
Appendix K
Compensatory Mitigation Plan

Compensatory Mitigation Plan

July 2013

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Compensatory Mitigation Plan

EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers (Corps) has developed this Compensatory Mitigation Plan (CMP) to address environmental impacts associated with Alternative 3 for the Feasibility Report/Environmental Impact Statement (FR/EIS) for the proposed reallocation of storage at Chatfield Reservoir. The CMP, as presented in this report, is considered an integral part of the recommended plan, and as such, its implementation must be carried out concurrently as part of the overall project. The CMP has been developed at a feasibility level and considers the ecological resources that will be adversely affected to a sufficient degree and detail to enable a reasoned judgment whether the recommended compensatory mitigation will be implementable and adequate to compensate for the functions and values of resources to be impacted. The CMP describes the proposed mitigation activities with sufficient specificity for reviewers of the FR/EIS to determine the mitigation proposed and provide comments on the adequacy of the proposed compensatory mitigation. The draft FR/EIS identified Preble's meadow jumping mouse (Preble's) habitat, bird habitat, and wetlands as resources of particular concern and warranting specific mitigation strategies for the estimated adverse impacts to those resources. These resources are referred to as the "target environmental resources" in the CMP. The CMP is designed to offset the adverse impacts to the target environmental resources associated with Alternative 3, should Alternative 3 be approved as proposed in the FR/EIS.

The CMP concludes that:

- There are adequate opportunities within the Chatfield Reservoir watershed to mitigate for adverse impacts to the target environmental resources;
- The proposed compensatory mitigation measures have a high likelihood of being successfully implemented; and
- The estimated costs for implementing, managing, and monitoring the proposed mitigation are within the range of feasibility for the Chatfield Water Providers.

The CMP is informed by and complies with applicable regulations, policies and guidelines including:

- Department of the Army Planning Guidance Notebook – ER 1105-2-100 (April 22, 2000) six-step planning process;
- Water Resources Development Act of 2007 (WRDA 07) – 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; and
- Memorandum addressing Implementation Guidance for Section 2036(a) of the Water Resources Development Act of 2007.

The CMP has been developed with substantial input from the U.S. Fish and Wildlife Service (Service), Environmental Protection Agency (EPA), Colorado Division of Wildlife (CDOW), Colorado State Parks, Denver Chapter of the Audubon Society, Sierra Club, South Suburban Parks and Recreation District, and the Chatfield Basin Conservation Network and other involved entities.

The CMP is based on the following conservative assumptions:

- All of the existing target environmental resources will be lost below 5,444 feet in elevation (Alternative 3);
- None of the target environmental resources will reestablish below 5,444 feet in elevation (Alternative 3);
- Off-site mitigation areas are generally limited to reaches of Plum Creek, West Plum Creek, and their major tributaries for which Preble’s critical habitat has been designated; and
- Only 15 percent of the private land in the off-site target mitigation area will be available for habitat protection.

The CMP is ecologically based. The “currency” of the CMP is ecological functional units (EFUs). This ecological functions approach was taken because of the substantial geographic overlap in the target environmental resources. The EFUs capture the ecological functions provided by the individual target environmental resources as well as their overlap. To ensure a diversity and balance of mitigation activities, minimum levels of mitigation activities were established for Preble’s, birds, and wetlands that will contribute to meeting the overall goal to replace lost ecological functions and values of Preble’s habitat, bird habitat, and wetlands associated with adverse impacts of reallocation. Although the CMP focuses its mitigation activities on the target environmental resources, it is structured to provide a diversity of ecological functions that will benefit a broad range of wildlife including insects, amphibians, reptiles, and mammals.

The CMP establishes quantifiable objectives and maximizes, to the degree practicable, the amount of mitigation that will occur on Corps lands in the vicinity of Chatfield Reservoir (on-site). The CMP provides requirements for monitoring, reporting, and adaptive management.

The CMP specifies:

- The location of the mitigation activities;
- The activities that will occur;
- When the activities will occur;
- The approximate scope of the activities;
- The estimated range of EFUs to be gained; and
- The criteria for determining success of the mitigation activity.

To ensure the CMP is successfully implemented, it establishes an escrow fund to fully fund mitigation up front and milestones for implementing mitigation activities and meeting success criteria as a precondition to use of proportionate amounts of reallocated storage. The mitigation milestones are linked to use of the reallocated storage by the Chatfield Water Providers, thus assuring that the mitigation will be accomplished as a prerequisite to proportionate use of the storage reallocation.

The CMP has been developed at a feasibility level and provides a process to proceed from the feasibility level to the detailed level needed to implement the mitigation activity. The CMP will benefit from refinements and will mature over time. The process for refinement of the CMP and adaptive management measures are specified.

The Department of the Army and the Colorado Department of Natural Resources (CDNR) will enter into a Water Storage Agreement (WSA) setting out their respective obligations for reallocating the designated water supply storage and implementing the CMP. The CDNR will then execute subagreements, identical in their terms and conditions, with each of the Chatfield Water Providers. The subagreements will set out the responsibilities of the Chatfield Water Providers to the CDNR for undertaking the CDNR's obligations to the U.S. Government under the WSA for implementing the CMP. However, the Corps continues to have discussions with the State and the Chatfield Water Providers to further refine the legal relationship between the entities.

After execution of the WSA, the Chatfield Water Providers will place the funds then judged necessary to satisfy all of the nonfederal obligations under the WSA, including implementation of the CMP, into an escrow account. The Chatfield Water Providers will also create a new nonprofit corporation called the Chatfield Reservoir Mitigation Company as a vehicle for facilitating the coordinated management of the process for implementing the CMP.

In accordance with the terms of the WSA, senior management oversight of the implementation of the Plans will reside in the Project Coordination Team, consisting of senior management representation from the Corps, the CDNR, and the Chatfield Water Providers. The Project Coordination Team shall consult on the progress of the nonfederal work being undertaken pursuant to the Plans, with a view toward anticipating and offering solutions to potential problems to the Plans' scheduled completion and make recommendations to the Omaha District Commander. The Corps has the final authority on acceptance or rejection of the Project Coordination Team's recommendations.

The EIS describes the target resources present at Chatfield Reservoir in Section 3.9.1 (Preble's and birds) and Section 3.7.1 (wetlands) and depicts Preble's habitat in Figure 3-12 and bird habitat in Figure 3-10. The EIS summarizes impacts to the target resources in Table 4-16 (Preble's), Table 4-13 (birds), and Table 4-11 (wetlands). About 789 acres and 1,180 EFUs of the target environmental resources are estimated to be impacted by Alternative 3, by inundation and permanent and temporary impacts associated with the relocation of recreation facilities. This maximum impact estimate is conservative because the estimate assumes that all of the target environmental resources below 5,444 feet in elevation will be lost. Some of the maximum estimated impacts are unlikely to occur. The estimated maximum impacts will be reviewed and verified through monitoring and the estimated EFUs will be documented. Use of the term "up to" in describing the CMP objectives refers to the impact and associated mitigation as estimated maximum values. The Project Coordination Team will be responsible for determining when the defined CMP objectives have been met and impacts to the target environmental resources have been fully mitigated. The Project Coordination Team can adjust the environmental mitigation requirements if it is determined that the actual impacts to the target environmental resources are less than the maximum impact estimate.

The CMP proposes to mitigate environmental impacts through maximizing on-site mitigation (469 EFUs) in combination with additional off-site mitigation along tributary corridors upstream from Chatfield Reservoir (711 EFUs). Of the 469 EFUs of on-site mitigation, 384 EFUs are estimated to be temporary impacts that would occur in disturbed areas during the construction of modifications to utilities, roads, and recreation facilities and will be mitigated in place following construction. Of the 384 EFUs, about 118 EFUs would be mitigated above 5,444 feet and reclaimed to upland grasslands, and about 266 EFUs would be restored in place below 5,444 feet prior to inundation from the reallocation. Following restoration of these areas, compensatory mitigation would be required for the remaining maximum of 796 EFUs (1,180 EFUs minus the 118 EFUs and 266 EFUs mitigated in place). The total of 796 EFUs is the target for compensatory mitigation used throughout the CMP (85 EFUs on-site plus 711 EFUs off-site) (Table ES-1). The CMP includes the on-site creation of up to 85 EFUs of combined wetland and riparian habitat that will benefit Preble's and birds. The total estimated cost for on-site mitigation for impacts to the target environmental resources is \$18,862,165, which equates to an average of about \$113,970 per acre or \$221,908 per EFU.

The mitigation for the remaining EFUs (up to 711) will occur off-site. The majority of the off-site mitigation will occur on private lands in the Plum Creek watershed through the permanent protection, enhancement, and management of riparian habitats and adjoining uplands to benefit the target environmental resources. Section 6.4 includes several tables that summarize impacts, on-site mitigation, and off-site mitigation in greater detail. These tables provide both acreages and EFUs.

Table ES-1. Mitigation in EFUs.

Resource/Activity	EFUs
<i>On-Site</i>	
Restoration (recreation facilities and borrow areas below 5,444 ft msl)	266
Restoration (recreation facilities, borrow areas, and utilities above 5,444 ft msl)	118
Preble’s Noncritical Habitat	43
Preble’s Critical Habitat – Plum Creek CHU	3
Birds	9
Wetlands	<u>30</u>
Total On-Site Mitigation	469
<i>Off-Site</i>	
Habitat Protection, Enhancement, Restoration, and Management	<u>711</u>
Total On-Site and Off-Site Mitigation	1,180

Off-site mitigation for impacts to Preble’s critical habitat in the South Platte River arm of Chatfield Reservoir will involve implementation of the Sugar Creek Sediment Mitigation Project and other habitat enhancement measures in the Pike National Forest. The designated critical habitat on Sugar Creek encompasses about 380 acres and 4.5 stream miles, which is more than four times the acres and about three and a half times the length of stream miles of critical habitat lost to reallocation. Stream miles and acres instead of EFUs are used because the EFUs were developed for the plains environment and this off-site critical habitat mitigation will occur in a montane environment. The sediment impacts to Sugar Creek and its riparian habitats are pervasive and implementation of the Sugar Creek Sediment Mitigation Project will benefit 4.5 miles of Preble’s critical habitat by returning Sugar Creek to a functioning aquatic and riparian ecosystem. Off-site mitigation for impacts to Preble’s critical habitat in the Plum Creek arm of Chatfield Reservoir will involve the permanent protection and, where needed, enhancement of Preble’s habitat within the West Plum Creek critical habitat unit (CHU) that includes lands designated for a large Preble’s recovery population.

Subsequent to release of the draft FR/EIS and draft Biological Assessment (BA), the Corps and Service held discussions regarding crediting of off-site mitigation measures. In addition to providing additional detail to the CMP regarding mitigation, monitoring, adaptive management, and reporting, sections of the draft CMP were revised as to how weighting factors are applied to EFU calculations for the long-term protection, enhancement, and management of Preble’s

habitat. While the EFUs are calculated solely on the basis of target habitat within a particular area, weighting factors form the basis of benefit that comes from the ecological effects of the landscape context in which the off-site mitigation habitats are situated. Revisions to the weighting factors increased the amount of off-site mitigation needed and the associated costs of that mitigation and are addressed in this revised version of the CMP.

It is estimated that it will take 6 years to implement the CMP at an estimated present value cost of about \$77.8 million for on- and off-site mitigation activities, including monitoring and maintenance.

1.0 INTRODUCTION

The Corps has developed this Compensatory Mitigation Plan to address the remaining unavoidable impacts associated with the reallocation of storage under Alternative 3 and the recreation facilities modification following impact avoidance and minimization. The CMP, as presented in this report, is considered an integral part of the recommended plan, and as such, its implementation must be carried out concurrently as part of the overall project. The CMP has been developed at a feasibility level, and considers the ecological resources that will be adversely affected at a sufficient scope and detail to enable a reasonable judgment that the recommended compensatory mitigation will be implementable and adequate to compensate for the functions and values of resources to be impacted. The CMP has been developed with substantial input from stakeholders including the Service, EPA, CDOW, Colorado State Parks, Denver Chapter of the Audubon Society, Sierra Club, South Suburban Parks and Recreation District, and the Chatfield Basin Conservation Network (Appendix A). The CMP is informed by and conforms to applicable regulations, policies, and guidelines including the Water Resource Development Act (WRDA) and Department of the Army Planning Guidance Notebook ER 1105-2-100 (Appendix B).

The CMP focuses on providing mitigation for impacts to:

- Preble's meadow jumping mouse (Preble's) habitat, including designated critical habitat;
- Migratory bird habitat; and
- Wetlands.

The draft FR/EIS identified Preble's habitat, bird habitat, and wetlands as resources of particular concern and warranting specific mitigation strategies for the estimated adverse impacts to those resources. These resources are referred to as the "target environmental resources" in the CMP. Although the CMP focuses on the target environmental resources, it is structured to provide a diversity of ecological functions that will benefit a broad range of wildlife including insects, amphibians, reptiles, and mammals. Mitigation for other types of impacts is addressed in the FR/EIS.

The CMP is designed to offset the adverse impacts to the target environmental resources associated with the reallocation of storage space and effects of inundation under Alternative 3, should Alternative 3 be approved as proposed in the FR/EIS. The CMP also includes actions to offset adverse impacts associated with the relocation of recreation facilities and use of borrow areas, the impacts of which have been separately identified. This CMP is designed to replace the lost ecological functions and values of the target resources from both types of actions. The impacts and corresponding mitigation requirements for each of these actions are identified in Section 6.0. Section 6.3.2.5 includes several tables that summarize impacts, on-site mitigation, and off-site mitigation. For ease of reference, they are collectively referred to as the "adverse impacts of reallocation to be mitigated" or "reallocation." The adverse impacts estimated for the target environmental resources in Chapter 4 of the FR/EIS 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 would be lost. As a practical matter, this may not be the case, and can be addressed through monitoring and adaptive management (Section 7.0). Implementation of the CMP is expected to produce quantitative and qualitative benefits for the target environmental resources. The quantitative benefits will be measured by the ecological functional units (EFUs) gained.

The CMP establishes quantifiable objectives and maximizes, to the degree practicable, the amount of mitigation that will occur on Corps land in the vicinity of Chatfield Reservoir (on-site) (Section 5.0). The CMP provides requirements for monitoring, reporting, and adaptive management (Sections 7.4 and 7.5). Monitoring will occur at least annually until the entire CMP is fully implemented. Each individual mitigation activity will be monitored at least annually for a minimum of 5 years or until success criteria are met. An adaptive management plan for the target environmental resources and other resources is presented in Appendix GG of the EIS. The

“currency” of the CMP is EFUs. This ecological functions approach was taken because of the substantial geographic overlap in the target environmental resources (Appendix B). The EFUs capture the ecological functions provided by the individual target environmental resources as well as their overlap. To ensure diverse and balanced mitigation activities, minimum levels of mitigation activities were established for Preble’s, birds, and wetlands that will contribute to meeting the overall goal to replace lost ecological functions and values of Preble’s habitat, bird habitat, and wetlands associated with adverse impacts of reallocation to be mitigated (Section 5.0). The modeling developed to determine the EFUs has received approval through appropriate review as coordinated with the Corps of Engineers Ecosystem Center of Expertise. EFUs were not used for the off-site mitigation of impacts to designated Preble’s critical habitat in the Upper South Platte CHU. The off-site critical habitat mitigation for impacts to the Upper South Platte CHU focuses on stream miles rather than EFUs because the EFUs were developed for a plains environment and this off-site critical habitat mitigation will occur in a montane environment on the Pike National Forest. Stream miles are an appropriate unit to measure impacts and mitigation for Preble’s critical habitat in this montane environment because Preble’s is a riparian species and this off-site mitigation will be applied to a riparian system. EFUs will be applied to off-site critical habitat mitigation in the West Plum Creek CHU because this mitigation will occur in a plains environment near Chatfield Reservoir.

The CMP describes the proposed mitigation activities with sufficient specificity for reviewers of the FR/EIS to determine the mitigation proposed and provide comments on the adequacy of the CMP. The CMP specifies: 1) the location of the mitigation activity, 2) what activity will occur, 3) when the activity will occur, 4) the approximate scope of the activity, 5) the estimated range of EFUs to be gained from the activity, and 6) the criteria for determining success of the mitigation activity. Upon approval of the Federally Recommended Plan, preliminary plans will be prepared and submitted for Corps’ approval prior to the development of final design documents. The plans and specifications for the mitigation activities respond to and are informed by comments received on the draft FR/EIS and the CMP (Section 7.1).

1.1 Report Organization

The CMP is organized into nine sections and nine appendices as follows:

- Section 1: *Introduction* – Provides background for the CMP.
- Section 2: *Corps Planning Policy and Guidance* – Discusses how the CMP complies with key Corps Civil Works Guidance documents pertaining to compensatory environmental mitigation for water projects.
- Section 3: *Guiding Principles* – Discusses the principles that guided development of the CMP.
- Section 4: *Mitigation Approach* – Combines the Corps regulation, policy, and guidance on mitigation with the guiding principles; stakeholder and agency expectations; and ecological priorities to develop an approach to the CMP that focuses on ecological functions.
- Section 5: *Objectives* – Presents the overarching goal of replacing lost ecological functions of Preble's habitat, bird habitat and wetlands and establishes quantifiable and measurable objectives to meet this goal.
- Section 6: *Proposed Mitigation Activities* – Provides descriptions and locations of the specific on- and off-site compensatory mitigation activities proposed to mitigate for impacts to the target environmental resources. At the end of Section 6 is a summary of the proposed mitigation and tables that summarize the impacts and mitigation in several ways.
- Section 7: *Implementation* – Describes the process for refining the CMP, establishes milestones for implementing the CMP, assigns responsibilities and oversight, establishes monitoring and reporting requirements and provides a framework for adaptive management and describes operation scenarios that could minimize environmental impacts.
- Section 8: *Costs* – Summarizes the estimated costs for implementing the Compensatory Mitigation Plan and presents the cost effectiveness/incremental cost analysis.
- Section 9: *References* – Provides references cited in Sections 1.0 through 8.0. Separate references are provided at the end of each appendix for references cited in the appendix.

- Appendix A: *Stakeholder Involvement* – Lists the various stakeholders involved in development of the CMP and meetings held with stakeholders where the CMP was discussed.
- Appendix B: *Compliance with Policy and Guidance on Compensatory Mitigation* – Steps through the various applicable Corps regulations and guidance on environmental mitigation and how and where the CMP complies with the regulations and guidance. Appendix B provides the supportive detail for Section 2.0.
- Appendix C: *Ecological Functions Approach* – Presents detailed information on development of the ecological functions approach for determining impacts and mitigation credits for the target environmental resources and provides

support for Sections 4.0 and 6.0. Appendix C also provides information on the feasibility and adequacy of the proposed mitigation.

- Appendix D: *Regional Conservation Planning* – Presents information on regional conservation plans that the CMP draws from and integrates with.
- Appendix E: *Challenge Cost Share Agreement* – Establishes responsibilities for each of the signatories regarding off-site Preble’s critical habitat mitigation at Sugar Creek on the Pike National Forest. The Agreement specifies mitigation activities, costs, and a schedule.
- Appendix F: *Guidelines for the Restoration and Revegetation of Temporarily Disturbed Upland Areas at Chatfield State Park* – Provides specification for soil preparation, seeding, mulching, monitoring and maintenance for temporarily disturbed upland areas, including best management practices to minimize the spread of noxious weeds.
- Appendix G: *Assumptions and Calculations for On-Site Mitigation Gains in EFUs and Costs* – Provides a table showing how costs were developed for each on-site mitigation area.
- Appendix H: *Review of Designated Critical Habitat in the Pike National Forest* – Memorandum to the U.S. Fish and Wildlife Service discussing a review of the Upper South Platte Critical Habitat Unit on the Pike National Forest and mitigation opportunities and constraints.
- Appendix I: *Ecological Functions Approach, Model Review Report, Chatfield Reallocation Study* – Report from the U.S. Army Corps of Engineers, Omaha District, reviewing the ecological functions approach for determining impacts and mitigation credits for the target environmental resources.

2.0 CORPS PLANNING POLICY AND GUIDANCE

The Corps Civil Works planning process for water and related land resources planning is guided by the Water Resources Planning Act, as amended (WRPA) (42 U.S.C. 1962a-2) and the National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4321-4347). This CMP complies with key Corps Civil Works guidance documents pertaining to compensatory environmental mitigation for water and related land resources projects that integrate the requirements of WRPA and NEPA. These documents are:

- Department of the Army Planning Guidance Notebook – ER 1105-2-100 (April 22, 2000) six-step planning process and Appendix C Environmental Evaluation and Compliance;
- Water Resources Development Act of 2007 (WRDA 07) – 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; and

- Memorandum addressing Implementation Guidance for Section 2036(a) of the Water Resources Development Act of 2007.

The Corps Planning Guidance Notebook is grounded in the economic and environmental principles and guidelines (P&G) originally established in 1983 by the U.S. Water Resources Council. These P&G guide the formulation and evaluation studies for major federal water resource development agencies.

Additionally, the compensatory mitigation of impacts to designated critical habitat for Preble’s is in accordance with Service guidance. The Service considers only mitigation actions within the same CHU when determining whether an action will result in destruction or adverse modification of critical habitat (Service 2004). See Appendix B for further discussion on how the CMP complies with this guidance on compensatory mitigation.

3.0 GUIDING PRINCIPLES

Several principles guided the development of the CMP and are listed in Table 1.

Table 1. Guiding Principles for Compensatory Mitigation.

Principle	Explanation
Prioritize mitigation	In order of priority: on-site, Preble’s critical habitat, off-site.
Consider the context of mitigation activities	Mitigation measures must be appropriate on a landscape scale for the target environmental resources.
Account for habitat overlap	The non-aquatic habitat at Chatfield Reservoir provides shared ecological functions for Preble’s, birds, and wetlands.
Replace lost ecological functions	Mitigation aims to adequately compensate for ecological functions degraded or lost as a result of implementing an alternative.

3.1 Prioritize Mitigation

Having compensatory mitigation as close as possible to the location of impacts, preferably in Chatfield State Park, was identified as an important issue during scoping. Keeping mitigation close to impacts is also often desirable as a means to maintain the ecological integrity of impacted ecosystems. Proposed on-site compensatory mitigation has been maximized to the degree practicable for the following reasons:

- On-site mitigation provides the least amount of risk regarding the ability to acquire lands and ensure mitigation is fully implemented.

- The Service considers only mitigation actions within the same CHU when determining whether an action will result in destruction or adverse modification of critical habitat (Service 2004). There are two separate CHUs within Chatfield State Park.
- Ecological resources are an important part of the overall makeup and feel of Chatfield State Park. Maximizing on-site mitigation to compensate for adverse impacts to these ecological resources helps restore the overall integrity of Chatfield State Park by providing comparable resources to the extent practicable following reallocation.
- Agencies that manage resources within Chatfield State Park have been involved in development of the principles that guide the CMP. The Colorado Division of Parks and Wildlife manages the site for recreation, fisheries, and wildlife and the Service oversees compliance with the ESA and has designated the South Platte River and Plum Creek arms of Chatfield Reservoir as critical habitat for Preble's.
- Local environmental groups that use Chatfield State Park (e.g., Audubon Society) were invited by the Corps to participate as special technical advisors for the FR/EIS process because of their expertise and knowledge of ecological resources in Chatfield State Park. These organizations and the agencies above have provided valuable input for developing and prioritizing mitigation strategies.
- On-site compensatory mitigation is considered a priority by the Corps and EPA when it is practicable (EPA and Department of the Army 1990).
- The cost of on-site compensatory mitigation is estimated to be more expensive than the cost of off-site compensatory mitigation; however, compensatory mitigation will be entirely funded by the Chatfield Water Providers. No federal funds will be used to implement the proposed compensatory mitigation.

On-site compensatory mitigation primarily will be accomplished by expanding or enhancing existing habitats that are not impacted by reallocation in order to offset impacts from reallocation. The CMP includes descriptions of on-site mitigation activities that would be undertaken to maximize on-site compensatory mitigation (Section 6.1).

The second priority, compensatory mitigation for impacts to designated critical habitat for Preble's, is required to occur within the CHU in which the impacts occur (Section 6.3), a portion of which occur in Chatfield State Park. To the degree practicable, the on-site compensatory mitigation for impacts to critical habitat has been maximized (Section 6.3.1). The remainder of the compensatory mitigation for impacts to designated critical habitat for Preble's will occur within the West Plum Creek CHU and the Upper South Platte CHU within the Pike National Forest (Section 6.3.2).

The remainder of the compensatory mitigation will occur in off-site locations, with incentives to provide buffers and habitat connectivity (Appendix C, Section 4.3). Incentives for protecting multistructure bird habitat near Chatfield State Park also are included because this

type of bird habitat that will be lost at Chatfield State Park is restricted to a relatively small geographic area near Chatfield State Park that is defined by urban development to the east and north, by foothills and canyons to the west, and by a distinct change in riparian communities south of Sedalia.

3.2 Context

The compensatory mitigation will occur in a watershed context. The majority of the compensatory mitigation will occur within the Chatfield Reservoir watershed and all mitigation will occur in the Upper South Platte River watershed. The target environmental resources were considered when developing the mitigation activities and selecting mitigation sites. Potential Preble's mitigation sites are most restricted as compared to bird habitat or wetland mitigation sites. Preble's is not found downstream of Chatfield Dam; therefore, sites for Preble's mitigation are limited to areas above the reservoir (above the proposed inundated areas) along the South Platte River and Plum Creek and their tributaries. Site selection for bird habitat mitigation and wetland mitigation is much less restrictive. Sites can be targeted along Deer Creek, Massey Draw, Marcy Gulch, and downstream reaches of the South Platte River (below Chatfield Reservoir), as well as upstream reaches of the South Platte River and Plum Creek. All of these sites are important for maintaining and improving the ecological functions of the watershed. Additionally, the CMP considers regional conservation plans and opportunities for off-site compensatory mitigation (Appendix D).

3.3 Habitat Overlap

The non-aquatic habitat at Chatfield Reservoir provides shared ecological functions for the target environmental resources identified during the FR/EIS process. This habitat also supports other types of wildlife such as insects, amphibians, reptiles, and other mammals. It is important to account for and incorporate this overlap in the development of the CMP so that mitigation activities provide the maximum combined ecological benefit rather than focusing on resource-specific activities (Section 4.0).

3.4 Replace Lost Ecological Functions

Chatfield State Park provides habitat for multiple species; however, the same location does not necessarily provide similar ecological values for each of the species. For instance, a willow-dominated wetland is of high value to Preble's for foraging and cover, but is of lower value to

ground-nesting birds that spend most of their time in upland grasslands, even though the birds may occasionally forage in the wetland. In another instance, a grove of mature cottonwoods with a sparse understory is of high value to tree-nesting birds but of only moderate value to Preble's.

As part of the development of the CMP, the functional value that a particular habitat type provides for Preble's and birds has been calculated by developing a system that quantitatively rates how various attributes of the habitat contribute to the overall survival of the resource. The variations in ecological values provided to the different target environmental resources by the same habitat are captured by summing the separate functional values. This provides the overall functional value or functional index of the habitat. This means that a habitat type that provides high value to all three of the target environmental resources will have a higher ecological index rating than a habitat type that does not (Appendix C). This approach ensures that no one type of habitat is over-represented and accounts for the benefits of mitigation involving multiple resources.

3.5 Selection of Locations for Compensatory Mitigation

In addition to the guiding principles, the selection of the locations for mitigation activities was based on the following criteria:

- To the degree feasible, maximize the amount of compensatory mitigation that will occur on-site;¹
- Target mitigation activities to occur within the Chatfield Reservoir Watershed;
- To the degree feasible, locate off-site mitigation as close to Chatfield State Park as possible;
- Focus on mitigation activities that can provide benefits to all of the target environmental resources;
- To the degree practicable, implement off-site mitigation in a way that will expand connections to existing protected lands forming longer continuous corridors of protected lands;
- Select locations for mitigation activities that provide a high likelihood for successful mitigation; and
- To the degree practicable, consider the use of approved mitigation banks.

¹ For the purposes of the CMP, "on-site" is defined as property owned by the United States and managed by the Corps in the vicinity of Chatfield State Park.

4.0 MITIGATION APPROACH

The CMP approach is based on using ecological function as a “common currency” for determining impacts and compensatory mitigation. The approach to developing the CMP was informed by Corps and Service regulations, policy, and guidance on mitigation (Section 2.0), regional conservation plans (Appendix D), and the guiding principles for compensatory mitigation (Section 3.0). These policies, plans, and principles focus on the need for compensatory environmental mitigation to replace lost ecological functions. ER 1105-2-100, paragraph C-3(e) and Policy Guidance on Certification of Ecosystem Output Models (August 13, 2008) require the use of a habitat-based method, supplemented with other appropriate information to describe and evaluate impacts and mitigation (Colorado Department of Transportation’s Functional Assessment of Colorado Wetlands Method by Johnson et al. 2009).

The terrestrial habitat at Chatfield Reservoir provides shared ecological functions for the target environmental resources (Section 3.3). An ecological functions approach (EFA) was used to assess these overlapping resources during development of the CMP. Several existing models that evaluate habitat functions were assessed for their applicability to the draft FR/EIS. Assessed models included Habitat Equivalency Analysis (HEA), and Habitat Evaluation Procedures (HEP) and its associated Habitat Suitability Indices (HSI). No existing model is capable of accurately representing the site-specific characteristics of Preble’s and bird resources addressed in the FR/EIS (Appendix C, Section 2.0); therefore, a site-specific approach was developed for the draft FR/EIS (ERO 2010). In accordance with Corps guidance (EC 1105-2-407: Planning Models Improvement Program: Model Certification (CECW-CP, May 31, 2005), the model developed to determine EFUs was reviewed and approved in close coordination with the National Ecosystem Planning Center of Expertise (Appendix I).

To provide an ecologically meaningful assessment of impacts to the overlapping habitats of the target environmental resources, an ecological functioning index (EFI) was developed for each habitat type. The EFI is a unitless measure that rates habitat components for the target environmental resources on a scale of zero to one. The EFIs for the target environmental resource habitat components were multiplied by acres of impacts to determine the number of impacted EFUs for each target environmental resource. For example, if a habitat type has an EFI of 0.5 for Preble’s and 12 acres of the habitat are lost, six Preble’s EFUs would be lost. The total

number of EFUs impacted is the sum of EFUs provided in the impact area for each target environmental resource.

Scientific and technical literature and the professional opinions of local experts were relied on to evaluate the terrestrial ecological functions that would be impacted by reallocation. This information was used to develop an EFA model to calculate the number of baseline EFUs being impacted for each target resource and the reduction in total EFUs that may occur with reallocation (ERO 2010). The model also will be used to identify how many EFUs might be generated from mitigation activities (Appendix C).

Development of the CMP integrated the following ecological priorities and stakeholder expectations, some of which overlap (Table 2).

Table 2. Ecological Priorities and Stakeholder Expectations for Environmental Mitigation.

Stakeholder and Agency Expectations	Ecological Priorities
Provide mitigation close to the impact. The target environmental resources in Chatfield State Park provide a valuable resource to the Park.	Provide as much mitigation as practicable close to the impact to maintain local habitat and ecological functions within the watershed.
Provide as much mitigation as practicable prior to the impact occurring.	Provide as much mitigation as practicable prior to the impact occurring or as soon as practicable following the impact.
Develop mitigation for wetlands using a watershed approach (Corps and EPA compensatory mitigation rule)	Locate mitigation within the Chatfield Reservoir watershed to help offset resources lost at Chatfield Reservoir and benefit the watershed.
Base mitigation success criteria on ecological functions (WRDA Section 2036, 2007)	<p>Focus on ecological functions as the currency for impact assessment and mitigation.</p> <p>Provide off-site mitigation as close to Chatfield State Park as possible (weighting for proximity).</p> <p>Protect lands in perpetuity for off-site mitigation from development (use conservation easements and buffers).</p> <p>Protect lands that can provide a network of connected protected lands (weighting for connectivity).</p>

Stakeholder and Agency Expectations	Ecological Priorities
Provide full mitigation for adverse modifications to Preble’s designated critical habitat within the Upper South Platte and West Plum Creek CHUs (U.S. Fish and Wildlife Service guidelines)	Mitigate within the Upper South Platte and West Plum Creek CHUs – onsite to the extent possible, then offsite where Preble’s critical habitat is severely degraded and otherwise would likely further deteriorate in the future in the Upper South Platte CHU, and protect, manage and enhance habitats targeted for a large recovery population in the West Plum Creek CHU.

These ecological priorities and stakeholder expectations, the guiding principles previously discussed (Section 3.0), and the ecological functions approach discussed below provided the framework for the CMP. The CMP is composed of three primary components:

- On-site mitigation – the restoration of temporarily disturbed areas and the conversion of upland areas to wetland, riparian and Preble’s habitat within Chatfield State Park
- Off-site critical habitat mitigation – the enhancement, restoration, and control of sediment along 4.5 miles of Sugar Creek in the Pike National Forest and the permanent protection, and enhancement and management as needed, of private lands in the West Plum Creek CHU designated to support a large recovery population of Preble’s
- Off-site mitigation – the permanent protection of private lands in the Plum Creek/West Plum Creek watershed upstream of Chatfield Reservoir, with management and enhancement to benefit the target environmental resources.

The first priority is to maximize on-site mitigation. Providing the maximum amount of on-site mitigation will provide as much mitigation as possible as close as possible to the impact location and will meet stakeholder expectations of replacing lost resources within Chatfield State Park. On-site mitigation also provides mitigation within the Chatfield Reservoir watershed. The reasons for considering on-site mitigation as the first priority are discussed in Section 3.1.

The second priority is to provide off-site compensatory mitigation for the loss of designated Preble’s critical habitat not mitigated on-site. Per Service guidelines, the Service considers only mitigation actions within the same CHU when determining whether an action will result in destruction or adverse modification of critical habitat. For the Upper South Platte CHU, the remainder of the Upper South Platte CHU outside Chatfield State Park occurs in the Pike National Forest. Sugar Creek has the greatest potential for restoration and enhancement of Preble’s habitat in the Upper South Platte CHU. Providing the off-site critical habitat mitigation along Sugar Creek meets the Service’s expectations and provides the most favorable ecological gains for Preble’s within the Upper South Platte CHU. In the absence of compensatory

mitigation activities along Sugar Creek, the U.S. Forest Service indicates that the agency's projected funding levels would not be adequate to restore this severely degraded Preble's critical habitat. Impacts to the West Plum Creek CHU will occur within the West Plum CHU upstream of Chatfield Reservoir in habitats designated for a large Preble's recovery population. The permanent protection of private lands within the West Plum Creek CHU will advance the recovery of Preble's, because the protection of habitat on private lands will occur in areas designated for a large recovery population and the critical habitat designation affords no protection for nonfederal actions on nonfederal lands.

The third priority is to provide the remainder of the needed compensatory mitigation for the target environmental resources. The protection of private lands within the Plum Creek/West Plum Creek watershed upstream of Chatfield Reservoir was targeted as the most favorable means to benefit the target environmental resources while aligning with stakeholder and agency expectations and ecological priorities (Table 2). This watershed affords numerous opportunities for ecological benefits through protection because:

- The Plum Creek/West Plum Creek watershed flows into Chatfield State Park.
- Private lands on Plum Creek are adjacent and near the park.
- The Plum Creek/West Plum Creek watershed has been proposed as the location for a large Preble's recovery population (Appendix D).
- Much of the Plum Creek/West Plum Creek watershed has been designated as critical habitat for Preble's (75 Fed. Reg. 78430 (December 15, 2010)).
- West Plum Creek has been determined to be one of the most biologically diverse areas in Douglas County (Pague et al. 1995).
- The upper portions of the watershed are located in the Pike National Forest, and scattered areas of protected lands within the watershed provide a matrix of protected lands to build upon and with which to connect.
- Plum Creek and lower portions of West Plum Creek support existing mature cottonwood habitat near Chatfield State Park that provides a habitat complex that supports a variety of bird species including several uncommon and sensitive species (Appendix C, Section 4.3.1).

The Plum Creek/West Plum Creek watershed has extensive riparian areas that support woodlands of plains cottonwoods and peachleaf willows. West Plum Creek is a transitional stream that flows south to north, forming a divide between the foothills to the west and the plains to the east. Its western tributaries link West Plum Creek to montane environments and, in some instances the Pike National Forest. The eastern tributaries add plains influences to West Plum

Creek. The combination of montane, foothills, and plains influences; favorable historical land management; and a relatively natural hydrologic regime help to form and maintain a large intact riparian area that supports a high biological diversity. The Colorado Natural Heritage Program designated West Plum Creek as a conservation “macrosite” and considers it to be perhaps the best remaining transition zone stream system in Colorado (Pague et al. 1995). West Plum Creek contains a number of rare or imperiled species, demonstrating that this macrosite represents a significant proportion of Douglas County’s biological diversity. High-quality Preble’s habitat occurs throughout the drainage. The riparian habitats are of the highest quality of any in Douglas County (Douglas County et al. 2006). The protection of private lands with habitat that benefits the target environmental resources in the Plum Creek/West Plum Creek watershed for off-site mitigation will be credited at a level of 15 percent (0.15) of the existing EFUs of the protected property.

The development of the CMP also considered incentives to accomplish the identified ecological priorities and meet stakeholder and agency expectations. The use of incentives focused on off-site mitigation because off-site mitigation potentially had the greatest diversity of lands that could be involved. The target habitat for off-site mitigation is composed of about 6,075 acres of private lands (Appendix C, Section 4.0).

The CMP provides incentives in the form of weighting factors for protected properties as discussed in detail in Appendix C, Section 4.3. Subsequent to release of the draft FR/EIS and draft BA, the Corps and Service held discussions regarding crediting of off-site mitigation measures. Based on these discussions, the CMP was revised as to how weighting factors are applied to EFU calculations for the long-term protection, enhancement, and management of Preble’s habitat. While the EFUs are calculated solely on the basis of target habitat within a particular area, weighting factors form the basis of benefit that comes from the ecological effects of the landscape context in which the off-site mitigation habitats are situated. Weighting factors increase the credited EFUs for protected habitats when buffers from potential development and connections to other protected lands are established. These weighting factors encourage an expanded network of connected protected lands buffered from development that will benefit the target environmental resources. Weighting factors for proximity to Chatfield State Park are also applied to lands protected within areas specified near Chatfield State Park that provide a multi-

structure habitat of mature cottonwood and a diverse shrub community with a herbaceous understory (Appendix C, Section 4.3.1).

The EFU approach and weighting factors were developed with considerable input from a variety of experts. The overall approach to developing the ecological functions model was to convene an Ecological Functions Technical Committee of locally recognized experts with expertise in the three target environmental resources (Appendix A). The ecological functions approach model was reviewed and approved per the Corps' Policy Guidance on Certification of Ecosystem Output Models (Corps 2007). The Service and Corps worked through several iterations of the weighting factors to ensure the factors were consistent with recognized conservation planning principles and would provide an incentive to provide high-quality mitigation.

These weighting factors were not applied to on-site mitigation because the land within Chatfield State Park is already protected from future development (no weighting factor needed for buffers from development, connectivity to protected lands, or proximity relative to Chatfield State Park).

The off-site mitigation weighting factors provide incentives to accomplish the ecological priorities for mitigation. An acre of land protected for off-site mitigation will be credited with more EFUs if it is buffered, provides a connection to other protected lands, and occurs within specified areas near Chatfield State Park that provide the mature cottonwood habitat complex. Assuming similar land protection costs, the cost per EFU credited will be lower with protected lands that are buffered from development, connected to other protected lands, and close to Chatfield State Park.

Based on discussions between the Corps and Service, the weighting factors presented in Appendix C have been revised as follows for buffers:

- Minimum buffer width of 100 feet = EFUs multiplied by 1.3;
- Average buffer width 200+ feet with no portion of the buffer <100 feet = EFUs multiplied by 1.5; and
- Average buffer width 300+ feet with no portion of the buffer <150 feet = EFUs multiplied by 1.6.

