environmentally sustainable water resources solution to the problem of adequate water availability. The Selected Plan facilitates continuation of (sustainable) economic development and quality of life while fully mitigating environmental impacts in a manner that includes monitoring and adaptive management, to better ensure recovery of impaired ecological functions and result in healthy ecosystems.

EOP 4—The Selected Plan enables the Corps to continue to meet its corporate responsibility and accountability to ensure that resources, including water resources, are used wisely while adhering to all environmental laws and regulations. Early collaboration with an interagency team of wildlife habitat experts, including representatives of the USFWS, CDOW, Corps Regulatory staff, and non-governmental organizations ensured the Corps' accountability for achieving full mitigation of human and natural environmental impacts. Impacts to recreational facilities and recreation facility operators' incomes will also be offset. The Selected Plan was also developed in conjunction with 26 Cooperating Agencies and 11 Special Technical Advisors (non-governmental organizations) that ensured compliance with the National Environmental Policy Act and all other environmental laws.

The Corps continues to have discussions with the state and the water providers to further refine the legal relationship between the entities.

EOP 5—A risk management and systems approach was employed to consider the environment throughout the life of the Selected Plan, which includes an assessment of cumulative environmental impacts and, where required, mitigation (which incorporates adaptive management to reduce risk of failure). The mitigation plan for Preble's meadow jumping mouse habitat, called the "Systems Approach," focuses on enabling the USFWS' Recovery Plan for Preble's to be achieved by concentrating on maximizing habitat connectivity in addition to habitat attributes, and ecological functional units rather than acres alone. Risk assessments were related to costs, effects of mining non-sustainable NTGW, and effects of increased storage of surface water (including recapture and reuse of upstream effluents). The residual risk that reallocation at Chatfield would fulfill only a fraction of the unmet water needs during the 50-year period of analysis was clearly communicated.

EOP 6—The Selected Plan resulted from collaborative leveraging and integration of economic data and social knowledge from the non-federal sponsor with scientific knowledge provided by Corps staff, contractors, and representatives of other federal, state, and local agencies and non-governmental organizations. These entities shared their knowledge in FR/EIS progress meetings coordinated by the CWCB and open to the public; in working groups comprised of Cooperating Agencies and Special Technical Advisors (who also provided comments on preliminary draft FR/EIS chapters); on a panel of experts providing input to decision-making on mitigation for impacts to three types of wildlife habitat; and in a group of Chatfield State Park recreation activity participants who assessed short-term and long-term impacts of reallocation on recreation enjoyment based on the Corps' Unit Day Value method of calculating recreation benefits.

EOP 7—The Selected Plan, the level of quality, and progress on the FR/EIS was made possible by all stakeholders respecting others' views and perspectives and feeling free to share information with the group, because of the open, transparent process used. This process included public scoping meetings, FR/EIS progress meetings open to the public, public involvement meetings, public review and comment on the draft FR/EIS, and internet-based outreach efforts. The collaboration among stakeholders and customers fostered and strengthened strategic alliances that resulted in innovative win-win solutions for all participating agencies, organizations, and individuals to achieve the maximum amount of reallocated storage available while protecting and enhancing the human and physical environment.

6. DESCRIPTION OF SELECTED PLAN

6.1 Introduction

The Selected Plan is Alternative 3, the reallocation of 20,600 acre-feet of storage at the Chatfield Reservoir Project to municipal and industrial water supply. This chapter describes the plan features, which include water supply, recreation modifications, environmental mitigation and other modifications to the Chatfield Reservoir Project. The chapter also provides a summary of the first costs to implement the project, summarizes the Compensatory Mitigation Plan (CMP, Appendix K), and identifies other additional measures which the water providers (Chatfield water providers) and the Colorado Department of Natural Resources are developing beyond the federal reallocation project.

6.2 Features of Selected Plan

6.2.1 General

The Selected Plan reallocation would fully meet the purpose of and need for the project, which is to increase the availability of 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 Selected Plan meets all federal NED goals, providing $8.42 million in annual NED benefits at total annual NED project costs of $7.92 million, for an NED benefit to cost ratio of 1.06. This alternative would provide storage to help meet part of the growing demand for water in the Denver Metro area by using existing federal infrastructure, and lessening the dependence on NTGW. The impacts of the Selected Plan can be fully compensated. The CMP for impacts to wetlands, to the federally listed threatened Preble's meadow jumping mouse habitat (including Designated Critical Habitat), and to bird habitat that also provides habitat for other wildlife, is presented in Appendix K. The Recreation Facilities Modification Plan for impacts to recreation facilities is provided in Appendix M. A summary of the major features of the CMP and recreation modification plan, which would be paid for by the non-federal sponsors of the Chatfield Reservoir storage reallocation project, is presented in this chapter.

In accordance with the cost-sharing provisions of the 1958 Water Supply Act and Section 103(c)(2) of WRDA 1986, the CDNR, through its agencies and non-federal project partners, will fund implementation and operation of the water supply reallocation project 100 percent at no cost to the federal government, and in accordance with Section 116 will perform design and construction of the recreation modifications and the environmental mitigation. In this report, the estimated costs to be paid by the water providers are presented as financial costs not NED costs.

6.2.2 Water Supply

The Selected Plan reallocates an additional 20,600 acre-feet to water supply storage. The storage would be reallocated from the flood control pool to the conservation pool. Under this alternative, the base elevation of the flood control pool would be raised 12 feet, from 5,432 to 5,444 feet msl, but the reallocation of storage for this project only involves the volume between 5,432 and 5,444 feet msl. This amount of storage would provide an average year yield of 8,539 acre-feet. The average year yield is based on regional experience that one acre-foot of available storage provides about 0.41 acre-foot of average year yield. Mitigation will be required to offset impacts to terrestrial-based

effects (wetland and riparian habitats, including Preble's mouse critical habitat). The CDNR is the non-federal signatory to the WSA. The water providers seeking storage space in Chatfield Reservoir are the Penley Reservoir User Group, the Lower South Platte Gravel Pit User Group, and Denver Botanic Gardens at Chatfield. The Penley Reservoir User Group includes Mount Carbon Metropolitan District, the eight SMWSA members that are participants in the study, Colorado Parks and Wildlife, Center of Colorado Water Conservancy District, and CWCB. The Lower South Platte Gravel Pit User Group is composed of Central Colorado WCD and Western Mutual Ditch Company.

6.2.3 Recreation

The Recreation Facilities Modification Plan is considered to be an integral component of the Selected Plan, as it is required to address the adverse impacts caused by operating the reservoir under the new system, which involves a significant change in how water levels fluctuate within the reservoir. The recreation modifications can be fully accomplished within the current boundaries of Chatfield State Park and are considered sufficient for maintaining recreational purposes of the Corps project.

To offset adverse impacts to the existing recreation facilities, the Selected Plan includes relocations and modifications of recreation facilities. In developing the Recreation Facilities Modification Plan for Chatfield State Park, operating conditions, including the relationship between water levels and existing facilities and how visitors use the park, were considered. Below is a list of impacted areas, modifications to occur, and estimated cost for modifications as shown in Appendix 1 of the Recreation Facilities Modification Plan (Appendix M). The cost price level is fiscal year (FY) 2010.

The Recreation Facilities Modification Plan would include the on-site actions listed below. Appendices M and N should be consulted for additional details about the recreation modifications.

- *North Boat Ramp:* Construction of new boat ramps, changes in ramp gradients, and facility relocation. Parking areas, concrete boat ramp, trails, day use shelter, picnic tables, trash receptacles, bollards, grills, regulatory signs, and water hydrants. Estimated cost: $636,228.

- *Massey Draw:* Relocation of facilities. Asphalt trails, picnic tables, benches, trash receptacles, grills, beach volleyball court, and horse shoe pit. Estimated cost: $357,851.

- *Eagle Cove:* Reconstruction of facilities and parking. Parking area, portable restroom, dumpsters, trash receptacles, regulatory signs, and fencing. Estimated cost: $222,432.

- *Deer Creek Day Use and Balloon Launch Area:* Reconstruction of facilities and parking and road relocation. Parking area, trails, picnic tables, trash receptacles, grills, and regulatory sign. Estimated cost: $779,343.

- *Swim Beach:* Reconstruction of beach, facility and parking and road relocation. Parking area, shower/restroom building, concession, first aid station, information kiosk, picnic tables, benches, water fountain, dumpsters, trash receptacles, bollards, grills, regulatory signs, fencing, beach volleyball court, horse shoe pits, sand, and utilities. Estimated cost: $5,109,500.

- *Jamison Area:* Reconstruction of facilities and parking and road relocation. Parking area, trails, restroom, picnic tables, benches, water fountain, dumpsters, trash receptacles, grills, regulatory signs, utilities, and electrical transformer. Estimated cost: $999,890.

- *Catfish Flats*: Relocation of facilities and parking. Parking areas, trails, restroom building, group picnic shelters, picnic tables, benches, water fountain, dumpsters, regulatory signs, utilities, and electrical transformer. Estimated cost: $902,609.

- *Fox Run:* Relocation of facilities and parking. Trails, group picnic area, picnic tables, benches, water fountain, dumpsters, trash receptacles, regulatory signs, beach volleyball court, and horse shoe pits. Estimated cost: $160,574.

- *Kingfisher Area:* Creation of new parking areas, facility relocation. Parking area, portable restrooms, dumpsters, trash receptacles, regulatory signs, fencing. Estimated cost: $154,280.

- *Gravel Ponds Area:* Creation of new parking areas, facility relocation. Construction of bridge over South Platte River (separate cost). Parking area, portable restrooms, picnic tables, dumpsters, trash receptacles, regulatory signs, and fencing. Estimated cost: $113,640.

- *Platte River Trailhead Area:* Construction of new trails. Estimated cost: $58,575.

- *Marina Point:* Facility relocation, breakwater construction, fishing pier replacement, new anchor construction, winch replacement, installation of floating platforms, relocation of entry road, parking, boat ramp, trails, and walkways. Parking area, trails, shower/restroom building, concession, day use area, information kiosk, riverside marina slips, group picnic area, picnic tables, benches, water fountain, dumpsters, trash receptacles, regulatory signs, beach volleyball court, horse shoe pits, sand, and utilities. Estimated cost: $6,023,353.

- *Roxborough Cove:* Facility relocation. Portable restroom, regulatory signs, picnic tables, trash receptacles, grills, and sand. Estimated cost: $213,949.

- *Plum Creek Picnic Area:* Relocation of parking area, entry road, and day use area, rerouting of trail, and relocating sanitary sewer line. Parking areas, trails, restroom building, picnic tables, benches, dumpsters, regulatory signs, fencing, and volleyball court. Estimated cost: $249,943.

- The Recreation Facilities Modification Plan includes a small amount of dredge and fill of wetlands. The potential impacts of these actions are evaluated in Appendix W and summarized below in Section 6.5.3.

- In addition to the items specified above, the Recreation Facilities Modification Plan will replant trees as part of relocating facilities; however the ability of those trees to immediately provide shade and aesthetic value will be limited. The Tree Management Plan (Appendix Z) attempts to minimize the amount of large trees removed by minimizing the number of trees that are removed above elevation 5,439 feet msl due to their higher likelihood of survival. In addition, the CMP (discussed in environmental considerations below) also identifies onsite mitigation to be priority for mitigating ecological resources. In completing onsite mitigation,

replacement of lost riparian areas and wetlands will occur, not only helping to replace ecological values, but also will eventually provide some replacement value for shade and aesthetics.

6.2.4 Environmental Mitigation

To off-set the adverse impacts to environmental resources, the Selected Plan includes the CMP which consists of on-site and off-site mitigation measures.

On-site mitigation would occur within Chatfield Reservoir project lands. Twenty-nine potential on-site mitigation sites are being evaluated for their mitigation potential. The mitigation sites occur within four general areas of the Chatfield Reservoir project lands: Lower Marcy Gulch, Deer Creek, West Plum Creek, and South Platte River. The on-site mitigation site locations are shown in Appendix K (CMP Figures 7 through 15). Two potential mitigation sites totaling 17.4 acres are located in Lower Marcy Gulch, four potential mitigation sites totaling 13.6 acres are located in the Deer Creek area, 10 potential mitigation sites totaling 54.1 acres are located in the West Plum Creek arm of Chatfield Reservoir, and 13 potential mitigation sites totaling 80.2 acres are located in the South Platte River arm of Chatfield Reservoir. All of the on-site mitigation sites are designed to provide gains in EFUs for the target environmental resources (Preble's, wetlands, and birds). Similar to how the target environmental resources overlap within the Chatfield Reservoir project lands, the on-site mitigation areas will provide overlapping and combined resources for the target environmental resources. Detailed information for each potential mitigation site, including the existing conditions and proposed habitat gains can be found in Appendix K.

Off-site mitigation would occur outside the boundaries of Chatfield Lake project and would include:

- Permanent protection of habitat associated with the target environmental resources (Preble's, wetlands, and birds) for an estimated 888 acres (of the 5,917 acres identified) by conservation easements put in place on property purchased in fee from willing sellers or through conservation easement agreements with willing property owners. This habitat protection will be acquired from willing sellers only and the non-federal sponsor (CDNR) will not subject any owner to condemnation;

- Off-site habitat conversion and enhancement activities associated with protection of the estimated 888 acres of protected habitat described above; and

- Protection of up to 22.5 acres of off-site existing mature cottonwood habitat and designation of up to 10 acres for cottonwood regeneration associated with protection of the estimated 888 acres of protected habitat described above.

As part of the on-site and off-site mitigation actions discussed above, mitigation for impacts to Preble's designated critical habitat would include:

- On-site mitigation of approximately 17 acres in the Upper South Platte CHU and 6 acres in the West Plum Creek CHU as described in Section 6.3.1 of Appendix K; and

- Off-site mitigation in the form of sediment control and riparian habitat extension along 4.5 stream miles of Sugar Creek in the Upper South Platte CHU on U.S. Forest Service land,

Appendix S
Compliance with Environmental Statutes

1. COMPLIANCE WITH ENVIRONMENTAL STATUTES

The Proposed Action/project has been determined to be in compliance with the following federal laws, executive orders, and memorandums.

American Indian Religious Freedom Act (AIRFA) of 1978
Public Law 95-341; 42 United States Code (U.S.C.) §§ 1996 and 1996a
In compliance

This Act protects "and preserves for American Indians their inherent right of freedom to believe, express, and exercise the traditional religions of the American Indian, Eskimo, Aleut, and Native Hawaiians, including but not limited to access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites." The proposed project would not adversely affect the protections offered by AIRFA. Access to sacred sites by Tribal members would not be affected.

Bald and Golden Eagle Protection Act (BGEPA) of 1940, as amended
16 U.S.C. §§ 668, 668 note, 668a-668d
In compliance

This Act prohibits any form of possession or taking of both bald and golden eagles. The statute imposes criminal and civil sanctions as well as an enhanced penalty provision for subsequent offenses. Further, the BGEPA provides for the forfeiture of anything used to acquire eagles in violation of the statute. The statute excepts from its prohibitions on possession the use of eagles or eagle parts for exhibition, scientific, and Indian religious uses. The Corps has, and will continue to, coordinate with the U.S. Fish and Wildlife Service (USFWS) and the Colorado Division of Wildlife (CDOW) to avoid taking the species during construction activities, and will follow the USFWS and State guidelines regarding eagle nests as appropriate.

Clean Air Act of 1972, as amended
Public Law Chapter 360; 69 Statute 322; 42 U.S.C. § 7401, et seq.
In compliance

The purpose of this Act is to protect public health and welfare by the control of air pollution at its source, and to set forth primary and secondary National Ambient Air Quality Standards to establish criteria for States to attain, or maintain. Section 118 of the Act requires all federal facilities to comply with existing federal, state, and local air pollution control laws and regulations. Land development activities release fugitive dust, a pollutant regulated by the Air Pollution Control Division of the Colorado Department of Public Health and Environment (CDPHE). Under Colorado air quality regulations, land development refers to all land clearing activities, including excavating or grading. Land development projects that are greater or equal to 25 continuous acres or 6 months in duration typically require the submission of an Air Pollutant Emission Notice (APEN) and an air permit. In some cases APENs and air permits are not required due to estimated air emissions below reporting thresholds. The APEN form is used to record general project information including the project description, location, size, and duration of the land development project. It includes detailed information on the Fugitive Dust Control Plan (FDCP), which addresses how dust will be minimized at the project site. Temporary land development permits are typically issued for a period

of up to five years. Based on the information provided on the APEN, the permit may cover a single land development activity or a series of activities (or project phases) over a defined period of time.