Targeted properties will have riparian habitats and the potential exists for one side of the property to be buffered while the other side of the property is not. The goal is to have the protected property fully buffered. Reduced credit will be received for partially buffered properties. For partially buffered areas, the EFUs bordering the buffered area will receive 25 percent of the buffer credit applied to the EFUs between the buffer and the stream. If a portion of the protected property had a buffer prior to protection and the remainder of the property is buffered as part of protection, then crediting will be received for the appropriate buffer width applied to the EFUs between the buffer and the creek.

The weighting factor for connectivity has been revised as follows:

Connectivity between protected off-site mitigation properties in the West Plum and Plum Creek watershed upstream of Chatfield Reservoir will receive a weighting of 1.25 times the baseline EFUs and enhancement EFUs of the protected property. Crediting for increasing the connectivity will be received when the protected property adds to the connection of an existing protected property. The crediting for connectivity can occur at the time of protection or could occur in the future as the protection of other adjoining properties builds a series of connected properties.

The weighting factors for proximity are applied only to properties near Chatfield State Park that could provide bird habitat as described below and have been revised as follows:

The type and structure of bird habitat impacted by the Chatfield Reservoir reallocation is limited by both space and structure to areas close to Chatfield Reservoir. Much of the bird habitat impacted by reallocation consists of a multistory, multistructure habitat of mature cottonwood, diverse shrub community, and herbaceous understory. Because mitigating Preble's and wetland habitats close to impacts is not as ecologically beneficial as for bird habitat, a weighting factor for proximity will only be applied to bird habitat EFUs at off-site mitigation sites. The weighting factor for bird habitat is a three-tiered weighting based on the proximity of the three zones below to Chatfield State Park:

Zone 1 – Chatfield State Park boundary to upstream to Sedalia, has multistoried cottonwoods and this zone generally provides the functions needed to sustain a cottonwood forest. Crediting is 1.25 X baseline bird habitat EFUs.

Zone 2 – Sedalia to U.S. 86 (Wolfensberger Road). Crediting is 1.0 X baseline bird habitat EFUs.

Zone 3 – All areas farther away from Chatfield State Park than Zone 2. Crediting is 0.75 X baseline bird habitat EFUs. After applying each of the weighting factors as described above, the weighted EFUs are totaled to calculate the total EFU for the protected off-site mitigation property. The revised weighting and adding the weighted EFUs instead of multiplying the weighted EFUs resulted in an increased amount of EFUs needed to be provided by off-site mitigation and is addressed in Section 6.2.2.

5.0 OBJECTIVES

The following objectives for the CMP were developed based on the estimated maximum impacts to the target environmental resources associated with Alternative 3 and the relocation of recreation facilities. This maximum impact estimate is conservative because the estimate assumes that all of the target environmental resources below 5,444 feet in elevation will be lost. Some of the maximum estimated impacts are unlikely to occur. The maximum impact assessment conservatively assumes that any of the target environmental resources that will be inundated (i.e., occur below an elevation of 5,444 feet) will be lost. As a practicable matter, some of these maximum estimated impacts are unlikely to occur for the following reasons:

- The reallocation storage will not be completely full every year;
- The reallocation storage will not remain full in the years it does fill; and
- Some vegetation, particularly between 5,442 feet and 5,444 feet in elevation, will likely tolerate infrequent and/or short-term flooding and will not be lost.

The Tree Management Plan (Appendix Z of the FR/EIS) proposes the removal of trees up to 5,439 feet in elevation, assuming that all trees below 5,439 feet in elevation will be lost to inundation. For areas between 5,439 and 5,444 feet in elevation, an adaptive management approach would be used that entails leaving these trees in place and then monitoring the trees for signs of severe stress and mortality; and removing unhealthy and dead trees from this area on an as-needed basis to eliminate potential risks to visitor and dam safety.

This estimate of maximum impacts will be reviewed and verified through monitoring and the estimated EFUs will be documented as discussed in Section 7.1.4. Use of the term “up to” in describing the CMP objectives refers to the impact and associated mitigation as estimated

maximum values. The Project Coordination Team will be responsible for determining when the defined CMP objectives have been met and impacts to the target environmental resources have been fully mitigated (Section 7.2.2).

These objectives are used to guide compensatory mitigation planning and establish success criteria that then inform mitigation monitoring, corrective actions, and adaptive management. The overarching goal is to replace lost ecological functions of Preble’s habitat, bird habitat, and wetlands associated with adverse impacts of reallocation at Chatfield Reservoir.

The following objectives will be met to reach the overarching goal of the CMP:

1. **Provide the total compensatory mitigation needed.** The combination of all compensatory mitigation activities in noncritical habitat will provide a total of up to 796 EFUs to replace the estimated maximum loss of 796 EFUs that will remain to be mitigated after restoration of the borrow and fill areas.
2. **Include a diversity and balance of resources and the following important resource considerations when providing up to 796 EFUs of compensatory mitigation:**
 - Ensure a diversity and balance of mitigation activities by implementing compensatory mitigation activities that will provide up to the maximum estimated number of EFUs permanently impacted for each target environmental resource – up to 211 EFUs for noncritical Preble’s habitat, up to 65 EFUs for West Plum Creek critical habitat, up to 396 EFUs for bird habitat, and up to 124 wetland habitat EFUs; and
 - Compensate for the loss of up to 42.5 acres of mature cottonwood bird habitat by protecting up to 22.5 acres of mature cottonwood woodlands within a defined off-site bird habitat complex and creating up to 13 acres of specifically designated cottonwood recruitment areas on-site and up to 10 acres off-site that will contribute toward the total compensatory mitigation goal of up to 796 EFUs.
3. **Mitigate impacts to critical habitat.** To mitigate for impacts to 80 acres and 1.3 stream miles of critical habitat inundated in the South Platte River arm that is within the Upper South Platte CHU, enhance up to 17 acres of Preble’s habitat on-site in the CHU, and implement measures to benefit 4.5 stream miles of Preble’s habitat off-site within the Upper South Platte CHU. To mitigate for impacts to the 75 acres, 2.8 stream miles, and 65 Preble’s EFUs of critical habitat inundated in the Plum Creek arm of Chatfield Reservoir, enhance up to 6 acres of riparian and wetland Preble’s habitat on-site and implement measures to permanently protect, manage and enhance private lands in the West Plum Creek CHU that will provide up to 65 Preble’s EFUs. To the degree feasible, maximize the amount of compensatory mitigation that occurs within the CHUs within Chatfield State Park. Based on existing information and conservative assumptions, the mitigation within the CHUs within Chatfield State Park will result in an estimated 3 EFUs and 23 acres of enhanced Preble’s critical habitat.

The Chatfield Water Providers will pursue implementation of these objectives. These objectives are designed to provide a diversity and balance of mitigation activities. However, situations may occur that would not allow full implementation of all of these objectives. As discussed in Section 7.4.1, the Project Coordination Team and the Chatfield Water Providers have the flexibility in certain circumstances to adjust the CMP. Any adjustments to the CMP must meet the following core objectives:

1. Provide up to 796 EFUs to offset the 796 EFUs conservatively estimated to be permanently lost with reallocation, comprised of up to 211 EFUs for noncritical Preble's habitat, up to 65 EFUs for West Plum Creek critical habitat, up to 396 EFUs for bird habitat, and up to 124 wetland habitat EFUs that will contribute to the estimated maximum total of 796 EFUs conservatively estimated to be permanently lost.
2. Mitigate for the conservatively estimated loss of 1.3 miles of designated critical Preble's habitat along the South Platte River arm through habitat creation, restoration, enhancement, or preservation within the Upper South Platte CHU. This objective is not tied to providing a target amount of EFUs because most of the mitigation for impacts to critical habitat in the Upper South Platte CHU will occur within the montane environment of the Pike National Forest and the model for EFUs was developed for the plains environment.
3. Compensate for the conservatively estimated loss of 42.5 acres of mature cottonwood bird habitat by protecting up to 22.5 acres of cottonwood woodlands off-site and creating up to 13 acres (on-site) and 10 acres off-site of cottonwood recruitment areas, all of which will contribute to the compensatory mitigation goal of 796 EFUs.

6.0 PROPOSED MITIGATION ACTIVITIES

Of the three target environmental resources, the mitigation of impacts to Preble's habitat tends to drive mitigation for impacts to the other target environmental resources. This is because:

- Preble's habitat is geographically limited to well-developed riparian corridors with reliable sources of water;
- Preble's habitat has substantial functional and geographic overlap with bird habitat and wetlands;
- Preble's is a threatened subspecies protected under the ESA; and
- Impacts to Preble's designated critical habitat are required to be mitigated within the same CHU.

Because of this substantial functional and geographic overlap, compensatory mitigation actions for Preble's will benefit birds and wetlands and provide the majority of the compensatory mitigation needed for impacts to the target environmental resources. This approach will provide mitigation cost efficiencies by accounting for the functional and geographic overlap of impacts to the target environmental resources and focusing mitigation first on mitigation for Preble's habitat. On-site mitigation activities will enhance bird habitat and create wetlands and off-site compensatory mitigation actions will permanently protect and enhance bird and wetland habitat through long-term management of riparian areas and associated wetlands and adjacent uplands that provide substantial habitat for a variety of birds. Additionally, because Preble's habitat has a diversity of components (wooded riparian, riparian wetlands, and adjoining uplands), Preble's habitat supports a broad diversity of wildlife other than birds, including large and small mammals, reptiles, amphibians, and insects. Therefore, other wildlife will benefit from mitigating impacts to Preble's habitat.

Although birds will also benefit from Preble's mitigation activities, there are certain activities specifically intended to compensate for impacts of up to 42.5 acres of mature cottonwood bird habitat that will be adversely affected. Because mature cottonwood habitat has been specifically identified as an important habitat type in Chatfield State Park, mitigation for this resource will include not only compensating for lost EFUs, but also compensating for lost acres. Proposed activities include designating up to 13 acres of on-site mitigation for recruitment of new cottonwood growth (Section 6.1.1.3), protecting up to 22.5 acres of existing mature cottonwood habitat in off-site compensatory mitigation areas, and designating up to 10 acres of off-site mitigation areas for recruitment of new cottonwood growth (Section 6.1.1.4). Areas designated for new recruitment will contribute to the long-term persistence of multi-aged patches of cottonwoods, including future stands of mature cottonwoods.

In addition to compensatory mitigation activities, restoration activities will be undertaken to restore areas that are disturbed during relocation of the recreation facilities, but are not part of the permanent footprint of the facilities. These areas include the borrow areas, haul roads, and the majority of areas filled to elevate the relocated facilities.

The remainder of this section describes various proven techniques that will be used to restore, enhance, create, and conserve habitat for compensatory mitigation. Some activities, such

as conservation, will only occur on private lands off-site; others will occur on- and off-site depending on site-specific opportunities and constraints.

Mitigation activities are described in three categories:

- On-site mitigation;
- Off-site mitigation; and
- Preble's critical habitat mitigation (on-site and off-site).

Anticipated EFUs and acreages are provided for on-site mitigation activities and acreages and critical habitat mitigation in the West Plum Creek CHU. Acreages and stream miles are provided for critical habitat mitigation activities in the Upper South Platte CHU.

The proposed approach to compensatory mitigation for Preble's and its designated critical habitat, including the ecological functions approach, has been coordinated with the Service. The compensatory mitigation for Preble's and its designated critical habitat proposed in this CMP also will be included in the Biological Assessment prepared by the Corps as part of the FR/EIS (Appendix V of FR/EIS). In its Biological Opinion, the Service will include conservation measures (mitigation) that address adverse impacts to Preble's and its designated critical habitat. The CMP, as it is presented within this report, is considered an integral part of the recommended plan, and as such, its implementation must be carried out concurrently as part of the overall project.

6.1 On-Site Mitigation

On-site mitigation is mitigation that will occur on property owned by the United States and managed by the Corps in the vicinity of Chatfield Reservoir. On-site mitigation will include two categories of activities: 1) activities associated with compensatory mitigation for assumed permanent impacts to targeted environmental resources, and 2) activities associated with restoring nonpermanent impacts. Permanent impacts are assumed for all targeted environmental resources below 5,444 feet in elevation and within the permanent footprint of relocated recreation facilities, including buildings, parking lots, trails, and permanent roads. Additionally, on-site mitigation will include restoring areas disturbed by recreation relocation activities, but not within the permanent footprint of relocated facilities. These areas include borrow areas, temporary haul roads, and filled areas not permanently impacted by relocated facilities. In these

areas, mitigation will consist of restoring disturbed areas to conditions similar to those present prior to disturbance.

The amount of on-site mitigation will be maximized to the degree practicable. The following describes the on-site mitigation actions for impacts to Preble's habitat. These mitigation actions will also provide EFUs that will benefit birds and wetlands. Upon approval of the Federally Recommended Plan, preliminary plans will be prepared and submitted for Corps' approval prior to the development of final design documents. This process is described in Sections 6.1.1.1 and 7.1.1.1.

6.1.1 Compensatory Mitigation

Several types of on-site mitigation activities are proposed to convert habitat from one type to another and also to enhance existing habitat. Examples of habitat conversion include changing upland grasslands to shrublands or wetlands, and changing upland shrublands to wetland shrublands. Two examples of enhancing existing habitat are increasing shrub cover in existing wetland shrublands by planting more shrubs and performing weed control in any habitat type to increase cover of native species. The greatest gain in EFUs will be from habitat conversion activities. The greatest gain in EFUs per acre would result from converting upland grasslands to wetland habitat that also provides high value riparian habitat for Preble's. A total of 158 acres of wetlands are targeted for creation by compensatory mitigation, which is equal to the maximum acres of wetlands that would be lost.

Most on-site mitigation areas targeted for habitat conversion are currently upland grasslands. Wetland areas typically have saturated soils within 12 inches of the surface for a significant portion of the growing season. As a result, habitat conversion will primarily be accomplished by manipulating ground surface elevations and surface and ground water to provide hydrology adequate to support mesic riparian vegetation and wetlands. Most habitat conversion activities will require heavy equipment and earthwork. Three primary habitat conversion activities are proposed for on-site mitigation areas:

- Install sheet pile cutoff structures to raise the ground water table closer to the surface (Figure 1);
- Create new secondary channels, ditches, or backwaters to bring surface water to mitigation areas (Figure 2); and

- Modify surface topography to lower the ground surface closer to ground water or to better retain surface water (Figure 1).

These conversion activities have been successfully applied in numerous locations with similar conditions along the Colorado Front Range, including in a Preble's habitat enhancement project on East Plum Creek in Castle Rock (Figure 3). Other successful projects in Preble's habitat on Cherry Creek include those at 17-Mile House (Figure 4), Stroh Ranch (Figure 5), and Apache Plume Outfall (Figure 6).

In many cases, a combination of the three activities will likely be necessary to create successful mitigation conditions. The exception is the two borrow areas below 5,444 feet in elevation. Because they will have been excavated as borrow areas and because they will be in close proximity to ground water, sheet piles will not be used, surface water will not be diverted, and only a small amount of grading will be necessary to create suitable mitigation areas.

Installing sheet pile cutoff structures will entail driving interlocking sheets of 20-foot-tall, 25-inch-wide, 0.5-inch-thick steel sheets into the ground. In most locations, the sheets will be driven flush with the existing surface elevation. Where the sheet pile crosses a stream, it may extend 1 to several feet above the channel bottom, creating a grade-control structure that effectively raises the elevation of the channel behind it. Structures with a vertical face of taller than 1 foot are designed to minimize barriers to movement of fish and other aquatic organisms, per guidance from the Corps Denver Regulatory Office. The sheets will extend for some distance across the floodplain, perpendicular to the flow line of the stream. The concept behind installing sheet pile is to intercept ground water as it moves below the surface of the floodplains of Plum Creek and the South Platte River. As the ground water encounters the sheet pile, it will back up behind it, and flow in all directions until it reaches the edges of the structure and can pass beyond it. As the ground water backs up behind the structure, it gets closer to the surface and is eventually close enough to the existing or excavated surface to support wetland and riparian vegetation. Extending the sheet pile across the floodplain allows the channel to move in response to sediment movement along the stream. The conceptual design takes into account the dynamic nature of Plum Creek. The sheet pile cutoffs would be wide enough across the floodplain to accommodate channel migration. This technique has been used successfully on Plum Creek, Cherry Creek, Piney Creek, and Sand Creek.

Figure 1. Habitat Conversion Techniques

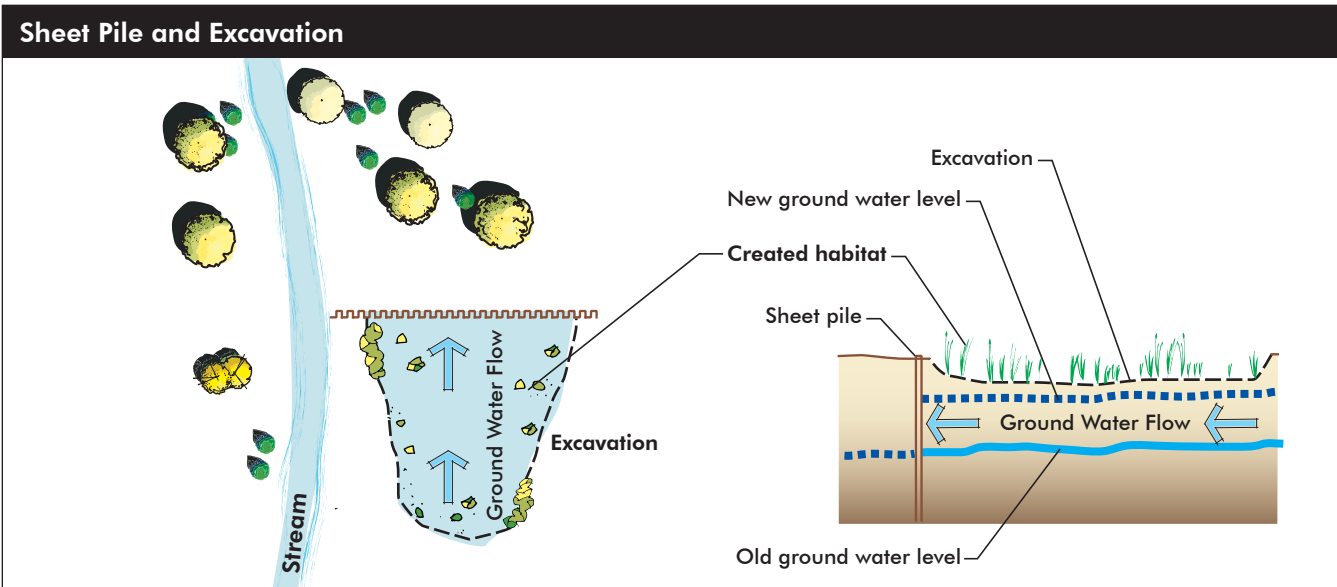
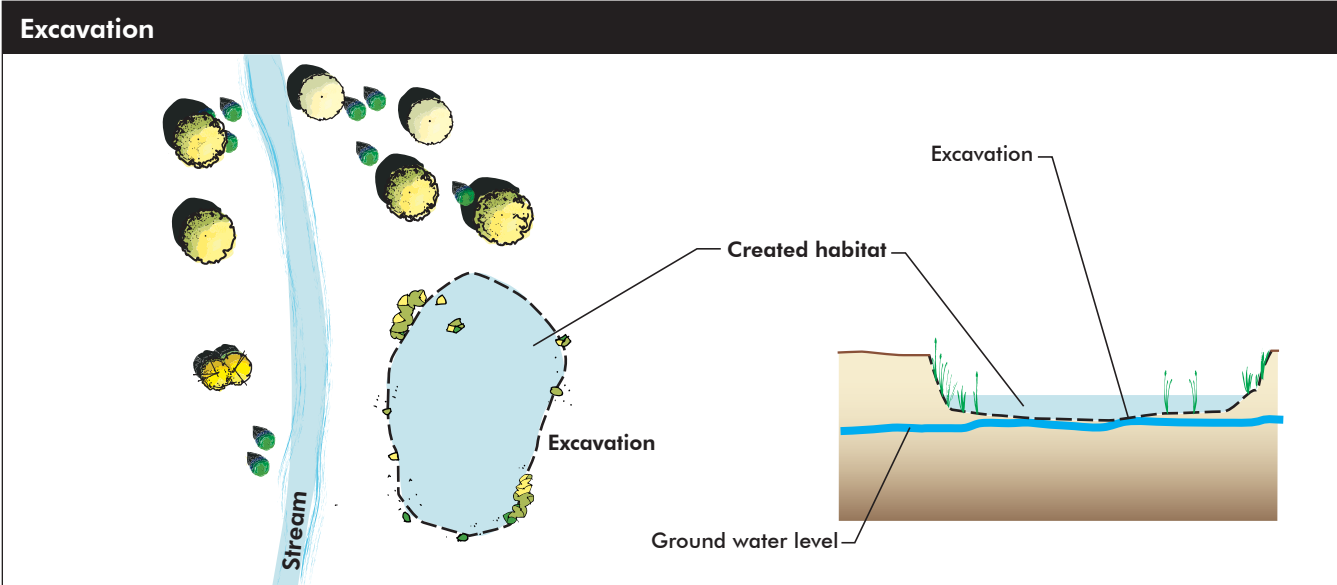
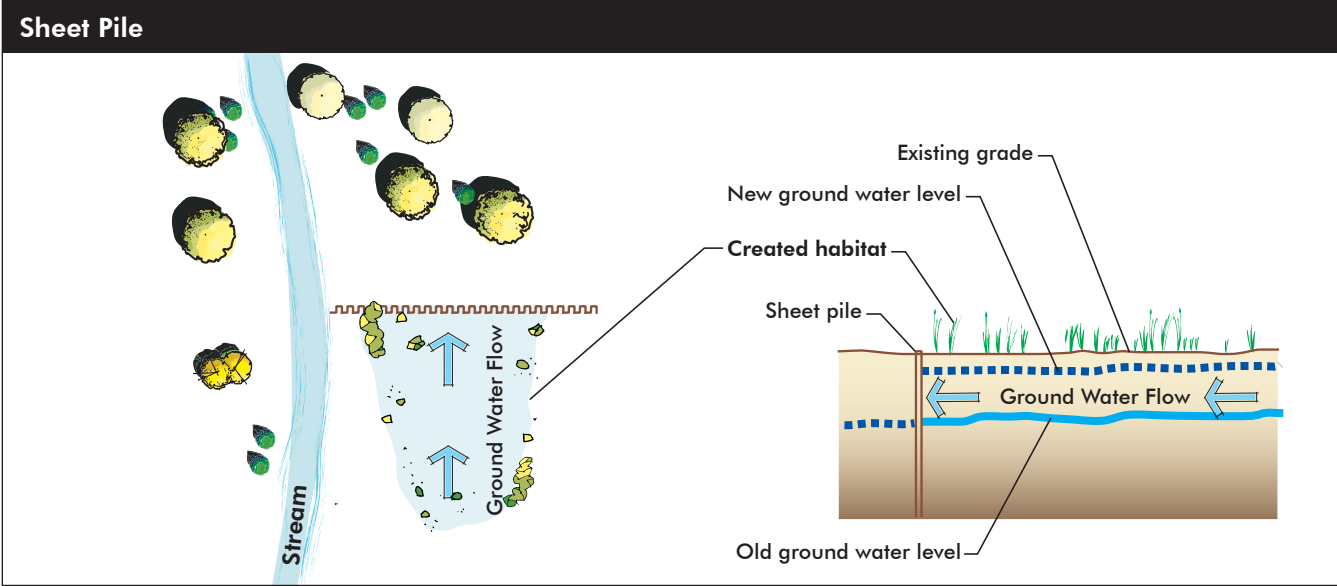


Figure 2. Habitat Conversion Techniques, Cont.

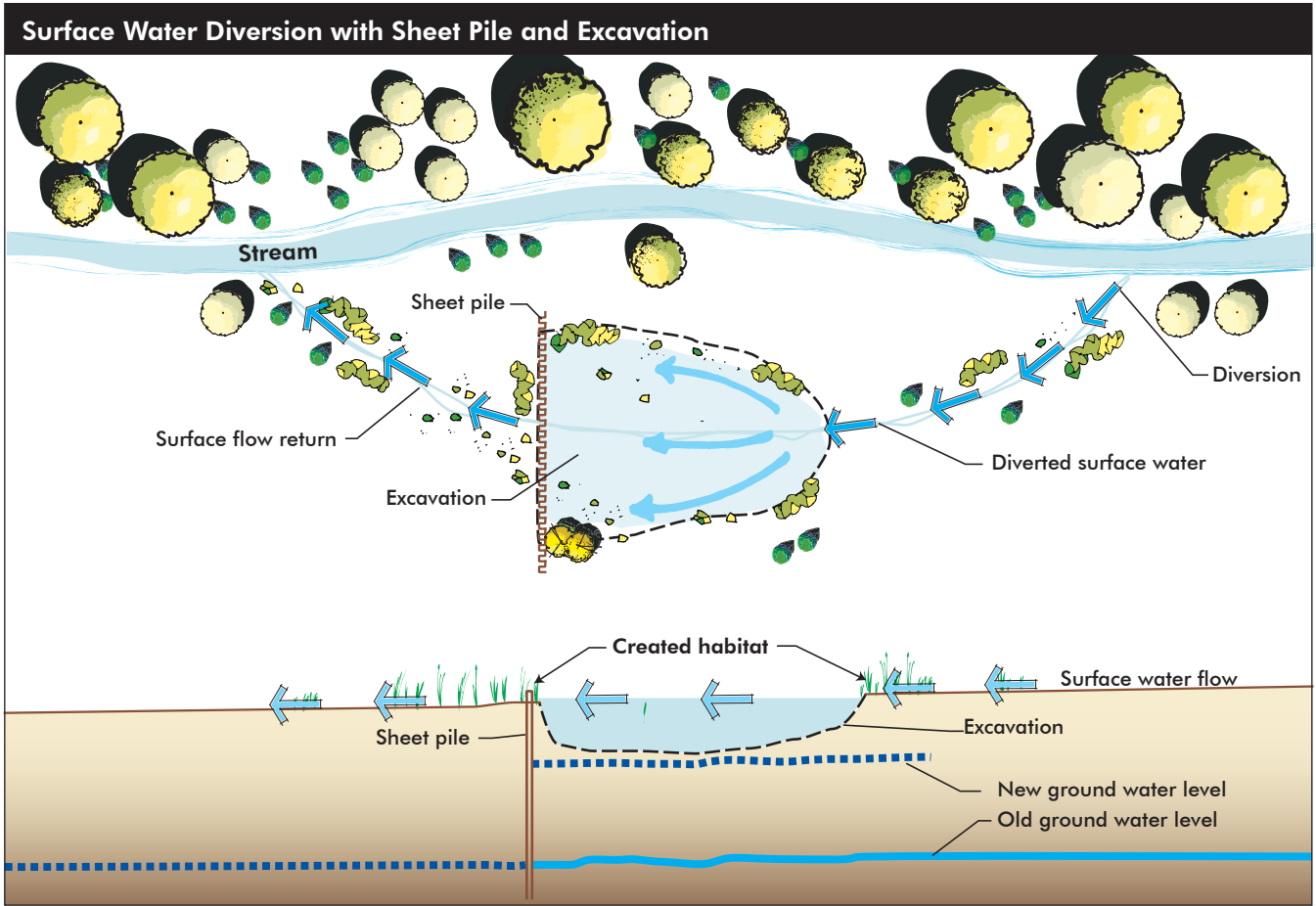




Figure 3 - Example of sheet pile cutoff drop structure on East Plum Creek in Castle Rock, Colorado used to enhance Preble's habitat.



Figure 4 - Aerial photo of Cherry Creek at 17-Mile House stream restoration project. The project included the creation of a new secondary channel to distribute surface water. (Photo courtesy of Muller Engineering Company).



Figure 5 - Cherry Creek at Stroh Ranch stream restoration project. Looking upstream at small riffle structure. Wetlands have expanded upstream of the structure.



Figure 6 - Cherry Creek at Apache Plume Outfall. Looking downstream at expanded Preble's habitat behind low sheet pile cutoff wall. Cutoff wall is visible at about the middle of the photo, just before the stream bends out of sight.

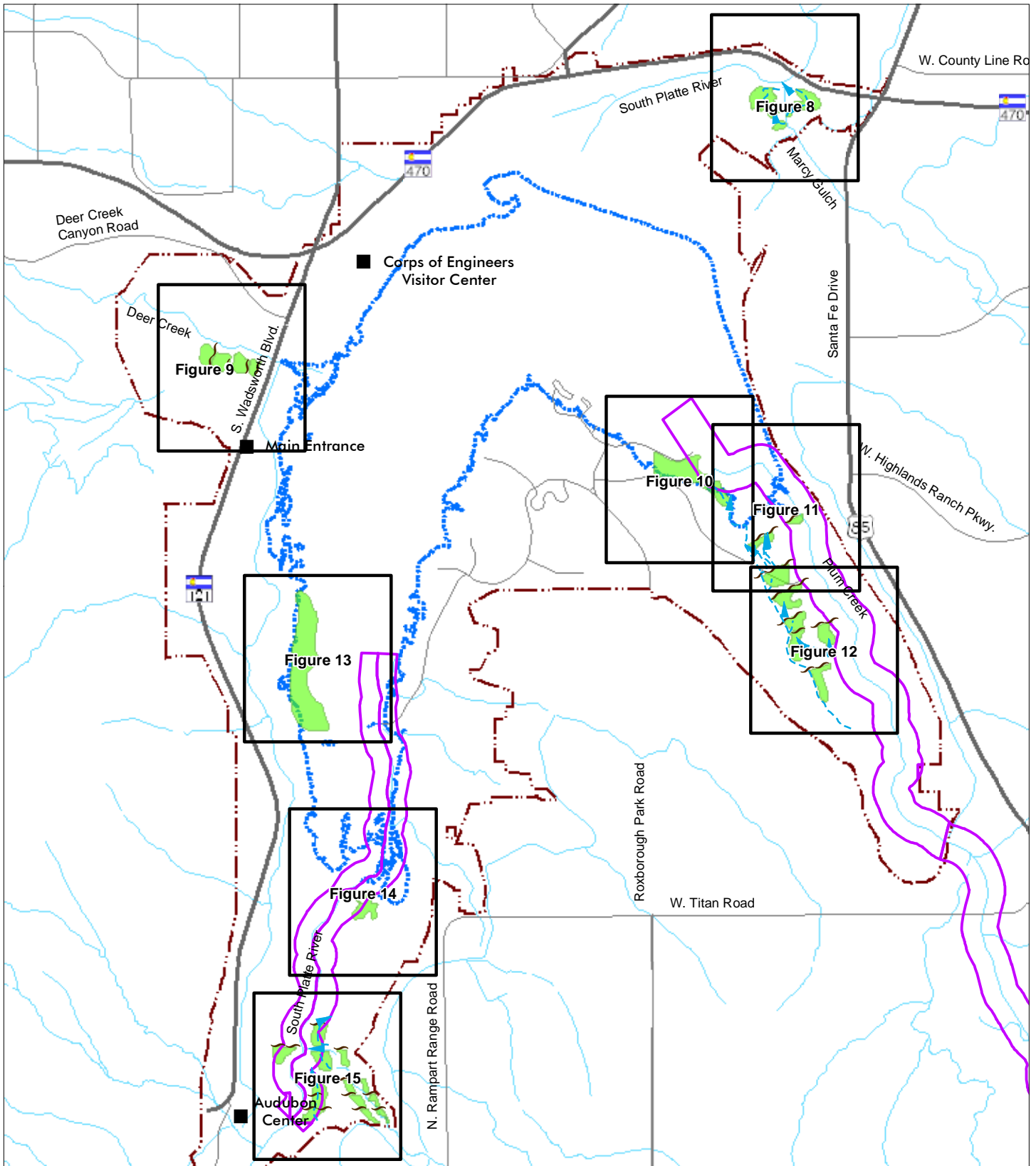
Constructing secondary channels, ditches, and backwaters is a means to convey and spread surface water to areas and to increase water available to support vegetation. If enough water is made available within the root zone, habitat will convert from one type to another. This approach often makes use of existing abandoned channels or oxbows to minimize earthwork.

Excavation lowers the ground surface to near the ground water. Topsoil is typically salvaged and stored for reuse following removal of subsoil. The depth of excavation depends on how far the ground water is below the ground surface. Depending on site conditions, up to several feet of material could be removed.

Based on data gathered on existing conditions in proposed on-site mitigation areas subsequent to publication of the draft FR/EIS, it is likely that most of the mitigation areas will be created by distributing surface water by means of channels and ditches. Ground water in most areas is too deep below the surface to use as a reliable source of water to support successful mitigation conditions. Sheet pile will still be used in some locations to protect against erosion and to aid in saturating the soil with surface water behind the sheet pile. Upon approval of the Federally Recommended Plan, preliminary plans will be prepared and submitted for Corps' approval prior to the development of final design documents. Those plans will be based on information gathered from ground water monitoring wells that have been established in the proposed mitigation areas and on the detailed topographic survey that has been conducted for each mitigation area. The plans will adhere to relevant Corps' and State Parks' standard practices and guidelines for plantings and revegetation, including the Corps' Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams and Appurtenant Structures (Corps 2009a). Once detailed plans and specifications are prepared, on-site mitigation construction will begin. Following construction, mitigation areas will be monitored to document progress toward the number of EFUs anticipated to be gained at each mitigation area.

6.1.1.1 Proposed Activities

Using information available during preparation of the draft FR/EIS, 29 on-site mitigation areas were proposed in the project area – two along Marcy Gulch, four along Deer Creek, 10 along Plum Creek, and 13 along the South Platte River (Figure 7 through Figure 15). The proposed mitigation areas were selected to be close to potential sources of ground and surface



Chatfield Reallocation Study

- Potential Mitigation Area
- Preble's Critical Habitat
- Sheet Pile Cutoffs
- Chatfield State Park
- Figure Index
- 5444 Pool Elevation (Maximum Pool Elevation of Alternative 3)

Pool Elevations: TetraTech

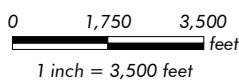
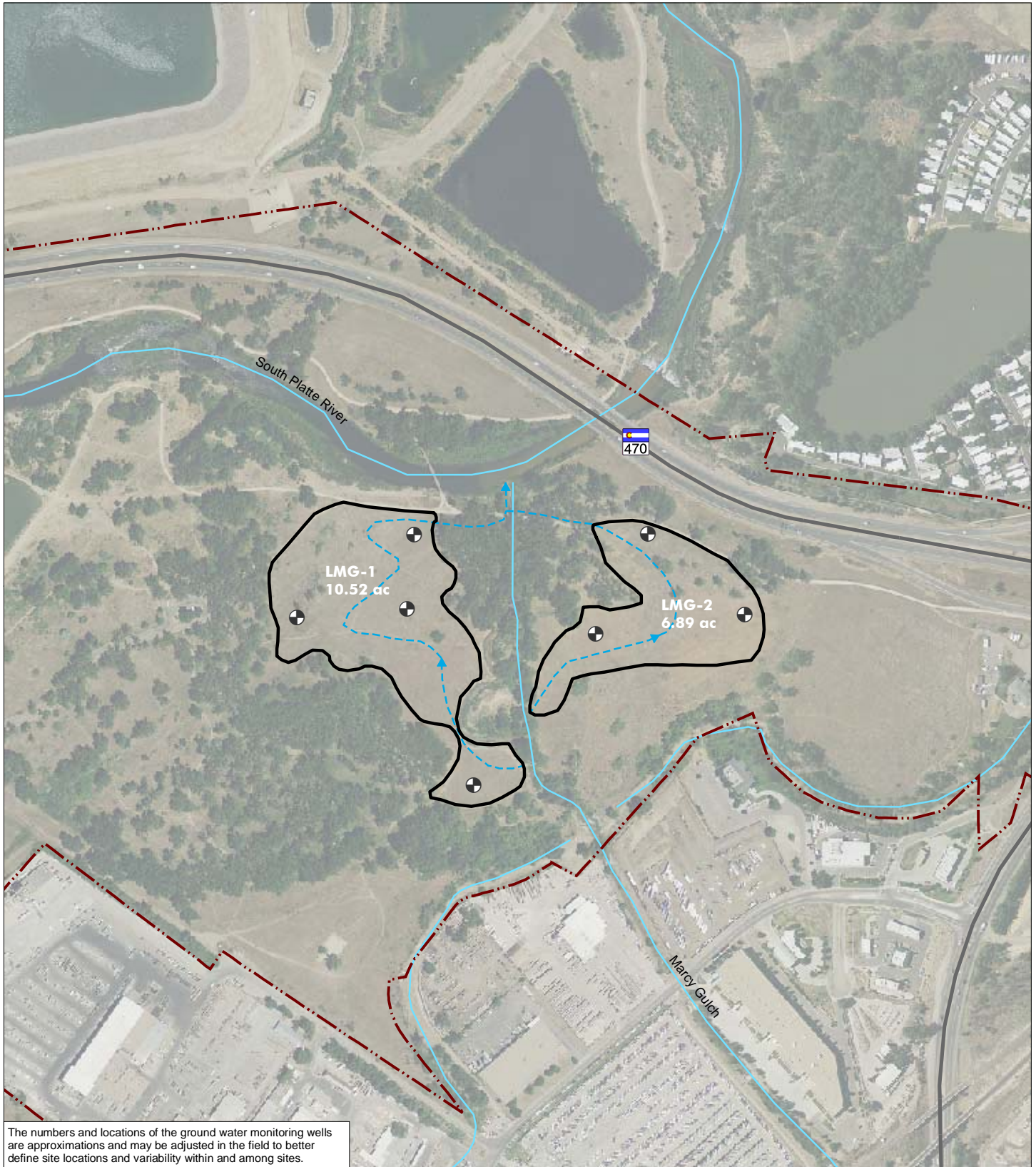


Figure 7
Locations of Potential On-Site Mitigation Areas

File: 4048 Fig 7 locs onsite mit.mxd (WH)
February 2011



Chatfield Reallocation Study

Imagery Source : LandisCor©, June 2008
Pool Elevations: Tetrattech

- Potential Mitigation Area
- Ground Water Monitoring Well
- Sheet Pile Cutoffs
- Diversion Channel

- 5444 Pool Elevation (Maximum Pool Elevation of Alternative 3)
- Chatfield State Park

0 250 500 feet
1 inch = 500 feet



Figure 8
Lower Marcy Gulch
Potential On-Site Mitigation Areas

File: 4048 Figs 8-15 onsite mit mapbook.mxd (WH)
February 2011

ERO
ERO Resources Corp.



The numbers and locations of the ground water monitoring wells are approximations and may be adjusted in the field to better define site locations and variability within and among sites.

Chatfield Reallocation Study

Imagery Source : Landiscor©, June 2008
Pool Elevations: Tetrattech

- Potential Mitigation Area
- Ground Water Monitoring Well
- Sheet Pile Cutoffs
- Diversion Channel

- 5444 Pool Elevation (Maximum Pool Elevation of Alternative 3)
- Chatfield State Park

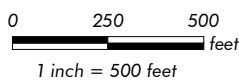
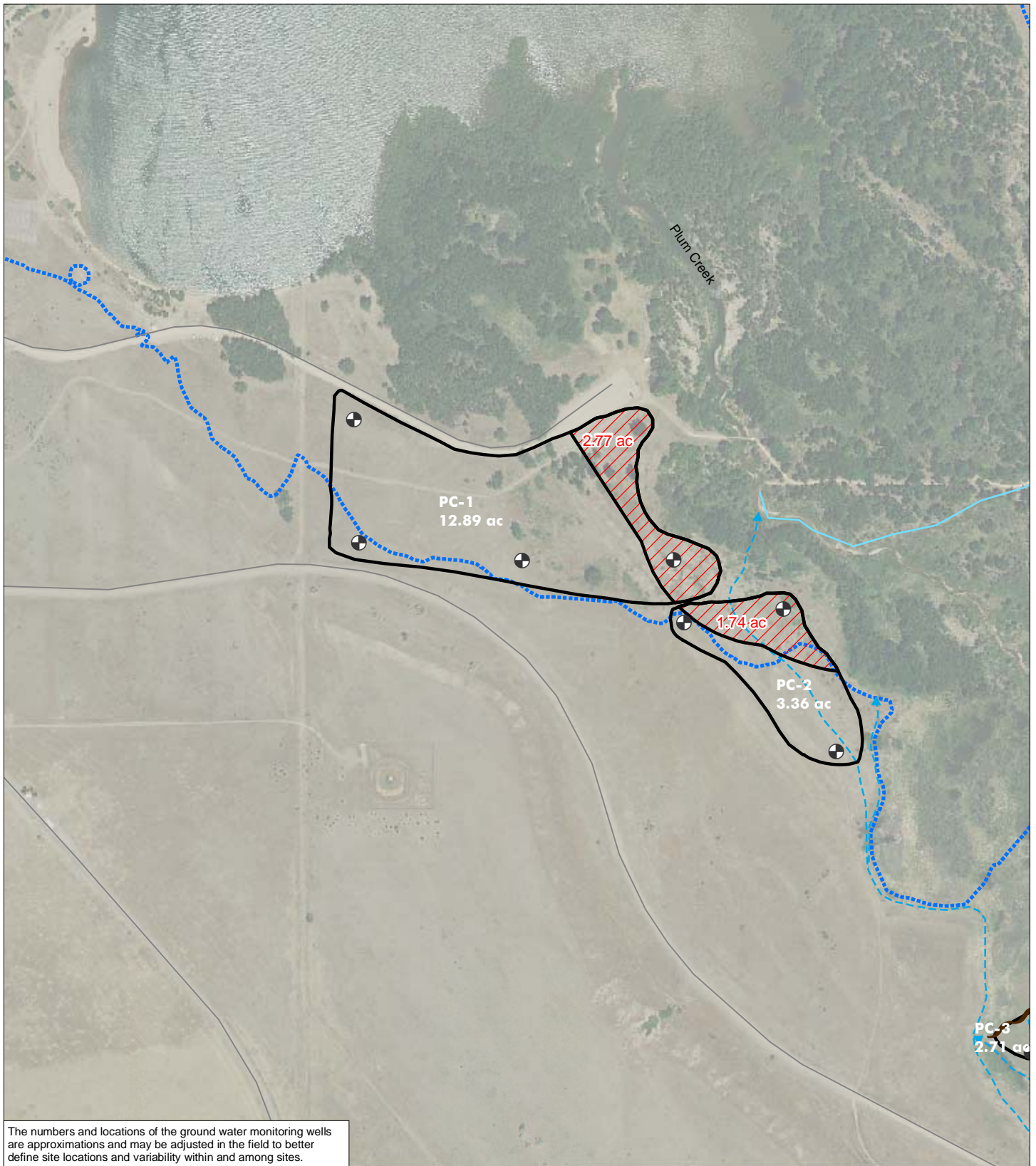


Figure 9
Deer Creek
Potential On-Site Mitigation Areas

File: 4048 Figs 8-15 onsite mit mapbook.mxd (WH)
February 2011











The numbers and locations of the ground water monitoring wells are approximations and may be adjusted in the field to better define site locations and variability within and among sites.

Chatfield Reallocation Study

Imagery Source : Landiscor©, June 2008
Pool Elevations: Tetrattech

-  Potential Mitigation Area
-  Preble's Critical Habitat
-  Potential Mitigation
-  Ground Water Monitoring Well
-  Sheet Pile Cutoffs
-  Diversion Channel

-  5444 Pool Elevation (Maximum Pool Elevation of Alternative 3)
-  Chatfield State Park

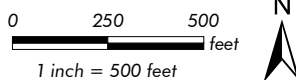
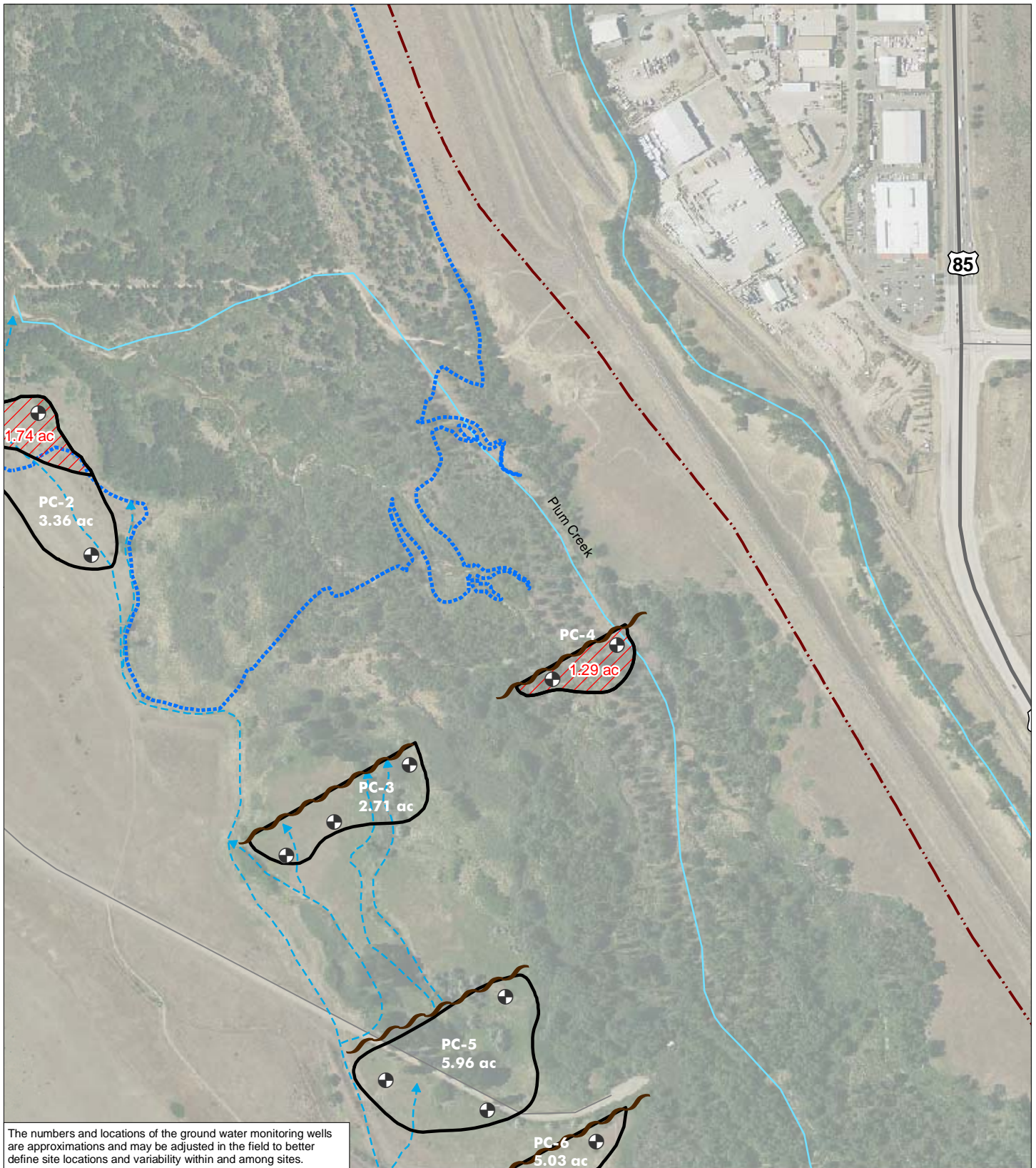


Figure 10
Plum Creek
Potential On-Site Mitigation Areas

File: 4048 Figs 8-15 onsite mit mapbook.mxd (WH)
February 2011



The numbers and locations of the ground water monitoring wells are approximations and may be adjusted in the field to better define site locations and variability within and among sites.

Chatfield Reallocation Study

Imagery Source : Landiscor©, June 2008
Pool Elevations: Tetrattech

- Potential Mitigation Area
- Preble's Critical Habitat
- Potential Mitigation
- Ground Water Monitoring Well
- Sheet Pile Cutoffs
- Diversion Channel

- 5444 Pool Elevation (Maximum Pool Elevation of Alternative 3)
- Chatfield State Park

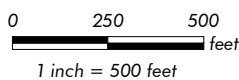


Figure 11
Plum Creek
Potential On-Site Mitigation Areas

File: 4048 Figs 8-15 onsite mit mapbook.mxd (WH)
February 2011





Chatfield Reallocation Study

- Potential Mitigation Area
- Preble's Critical Habitat
- Potential Mitigation
- Ground Water Monitoring Well
- Sheet Pile Cutoffs
- Diversion Channel

Imagery Source: Landiscor©, June 2008
Pool Elevations: Tetrattech

- 5444 Pool Elevation (Maximum Pool Elevation of Alternative 3)
- Chatfield State Park

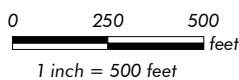
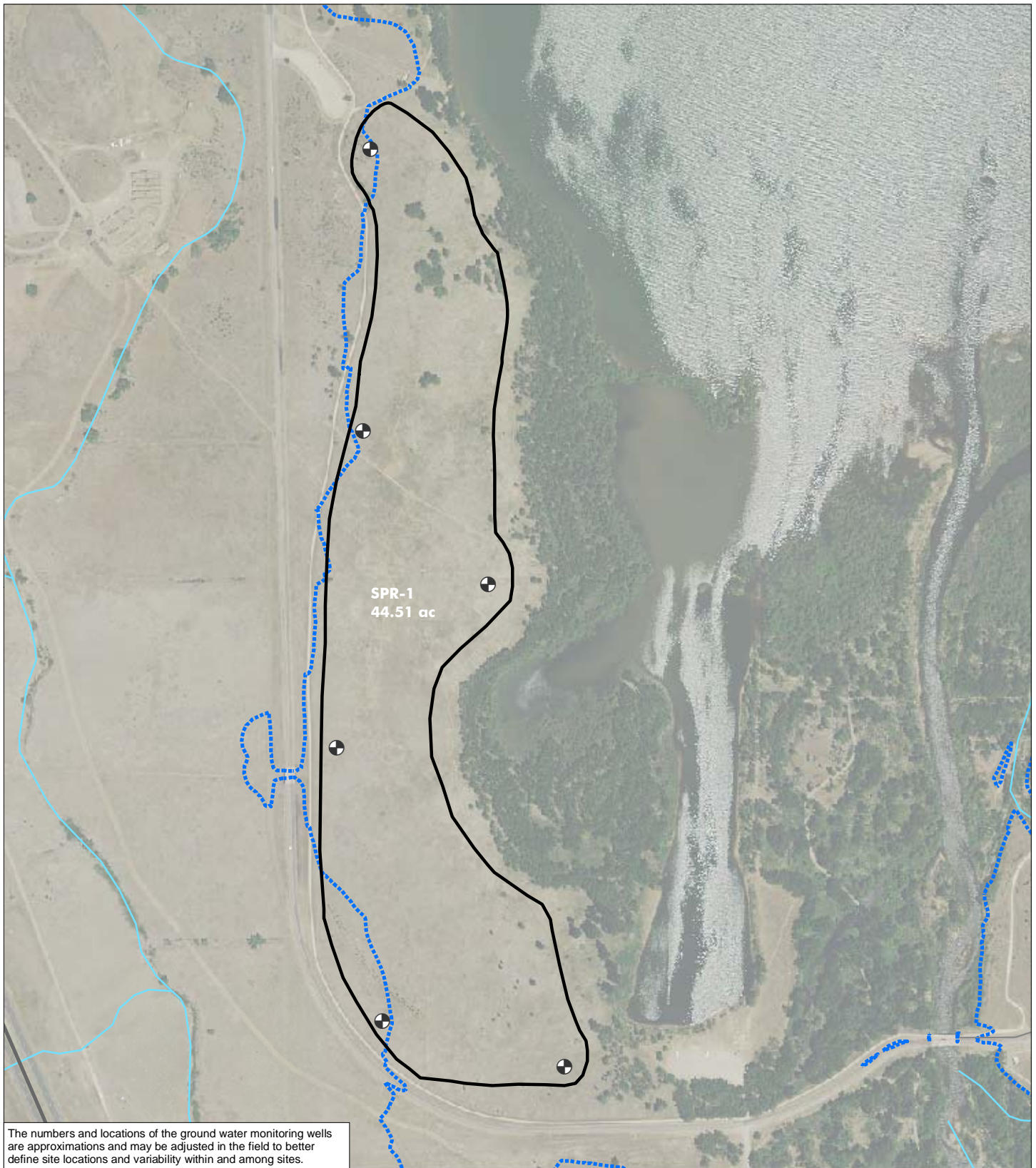


Figure 12
Plum Creek
Potential On-Site Mitigation Areas

File: 4048 Figs 8-15 onsite mit mapbook.mxd (WH)
February 2011





The numbers and locations of the ground water monitoring wells are approximations and may be adjusted in the field to better define site locations and variability within and among sites.

Chatfield Reallocation Study

Imagery Source : Landiscor©, June 2008
Pool Elevations: Tetratech

- Potential Mitigation Area
- Ground Water Monitoring Well
- Sheet Pile Cutoffs
- Diversion Channel

- 5444 Pool Elevation (Maximum Pool Elevation of Alternative 3)
- Chatfield State Park

0 250 500 feet
1 inch = 500 feet



Figure 13
South Platte River
Potential On-Site Mitigation Areas

File: 4048 Figs 8-15 onsite mit mapbook.mxd (WH)
February 2011







ERO
ERO Resources Corp.



The numbers and locations of the ground water monitoring wells are approximations and may be adjusted in the field to better define site locations and variability within and among sites.

Chatfield Reallocation Study

Imagery Source: Landiscor©, June 2008
Pool Elevations: Tetratech

-  Potential Mitigation Area
-  Preble's Critical Habitat
-  Potential Mitigation
-  Ground Water Monitoring Well
-  Sheet Pile Cutoffs
-  Diversion Channel

-  5444 Pool Elevation (Maximum Pool Elevation of Alternative 3)
-  Chatfield State Park

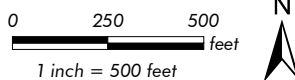


Figure 14
South Platte River
Potential On-Site Mitigation Areas

File: 4048 Figs 8-15 onsite mit mapbook.mxd (WH)
February 2011





The numbers and locations of the ground water monitoring wells are approximations and may be adjusted in the field to better define site locations and variability within and among sites.

Chatfield Reallocation Study

- Potential Mitigation Area
- Preble's Critical Habitat
- Potential Mitigation
- Ground Water Monitoring Well
- Sheet Pile Cutoffs
- Diversion Channel

Imagery Source : Landiscor©, June 2008
Pool Elevations: Tetratech

- 5444 Pool Elevation (Maximum Pool Elevation of Alternative 3)
- Chatfield State Park

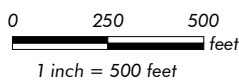


Figure 15
South Platte River
Potential On-Site Mitigation Areas

File: 4048 Figs 8-15 onsite mit mapbook.mxd (WH)
February 2011

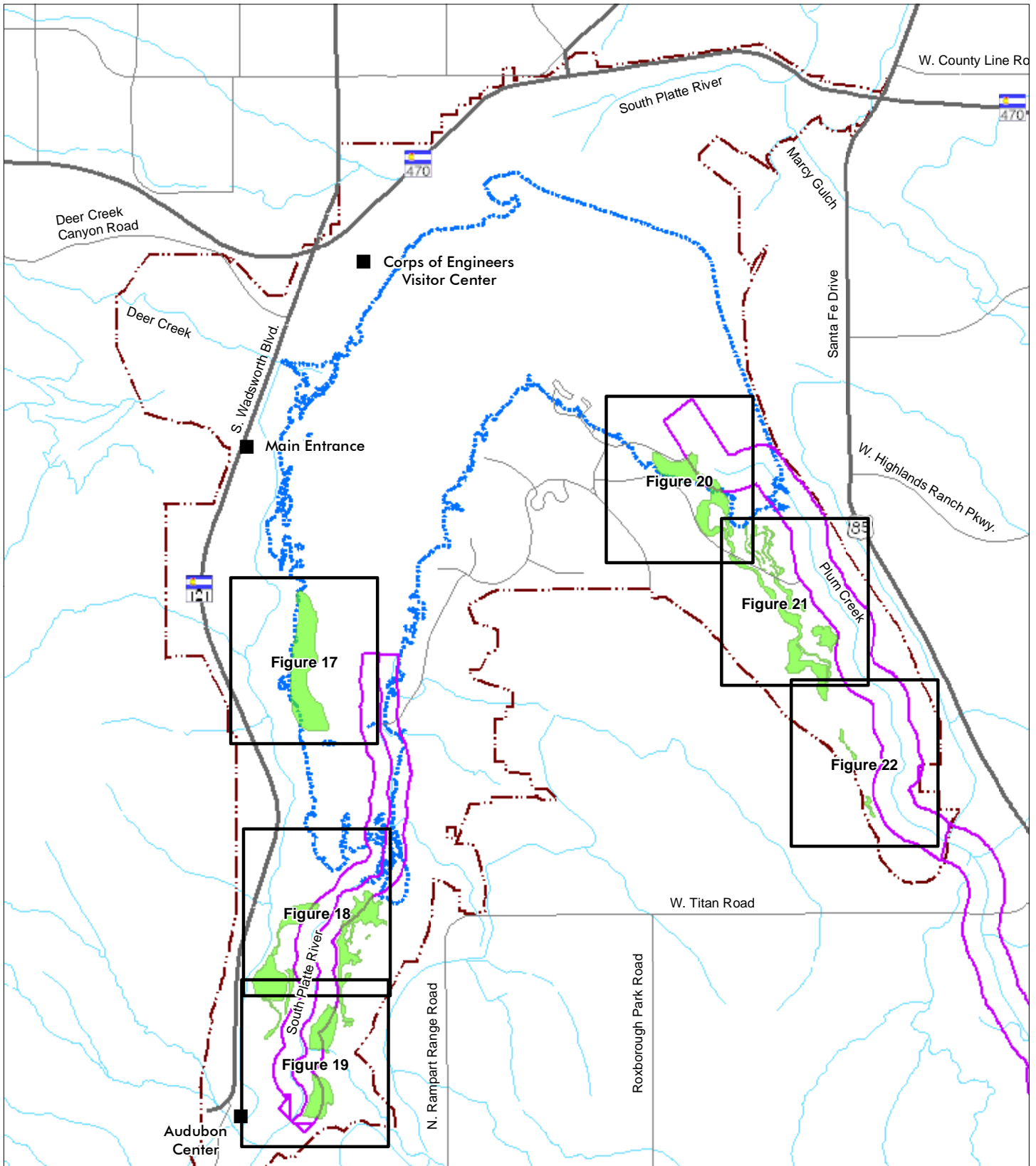


water and to maximize EFU mitigation credits. Two of the mitigation areas will be established in two borrow areas below elevation 5,444 (Figure 10 and Figure 12). The areas will be excavated for material that will be used as part of the recreation facility relocation activities. If not used as mitigation areas, the borrow areas would be restored to upland grasslands. The borrow areas are proposed for use as mitigation areas because they are located below the proposed maximum pool elevation, which means it is likely that ground water will be close to the surface and will be capable of supporting riparian and wetland habitats.

The on-site mitigation areas proposed in the draft CMP were conservative, rough outlines of areas estimated to have the best opportunities to provide mitigation that will result in a significant gain in EFUs. Subsequent to publication of the draft FR/EIS, locations and limits of potential on-site mitigation areas were reevaluated based on data generated by the following activities that have occurred subsequent to publication of the draft FR/EIS:

- Topographic mapping at 1-foot contour intervals;
- Installation and monitoring of ground water monitoring wells in locations indicated on Figure 8 through Figure 15;
- Delineation of any wetlands in proposed mitigation areas;
- Identification of areas of existing desirable vegetation to avoid disturbing them during design and construction;
- Sampling and evaluation of soils for permeability;
- Development of preliminary grading plans; and
- Continued development of the habitat field evaluation to finalize the ecological functions model to eventually determine the number of existing EFUs and EFU impacts based on existing site conditions.

Data analyses determined that surface and ground water conditions in the four mitigation sites proposed along Deer Creek and seven sites along Willow Creek, a tributary to the South Platte River, were unsuitable for successful mitigation efforts. However, other sites along the South Platte River and Plum Creek were expanded or added (Figure 16 through Figure 22). Preliminary estimates of acres of on-site mitigation and EFU mitigation credits for the revised mitigation areas are higher than estimates contained in the draft CMP. Although preliminary estimates of on-site acres and EFUs are higher than those in the draft CMP, preliminary cost estimates for the revised mitigation areas are no higher, and may be lower, than the draft CMP cost estimates. The anticipated reduction in the use of sheet pile reduces construction costs.



Chatfield Reallocation Study

- Potential Mitigation Area
- Preble's Critical Habitat
- Figure Index
- 5444 Pool Elevation (Maximum Pool Elevation of Alternative 3)

Chatfield State Park

Pool Elevations: Tetratrch

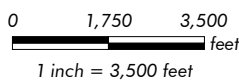
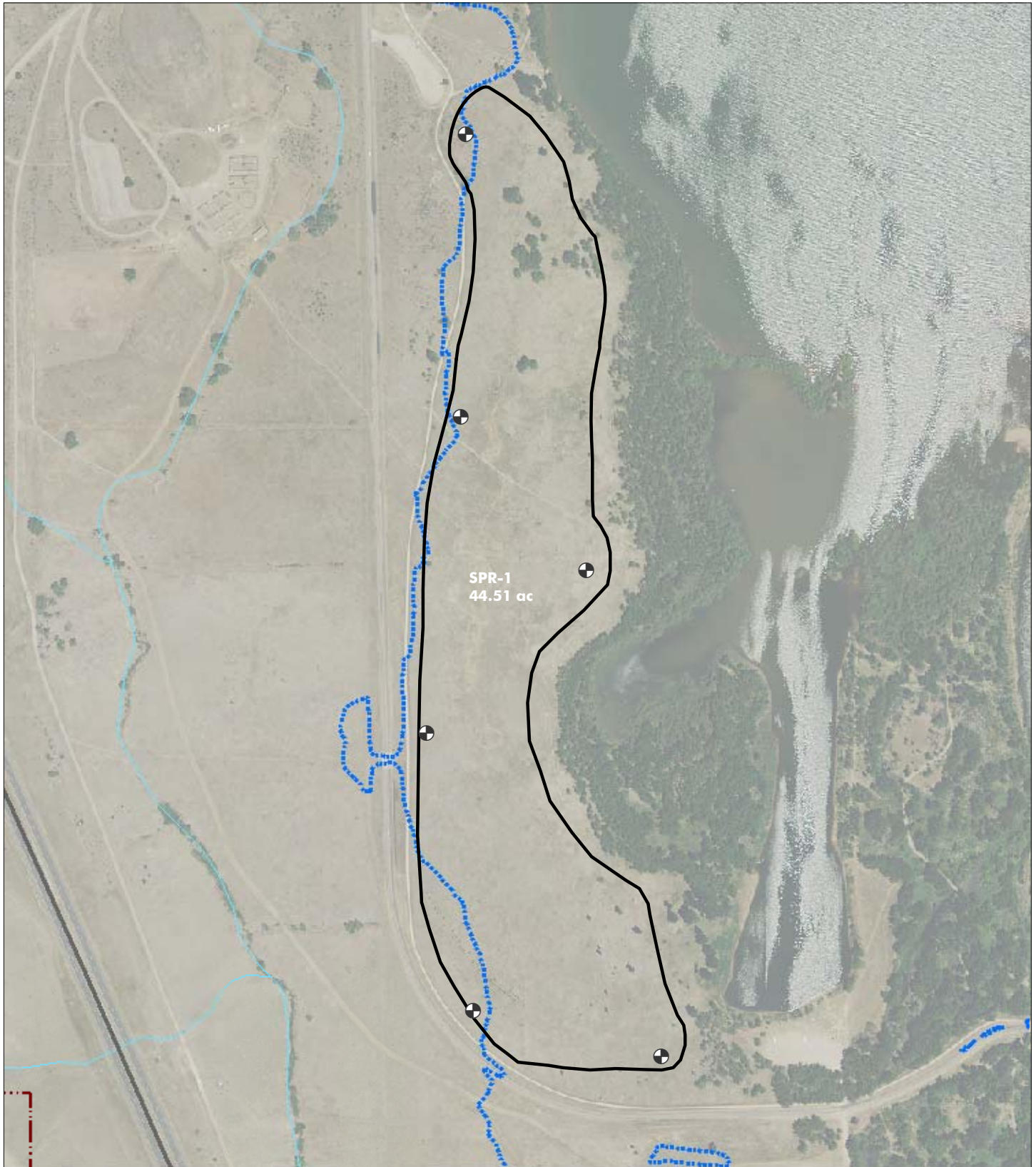


Figure 16
Revised Locations of Potential On-Site Mitigation Areas

File: 4048 Fig 16 revised locs onsite mit.mxd (WH)
 January 2013





Chatfield Reallocation Study

- Potential Mitigation Area
- Ground Water Monitoring Well
- ~ 5444 Pool Elevation (Maximum Pool Elevation of Alternative 3)
- Chatfield State Park

Imagery Source : Landiscor©, June 2008
Pool Elevations: Tetrattech

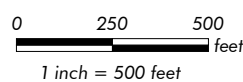
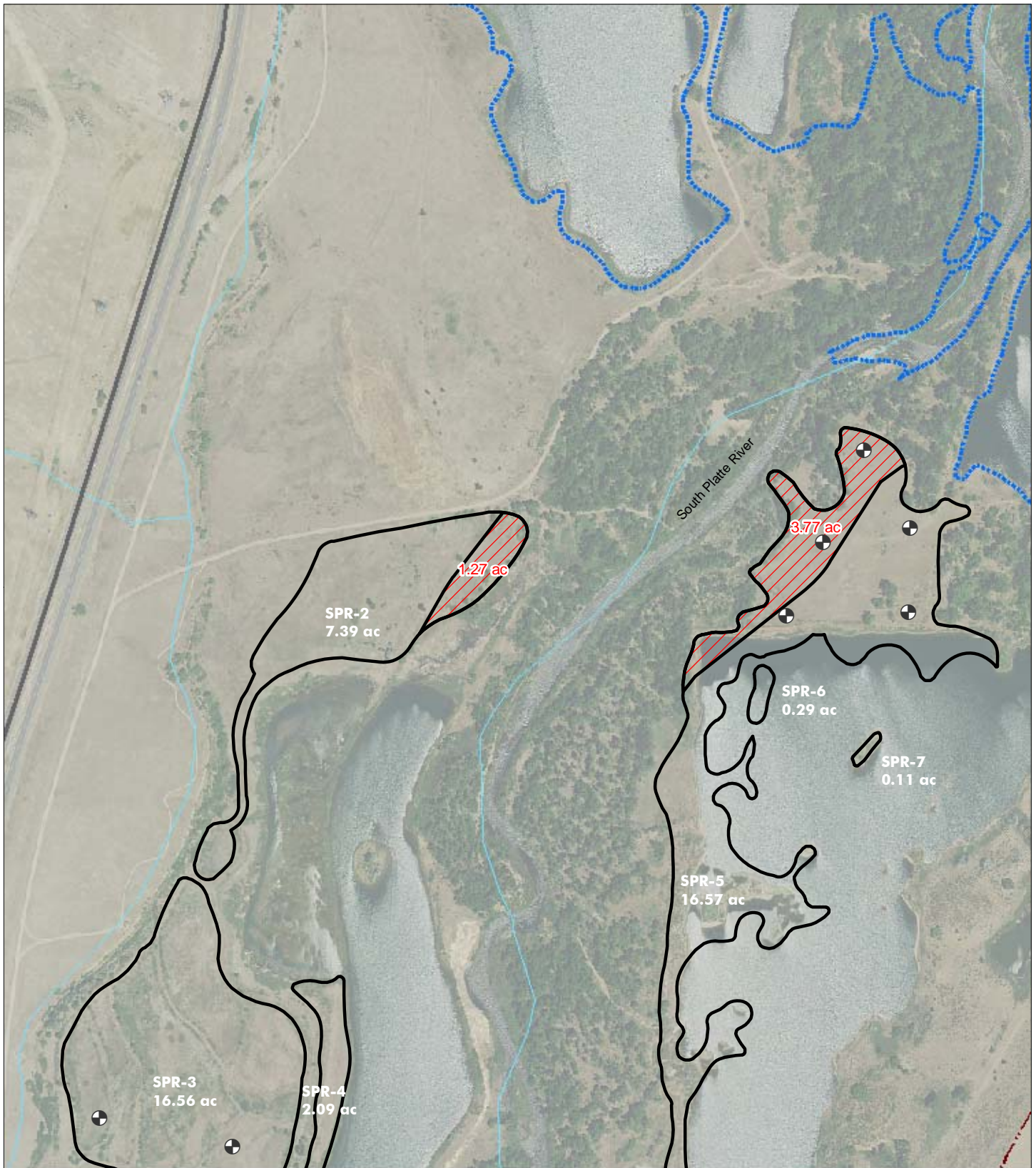


Figure 17
South Platte River
Revised Potential On-Site
Mitigation Areas






File: 4048 Figs 17-22 rev onsite mit mapbook.mxd (WH)
January 2013





Chatfield Reallocation Study

Imagery Source : Landiscor©, June 2008
Pool Elevations: Tetratech

-  Potential Mitigation Area
-  Preble's Critical Habitat
-  Potential Mitigation
-  Ground Water Monitoring Well
-  5444 Pool Elevation (Maximum Pool Elevation of Alternative 3)

 Chatfield State Park

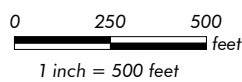
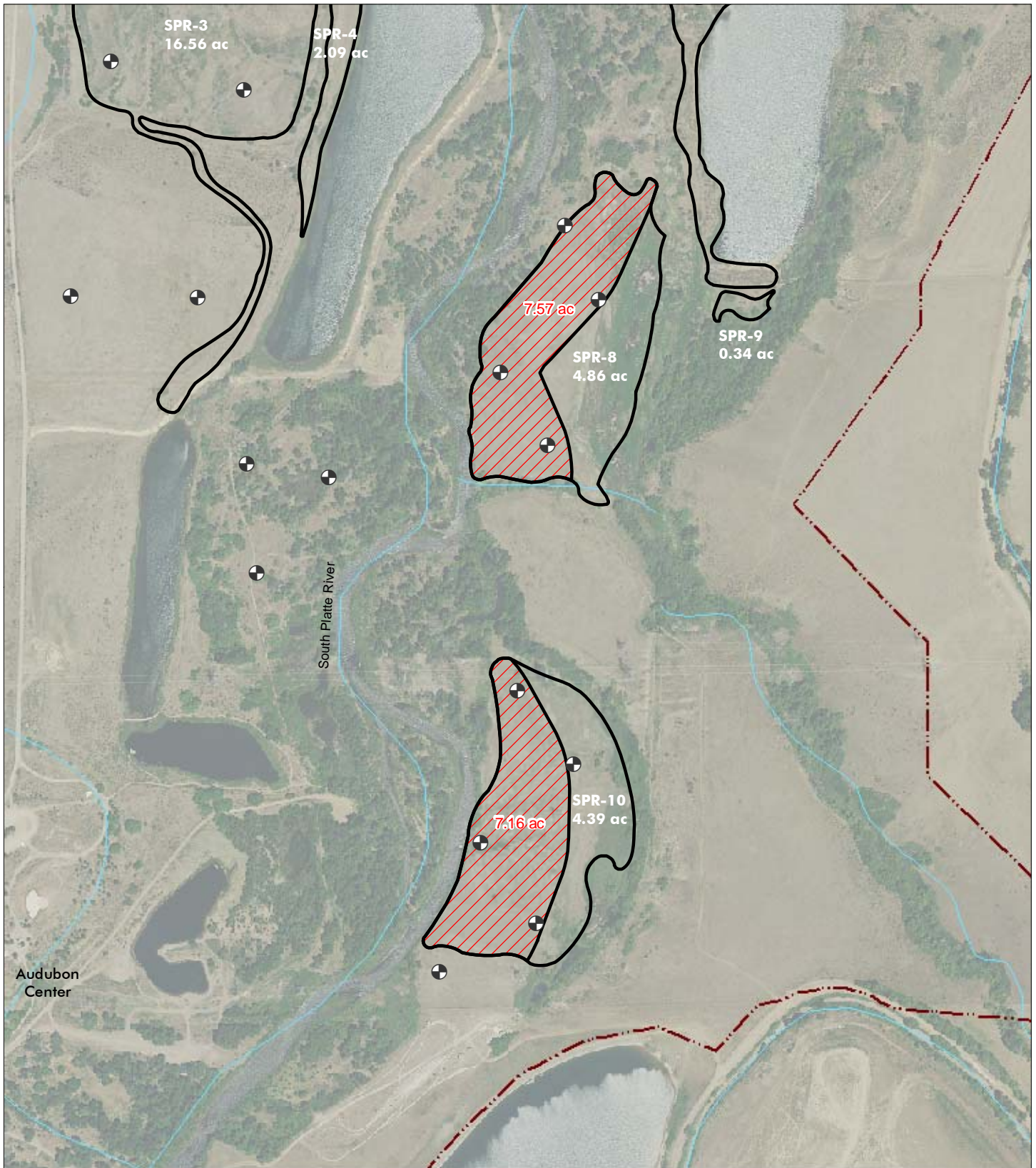







Figure 18
South Platte River
Revised Potential On-Site
Mitigation Areas

File: 4048 Figs 17-22 rev onsite mit mapbook.mxd (WH)
January 2013





Chatfield Reallocation Study

-  Potential Mitigation Area
-  Preble's Critical Habitat
-  Potential Mitigation
-  Ground Water Monitoring Well
-  5444 Pool Elevation (Maximum Pool Elevation of Alternative 3)

Imagery Source : Landiscor©, June 2008
Pool Elevations: Tetrattech

 Chatfield State Park

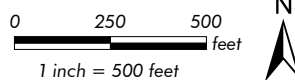
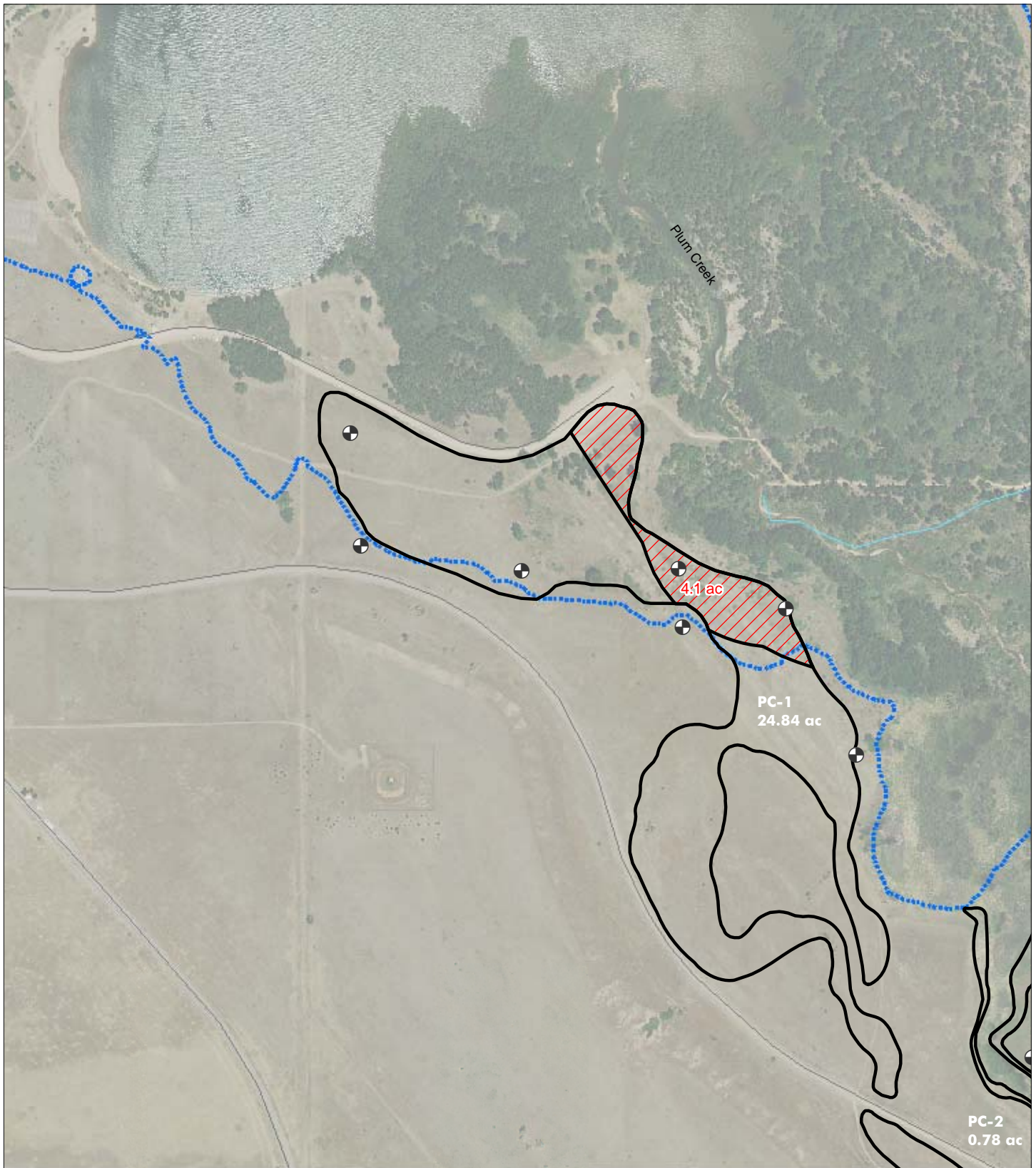






Figure 19
South Platte River
Revised Potential On-Site
Mitigation Areas

File: 4048 Figs 17-22 rev onsite mit mapbook.mxd (WH)
January 2013



Chatfield Reallocation Study

-  Potential Mitigation Area
-  Preble's Critical Habitat Potential Mitigation
-  Ground Water Monitoring Well
-  5444 Pool Elevation (Maximum Pool Elevation of Alternative 3)

 Chatfield State Park

Imagery Source : Landiscor©, June 2008
Pool Elevations: Tetrattech

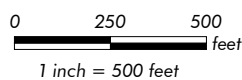
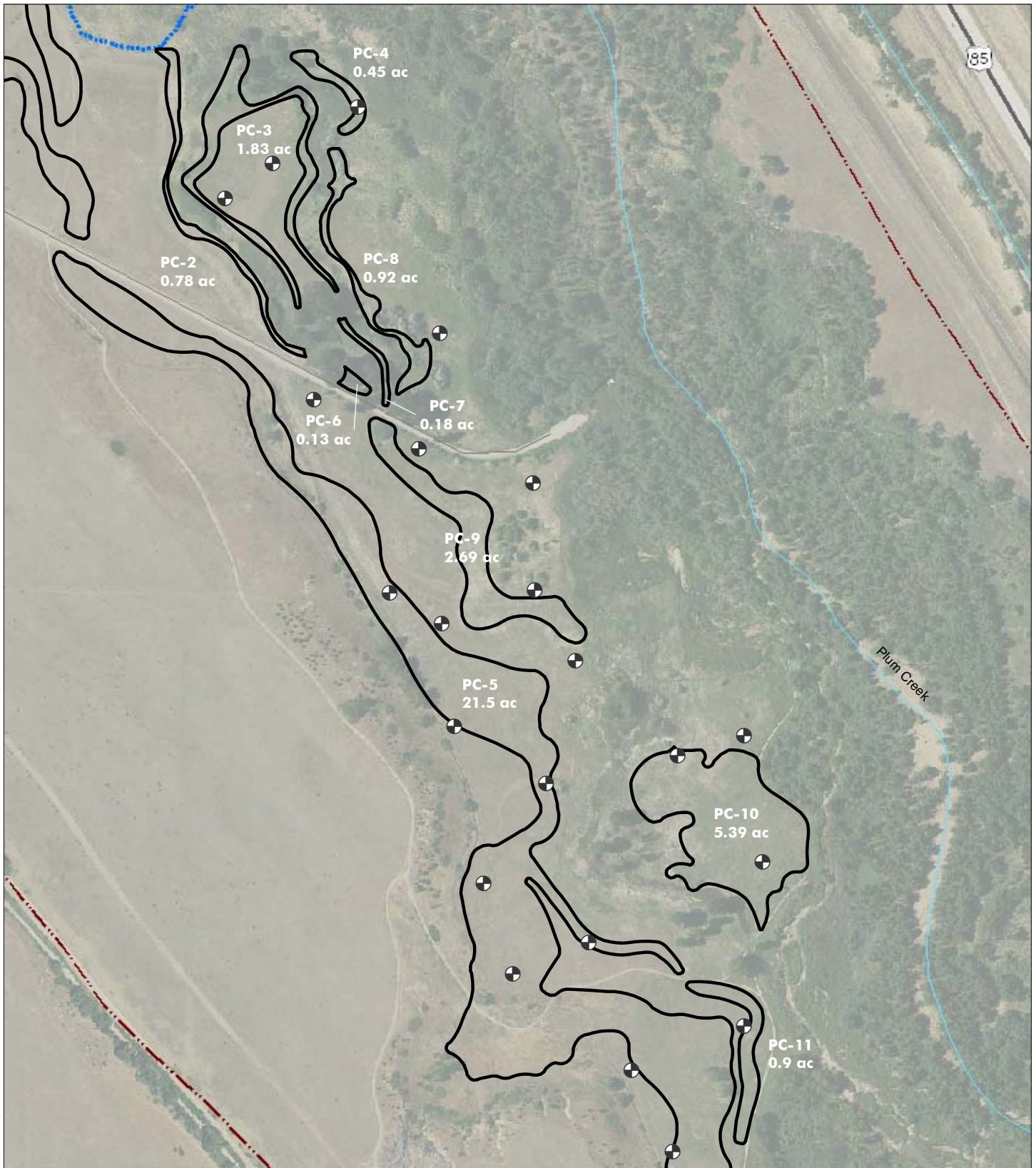