The Corps will work in conjunction with CDPHE to ensure that all construction activities meet these requirements. Some temporary emission releases may occur during construction activities; however, air quality is not expected to be impacted to any measurable degree. Air quality is evaluated in Section 4.12 of the FR/EIS.

Clean Water Act of 1977, as amended (Federal Water Pollution Control Act)
Public Law 845, June 30, 1948; 62 Statute 1155; 33 U.S.C. § 1251, et seq.
In compliance

This Act provides for the restoration and maintenance of the physical, chemical, and biological integrity of the nation's waters. Section 404 of the act prohibits the discharge of fill material into waters of the United States, including wetlands, except as permitted under separate regulations by the Corps and the Environmental Protection Agency (EPA). The Section 404(b)(1) Guidelines (40 Code of Federal Regulations 230) are the substantive criteria used in evaluating discharges of dredged or fill materials in waters of the United States under Section 404 of the Clean Water Act. Fundamental to these Guidelines is the precept that dredged or fill materials should not be discharged into an aquatic ecosystem unless it can be demonstrated that such discharges would not have unacceptable adverse impacts either individually or in combination with known or probable impacts of other activities affecting the ecosystem of concern. In addition, according to the federal Clean Water Act, anyone who wishes to obtain a federal permit for any activity that may result in a discharge to waters of the United States must first obtain a state Section 401 water quality certification to ensure the project will comply with state water quality standards. The increase in the pool elevation of Chatfield Reservoir will not discharge fill into any jurisdictional waters of the United States and; therefore, a 404 permit and a 401 certification are not required for this aspect of the Proposed Action. The Proposed Action would involve relocation of recreation facilities (e.g., boat ramps, bike paths), and road and bridge construction, actions incidental to this alternative that would result in discharge of dredged or fill material into waters of the United States. The environmental impacts of and alternatives to the recreation facilities-related discharges are described in Appendix W.

Correspondence between the EPA and the Corps related to Clean Water Act compliance is included as Attachment 1.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended
Public Law 97-98; 42 U.S.C. § 9601, et seq.
In compliance

CERCLA, commonly known as Superfund, created a tax on the chemical and petroleum industries and provided broad federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. This Act (1) established prohibitions and requirements concerning closed and abandoned hazardous waste sites; (2) provided for liability of persons responsible for releases of hazardous waste at these sites; and (3) established a trust fund to provide for cleanup when no responsible party could be identified. Typically CERCLA is triggered by (1) the release or substantial threat of a release of a hazardous substance into the

environment; or (2) the release or substantial threat of a release of any pollutant or contaminant into the environment which presents an imminent threat to the public health and welfare. To the extent such knowledge is available, 40 C.F.R. Part 373 requires notification of CERCLA hazardous substances in a land transfer. No spills, reported releases, or underground tanks have been identified in the affected area. Pipeline construction activities would be monitored to avoid spills of potentially hazardous materials (e.g., fuel, hydraulic fluid). This project will not involve any real estate transactions.

Endangered Species Act of 1973, as amended
Public Law 93-205; 87 Statute 884; 16 U.S.C. § 1531, et seq.
In compliance

This Act protects threatened and endangered species, as listed by USFWS, from unauthorized take, and directs federal agencies to ensure that their actions do not jeopardize the continued existence of such species. Section 7 (16 U.S.C. § 1536) of the act defines federal agency responsibilities for consultation with USFWS and requires preparation of a Biological Assessment after an alternative is selected through the public NEPA process. The Biological Assessment (Appendix V) identifies any threatened or endangered species that are likely to be affected by the Proposed Action. The Corps is informally consulting with USFWS, a cooperating agency, regarding potential project effects to federally listed species. The Corps has determined that habitat loss could result for some threatened and endangered plant and wildlife species. USFWS will present the results of consultation in a Biological Opinion.

Farmland Protection Policy Act (FPPA) of 1981 (Subtitle I of Title XV of the Agriculture and Food Act of 1981), of 1984
7 U.S.C. § 4201, et seq.
In compliance

This Act is intended to minimize the impact federal programs have on the unnecessary and irreversible conversion of farmland to nonagricultural uses. It assures that—to the extent possible—federal programs are administered to be compatible with state, local units of government, and private programs and policies to protect farmland. Federal agencies are required to develop and review their policies and procedures to implement the FPPA every 2 years. For the purpose of FPPA, farmland includes prime farmland, unique farmland, and land of statewide or local importance. Farmland subject to FPPA requirements does not have to be currently used for cropland. It can be forest land, pastureland, cropland, or other land, but not water or urban built-up land. This Act instructs the Department of Agriculture, in cooperation with other departments, agencies, independent commissions and other units of the federal government, to develop criteria for identifying the effects of federal programs on the conversion of farmland to nonagricultural uses. Information on soils within the study area was obtained from the U.S. Department of Agriculture Natural Resource Conservation Service published soil maps for the five-county study area. Construction of the proposed project would not significantly impact prime or unique farmland soils.

Federal Water Project Recreation Act of 1965, as amended
Public Law 89-72, July 9, 1965; 79 Statute 213; 16 U.S.C. §§ 460(L)(12)-460(L)(21)
In compliance

The Act establishes the policy that consideration be given to the opportunities for outdoor recreation and fish and wildlife enhancement in the investigating and planning of any federal

navigation, flood control, reclamation, hydroelectric or multi-purpose water resource project, whenever any such project can reasonably serve either or both purposes consistently. This project relocates all necessary recreational opportunities, and this recreational development will not negatively impact fish and wildlife habitat in the reservoir or the downstream channel.

Fish and Wildlife Coordination Act (FWCA) of 1958, as amended
16 U.S.C. §§ 661-667e
In compliance

This Act, as amended, proposes to assure that fish and wildlife resources receive equal consideration with other values during the planning of water resources development projects. FWCA was passed because the goals of water-related projects (e.g., flood control, irrigation, navigation, hydroelectric power) may conflict with the goal of conserving fish and wildlife resources. The Corps is working closely with the USFWS and CDOW to show how the project is incompliance with the FWCA. The USFWS is a cooperating agency and is responsible for consultation with the Corps under the Endangered Species Act and the Fish and Wildlife Coordination Act. The USFWS will consult regarding potential impacts to federally listed threatened or endangered species and their designated critical habitat based on the Biological Assessment (Appendix V), prepared by the Corps, that addresses impacts from a selected alternative. The USFWS's FWCA Report is included in Appendix X.

Land and Water Conservation Fund Act (LWCFA) of 1964, as amended
16 U.S.C. §§ 4601-4 through 4601-11
In compliance

Planning for recreation development at Corps projects is coordinated with the appropriate states so that the plans are consistent with public needs. The Corps must coordinate with the National Park Service (NPS) to insure that no property acquired or developed with assistance from this Act will be converted to other than outdoor recreation uses. If conversion is necessary, approval of NPS is required, and plans are developed to relocate or re-create affected recreational opportunities. Some lands involved in the project were acquired or developed with LWCFA funds. The proposed project will not result in removal of any facilities acquired with LWCFA funding or in any areas being converted to non-recreational uses. If removed, these facilities will be replaced. The National Park Service has issued a letter to Colorado State Parks indicating that the Chatfield Reservoir Storage Reallocation Project does not constitute a section 6(f)(3) conversion under the LWCF program (see Attachment 3).

Migratory Bird Conservation Act of 1929, as amended
16 U.S.C. §§ 715-715r
Not applicable

This Act establishes a Migratory Bird Conservation Commission to approve areas of land or water recommended by the Secretary of the Interior for acquisition as reservations for migratory birds. Consultation with state and local government is required prior to acquisition. This is not applicable to the project.

Migratory Bird Treaty Act (MBTA) of 1918, as amended
40 Statute 755; 16 U.S.C. §§ 703-712
In compliance

This Act regulates or prohibits taking, killing, possession of, or harm to migratory bird species listed in Title 50 C.F.R. Section 10.13. The MBTA is an international treaty for the conservation and management of bird species that may migrate through more than one country and is enforced in the United States by USFWS. Hunting of specific migratory game birds is permitted under the regulations listed in Title 50 C.F.R. 20. The Act was amended in 1972 to include protection for migratory birds of prey (raptors). Executive Order 13186 (see below) directs executive agencies to take certain actions to implement the Act. The Corps will avoid impacts to migratory birds, and their nests, to the extent possible. Any vegetation management (especially tree removal) will be planned to avoid the nesting season to comply with this law. Removal of trees under "The Tree Management Plan" will be in compliance with the MBTA as noted in Appendix Z.

National Environmental Policy Act (NEPA) of 1969, as amended
Public Law 91-190; 83 Statute 852; 42 U.S.C. § 4341, et seq.
In compliance

The NEPA process is intended to assist public officials to make decisions that are based on an understanding of environmental consequences and take actions that protect, restore, and enhance the environment. Regulations implementing NEPA are set forth by the CEQ. This EIS was prepared to comply with NEPA.

National Historic Preservation Act (NHPA) of 1966, as amended
Public Law 89-665; 80 Statute 915; 16 U.S.C. § 470, et seq.
In compliance

NHPA requires agencies to take into account the effects of their actions on properties listed in or eligible for listing in the National Register of Historic Places. The Advisory Council on Historic Preservation has developed implementing regulations (36 C.F.R. 800) that allow agencies to develop agreements for consideration of these historic properties. The Corps has complied with Section 106 by making appropriate efforts to identify cultural resources that might be present within the project area by conducting surveys and archival research. The Corps has also complied with the consultation provisions by contacting the Native American Heritage Commission and directly contacting 14 Indian tribes (this process is currently ongoing) (Attachment 4). In addition, the Corps has reported findings, and is consulting with SHPO for concurrence on the results of their investigations (Attachment 2).

Native American Graves Protection and Repatriation Act (NAGPRA) of 1990
Public Law 101-601; 104 Statute 3048; 25 U.S.C. § 3001, et seq.
In compliance

This Act describes the rights of Native American lineal descendants, Indian tribes, and Native Hawaiian organizations with respect to the treatment, repatriation, and disposition of Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony, referred to collectively in the statute as cultural items, with which they can show a relationship of lineal descent or cultural affiliation. One major purpose of this statute (Section 3) is to provide greater protection for Native American burial sites and more careful control over the removal of Native American human remains, funerary objects, sacred objects, and items of cultural patrimony on federal and tribal lands. NAGPRA requires that Indian tribes or Native Hawaiian organizations be consulted whenever archeological investigations encounter, or are expected to encounter, Native American cultural items or when such items are unexpectedly discovered on federal or tribal lands.

Excavation or removal of any such items also must be done under procedures required by the ARPA. If any Native American cultural items covered by this Act are uncovered during relocation of the proposed recreational facilities or water levels, any claims to such items will be reviewed in accordance with the provisions of the Act, and the procedures to repatriate within the Act will be followed.

Noise Control Act of 1972
42 U.S.C. §§ 4901 to 4918
In compliance

This Act establishes a national policy to promote an environment for all Americans free from noise that jeopardizes their health and welfare. Federal agencies are required to limit noise emissions to within compliance levels. To accomplish this, the Act establishes a means for the coordination of federal research and activities in noise control, authorizes the establishment of federal noise emissions standards for products distributed in commerce, and provides information to the public respecting the noise emission and noise reduction characteristics of such products (42 U.S.C. § 4901). The Act authorizes and directs that federal agencies, to the fullest extent consistent with their authority under federal laws administered by them, carry out the programs within their control in such a manner as to further the policy declared in 42 U.S.C. § 4901. Each department, agency, or instrumentality of the executive, legislative, and judicial branches of the federal government having jurisdiction over any property or facility or engaged in any activity resulting, or which may result in, the emission of noise shall comply with federal, state, interstate, and local requirements respecting control and abatement of environmental noise. Each federal agency shall, upon request, furnish information to the EPA regarding the nature, scope, and results of the noise research and noise-control programs of that agency, and shall consult with EPA, as required, in prescribing standards or regulations respecting noise. Certified low-noise-emission products shall be acquired for use by the federal government in lieu of other products if the Administrator of General Services determines that reasonably priced, reliable substitutes exist (42 U.S.C. § 4914). The Act includes provision for citizen suits (42 U.S.C. § 4911(a)) whereby any person may commence civil action against the United States or any governmental instrumentality or agency who is alleged to be in violation of any noise control requirement. Noise emission levels at the project site will increase above current levels temporarily due to construction; however, appropriate measures will be taken to keep the noise level within the compliance levels. Noise is evaluated in Section 4.13 of the FR/EIS.

North American Wetlands Conservation Act (NAWCC) of 1989
16 U.S.C. § 4401, et seq.
In compliance

This Act provides matching grants to organizations and individuals who have developed partnerships to carry out wetlands conservation projects in the United States, Canada, and Mexico for the benefit of wetlands-associated migratory birds and other wildlife. NAWCC establishes the North American Wetlands Conservation Council (16 U.S.C. § 4403) to recommend wetlands conservation projects to the Migratory Bird Conservation Commission. Section 9 of the Act (16 U.S.C. § 4408) addresses the restoration, management, and protection of wetlands and habitat for migratory birds on federal lands. Federal agencies acquiring, managing, or disposing of federal lands and waters are to cooperate with the USFWS to restore, protect, and enhance wetland ecosystems and other habitats for migratory birds, fish, and wildlife on their lands, to the extent consistent with

their missions and statutory authorities. The Corps is coordinating with the USFWS to mitigate the impacts to migratory bird habitats, including those that would occur in wetland habitats.

Resource Conservation and Recovery Act (RCRA) of 1976, as amended
42 U.S.C. § 6901, et seq.
In compliance

RCRA gives EPA the authority to control hazardous waste from the "cradle-to-grave." This includes the generation, transportation, treatment, storage, and disposal of hazardous waste. This Act also sets forth a framework for the management of non-hazardous solid wastes. The 1986 amendments to RCRA enabled EPA to address environmental problems that could result from underground tanks storing petroleum and other hazardous substances. Any potentially hazardous materials used during construction activities would be handled in compliance with RCRA. Hazardous, toxic, and radiological wastes are discussed in Section 4.11 of the FR/EIS.

Rivers and Harbors Act of 1899
30 Statute 1151; 33 U.S.C. § 403
Not applicable

This law prohibits the unauthorized obstruction or alteration of any navigable water of the United States. This section provides that the construction of any structure in or over any navigable water of the United States, or the accomplishment of any other work affecting the course, location, condition, or physical capacity of such waters is unlawful unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of the Army. The Secretary's approval authority has since been delegated to the Chief of Engineers. No Section 10 permit is required for this project.

Toxic Substances Control Act (TSCA) of 1976
15 U.S.C. § 2601, et seq.
In compliance

This Act was enacted by Congress in 1976 to give EPA the ability to track the 75,000 industrial chemicals currently produced or imported into the United States. EPA repeatedly screens these chemicals and can require reporting or testing of those that may pose an environmental or human-health hazard. EPA can ban the manufacture and import of those chemicals that pose an unreasonable risk. Also, EPA has mechanisms in place to track the thousands of new chemicals that industry develops each year with either unknown or dangerous characteristics. EPA then can control these chemicals as necessary to protect human health and the environment. TSCA supplements other federal statutes, including the Clean Air Act and the Toxic Release Inventory under Emergency Planning Community Right to Know Act (EPCRA). The relocation transformers would be conducted in compliance with TSCA. Hazardous, toxic, and radiological wastes are discussed in Section 4.11 of the FR/EIS.

Watershed Protection and Flood Prevention Act of 1954, as amended
Public Law 83-566; 16 U.S.C. § 1101, et seq.
Not applicable

Under this Act, the Natural Resources Conservation Service at the Department of Agriculture provides planning assistance and construction funding for projects constructed by local sponsors, often in the form of flood control districts. This Act authorizes the Secretary of Agriculture to

cooperate with states and other public agencies in works for flood prevention and soil conservation, as well as the conservation, development, utilization, and disposal of water. This act imposes no requirements on Corps Civil Works projects.

Wild and Scenic Rivers Act of 1968, as amended
16 U.S.C. §§ 1271-1287
Not applicable

This Act establishes a National Wild and Scenic Rivers System for the protection of rivers with important scenic, recreational, fish and wildlife, and other values. Rivers are classified as wild, scenic, or recreational. The Act designates specific rivers for inclusion in the System and prescribes the methods and standards by which additional rivers may be added. The Act contains procedures and limitations for control of lands in federally administered components of the System and for disposition of lands and minerals under federal ownership. Hunting and fishing are permitted in components of the System under applicable federal and state laws. The area in which the proposed activity would occur is not designated as a wild or scenic river, nor is it on the National Inventory of Rivers potentially eligible for inclusion.