Figure 20
Plum Creek
Revised Potential On-Site
Mitigation Areas

File: 4048 Figs 17-22 rev onsite mit mapbook.mxd (WH)
January 2013





Chatfield Reallocation Study

-  Potential Mitigation Area
-  Ground Water Monitoring Well
-  5444 Pool Elevation (Maximum Pool Elevation of Alternative 3)
-  Chatfield State Park

Imagery Source : Landiscor©, June 2008
Pool Elevations: Tetrattech

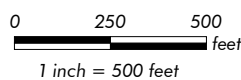
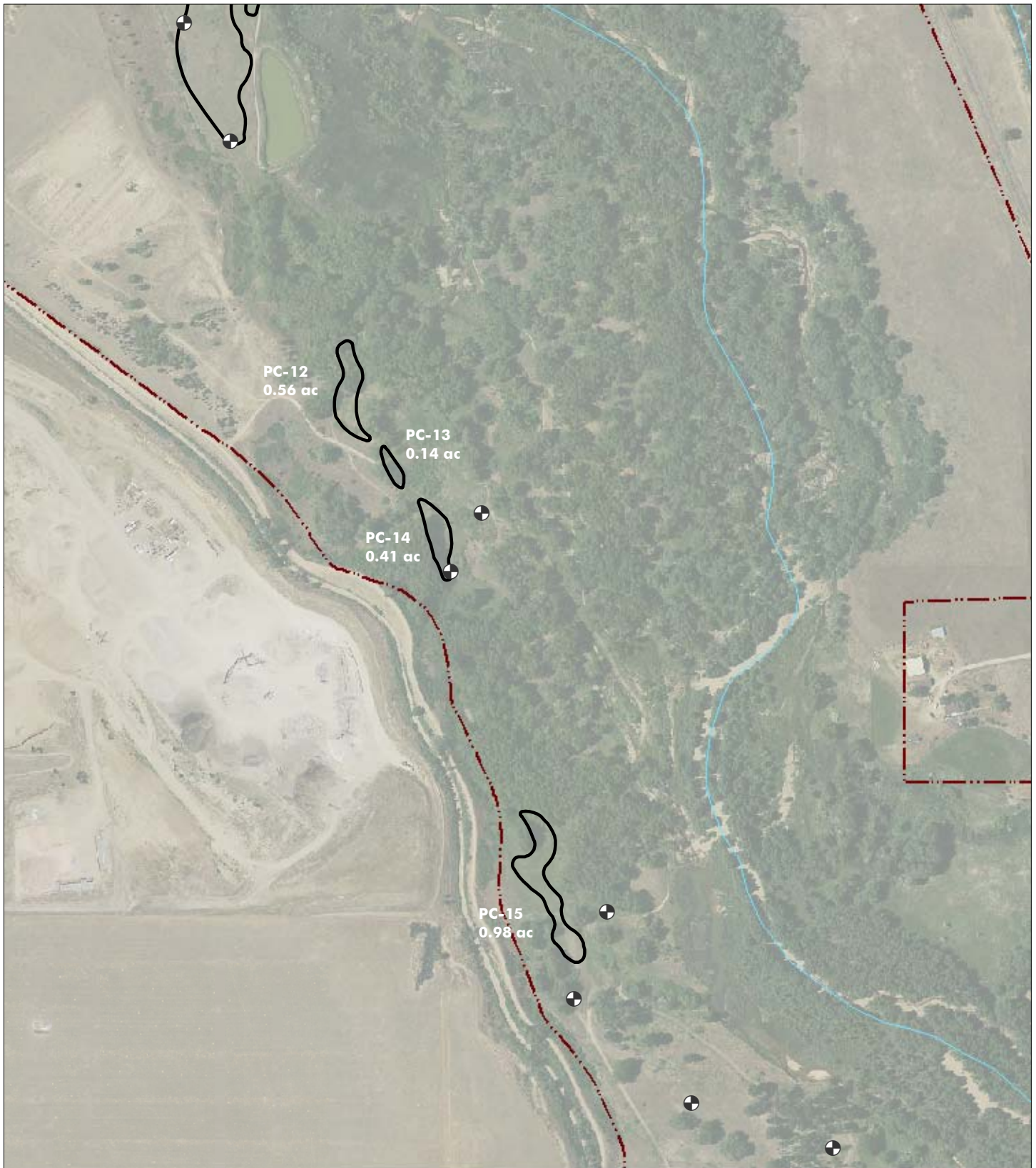






Figure 21
Plum Creek
Revised Potential On-Site
Mitigation Areas

File: 4048 Figs 17-22 rev onsite mit mapbook.mxd (WH)
January 2013





Chatfield Reallocation Study

-  Potential Mitigation Area
-  Ground Water Monitoring Well
-  5444 Pool Elevation (Maximum Pool Elevation of Alternative 3)
-  Chatfield State Park

Imagery Source: Landiscor©, June 2008
Pool Elevations: Tetrattech

0 250 500 feet
1 inch = 500 feet



Figure 22
Plum Creek
Revised Potential On-Site
Mitigation Areas

File: 4048 Figs 17-22 rev onsite mit mapbook.mxd (WH)
January 2013



Although different than revised estimates, the draft CMP EFU mitigation credits, acres, and costs are used throughout the remainder of this document because they are more conservative estimates and because estimates will be further refined when site-specific mitigation plans are finalized.

The final extent, location, and number of mitigation areas will change as additional site analyses and designs are completed, but the number of on-site EFU mitigation credits will be maximized and are anticipated to generate at least the minimum number of credits described in Section 6.1.3.

Engineers and wetland ecologists will continue to better define on-site mitigation opportunities and will ultimately produce detailed, site-specific plans to provide the most EFUs in the most cost-efficient manner. These plans will include the following:

- Location map showing where the activity will occur within Chatfield State Park;
- A description of what will occur within the mitigation site, including anticipated acres and noncritical habitat EFUs for planned habitat types;
- CMP view of mitigation site at a scale of 1"=100';
- Cross sections and profiles of mitigation site for those activities involving earthwork that will alter the existing ground surface elevation at a scale of 1"=50';
- A plan for the salvage and use of topsoil for all activities that involve earthwork;
- Water sources, if a supportive hydrologic regime is required (e.g., wetlands);
- Erosion control plan;
- A list of plant materials to be used including species (common and scientific name), type (e.g., balled and burlap tree, container, bare root, and stakes), size, quantity, and schedule;
- A planting and/or seeding plan including specifications for planting, plant spacing, temporary irrigation, and mulching. Seeding plans will include species (common and scientific name), percent of species in seed mix, seeding rate, seed bed preparation, seed application, schedule, and mulching;
- Plans requiring an engineered structure will include a review and stamp by a registered engineer;
- Weed control plan; and
- Monitoring plan to determine success (Section 6.1.1.2).

6.1.1.2 *Success Criteria*

Each compensatory mitigation area will be monitored annually for at least 5 years after completion of the mitigation activities (Section 7.4). The on-site mitigation areas will be designed to support a mixture of wetland palustrine scrub-shrub, forested riparian, and riparian

shrublands. The following criteria relate to these created habitat types. Compensatory mitigation areas will be considered successful when these criteria have been met for at least 3 consecutive years without intervening remedial activities:

- For each planned habitat type, herbaceous cover will be at least 90 percent of the herbaceous cover of the reference area for that habitat type. Habitat type reference areas will be established in nearby areas of undisturbed habitat similar to that planned in the mitigation areas.
- At least 80 percent survival of planted trees and shrubs (including volunteers and vegetative reproduction). Species composition will be representative of species planted.
- State-listed A and B noxious weed species will be managed to comply with current State management guidelines for Jefferson and Douglas counties. State-listed A noxious weed species will be eradicated and in no case will State-listed B species make up more than 10 percent of vegetative cover.
- In areas designed as wetlands:
 - At least 50 percent of the species will consist of species rated as facultative or wetter, and
 - A least one primary or two secondary indicators of wetland hydrology will be present. These indicators of hydrology will be according to the *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region* (Corps 2008).
 - For plant establishment, temporary watering past year one of planting will be considered a remedial activity.

6.1.1.3 Cottonwood Regeneration Areas

To compensate for the loss of mature cottonwood habitat, the draft CMP designated 13 acres in on-site mitigation areas SPR-2, SPR-3, and SPR-5 as cottonwood regeneration areas. Based on the revised mitigation areas, at least 13 acres in SPR-5 north of the gravel lake (Figure 18) and SPR-8 (Figure 19) are designated as cottonwood regeneration areas. The final grades and hydrology of these areas will be conducive to the establishment of a combination of cottonwood seedlings and planted trees. Cottonwood seedling areas will consist of gravely and sandy soils saturated during the early portion of the growing season. Surface water will be diverted to seedling areas until the root systems are developed enough to reach the ground water table.

6.1.1.4 Water Supply for Mitigation

The approach for creation of wetlands and cottonwood woodlands is to select and modify mitigation sites as needed to provide a supportive hydrology to sustain the wetland and riparian vegetation. Establishing wetland vegetation and cottonwoods will, in many instances, require a temporary supplemental water supply. The 158 acres of wetlands proposed to be created and the

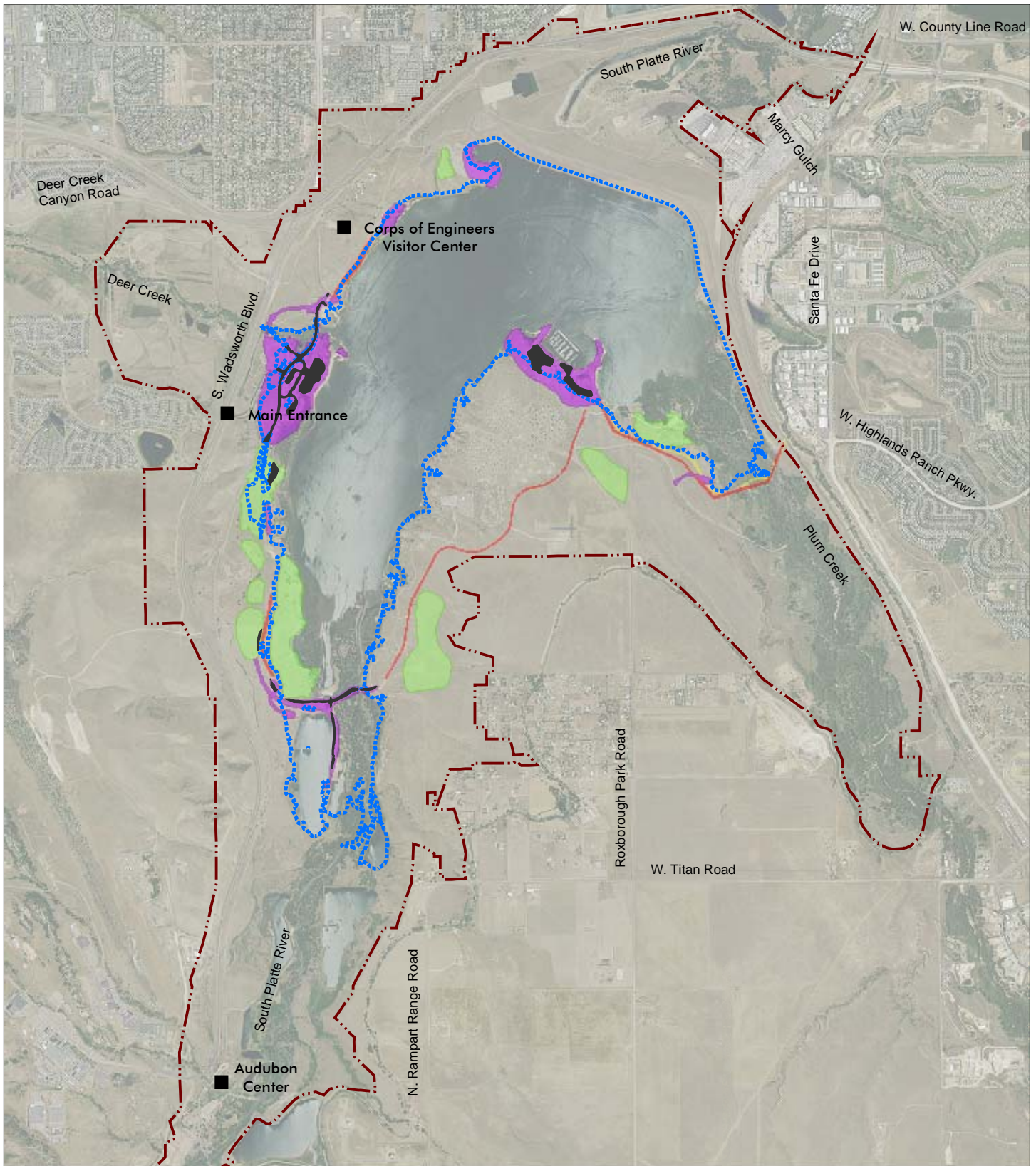
22.5 acres of cottonwood woodlands to be created do not exceed the maximum acres of wetlands and cottonwoods that have been estimated to be inundated by reallocation. Therefore, the transpiration (consumptive use) associated with the proposed creation of wetlands and cottonwood woodlands would not exceed the consumptive use of the wetlands and cottonwood woodlands estimated to be lost with reallocation. It is the policy of the Denver Regulatory Office of the Corps and the Colorado State Engineer's Office not to require water rights for wetland and riparian mitigation that does not exceed the consumptive use of the resources that will be lost. The Chatfield Water Providers will secure the necessary water rights and augmentation supplies if it is determined that a water right or permanent plan of augmentation is required for the mitigation.

6.1.2 Restoration of Borrow and Fill Areas

In addition to on-site compensatory mitigation for permanent impacts associated with inundation and recreation facility relocation, impacts to borrow areas above 5,444 feet in elevation and to fill areas and temporary roads will be mitigated in-place by restoring the areas to conditions similar to those present prior to disturbance (Figure 23). The two borrow areas below 5,444 feet in elevation will be used as compensatory mitigation areas (Section 6.1.1.1). Construction plans for the borrow and fill areas will include plans and specifications that follow restoration and revegetation guidelines developed for use in these areas (Appendix F). The guidelines include sections on soil preparation, seeding, mulching, and monitoring and maintenance. The restored areas will be monitored annually to ensure progress toward specific success criteria (Appendix F). Preliminary construction plans, specifications, and cost estimates for restoration of the borrow and fill areas are included in the recreation facilities relocation plan (EDAW 2009). Upon approval of the Federally Recommended Plan, preliminary plans will be prepared and submitted for Corps' approval prior to the development of final design documents.






6.1.3 Anticipated On-Site Compensatory Mitigation EFUs and Acreages

Once the mitigation areas were selected, the number of acres, potential EFU credits, and estimated costs for each potential on-site compensatory mitigation area were calculated (Table 3). As previously discussed, to be conservative, the estimates and examples are based on the mitigation areas depicted in Figure 7 and not the revised areas depicted in Figure 16. Figure 24 shows an example of how the net gain in EFUs, or EFU credits, were calculated for a habitat



Chatfield Reallocation Study

Imagery Source : Landiscor©, June 2008
Pool Elevations: Tetratech

-  Borrow Area
-  New Trail
-  Recreation Facility Relocation
-  Utility/Haul Road
-  Non-Habitat

-  5444 Pool Elevation (Maximum Pool Elevation of Alternative 3)
-  Chatfield State Park

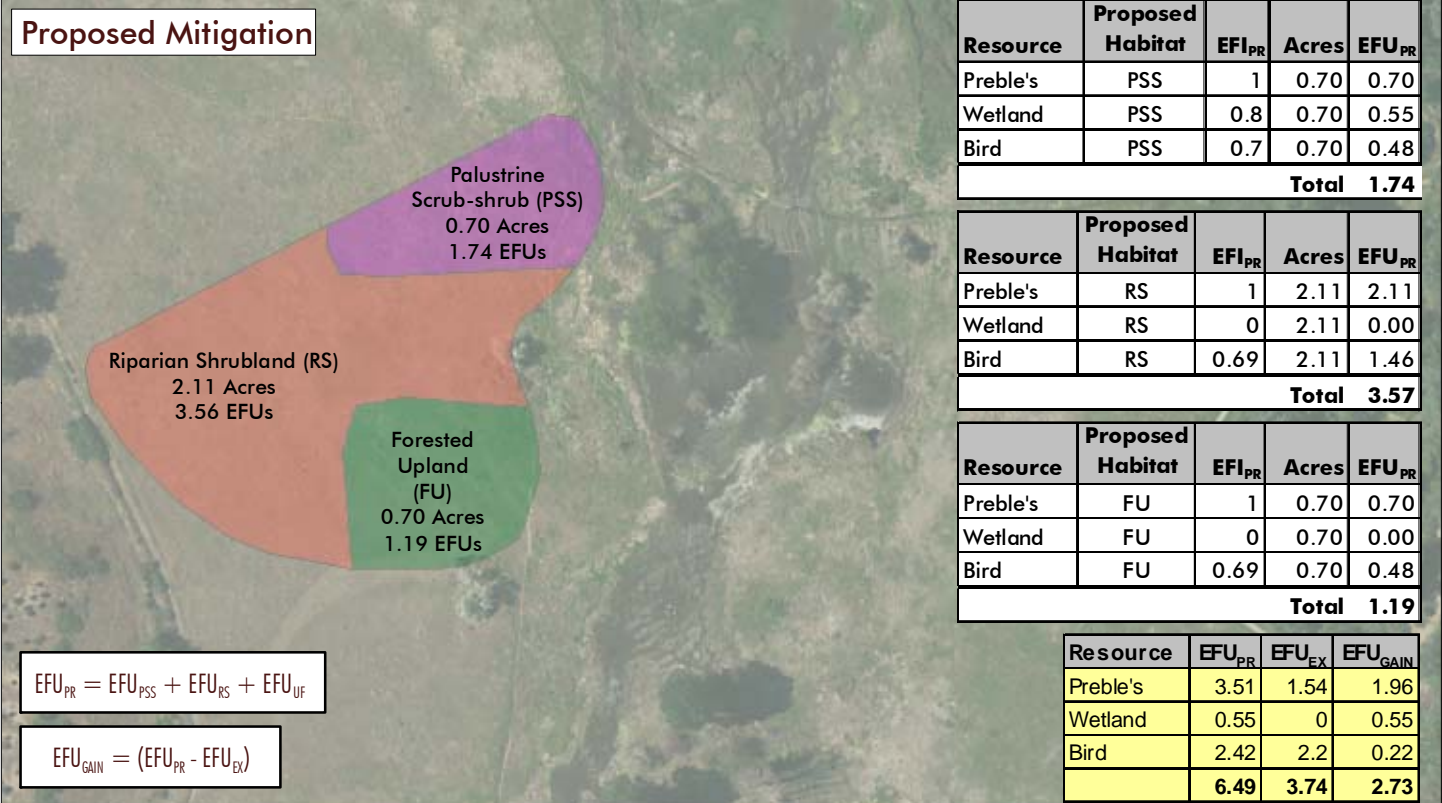
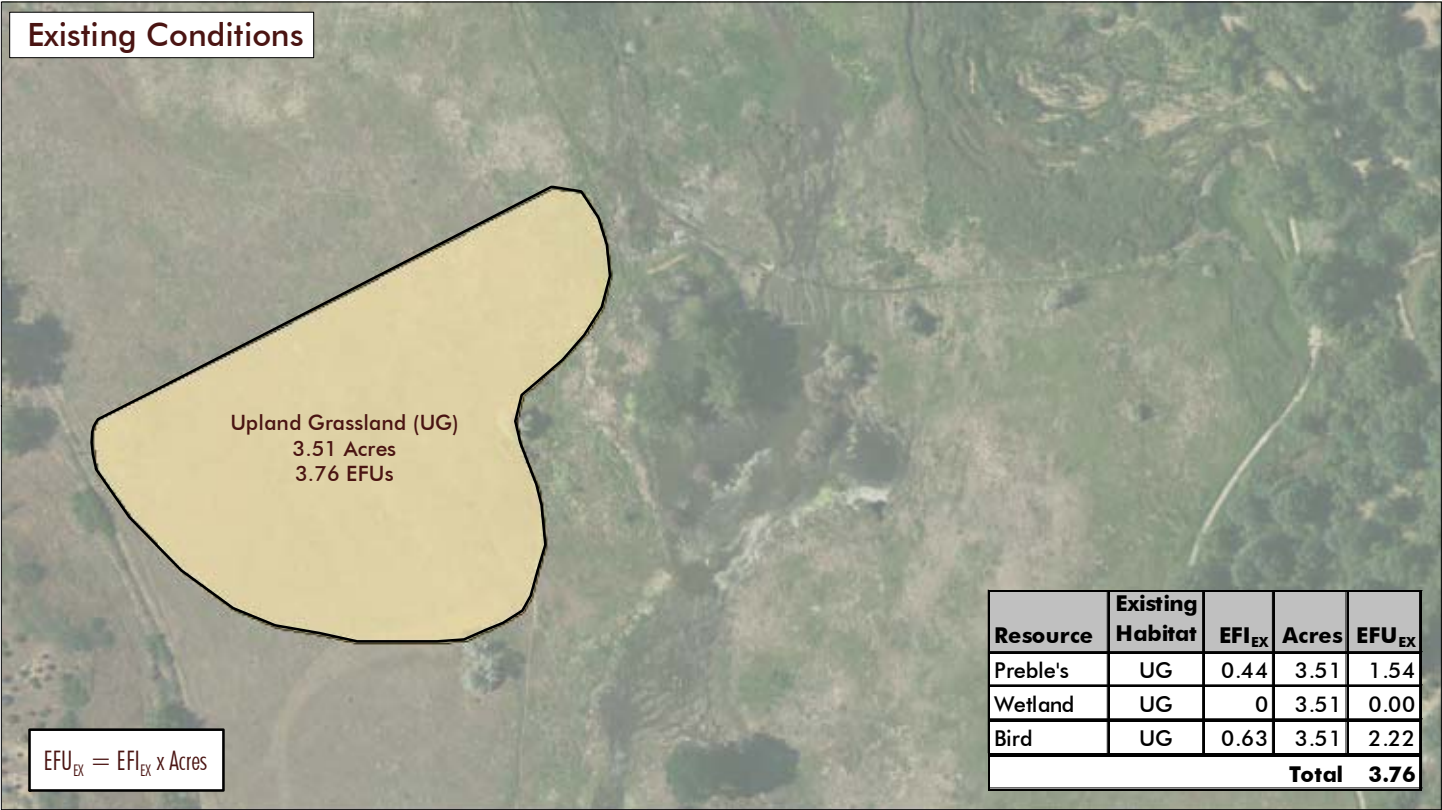
0 1,750 3,500 feet
1 inch = 3,500 feet



Figure 23
Impacts Associated with Recreation Facility Relocation and Borrow Areas

File: 4048 Figure 23 Rec Facs and Borrow areas.mxd (GS)
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Chaffield Reallocation Study

Potential Mitigation Area

- EFI_{EX} = Existing EFI
- EFU_{PR} = Proposed EFUs
- EFU_{EX} = Existing EFUs
- EFU_{GAIN} = Net gain in EFUs

Image Source: Landiscor®, June 2008

This example is based on site PC-7. Subtotals and totals may differ due to rounding.

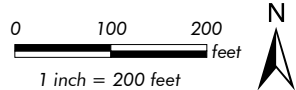


Figure 24
Example Calculation of Net Gain in EFUs From Habitat Conversion Activities

conversion activity at mitigation site PC-7. Net gains in EFUs were calculated in a similar manner for all of the on-site compensatory mitigation areas. There would be no net change in EFUs from borrow and fill areas and temporary roads restored in place (Figure 23), so they are not addressed in this section. The following general assumptions were used to provide estimates of EFUs anticipated to result from mitigation activities and estimates of costs for each of the proposed on-site mitigation areas.

Table 3. Acres, EFUs, and Estimated Costs of Proposed On-Site Habitat Compensatory Mitigation Areas (exclusive of the restoration of borrow areas and other temporary disturbances).

Proposed On-site Mitigation Area	Figure Number	Acres		Estimated Gain Preble's EFUs	Estimated Gain Bird EFUs	Estimated Gain Wetland EFUs	Estimated Total Gain in EFUs	Estimated Cost
Lower Marcy Gulch								
LMG-1 ¹	Figure 8	10.52		0.00	0.47	7.27	7.82	\$ 913,530
LMG-2 ¹	Figure 8	6.89		0.00	0.41	5.40	5.81	\$ 600,320
Deer Creek								
DC-1	Figure 9	4.00		0.00	1.30	0.45	1.75	\$ 639,012
DC-2	Figure 9	4.07		0.00	0.89	0.42	1.31	\$ 748,037
DC-3	Figure 9	3.74		0.00	1.78	0.59	2.37	\$ 659,194
DC-4	Figure 9	1.82		0.00	0.42	0.29	0.71	\$ 468,192
Plum Creek								
PC-1 ²	Figure 10	15.66		7.22	0.77	2.04	10.03	\$ 89,347
PC-2 ¹	Figure 10	5.10		2.85	0.31	0.81	3.96	\$ 581,944
PC-3	Figure 11	2.71		1.05	0.07	0.30	1.41	\$ 758,088
PC-4	Figure 11	1.29		0.24	-0.03	0.06	0.27	\$ 471,198
PC-5	Figure 11	5.96		3.34	0.36	0.94	4.64	\$ 1,159,240
PC-6	Figure 12	5.03		2.82	0.30	0.79	3.91	\$ 1,131,533
PC-7	Figure 12	3.51		1.96	0.21	0.55	2.73	\$ 783,373
PC-8	Figure 12	5.40		3.02	0.32	0.85	4.20	\$ 887,976
PC-9 ¹	Figure 12	4.22		2.33	0.25	0.66	3.24	\$ 784,530
PC-10	Figure 12	5.19		2.91	0.31	0.82	4.04	\$ 1,005,013
South Platte River								
SPR-1 ²	Figure 13	44.51		6.21	-1.34	1.75	6.62	\$ 253,244
SPR-2 ¹	Figure 14	5.74		1.81	0.34	0.90	3.05	\$ 650,408
SPR-3	Figure 15	4.01		0.44	0.24	0.63	1.31	\$ 712,626
SPR-4	Figure 15	3.82		0.32	0.12	0.30	0.74	\$ 870,405
SPR-5	Figure 15	4.50		2.48	0.26	0.70	3.43	\$ 831,480
SPR-6	Figure 15	1.71		0.96	0.10	0.27	1.33	\$ 397,381
SPR-7	Figure 15	8.55		0.72	0.49	1.32	2.53	\$ 1,682,706
SPR-8	Figure 15	1.47		0.80	0.09	0.23	0.23	\$ 336,160
SPR-9	Figure 15	0.95		0.53	0.06	0.15	0.74	\$ 232,896
SPR-10	Figure 15	1.74		0.98	0.10	0.28	1.36	\$ 401,581
SPR-11	Figure 15	0.92		0.46	0.04	0.13	0.63	\$ 218,496
SPR-12	Figure 15	1.44		0.81	0.09	0.23	1.12	\$ 337,949
SPR-13	Figure 15	0.97		0.48	0.05	0.13	0.66	\$ 256,307
Totals		165.45		46.27	8.94	29.70	84.91	\$18,862,165

¹LMG-1, LMG-2, PC-2, and SPR-2 will be created by excavation only. No sheet pile will be used.

²PC-1 and SPR-1 are located in proposed borrow areas that are below the maximum pool elevation of 5,444 feet. Sheet pile will not be used in these areas and earthwork will be done as part of the recreation facility relocation. Potential EFUs for these areas are calculated assuming starting condition of upland grasslands.

Assumptions for calculating anticipated gain in EFUs:

1. Gains in EFUs from mitigation areas within currently mapped habitat are calculated using existing EFUs (Figure 24).
2. Gains in EFUs from mitigation areas beyond currently mapped habitat are estimated using CDOW riparian mapping equivalencies (Appendix C, Section 5.1).
3. Gains in EFUs include EFUs gained from mitigation activities in on-site critical habitat.
4. In most of the mitigation areas, existing upland grassland habitat will be converted on average to about 20 percent wetland palustrine scrub-shrub, 20 percent forested upland, and 60 percent riparian shrublands.
5. As shown in Table C-1 of Appendix C, following mitigation activities, the three habitat types in the mitigation areas will have the following EFIs for target resources:
 - a. Palustrine scrub-shrub: Preble's – 1.0 (high value riparian), birds – 0.69 (shrubs (riparian)), and wetlands – 0.79 (palustrine scrub-shrub);
 - b. Forested upland: Preble's – 1.0 (high value riparian), birds – 0.69 (trees), and wetlands – 0 (upland); and
 - c. Riparian shrublands: Preble's – 1.0 (high value riparian), birds – 0.69 (shrubs (riparian)), and wetlands – 0 (upland).
6. In mitigation areas LMG-1 and LMG-2 (Figure 8), 100 percent of the habitat will be converted to one or more wetland habitat types.
7. Mitigation areas SPR-2, SPR-3, and SPR-5 (Figure 14 and Figure 15) are designated as cottonwood regeneration areas and 100 percent of the habitat will be converted to riparian trees.
8. Mitigation areas on Marcy Gulch and Deer Creek do not include Preble's EFUs because they are outside of known occupied Preble's habitat.

Weed control for the mitigation sites is part of the success criteria and mitigation credit will not be given for weed control in areas disturbed by mitigation activities. Detailed calculations of gains in EFUs are contained in Appendix G.

Assumptions for cost estimates:

1. Cost estimates include compensatory mitigation activities in on-site critical and noncritical habitat.
2. The earthwork, seeding, and mulching costs for PC-1 and SPR-1, which will be in the proposed borrow areas below 5,444 feet in elevation, are included in the recreation facility relocation costs.
3. Sheet pile cutoff structures will be used in 23 of 29 nonborrow area mitigation areas. Sheet pile is not proposed in six sites due to site-specific conditions.
4. Nonborrow areas will require salvage, storage, and reapplication of topsoil and removal of 2 feet of subsoil.
5. Excess excavated material will be disposed of off-site.
6. Sheet piles will extend 20 feet below the ground surface.

7. Mitigation area survey, design, construction administration, and contractor mobilization are 20 percent of estimated project costs (estimate based on professional judgment of Joe Juergensen, P.E., Muller Engineering Company).
8. All mitigation sites will receive the same revegetation treatment of native seeding and tree and shrub planting for each habitat type.
9. Line item cost estimates are based on average unit costs in the Urban Drainage and Flood Control District (District) Bid Tabulation software that compiles information on competitive bids for 35 channel improvement projects with District funding from 2010 to 2012.

More detailed assumptions and calculations are contained in Appendix G. Better defined estimates of on-site mitigation acres and estimated costs will be developed as the site-specific mitigation plans are finalized prior to issuance of the decision documents. Estimates of on-site mitigation EFUs will be revised based on field evaluations and the final site-specific mitigation area plans.

In addition to habitat conversion activities, there are opportunities for habitat enhancement, particularly along Plum Creek and the South Platte River. For example, significant channel degradation along Plum Creek has lowered the water table, adversely affecting adjacent wetland and riparian vegetation. Numerous cottonwood and peachleaf willow trees have died because of the change in hydrology and former wetland areas have transitioned to mesic or upland conditions. Approaches to restoring the degraded channel reach are being studied to determine potential gains in EFUs from restoration and from prevention of additional habitat degradation if the channel instability is not addressed.

Generally, the number of compensatory EFUs gained from enhancement activities, such as weed control, will be lower than those gained from habitat conversion activities such as converting upland grasslands to shrub-scrub wetlands. Because EFUs gained through habitat enhancement such as weed control will be relatively small, they are not included in current calculations of EFUs anticipated to result from on-site mitigation activities. Habitat enhancement activities may be implemented as part of adaptive management (Section 7.5).

Using currently available mapping and estimates of EFUs, 165 acres on-site will be converted to a mosaic of riparian shrublands (89 acres), wetlands (33 acres), and riparian forest (43 acres), and will provide a total of 85 compensatory EFUs. The 85 EFUs will include 3 West

Plum Creek CHU EFUs, 43 noncritical habitat Preble's EFUs, 9 bird EFUs, and 30 wetland EFUs.

6.1.4 Summary of On-Site Noncritical Habitat Mitigation

Based on the best information currently available and using conservative approximations of potential mitigation acreage and EFUs, the following will occur on-site:

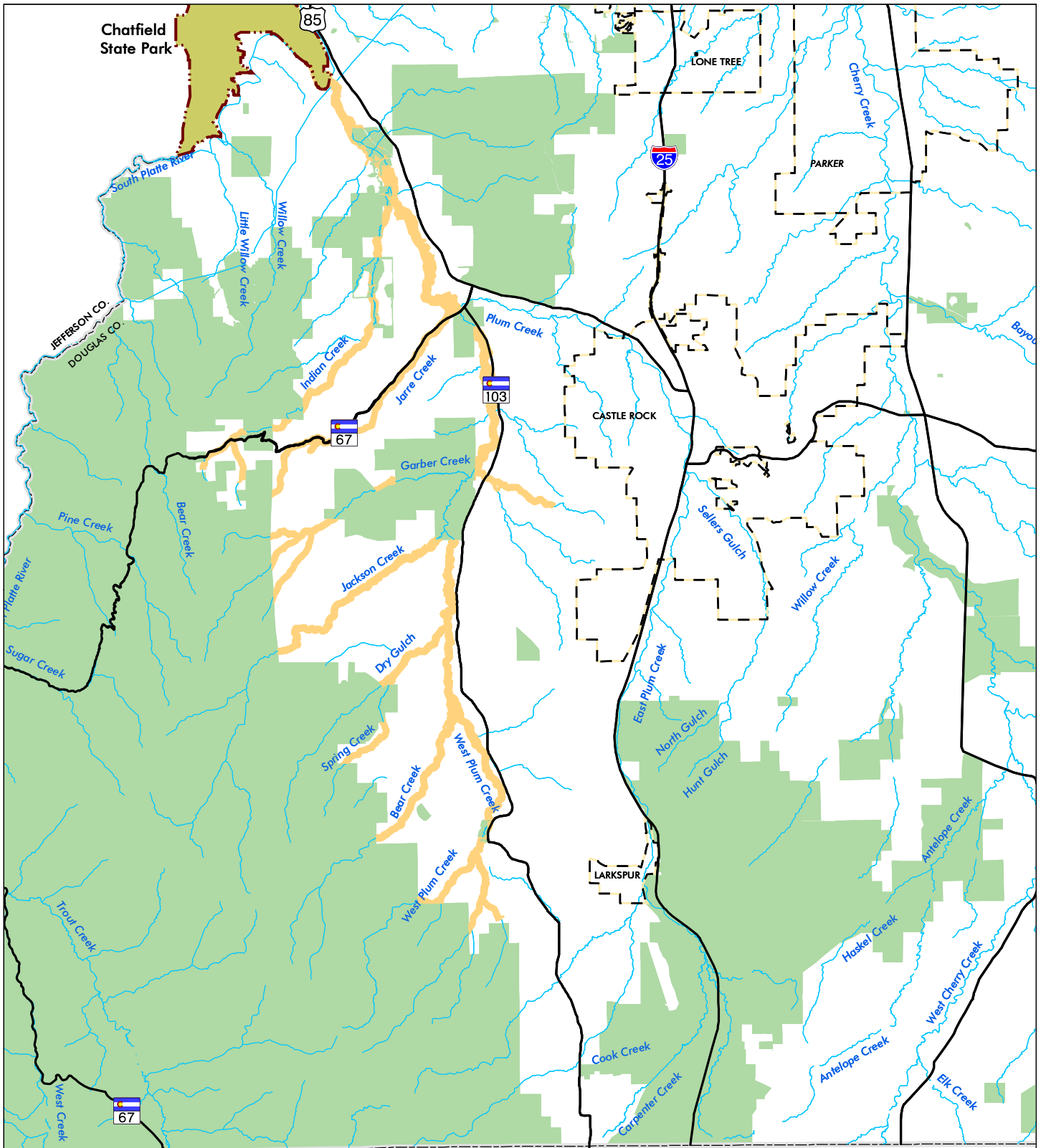
- Conversion of about 134 acres of uplands to Preble's habitat that will enhance 17 acres of Upper South Platte CHU habitat, 6 acres of West Plum Creek CHU habitat, and 111 acres on noncritical habitat, which will provide a net gain of 43 noncritical habitat Preble's EFUs and 3 West Plum Creek CHU EFUs;
- Enhancement of about 165 acres of upland grassland bird habitat to habitat that will provide a net gain of 9 bird EFUs;
- Creation or enhancement of about 47 acres of wetlands that will provide a net gain of 30 wetland EFUs;
- Restoration and revegetation of about 173 acres of borrow and fill areas, and areas disturbed by utility realignment and haul roads to upland grasslands, resulting in no net change in EFUs; and
- Creation of about 13 acres of cottonwood regeneration.

Section 6.3.2.5 includes several tables that summarize impacts, on-site mitigation, and off-site mitigation.

6.2 Off-Site Mitigation

The CMP focuses mitigation efforts first in on-site areas. However, it is recognized that mitigation requirements will exceed what is available within on-site areas. Therefore, additional mitigation sites will be identified off-site, primarily on private lands upstream of Chatfield State Park in the Plum Creek and West Plum Creek watersheds (Figure 25). The final number and extent of off-site mitigation areas will be determined by how many EFU credits are generated from each mitigation area.

For on-site mitigation, calculating EFU credits gained by mitigation activities, such as habitat conversion of upland grassland to a scrub-shrub wetland, is a relatively straightforward process of determining the number of EFUs in the area prior to mitigation activities and the number of EFUs in the area after mitigation activities. The net gain in EFUs will be credited to offset impacts.



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-  Primary Target Off-Site Mitigation Area
-  Protected Lands
-  Incorporated Towns
-  Chatfield State Park

Unshaded areas are unprotected lands in Douglas County

Imagery Source : Landiscor©, June 2008
Pool Elevations: Tetratich

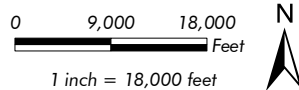


Figure 25
Off-Site Mitigation Target
Habitat within Private
Douglas County Parcels

File: 4048 - Figure 25 Off-Site Mit Target.mxd (6S)
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Calculating mitigation credits for off-site mitigation is not as straightforward as that for on-site mitigation. Off-site mitigation sites will consist of numerous areas surrounded by various land uses. Unlike on-site mitigation, development may be in close proximity to off-site mitigation areas and there may not be certainty that adjacent land uses will not significantly change over time and adversely affect existing habitat. Also, unlike on-site mitigation areas, most off-site areas will require legal real estate instruments such as conservation easements or deed restrictions to ensure perpetual protection and management of the mitigation areas to benefit the target environmental resources. Finally, conservation and maintenance of existing habitat to benefit Preble's is a mitigation measure available off-site but not possible on-site.

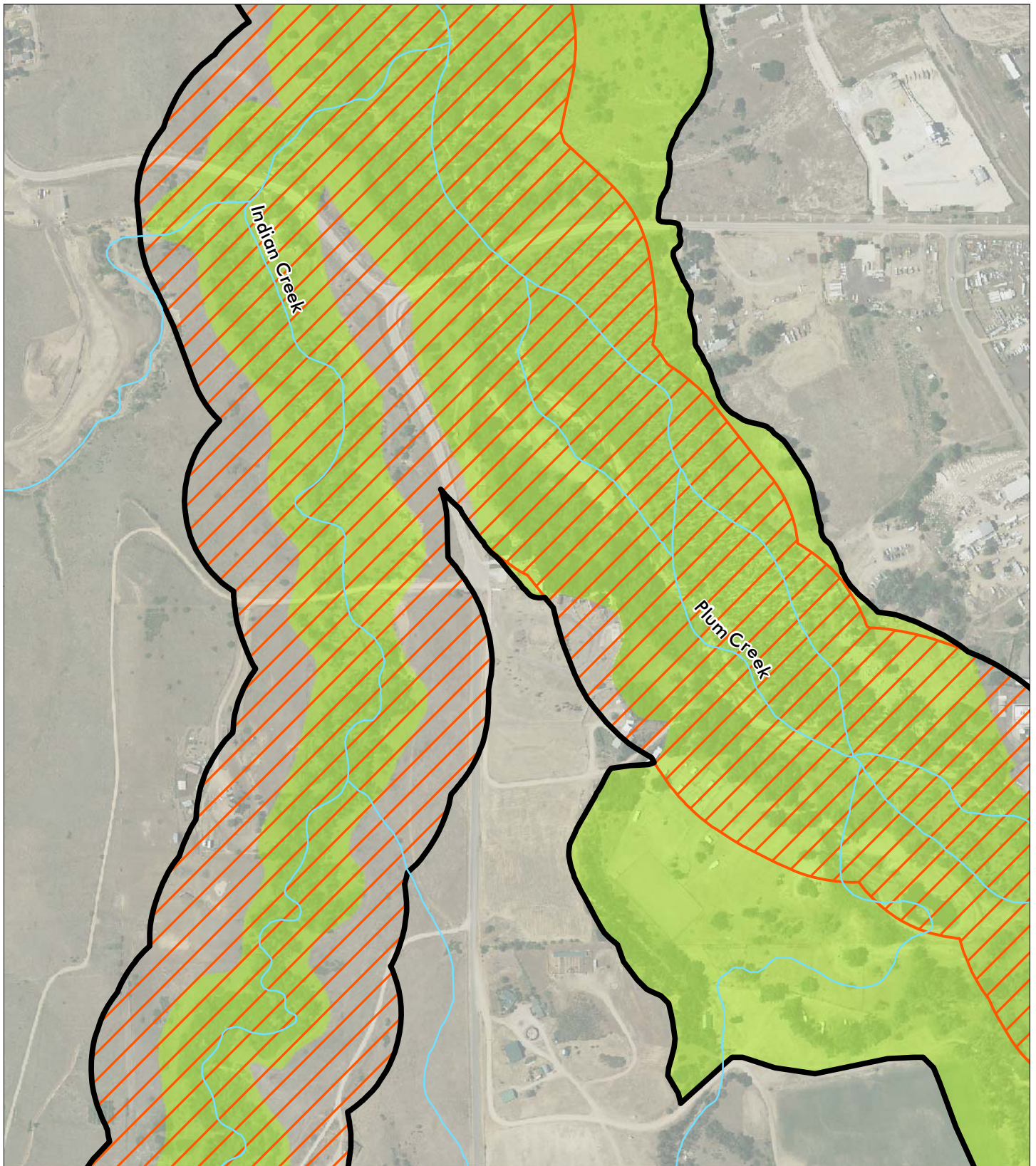
To account for these differences, baseline mitigation credits for preservation and weighting factors related to the ecological effects of landscape context were developed as part of the ecological functions approach. In recognition of the value of protecting existing habitat from loss or degradation by allowable changes in land use in or near the habitat, conservation of existing habitat would generate some amount of baseline mitigation credit. Weighting factors for the proximity of mitigation areas to impacts, the presence of habitat buffers, and the connectivity of off-site mitigation areas to other protected areas have been developed as well. The weighting factors will be applied to existing EFUs present in off-site mitigation areas and to EFUs generated from habitat conversion and enhancement activities as described below. Weighting factors are not applied to on-site mitigation activities because the on-site mitigation activities occur, for the most part, within Chatfield State Park. It was assumed that buffers from potential development, connectivity to other protected habitats, and proximity to Chatfield State Park would have little meaning for on-site mitigation activities.

There also will be off-site mitigation activities to compensate for the mature cottonwood habitat that will be impacted. The mature cottonwood habitat mitigation will contribute to the overall EFUs needed for mitigation. The mature cottonwood habitat mitigation also will be tracked by mitigation acreage to ensure that impacts to mature cottonwoods will be compensated by mitigation activities that involve mature cottonwood habitat. About 13 acres of the mature cottonwood habitat mitigation will take place on-site (Section 6.1.1.3), leaving about 29.5 acres to be compensated for off-site.

6.2.1 Proposed Activities

6.2.1.1 Permanent Protection of Target Habitat

The off-site mitigation for impacts to Preble's noncritical habitat focuses on the West Plum Creek and Plum Creek watersheds upstream of Chatfield State Park (Figure 26). Similar large-scale conservation efforts have been successful in Douglas County (Douglas County et al. 2006). Mitigation areas will be permanently protected by conservation easements put in place on property purchased from willing property owners or through conservation easement agreements with willing property owners. To ensure that mitigation credits are associated with suitable Preble's habitat, only portions of private parcels identified as target habitat would contribute to accrual of mitigation credits (Appendix C, Section 4.1). Target habitat typically includes well-developed riparian habitat and some amount of adjacent upland areas. Douglas County has mapped Preble's habitat as part of the Douglas County Habitat Conservation Plan (DCHCP) (Douglas County et al. 2006). The mapped areas are the Riparian Conservation Zone (RCZ) in the DCHCP. Additionally, in 2009 the Service proposed to designate certain reaches of Plum Creek and its tributaries as critical habitat for Preble's. Off-site target habitat was mapped by overlaying the RCZ and proposed critical habitat and using whichever boundary was wider as the outer boundary of target habitat (Figure 27). The combination of the 2009 proposed critical habitat designation for Preble's and the RCZ mapping provide the maximum target habitat width for off-site mitigation within the target habitat area (Figure 27). Generally, the RCZ is wider than the 2009 proposed critical habitat designation on larger streams (e.g., Plum Creek) and narrower on tributaries to West Plum Creek (e.g., Jarre Creek or Garber Creek). The combination of the RCZ and the 2009 proposed critical habitat designation will facilitate the potential for increased protection of riparian habitats and their adjoining uplands in the off-site mitigation target habitat area.



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-  Primary Target Habitat
-  Critical Habitat Proposed in 2009
-  Riparian Conservation Zone

Imagery Source : Landiscor©, June 2008
 Critical Habitat: USFWS, October 2009

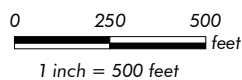


Figure 26
Example Off-Site Mitigation
Target Habitat

File: 4048 Figure 26 Off-Site Mit Target Hab.mxd (GS)
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$$EFI_{EX} = BEFI_{EX} + PEFI_{EX} + WEFI_{EX}$$

$$EFU_{EX} = EFI_{EX} \times \text{Acres}$$

$$B = 1.5$$

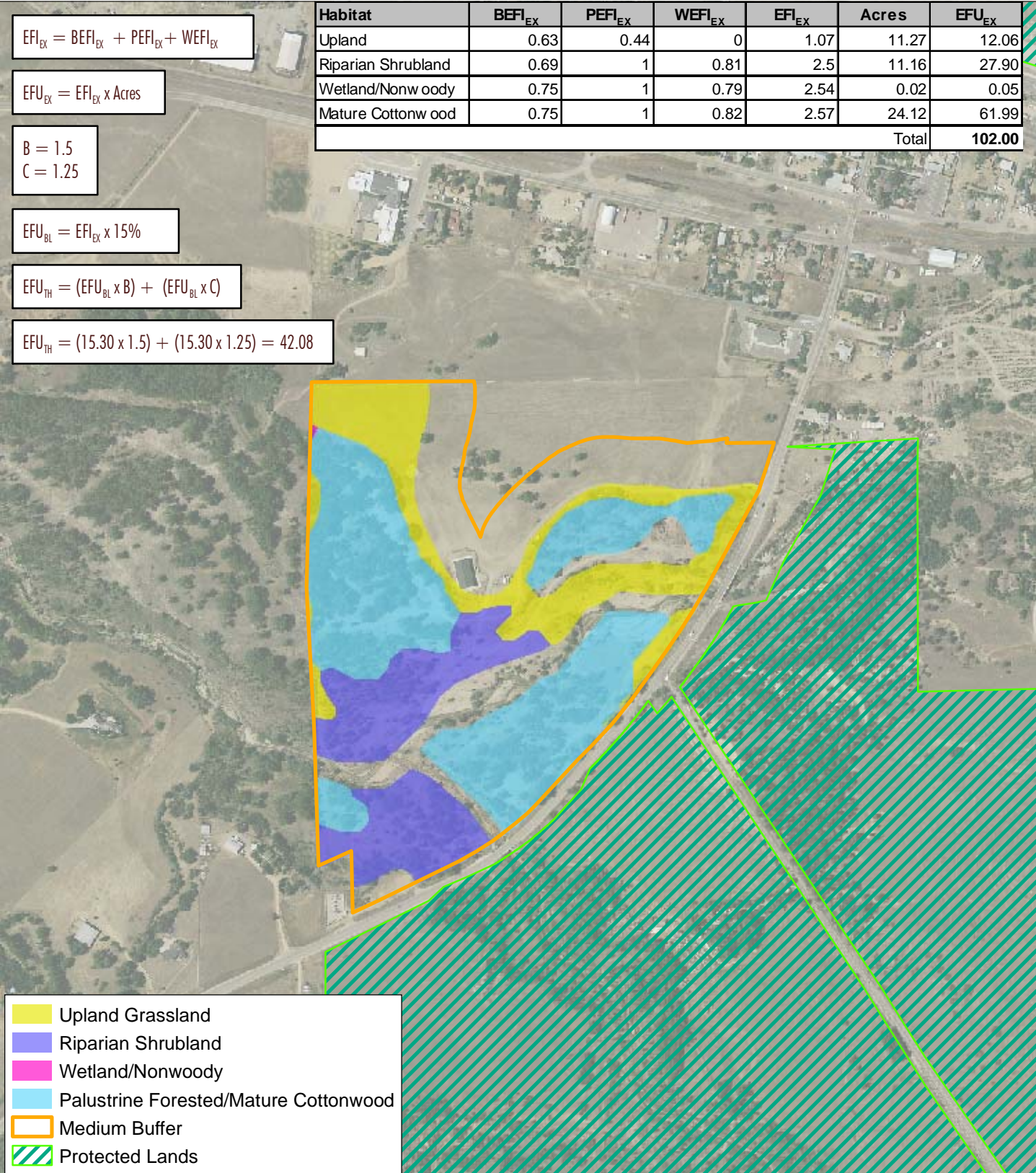
$$C = 1.25$$

$$EFU_{BL} = EFI_{EX} \times 15\%$$

$$EFU_{TH} = (EFU_{BL} \times B) + (EFU_{BL} \times C)$$

$$EFU_{TH} = (15.30 \times 1.5) + (15.30 \times 1.25) = 42.08$$

Habitat	BEFI _{EX}	PEFI _{EX}	WEFI _{EX}	EFI _{EX}	Acres	EFU _{EX}
Upland	0.63	0.44	0	1.07	11.27	12.06
Riparian Shrubland	0.69	1	0.81	2.5	11.16	27.90
Wetland/Nonwoody	0.75	1	0.79	2.54	0.02	0.05
Mature Cottonwood	0.75	1	0.82	2.57	24.12	61.99
Total						102.00



- Upland Grassland
- Riparian Shrubland
- Wetland/Nonwoody
- Palustrine Forested/Mature Cottonwood
- Medium Buffer
- Protected Lands

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EFI_{EX} = Existing EFI
 EFU_{EX} = Existing EFUs
 EFU_{BL} = Baseline EFUs
 EFU_{TH} = Target Habitat Weighted EFUs
 BEFI_{EX} = Existing Bird EFI
 PEFI_{EX} = Existing Preble's EFI
 WEFI_{EX} = Existing Wetland EFI

Weighting Factors
 B = Buffers
 C = Connectivity

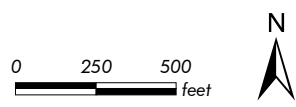


Figure 27
Example Calculation of
Off-Site EFUs

6.2.1.2 *Habitat Enhancement*

In addition to weighted baseline mitigation credits generated from the permanent protection of habitat on private lands, credits will also accrue from increases in EFUs resulting from habitat conversion and enhancement activities. Off-site habitat conversion activities will generally be the same as those described for on-site habitat conversion (Section 6.1.1). The same method described to calculate the net gain in EFUs, or EFU credits, for on-site habitat conversion activities will be used to calculate EFU credits for off-site habitat conversion activities (Figure 27). There will likely be additional, site-specific opportunities that will be identified and developed as properties become available for preservation.

6.2.1.3 *Success Criteria*

Each enhanced mitigation area will be monitored annually for at least 5 years after completion of the mitigation activities (Section 7.4). Enhanced areas of off-site mitigation will be designed to support a mixture of wetland palustrine scrub-shrub, forested riparian, and riparian shrublands. The following criteria relate to these created habitat types. Compensatory mitigation areas will be considered successful when these criteria have been met for at least 3 consecutive years without intervening remedial activities:

- For each planned habitat type, herbaceous cover will be at least 90 percent of the herbaceous cover of the reference area for that habitat type. Habitat type reference areas will be established in nearby areas of undisturbed habitat similar to that planned in the mitigation areas.
- There will be at least 80 percent survival of planted trees and shrubs (including volunteers and vegetative reproduction). Species composition will be representative of species planted; and
- State-listed A and B noxious weed species will be managed to comply with current State management guidelines for Douglas County. State-listed A noxious weed species will be eradicated and in no case will State-listed B species make up more than 10 percent of vegetative cover.
- In areas designed as wetlands:
 - At least 50 percent of the species will consist of species rated as facultative or wetter, and
 - At least one primary or two secondary indicators of wetland hydrology will be present. These indicators of hydrology will be according to the *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region* (Corps 2008).

6.2.1.4 Cottonwood Regeneration Areas

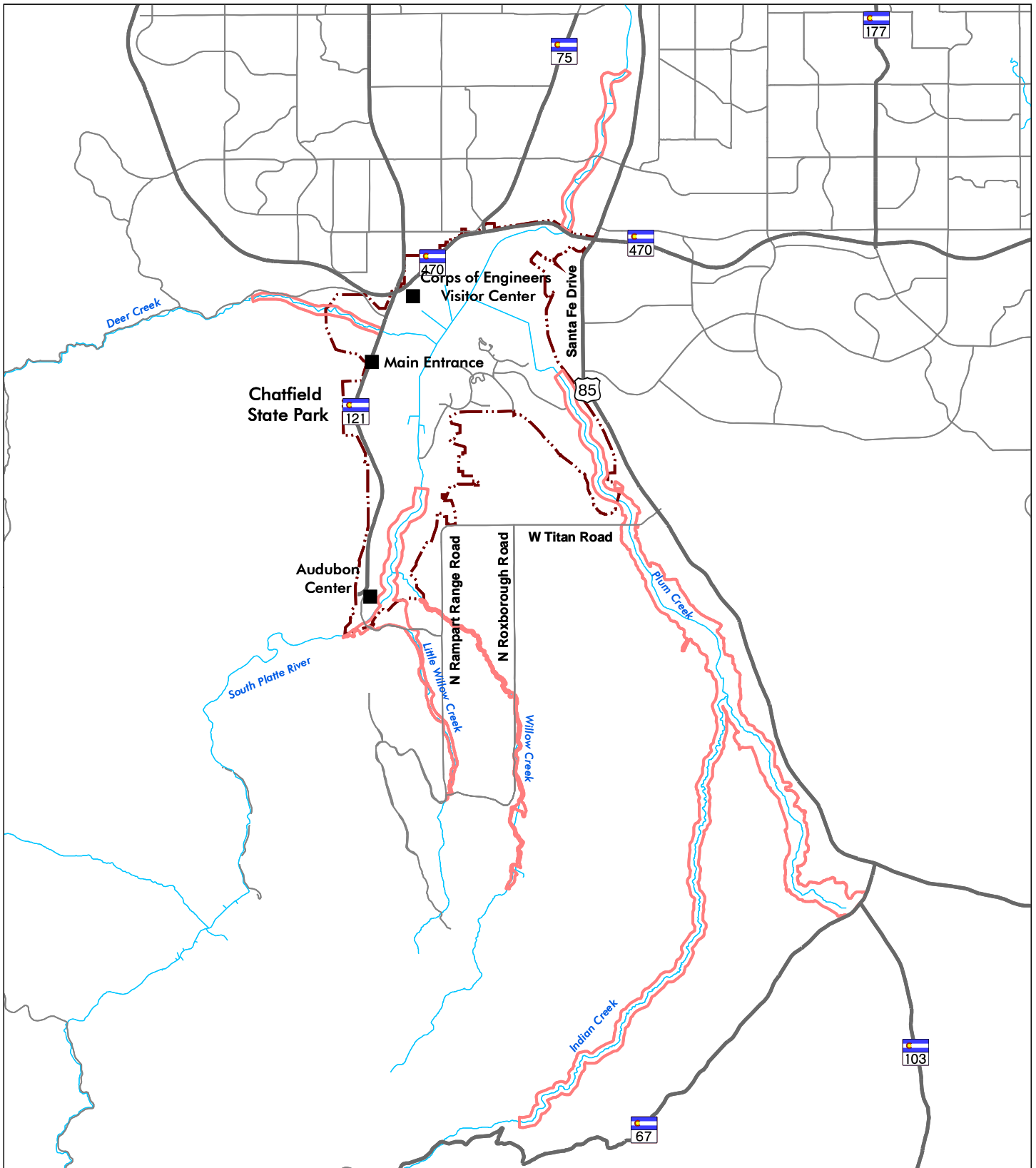
Off-site mitigation activities will also include protecting up to 22.5 acres of existing mature cottonwood habitat and designating up to 10 acres for cottonwood regeneration. Protected areas of existing mature cottonwood habitat will be as large as feasible and not less than 5 acres in size. Cottonwood regeneration areas will be created using the approach described in Section 6.1.1.3.

As with off-site target habitat, areas suitable for cottonwood preservation and regeneration were defined. Conditions suitable to support large stands of mature cottonwood off-site are limited to stream reaches with broad floodplains and perennial sources of both surface and ground water. The existing mature cottonwood habitat that will be impacted is part of a larger habitat complex that supports a variety of bird species including several uncommon and sensitive species. This bird habitat complex has been delineated as part of the ecological functions approach (Appendix C, Section 4.3.1) and contains conditions suitable to support large stands of mature cottonwood. Because of the appropriate conditions and adequate amount of existing cottonwood habitat, mitigation activities for mature cottonwood habitat will take place within the boundaries of the mapped bird habitat complex (Figure 28).

6.2.2 Anticipated EFUs and Acreages

Based on current information and assumptions, on-site, noncritical habitat compensatory mitigation activities will generate 85 EFUs (Section 6.1.3) to partially offset the 796 permanently impacted EFUs (exclusive of impacts to Preble's EFUs in critical habitat in the Upper South Platte River CHU). This number will be refined as more information becomes available during detailed design of the on-site mitigation areas, but is not likely to be significantly lower because the size of the proposed on-site mitigation areas is estimated conservatively. The current EFU estimate is likely the minimum number that will be generated on-site because, under adaptive management (Section 7.5), additional EFU credits can be gained as habitat below the 5,444-foot elevation stabilizes over time.

If 85 EFUs is a conservative estimate of the minimum number of anticipated on-site EFUs that will be gained, then a conservative estimate of the maximum number of EFUs required from off-site activities to fully offset the 796 impacted EFUs is 711 EFUs. If more EFU credits are generated on-site, fewer are necessary off-site.



Chatfield Reallocation Study

- Bird Habitat Complex Boundary
- Chatfield State Park

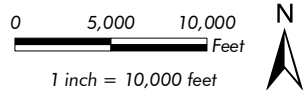


Figure 28
Bird Habitat Complex Targeted
for Cottonwood Regeneration
and Mature Cottonwood
Conservation

File: 4048 - Figure 28 Bird Hab CW Regen Target.mxd (GS)
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The feasibility of generating up to 711 off-site EFUs has been determined as part of the ecological functions approach (Appendix C, Section 4.0). Using conservative assumptions, about 5,917 acres of target habitat is available on private parcels in the Plum Creek and West Plum Creek watersheds in Douglas County. Assuming that EFUs are evenly distributed throughout the 5,917 acres, an estimated 8,035 existing EFUs are potentially available for protection.

Not all private property owners would be willing to sell or enter into conservation easement agreements. Anecdotal information from three large successful mitigation efforts associated with habitat protection for federally listed species suggests that the percentage of potentially suitable habitat that could be protected through transactions with willing land owners could be as low as 15 percent of the potential properties available. An objective for a multiple-species recovery plan on the Platte River calls for the protection of about 29,000 acres of land along the Platte River that contains riparian habitat somewhat similar to that targeted along Plum Creek. Over the last 2 years, the land acquisition effort has assessed 69 parcels of suitable habitat, nine of which, or 13 percent, were purchased (Sackett, pers. comm. 2009). More of the parcels could have been purchased from willing sellers, but because of funding priorities, only the highest quality parcels were acquired. Habitat conservation plans for multiple species along the Salt and Verde rivers in Arizona committed to protecting and managing about 2,000 acres of habitat for off-site mitigation. To date, all but 150 acres have been acquired. In areas targeted for acquisition, from 10 to 50 percent of the available land has been acquired (Sommers, pers. comm. 2009).

Based on this information, for purposes of the CMP, it is assumed that 15 percent of the potential off-site target habitat acreage can be successfully protected. If 15 percent of the existing acreage and EFUs are opportunistically available on properties with owners willing to sell or enter into conservation easement agreements, 888 acres and 1,205 EFUs would be conserved. With a baseline conservation credit of 15 percent, conservation alone of the 888 acres would generate 181 EFU credits. Assuming that all available mitigation areas will have weighting factors applied for connectivity (1.25) and a medium buffer (1.5), applying weighting factors to the baseline credits would increase the mitigation credits to 317 EFUs. Figure 27 shows an example of calculating existing, baseline, and weighted EFUs for a representative parcel on Plum Creek. Finally, if habitat enhancement and conversion activities increase

existing EFUs by 20 percent on average, and if the same weighting factors are applied to the new EFUs, there would be an additional 422 EFUs. With conservation, weighting, and enhancement, off-site mitigation activities would result in an estimated minimum of 739 EFUs.

Section 6.2 and Appendix C provide information on the development and use of weighting factors. Weighting factors are a form of mitigation credits that are applied to off-site protected properties and are used to reflect the added ecological value of providing buffers for the protected property and connectivity to other protected properties. The weighting factors are in agreement with and support the CMP’s guiding principles (Table 1) and the ecological priorities and stakeholder expectations for environmental mitigation (Table 2). As shown below, the weighting factors can be applied to the baseline EFUs for protecting a property and to EFUs for enhancing a protected property. When applied to both baseline protection and enhancement of a protected property the products of the weighted baseline protection and weighted enhancement are summed to arrive at the total weighed baseline protection and weighted enhancement EFUs (see below).

The following is a summary of calculations used to estimate the number of off-site EFUs potentially available for mitigation and the number of EFUs that would be gained per acre of potential target habitat (numbers have been rounded to whole numbers). In the calculations below, 15 percent (0.15) is used twice for independent calculations. As described above, it is estimated that 15 percent of the potential off-site target habitat acreage can be successfully protected. The protected habitats will receive a 15-percent conservation credit (i.e., a mitigation credit equal to 0.15 times the existing baseline EFUs):

Total of off-site target habitat 5,917 acres
 Total of EFUs in off-site target habitat 8,035 EFUs

- Acres of target habitat and EFUs available assuming 15 percent will be on property of willing owners:

Available Acres..... $5,917(0.15) = 888$ acres
 Available EFUs..... $8,035(0.15) = 1,205$ EFUs

- Number of baseline EFUs assuming 15 percent conservation credit:

Baseline EFUs..... $1,205(0.15) = 181$ EFUs

- Number of weighted baseline EFUs using assumed weighting factors of 1.25 for connectivity and 1.5 for medium buffer width:
 Weighted baseline EFUs $(181 + (181(0.25)) + (181(0.5)) = 317$ EFUs
- Number of weighted EFUs generated by enhancing 20 percent of the total available EFUs:
 Enhancement EFUs.....1,205(0.2) = 241
 Weighted Enhancement EFUs $(241 + (241(0.25) + (241(0.5)) = 422$ EFUs
- Total estimated weighted baseline and weighted enhancement off-site EFUs:
 Total estimated minimum off-site EFUs.....317 + 422 = 739 EFUs
- The amount of EFUs generated on average per acre of protected target habitat:

$$\frac{739 \text{ EFUs}}{888 \text{ acres}} = 0.83 \text{ EFUs/acre} \quad \frac{888 \text{ acres}}{739 \text{ EFUs}} = 1.20 \text{ acres/EFU}$$

The estimated minimum of 739 EFU credits available off-site exceeds the estimated 711 EFUs off-site mitigation credits needed. Section 6.3.2.5 includes tables that summarize needed off-site mitigation.

The estimated maximum 711 EFUs of needed off-site mitigation include impacts to mature cottonwood woodlands. To ensure that the off-site EFUs include mitigation for impacts to mature cottonwoods, off-site mitigation for impacts to mature cottonwood will include preserving up to 22.5 acres of the existing mature cottonwood habitat and creating up to 10 acres for cottonwood regeneration. More than 200 acres of mature or nearly mature cottonwood habitat occurs in off-site target habitat. The combined 32.5 acres of off-site mitigation, along with the 13 acres of on-site mitigation, will compensate for the 42.5 acres of impacts to mature cottonwood habitat.

6.2.2.1 Uncertainties

As discussed above, the CMP conservatively assumes that at least 15 percent of the potential off-site target habitat acreage can be successfully protected. The CMP also assumes that all available mitigation areas will have weighting factors applied for connectivity (1.25) and an average buffer width of 200+ feet (1.5), and that habitat enhancement and conversion activities will increase existing EFUs by 20 percent on average. There are uncertainties in implementing the off-site mitigation. 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. The lands that are protected may not on average provide the needed connectivity, buffers, and habitat enhancement potential that would increase the EFUs beyond the baseline protection credit. As further discussed in Section 7.5 Adaptive Management, these circumstances would require the protection of additional private lands, which might require expanding the geographic scope of private lands considered for protection (Figure 25) and could add to the estimated off-site mitigation costs because additional properties would need to be protected.

6.3 Mitigation for Impacts to Preble's Designated Critical Habitat

Critical habitat has been designated on the South Platte River and Plum Creek arms of Chatfield Reservoir (75 Fed. Reg. 78430 (December 15, 2010)). Up to 80 acres and 1.3 stream miles of Preble's designated critical habitat will be inundated on the South Platte River arm and up to 75.2 acres and 2.8 stream miles of designated critical habitat will be inundated on the Plum Creek arm. The Plum Creek arm of Chatfield Reservoir occurs in the West Plum Creek CHU and the South Platte River arm occurs in the separate Upper South Platte CHU.

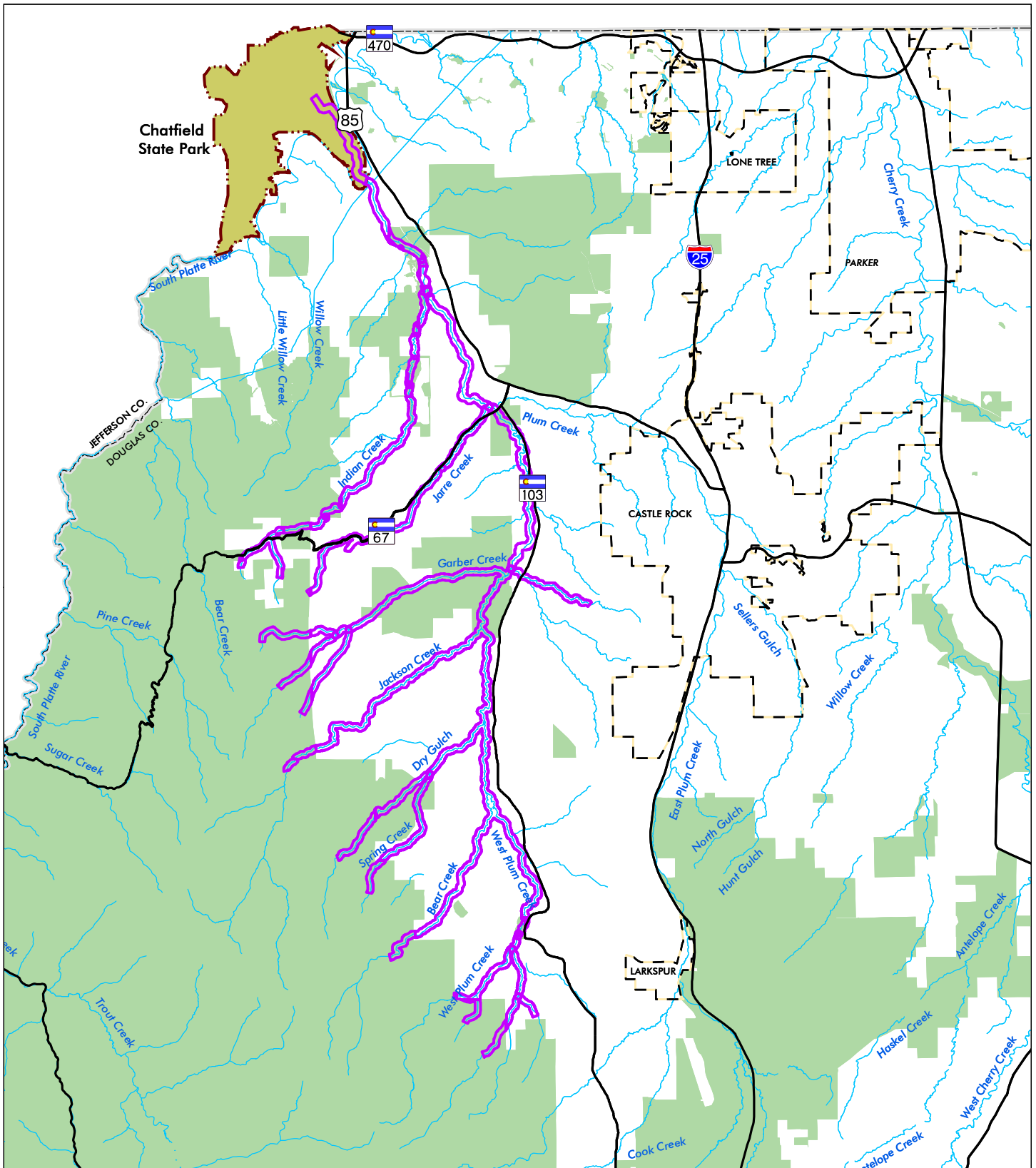
The development of mitigation for impacts to designated critical habitat for Preble's used the following approach:

1. All mitigation for impacts to critical habitat will occur within the same CHU in which the impacts occur (Service 2004).
2. The mitigation must be demonstrated to be cost effective and efficient in producing the needed ecological functions for replacement of the functions lost.
3. Mitigation for impacts to critical habitat will be maximized to the degree practicable within Chatfield State Park before developing off-site mitigation.
4. Once the on-site mitigation has been maximized, off-site alternatives for mitigation will be evaluated and screened to determine the practicable alternatives that have the greatest opportunity to benefit the CHU and provide the greatest ecological benefit for the cost of the measures.
5. Potential mitigation sites were eliminated from further consideration if the effects for which mitigation would be provided were caused by the discrete actions of others and, therefore, are the responsibility of these actors to provide mitigation.
6. The proposed mitigation is acceptable to the agencies and stakeholders.
7. The mitigation will avoid jeopardy to the subspecies and adverse modification of its critical habitat.

With the exception of the South Platte River arm of Chatfield Reservoir, the Upper South Platte CHU occurs on the Pike National Forest (Figure 30). Opportunities for on-site critical habitat mitigation are limited, so most of the mitigation for loss of Preble's critical habitat on the South Platte River arm will occur off-site on the Pike National Forest. As discussed below, the off-site critical habitat mitigation for impacts to the Upper South Platte CHU will occur in the montane environment of the Pike National Forest, and not the plains environment in the vicinity of Chatfield Reservoir in which the ecological functions approach and EFUs were developed. Therefore, the ecological functions approach and EFUs are not an appropriate approach to determine impacts and mitigation in the montane environment of the Pike National Forest. Because most of the mitigation for impacts to critical habitat in the Upper South Platte CHU will occur within the montane environment of the Pike National Forest, impacts and mitigation for designated critical habitat in the Upper South Platte CHU will be expressed in stream miles and not in EFUs.

Mitigation of up to 75.2 acres and 65 Preble's EFUs of designated critical habitat within the Plum Creek arm will be mitigated in the West Plum Creek CHU. About 6 acres and 4 EFUs will be mitigated within the proposed designated critical habitat within the Plum Creek arm of the reservoir. The remainder of the mitigation for impacts to the Plum Creek critical habitat would be compensated through off-site mitigation within the West Plum Creek CHU as described in Section 6.2. The West Plum Creek CHU (Figure 29) covers generally the same area as the area for the primary target off-site mitigation area (Figure 26).

The required mitigation for impacts to Preble's will be determined through the Section 7 consultation process between the Corps and the Service. A Biological Assessment addressing ESA compliance has been prepared by the Corps as part of the FR/EIS (Appendix V of FR/EIS). The Service will prepare its Biological Opinion for the final FR/EIS. The Biological Opinion will include conservation measures (mitigation) that address adverse impacts to Preble's and its designated critical habitat. The following proposed mitigation for impacts to critical habitat has been discussed with the Service and was included in the Biological Assessment submitted to the Service for concurrence.



Chatfield Reallocation Study

- Preble's Proposed Critical Habitat
- Protected Lands
- Incorporated Towns
- Chatfield State Park

Unshaded areas are unprotected lands in Douglas County

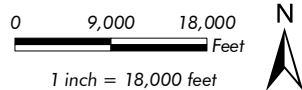
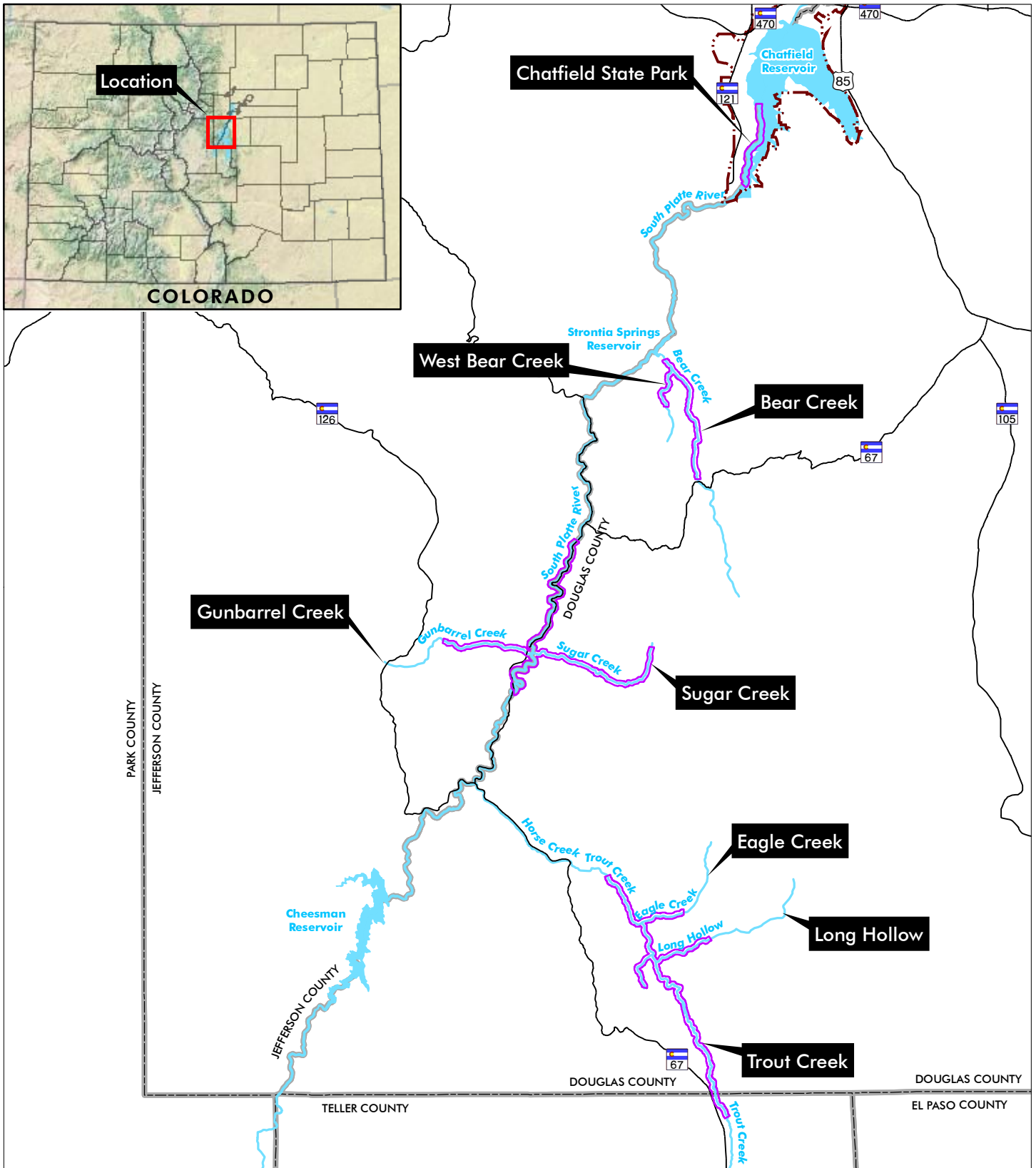







Figure 29
West Plum Creek Critical
Habitat Unit for Preble's

File: 4048 - Figure 29 West Plum Creek CH.mxd (WH)
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Chatfield Reallocation Study

-  Preble's Critical Habitat
-  Stream
-  Chatfield State Park
-  Major Road
-  County Boundary

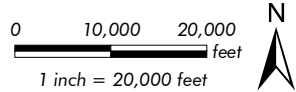


Figure 30
Upper South Platte River
Critical Habitat Unit for Preble's

File: 4048 - Figure 30 UPSPR CH.mxd (WH)
 February 2013



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6.3.1 On-Site Critical Habitat Mitigation

The amount of mitigation for impacts to designated critical habitat for Preble’s will be maximized within the designated critical habitat within Chatfield State Park to the degree practicable within each of the respective CHUs where the impacts occur. The types of on-site mitigation activities proposed for Preble’s critical habitat are the same as those described for on-site noncritical habitat (Section 6.1.1).