Executive Order No. 11988 of May 24, 1977: Floodplain Management
In compliance

Section 1 requires each agency to "provide leadership and…take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities." This project will not adversely affect the flood holding capacity or flood surface profiles of any stream.

Executive Order No. 11990 of May 24, 1977: Protection of Wetlands
In compliance

This Executive Order requires federal agencies to "take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; and (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities…Each agency, to the extent permitted by law, shall avoid undertaking or providing assistance for new construction located in wetlands unless the head of the agency finds (1) that there is no practicable alternative to such construction, and (2) that the proposed action includes all practicable measures to minimize harm to wetlands, which may result from such use. In making this finding the head of the agency may take into account economic, environmental and other pertinent factors. Each agency shall also provide opportunity for early public review of any plans or proposals for new construction in wetlands." The Corps is cooperating with the USFWS to mitigate the wetland functions and values likely to be impacted by project development.

Executive Order No. 12692 of June 9, 1995: Recreational Fisheries
In compliance

This Executive Order mandates that federal agencies, "to the extent permitted by law and where practicable, and in cooperation with States and Tribes, improve the quantity, function, sustainable productivity, and distribution of U.S. aquatic resources for increased recreational fishing opportunities by: (a) developing and encouraging partnerships between governments and the private sector to advance aquatic resource conservation and enhance recreational fishing opportunities; (b) identifying recreational fishing opportunities that are limited by water quality and habitat degradation and promoting restoration to support viable, healthy, and, where feasible, self-sustaining recreational fisheries; (c) fostering sound aquatic conservation and restoration endeavors to benefit recreational fisheries; (d) providing access to and promoting awareness of opportunities for public participation and enjoyment of U.S. recreational fishery resources;

(e) supporting outreach programs designed to stimulate angler participation in the conservation and restoration of aquatic systems; (f) implementing laws under their purview in a manner that will conserve, restore, and enhance aquatic systems that support recreational fisheries; (g) establishing cost-share programs, under existing authorities, that match or exceed Federal funds with nonfederal contributions; (h) evaluating the effects of Federally funded, permitted, or authorized actions on aquatic systems and recreational fisheries and document those effects relative to the purpose of this order; and (i) assisting private landowners to conserve and enhance aquatic resources on their lands." The reservoir is stocked with sport fish and forage fish by CDOW to enable a quality fishery to be maintained. The proposed project is not anticipated to impact recreational fisheries within the reservoir.

Executive Order No. 12898 of February 11, 1994: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations
In compliance

This Executive Order directs federal agencies to "make…achieving environmental justice part of its mission" and to identify and address "…disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations." The project does not disproportionately impact minority or low-income populations.

Executive Order No. 13045 of April 23, 1997: Protection of Children from Environmental Health Risks and Safety Risks
In compliance

This Executive Order states that "to the extent permitted by law and appropriate, and consistent with the agency's mission, each Federal agency: (a) shall make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children; and (b) shall ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks." The proposed recreational facilities development will be designed, operated, and maintained in a manner that meets all applicable safety requirements and ensures the safety of all visitors, including children. Supervision by lifeguards in the swim beach area will be provided during daylight hours.

Executive Order No. 13112 of February 3, 1999: Invasive Species
In compliance

This Executive Order prevents "the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause." This Executive Order directs federal agencies to not authorize, fund, or carry out actions that are likely to cause or promote the introduction or spread of invasive species. The project actions include measures to prevent the introduction and spread of invasive species.

Executive Order No. 13186 of January 10, 2001: Responsibilities of Federal Agencies to Protect Migratory Birds

In compliance

This Executive Order "directs executive departments and agencies to take certain actions to further implement the [Migratory Bird Treaty] Act…Each Federal agency taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations is directed to develop and implement, within 2 years, a Memorandum of Understanding (MOU) with the Fish and Wildlife Service (Service) that shall promote the conservation of migratory bird populations." The Corps is coordinating with the USFWS to mitigate the impacts to migratory bird habitats and restore ecological values and avian functions to the extent possible within the Corps project proximity.

Executive Order No. 13195 of January 18, 2001: Trails for America in the 21st Century

In compliance

This Executive Order requires Federal agencies, "to the extent permitted by law and where practicable—and in cooperation with Tribes, States, local governments, and interested citizen groups—protect, connect, promote, and assist trails of all types throughout the United States." Paved and unpaved hiking and bicycle trails are sited throughout the Chatfield project and the total trail length will not be decreased by the proposed new recreational facilities.

Executive Order No. 13352 of August 26, 2004: Facilitation of Cooperative Conservation

In compliance

This Executive Order requires that the secretaries of the Interior, Agriculture, Commerce, and Defense and the Administrator of the EPA shall "carry out the programs, projects, and activities of the agency that they respectively head that implement laws relating to the environment and natural resources in a manner that: (a) facilitates cooperative conservation; (b) takes appropriate account of and respects the interests of persons with ownership or other legally recognized interests in land and other natural resources; (c) properly accommodates local participation in Federal decision making; and (d) provides that the programs, projects, and activities are consistent with protecting public health and safety." The project is in accordance with this Executive Order because its design, operation, and siting incorporates conservation aspects and safety requirements and has considered the needs of neighboring landowners and input from public involvement.

Executive Order No. 13443 of August 20, 2007: Facilitation of Hunting Heritage and Wildlife Conservation

In compliance

This Executive Order requires federal agencies, consistent with each agency's mission, to "(a) evaluate the effect of agency actions on trends in hunting participation and, where appropriate to address declining trends, implement actions that expand and enhance hunting opportunities for the public; (b) Consider the economic and recreational values of hunting in agency actions, as appropriate; (c) Manage wildlife and wildlife habitats on public lands in a manner that expands and

enhances hunting opportunities, including through the use of hunting in wildlife management planning; (d) Work collaboratively with State governments to manage and conserve game species and their habitats in a manner that respects private property rights and State management authority over wildlife resources; (e) Establish short and long term goals, in cooperation with State and tribal governments, and consistent with agency missions, to foster healthy and productive populations of game species and appropriate opportunities for the public to hunt those species; (f) Ensure that agency plans and actions consider programs and recommendations of comprehensive planning efforts such as State Wildlife Action Plans, the North American Waterfowl Management Plan, and other range-wide management plans for big game and upland game birds; (g) Seek the advice of State and tribal fish and wildlife agencies, and, as appropriate, consult with the Sporting Conservation Council and other organizations, with respect to the foregoing Federal activities." Although hunting is prohibited on project lands, the proposed activity does not adversely impact conservation measures to enhance habitat for game species such as waterfowl.

Council on Environmental Quality (CEQ) Memorandum, August 10, 1980, Interagency Consultation to Avoid or Mitigate Adverse Effects on Rivers in the Nationwide Inventory
Not applicable

This memorandum states that each federal agency shall take care to avoid or mitigate adverse effects on rivers identified in the Nationwide Inventory. No portion of this project is listed on the Nationwide Rivers Inventory.

Appendix W
CWA Section 404(b)(1) Analysis
Dredge and Fill Compliance

CWA Section 404(b)(1) Analysis
Dredge and Fill Compliance
Chatfield Reservoir Storage Reallocation FR/EIS

1. INTRODUCTION

In 1986, Congress authorized the USACE to conduct a reallocation study for Chatfield Reservoir for joint flood risk management (flood control)-conservation purposes, including storage for M&I water supply, agriculture, and recreation and fishery habitat protection and enhancement. In 1996, the Colorado Water Conservation Board (CWCB), a division of the State of Colorado's Department of Natural Resources (DNR), requested that the U.S. Army Corps of Engineers (USACE; the Corps) consider reallocating space within Chatfield Reservoir for water supply purposes, on behalf of a group of 15 water providers (Providers) in the Denver metropolitan area. Reallocation is the assignment of the use of existing storage space in a reservoir project to another use. Section 808 of the Water Resources Development Act of 1986 authorizes the Corps to implement a reallocation of existing storage space at Chatfield Reservoir to joint flood control-conservation purposes, including storage for municipal and industrial water supply and other named uses, upon meeting two conditions. First, the DNR must request and coordinate the reallocation. Second, the Chief of Engineers must find the reallocation to be feasible and economically justified. Public Law 99-662. See also River and Harbor Act of 1958 (Title III, Water Supply Act of 1958), as amended (43 U.S.C. 390b).

In 1999, a Feasibility Report and Environmental Impact Statement (FR/EIS) was commissioned under the Section 808 project authorization to develop the plan and conduct the analyses required for the Chief of Engineer's findings (ER1105-2-100, Ch. 4). The FR/EIS evaluates the proposed reallocation, identifies alternatives, evaluates those alternatives, and selects the best alternative for addressing the requested reassignment of existing storage space at Chatfield Reservoir based on solid planning principles. The Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&Gs) (U.S. Water Resources Council 1983) establish the standards and procedures that the Corps and other federal water resources agencies use for planning and evaluating the merits of a proposed water storage reallocation. The FR/EIS has evaluated in detail the environmental, social, and economic effects of the Recommended Alternative, as well as two other alternatives and the No Action alternative. As discussed in the FR/EIS, the impacts associated with each alternative would be fully mitigated and would result in alternatives with minimal net effects, and alternatives that would be relatively equal when considering net environmental effects.

The FR/EIS involved an initial screening process that used the State of Colorado's State Water Supply Initiative (CWCB 2004, 2009) and other recent, relevant planning studies to identify candidate alternatives to reallocation. A total of 37 concepts were evaluated in the initial screening process. The development of alternatives to reallocation and the screening process are described in detail in Chapter 2 of the FR/EIS. The Chatfield Reservoir reallocation alternative with 20,600 acre-feet of reallocated storage (Alternative 3) was selected as the Recommended Plan. This plan is the National Economic Development (NED) plan and is the plan preferred by the Providers.

The proposed reallocation of storage at Chatfield Reservoir requires the Corps to make decisions regarding feasibility and economic justification of the proposed reallocation and appropriate contract terms and conditions if the reallocation is approved. The proposed reallocation of storage and use of the reallocated storage will not require the discharge of dredge or fill material into waters of the U.S. The reallocation of storage space and the subsequent filling of that space will only involve the inundation of environmental and recreational resources. As such, as required in its planning guidance, the Corps must consider modifying the affected recreational facilities to maintain recreation, as well as identify mitigation for affected environmental resources. The proposed reallocation will increase water elevations at Chatfield Reservoir, and the increased water levels will inundate recreation infrastructure and environmental resources. The proposed mitigation of environmental resources and modification of recreation facilities will involve the discharge of dredge or fill material into waters of the U.S.

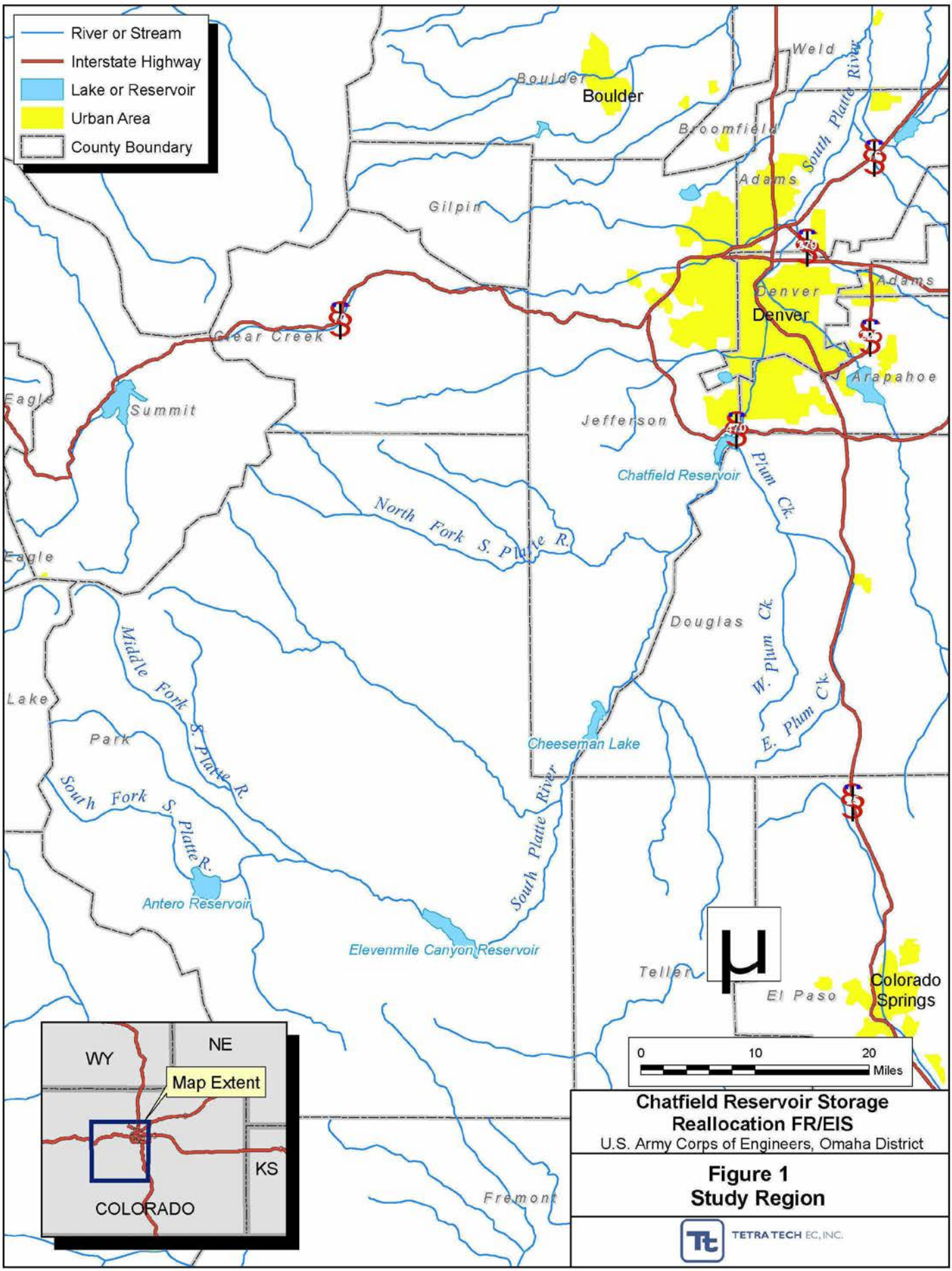
The Section 404(b)(1) Guidelines (Guidelines) are the substantive criteria used to evaluate discharges of dredge or fill material into waters of the U.S. under Section 404 of the Clean Water Act. This analysis addresses how the activities that involve a discharge of dredge or fill material into waters of the U.S. comply with the Guidelines. As used in this analysis, the discharge of dredge and fill material into waters of the U.S. refers to the following:

- Fill material placed below the existing ordinary high water mark (OHWM) of Chatfield Reservoir of 5,432 feet above mean sea level (msl);
- Dredging (discharge of dredged material) below the existing OHWM; dredging will typically involve the scraping and pushing of soil with earthmoving equipment (dredging is also referred to as "cuts"); and
- The discharge of dredged or fill material into wetlands (above or below the existing OHWM).

2. PROJECT DESCRIPTION

2.1 Location and General Description

Chatfield Reservoir is southwest of Denver at the confluence of the South Platte River and Plum Creek within the South Platte River Basin (Figure 1). The reservoir is owned and operated by the USACE. The reservoir was completed in 1976 for purposes of flood protection for the metropolitan Denver area following the disastrous South Platte River flood of 1965. 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 flows through a mixture of rangelands and suburban areas. The overall EIS study area encompasses the area in the immediate vicinity of Chatfield Reservoir and extends downstream to where the river intersects the Adams/Weld county line. The Chatfield Reservoir has a maximum depth of about 45 feet and an average depth of 24 feet. Water levels in the reservoir vary in response to climatic conditions and other factors, but in general the reservoir has been managed to maintain water levels within a 9-foot range (elevation 5,425 to 5,434 feet above msl) (USACE 2000). From 1976 to 1996, the change in water level was within this 9-foot range approximately 80 percent of the time. The average range of mean monthly elevations is small, less than 3 feet from low to high reservoir periods. The current OHWM elevation is 5,432 feet above msl.


River or Stream
Interstate Highway
Lake or Reservoir
Urban Area
County Boundary
Boulder
Boulder
Weld
Broomfield
South Platte River
Adams
Gilpin
Denver
Denver
Adams
Clear Creek
Arapahoe
Eagle
Summit
Jefferson
Chatfield Reservoir
Plum Ck.
North Fork S. Platte R.
Eagle
Douglas
W. Plum Ck.
E. Plum Ck.
Middle Fork S. Platte R.
Lake
Park
Cheesman Lake
South Fork S. Platte R.
South Platte River
Antero Reservoir
Elevenmile Canyon Reservoir
Teller
El Paso
Colorado Springs
0
10
20
Miles
WY
NE
Map Extent
KS
COLORADO
Fremont
Chatfield Reservoir Storage Reallocation FR/EIS
U.S. Army Corps of Engineers, Omaha District
Figure 1
Study Region
TETRA TECH EC, INC.