6.3.1.1 Proposed Activities

Nine on-site compensatory mitigation areas overlap with critical habitat. Mitigation areas SPR-2, SPR-3, SPR-4, SPR-5, and SPR-7 occur within the Upper South Platte CHU (Figure 14 and Figure 15) and mitigation areas PC-1, PC-2, PC-4, and PC-9 occur within the West Plum Creek CHU (Figure 10, Figure 11, and Figure 12). Mitigation activities in these areas would result in about 23 acres of enhanced critical habitat (Table 4).

Table 4. On-Site Critical Habitat Mitigation Areas.

Mitigation Area	Acres
SPR-2	2.50
SPR-3	3.23
SPR-4	2.49
SPR-5	1.77
SPR-7	7.09
PC-1	2.77
PC-2	1.74
PC-4	1.29
PC-9	0.03
TOTAL	22.91

Because they are subareas of on-site mitigation areas for noncritical habitat and would be constructed at the same time, the preconstruction activities and success criteria described for on-site noncritical habitat will be the same for the on-site critical habitat mitigation areas (Section 6.1.1.1). Similarly, the costs for the critical habitat portion of the mitigation areas have not been estimated separately, but are included in the estimated on-site, noncritical habitat mitigation area costs (Table 3).

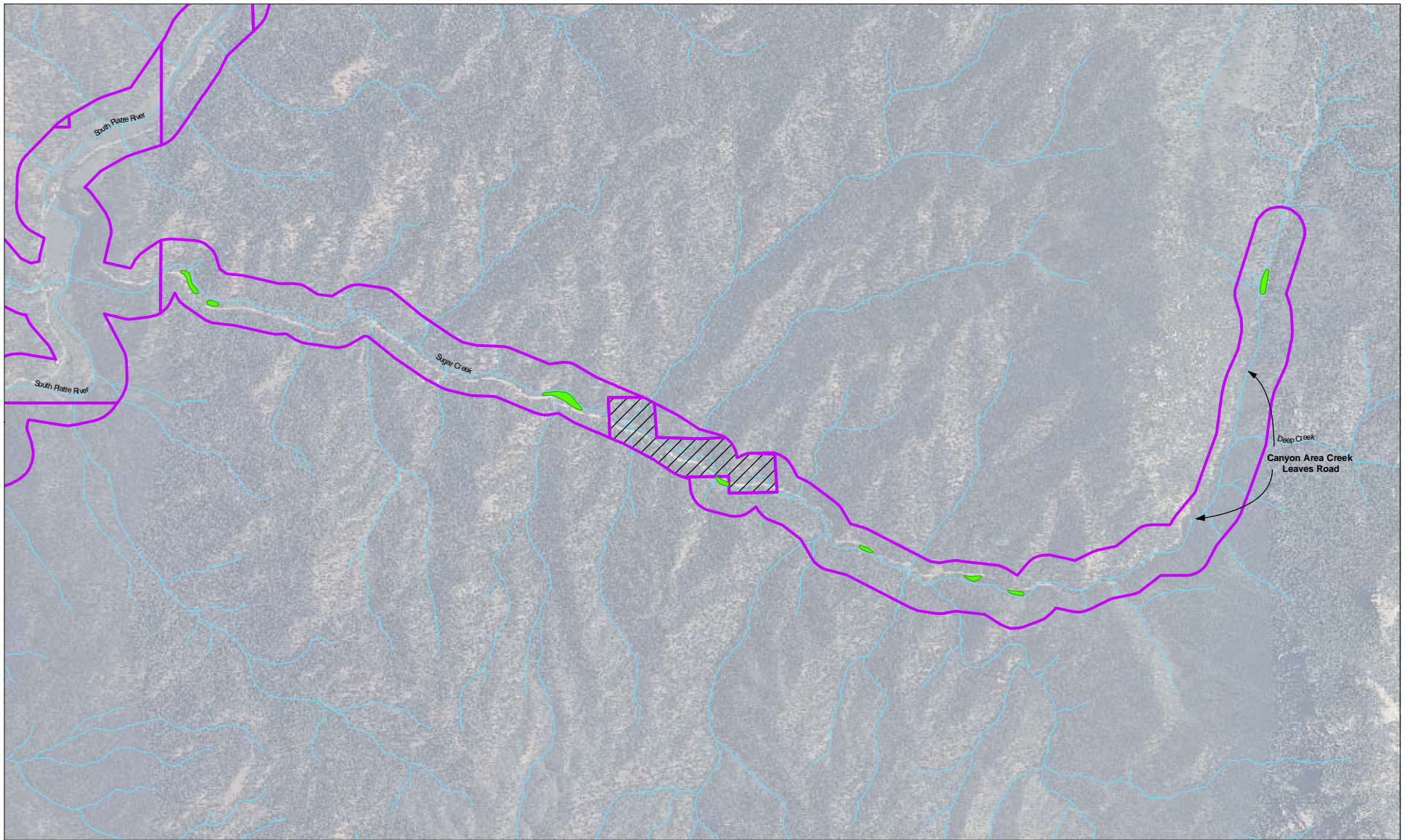
There may be additional opportunities to enhance critical habitat with noxious weed control or shrub plantings. Those opportunities and the amount of mitigation credit they would generate will be further evaluated in consultation with the Service between receipt of comments on the draft FR/EIS and the final decision documents.

6.3.2 Off-Site Critical Habitat Mitigation

The remaining mitigation for impacts to designated critical habitat for Preble's will occur off-site within the Upper South Platte CHU that occurs within the Pike National Forest (Figure 30) and the West Plum Creek CHU upstream of Chatfield Reservoir (Figure 29). The mitigation activities in the Upper South Platte CHU are based on a review of designated critical habitat of Preble's within the Pike National Forest (Appendix H) and have been coordinated with the U.S. Forest Service (USFS) and the Service (ERO, pers. comm. 2009).

6.3.2.1 Proposed Activities – Upper South Platte CHU

The Upper South Platte CHU within the Pike National Forest is distributed over eight drainage segments and includes about 3,298 acres and 36.5 stream miles (Figure 30 and Figure 31). The entire CHU was reviewed to determine the potential for enhancing, restoring, or creating habitat for Preble's, and, for the sites potentially suitable for mitigation, the feasibility (relative costs, logistics, and habitat gains) of implementing mitigation was determined (Table 5 and Appendix H). Potential mitigation sites were eliminated from further consideration if the effects for which mitigation would be provided were caused by the discrete actions of others and, therefore, are the responsibility of these actors to provide mitigation. The drainage segments designated as critical habitat were screened to determine which sites had the greatest potential to provide suitable mitigation for impacts to designated critical habitat and where mitigation could be feasibly implemented. Although the designated critical habitat within the Pike National Forest is extensive, opportunities for habitat enhancement, restoration, and creation are limited in most drainages by existing high quality habitat, steep topography, and poor access.



Chatfield Reallocation Study





-  Preble's Critical Habitat
-  Potential Mitigation Area
-  Private Land
-  River or Stream

Image Source: USDA NAIP 2009

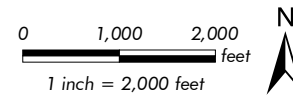


Figure 31
Potential Preble's Critical
Habitat Mitigation, Sugar
Creek, Pike National Forest

File: 4048 Fig 31 Pot CH Mit sugarcreek.mxd (WH)
 February 2013



Table 5. Drainages within the Upper South Platte CHU Evaluated for Mitigation.

Site Evaluated	Opportunities	Constraints	Determination
Trout Creek	Localized areas of erosion associated with past fires and the decomposed granitic soils have fed tributaries which have deposited sediments that encroach into the riparian zone of Trout Creek. These sediments could potentially be removed, allowing a gain in the riparian communities and Preble’s habitat. Historically there has been some channel downcutting and erosion in the very upper reach of Trout Creek in Teller County. However, the steep eroded banks and point bars formed from the eroded banks are now well vegetated.	Existing high quality habitat. The one reach with some mitigation potential (above Rainbow Falls Park North) has constructability issues because it lacks suitable access to bring in equipment to remove sediment from the riparian zone. The steep west-facing slopes in this reach would also present challenges to securely storing the removed sediment and ensuring sediments would not be redeposited in the riparian habitat and stream in the future.	No mitigation activities are proposed for Trout Creek due to the lack of feasible opportunities and access.
Long Hollow	Opportunities for mitigation are limited by narrow riparian corridors in a steep canyon, current high quality of the habitat that is present with little potential to expand habitat due to steep narrow canyon.	Limited access, existing high quality of habitat, and steep topography limit the opportunities for mitigation.	No mitigation activities are proposed for Long Hollow or the unnamed tributary due to lack of opportunities and access.
Eagle Creek	Opportunities for mitigation are limited by narrow riparian corridors in a steep canyon, current high quality of the habitat that is present with little potential to expand habitat due to steep narrow canyon.	Limited access, existing high quality of habitat, and steep topography limit the opportunities for conservation.	No activities are proposed for Eagle Creek due to lack of opportunities and access.
Sugar Creek	Sediment from Highway 67 affects most of the critical habitat portions of Sugar Creek. Sediment from Highway 67 fills the channel and buries portions of the riparian zone, which degrades the quality and quantity of Preble’s habitat. Historically, pullouts between Highway 67 and Sugar Creek destroyed vegetation and further	Short reaches of Sugar Creek do not occur adjacent to Highway 67 and are narrow and canyon-like, which limit access and opportunities for improvements to stream and riparian habitats. The USFS and Douglas County are currently developing plans to minimize the sediment input into Sugar Creek, but there is no funding to implement	Sugar Creek provides the most feasible site for mitigation within the Upper South Platte CHU and would provide the greatest benefits relative to mitigation cost. The mitigation would need to be integrated with the plans and efforts of the USFS and Douglas County. The Chatfield Water Providers would fund the work that occurs within the

COMPENSATORY MITIGATION PLAN

Site Evaluated	Opportunities	Constraints	Determination
	<p>exacerbated erosion. These situations present opportunities to improve and expand the riparian habitats along Sugar Creek. Highway 67 provides the needed access to Sugar Creek to construct the facilities needed to implement the mitigation.</p>	<p>the Plans. Mitigation activities need to be above and beyond activities that would be undertaken by others.</p>	<p>critical habitat reach. This could be done separately by the Chatfield Water Providers or as part of an integrated project with the USFS and Douglas County.</p>
Gunbarrel Creek	<p>Limited mitigation opportunities occur in a couple of short reaches that are less confined by topography where excavation and planting next to the riparian corridor could expand the riparian corridor.</p>	<p>Access is limited to foot or pack animal traffic. It would not be feasible to get earthmoving equipment to potential mitigation sites.</p>	<p>No mitigation activities are proposed for Gunbarrel Creek due to the lack of feasible opportunities and access.</p>
South Platte River	<p>There are a few areas where sediment has accumulated and is elevated to a degree that inhibits the growth of riparian vegetation, primarily coyote willow. These sediments could be excavated to the elevation of adjacent riparian vegetation and planted with coyote willow (plants or stakes).</p>	<p>Areas that could benefit from mitigation activities are limited and most occur on the side of the river away from the road; therefore, earthmoving equipment would need to cross the river. Excavated sediment would need to be hauled away, which could be challenging for sites not adjacent to the road. Because of these constraints, excavation and sediment removal would be expensive. Sediment could accumulate again due to upstream inputs from burn areas.</p>	<p>Activities on the South Platte River could be combined with other mitigation activities in the Upper South Platte CHU, but on their own would not provide enough conservation.</p>
Bear Creek	<p>Some mitigation opportunities occur in upper Bear Creek where the growth and distribution of upland shrubs adjacent to the riparian corridor, particularly Gambel's oak, could potentially be improved by removing or thinning the overstory trees. These opportunities occur in scattered locations from the upper limit of critical habitat to where the steep canyon begins about 1 mile downstream.</p>	<p>Limited opportunities, high quality existing habitat, steep terrain, and limited access greatly limit any mitigation activities on Bear Creek and would make any such activities expensive relative to benefits gained.</p>	<p>No mitigation activities are proposed for Bear Creek due to limited opportunities, high quality existing habitat, steep terrain, and limited access</p>

Site Evaluated	Opportunities	Constraints	Determination
West Bear Creek	Opportunities for mitigation are limited by narrow riparian corridors in a steep canyon, current high quality of the habitat that is present with little potential to expand habitat due to steep narrow canyon.	High quality existing habitat, narrow riparian corridor, steep terrain, and limited access greatly limit any feasible mitigation activities on West Bear Creek and would make any such activities expensive relative to benefits gained.	No mitigation activities are proposed for West Bear Creek due to high quality existing habitat, narrow riparian corridor, steep terrain, and limited access

Based on the review of all of the drainages within the Upper South Platte CHU, two options for mitigation became apparent: 1) provide the mitigation at multiple sites within multiple drainages, or 2) provide all of the mitigation at the Sugar Creek site. Providing the mitigation at multiple sites would have had increased risk and been more expensive than the Sugar Creek option because of limited and challenging access for equipment, scattered small sites suitable for mitigation, and the potential inability to control forces that created the problems on which the mitigation would focus (e.g., erosion in the watershed associated with past large-scale fires). It was determined that the most feasible opportunities for habitat restoration and enhancement occur on Sugar Creek, which encompasses about 381 acres and 4.5 stream miles. Based on live trapping surveys performed by the USFS, Preble’s is known to inhabit the critical habitat reach of Sugar Creek. The Service’s designation of critical habitat was limited to stream reaches known or believed to be occupied by Preble’s (68 Fed. Reg. 37301 (June 23, 2003)).

Sediment from Highway 67, the adjoining decomposed granite slopes, and forest fires in the watershed have overwhelmed the capacity of Sugar Creek to move the sediment through the stream environment. Sediment from Highway 67, which parallels Sugar Creek, affects most of the critical habitat portions of Sugar Creek. This sediment fills the channel and buries portions of the riparian zone, which degrades the quality and quantity of Preble’s habitat. Historically, pullouts between Highway 67 and Sugar Creek destroyed vegetation and further exacerbated erosion. Most of these pullouts have now been fenced off by the USFS. These adverse situations present opportunities to improve and expand the riparian habitats along Sugar Creek.

The stream and riparian habitats within the critical habitat reach of Sugar Creek would be improved by:

- Better defining the streamside road edge of Highway 67 to minimize the continued introduction of sediment into the riparian and aquatic habitats;

- Constructing sediment traps to control sediment before it reaches the riparian zone and creek;
- Revising the drainage to maximize the control of stormwater runoff on the off-stream channel side of Highway 67 including properly sized culverts and channels to route stormwater flows; and
- Reshaping the tilt of the Highway 67 roadbed to drain away from Sugar Creek.

Additionally, several opportunities occur in the critical habitat reach to expand the riparian corridor. The riparian corridor can be expanded into the historical pullouts along Sugar Creek previously described. On the downstream end of each of the pullouts, a cutoff or drop structure would be created (see Section 6.1 for a description of cutoff structures). The structure would slow and spread surface and ground water upstream of the structure. As ground water levels rise and spread, a supportive hydrologic regime for an expanded riparian corridor would occur in the fenced-off pullout area. The expansion of the woody riparian vegetation into the pullouts would be assisted by planting shrubs native to the Sugar Creek riparian corridor. Planting would occur once a supportive hydrologic regime was established.

The shallow pools that would form behind the structures help capture sediment that is currently mobile within the Sugar Creek system. As these pools fill with sediment, they will be colonized by riparian vegetation, further expanding the riparian habitat.

Because of the systemic environmental factors discussed above that have led to Sugar Creek and its riparian habitats being overwhelmed with sediment, the USFS and Douglas County have investigated what could be done at Sugar Creek to control sediment inputs to Sugar Creek and improve the aquatic and riparian habitats. A plan was developed to address sediment issues along Sugar Creek (CH2M Hill 2009). The USFS and Douglas County have implemented some minor components of this plan, but there is no funding in place to comprehensively implement the Sugar Creek Sediment Mitigation Project. To mitigate for impacts to critical habitat associated with reallocation, the Chatfield Water Providers would fund implementation of the Sugar Creek Sediment Mitigation Project within the critical habitat reach of Sugar Creek (Station 00+0 to Station 240+50). The Chatfield Water Providers would enter into an agreement with the USFS and Douglas County addressing the measures to be implemented, the schedule for implementation and the funding required to implement the sediment control and reduction measures (Appendix E). The USFS and Douglas County will need to agree that the sediment

reduction and control measures to be implemented are consistent with the Sugar Creek Sediment Mitigation Project and that they are the measures necessary to substantially minimize the sediment inputs to the critical habitat reach of Sugar Creek. In addition to the sediment control measures, the Chatfield Water Providers agree to expand riparian habitat at several locations (Figure 33). The riparian expansion will consist of the following at the historical pullouts:

- Construction of a drop structure that mimics a beaver dam at the lower end of the historical pullouts combined in some instances with excavation of the pullout area;
- Monitoring ground water level rise; and
- Planting native woody riparian vegetation in areas of elevated ground water levels.

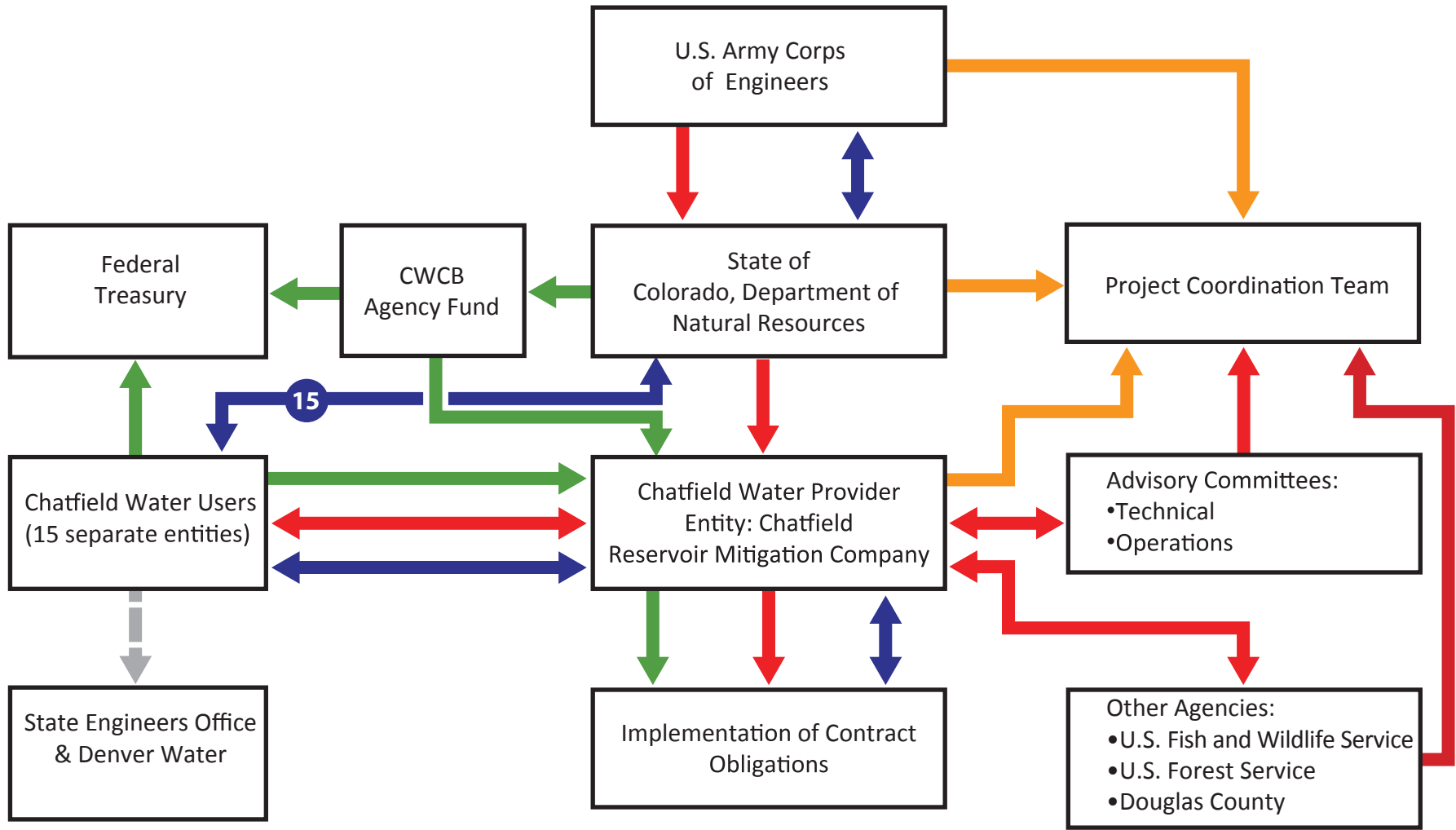
There is agreement among the Chatfield Water Providers, Douglas County, and the USFS on how the mitigation activities will proceed on USFS lands (Appendix E). The mitigation activities in the Upper South Platte CHU are in addition to any Douglas County and/or USFS management responsibilities and/or funded programs (i.e., these activities would not occur without the proposed compensatory mitigation). Upon approval of the Federally Recommended Plan, preliminary plans will be prepared and submitted for Corps' approval prior to the development of final design documents. This process is described in Section 7.1.

6.3.2.2 *Anticipated Benefits – Upper South Platte CHU*

The sediment impacts to Sugar Creek and its riparian habitats are pervasive and implementation of the Sugar Creek Sediment Mitigation Project will benefit the entire 4.5-mile reach of Preble's critical habitat by returning Sugar Creek to a functioning aquatic and riparian ecosystem. The sediment mitigation needs to be implemented systematically throughout the critical habitat reach to minimize the systemic problem of sediment from the road, adjoining cut slopes and watershed. Implementation of sediment control measures on a portion of the creek and road reach would not solve the problem. The Sugar Creek Sediment Mitigation Project directly addresses the maintenance of dynamic geomorphological processes and systems, which is one of the primary constituent elements of the designated critical habitat for Preble's (68 Fed. Reg. 37301 (June 23, 2003)). These processes are described as those that create and maintain river and stream channels, floodplains and floodplain benches, and promote patterns of vegetation favorable to Preble's. Controlling and removing sediment will prevent and reverse the burying of riparian vegetation by sediment and the associated rise of the floodplain above the water table, which will in turn support and promote patterns of vegetation favorable to Preble's.

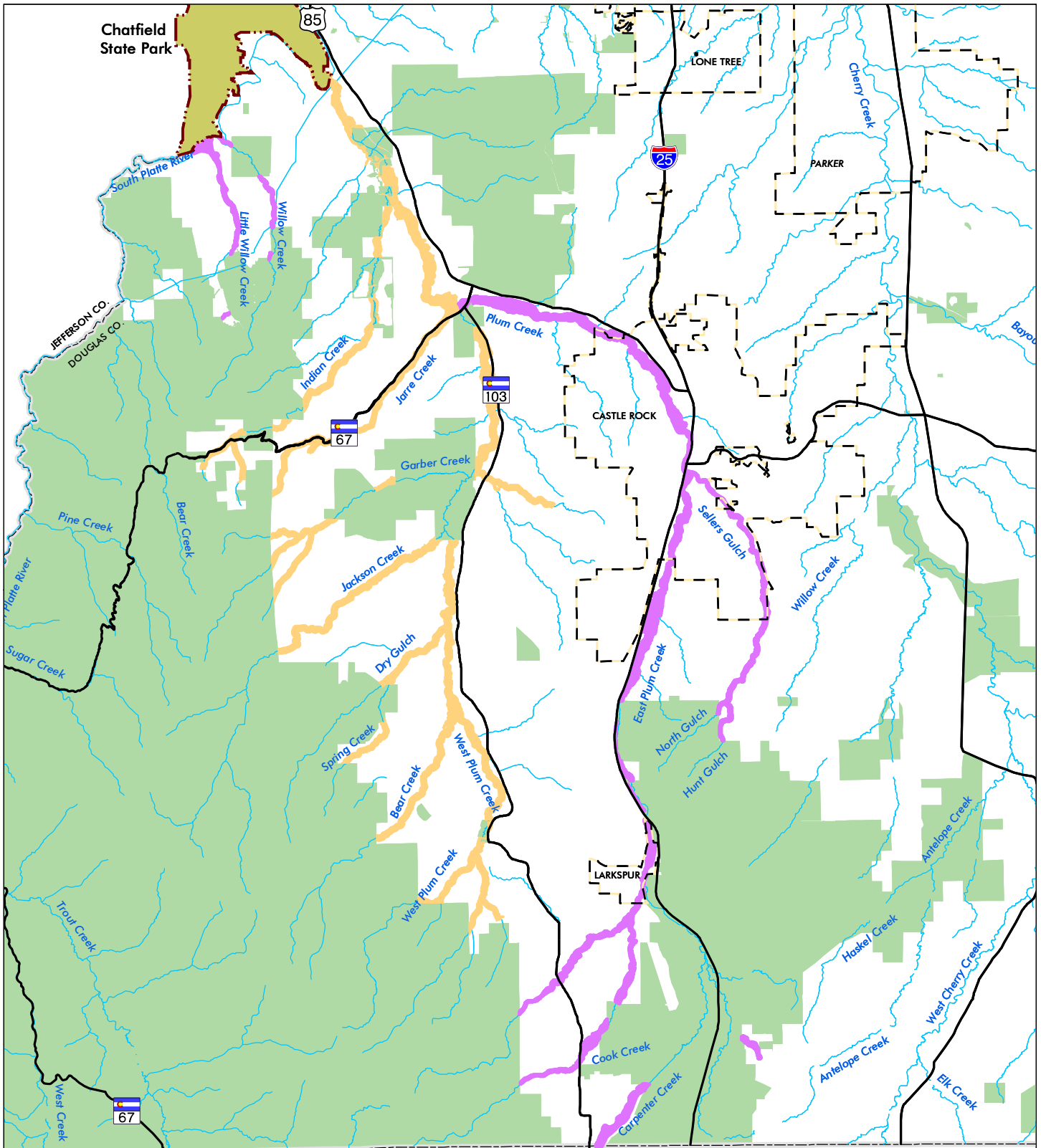
Figure 32.

Chatfield Reservoir Reallocation Project Proposed Implementation Organizational Chart *



Representation → Contract → Operations/Accounting → Funding → Technical Input

* The U.S. Army Corps of Engineers continues to have discussions with the State and the Chatfield Water Providers to further refine the legal relationship between the entities



Chatfield Reallocation Study

- Primary Target Off-Site Mitigation Area
- Secondary Off-Site Mitigation Area
- Protected Lands
- Chatfield State Park
- Incorporated Towns

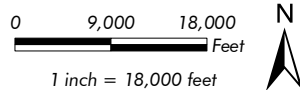


Figure 33
Potential Areas of Expanded
Off-Site Target Habitat

File: 4048 - Figure 33 Expanded Off-Site Target.mxd (GS)
 February 2013



The off-site critical habitat mitigation focuses on stream miles rather than EFUs or acres. This is because the EFUs were developed for a plains environment (Appendix C) and the off-site critical habitat mitigation will need to occur in a montane environment (i.e., the remainder of the Upper South Platte CHU occurs outside of Chatfield State Park in a montane environment). Stream miles are an appropriate unit to measure impacts and mitigation for Preble's critical habitat because Preble's is a riparian species and off-site mitigation will be applied to Sugar Creek's riparian system. For example, the working draft of the Recovery Plan for Preble's (Service 2003) describes the required amounts of habitat for recovery in terms of stream miles and not acres. This approach is consistent with Preble's habitat measures described for recovery.

6.3.2.3 *Success Criteria*

The off-site critical habitat mitigation within the critical habitat along Sugar Creek will be considered successful when the following occur:

- All of the mitigation activities agreed upon (Appendix E) have been fully implemented;
- All funds for operations and maintenance have been provided; and
- All riparian plantings (including volunteers and vegetative reproduction) have at least 80 percent survival.

The Sugar Creek critical habitat mitigation area will be monitored annually for at least 5 years following implementation of the mitigation activities and reported annually (Section 7.4.1).

6.3.2.4 *Proposed Activities – West Plum Creek CHU*

The West Plum Creek CHU occurs within and upstream of Chatfield Reservoir State Park and consists of about 90 stream miles and 5,518 acres (75 Fed. Reg. 78451 (December 15, 2010)). The proposed off-site mitigation for impacts to designated Preble's critical habitat in the Plum Creek arm will be the same as those described previously in Section 6.2.

6.3.2.5 *Anticipated Benefits – West Plum Creek CHU*

The off-site mitigation proposed to occur in the target habitat area (Figure 26) will complement the purposes of the proposed critical habitat designation. The location of the West Plum Creek CHU was proposed to address the large recovery population for Preble's identified for this watershed by the working draft of the Preble's Recovery Plan (74 Fed. Reg. 52081 (October 8, 2009)). The designation of critical habitat does not affect land ownership or establish a refuge, wilderness, reserve, preserve, or other conservation area. Critical habitat does

receive protection under Section 7(a)(2) of the Endangered Species Act through the prohibition against federal agencies carrying out, funding, or authorizing the destruction or adverse modification of critical habitat (74 Fed. Reg. 52071 (October 8, 2009)). Therefore, unless there is a federal action, the designation of critical habitat affords no habitat protection on private lands. The permanent protection of private lands within the West Plum Creek CHU is consistent with the designation as the protected lands would support the recovery of Preble's and afford protection of critical habitat on private lands not provided by the designation of critical habitat.

6.3.2.6 Success Criteria

The off-site critical habitat mitigation within the West Plum Creek CHU will be determined to be successful when the habitat has been permanently protected and enhanced habitat meets the criteria listed in Section 6.2.1.3.

6.4 Summary

Proposed mitigation activities range from on- and off-site conversion of one habitat type to another, to off-site conservation of target habitat, to sediment and erosion control and habitat improvements in Preble's critical habitat. The proposed activities will compensate for impacts to ecological functions that result from reallocation activities. The activities are based on construction techniques and conservation strategies that have been effectively used for other projects in the region (Sections 6.1.1, 6.2.1, and 6.2.2; Figure 3 through Figure 6).

Impacts and mitigation associated with noncritical habitat and with Preble's West Plum Creek critical habitat are tracked using the number of functional units (EFUs) for each target environmental resource. Impacts and mitigation associated with critical habitat mitigation in the Upper South Platte CHU are tracked using acres and stream miles. A total of 1,180 EFUs are estimated to be impacted by the project consisting of 775 EFUs in permanent impacts from inundation, 21 EFUs in permanent impacts from recreation facility modifications, and 384 EFUs in temporary impacts from activities associated with construction of modifications to utilities, roads, and recreation facilities.

Table 6 through Table 10 summarize impacts and proposed mitigation for comparison. Table 6 organizes by target environmental resource the impacts and proposed mitigation associated with the effects of inundation on critical and noncritical habitat. Table 7 organizes by target environmental resource the impacts and mitigation associated with the effects of relocating

recreation facilities, including borrow and fill activities and permanent facilities above and below 5,444 feet. Relocating the recreation facilities is estimated to permanently impact 21 EFUs. Table 8 provides the total number of EFUs impacted by inundation and recreation facility relocation, and the estimated number of EFUs anticipated to result from on- and off-site mitigation activities. Table 9 summarizes the acres of permanent and temporary impacts anticipated. Table 10 itemizes acres of on-site mitigation for each proposed habitat type in critical and noncritical habitat. The proposed on-site mitigation would focus on replacing upland grasslands with shrub and forested habitat. Of note, quantities in Tables 6 through 10 have been rounded to the nearest whole number, which may result in minor differences from quantities presented elsewhere in the FR/EIS.

Table 6. Acres and EFUs of Impacts and On- and Off-Site Mitigation for Impacts to Target Environmental Resources Resulting from Inundation.

Resource	Impacts		Estimated Mitigation				Comments
			On-site (est. available)		Off-site (max. needed)		
	Acres	EFUs	Acres	EFUs	Acres	EFUs	
Wetlands	158	123	47	30	Unknown	93	On-site wetland mitigation acres calculated assuming Lower Marcy Gulch mitigation areas are 100 percent wetlands and other areas are 20 percent wetlands.
Birds	586	377	165	9	Unknown	368	
Preble's Non-CH	298	210	111	43	Unknown	167	Preble's on-site mitigation acres and EFUs do not include mitigation areas along Deer Creek or Marcy Gulch because those areas are not considered Preble's habitat.
Preble's Plum Creek CH	75	65	6	3	Unknown	62	Off-site EFUs must be mitigated for within the West Plum Creek CHU.
Preble's South Platte River CH	80	NA	17	NA	73 acres/ 1.3 stream miles	NA	Preble's EFUs are not used in calculations of impacts or mitigation for Preble's habitat in the Upper South Platte CHU. 4.5 miles of Sugar Creek will be improved.
Mature Cottonwood	43	NA	13	NA	29	NA	Mitigation areas SPR-2,3,5 are designated for on-site cottonwood regeneration. Cottonwood mitigation EFUs are not calculated separately, but are reflected in Preble's, bird, and wetland EFUs.
Inundation EFU Subtotal		775		85		690	

Table 7. Acres and EFUs of Impacts and On- and Off-Site Mitigation for Impacts to Target Environmental Resources from Recreation Facility Relocation Activities.

Resource	Impacts		Estimated Mitigation				Comments
			On-site (est. available)		Off-site (max. needed)		
Permanent Impacts Associated with Recreation Facility Relocation							
Permanent Facilities above 5,444 feet (there are no permanent facilities below 5,444 feet)							
	Acres	EFUs	Acres	EFUs	Acres	EFUs	
Preble's Non-CH	2	1	0	0	Unknown	1	Permanent impacts estimated using existing areas of permanent facilities, final impact to be provided by Tetra Tech/EDAW.
Preble's Plum Creek CH	0	0	0	0	0	0	
Preble's South Platte CH	0	NA	0	NA	0	NA	
Birds	30	19	0	0	Unknown	19	
Wetlands	1	1	0	0	Unknown	1	
Total Permanent EFUs		21				21	
Temporary Impacts Associated with Recreation Facility Relocation							
Borrow, Fill, and Utility Line Areas above 5,444 feet (temporary impacts)							
	Acres	EFUs	Acres	EFUs	Acres	EFUs	
Preble's Non-CH	12	6	12	6	0	0	Because impacts to borrow, fill, and utility line areas above 5,444 feet will be mitigated in-place and in-kind, there will be no net change in acres of habitat or EFUs.
Preble's Plum Creek CH	1	1	1	1	0	0	
Preble's South Platte CH	0	NA	0	NA	0	0	
Birds	173	109	173	109	0	0	
Wetlands	3	2	3	2	0	0	
Borrow, Fill, and Utility Line Areas below 5,444 feet							
	Acres	EFUs	Acres	EFUs	Acres	EFUs	
Preble's Non-CH	83	40	88	42	0	0	To simplify calculations and avoid double counting impacts, it is assumed borrow and fill areas below 5,444 feet will be restored to their current conditions prior to being inundated or, in the case of the borrow areas below 5,444 feet, modified for use as mitigation areas PC-1 and SPR-1. Impacts associated with inundation of these areas are included in the inundation impact calculations.
Preble's Plum Creek CH	5	3	5	3	0	0	
Preble's South Platte CH	1	NA	1	NA	0	0	

COMPENSATORY MITIGATION PLAN

Resource	Impacts		Estimated Mitigation				Comments
			On-site (est. available)		Off-site (max. needed)		
Birds	183	117	183	117	0	0	
Wetlands	132	105	132	105	0	0	
Total Temporary EFUs		384¹		384^{1, 2}			
Recreation EFU Impacts		405		384		21	

¹ Individual temporary resource EFU impacts and mitigation values do not add to 384 because of the effects of rounding to whole numbers.

² Of the 384 EFUs of on-site mitigation, 118 EFUs are above 5,444 feet and 265 are below 5,444 feet.

Table 8. Total EFU Impacts and Estimated Mitigation.

Impacts		Mitigation				
Impact Activity Subtotals (from Tables 4 and 5)	Impacted EFUs	On-site, in- place EFUs	Compensatory Mitigation			Total Mitigation
			On-site EFUs	Off-site EFUs	Total Compensatory Mitigation	
Inundation	775	0	85	690	775	775
Recreation Facility Permanent Footprint	21	0	0	21	21	21
Recreation Facility Borrow, Fill, and Utility Areas Restored In-place	384	384 ¹	0	0	0	384
TOTAL EFUs	1,180	384	85	711	796	1,180

¹In-place mitigation for borrow, fill, and utility areas includes 265 EFUs below 5,444, which are assumed to be mitigated in-place prior to inundation, resulting in 118 EFUs of net in-place mitigation above 5,444.

Table 9. Acres of Impacts from Inundation and Recreation Facility Relocation Activities.

Type of Impact	Impact Acres	
	Subtotal	Total
1. Permanent		
a. Inundation	586	
b. Recreation facilities (above 5,444)	30	
Permanent Impacts		616
2. Temporary (Borrow, Fill, and Utility Areas above 5,444)		173
TOTAL		789

Table 10. Types and Acres of On-Site Mitigation Habitat Types in Critical and Noncritical Habitat.

On-Site Mitigation Habitat Types	Acres			
	Plum Creek Critical Habitat	South Platte River Critical Habitat	Noncritical Habitat	Total
Scrub-shrub wetlands	1	3	28	33
Riparian shrubs	3	10	85	99
Forested riparian	1	3	28	33
TOTAL	6	17	142	165

7.0 IMPLEMENTATION

7.1 Process

The Corps, the CDNR, and the water users (Chatfield Water Providers) will each have complementary responsibilities for ensuring the accomplishment of the reallocation, and of the CMP and the Recreation Modification Plan (the Plans), as described in this CMP.

The Department of the Army and the CDNR will enter into a Water Storage Agreement (WSA) setting out their respective obligations for reallocating the designated water supply storage, and for accomplishing the two Plans. The CDNR will then execute subagreements, identical in their terms and conditions, with each of the Chatfield Water Providers. The subagreements will set out the responsibilities of the Chatfield Water Providers to the CDNR for funding the reallocation of the water supply storage under the WSA, and for undertaking the CDNR's obligations to the U.S. Government under the WSA for implementing the Plans. The subagreements, however, will not affect the ultimate duty of the CDNR and the U.S. Government to fulfill their reciprocal obligations under the WSA, unless the WSA is suitably modified by mutual consent of the Corps and the CDNR. However, the Corps continues to have discussions with the State and the Chatfield Water Providers to further refine the legal relationship between the entities.

After execution of the WSA, the Chatfield Water Providers will place the funds then judged necessary to satisfy all of the nonfederal obligations under the WSA into an escrow account. The Chatfield Water Providers will also create a new nonprofit corporation called the Chatfield Reservoir Mitigation Company as a vehicle for facilitating the coordinated management of the process for implementing the Plans. Through the subagreements with CDNR, the monitoring will be performed by the Chatfield Water Providers as part of the nonfederal responsibilities for operation and maintenance of the mitigation sites.

In accordance with the terms of the WSA, senior management oversight of the implementation of the Plans will reside in the Project Coordination Team, consisting of senior management representation from the Corps, the CDNR, and the Chatfield Water Providers. The Project Coordination Team shall consult on the progress of the nonfederal work being undertaken pursuant to the Plans, with a view toward anticipating and offering solutions to potential problems to the Plans' scheduled completion and make recommendations to the Omaha

District Commander. The Corps has the final authority on acceptance or rejection of the Project Coordination Team’s recommendations.

7.1.1 On-Site Mitigation Process

The CMP specifies the on-site mitigation activities including where the activities will occur, when they will occur, the scope of the activity, how the activity will be accomplished, the estimated range of EFUs to be gained from the activity, the criteria for determining success, and any specific monitoring requirements in addition to the monitoring required for all compensatory mitigation activities.

Upon approval of the Federally Recommended Plan, preliminary plans will be prepared and submitted for Corps’ approval prior to the development of final design documents. The detailed plans developed for each on-site mitigation activity will require construction, earthwork, grading, and planting or seeding. If additional mitigation areas are identified later, such as during adaptive management, similar mitigation activities can use typical plans and specifications for common components of the mitigation activities. These plans will include the information listed in Proposed Activities (Section 6.1.1.1).