AR038959

This page intentionally left blank.

The Recommended Plan would reallocate 20,600 acre-feet of Chatfield's flood control storage to water supply storage. The Providers would be responsible for the operation, maintenance, and repair of infrastructure, treatment, and distribution facilities associated with their water. They would also provide their share of the Chatfield Reservoir project operation, maintenance, repair, rehabilitation, and replacement costs. Environmental mitigation and recreation modifications would be required to mitigate the impacts of operating the reservoir under the storage reallocation. The Providers would fully fund environmental mitigation and recreation modifications. The USACE, U.S. Fish and Wildlife Service (USFWS), and State of Colorado would continue to be involved in the design and overview of environmental mitigation and recreation modification measures.

2.2 General Description of Dredge and Fill Activities

The discharge of dredge and fill material into waters of the U.S. will occur with the following proposed activities that are incidental to the proposed reallocation:

- Relocation of recreation facilities and associated infrastructure
- On-site environmental mitigation
- Off-site mitigation for impacts to Preble's meadow jumping mouse (Preble's) designated critical habitat

The following describes each of these activities and the associated discharge of dredge and fill material into waters of the U.S. Alternatives to these discharges and measures taken to avoid and minimize the discharge of dredge and fill material into waters of the U.S. are discussed in Section 4.2.

2.2.1 Dredge and Fill Activities Associated with the Recreation Facilities Modification Plan

The proposed Recreation Facilities Modification Plan (EDAW/AECOM 2010) identified 10 areas where fill material (in uplands, wetlands, or waters) would be required for site preparation, such as slope adjustment and general grading. A summary of disturbance area size, cut and fill requirements, and anticipated wetland disturbance area is presented in Table 1. Each area is described in detail below with locations shown in Figure 2. Upland borrow areas that would be used to provide the fill material are described in Section 2.3.

Table 1. Summary of Cuts and Fills in Waters and Wetlands for Each Recreational Facility Modification Area (EDAW 2009)

Area	Fill Area below 5,432 feet msl (Acres)	Cut Area below 5,432 feet msl (Acres)	Wetlands Above OHWM (5,432)		Wetlands Below OHWM (5,432)		Wetland Fill (CY)
			Cut	Fill	Cut	Fill	
North Boat Ramp	2.105	0.841					
Massey Draw							
Eagle Cove Day Use Area			2.02		0.83		
Swim Beach Area, & Jamison Area	0.26	7.63		0.24		1.13	1820
Catfish Flats & Fox Run		13.50					
Kingfisher & Gravel Pond Area				0.17		0.01	11
Platte River Trailhead							
Riverside Marina & Roxborough Day Use Area	3.41	4.68	0.01	0.02	0.09	0.27	443
Campground Area		0.13					
Plum Creek		0.2		0.78			

The CWCB and Providers received a waiver from the Corps allowing floodable, wet floodproofed recreation facilities to be located within the 10-year floodpool at an elevation of 5,447 feet msl (see Section 4.2.1). This waiver allows the recreation facilities to be relocated closer to the new OHWM. The discharge of dredge and fill material into wetlands associated with relocation of recreation facilities will be used to elevate the relocated facilities above the new OHWM of 5,444 feet msl and transition grades (cut and fill) between the new recreation facilities and the new OHWM. The recreation facilities would be relocated prior to use of the reallocated storage by the Providers. This sequencing will facilitate relocation of the facilities and dredging activities below the existing OHWM by maintaining lowered reservoir levels during construction. The wetlands that will be filled by the relocation of the recreation facilities occur below 5,444 feet msl and would be inundated, at least periodically, by the new reservoir levels associated with reallocation. Therefore, the wetland losses associated with the discharge of fill implementing the Recreation Facilities Modification Plan also would occur with reallocation.

North Boat Ramp. This is the only formal boat launch area on the west side of the reservoir, and includes two ramps, paved parking and circulation areas, and a variety of support facilities. The two existing boat ramps would largely be inundated and several of the picnic shelters would also be affected. Remaining areas, including most of the parking and circulation roads, would remain above the proposed high water elevation (5,444 feet msl).

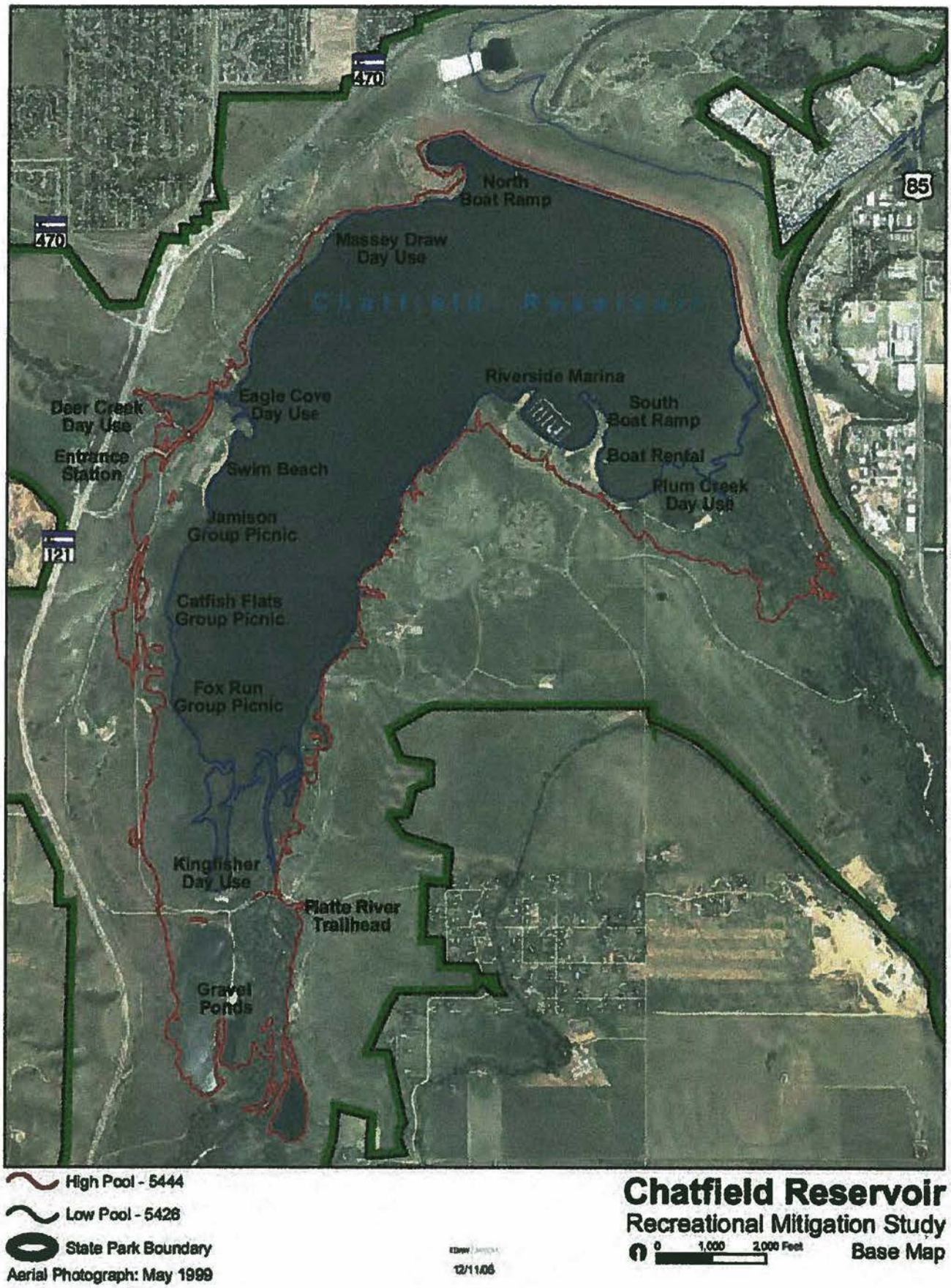


Figure 2. Location of Recreation Facility Modification Areas

This page intentionally left blank.

Boat ramps would be constructed to extend to the elevation of the existing ramps in order to operate at low water levels. The slope on the new ramps would be reduced. Day use shelters and furniture would be relocated, as would trails. This involves a substantial amount of fill to raise a portion of the parking area. Development would require some cut and fill below the current high water elevation of 5,432 feet msl (Table 1). No discharge of fill material into wetlands is anticipated.

Massey Draw. Massey Draw is a day use area in the vicinity of the North Boat Ramps. The beach area, including a volleyball court and horseshoe pits, would be inundated at the proposed high water elevation of 5,444 feet msl. Relocation of this area would include importing fill material to raise the elevation above 5,444 feet msl and to create a usable recreational area in the same location with a similar amount of usable area that currently exists. Existing beach volleyball and horseshoe pits would be rebuilt. No discharge of dredge or fill material into waters of the U.S., including wetlands, is anticipated.

Eagle Cove Day Use Area. Eagle Cove is north of Deer Creek and has limited facilities. All of the facilities in this area would be relocated. The existing gravel parking lot and portable restroom at Eagle Cove would be inundated at 5,444 feet msl.

The gravel parking lot at Eagle Cove would be redeveloped within the same general area at an elevation above 5,444 feet msl. The use of additional fill would be minimized in this area due to existing grades above 5,444 feet msl. Approximately 3 acres of wetlands would be cut in developing this area (Table 1).

Swim Beach Area, including Jamison Group Use Area. The Swim Beach Area also includes the Deer Creek Area with its balloon launch facilities and day use sites. An increase in water elevation to 5,444 feet msl would inundate most of the area and require that these facilities and parking area be developed at another location. The Jamison Group Use Area is immediately south of the Swim Beach Area and includes a parking area, restroom, and picnic tables. All of these would be inundated at 5,444 feet msl.

The Swim Beach would be relocated to the southwest of the current facility. In order to construct the beach, the existing facility would be demolished and excavated. Sand would be saved and also imported to create the new beach. Relocation of the Swim Beach Area involves 7.63 acres of excavation below the current OHWM. The excavated material would assist in filling low areas that would be inundated at 5,444 feet msl to ensure these areas are usable at this proposed elevation. The redevelopment would entail cut and fill below the current high water elevation, and would have limited disturbance to wetlands above (0.24 acre) and below (1.13 acres) the current high water elevation (Table 1).

Catfish Flats and Fox Run Group Use Areas. These areas consist of a series of group use areas that include picnic shelters, restrooms, parking, and related facilities. At 5,444 feet msl, all of these facilities would be inundated and they would be redeveloped at another location. Portions of the trail system would also be redeveloped. The entrance to the Fox Run Group Use area parking lot would be reconstructed due to the new location of the main park road. About 13.5 acres would be excavated below the existing OHWM. There would be no discharge of dredge or fill material into wetlands.

Kingfisher, Gravel Ponds, and Platte River Trailhead Areas. A variety of uses occur at the south end of the reservoir, especially around the gravel ponds that are south of the main park road that leads to the Campground and Marina Area. The large gravel pond is used by dog training clubs, nonmotorized boaters, fishermen, and others. There are relatively few developed facilities in this area, primarily parking areas and trails. The Kingfisher area would be entirely inundated at 5,444 feet msl.

For the Kingfisher Area, a long section of the main park road would be raised and a new bridge constructed across the South Platte River. The bridge would remain in the same general location and would be designed to provide for pedestrian use. A new parking area would be developed along the shoreline at a site west of its current location. The area would include a portable restroom and similar facilities to those that exist at the current site. Existing trail connections would be redeveloped above the high waterline. The borrow area would be reconfigured to enhance fishing opportunities and recreational experience.

For the Gravel Ponds Area, a new parking lot would be constructed west of the existing site and above the 5,444 feet msl elevation. Roads for emergency access only would be developed on the berms to the east and south of the gravel pond, and a new permeable dike would be built to an elevation of 5,457 feet msl based on the current bridge elevation above the current high water level. The dike would prevent inundation of the gravel pond. The redevelopment would entail limited filling of wetlands above (0.17 acre) and below (0.01 acre) the current high water elevation (Table 1).

Riverside Marina Area and Roxborough Day Use Area. This is a major use area that has been extensively developed. The area includes the marina, a fishing pier, extensive paved parking areas, a boat ramp, group picnic sites, and an extensive network of walkways and trails. Nearly all of the existing facilities in this area would be affected by an increase in the water level to 5,444 feet msl and most of the area would be redeveloped.

Significant fill would be completed to ensure future use in this area. The current facilities would be on an elevated surface and the fill placement would include construction of new breakwaters similar to those that currently exist that would function at water elevation 5,444 feet msl. The accessible fishing pier would be replaced in a similar location. At the marina, the reservoir floor would be excavated down to 5,412 feet msl to enable it to operate at extreme low water levels. This excavated material would be used to raise the breakwater elevations and provide fill for other locations. The marina would operate close to the existing location. The redevelopment would entail cut and fill below the current high water elevation, and would fill wetlands above (0.03 acres) and below (0.36 acre) the current high water elevation (Table 1).

The adjacent Roxborough Day Use Area would be entirely inundated at water elevation 5,444 feet msl. It would be relocated to a new location close to its existing one.

Campground Area. The Campground Area would be relocated to a higher location relative to the planned high water elevation, involving some regrading. About 0.13 acre of excavation below the existing OHWM would occur. There would be no discharge of dredge or fill material in wetlands.

Plum Creek Day Use Area. The Plum Creek Day Use Area serves as a trailhead and also has a day use area with tables, a restroom, and parking. This area would be entirely inundated at the proposed water elevation.

The area would be relocated to the southern edge of the reservoir. The recreational facilities would be replaced at this location and a new restroom built. The trailhead would be relocated to this area and inundated trail segments replaced. A new trail bridge would be built to span Plum Creek. Relocation of the Plum Creek Trail would involve the filling of an estimated 0.78 acre of wetlands. The existing sanitary sewer line at Plum Creek would need to be relocated above 5,444 ft msl. The relocation of this utility would impact 1.1 acres of wetlands. These impacts are considered temporary as they would be addressed through onsite revegetation and restoration that would be performed as part of the recreation facility relocation.

Fill material for the modification of recreation facilities would be derived from five borrow sources within the park boundary. These areas are discussed in Section 2.3. Impacts to borrow areas above 5,444 feet msl and to fill areas would be mitigated in-place by restoring the areas to conditions similar to those present prior to disturbance. The two borrow areas below 5,444 feet msl would be used as compensatory mitigation areas. These areas would be converted to wetlands using a limited amount of grading.

2.2.2 Dredge and Fill Activities Associated with Environmental Mitigation

On-site environmental mitigation will involve the creation, enhancement, and protection of wetlands, riparian habitat, Preble's habitat, and bird habitat as presented in the Compensatory Mitigation Plan (CMP) (FR/EIS, Appendix K). The creation of wetlands and riparian and Preble's habitat will focus on the conversion of uplands to wetter habitats by driving sheet pile to "mound" ground water and/or redirected surface water. The majority of the on-site mitigation will occur in uplands and will involve the use of sheet pile, and will not involve the discharge of fill material into waters of the U.S. The redirection of surface water to mitigation areas may require minor discharges of fill material into waters of the U.S. The amount and location of these minor discharges would be determined as part of final design, and would typically involve a small diversion structure. The CMP identified areas where habitat conversion would occur on-site to change upland grasslands to wetlands (Figure 3, based on Figure 7 of the CMP; see Figures 8-15 of the CMP for additional detailed figures of each mitigation area). This type of conversion is generally accomplished by manipulating ground surface elevations, and surface water and groundwater, to provide hydrology adequate to support mesic riparian and wetland habitats. In most cases, the habitat conversion activities would require heavy equipment and earthwork, including the installation of sheet pile cutoff structures to raise the ground water table closer to the surface, the creation of new secondary channels, ditches, or backwaters to bring surface water to mitigation areas, and the modification of surface topography to lower the ground surface closer to ground water or to better retain surface water. These activities entail localized in-place excavation and grading and would not impact long-term water quality or the aquatic ecosystem. In many locations, the proposed activities would provide a beneficial effect on sediment erosion control and riparian habitat preservation.

Off-site environmental mitigation for impacts to wetlands, Preble's and bird habitat will focus on the protection, restoration, and enhancement of habitat in the Chatfield Reservoir watershed. These mitigation activities will be designed to meet the opportunities for mitigation for each protected

property. It is unlikely that these off-site habitat enhancement and restoration activities would involve the discharge of dredge or fill material into waters of the U.S.

Mitigation for impacts to Preble's designated critical habitat in the Upper South Platte critical habitat unit (CHU) is proposed to occur on Sugar Creek, a tributary to the South Platte River on the Pike National Forest. The mitigation involves reduction of sediment inputs into Sugar Creek and its associated wetlands and riparian areas that are Preble's designated critical habitat, and the creation and enhancement of riparian habitat (CH2M Hill 2009a). Implementation of the proposed mitigation would involve the discharge of fill material into and a loss of about 0.8 acre of wetlands, but would result in minimizing sediment impacts into about 4.5 miles of Sugar Creek and its associated wetlands and riparian habitats, and would result in gains in Preble's riparian habitat. The activities involving the discharge of fill material into wetlands bordering Sugar Creek include:

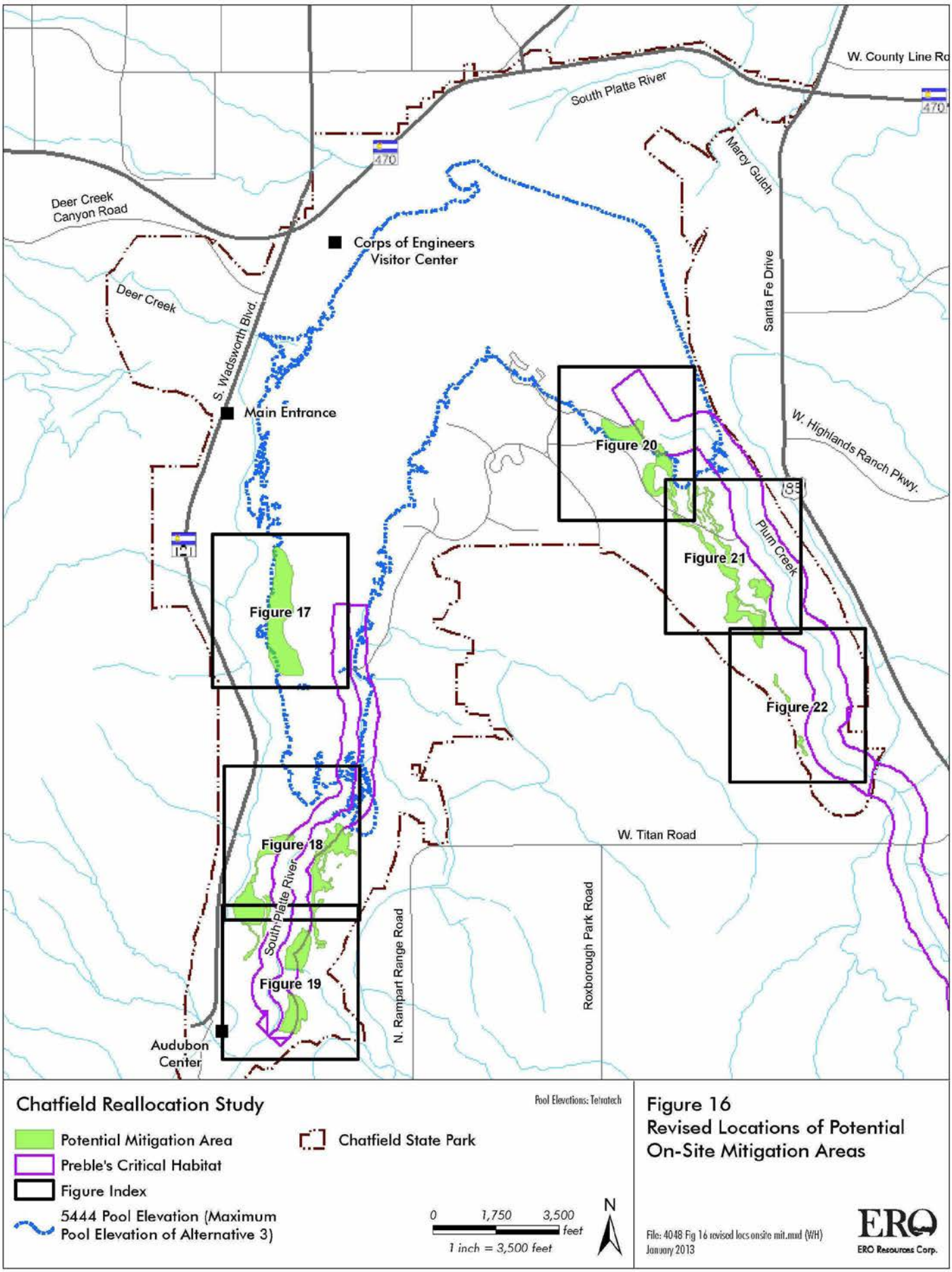
- Stilling basins for culvert rundowns from sediment traps to minimize bank erosion;
- Construction of low head water control structures to raise alluvial ground water levels to provide supportive hydrology to expanded riparian areas; and
- Replacement of road crossings of Sugar Creek with culverts designed to promote fish and small mammal passage.

2.3 Source, Description and Quantities of Fill Material (Subpart G)

Fill material for the modification of recreation facilities would be derived from five borrow sources within the park boundary (Figure 4). Based on detailed analysis in the Recreation Facilities Modification Plan, approximately 65,000 cubic yards of fill material would be needed to make the improvements to the ten recreation areas.

The five borrow areas have varying topographic conditions including flat ground, drainage channel, depression, local knob, and rolling hill. The ground is covered with native grasses, weeds and some trees. All borrow locations are above the current mean reservoir elevation so there would be no impacts to water quality caused by excavation. Three borrow locations are above the 5,444 feet msl elevation and two locations are below this elevation.

Subsurface conditions at the proposed borrow sites were investigated by drilling 34 exploratory borings (CTL Thompson 2009; Appendix 10 in EDAW/AECOM 2010). The borings were drilled to depths of 5 to 10 feet and samples of subsoils were obtained by using California drive and thin-walled, Shelby tube samplers and bulk samples of different soil types were also collected from auger cuttings. Slotted PVC pipe was installed in selected test holes to allow ground water measurement after drilling. Soil samples obtained during drilling were returned to the laboratory and visually examined by a geotechnical engineer. Laboratory testing was then assigned and included moisture content and dry density, swell/consolidation, gradation, Atterberg Limits, Proctor compaction, unconfined compression, pH, resistivity and water-soluble sulfate content. These tests were performed on natural and remolded samples. Results of the laboratory tests are presented in Appendix 10 of the Recreation Facilities Modification Plan (EDAW/AECOM 2010). Analyses of soil samples for pollutants were not conducted since there was no history or physical evidence of chemical usage or disposal.


W. County Line Rd
South Platte River
Marcy Gulch
Deer Creek Canyon Road
Corps of Engineers Visitor Center
Deer Creek
S. Wadsworth Blvd.
Santa Fe Drive
Main Entrance
W. Highlands Ranch Pkwy.
Figure 20
Figure 21
Plum Creek
Figure 17
Figure 22
W. Titan Road
Figure 18
South Platte River
Figure 19
N. Rampart Range Road
Roxborough Park Road
Audubon Center
Chatfield Reallocation Study
Pool Elevations: Tetratech
Potential Mitigation Area
Chatfield State Park
Preble's Critical Habitat
Figure Index
5444 Pool Elevation (Maximum Pool Elevation of Alternative 3)
0 1,750 3,500 feet
1 inch = 3,500 feet
N
Figure 16
Revised Locations of Potential On-Site Mitigation Areas
File: 4048 Fig 16 revised locs onsite mit.mxd (WH)
January 2013
ERO
ERO Resources Corp.

AR038969

This page intentionally left blank.

CHATFIELD RESERVOIR BORROW AREA PLANS

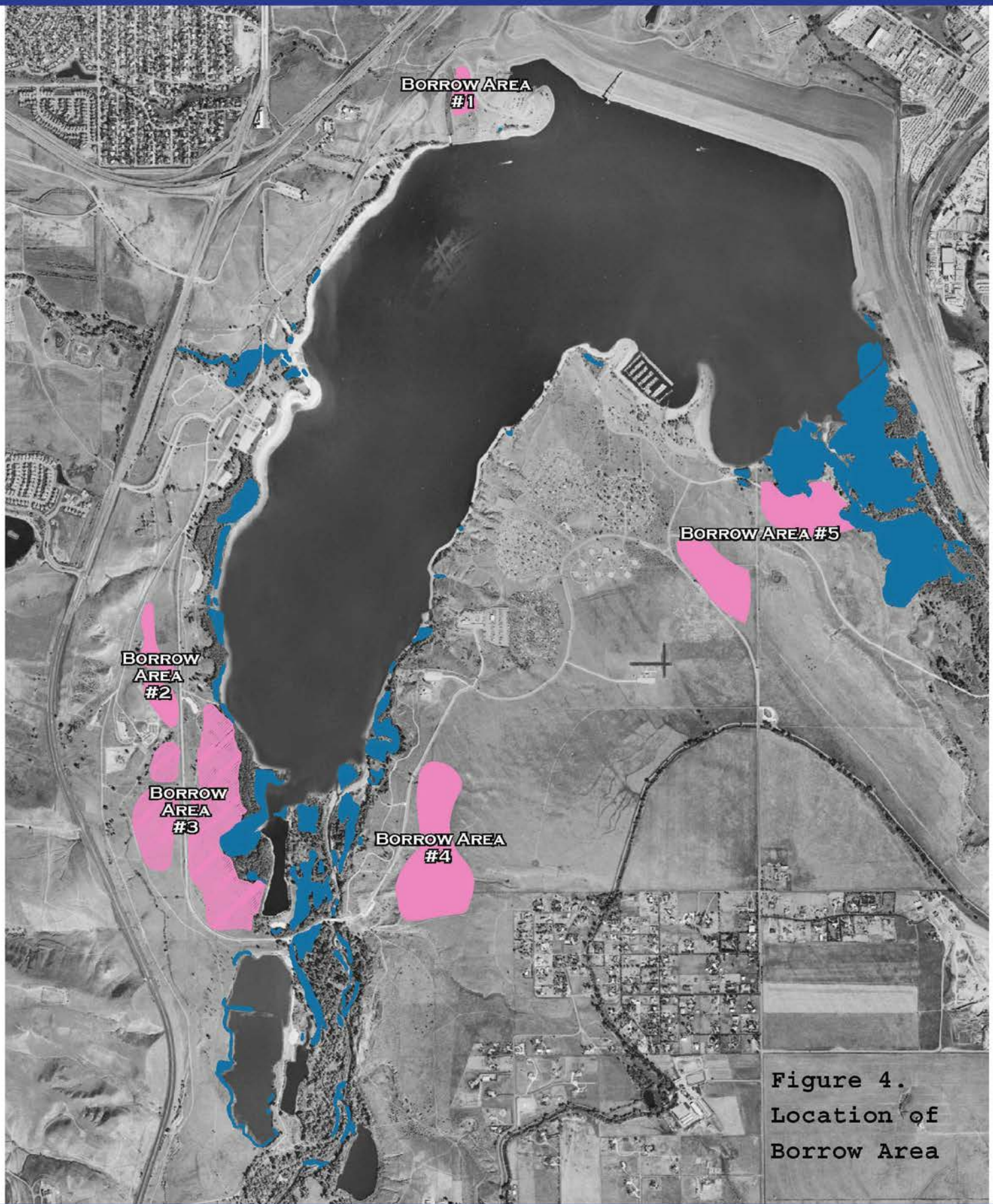


Figure 4. Location of Borrow Area

OVERALL BORROW AREA LOCATION MAP

This page intentionally left blank.

Key findings of the investigation included:

- Subsoils found in the borings generally consisted of a thin cover of topsoil over clean to clayey sands and sandy clays to the maximum depth explored of 10 feet. The soils encountered in the test holes are suitable for use as structural and non-structural fill material provided that vegetation, debris and other deleterious materials are substantially removed.

- The sand is non-expansive or low swelling and a better fill material for supporting foundations, slabs-on-grade and pavements. The clay may have high plasticity and moderate to high swell potential. The potential swell of the clay fill can be reduced to low if the clay fill is moisture conditioned to moisture contents above optimum or mixed with the sand.

- Ground water was encountered during drilling in one test hole (TH-31) at a depth of 3 feet below the existing ground surface (elevation 5,438 feet msl). When the test holes were checked about two weeks after drilling, no ground water was present in any of the test holes. Therefore, ground water is not expected to be encountered during excavation.

3. FACTUAL DETERMINATIONS – EVALUATION OF POTENTIAL IMPACTS OF PROPOSED DREDGE AND FILL MATERIALS

3.1 Potential Impacts on Physical and Chemical Characteristics of the Aquatic Ecosystem (Subpart C)

3.1.1 Physical Substrate

The substrate of the aquatic ecosystem underlies open waters and constitutes the surface of wetlands. It consists of organic and inorganic solid materials and includes water and other liquids or gases that fill the spaces between solid particles.

Modifications at some of the recreational facilities would involve dredging below the current OHWM of 5,432 feet msl (Table 1). The North Boat Ramp and Riverside Marina would involve limited dredging to shape channels for boat ramps and local boat access. Relocation of the facilities of the Catfish Flats Area (picnic shelters, restrooms, parking lot) would involve dredging below 5,432 feet msl. These dredging activities would be scheduled to occur during low reservoir periods such that there would be minimal impact to the benthic environment during construction.

3.1.2 Suspended Particulates/Turbidity

Suspended particulates in the aquatic ecosystem consist of fine-grained mineral particles, usually smaller than silt, and organic particles. Suspended particulates may enter water bodies as a result of land runoff, flooding, vegetative and planktonic breakdown, resuspension of bottom sediments, and activities including dredging and filling. Particulates may remain suspended in the water column for variable periods of time as a result of such factors as agitation of the water mass, particulate specific gravity, particle shape, and physical and chemical properties of particle surfaces.

Since dredging at the North Boat Ramp, Riverside Marina, and Catfish Flats would be scheduled to occur during low reservoir periods, there would be a very limited localized and temporary increase in suspended particulates and turbidity during construction. Dredging of the marina area would use a coffer dam and lowered reservoir levels to facilitate dry excavation of the marina area. Dry excavation will minimize suspension of particulates and turbidity during the excavation.

Disturbed areas (upland and wetland) between the current OHWM and 5,444 feet msl would be subject to erosion as the reservoir fills, resulting in some potential for suspension of finer grain materials. This impact is expected to be short-term and minimal because the fill material is composed of clayey sands and sandy clays that are suitable for use as structural and nonstructural fill. Best management design and construction practices would be used to minimize erosion during construction.

On-site mitigation will occur in upland areas. The off-site mitigation of designated critical habitat in the Upper South Platte CHU is designed to minimize erosion and sediment into Sugar Creek (CH2M Hill 2009a). Implementation of the mitigation will substantially reduce suspended particulation and turbidity in Sugar Creek.

3.1.3 Water Quality

The proposed dredge and fill activities would have little effect on water quality due to limited dredge and fill footprints of the respective sites relative to the overall area and volume of the reservoir. As previously discussed, the dredge and fill activities associated with the proposed relocation of the recreation facilities will cause some temporary suspension of particulates and turbidity. The fill material used for the recreation facilities will come from Chatfield State Park and will be similar to the materials that are currently within the reservoir (Section 2.5). Clean rock would be used for construction of the stilling basins and low-head check structure at the Sugar Creek mitigation site. The reduction of erosion and sediment to Sugar Creek is expected to improve the water quality of Sugar Creek.

3.1.4 Water Fluctuations and Circulations

No impacts to water fluctuations and circulation would result from the dredging and filling activities associated with the relocation of the recreation facilities due to the limited dredge and fill footprints of the respective sites relative to the overall area and volume of the reservoir. The on-site conversion of uplands to wetlands and riparian habitats will be supported by shallow ground water levels created by excavation and mounding created by driving sheet piles. These actions are intended to alter the current circulation and elevation of ground water to provide a supportive hydrology for the created wetlands and riparian areas. Similarly, the low-head check structures and excavation of upland areas at Sugar Creek will affect the elevation and circulation of surface and ground water to provide a supportive hydrology for expanded riparian habitat for Preble's.

3.2 Potential Impacts on Biological Characteristics of the Aquatic Ecosystem (Subpart D)

3.2.1 Threatened and Endangered Species

Federal threatened and endangered species, state-listed threatened or endangered species, and species of special concern have been identified in the study area. Respective habitats have been mapped as part of the FR/EIS. Preble's, a threatened mouse subspecies, occurs in riparian habitat along the South Platte River and Plum Creek above Chatfield Reservoir. Approximately 2.54 acres of Preble's habitat would be impacted by land disturbance associated with the relocation of the trail at the Plum Creek day use area. This lost habitat would be mitigated as part of the CMP (Appendix K).