Mitigation activities not requiring construction, earthwork, and/or grading (i.e., land conservation activities with improvements) will be required to provide the following information in a plan. Similar mitigation activities can use “typical specifications” for common components of the mitigation activities.

- Location map showing where the activity will occur within Chatfield State Park;
- A description of what will occur within the mitigation area;
- Plan view of the mitigation site showing where specific activities will occur;
- Plant materials and seeding plan; and
- Weed control plan.

All plans for on-site mitigation will be submitted to the Project Coordination Team for review and comment, and will be reviewed by Colorado State Parks for consistency with management of Chatfield State Park.

7.1.2 Off-Site Critical Habitat Mitigation Process

The CMP specifies the off-site mitigation activities for impacts to designated critical habitat. These activities involve structural and nonstructural habitat enhancements that will occur within

the Upper South Platte CHU in the Pike National Forest and have been coordinated with the USFS and Service. The CMP also includes mitigation that will occur in the West Plum Creek CHU. The CMP specifies the off-site mitigation activities in the Upper South Platte CHU including where the activities will occur, the scope of the activity, how the activity will be conducted, criteria for determining success, and any specific monitoring requirements in addition to the monitoring required for all compensatory mitigation activities. Upon approval of the Federally Recommended Plan, preliminary plans will be prepared and submitted for Corps' approval prior to the development of final design documents. Detailed plans will be developed for each mitigation activity in the Upper South Platte CHU. These plans will be reviewed by the Service and USFS and will need their approval prior to implementation. The approved plans will be contained in the project decision documents. An agreement relating to the Sugar Creek Sediment Mitigation Project (Appendix E) sets forth the process and criteria for approval of off-site critical habitat mitigation in the Upper South Platte CHU. The plans for critical habitat mitigation on USFS lands will include the following:

- Location map showing where the activity will occur within the Pike National Forest and the Upper South Platte CHU;
- A description of what will occur within the mitigation site;
- Detailed plans and specifications for any proposed construction; and
- For any planting or seeding, the same requirements specified for plant materials and seeding listed for on-site mitigation.

The off-site critical habitat mitigation in the West Plum Creek CHU will follow the process described in Section 7.1.3.

7.1.3 Off-Site Mitigation Process

About 5,917 acres of private lands have been identified within the Chatfield Reservoir watershed that could be permanently protected and managed in a way that benefits habitat for Preble's and birds and permanently protects riparian and wetland habitats (Figure 25). Each private property or portion of a private property considered for permanent protection will need to be evaluated for the following:

- Fair market value of land to be protected (real estate appraisal);
- Baseline EFUs associated with the property and the potential net gain of EFUs associated with protection, enhancements, and long-term management; and

- Suitability of property to contribute to meeting the off-site compensatory mitigation objectives.

Property evaluations will be the responsibility of the Chatfield Water Providers (Section 7.2.1). The Chatfield Water Providers will coordinate with the Project Coordination Team (Section 7.2.1) regarding the protection of properties. Permanently protecting any private property, or portion of private property, that is within the off-site target habitat and any associated buffers (Appendix C) will count toward contributing to off-site mitigation objectives without review and comment by the Project Coordination Team. Permanently protecting private lands that do not occur within the off-site target habitat and any associated buffers will be subject to review and approval by the Project Coordination Team prior to the property counting toward contributing to the off-site mitigation objectives.

For protection of a property to be considered fully implemented, the Chatfield Water Providers must produce the following documentation to the Project Coordination Team:

- Copy of original deed for Corps real estate section records;
- A description of the property protected that includes a legal description, a general location map, a map of the property boundaries, and the target habitat and any associated buffers on an aerial imagery background at a scale of 1" = 1,000';
- A copy of the legal instrument that permanently protects the property; and
- Recent on-the-ground photographs that characterize the protected property.

All protected properties will be managed by the Chatfield Water Providers, or its designee, to benefit one or more of the target environmental resources. The Chatfield Water Providers will have 2 years from submittal of the protection documentation to develop a management plan for the protected property and submit it to the Project Coordination Team and Technical Advisory Committee for their review and comment and approval by the Corps. Activities will consist of either land conservation by acquisition or easements to protect areas with the target environmental resources, to be managed to maintain current conditions, or land conservation with additional improvements to the property that benefit the target environmental resources.

Each management plan will do the following:

1. Provide baseline data on physical and biological attributes and EFUs.
2. Establish management objectives including:
 - a. Provide or maintain ecological and conservation benefits to Preble's;

- b. Protect and enhance a naturally functioning system to maintain a dynamic mosaic of riparian vegetation communities;
 - c. Reduce threats such as noxious weeds and fire; and
 - d. Provide an initial estimate of EFUs to be gained from enhancements and management including an estimated schedule for proposed enhancements and management; the final number of EFU credits will be updated after the enhancements and management actions are implemented, and credited as described in Section 7.2.
3. Provide strategies to achieve the management objectives.
 4. Establish success criteria for determining if the management objectives have been met.
 5. Provide a plan and schedule to monitor riparian vegetation and overall condition of the property.
 6. Evaluate enhancement and/or management success, as appropriate depending on whether enhancements were included with the land conservation, using periodic surveys and vegetation monitoring data.
 7. Identify the need to implement adaptive management measures if necessary, and revise the management plan.

The management plan will identify specific management activities that may include:

1. Managing livestock grazing and adverse recreation impacts by either eliminating grazing or erecting and maintaining fences to protect the riparian corridor.
2. Providing signage and meeting with neighbors and the public to increase awareness of conservation efforts.
3. Reducing the threat of fires using mowing, fire breaks, or controlled burns where needed.
4. Coordinating fire response with local, state, and federal fire management entities.
5. Stabilizing erosion or channel downcutting, as needed, caused by increased urban runoff.
6. Planting or seeding with native species to improve habitats.
7. Controlling invasive nonnative plants if necessary and feasible.

Monitoring of all protected properties will document the EFUs preserved and gained for each property and success and failures in the implementation of the management plan. Monitoring of protected properties will occur over the life of the project to ensure the properties are managed as specified in the required management plans. The frequency of the long-term monitoring will be specified in the management plan for each property. Long-term monitoring will determine if

corrective actions need to occur to maintain the benefits to the target environmental resources for which the property was protected and managed.

7.1.4 EFU Determination Process

The existing EFUs for each mitigation site will be documented prior to implementing a mitigation activity. EFUs are calculated by multiplying the ecological functional index of each Chatfield Reservoir habitat-mapping unit by the acreage of the habitat unit in the area of interest (Appendix C).

The range of EFUs provided by a mapped habitat unit must be determined to accurately and consistently determine existing EFUs or EFUs gained from a mitigation activity or by protecting property. For example, although a broad area may be mapped as high value riparian habitat for Preble's, in reality, the area is made up of a mosaic of smaller habitat patches that provide varying EFUs. The method for more finely calculating EFUs needs to be finalized and field calibrated. The method for determining the existing EFUs and EFUs gained will be finalized between receipt of comments on the draft FR/EIS and the final decision documents. The status of the methods and the process for finalizing the methods are presented in Appendix C, Section 5.

For the purposes of the CMP, the existing EFUs and EFUs gained from mitigation activities have been preliminarily estimated using the assigned values in Table 11 and existing habitat mapping for Chatfield Reservoir and the watershed.

Table 11. Ecological Functional Values (EFVs) for Habitat Attributes and Ecological Functional Indices (EFIs) for Habitat Types.

Chatfield EIS Mapping Habitat Unit	Preble's EFV				Bird EFV				EFI=Avg. of EFV for each Target Resource
	Breeding	Winter	Forage	Cover	Species Richness	Species Abundance	Supports Sensitive spp.	Limited Habitat (local or regional)	
Preble's Habitat					Not Applicable to Preble's Habitat				
High Value Riparian	1	1	1	1					1
Low Value Riparian	0.50	0.50	0.75	0.75					0.63
Upland	0.25	0.25	0.75	0.50					0.44
Nonhabitat	0	0	0	0					0
Bird Habitat	Not Applicable to Bird Habitat								
Shrub (riparian)					0.75	1	0.25	0.75	0.69
Trees					0.75	0.75	0.50	0.75	0.69
Upland					0.50	0.50	1	0.50	0.63
Wetland/Nonwoody					1	0.75	0.25	1	0.75
Mature Cottonwood					0.75	0.75	0.50	1	0.75
Nonhabitat					0	0	0	0	0
Wetland Habitat	Wetland Habitat EFIs Were Developed Using FACWet (ERO 2010)								
Lacustrine Emergent								0.67	
Palustrine Aquatic Bed								0.75	
Palustrine Emergent								0.79	
Palustrine Forested								0.82	
Palustrine Scrub-Shrub								0.79	

The following steps are needed to refine and implement a method to accurately calculate and track EFU mitigation credits for Preble's and bird habitat. These steps will be completed between the receipt of comments on the draft FR/EIS and the final decision documents.

1. Finalize a field data form that allows quantification of habitat parameters that directly relate to habitat attributes used to generate ecological functional values and indices (Appendix C, Section 5.1).
2. Complete a field test of the data form.
3. Refine and finalize the data form.
4. Perform fieldwork using final data form to document baseline conditions of habitat categories mapped for the FR/EIS (fieldwork must be extensive enough to capture variations within habitat categories).
5. Assign ranges of ecological functional indices to each habitat category based on fieldwork. The ranges would be based on variations within each habitat category of mapped habitat. This will allow for tracking gains in EFUs for activities, such as

weed control, that do not change habitat from one type to another but that do increase the ecological value of the habitat type.

6. Use data form to document existing EFUs in each specific mitigation area.
7. Determine the anticipated number of EFUs that will be gained from mitigation activities in each specific area by using data forms to establish opportunities for enhancement.
8. Periodically monitor mitigation areas to document progress toward target conditions.

This method will be field tested and finalized between receipt of comments on the draft FR/EIS and the final decision documents.

The preliminary estimates of EFUs gained presented in the CMP are relatively accurate because they typically involve dramatic changes (e.g., uplands to wetlands). The preliminary estimates of EFUs will be finalized when the method for determining EFUs in the field is finalized. All finalized EFUs will be documented in the annual monitoring reports (Section 7.2.1).

7.2 Schedule

If the reallocation is approved, the Chatfield Water Providers will begin implementing the CMP as soon as practicable following the approval. The CMP establishes milestones and incentives to ensure the environmental mitigation is fully implemented in a timely manner. Because the environmental mitigation is substantial and will take years to implement, it will be implemented incrementally according to its respective priorities. On-site mitigation also needs to coincide with the recreation facilities modification, which will also disturb Chatfield State Park, so that the total disturbance and duration of disturbance to Chatfield State Park is minimized. Table 12 presents an estimated schedule for environmental mitigation relative to key events in the reallocation review and approval process (e.g., release of the draft FR/EIS and final decision documents).

Table 12. Estimated Schedule for Environmental Mitigation.

Year	Activities
0	Draft FR/EIS released to public.
1	Recreation facilities design and environmental mitigation design in progress.
2	Record of Decision, Reallocated Storage Contracts, recreation facilities modification begin, on-site environmental mitigation begins, and off-site Preble’s critical habitat mitigation begins.
3	Recreation facility modification, on-site environmental mitigation, and off-site critical habitat mitigation continue. Environmental mitigation monitoring begins.
4	Recreation facility modification, on-site environmental mitigation, off-site critical habitat mitigation, and implementation of 25 percent of off-site noncritical habitat mitigation completed. Environmental mitigation monitoring continues.
5	Complete implementation of 50 percent of off-site noncritical habitat mitigation. Environmental mitigation monitoring continues.
6	Complete implementation of 70 percent of off-site noncritical habitat mitigation. Environmental mitigation monitoring continues.
7	Complete implementation of 90 percent of off-site noncritical habitat mitigation. Environmental mitigation monitoring continues.
9–13+	Management of environmental mitigation sites continues to meet success criteria. Environmental mitigation monitoring continues.

By implementing the CMP soon after approval and the execution of the WSA and the subagreements, mitigation EFUs will accrue over the first 3 years of reallocation before any inundation within the reallocated storage space occurs (Table 13). There would be a net increase in EFUs in the early years following the reallocation approval (i.e., mitigation EFUs plus existing EFUs) because the impacts from inundation to the target environmental resources would not occur until at least 3 years following reallocation approval. The total count of 725 EFUs in Table 13 does not equal the total number of EFUs estimated to be needed because Table 13 addresses crediting for implementation of mitigation and the last increment (10 percent) of off-site mitigation (year 6) will be based on the results of meeting the success criteria defined in the approved management plans in accordance with the CMP. The remaining needed EFUs will be gained from mitigation meeting the success criteria estimated to occur in years 7 through 11 (Table 14).

The final design for environmental mitigation will occur between the receipt of comments on the draft FR/EIS and the final decision documents (Table 12). This will allow the implementation of mitigation to begin as soon as feasible following the execution of the WSA and the subagreements.

Table 13. Compensatory Mitigation Implementation Schedule and Reallocated Storage Milestones.

Year Following Approval	Milestone	Estimated EFUs Gained Per Milestone	Estimated Running Total of EFUs Gained Per Milestone	Estimated % of EFUs Gained of Total EFUs Needed	% of Reallocated Storage Available	Approximate Maximum Pool Elevation (ft) ⁴
3	Complete implementation of all on-site compensatory mitigation, including on-site mitigation in critical habitat ¹	85	85	9	10	5,433.0
3	Complete implementation of all off-site mitigation of impacts to Preble's critical habitat on the South Platte River arm	-- ²	-- ²	-- ²	20	5,435.0
3	Complete implementation of off-site mitigation to gain 100% of needed Preble's EFUs in the West Plum Creek CHU including implementation of 25% of off-site mitigation	178	263	26	25	5,435.5
4	Complete implementation of 50% of off-site mitigation	178	441	44	45	5,437.5
5	Complete implementation of 70% of off-site mitigation	142	583	59	60	5,440.0
6	Complete implementation of 90% of off-site mitigation ³	142	725	73	80	5,442.0

¹ Includes restoration and revegetation of borrow areas and temporary impacts associated with the relocation of recreation facilities.

² Preble's critical habitat impacts and mitigation in the Upper South Platte CHU are calculated in terms of acres and stream miles. For purposes of the CMP schedule, completion of the implementation of all mitigation of Preble's Upper South Platte CHU will allow use of another 10 percent of the reallocated storage.

³ The last increment (10 percent) of off-site mitigation will be based on the results of meeting the success criteria defined in the approved management plans in accordance with the CMP (i.e., 85 on-site EFUs + (0.9 x 711) off-site EFUs = 724.9 EFUs).

⁴ Storage between elevation 5,444 feet and 5,442 feet cannot exceed 30 days within any calendar year until the CMP is fully implemented.

Table 14. EFUs Gained and Reallocated Storage Milestones.

Year Following Approval	% of Total EFUs Gained	Additional % of Reallocated Storage Available¹
7	80	0 ²
8	85	5
9	90	10
10	95	15
11	100	20

¹Additive to the percent of reallocated storage available to the Chatfield Water Providers once the CMP has been 80 percent implemented.

²No credit is given for providing up to 80 percent of the EFUs because it is estimated that 80 percent of the EFUs will be provided with implementation of the mitigation activities.

7.2.1 Environmental Mitigation Escrow Fund

The Chatfield Water Providers will establish an environmental mitigation escrow fund that will be at least equal to the estimated cost of fully implementing and completing the CMP including a reasonable contingency. The funding amount will be established by the Project Coordination Team based on information provided in the FR/EIS and will consider funds already expended toward implementing the CMP prior to establishment of the escrow fund. The establishment of the escrow fund prior to any storage in the reallocated space will allow the Chatfield Water Providers to fully use the reallocated storage subject to the following conditions:

1. Storage between elevations of 5,444 feet and 5,442 cannot exceed 30 days within any calendar year until the CMP is fully implemented; and
2. If the Chatfield Water Providers are unable to meet the mitigation schedules shown in Table 13 and Table 14, the ability to use storage will be defined by the mitigation milestones described in Section 7.2.2 until mitigation implementation and EFUs gained meet the milestones in Table 13 and Table 14.

The limitation on storage above 5,442 feet in elevation until the CMP is fully implemented is intended to delay losses of woody riparian vegetation until the CMP is fully implemented. The limitation in storage above 5,442 feet in elevation assumes an estimated new OHWM of 5,442 feet and that water will be infrequently stored above 5,442 feet with reallocation. The elevations between 5,444 feet and 5,442 feet contain a substantial amount of vegetation that could be lost to inundation. Information presented in the FR/EIS demonstrates that most of the riparian vegetation associated with a new OHWM would likely tolerate up to 30 days of inundation.

7.2.2 Mitigation Milestones

In order to fully use the reallocated storage, as described in Section 7.2.1, the Chatfield Water Providers must meet the mitigation schedules shown in Table 13 and Table 14. If these mitigation milestones are not met, the ability to use the reallocated storage will be defined by the phased use of the storage shown in Table 13 and Table 14 until mitigation implementation and EFUs gained meet the milestones. This approach will ensure that the Chatfield Water Providers continually make progress toward meeting goals and objectives of the CMP or they will not fully benefit from use of the storage reallocation. The compensatory mitigation activities have two major components: 1) implementation, and 2) meeting the success criteria for gained EFUs. The mitigation schedule and use of reallocated storage milestones (Table 13 and Table 14) are linked to these two major components. Of these two major components, implementation is the most expensive and results in the majority of the EFUs gained. Implementation of the compensatory mitigation measures listed in Table 13 will provide about 80 percent of the estimated noncritical habitat EFUs needed for compensatory mitigation (i.e., 573 EFUs estimated to be gained with implementation out of the estimated maximum total of 796 EFUs needed, assuming the last increment of 10 percent of off-site mitigation will not be needed because the maximum estimated impacts will not occur). Therefore, 80 percent of the use of reallocated storage is linked to implementation and 20 percent of the use of reallocated storage is linked to meeting the success criteria defined in the approved management plans in accordance with the CMP.

For the purposes of the CMP, “fully implemented” means that the mitigation activity has been implemented as described in the CMP and if required, an as-built report has been submitted to the Corps. For off-site mitigation activities that involve protection of private lands, “fully implemented” means a recordation of a conservation easement, deed restriction, or other protective instrument. “Fully implemented” does not imply that all success criteria have been met. Ultimately, for the CMP to be fully implemented and functioning, the following must occur:

- All on-site mitigation activities have been implemented (up to 85 on-site compensatory EFUs);
- All critical habitat mitigation activities have been implemented; and

- Sufficient off-site mitigation has been implemented (up to 711 EFUs) and management activities are in place such that over time, when combined with on-site mitigation, up to the 796 EFUs lost due to reallocation will be offset.

The compensatory mitigation implementation milestones are listed in Table 13. The CMP is multifaceted and involves a substantial amount of land transactions. It is anticipated that it will take 6 years to fully implement the CMP. The milestones in Table 13 are listed in order of priority and are additive when determining if the percent of water stored in the reallocated space is available to the Chatfield Water Providers. That is, all of the on-site compensatory mitigation needs to be implemented before credit toward the use of reallocated storage is given for the implementation of Preble's critical habitat mitigation. The following is a discussion of the mitigation milestones and associated use of the reallocated storage if the Chatfield Water Providers are unable to meet the mitigation milestones.

Following the completion of the modification of the recreation facilities, the Chatfield Water Providers will, at their option if the use of the Providers' water rights is involved, and as water is available, use the percentage of reallocated space at Chatfield Reservoir available for their use based on their progress in meeting the mitigation milestones (Table 13 and Table 14).

Although mitigation activities will be implemented according to the schedule in Table 13, accumulation of EFUs credited toward mitigation objectives would occur over time as management and enhancement measures result in desired changes in vegetation. Post-implementation use of the remaining 20 percent of the reallocated storage will be linked to providing the remainder of the required compensatory mitigation to ensure that the compensatory mitigation activities, once implemented, also fully meet the objectives of the CMP. Because most of the EFUs are estimated to be gained with implementation of the compensatory mitigation activities, the use of reallocated storage is weighted toward meeting the implementation EFU objective. The compensatory mitigation milestones for successfully providing the remaining EFUs are listed in Table 14. The milestones for successfully providing the remaining EFUs are additive to successfully meeting the final implementation milestones. That is, once 100 percent of the on-site critical habitat and 90 percent of the off-site mitigation has been successfully implemented, the EFUs gained milestones (Table 14) are added to the milestone for 80 percent use of the reallocated storage.

The EFUs gained from habitat enhancements and management of lands protected associated with the milestones in Table 13 could begin soon after the property is protected, but will likely take a few years to develop and be documented, and will vary with the pre-protection condition of the property, the type of enhancements, and management direction. The schedule in Table 14 assumes that it will take an average of about 5 years of management and habitat improvement to realize the target gains in EFUs reflected in Table 14. However, properties protected in year 3 could be meeting their EFU targets for habitat improvement by year 6, or the Chatfield Water Providers could decide to protect more areas of higher quality habitat (resulting in a higher gain in implementation EFUs) and pursue less off-site habitat improvement. In the event that the Chatfield Water Providers are unable to meet the mitigation schedules and their use of storage is defined by the mitigation milestones they have met, meeting any of the milestones earlier than indicated in Table 14 will allow a corresponding earlier use of the reallocated storage. For example, if 95 percent of the total needed EFUs for compensatory mitigation are met in year 8, then the Chatfield Water Providers would be able to use 95 percent of the reallocated storage (80 percent from Table 13 plus 15 percent from Table 14).

7.2.2.1 On-Site Enhancement

On-site compensatory mitigation activities (Section 6.1) will be implemented first. Disturbance to Chatfield State Park can be minimized by implementing all of the on-site mitigation measures in 3 years including the estimated 2 years when Chatfield State Park will be disturbed by the relocation of recreation facilities.

7.2.2.2 Mitigation for Designated Critical Habitat

Implementation of mitigation activities for impacts to Preble's designated critical habitat in the Upper South Platte CHU are scheduled to occur during the 3 years following the approval of reallocation. Implementation of mitigation activities for impacts to Preble's designated critical habitat in the West Plum Creek CHU are also scheduled to occur during the 3 years following the approval of reallocation. On-site critical habitat mitigation in both CHUs will occur as part of the on-site mitigation activities discussed above. On- and off-site critical habitat mitigation activities can begin as soon as possible following approval of the reallocation. The proposed off-site mitigation within the critical habitat on Sugar Creek in the Pike National Forest is extensive and it is anticipated that it will take 3 years to fully implement.

7.2.2.3 *Off-Site Mitigation Measures*

Implementation of the off-site mitigation measures will occur over the 6-year mitigation implementation period. It is anticipated that the lands protected for mitigation will begin in the first year following reallocation approval. As discussed above, years 1 through 3 of the mitigation implementation period will focus on on-site and critical habitat mitigation in the Upper South Platte CHU; however, 25 percent of the off-site mitigation will be implemented by year 3 (Table 13).

7.3 Responsibilities for Compensatory Mitigation

The Department of the Army and the CDNR will enter into a WSA setting out their respective obligations for reallocating the designated water supply storage and implementing the CMP. The CDNR will then execute subagreements, identical in their terms and conditions, with each of the Chatfield Water Providers. The subagreements will set out the responsibilities of the Chatfield Water Providers to the CDNR for undertaking the CDNR's obligations to the U.S. Government under the WSA for implementing the CMP. However, the Corps continues to have discussions with the State and the Chatfield Water Providers to further refine the legal relationship between the entities.

After execution of the WSA, the Chatfield Water Providers will place the funds then judged necessary to satisfy all of the nonfederal obligations under the WSA, including implementation of the CMP, into an escrow account. The Chatfield Water Providers will also create a new nonprofit corporation called the Chatfield Reservoir Mitigation Company as a vehicle for facilitating the coordinated management of the process for implementing the CMP.

In accordance with the terms of the WSA, senior management oversight of the implementation of the Plans will reside in the Project Coordination Team, consisting of senior management representation from the Corps, the CDNR, and the Chatfield Water Providers. The Project Coordination Team shall consult on the progress of the nonfederal work being undertaken pursuant to the Plans, with a view toward anticipating and offering solutions to potential problems to the Plans' scheduled completion and make recommendations to the Omaha District Commander. The Corps has the final authority on acceptance or rejection of the Project Coordination Team's recommendations. The CMP has a robust plan for ensuring that the mitigation is implemented in a timely manner which includes the following:

- The Corps will retain authority over implementation of the mitigation.
- The obligation to implement the CMP as specified in the project decision documents will be specified in the WSA and subagreements between Chatfield Water Providers and CDNR. However, the Corps continues to have discussions with the State and the Chatfield Water Providers to further refine the legal relationship between the entities.
- Each of the 12 Chatfield Water Providers will be required to be a member of the Chatfield Reservoir Mitigation Company, which will remain incorporated until all compensatory mitigation obligations have been successfully met and all monitoring and financial obligations are completed.
- The Chatfield Water Providers will be responsible for paying all compensatory mitigation obligations. This will be enforced through the conditions of membership in the Chatfield Reservoir Mitigation Company.
- The mitigation for impacts to Preble’s habitat will be specified in the Service’s Biological Opinion and incorporated into the project decision documents and the Reallocated Storage User Agreements.
- The mitigation for impacts to designated critical habitat along Sugar Creek will be enforced by the Challenge Cost Share Agreement between Douglas County, the USFS, and the Chatfield Reservoir Mitigation Company (Appendix E).
- As described in detail below, there is a process for overseeing and reporting mitigation implementation and the monitoring of mitigation success.
- As described in Section 7.2, the CMP has established milestones for implementation of mitigation and incentives to meet the milestones.

The Chatfield Water Providers plan to form a nonprofit corporation, known as the Chatfield Reservoir Mitigation Company, which will be responsible for the day-to-day tasks of implementing the obligations in the project decision documents, including the CMP and other mitigation obligations. Ongoing discussions are taking place between the Chatfield Water Providers, CDNR, Colorado Parks and Wildlife, and CWCB regarding implementation roles and responsibilities for those entities. Information provided in this section represents the most current proposal from the Chatfield Water Providers at the time of printing; however, potential revisions and additional details regarding this aspect of the CMP may be included in the project decision documents.

The Chatfield Reservoir Mitigation Company would be empowered to own land, hold conservation easements, enter into contracts, and employ staff on behalf of the Chatfield Water Providers. Figure 32 shows the relationship of the Chatfield Reservoir Mitigation Company to other organizations involved in the Project (discussed below).

The Chatfield Reservoir Mitigation Company would annually elect directors (currently assumed to be five) to manage the implementation of all mitigation obligations. The responsibilities of the directors would include:

- Implementation of the mitigation obligations described in the project decision documents with oversight by the Project Coordination Team;
- Management of the mitigation project;
- Contract for mitigation activities and manage such contracts;
- Oversee the writing of periodic reports, as follows:
 - Annual report of overall progress,
 - As-built reports for facilities,
 - Monitoring reports,
 - Adaptive management analyses, and
 - Design reports;
- Monitor operations;
- Obtain reviews and approvals from other involved agencies;
- Implement invoicing for annual assessments of members; and
- Acquire lands, easements, or rights-of-way, as needed, on behalf of the Chatfield Water Providers and then manage protected properties.

The Project Coordination Team will be created in the WSA between the Corps and CDNR and the Reallocated Storage Users Agreement between CDNR and each Chatfield Water Provider. The Project Coordination Team consists of representation from the Corps and CDNR and is the vehicle by which the Corps and CDNR will have the opportunity to oversee the design, construction, and implementation of the Chatfield Reallocation Project. The Team will be kept informed on the progress of the project, will be responsible for reviewing project documents or other information, and will provide comments or recommendations, as appropriate, to the Chatfield Water Providers for their consideration.

The Project Coordination Team will be responsible for providing comments annually to the Company as to whether the CMP:

- Is being implemented according to the approved management plans;
- Is trending positively in meeting the success criteria defined in the approved management plans;
- Needs adjustments; and

- Has been fully implemented and successfully meets the success criteria defined in the approved management plans and so determines monitoring can be concluded in whole or in part.

The Project Coordination Team can create advisory committees if it determines that the advice from such committees may be helpful. Such advisory committees would be created to provide review and comments upon the activities conducted to implement all of the mitigation obligations, including the CMP. Two such committees, the Technical Advisory Committee and the Operations Advisory Committee, will be created to provide assistance with technical and operational issues. The Chatfield Reservoir Mitigation Company will have discretion to accept or reject, in whole or in part, the recommendations from its advisory committees (Figure 32). The Technical Advisory Committee will tentatively be comprised of representatives from the following:

- Environmental organizations;
- Chatfield Water Providers;
- Colorado Division of Parks and Wildlife;
- Chatfield State Park;
- Douglas County Land Trust or other land conservation organization;
- Colorado Water Conservation Board and/or CDNR;
- Denver Water;
- U.S. Army Corps of Engineers;
- U.S. Fish and Wildlife Service; and
- Other “in-stream” interests.

The Technical Advisory Committee will provide review and comments on technical components of the implementation process including the following:

- Suitability of private properties for lands protection and enhancement that occur outside the off-site target mitigation area;
- Management plans for off-site properties;
- Technical questions regarding proposed changes to the CMP resulting from the adaptive management process (Section 7.5);
- Annual Monitoring Report; and
- Other aspects of the project requested by the Chatfield Water Providers.

The Operational Advisory Committee will provide review and comments on mitigation obligations related to operational issues. The principal goal of the committee is to facilitate efficient collective operations. The committee would tentatively be composed of the following:

- Corps representative;
- All of the Chatfield Water Providers;
- Denver Water representative; and
- Colorado State Engineers Office representative.

7.3.1 Responsible Party Contact Information

Chatfield Water Providers (temporary contact information):

William R. (Rick) McCloud
Water Resources Manager
Centennial Water and Sanitation District
62 West Plaza Drive
Highlands Ranch, CO 80126
303-791-0430
Fax: 303-791-0437
email: RMcCloud@highlandsranch.org

7.4 Monitoring

The goal of monitoring is to 1) determine if the estimated maximum impacts to the target environmental resources stated in the CMP that form the basis of the mitigation objectives need to be revised, 2) document that compensatory mitigation activities are properly and fully implemented, 3) ensure the defined compensatory mitigation objectives are met, and 4) provide information needed for adaptive management (Section 7.5). The following monitoring actions are common to all mitigation activities:

- Documentation that the mitigation activity has been fully implemented (e.g., as-built report, recordation of a conservation easement for protected properties, or report on habitat enhancement activities);
- Documentation of progress in meeting the success criteria;
- Recommended corrective actions;
- Management or corrective actions taken since last monitoring; and
- Number of EFUs gained to date.

Through the subagreements with CDNR, the monitoring will be performed by the Chatfield Water Providers as part of the nonfederal responsibilities for operation and maintenance of the

mitigation sites. Monitoring will occur at least annually until the entire CMP is fully implemented. Each individual mitigation activity will be monitored at least annually for a minimum of 5 years or until success criteria are met. If success criteria are met prior to year 5 of monitoring, the Chatfield Water Providers may request concurrence from the Project Coordination Team that monitoring end since the success criteria have been met. Given that the compensatory mitigation implementation process is anticipated to span 6 years, monitoring will take at least 6 years, and the monitoring of some of the individual mitigation activities may extend beyond the 6-year mitigation implementation period.

7.4.1 Reporting

The Chatfield Water Providers will provide annual monitoring reports to the Project Coordination Team and the Technical Advisory Committee for review and comment. The reports will address the monitoring actions listed in Section 7.4 for each mitigation activity. As appropriate, this will be done in table format that will readily summarize the status of each monitoring action listed above for each individual compensatory mitigation activity. An example is provided in Table 15.

Table 15. Status of Monitoring Activities.

Monitoring Activity ID	Status	As-built Report	Recordation of Protective Instrument	Progress in Meeting Success Criteria	Corrective Actions Taken	No. of EFUs Gained to Date
	Fully implemented (date), scheduled for implementation (date), protected (date)	Date submitted, not submitted (date due), not required	Date; not required	Description	Describe (dates)	#

The annual monitoring reports will also include a separate section each for 1) on-site, 2) critical habitat, and 3) off-site mitigation area. Each of these sections will describe the progress of implementing mitigation activities, the estimated time for completing the full implementation of mitigation activities, the mitigation activities proposed for the upcoming year, and any adaptive management recommended or taken. The annual monitoring reports will include photos taken from established photo points and copies of any as-built reports or land protection transactions (e.g., conservation easements or deed restrictions) that occurred during the monitoring period covered by the report.

The monitoring reports will be submitted annually to the Project Coordination Team and the Technical Advisory Committee by no later than March 1 of the year following the year the monitoring report addresses.

7.4.1.1 As-Built Reports

For all compensatory mitigation activities involving construction, earth moving, or grading, including the restoration and revegetation of borrow areas and other temporary disturbance within Chatfield State Park, an as-built report will be provided to the Corps and Colorado State Parks no later than 60 days following completion of the mitigation activity.² These as-built reports will address the following:

- Activity name and identifier;
- Location of activity;
- Activity description;
- Proposed dimensions and scope of activity;
- Actual dimensions and scope of activity as built;
- Any variations from proposed plans and reasons for variations;
- Site evaluation of existing EFUs (Appendix C, Section 6.0);
- Proposed gain in EFUs;
- Any revised gain in EFUs and reasons for differences than proposed;
- Photographs of the site prior to construction and post-construction taken from the same vantage points; and
- As-built notations on mitigation plans showing any changes in the mitigation activity as-built, including any changes in plant materials (number, size, or species) or any change in seeding (species, rate, or application).

As-built reports for multiple mitigation activities can be combined provided the final report addresses all the information specified above for each mitigation activity within 60 days of the completion of the mitigation activity.

7.4.2 Conclusion of Monitoring

Monitoring will be concluded when all of the core mitigation objectives are met. As discussed in Section 7.5 Adaptive Management, some objectives may be adjusted, but it is anticipated that the core objectives will persist. The Corps will determine when all mitigation objectives have been successfully met. The majority of the off-site mitigation will require the

² For the purposes of the as-built report, “completion of the mitigation activity” means completion of all construction, earth moving, grading, seeding, and planting needed to implement the mitigation activity.

preservation and management of the mitigation lands in perpetuity. The Chatfield Water Providers will have the option of transferring ownership of lands, conservation easements, and management of preserved off-site mitigation lands to a land trust, local government, or other qualified land management entity. Prior to crediting for mitigation or transfer, all protected mitigation lands will require a legal instrument that runs with the property that permanently protects the mitigation and the property that benefits one or more of the target environmental resources (see Section 7.1.3). Any transfer of such land management responsibilities may require that the Chatfield Water Providers provide the funds needed for long-term operation and maintenance.

7.5 Adaptive Management

An Adaptive Management Plan (AMP) was developed for the final FR/EIS (Appendix GG of the final FR/EIS). The AMP includes the adaptive management provisions of the CMP and addresses other resource issues not addressed in the CMP for which adaptive management will be needed. The CMP has a broad array of components and for each component, success criteria have been established and the net environmental benefit estimated (EFU gain). Adjustments to the methods used to achieve objectives may need to be made as the CMP is implemented. In addition to unanticipated issues and challenges, the following are examples of what 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; and
- 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.

The Chatfield Water Providers will not be responsible for natural disasters (such as forest fires) that may impact mitigation activities once complete. Adaptive management will not be triggered for such instances, nor for any additional impacts caused by the storage or release of water not associated with the reallocation of storage that are not identified as significant impacts in the FEIS and project decision documents (e.g., flood releases). If mitigation properties are adversely affected by such acts, the protected properties will continue to be managed by the

Chatfield Water Providers, or its designee, to benefit one or more of the target environmental resources per the management plan developed for the mitigation property.

Adaptive management will be used to address anticipated and unanticipated issues and events (subject to the limitations above) that affect compensatory mitigation activities for the target environmental resources. Monitoring will determine the degree to which issues and events adversely affect or limit proposed compensatory mitigation activities, as well as document benefits greater than estimated for the CMP. 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 (Figure 33) 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, reseeded, 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;
- 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; and
- Other measures agreed upon by the Project Coordination Team and the Chatfield Water Providers that are appropriate to address mitigation issues.

Adaptive management proposals will be distributed to the Project Coordination Team and the Technical Advisory Committee for review and comment. All such proposals will be designed to be consistent with the FR/EIS and project decision documents.

7.5.1 Framework for Adaptive Management

The objective of adaptive management is to ensure that, if adjustments to the proposed CMP are needed, those adjustments occur in a manner that will meet the core objectives of the CMP.

The “core objectives” are:

1. Provide up to 796 EFUs to offset the 796 EFUs conservatively estimated to be permanently lost with reallocation.
2. Mitigate for the conservatively estimated loss of 1.3 miles of designated critical Preble’s habitat.
3. Provide up to 65 EFUs for West Plum Creek critical habitat, up to 211 EFUs for noncritical Preble’s habitat, up to 396 EFUs for bird habitat, and up to 124 wetland

habitat EFUs that will contribute to the estimated maximum total of 796 EFUs conservatively estimated to be permanently lost.

4. Compensate for the conservatively estimated loss of 42.5 acres of mature cottonwood bird habitat by protecting up to 22.5 acres of cottonwood woodlands off-site and creating up to 13 acres (on-site) and 10 acres off-site of cottonwood recruitment areas, all of which will contribute to the compensatory mitigation goal of 796 EFUs.

The Chatfield Water Providers will first work to implement the CMP as proposed. The Chatfield Water Providers will have the flexibility to adjust the CMP as needed to meet the core objectives if it is not practicable to fully implement the CMP as proposed. Proposed adaptive management adjustments to the CMP will be distributed to the Project Coordination Team and Technical Advisory Committee for their review and comment.

Proposed adjustments to the CMP will document the following:

- Purpose and need of the adjustment;
- How the proposed adjustment will alter the proposed CMP;
- What mitigation activities, if any, are proposed to not be implemented and the estimated EFUs (per the CMP) for these mitigation activities;
- How the proposed adjustment will meet the core objectives of the CMP; and
- How many EFUs are estimated to be gained from the substitution mitigation activities.

Upon consultation with CDNR and the appropriate resource agencies, the decision to adjust the CMP through the adaptive management process will be made by the Corps.

7.6 Consultation with Federal and State Agencies

To facilitate project oversight, the annual monitoring report will be prepared by the Chatfield Water Providers and submitted to the Project Coordination Team by no later than March 1 of the year following the year that the monitoring report addresses. Each annual monitoring report will evaluate 1) the ecological services provided by the mitigation through the end of the year the report is addressing, 2) the likelihood that the mitigation will achieve success as defined in the mitigation plan, 3) the projected timeline for achieving success, and 4) any recommendations for improving the likelihood of success.

The Project Coordination Team will review, comment, and approve the annual monitoring report, and will meet prior to May 1 for at least the first 6 years of the CMP to discuss the status of mitigation, make recommendations for the upcoming field season, and discuss any required

adjustments to the mitigation. The Project Coordination Team will document its approval, recommendations, and required adjustments in an annual memo to the Chatfield Water Providers.

The following is a summary of the roles federal, state, and local agencies have relative to the CMP.

Role of U.S. Army Corps of Engineers

- Review, comment, and provide approval (to the Chatfield Water Providers) on:
 - Contractor selection;
 - Contracts and contract adjustments;
 - Annual progress reports;
 - Regular briefings on status of mitigation;
 - As-built reports;
 - Monitoring reports;
 - Mitigation designs at 30 and 100 percent completion;
 - Adaptive management proposals; and
 - Protected land management plans
- Conduct periodic inspections;
- Have the right to enter mitigation properties of Chatfield Water Providers;
- Determine when CMP objectives and success criteria have been met.

Role of Colorado Department of Natural Resources (CDNR) (and therefore for CWCB, Colorado State Parks and Colorado Division of Wildlife, as CDNR determines):

- Review and comment (to the Chatfield Water Providers) on:
 - Contractor selection;
 - Contracts and contract adjustments;
 - Annual progress reports;
 - Regular briefings on status of mitigation;
 - As-built reports;
 - Monitoring reports;
 - Mitigation designs at 30 and 100 percent completion;
 - Adaptive management proposals; and
 - Protected land management plans
- Conduct periodic inspections;
- Have the right to enter mitigation properties of Chatfield Water Providers;

Additional Role of Colorado State Parks

- Review and comment (to the Chatfield Water Providers) on:
 - Plans for on-site mitigation;
 - Contractor contract adjustments;
 - Reference area locations for revegetation monitoring; and
 - As-built reports for mitigation activities within Chatfield State Park
- Select and hire a temporary Parks employee who will serve as a resident engineer or agency representative for the recreational facilities modification phase of project implementation.