Preble's critical habitat has been designated on the Plum Creek arm of Chatfield Reservoir in the West Plum Creek critical habitat unit (75 Fed. Reg. 78430 (December 15, 2010)). The CMP includes full mitigation for impacts to designated critical habitat in the West Plum Creek CHU.

A number of species of listed birds were identified, including bald eagles, golden eagle, and ferruginous hawks. Nesting areas for these species are not expected to be in the recreation relocation areas and, therefore, would not be impacted by any of the proposed dredge and fill activities.

3.2.2 Fish, Crustaceans, Mollusks, and other Aquatic Organisms in the Food Web

Chatfield Reservoir is suitable to cold-water fish species as well as cool- and warm-water species. The reservoir maintains a state designation of Class I for recreation and cold-water aquatic life.

Their respective habitat would not be impacted by any of the proposed dredge and fill activities due to limited dredge footprints of the respective sites relative to the overall area and volume of the reservoir. Dredging at the North Boat Ramp, Riverside Marina and Catfish Flats would be scheduled to occur during low reservoir periods ensuring that there would be a very limited localized and temporary increase in suspended particulates and turbidity during construction.

Mitigation associated with on-site and off-site components of the CMP include numerous sediment control measures that would provide a long-term beneficial effect on the aquatic ecosystem.

3.2.3 Other Wildlife

Landscaped and disturbed areas associated with the recreation areas planned for relocation most likely do not provide significant habitat for wildlife although several species may be found in these areas on a temporary basis. However, the recreation trail associated with the Plum Creek day use area crosses through the Plum Creek riparian area and relocation of this trail would result in approximately 2.54 acres of impact to bird habitats that will be mitigated as part of the CMP.

3.3 Potential Impacts on Special Aquatic Sites (Subpart E)

3.3.1 Sanctuaries and Refuges

Chatfield Reservoir is not a designated sanctuary or refuge under State and Federal laws or local ordinances to be managed principally for the preservation and use of fish and wildlife resources.

3.3.2 Wetlands, Mudflats and Vegetated Shallows

The discharge of dredge and fill material into wetlands was previously discussed in Section 2.3. The relocation of recreation facilities and implementation of environmental mitigation will not involve the discharge of dredge and fill material into mudflats and vegetated shallows. Adverse impacts to wetlands associated with the discharge of dredge and fill material are summarized in Table 2. Table 2 does not reflect gains in wetlands associated with these discharges for environmental mitigation on-site and at Sugar Creek.

Table 2. Estimated Adverse Impacts to Wetlands Associated with the Discharge of Dredge and Fill Material for the Relocation of Recreation Facilities and Environmental Mitigation

Activity	Temporary Impact (acres)	Permanent Impact (acres)
Recreation facility relocation	0.03	5.57
On-site environmental mitigation	0.50	0.50
Off-site Preble's critical habitat mitigation	5.00	0.82
Total	5.53	6.89

These wetland impacts would be mitigated as part of the CMP.

3.4 Potential Effects on Human Use Characteristics (Subpart F)

3.4.1 Municipal and Private Water Supplies

The discharge of dredge and fill material associated with the relocation of recreation facilities and environmental mitigation will have no adverse effect on municipal and private water supplies. Chatfield Reservoir currently serves as a component of the water supply system for Denver Water. The measures previously discussed in Section 3.1 will minimize any potential adverse effects to the water supply.

3.4.2 Recreational and Commercial Fisheries

Chatfield Reservoir supports a robust sport fish community. In addition, the reservoir is used as a walleye brood fish and wild egg collection source for statewide stocking needs. There are no commercial fisheries in the study area.

There would be a temporary impact to recreational fishing access during the relocation of the North Boat Ramp and the Riverside Marina. This is discussed in Section 3.4.3. The minimal discharge of fill material would have a minimal temporary effect on water quality and aquatic habitat as discussed in Section 3.1.

3.4.3 Water-related Recreation

The relocation of recreation facilities will affect recreation at Chatfield Reservoir. The analysis of the Recreation Facilities Modification Plan indicated a decrease in recreational user visitation and local economic activity during the estimated three-year period of construction with associated losses in revenues. Chatfield State Park is estimated to lose approximately $300,000 per year as a result of visitation reduction during the construction period, $175,000 per year during the post construction period and $90,000 per year when park management stabilizes. Local reduction in economic activity is estimated at approximately $3.8 million per year during the construction period, $2.1 million per year during the post construction period and $1.1 million per year when park management stabilizes (BBC 2010).

The USACE and Colorado State Parks plan to mitigate visitation loss by developing a construction schedule with minimal impact during high season and extensive impact during low season. This includes allowing the swim beach and marina to remain open from May through September during the entire construction period. There would be a temporary and limited impact to water-related recreation during the relocation of the various recreational facilities. The preliminary construction

implementation concept and schedule indicated that the optimum construction concept would comprise a three year construction season, with maintenance of operations of the North Boat Ramp, Swim Beach and Riverside Marina during each high-use season and with closure for relocation occurring during one off season. The remaining lower use facilities would be sequenced for relocation during high-use and low-use seasons (CH2M Hill 2009b).

3.4.4 Aesthetics

Long-term positive impacts to the aesthetics of the Chatfield Reservoir would be associated with the Recreation Facilities Modification Plan. The relocation and reconstruction of the recreational facilities would comprise modern, well-designed facilities and surrounding landscape. The Recreation Facilities Modification Plan includes sufficient funds for above-standard facilities, and funds have been included for requisite facility and landscape design services.

Short-term impacts to the aesthetics of the Chatfield Reservoir would occur during the anticipated three-year construction program. These impacts include exposure of cut; the use and restoration of borrow, fill and stockpile areas; the visual and sound impacts associated with earthmoving equipment, and the visual and sound impacts associated with facility construction. Much of the earthmoving and construction activities would occur during low-use seasons.

Construction of the on-site environmental mitigation areas will also alter the existing aesthetics of Chatfield State Park. Short-term during construction, the mitigation areas will appear as disturbed areas. Long-term, the on-site mitigation areas will change the targeted areas from upland grasslands to wetlands and riparian habitats.

Long-term, the aesthetics of the off-site environmental mitigation areas will remain as undeveloped lands as properties are protected within a matrix of developing lands. The long-term management of these properties provides the opportunity to improve aesthetics as livestock and weeds are controlled.

During construction, the Sugar Creek mitigation site would have adverse visual and sound effects associated with construction. Long-term, the reduction in erosion and sedimentation of Sugar Creek and its associated wetland and riparian habitats would have a long-term positive effect on aesthetics.

3.5 Secondary Effects on the Aquatic Ecosystem

Secondary effects are effects on an aquatic ecosystem that are associated with a discharge of dredged or fill materials, but do not result from the actual placement of the dredged or fill material.

The in-kind replacement of recreation facilities would result in similar levels of continued recreation at Chatfield State Park and Chatfield Reservoir. The water-based recreation can have effects on the aquatic ecosystem of Chatfield Reservoir through the introduction of oil and gas from gas motor-powered boats, increased shoreline erosion and turbidity associated with power boats and prop wash, and the potential introduction of nonnative aquatic invasive species (e.g., zebra mussels and Eurasian milfoil). The in-kind replacement of recreation facilities will not increase these secondary effects, but will continue the potential for these effects to occur.

The secondary effects of environmental mitigation are primarily beneficial and consistent with the purpose of environmental mitigation (i.e., creating wetlands and Preble's and bird habitat). The on-

site creation of wetlands and riparian habitat involve the conversion of xeric upland grasslands to these mesic and hydric habitats. The conversion of the upland grasslands will result in fewer upland grasslands, which are common at Chatfield State Park and will provide less habitat for the wildlife that use these upland grasslands.

Similarly, the conversion of upland areas along Sugar Creek to expand the wooded riparian habitats for Preble's will provide less upland habitat for wildlife that use this habitat. The areas along Sugar Creek selected for conversion were historically roadside pullouts and are now dominated by grasses and weeds. Similar upland habitats are common in the area.

3.6 Cumulative Effects on the Aquatic Ecosystem

Cumulative impacts are the changes in an aquatic ecosystem that are attributable to the collective effect of a number of individual discharges of dredged or fill material. Although the impact of a particular discharge may constitute a minor change in itself, the cumulative effect of numerous such piecemeal changes can result in a major impairment of the water resources and interfere with the productivity and water quality of existing aquatic ecosystems.

Cumulative impacts of the proposed dredge and fill activities associated with the Recreation Facility Modification Plan are expected to be small. These proposed activities, in total, would have little effect on the aquatic ecosystem due to limited dredge and fill footprints of the respective sites. The reasonably foreseeable future actions involving the discharge of fill in the Chatfield Reservoir watershed involve primarily road and bridge crossings (Douglas County et al. 2006). The discharges and impacts to waters of the U.S. including wetlands of these reasonably foreseeable actions are minor and when combined with discharge of dredge and fill material for the relocation of recreation facilities and environmental mitigation would have minor cumulative effects on the aquatic ecosystem of Chatfield Reservoir and its watershed.

The CMP identified a limited number of areas where habitat conversion would occur on-site to change upland grasslands to wetlands. These activities entail localized in-place excavation and grading in uplands and would not impact long-term water quality or the aquatic ecosystem. In many locations, the proposed activities would provide a beneficial effect on sediment erosion control and riparian habitat preservation.

4. FINDINGS OF COMPLIANCE OR NON-COMPLIANCE WITH RESTRICTIONS ON DISCHARGE

4.1 Adaptation of Section 404(b)(1) Guidelines to the Evaluation

There were no significant deviations from the applicable guidelines made in the preparation of this evaluation.

4.2 Evaluation of Available Practicable Alternatives to the Proposed Discharge Site Which Would Have Less Adverse Impact on the Aquatic Ecosystem

4.2.1 Recreation Facilities Modification Plan

Alternatives were considered to avoid and minimize the discharge of fill material into waters of the U.S. associated with relocation of the recreation facilities. The purpose of relocating the recreation infrastructure at Chatfield State Park is to maintain the recreation experience following the

reallocation of storage at Chatfield Reservoir by providing, to the maximum extent feasible, in-kind recreation facilities. The Providers contracted with EDAW to develop a plan for relocation of the recreation facilities. Once a preliminary plan for relocating the recreation facilities was developed, the preliminary plan was presented to the Corps to discuss 404 implications for the proposed relocation of the recreation facilities and how the discharge of fill material into waters of the U.S. could be avoided or minimized. Each recreation-related facility was reviewed and evaluated to determine if it could be located or constructed in a way to avoid or minimize the discharge of fill material into wetlands. Suggestions were made by the Corps, and EDAW revised the plan to minimize the discharge of dredge or fill material into wetlands. Specifically, the following components of the Recreation Facilities Modification Plan were revised to minimize the discharge of dredge or fill material into wetlands.

- **Gravel Pond Area**. The side slopes of the road north of the Gravel Pond were narrowed to 3:1 to minimize wetland loss to 0.17 acre. The road on the east side of the Gravel Pond was realigned to completely avoid the discharge of fill material into wetlands.

- **Catfish Flats**. The Catfish Flats recreation area was redesigned to avoid any discharge of dredge or fill material into waters of the U.S., including wetlands.

- **Marina Area**. The breakwaters of the marina were revised to reduce their footprint and the amount of cut and fill below the OHWM.

- **Plum Creek Area**. The relocation of the Plum Creek Trail went through several iterations to minimize the discharge of fill into wetlands.

- **North Boat Ramps**. The extension of the north boat ramps was revised to minimize the discharge of fill material below the OHWM.

A preliminary plan also was explored that would totally avoid all discharge of fill material into waters of the U.S. (EDAW 2009). While this approach is a feasible alternative to avoid the discharge of dredge or fill material into waters of the U.S., including wetlands, it would result in a greater area of net disturbance and environmental impact, and a significant reduction of the amount of desired in-kind replacement of existing recreational amenities and experiences relative to the proposed recreation facility relocation plan (Table 3). For example, the inability to do cuts and fills below the current OHWM would result in some of the existing recreational facilities needing to be moved in their entirety to be functional (i.e., components of the existing facilities could not be salvaged). For these facilities, existing parking lots, sidewalks, trails, roads, and boat ramps would be entirely relocated and reconstructed, which would result in a greater area of disturbance as previously undeveloped areas are used for the relocated facilities. As recreational facilities are moved farther from the reservoir to avoid cuts and fills below the current OHWM, other existing recreational facilities would be affected. For example, avoiding cuts and fills below the current OHWM for the marina would require moving the parking area and entry road farther south near the existing campground. These effects to the existing campground would trigger additional recreational facility relocation that would result in additional disturbance.

Table 3. Effects to Recreation Facilities for the No Discharge of Fill into Waters of the U.S. Alternative

Recreation Facility	Effects Relative to Proposed Relocation Plan
North Boat Ramp	• None of the existing amenities would be salvaged • The existing size of the parking lot would have to be smaller • The total area of disturbance would increase since none of the existing amenities could be used or salvaged • Costs would substantially increase
Massey Draw	No effects.
Swim Beach and Eagle Cove	• The existing causeway across Deer Creek would remain. At high flows and reservoir levels, the causeway would create a dam on Deer Creek. • The Balloon Launch Area would need to be relocated, which is less desirable due to microclimate conditions. • The existing parking lot, beach, and associated facilities would be moved to the west about 900 feet and would reduce the parking area and beach.
Jamison	• Reduced parking area.
Catfish Flats and Fox Run	No effects.
Gravel Pond Area	• A much longer bridge would need to be constructed, resulting in increased costs.
Platte River Trailhead	No effects.
Marina Area	• The parking lot and restrooms would need to be moved substantially farther to the south and would encroach on the existing campground. • The marina would remain in its current location, but the parking would be three times farther from the marina. • The access road to the marina would need to be moved farther to the south and would impact the existing campground south of the marina. • In order to avoid the discharge of fill material into the reservoir, the breakwaters would need to be a vertical structure. A wall would be less aesthetically pleasing. • The total area of disturbance above the OHWM would be greater. • The beach would be smaller.
Plum Creek	• No effects.

Providing recreation facilities that would maintain the existing recreational experience is an important goal for Colorado State Parks. To help provide the functional equivalency of the relocated recreation facilities, the State of Colorado and the Providers requested from the Corps a waiver of the Corps Land Use Development Policy (LUDP) given the unique and challenging conditions associated with Chatfield Reservoir in preserving "in-kind" recreation facilities and experiences. In January 2009, the Corps granted a waiver for the placement of closed floodable wet floodproofed relocated recreation structures in the upper range of the reallocated Zone 1 of Chatfield Reservoir (elevation 5,447.0 feet msl to 5,453.7 feet msl). This waiver was an important step in providing recreation facilities close enough to the reallocated reservoir elevations to provide in-kind recreational experiences.

Development of the proposed Recreation Facilities Modification Plan required consideration of the following constraints:

- The replaced recreation infrastructure needs to maintain the current recreational experience following reallocation (i.e., in-kind replacement);
- The plan needs to take advantage of the Corps LUDP waiver that will allow in-kind replacement of facilities closer to the new OHWM; and
- The existing recreational uses at the gravel pond need to be maintained by providing continued access and keeping the pond from being inundated by higher reservoir levels.

These constraints made it challenging to avoid all discharge of fill into waters of the U.S. However, the proposed relocation of recreation facilities were reviewed and evaluated to minimize the discharge of fill material into waters of the U.S., particularly wetlands. The discharge avoidance alternative was rejected because it in effect negates the benefits of the LUDP waiver and does not provide recreation facilities that maintain the existing level of recreational experience. The following are examples of how the discharge of fill material into waters of the U.S. were minimized:

- **North Boat Ramp.** Early conceptual alternatives for this area were replaced with a more extensive plan involving reconstruction of the parking lot, entry road, and boat ramps in order to minimize excavation below 5,432 feet msl and to avoid impacts to wetlands.
- **Swim Beach.** Alternative configurations of the beach and causeway were analyzed to ultimately develop an approach that minimizes the amount of wetlands filled.
- **Gravel Pond Area.** The plan includes the rebuilding of the dike with a new park road on top, in the same location as the old road in order to minimize impacts to the surrounding area as well as the preserve pond. The side slopes of the road/dike were steepened to 3:1 and the road was realigned to further reduce the filling of wetlands.
- **Marina Area.** Substantial modifications of this area were designed, including relocation of the entry road, parking lot and facilities, and the reconfiguration of the breakwater.

The proposed Recreation Facilities Modification Plan (EDAW/AECOM 2010) avoids and minimizes the discharge of fill material into waters of the U.S. to the maximum extent practicable while still meeting the objective of providing recreation facilities that maintain the existing recreational experience.

4.2.2 Environmental Mitigation

The Project also will require environmental mitigation that will involve the creation, enhancement, and protection of wetlands, riparian habitat, Preble's habitat, and bird habitat. Implementation of the proposed environmental compensatory mitigation was designed to avoid the discharge of fill material into waters of the U.S. For example, wetlands are proposed to be created at Chatfield State Park by "mounding" ground water by driving sheet pile in selected nonwetland areas to bring ground water to near the surface to support wetlands and Preble's habitat.

The entire upper South Platte Critical Habitat Unit was reviewed to determine which areas of Preble's designated critical habitat had opportunities for habitat restoration or enhancement (CMP, Appendix K). Eight drainages within the upper South Platte Critical Habitat Unit were reviewed.

With the exception of Sugar Creek, the drainages had limited opportunities for Preble's habitat restoration, enhancement, or creation. Restoration and enhancement along the 4.5-mile reach of designated critical habitat of Sugar Creek proved to be the only practicable alternative for providing the needed mitigation for impacts to Preble's designated critical habitat at Chatfield Reservoir. Structures (e.g., stilling basins and low-head water control structures) were sized to the minimum necessary to fulfill the purpose, and have minimal effects on wetlands and riparian habitats along Sugar Creek. Areas selected for excavation to create wetland and riparian habitat were historically pullouts for vehicles along the road. These areas are disturbed uplands and their conversion to riparian and wetland habitats will avoid the discharge of fill into wetlands.

The proposed environmental mitigation could be implemented without the discharge of dredged or fill material into waters of the U.S. At the Sugar Creek mitigation site, culvert rundowns could be shortened and stilling basins could be located outside of wetlands. Additionally, the low head water control structures could be eliminated with increased excavation of the riparian enhancement areas to lower these sites closer to the alluvial ground water table. For on-site wetland and riparian enhancement and creation, the discharge of dredge and fill material into waters of the U.S. could be avoided by increasing the depth of excavation to lower the mitigation sites closer to the ground water table and pumping water from wells to provide a supportive hydrology to the mitigation sites. While these approaches are a feasible alternative to avoid the discharge of dredge or fill material into waters of the U.S., including wetlands, it would result in a greater area of net disturbance and environmental impact; and would complicate the construction, maintenance, and reliability of the mitigation.

The CMP avoids and minimizes the discharge of fill material into waters of the U.S. to the maximum extent practicable while still meeting the objective of fully mitigating the impacts to wetlands, riparian habitat, Preble's habitat, and bird habitat impacted by the Project.

4.3 Compliance with Applicable State Water Quality Standards

Dredge and fill activities associated with the Recommended Plan would not violate any applicable State water quality standards.

4.4 Compliance with Applicable Toxic Effluent Standard or Prohibition Under Section 307 of the Clean Water Act

Dredge and fill activities associated with the Recommended Plan would not violate any Toxic Effluent Standard or Prohibition Under Section 307 of the Clean Water Act.

4.5 Evaluation of Extent of Degradation of the Waters of the United States

Dredge and fill activities associated with the Recommended Plan would not degrade waters of the U.S.

4.6 Appropriate and Practicable Steps Taken to Minimize Potential Adverse Impacts of the Discharge on the Aquatic System

In preparing the plan for the relocation of the recreation facilities, a number of practicable steps were taken to minimize potential adverse impacts of the discharge on the Chatfield Reservoir aquatic system:

- Dredge and fill activities associated with the recreational facility relocation were carefully analyzed and optimized in order to provide the minimum amount of dredge and fill activity and material, and the minimum amount of wetland impact.

- Dredging activities would be scheduled to occur during low reservoir periods such that there would be minimal impact to the benthos of these areas during construction.

- Fill areas above the current OHWM would be subject to erosion as the reservoir fills, resulting in some potential for suspension of finer grain materials. This impact would be minimal because best management design and construction practices would be used to minimize erosion during construction.

5. SUMMARY FINDINGS

The Corps was authorized to implement a reallocation of existing storage space at Chatfield Reservoir to joint flood control-conservation purposes, including storage for municipal and industrial water supply and other named uses if the reallocation was determined to be feasible and economically justified. The Corps initiated a FR/EIS to conduct the analysis required to determine the feasibility and economics of the proposed reallocation as required by the P&Gs (U.S. Water Resource Council 1983). The Chatfield Reservoir reallocation alternative with 20,600 acre-feet of reallocated storage (Alternative 3) was selected as the Recommended Plan. This alternative is the locally preferred plan as well as the federal National Economic Development (NED) plan. The Recommended Plan will result in higher water levels at Chatfield Reservoir that will inundate recreation facilities and environmental resources that have developed around the resources since its construction was completed in 1976. Plans to mitigate these impacts have been proposed as part of the FR/EIS process. The primary mitigation plans include a Compensatory Environmental Mitigation Plan and a Recreational Facilities Modification Plan. Implementation of these proposed plans will involve the discharge of dredge and fill material into waters of the U.S.

The CMP identified and addressed the unavoidable environmental impacts associated with the reallocation of storage under the Recommended Alternative. The CMP identified areas where habitat conversion would occur to change upland grasslands to wetlands. This type of conversion is generally accomplished by manipulating ground surface elevations, and surface water and ground water, to provide hydrology adequate to support mesic riparian and wetland habitat. In most cases, the habitat conversion activities would require heavy equipment and earthwork, including the installation of sheet pile cutoff structures to raise the ground water table closer to the surface, the creation of new secondary channels, ditches, or backwaters to bring surface water to mitigation areas, and the modification of surface topography to lower the ground surface closer to ground water or to better retain surface water.

Modifications to the recreation facilities comprise the vast majority of actions involving dredge and fill activities. The Recreation Facilities Modification Plan identified ten areas where fill material would be obtained for site preparation, such as slope adjustment and general grading. The Plan meticulously considered cut and fill requirements that allowed for minimal impact to the reservoir under the proposed operational high water elevation of 5,444 feet above msl.

Modifications to some of the recreational facilities would involve dredging below the current OHWM of 5,432 feet msl. The North Boat Ramp and Riverside Marina would involve limited dredging to shape channels for boat ramps and local boat access. This dredging would be scheduled to occur during low reservoir periods such that there would be no impact to benthos, turbidity, and general water quality during construction.

Use of the proposed fill sites would have a limited affect on federally listed threatened or endangered species or their critical habitats, as well as other wildlife and aquatic life in and around the reservoir. Approximately 2.54 acres of Preble's habitat and 2.54 acres of bird habitat would be impacted by land disturbance associated with relocation of the Plum Creek Day Use Area. The proposed dredge and fill activities would temporarily impact about 5.53 acres and permanently impact about 6.89 acres of wetlands. These impacts would be fully mitigated as part of the CMP.

Cumulative impacts of the proposed dredge and fill activities on the aquatic ecosystem are expected to be small. These proposed activities associated with the Recreation Facility Modification Plan, in total, would have little effect on the aquatic ecosystem due to limited dredge and fill footprints of the respective sites. Off-site mitigation includes conversion of upland grassland to scrub-shrub wetland primarily on private lands upstream of the Chatfield State Park in the Plum Creek and West Plum Creek watersheds. As with the on-site mitigation activities, there would be no impacts to long-term water quality or the aquatic ecosystem, and the benefit of improved sediment erosion control.

Dredge and fill activities associated with the Recommended Plan would not violate any applicable state water quality standards or any Toxic Effluent Standard or Prohibition Under Section 307 of the Clean Water Act, and it would not degrade waters of the U.S.

Development of the proposed Recreation Facilities Modification Plan and CMP evaluated alternatives to the proposed discharge. The proposed Recreation Facilities Modification Plan and CMP will have less adverse impact on the aquatic ecosystem and avoid and minimize the discharge of fill material into waters of the U.S. to the maximum extent practicable while still meeting the objectives of providing recreation facilities that maintain the existing recreational experience and fully mitigate the impacts to wetlands, riparian habitat, Preble's habitat, and bird habitat.

6. REFERENCES

BBC Research & Consulting (BBC). 2010. Chatfield State Park Reallocation Project Local Economic Impacts. Appendix U of the FR\EIS.

CH2M Hill. 2009a. Sugar Creek Sediment Mitigation Project, Site Assessment, Conceptual Solutions and Preferred Alternatives.

CH2M Hill. 2009b. Chatfield Construction Concept Analysis Technical Memorandum. Appendix 7 of the Recreation Facilities Modification Plan.

Colorado Water Conservation Board, Department of Natural Resources (CWCB). 2004. Statewide Water Supply Initiative (SWSI), A Collaborative Assessment of Future Water Needs and Solutions.

Colorado Water Conservation Board, Department of Natural Resources. 2009. Strategies for Colorado's Water Supply Future, Draft Report.

CTL Thompson, Inc. 2009. Borrow Fill Soil Investigation, Chatfield Reservoir Storage Reallocation Project, Douglas and Jefferson Counties, Colorado. Appendix 10 of the Recreation Facilities Modification Plan.

Douglas County and the Towns of Castle Rock and Parker, ERO Resources Corporation, Brooke Fox, and Trout, Raley, Montaño, Witwer and Freeman, P.C. 2006. Habitat Conservation Plan and Assessment for Douglas County and the Towns of Castle Rock and Parker.

EDAW. 2009. Memo from Scott Sinn, EDAW, to Tom Browning, Colorado Water Conservation Board, regarding alternative to the proposed relocation of recreation facilities for the reallocation at Chatfield Reservoir. June 4.

EDAW/AECOM. 2009. Chatfield Reservoir Recreation Facilities Plan 404 Permit Support Document Draft. Prepared for Colorado Water Conservation Board in Association with Colorado State Parks. June 2009.

EDAW/AECOM. 2010. Chatfield Reservoir Recreation Facilities Modification Plan. Appendix M of the FR\EIS.

ERO Resources Corporation (ERO). 2009. Memo from Steve Dougherty, ERO Resources Corporation, to Peter Plage, U.S. Fish and Wildlife Service and Denny Bohon, U.S. Forest Service, regarding proposed Preble's critical habitat mitigation on Pike National Forest land. Appendix J of the Compensatory Mitigation Plan. September 23.

ERO Resources Corporation (ERO) and Tetra Tech. 2010. Compensatory Mitigation Plan. Appendix K of the FR/EIS.

U.S. Department of the Army, Corps of Engineers (USACE). 2000. Planning Guidance Notebook – ER 1105-2-100. April 22.

USACE Northwestern Division. 2009. Memorandum for Commander, Omaha District, Subject: Application of Clean Water Act for Chatfield Project. October 8.

U.S. Water Resources Council. 1983. The Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&Gs).

Water Resources Development Act of 2007 (WRDA 07). 2007. Mitigation for Fish and Wildlife and Wetlands Losses (August 31, 2009) (P.L. 110-114), Section 2036, Mitigation for Fish and Wildlife and Wetlands Losses.

This page intentionally left blank.

Chatfield Reallocation
EPA Comment Letter – 13 May 2009

1. The Issue: To accomplish the reallocation of water storage at Chatfield Lake, no physical discharge of dredged or fill material into a water of the U.S. is required. The reallocation of storage would be accomplished through changed timing of flow releases, through operation of services gates contained within the dam. However, the discharge of dredged or fill material into waters of the U.S. may be required for the relocation of recreation facilities within Chatfield State Park. If storage is reallocated, resulting in a higher conservation pool elevation of the lake, the State of Colorado wants the recreation facilities to remain as "whole" as possible.

The EPA believes that the scope of analysis for Section 404, to include application of the 404(b)(1) guidelines (Guidelines), should include the Corps' proposed authorization of the reallocation of water storage. It has been the Corps' position that the correct scope of analysis for Section 404, to include application of the Guidelines, is the proposed relocation of recreation facilities and not the reallocation of water storage.

2. References Cited by EPA:

40 CFR 230.2 Applicability.

(a) These Guidelines have been developed by the Administrator of the Environmental Protection Agency in conjunction with the Secretary of the Army acting through the Chief of Engineers under section 404(b)(1) of the Clean Water Act (33 U.S.C. 1344). The Guidelines are applicable to the specification of disposal sites for discharges of dredged or fill material into waters of the United States. Sites may be specified through:

> (1) The regulatory program of the U.S. Army Corps of Engineers under sections 404(a) and (e) of the Act (see 33 CFR Parts 320, 323 and 325);
>
> (2) The civil works program of the U.S. Army Corps of Engineers (see 33 CFR 209.145 and section 150 of Pub. L. 94–587, Water Resources Development Act of 1976);

33 CFR 336.1 Discharges of dredged or fill material into waters of the U.S.

(a) *Applicable laws.* Section 404 of the CWA governs the discharge of dredged or fill material into waters of the U.S. Although the Corps does not process and issue permits for its own activities, the Corps authorizes its own discharges of dredged or fill material by applying all applicable substantive legal requirements, including public notice, opportunity for public hearing, and application of the section 404(b)(1) guidelines.

> (1) The CWA requires the Corps to seek state water quality certification for discharges of dredged or fill material into waters of the U.S.

Carey – 5/14/09

Planning Guidance Notebook (ER 1105-2-100) – Appendix C

Water Quality and Related Requirements

a. Purpose. This section provides guidance for the consideration of water quality and related programs in Civil Works planning studies. It incorporates water quality policies embodied in Sections 102, 401 and 404 of the Federal Water Pollution Control Act, Section 319 of the Water Quality Act of 1987, and Sections 102 and 103 of the Marine Protection, Research and Sanctuaries Act, which are applicable to Corps of Engineers feasibility studies and preconstruction planning and engineering.

b. Discharge of Dredged or Fill Material into Waters of the United States. Corps of Engineers proposed projects involving the discharge of dredged or fill material into waters of the United States shall be developed in accordance with guidelines promulgated by the Administrator of the Environmental Protection Agency (EPA) in conjunction with the Secretary of the Army under the authority of Section 404(b)(1) of the Clean Water Act, as amended, unless these activities are exempted by Section 404(f).

c. Conducting the Section 404(b)(1) Evaluation in the Planning Process. During feasibility planning, District commanders shall conduct and, to the fullest extent practicable, complete the investigations and analyses required by the Section 404(b)(1) Guidelines. Water quality and related information used in the evaluation will provide documentation to demonstrate that the recommended plan is in compliance with the Clean Water Act. A suggested format for the Section 404(b)(1) evaluation is included as Exhibit C-1.

d. Clean Water Act: Section 404. Feasibility reports recommending projects involving the discharge of dredged or fill material into waters of the United States, including wetlands, shall be developed consistent with Section 404(b)(1) Guidelines.

3. Comments on EPA's letter: There are several erroneous statements made in EPA's letter, statements that may or may not have a bearing on how the Corps proceeds. These statements are discussed below.

> a. In the first paragraph, the statement is made that, "…EPA acknowledges the need to ensure adequate water supply storage for the project sponsors. However, EPA wants to ensure that the decision of selecting an appropriate storage solution is made consistent with relevant laws and regulations". However, in the fifth paragraph of the letter, statements are made that, "EPA is concerned that the PDEIS does not adequately consider alternatives for increasing water supply…" and "EPA strongly recommends the alternatives analysis thoroughly address all appropriate alternatives for increasing water supply…". Increasing "water supply storage" is a different project purpose than increasing "water supply". Does EPA believe that providing additional water supply storage is a valid project purpose or

do they believe the project purpose should be to provide additional water supply; a broader definition that requires the analysis of more alternatives?

b. In the third paragraph, two environmental laws and an Executive Order are cited, followed by the statement that, "…these authorities mandate that information pertaining to any projects affecting wetlands and waters of the United States must be thoroughly disclosed and evaluated, and the least environmentally damaging practicable alternative (LEDPA) must be selected". Only Section 404 of the Clean Water Act requires this.

c. In the fourth paragraph, reference is made to requirements to consider the "single and complete project", to include the statement that, "…all actions that must be taken as a result of the higher water levels must be evaluated together as the single and complete project". The phrase "single and complete project" is only contained within the Corps' Nationwide Permit regulations, 33 CFR 330, with a definition found at 33 CFR 330.2(i). This term is not applicable, as the Section 404 review for the relocation of recreation facilities will be done in accordance with Corps regulations for evaluating standard permit applications. The applicable regulation for the issue at hand (scope of analysis) is 33 CFR 325, Appendix B.

4. Discussion:

The references cited by EPA require compliance with the Guidelines, for Civil Works projects, if there is a discharge of dredged or fill material into a water of the U.S. The Corps does not dispute this point. However, the action under review by the Corps is the reallocation of water storage at Chatfield Lake. No discharge of dredged or fill material is necessary for this action to occur. Authorization of this action will result in indirect impacts to the aquatic resources mentioned in EPA's letter. In others words, the reallocation of storage (no 404 authorization necessary) will cause the inundation of aquatic resources (indirect impacts). While the relocation of recreation facilities, which may require a 404 authorization, may result in direct impacts to aquatic resources, the relocation will not cause the inundation of aquatic resources.

Under 33 CFR 325, Appendix B, it is the Corps' responsibility to determine the appropriate scope of analysis for both NEPA and Section 404. However, the scope of analysis can be different for each statute. Historically, the Corps Regulatory Program has expanded the scope of analysis beyond the immediate permit area if our issuance of a permit would result in "environmental consequences" that are "essentially products of the Corps permit action". For Section 404, it would be incorrect to apply this principle in reverse; essentially expanding the scope of analysis backwards from the permit action to capture an action, as well as associated impacts, that did not require a Section 404 authorization. However, the NEPA scope of analysis should, and does, cover all actions related to the reallocation of storage at Chatfield Lake.

For the reallocation project, the most critical environmental issue relates to the Preble's meadow jumping mouse and compliance with the Endangered Species Act. Designated Critical Habitat will be impacted by the reallocation of storage and these impacts must be mitigated within the Critical Habitat Unit. This must occur regardless of whether or not Section 404 and the Guidelines are applicable to the entire reallocation project.

Carey – 5/14/09

RECORD OF DECISION

CHATFIELD RESERVOIR, COLORADO
STORAGE REALLOCATION PROJECT

The Chatfield Reservoir Storage Reallocation Final Integrated Feasibility Report and Environmental Impact Statement (FR/EIS), dated July 2013, with Addendum No. 1, dated March 2014, addresses the increasing water demand in the Denver, Colorado metropolitan area. The report recommends increasing the availability of water through the reallocation of existing storage in the Chatfield Reservoir to municipal and industrial (M&I) water supply and other purposes to help meet a portion of existing and future water needs. Based on the FR/EIS, the reviews of other federal, state, and local agencies, input from the public and the review by my staff, I find the plan recommended by the U.S. Army Corps of Engineers to be technically feasible, economically justified, environmentally acceptable and in the public interest. Thus, I approve the Chatfield Reservoir Storage Reallocation Project for implementation.

The recommended plan is Alternative 3, the reallocation of 20,600 acre-feet (AF) of Chatfield Reservoir storage to provide an average year yield of approximately 8,539 AF of water. It is the national economic development plan and the environmentally preferable alternative. The plan consists of the following features:

a. Alternative 3 provides 20,600 AF of storage in Chatfield Reservoir between the elevations 5,432 above mean sea level (msl) and 5,444 msl through a reallocation from the exclusive flood control pool to a joint conservation/flood control pool for M&I water supply and other purposes including agriculture, environmental restoration, recreation, and fishery habitat protection and enhancement. The reallocation raises the conservation pool level 12 feet. Implementation of the pool rise and use of the reallocated storage space would occur in increments as the recreation modifications and the environmental mitigation features are completed. The reservoir operations plan would be modified.

b. The existing recreation facilities, resources and roads that would be affected by the raising of the pool would be replaced.

c. A mitigation plan would compensate for the loss of habitat inundated by the raising of the pool. Mitigation features would be located on 165 acres of Chatfield Project lands; off-site on 888 acres along the West Plum Creek Critical Habitat Unit (CHU) for Preble's mouse; and off-site along 4.5 stream miles of Sugar Creek in the Pike National Forest within the Upper South Platte CHU. A monitoring and adaptive management plan has been included to ensure the adequacy of the mitigation plan.

d. Under the authority of Section 116 of Division C of the Omnibus Appropriations Act of 2009 (Public Law 111-8), the State of Colorado, would implement the recreation modifications and the environmental mitigation features under the oversight of the Corps.

The FR/EIS evaluated various alternatives to increase availability of water in the greater Denver, Colorado area. In addition to Alternative 3, the recommended plan, three other alternatives, all providing an average year yield of 8,539 AF, were identified and evaluated in detail in the FR/EIS, which is incorporated by reference. Alternative 1, the "no action plan" or the "most likely without project condition", included construction of a new Penley Reservoir combined with gravel pit storage, and did not include reallocation of the Chatfield Reservoir. Alternative 2 included non-tributary ground water (NTGW) combined with gravel pit storage, and no reallocation of the Chatfield reservoir. Alternative 4 included reallocation of 7,700 acre-feet at the Chatfield reservoir combined with NTGW and gravel pit storage.

The draft FR/EIS was circulated for public review between June 8, 2012, and September 6, 2012. A total of 903 comment letters were received on the draft report. All substantive draft FR/EIS comments were responded to in the final FR/EIS. Two hundred and one comments were received on the final FR/EIS during the public comment period from August 2, 2013 to September 3, 2013. All final FR/EIS comments were reviewed and considered.

The recommended plan incorporates all practicable means to avoid or minimize adverse environmental effects, and the unavoidable impacts are mitigated. The U.S. Fish and Wildlife Service provided final biological opinions on impacts to Preble's meadow jumping mouse and to other federally listed species in Colorado and downstream in the central and lower Platte River basin. Terms and Conditions to implement the Reasonable and Prudent Measures for Preble's mouse include that the Corps will ensure the formal adoption and implementation of the proposed conservation measures, provide annual monitoring reports, and report encounters (dead, injured, or hibernating) with the Preble's mouse.

Technical and economic criteria used in the formulation of alternative plans were those specified in the Water Resource Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. All applicable laws, executive orders, regulations and state and local government plans were considered in the evaluation of alternatives. Based on review of these evaluations, I find that the benefits of the Chatfield Storage Reallocation Project outweigh the costs and any adverse effects. This Record of Decision completes the National Environmental Policy Act compliance process for the project.

may 29, 2014
Date

Jo-Ellen Darcy
Assistant Secretary of the Army
(Civil Works)

Chatfield Storage Reallocation Project

Chatfield Storage Reallocation Project (CSRP)

The CSRP is a partnership between federal and state entities and eight water providers in the Denver Metro area and northeast Colorado.

The project stakeholders have been working for more than two decades to prepare for this project and want the mitigation work to be done with as little impact on visitors as possible. Project benefits include:

- Increased sustainable water supply for present and future generations
- Enhanced valuable ecological resources such as:
  - Planting of over 100,000 plants, trees, and shrubs
  - Stream restoration and stabilization
  - Extensive erosion and sediment control

Existing recreational amenities and facilities will again be offered upon completion of the project.

- New ADA compliant structures and facilities in reallocated areas
- Improved road surfaces; trails replaced in-kind

About 10% of the added water storage is dedicated to the Environmental Pool, increasing the flow of the South Platte River, enhancing the river's health, increasing recreational activities and supporting agricultural operations downstream.

The Adaptive Tree Management Plan will protect visitors and dam operations by removing debris and unhealthy trees from the fluctuation zone while also conserving healthy trees and maintaining important bird and wildlife habitat.

CONSTRUCTION

The project participants have formed the Chatfield Reservoir Mitigation Company, Inc. (CRMC) to implement the CSRP. The CRMC is committed to minimizing the impact to park visitors and has scheduled construction activities for the fall, winter and spring months. Please refer to the reverse side of this handout for 2017 / 2018 construction activities. For the most current updates on construction, please visit our website **chatfieldreallocation.org/construction.**

Chatfield State Park

While the Corps owns and operates the dam and reservoir, it leases land and the reservoir to Colorado Parks and Wildlife (CPW) to operate Chatfield State Park, Colorado's most visited state park with more than 1.6 million visitors annually.

History

Chatfield Reservoir, built in 1975 by the U.S. Army Corp of Engineers (Corps) as flood control, also provides storage space for multipurpose water including municipal, industrial, agricultural, and recreational uses, as well as maintenance of fisheries and wildlife habitat. Since 1986, the Corps and stakeholders studied the water supply benefits of additional water storage in Chatfield Reservoir and determined that up to 20,600 acre-feet could be reallocated for additional water storage, raising the water level by 12 feet, with no impact to the reservoir's flood control function.

On May 29, 2014, the Corps approved the final Feasibility Report/Environmental Impact Statement for the Chatfield Storage Reallocation Project (CSRP) that allowed the recreation and environmental mitigation efforts to move forward.

Colorado's population is projected to nearly double by 2050, according to Colorado's Water Plan. The additional water storage at Chatfield Reservoir will serve as an integral part of storing surface water and reducing dependency on non-renewable groundwater.

CONTACT US
Website: chatfieldreallocation.org/construction
Phone: 1-855-387-4660

Facebook: facebook.com/ChatfieldReallocation/
Twitter: twitter.com/ChatfieldWater
Instagram: instagram.com/chatfieldreallocation/

FALL 2017 — SPRING 2018 PARK CLOSURES

NORTH BOAT RAMP
CLOSED December 1, 2017
Anticipated to reopen April 1, 2018

MASSEY DAY USE AREA
CLOSED December 4, 2017
Anticipated to reopen May 1, 2018

EAGLE COVE DAY USE AREA
CLOSED January 15, 2018
Anticipated to reopen May 1, 2018

DEER CREEK DAY USE AREA / BALLOON LAUNCH
CLOSED December 4, 2017
Anticipated to reopen May 25, 2018

SWIM BEACH
CLOSED December 4, 2017
Anticipated to reopen May 25, 2018

JAMISON DAY USE AREA
CLOSED December 4, 2017
Anticipated to reopen May 25, 2018

CATFISH FLATS DAY USE AREA
CLOSED December 4, 2017
Anticipated to reopen July 1, 2018

FOX RUN DAY USE AREA
CLOSED December 4, 2017
Anticipated to reopen July 1, 2018

PLUM CREEK DAY USE AREA
CLOSED November 20, 2017
Anticipated to reopen Spring 2018

PLUM CREEK NATURE AREA
CLOSED November 13, 2017
Anticipated to reopen Fall 2018

FALL 2017 — SPRING 2018 ROAD CLOSURES

WEST PERIMETER ROAD
Swim Beach to west of King Fisher
CLOSED 24/7
December 4, 2017 - May 25, 2018

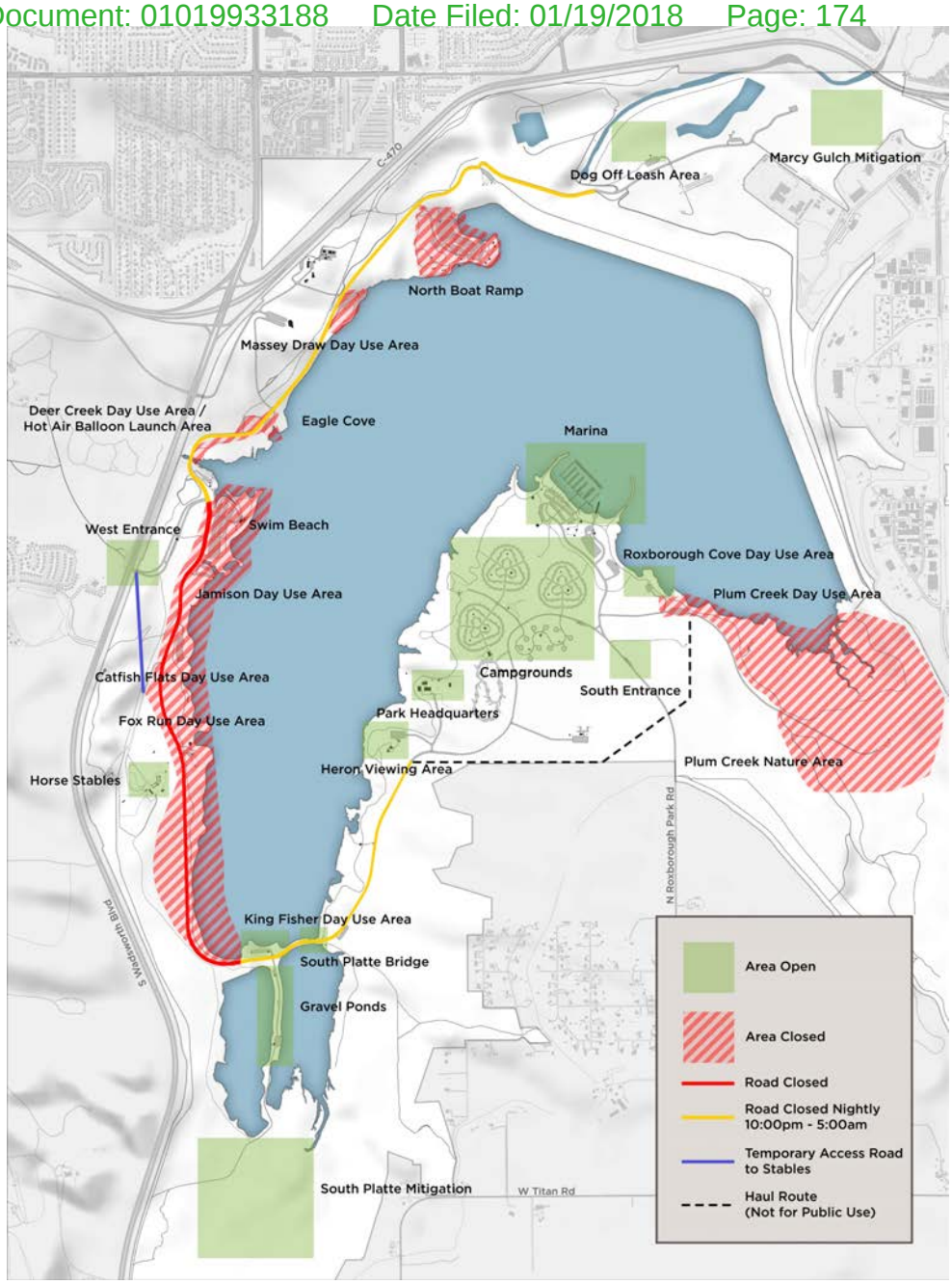
North of Swim Beach to Dog Off Leash Area
Open Daily: 5:00 am - 10:00 pm
CLOSED NIGHTLY: 10:00 pm - 5:00 am

Construction Traffic Begins at 6:00 pm
December 4, 2017 - March 1, 2018

PERIMETER ROAD
King Fisher to south of Heron Viewing Area
Open Daily: 5:00 am - 10:00 pm
CLOSED NIGHTLY 10:00 pm - 5:00 am

Construction Traffic Begins at 6:00 pm
December 4, 2017 - March 1, 2018

PEDESTRIAN AND BIKE TRAILS
All pedestrian and bike trails along the west side of the park from North Boat Ramp to King Fisher Day Use Area
CLOSED December 4, 2017
Anticipated to reopen May 25, 2018



FALL 2017 — SPRING 2018 OPEN AMENITIES

DOG OFF LEASH AREA
Access via West Park Entrance only

MARINA
Access via South Park Entrance only

CAMPGROUNDS
Access via South Park Entrance only

ROXBOROUGH COVE DAY USE AREA
Access via South Park Entrance only

MODEL AIRPLANE RUNWAY
Access via South Park Entrance only

HERON VIEWING AREA
Access via South Park Entrance only

KING FISHER DAY USE AREA
Access via South Park Entrance only

GRAVEL PONDS
Access via South Park Entrance only

HORSE STABLES
Access via temporary access road from West Park Entrance only

PARK HEADQUARTERS & ENTRANCES
Park Headquarters and the West and South Entrances will remain open during normal park hours

Chatfield Storage Reallocation Project

For a quick overview, watch the **Chatfield Storage Reallocation Project Video**

Call us toll free at: **1-855-387-4660**
or contact us at: **info@chatfieldreallocation.org**

CERTIFICATES OF SERVICE AND DIGITAL SUBMISSION

I hereby certify that on this 19th day of January, 2018, I electronically filed the foregoing with the Clerk of the Court for the United States Court of Appeals for the Tenth Circuit via the appellate CM/ECF system. The parties in this case will be served electronically by that system.

I hereby certify that I have scanned for viruses the Portable Document Format version of the attached document using our current version of Endpoint Protection (January 19, 2018) (v.1.261.39.0). I further certify that I have not made any privacy redactions in the attached document.

/s/ Dustin J. Maghamfar
DUSTIN J. MAGHAMFAR
Environment & Natural Resources Div.
United States Department of Justice
P.O. Box 7415
Washington, DC 20044
(202) 514-1806
dustin.maghamfar@usdoj.gov