Role of U.S. Fish and Wildlife Service

- Oversight of Corps' adherence to terms and conditions of the Biological Opinion;
- Review and approve plans for mitigation within Preble's CHUs or other mitigation related to ESA issues;
- Review and comment (to the Chatfield Water Providers) on:
 - Any proposed CMP adaptive management changes related to ESA issues;
 - Annual monitoring reports; and
 - Proposals for protection of lands that do not occur within the off-site mitigation target habitat area.
- Determine when CMP objectives and success criteria have been met and compensatory mitigation has been completed related to ESA issues.

Role of U.S. Forest Service

- As a signatory to the agreement related to the Sugar Creek Sediment Mitigation Project (Appendix E), review and approve plans for mitigation activities on USFS land.

Role of Douglas County

- As a signatory to the agreements related to the Sugar Creek Sediment Mitigation Project (Appendix E), review and approve decisions related to maintenance activities involving County Road 67 along Sugar Creek.

8.0 COSTS

8.1 Cost Estimate Summary and Assumptions

The Chatfield Water Providers will be contractually responsible for the full implementation and funding of the CMP (Section 7.2.2). No federal money will be used for implementing or

maintaining the compensatory mitigation. The CMP used the Corps' IWR Plan, a computerized program for cost effectiveness/incremental cost analysis (CE/ICA), to perform the incremental cost analysis of the mitigation plan considering cost and environmental services provided.

The majority of the estimated costs for the mitigation plan will occur in the first 11 years of implementing the CMP (Table 13 and Table 14). Use of the reallocated storage by the Chatfield Water Providers is linked to meeting the defined mitigation milestones (Section 7.2). The objective of both the Chatfield Water Providers and the CMP is to provide compensatory mitigation as rapidly as possible to offset impacts to the environmental target resources and allow use of the reallocated storage as soon as possible.

While the CMP will be implemented over an estimated 11 years, the ecological benefits of the mitigation will be in place in perpetuity, and restoration, enhancement, and management of the mitigation will continue to accrue environmental benefits. The majority of the benefits to the target environmental resources associated with the CMP will occur in the first 5 years with the implementation of all on-site compensatory mitigation, all Preble's critical habitat mitigation, and 70 percent of the off-site mitigation providing an estimated 498 EFUs of the maximum estimated 796 EFUs needed (Table 13).

Another 114 EFUs are estimated to be gained in year 6 from protecting off-site private lands and the remaining EFUs are estimated to be gained in years 7 through 11 as habitat conversions, restoration, enhancements and management mature (Table 13 and Table 14).

There will be some additional mitigation costs beyond year 11 for management and monitoring (Table 16). These future mitigation costs comprise about 5 percent of the total estimated mitigation cost. There will also be some changes in the environmental benefits provided by compensatory mitigation beyond year 11, and these changes are not accounted for in the CMP and CE/ICA:

- The permanent protection of habitat, particularly habitats that are buffered from development and connected to other protected lands, will increase in their relative ecological value to the watershed as development in the watershed occurs.
- Areas established to eventually provide mature stands of cottonwoods will be considered to meet mitigation success criteria when they have met criteria for area, density, and viability. However, these stands will be on a positive trajectory for increased environmental benefits as the cottonwood stands mature over a lifetime of 50-plus years.

- Protected existing mature cottonwood stands, including stands in Chatfield State Park will become decadent over time and are on a trajectory of declining environmental benefits.
- Long-term conservation and management of protected lands will establish a gradual trajectory of increasing environmental benefits for several years following protection and will likely provide additional EFUs beyond those calculated and credited at the end of monitoring.
- The designated Preble’s critical habitat along Sugar Creek would continue to decline without the proposed mitigation measures.

Table 16. Estimated Costs for Mitigating Impacts to Target Environmental Resources.

Activity	Cost per Unit	Cost per Activity	Cost per Activity with Contingency
1. On-site Noncritical and Critical Habitat Mitigation:			
Enhancement activities	\$114,316/acre	\$18,862,165	\$22,634,598
2. Off-site Noncritical Habitat Mitigation:			
Property acquisition/CE	\$15,800/acre	\$13,477,400	\$16,172,880
Enhancement activities	\$17,800/acre	\$15,183,400	\$18,220,080
3. Off-site Upper South Platte CHU Critical Habitat Mitigation			
Mitigation activities		\$3,879,702	\$3,879,702
Maintenance costs		\$2,262,350	\$2,262,350
4. Annual Costs for On- and Off-site Mitigation Areas			
5. Annual Monitoring (years 1 to 6)	\$150,000/year	\$900,000	\$1,035,000
6. Annual Monitoring (years 7 to 16)	\$75,000/year	\$450,000	\$517,500
7. Annual Management (12 years)	\$950/acre/year	\$11,605,200	\$13,345,980
8. Annual Management (years 13 through 50)	\$350/acre/year	\$13,183,100	\$15,160,565
TOTAL		\$79,803,317	\$93,228,655

For the purposes of the CMP schedule (Section 7.2), all of the compensatory mitigation is estimated to be complete and provide the needed EFUs once the mitigation success criteria have been met, or in the case of long-maturing resources like mature cottonwoods, are determined to be on a demonstrated satisfactory trajectory to meet their success criteria. Meeting the success criteria is scheduled to occur over the course of 11 years (Table 13 and Table 14).

The estimated 853 acres of off-site private lands that will need to be protected to provide 711 EFUs of off-site mitigation is based on all of the protected properties having weighting factors for minor connectivity and medium buffer width (Section 6.2.2). This estimate does not include a weighting factor for proximity. Fewer acres of land would need to be protected at a lower cost if

buffer widths, connectivity and proximity were increased. Conversely, more acres at an increased cost would need to be protected if buffer widths and connectivity were decreased.

A range of cost estimates is provided for each of the mitigation activities. Information for the cost estimates was obtained through discussions with staff from Muller Engineering Company (Muller has extensive experience with designing and constructing mitigation areas), Douglas County Open Space, Trust for Public Land, and Ray Sperger (formerly with South Platte Park). The cost estimates are based on the following assumptions:

1. There will be 165 acres of on-site noncritical and critical habitat mitigation.
2. Cost estimates for on-site critical habitat mitigation are combined with on-site noncritical habitat cost estimate because the mitigation activities are combined.
3. On-site mitigation cost is based on the detailed cost estimates in Appendix G.
4. Of the estimated 5,917 acres of potential off-site target noncritical habitat, about 853 acres will be protected by agreements with willing landowners (Section 6.2.2).
5. About 0.83 EFUs are estimated to be gained on average for each 1 acre of target habitat protected (Section 6.2.2).
6. About 853 acres of target habitat would need to be protected and managed to provide an estimated 711 EFUs of off-site mitigation (1.20 acres/EFU x 711 EFUs = 853 acres).
7. The estimated cost per acre to acquire target habitat ranges from \$14,000 for agricultural properties to \$50,000 for rural residential property. The estimated average cost per acre was calculated by assuming that 95 percent of the parcels will be agricultural land (0.95 x 853 acres x \$14,000 = \$11,344,900) and 5 percent will be rural residential (0.05 x 853 acres x \$50,000 = \$2,132,500). These assumptions result in an estimated average acquisition cost of \$15,800 per acre ($\$13,477,400/853 \text{ acres} = \$15,800$).

Per-acre costs were based on a market survey performed by the Real Estate section of the Corps, Omaha District (Corps 2009b). The market survey estimated that the median per-acre cost for land zoned agricultural was \$13,946 and the median per-acre cost for land zoned rural residential was \$52,016.

8. Cost estimates for off-site, noncritical habitat enhancement activities are based on activities ranging from seeding and planting (\$7,000/acre) to habitat conversion using sheet piles and excavation (\$115,000/acre). The estimated average cost per acre for enhancement is calculated by assuming that 90 percent of the areas will need nonstructural enhancement and 10 percent will need structural enhancement. These assumptions result in an estimated average enhancement cost of \$17,800 per acre.
9. The costs for off-site critical habitat mitigation in the Upper South Platte CHU were provided by CH2M Hill and are based on activities proposed along Sugar Creek to control sediment (CH2M Hill 2009) and are detailed in Appendix E.

10. The annual maintenance costs for off-site critical habitat mitigation in the Upper South Platte CHU were established as follows. Douglas County has estimated an annual maintenance cost of \$90,494 above the County’s current maintenance costs for the 4.5-mile segment of CR-67 that is a component of the off-site Preble’s critical habitat mitigation. The County’s increased maintenance costs include: annual applications of magnesium chloride lignin treatment to maintain a hardened road surface and reduce erosion, removal of sediment from sediment traps and permanently hauling the sediment out of the Sugar Creek watershed, and maintaining cross slopes and road side ditches that direct runoff to sediment traps and away from the creek and its riparian area.

The Chatfield Water Providers will pay the increased annual maintenance cost in perpetuity. The present value of this cost has been estimated using a capital-recovery factor as follows:

$$\frac{\$90,494 \text{ (annual O\&M)}}{0.04 \text{ (rate of return)}} = \$2,262,350$$

\$2,262,350 is the amount that would need to be invested in 2013 with a real rate of return of 4 percent to provide \$90,494 to Douglas County for increased annual maintenance of CR-67.

11. The annual management estimate includes 165 acres of on-site critical and noncritical habitat mitigation and 853 acres of off-site noncritical and West Plum Creek CHU habitat mitigation (1,018 acres total).
12. Based on the experience of the management of open lands in the region, annual management activities range from minimal weed control and repairs (\$500/acre) to extensive weed control, reseeding, and structural repairs (\$5,000/acre). The estimated average cost per acre for annual maintenance in years 1 through 12 was calculated assuming that, on average, 90 percent of the areas will require minimal management each year and 10 percent will require extensive maintenance. These assumptions result in an estimated average annual management cost of \$950 per acre.
13. In years 13 to 50, annual maintenance costs will be reduced, assuming that all habitat enhancement activities have met the success criteria. Using the per-acre costs for minimal versus extensive activities described above in item 12, the estimated average cost per acre for annual maintenance in years 13 through 50 was calculated assuming that, on average, 20 percent of the acres will require minimal management each year and 5 percent will require extensive maintenance. These assumptions result in an estimated average annual management cost of \$350 per acre.
14. The restoration and revegetation of the borrow areas and other temporarily disturbed areas (e.g., haul roads and relocated utilities) is included in the cost estimate of the relocation of the recreation facilities and is not included as estimated costs for implementing the CMP.

A contingency of 15 percent was applied to management and monitoring activities and a 20 percent contingency was applied to enhancement and property acquisition activities. The

increased contingency for property acquisition and conservation easement costs was applied because of the greater uncertainty in future land costs, negotiations with landowners, and construction costs. The choice of contingency values was based on experience, professional judgment, and input from professionals experienced with construction and land protection costs. Specific cost contingencies applied to the off-site critical habitat mitigation activities by the project engineer are included in the total cost per activity estimate and are shown in Attachment E-1.

8.2 Cost Effectiveness/Incremental Cost

Section C-3e of Engineering Regulation 1105-2-100 requires mitigation measures to be justified and an incremental analysis be performed. The justification of the mitigation measures in the CMP is presented in Section 6.0. The incremental analysis of the CMP is presented below. The recreation facility borrow and fill areas restored in place were not included in the analysis. The costs for these activities are contained in the recreation mitigation costs. The analysis includes the compensatory mitigation sites. The analysis reveals cost variation among the selected mitigation sites.

8.2.1 Formulation

The Cost Effectiveness/Incremental Cost Analysis (CE/ICA) is a two-step process. The cost effectiveness (CE) analysis identifies cost effective plans by combining sites into plans and eliminates all plans that are not cost effective. A plan is cost effective if it has greater or equal output for less cost than other plans. The CE analysis is a plan formulation process. The incremental cost analysis (ICA) develops costs per EFU that indicate the cost for each additional EFU for including the site in the plan. The ICA is used to decide the plan for implementation. The CMP has been formulated and it mitigates the adverse impacts of the Proposed Action (Alternative 3).

The formulation of the CMP is described above in this document. The CMP was not formulated with a computer algorithm such as the Institute of Water Resources' Planning Suite (IWR Plan). The formulation process included cost effective considerations that used sites located in areas that maximized output and/or minimized cost. Section 6.0 presents details about this process. The IWR Plan computer program will not be used to formulate a plan but rather will be used to show additional plan information such as incremental costs and benefits of CMP

sites. No formulation process guarantees that all cost effective measures have been considered so the CE/ICA process may be incomplete.

8.2.2 Critical Habitat for Preble's

Alternative 3 would inundate up to 80 acres and 1.3 stream miles of Preble's designated critical habitat on the South Platte River arm and up to 75.2 acres and 2.8 stream miles of designated critical habitat will be inundated on the Plum Creek arm. The Service considers only mitigation actions within the same CHU when determining whether an action will result in destruction or adverse modification of critical habitat. The Service considers only mitigation actions within the same CHU when determining whether an action will result in destruction or adverse modification of critical habitat. On-site mitigation consists of enhancing 23 acres of critical habitat. The on-site habitat costs are included in the on-site costs. Off-site mitigation in the Upper South Platte CHU on Sugar Creek consists of habitat restoration and enhancement on 4.5 stream miles and 381 acres. The average annual equivalent (AAE) cost is \$258,200, which includes construction costs of \$167,700, and maintenance costs of \$90,500. Output from mitigation is in stream miles and acres. EFUs were not estimated. The \$258,200 is the incremental cost for this measure. The off-site critical habitat component was not included in the CE/ICA because the environmental outputs were not EFUs. The off-site mitigation costs for impacts to the West Plum Creek CHU are included in the off-site mitigation discussed below.

8.2.3 On-site Locations

On-site mitigation sites are located on Marcy Gulch (LMG), Deer Creek (DC), Plum Creek (PC), and South Platte River (SPR). The AAE costs and EFUs in Table 17 were developed from Table 3, Table 13, Table 14, and Table 16 using a discount rate of 3.75 percent over 50 years to annualize costs. The AAE Cost and Ave EFU columns are the total cost and output for the site named in the first column, and represent the site's incremental cost, and output when combined with other sites.

Table 17. On-Site Analysis.

Site	In \$1,000 Construct	In \$1,000 Monitor	AAE Costs In \$1,000 Manage	In \$1,000 Cost	Ave EFU	\$1,000/EFU
Marcy Gulch						
LMG-1	\$48.89	\$0.85	\$7.07	\$56.82	7.66	\$7.41
LMG-2	\$32.10	\$0.56	\$4.64	\$37.30	5.69	\$6.55
Deer Creek						
DC-1	\$34.18	\$0.60	\$4.95	\$39.73	1.72	\$23.16
DC-2	\$40.01	\$0.70	\$5.79	\$46.50	1.28	\$36.22
DC-3	\$35.25	\$0.61	\$5.10	\$40.97	2.32	\$17.64
DC-4	\$25.04	\$0.44	\$3.62	\$29.09	0.70	\$41.81
Plum Creek						
PC-1	\$4.76	\$0.08	\$0.69	\$5.53	9.83	\$0.56
PC-2	\$31.13	\$0.54	\$4.50	\$36.18	3.88	\$9.32
PC-3	\$40.55	\$0.71	\$5.87	\$47.12	1.38	\$34.10
PC-4	\$25.20	\$0.44	\$3.65	\$29.28	0.26	\$110.66
PC-5	\$62.00	\$1.08	\$8.97	\$72.05	4.55	\$15.85
PC-6	\$60.56	\$1.06	\$8.76	\$70.37	3.83	\$18.37
PC-7	\$41.89	\$0.73	\$6.06	\$48.68	2.68	\$18.19
PC-8	\$47.50	\$0.83	\$6.87	\$55.20	4.12	\$13.41
PC-9	\$41.99	\$0.73	\$6.08	\$48.80	3.18	\$15.37
PC-10	\$53.76	\$0.94	\$7.78	\$62.48	3.96	\$15.78
South Platte River						
SPR-1	\$13.53	\$0.24	\$1.96	\$15.73	6.49	\$2.42
SPR-2	\$34.77	\$0.61	\$5.03	\$40.41	2.99	\$13.52
SPR-3	\$38.14	\$0.66	\$5.52	\$44.33	1.28	\$34.53
SPR-4	\$46.54	\$0.81	\$6.73	\$54.09	0.73	\$74.58
SPR-5	\$44.45	\$0.77	\$6.43	\$51.66	3.36	\$15.37
SPR-6	\$21.24	\$0.37	\$3.07	\$24.68	1.30	\$18.94
SPR-7	\$90.03	\$1.57	\$13.03	\$104.63	2.48	\$42.20
SPR-8	\$17.97	\$0.31	\$2.60	\$20.89	0.23	\$92.67
SPR-9	\$12.46	\$0.22	\$1.80	\$14.49	0.73	\$19.97
SPR-10	\$21.51	\$0.37	\$3.11	\$24.99	1.33	\$18.75
SPR-11	\$11.66	\$0.20	\$1.69	\$13.55	0.62	\$21.95
SPR-12	\$18.08	\$0.32	\$2.62	\$21.01	1.10	\$19.14
SPR-13	\$13.69	\$0.24	\$1.98	\$15.91	0.65	\$24.61
Total	\$1,008.92	\$17.59	\$145.97	\$1,172.48	80.31	\$14.60

8.2.4 Off-Site Location

The process used to determine the costs and output in EFUs for the off-site location is presented in Section 6.2.2 of the CMP. Table 18 shows the annualized costs and average output

for the off-site locations. The numbers were estimated using information from Section 6.2.2, Table 13, and Table 14 of the CMP and a discount rate of 3.75 percent over 50 years.

Table 18. Off-Site Costs.

	AAE Construct (in 1,000s)	In AAE		Cost (in 1,000s)	EFU	\$1,000/EFU
		Monitor (in 1,000s)	Manage (in 1,000s)			
Off-site	\$1,432.98	\$48.37	\$555.72	\$2,037.06	660	\$3.09

8.2.5 Compensatory Mitigation Plan

CMP combines the on-site, off-site, and critical habitat locations into a plan that meets the mitigation requirements for the Proposed Action (Alternative 3). Excluding off-site critical habitat, the plan has 29 separate sites. IWR Plan is capable of 26 sites so the on-site locations were combined by river or creek shown in Table 17 above. Table 19 shows the summarized plan components. The information in Table 19 with the exception of the CMP line was input into IWR Plan for the CE/ICA.

Table 19. CMP in AAE.

	AAE Cost (\$1,000)	Ave EFU	\$1,000/EFU
No Action	\$0	0	NA
Marcy Gulch	\$94.12	13.36	\$7.05
Deer Creek	\$156.29	6.02	\$25.97
Plum Creek	\$475.71	37.66	\$12.63
South Platte River	\$446.36	23.28	\$19.18
Off-Site	\$2,037.06	659.84	\$3.09
CMP	\$3,209.54	740.15	\$4.34

Table 20 shows the cost effective combinations, their costs, output, and the average cost per EFU. No Action is considered a cost effective plan by IWR Plan. Deer Creek was not included in the table because it is not cost effective; however, combinations which include Deer Creek are cost effective. All others sites when considered separately in the CMP were found to be cost effective. The first 11 combinations, which do not contain the off-site location, have average costs greater than the last 11 combinations. Six combinations of sites including No Action are ‘best buy’ plans as shown in Table 21. All best buys except No Action contain the off-site component and none except the CMP contains Deer Creek.

Figure 34 graphically shows the best buy results. The off-site component was first added followed by Marcy Gulch, Plum Creek, South Platte River, and Deer Creek, respectively. Figure 34 demonstrates the incremental analysis.

Table 20. Total and Average Cost.

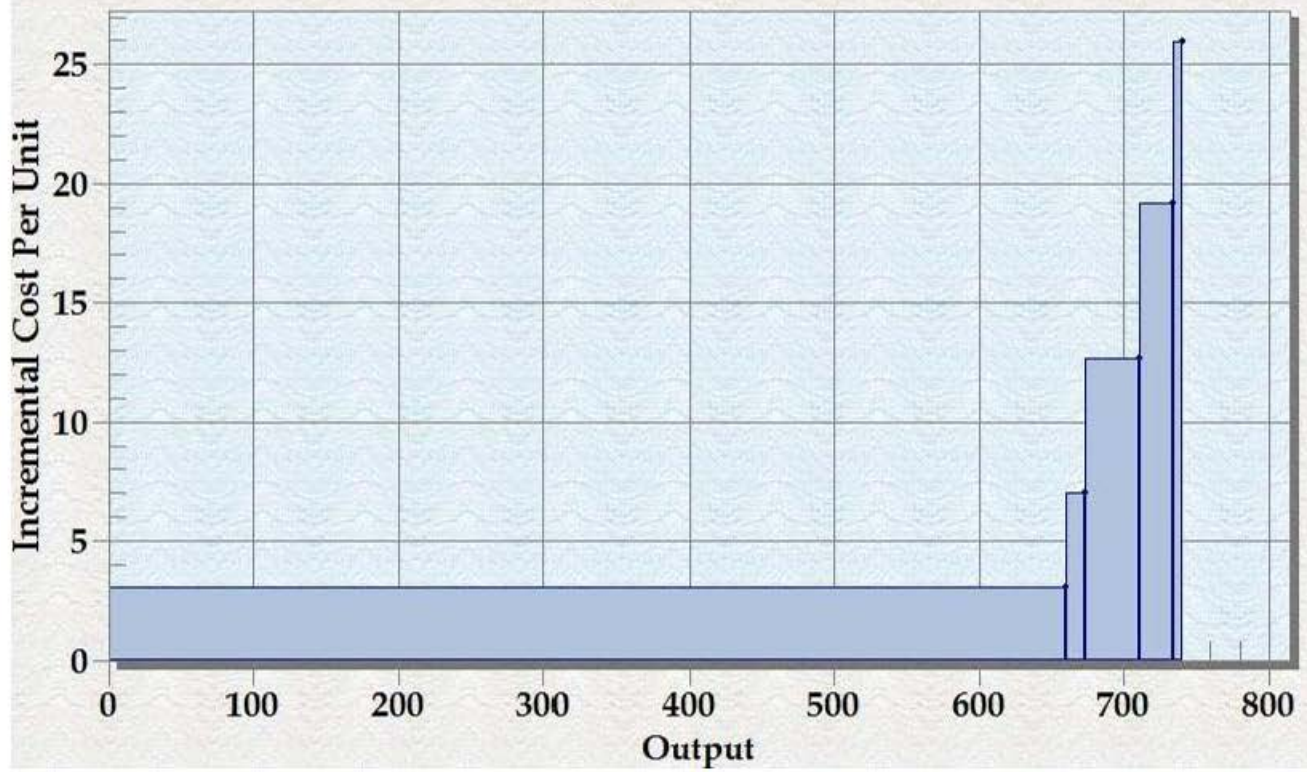
Alternative Number	Name	Ave EFU (Output) EFU	AAE Cost (Cost) \$ 1000	Average Cost \$ 1000
1	No Action Plan	0.00	0.00	NA
2	Marcy Gulch	13.4	\$94.12	\$7.05
3	Deer Ck, Marcy Gulch	19.4	\$250.41	\$12.92
4	South Platte	23.3	\$446.36	\$19.18
5	Plum Ck	37.7	\$475.71	\$12.63
6	Marcy Gulch, Plum Ck	51.0	\$569.83	\$11.17
7	Deer Ck, Marcy Gulch, Plum Ck	57.0	\$726.12	\$12.73
8	Plum Ck, South Platte	60.9	\$922.07	\$15.13
9	Marcy Gulch, Plum Ck, So Platte	74.3	\$1,016.19	\$13.68
10	Marcy Gulch, Deer Ck, Plum Ck, So Platte	80.3	\$1,172.48	\$14.60
11	Off-site	659.8	\$2,037.06	\$3.09
12	11+ Marcy Gulch	673.2	\$2,131.18	\$3.17
13	11+ Marcy Gulch, Deer Ck	692.6	\$2,287.47	\$3.30
14	11+ So Platte	683.1	\$2,483.43	\$3.64
15	11 + Plum Ck	697.5	\$2,512.77	\$3.60
16	11+ Marcy Gulch, Plum Ck	710.9	\$2,606.89	\$3.67
17	11+ Marcy Gulch, Deer Ck, Plum Ck	716.9	\$2,763.18	\$3.85
18	11+ Plum Ck, So Platte	720.8	\$2,959.13	\$4.11
19	11+ Marcy Gulch, Plum Ck, So Platte	734.1	\$3,053.25	\$4.16
20	CMP	740.2	\$3,209.54	\$4.34

Table 21. Incremental Cost of Best Buy Plan Combinations (Ordered By Output).

Alternative Number	Plan Alternative	Ave EFU	AAE Cost (\$1000)	Average Cost (\$1000/EFU)	Incremental Cost (\$1000)	Incremental Output (EFU)	Incremental Cost/ Output
1	No Action	0.00	0.00	NA	NA	NA	NA
2	Off-Site	659.84	\$2,037.06	\$3.09	\$2,037.06	659.84	\$3.09
3	Marcy Gulch +2	673.20	\$2,131.18	\$3.17	\$94.12	13.36	\$7.05
4	Plum Ck + 3	710.86	\$2,606.89	\$3.67	\$475.71	37.66	\$12.63
5	South Platte + 4	734.13	\$3,053.25	\$4.16	\$446.36	23.28	\$19.18
6	CMP (Deer Ck + 5)	740.15	\$3,209.54	\$4.34	\$156.29	6.02	\$25.97

Planning Set "CEICA Analysis 3" Incremental Cost and Output

Best Buy Plan Alternatives



8.2.6 Summary

The cost of the CMP from Table 19 in average annual equivalence is \$3,209,540 excluding the off-site critical habitat for the Preble's mouse. Including the critical habitat costs, the total is \$3,467,800 per year. It is the cost of a plan formulated to mitigate the impacts of Alternative 3. The average annual output of the plan is 660 EFUs. The off-site locations have a cost per EFU of \$3,090, which is the least expensive of all the combined sites. The combined Deer Creek sites have the most expensive EFUs at \$25,970 per EFU.

The CMP will provide an estimated 740.15 average annual equivalents of EFUs (Table 19). The CMP fully mitigates the estimated loss of 796 EFUs (Table 8) because the estimated loss of EFUs will occur over several years and in the first few years of implementing the CMP, mitigation gains will exceed impacts. Three scenarios estimating the timing of impacts (EFUs lost) were developed to determine if the CMP would fully mitigate the estimated impacts when considering the losses and gains of EFUs over 50 years (Table 22). All three scenarios assume that in the first 3 years of mitigation implementation, seven EFUs per year will be lost associated with the relocation of the recreation facilities, but during these first 3 years, mitigation implementation will result in a gain of about 100 EFUs per year. After year 3, the EFUs lost per year vary with each scenario. This variation will be affected by availability of water to store, length of storage, operations, adaptive management, and tolerance of vegetation to inundation. The three scenarios demonstrate the estimated average annual equivalent of EFUs lost is less than the estimated average annual gain of 740.15 EFUs provided by the CMP.

Table 22. Estimated EFUs Lost by Reservoir Elevation, Chatfield Reallocation.

Year Following Approval	Scenario 1			Scenario 2			Scenario 3		
	Apprx. Reservoir Elev.	EFUs Lost in Yr.	Cumulat-ive EFUs Lost	Apprx. Reservoir Elev.	EFUs Lost in Yr.	Cumulat-ive EFUs Lost	Apprx. Reservoir Elev.	EFUs Lost in Yr.	Cumulat-ive EFUs Lost
1	5432.00	7.00	7.00	5432.0	7.00	7.00	5432.0	7.00	7.00
2	5432.00	7.00	14.00	5432.0	7.00	14.00	5432.0	7.00	14.00
3	5432.00	7.00	21.00	5432.0	7.00	21.00	5432.0	7.00	21.00
4	5433.00	301.67	322.67	5433.0	301.67	322.67	5433.0	301.67	322.67
5	5435.00	100.30	422.97	5435.5	123.96	446.63	5435.5	123.96	446.63
6	5435.50	23.66	446.63	5437.5	96.80	543.43	5437.5	96.80	543.43
7	5437.50	96.80	543.43	5440.0	102.82	646.25	5440.0	102.82	646.25
8	5440.00	102.82	646.25	5440.0	0.00	646.25	5440.0	0.00	646.25
9	5440.00	0.00	646.25	5442.0	75.34	721.59	5442.0	75.34	721.59
10	5442.00	75.34	721.59	5442.0	0.00	721.59	5442.0	0.00	721.59
11	5443.00	44.77	766.36	5444.0	89.53	811.12	5443.0	44.77	766.36
Yrs 12-50	5444.00	44.76	31633.68	5444.0	0.00	31633.68	5444.0	44.76	31633.68
Total			36191.83			36535.21			36490.45
Avg Ann. Equivalent EFUs:			723.84			730.70			729.81

Selecting the desired plan for mitigation typically depends on a number of factors, including but not limited to the significance of the resource, available budget, and constraints placed on the project by regulatory and resource management agencies. The CMP (Alternative 6 in Table 20), including on-site mitigation components in Plum Creek, Deer Creek, and the South Platte River arm of Chatfield Reservoir, is considered the most appropriate approach to providing compensatory mitigation for impacts to the target environmental resources. Although it is not the least costly plan, the CMP is in fact a best buy plan (as shown in Table 20), albeit the one with the greatest incremental costs. The bulleted information below provides discussion on what has led to the selection of the CMP as opposed to other plans that were evaluated.

- **Prioritize Mitigation.** Per section 3.0 of the CMP, guiding principles call for the compensatory mitigation to be prioritized as follows: on-site, Preble’s critical habitat, and then off-site. This priority reflects input from environmental organizations and resource agencies. Providing compensatory mitigation as close as possible to the location of impacts, preferably within Chatfield State Park, was identified as important by environmental groups and resource agencies. Although off-site mitigation has the least incremental cost per output, it is the last choice in the mitigation priority. These mitigation priorities were established to avoid the very situation depicted in Table 20 where mitigation could be driven by the least cost alternative that would result in no, or very little, compensatory mitigation within Chatfield State Park.
- **Include a Diversity and Balance of Resource Considerations.** As discussed in section 5.0 of the CMP, this objective was included to ensure that mitigation would be balanced

and provide compensatory resources similar to those lost. This approach shapes the relative mix of mitigation components and prevents out-of-kind or imbalanced mitigation that could be driven by costs. For example, mature cottonwood woodlands are a valued resource at Chatfield State Park. The CMP calls for creating up to 13 acres of designated cottonwood recruitment areas on-site. This approach prevents out-of-kind mitigation (e.g., mitigating the lost cottonwood woodlands, with a greater area of uplands) or having all compensatory mitigation for cottonwood woodlands occur off-site.

The CMP is consistent with the guiding principles and objectives established for compensatory mitigation for impacts to the target environmental resources. These principles and objectives have been reviewed by environmental stakeholders and are intended to ensure a diversity and balance of mitigation that compensates for impacts to the target environmental resources. In addition, the water providers are willing to spend additional dollars required to implement the CMP alternative. Thus, while the water providers and stakeholders understand that the CMP is not the least cost mitigation alternative evaluated, it is the plan that should be implemented based on consideration of other overriding factors.

The Chatfield Water Providers will be responsible for CMP cost of \$77.8 million including the off-site CHU and capitalized management and monitoring costs of \$19.3 million. This represents the present value of the costs presented in Table 3, Table 13, and Table 16 using an interest rate of 3.75 percent and a time period of 50 years.

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**Appendix A
Stakeholder Involvement**

The CMP has been developed with the involvement of many individuals and stakeholder groups, including project participants (water entities), regulatory agencies, and special technical advisers and contractors. The following information lists regular and special meetings at which the content and status of the conceptual mitigation plan were discussed.

1.0 LIST OF COOPERATING AGENCIES AND SPECIAL TECHNICAL ADVISORS AS OF APRIL 2009

Audubon Society of Greater Denver	Denver Water
Capitol Representatives	ERO Resources Corporation
Castle Pines Metro District	Greenway Foundation
Castle Pines North Metropolitan District	Metro Wastewater Reclamation District
Centennial Water and Sanitation District	Mount Carbon Metropolitan District
Center of Colorado Water Conservancy District	Perry Park Country Club
Central Colorado Water Conservancy District	Roxborough Park Metropolitan District
Chatfield Basin Conservation Network	Sierra Club, South Platte Group
Chatfield Watershed Authority	South Metro Water Supply Authority
City and County of Denver	South Suburban Parks & Recreation District
City of Aurora	The Nature Conservancy
City of Brighton	Town of Castle Rock
City of Littleton	Trout Unlimited
Colorado Division of Wildlife	U.S. Environmental Protection Agency
Colorado Environmental Coalition	U.S. Fish and Wildlife Service
Colorado State Parks	WebbPR
Colorado Water Conservation Board	Western Mutual Ditch Company
Denver Botanic Gardens at Chatfield	Western Resource Advocates

2.0 CHATFIELD REALLOCATION ENVIRONMENT/RECREATION/ OUTREACH SUBCOMMITTEE

These subcommittee meetings are a venue for water entities, participating agencies, and special technical advisers to become informed of and discuss ideas and issues associated with mitigation. CMP progress reports are provided at each meeting.

2.1 Subcommittee Members (Name, Title/Representing, Entity)

Rich Vidmar	Aurora Water, City of Aurora
Katie Fendel	City of Brighton, Leonard Rice Engineers, Inc.
Tom Cech, Executive Director	Central Colorado Water Conservancy District
Frank Eckhardt, Jr., President	Western Mutual Ditch Company
Larry Vickerman, Director.....	Denver Botanic Gardens at Chatfield
Rod Kuharich, Executive Director.....	South Metro Water Supply Authority
Rick R. McCloud, Water Resources Manager	Centennial Water and Sanitation District
Heather Beasley, Engineering Manager	Town of Castle Rock
Larry Moore, General Manager	Roxborough Park Metropolitan District
Theresa Jehn-Dellaport	Castle Pines Metro District, Jehn Water Consultants, Inc.
James McGrady, Manager	Castle Pines North, Metropolitan District
Sheela S. Stack, Esq.....	Perry Park Country Club, Harvey W. Curtis & Associates
James W. Culichia	Center of Colorado Water Conservancy District, Felt, Monson & Culichia, LLC
Heather Dugan, Regional Manager.....	Colorado State Parks
Ken Brink, Chatfield State Park Manager	Colorado State Parks
Karen Sitoski, Natural Resource Specialist	U.S. Army Corps of Engineers
Greg Gerlich, Northeast Region Sr. Aquatic Biologist.....	Northeast Region Service Center
Jay Skinner, Water Unit Supervisor.....	Wildlife Conservation Section
Tom Browning, P.E. Chief	Flood Protection Program Colorado Water Conservation Board
Terry R. Baus, P.E. Program Manager	Dept. of Public Works, City and County of Denver
Bob Peters	Denver Water
Peter Plage, CO Ecological Services Field Office	U.S. Fish and Wildlife Service
Amy Conklin, Manager	Chatfield Watershed Authority
Ann Bonnell, Chatfield Reallocation Technical Advisor.....	Audubon Society of Greater Denver
Kent Wiley, Advisor Chatfield Reallocation Technical.....	Audubon Society of Greater Denver
Jeff Shoemaker, Executive Director	Greenway Foundation
David Howlett, Principal	Capitol Representatives
Marjorie Price, Principal	Capitol Representatives
Cecily Mui, Natural Resource Specialist	South Suburban Park and Recreation District/South Platte Park
Brooke Fox.....	Chatfield Basin Conservation Network
Dan Drucker, President.....	Center of Colorado Water Conservancy District
Lisa Darling	Aurora Water, City of Aurora
Bill Ruzzo	Denver Botanic Gardens

2.2 Partial List of Monthly Meetings

September 1, 2009	October 27, 2008
August 4, 2009	September 29, 2008
July 7, 2009	August 25, 2008
June 2, 2009	May 27, 2008
May 5, 2009	April 28, 2008
April 7, 2009	March 31, 2008
March 10, 2009	March 10, 2008
February 3, 2009	February 4, 2008
January 6, 2009	January 7, 2008
December 1, 2008	

3.0 CHATFIELD REALLOCATION FR/EIS FUNCTIONAL ASSESSMENT COMMITTEE

The following people participated in person or via teleconference in one or more meetings to develop the functional approach model for impact assessment and mitigation for the Chatfield Reallocation FR/EIS.

Eric Laux.....U.S. Army Corp of Engineers
Betty PeakeU.S. Army Corp of Engineers
Karen Sitoski.....U.S. Army Corp of Engineers
Scott Franklin.....U.S. Army Corp of Engineers
David Klute.....Colorado Division of Wildlife
Tina Jackson.....Colorado Division of Wildlife
Pete Plage.....U.S. Fish and Wildlife Service
Cecily MuiSouth Suburban Park and Recreation District/South Platte Park
Ann BonnellAudubon Society of Greater Denver/South Platte Group of the Sierra Club
Mike MuellerSierra Club
Ray Sperger.....Chatfield Basin Conservation Network
Brooke Fox.....Chatfield Basin Conservation Network
Tom RyonOttertail Environmental/Tetra Tech
Rick McCloudCentennial Water and Sanitation District
Steve Dougherty...ERO Resources Corporation
Ron BeaneERO Resources Corporation
Jana Pederson.....ERO Resources Corporation
Mary L. PowellERO Resources Corporation

3.1 Functional Assessment Committee Meeting Dates

July 28, 2008
August 28, 2008
September 12, 2008
October 6, 2008
December 3, 2008

Appendix B

Compliance with Policy and Guidance on Compensatory Mitigation

The U.S. Army Corps of Engineers' (Corps) planning process follows the six-step process defined in the policy and guidance and detailed in the Corps' planning regulations (ER 1105-2-100). This process is a structured approach to problem solving that provides a rational framework for sound decision making. The Compensatory Mitigation Plan (CMP) complies with and follows the Corps' policy and guidance. The following describes the main points of policy compliance.

1.0 Six-Step Planning Process

The Corps Civil Works follows a six-step planning process for water and related land resources projects (Engineering Regulation (ER) 1105-2-100, page 2-2).

- Step 1 – Identifying problems and opportunities.
- Step 2 – Inventorying and forecasting conditions.
- Step 3 – Formulating alternative plans.
- Step 4 – Evaluating alternative plans.
- Step 5 – Comparing alternative plans.
- Step 6 – Selecting a plan.

The CMP complies with the six-step process as described below.

1.1 Identifying Problems and Opportunities

The CMP is driven by the need to mitigate for the loss of Preble's habitat, bird habitat, and wetlands (target environmental resources) associated with the proposed reallocation. The compensatory mitigation is driven first by mitigation for impacts to Preble's habitat. Permanent impacts to Preble's habitat (Alternative 3) can be divided into:

1. Designated critical habitat – 80 acres and 1.3 stream miles, and
2. Noncritical habitat – 370 acres.

Compensatory mitigation for impacts to Preble's habitat was selected as the critical path for mitigation because of Endangered Species Act (ESA) requirements for mitigation and because it frequently overlaps other target environmental resources (see Problem 1 below). The following

problems (constraints) and opportunities have been identified associated with providing adequate compensatory mitigation for the target environmental resources.

1.1.1 Problems

The following problems were identified in the mitigation planning process:

1. There is a substantial geographic overlap in the target environmental resources. For example, about 454 acres of Preble's habitat would be inundated by Alternative 3 and most of the 158 acres of wetlands estimated to be inundated are also Preble's habitat and all of the Preble's habitat and wetlands that will be inundated are bird habitat. This is discussed in Section 6 and Appendix C.
2. All of the compensatory mitigation for the target environmental resources cannot occur in Chatfield State Park. The ability to provide all of the compensatory mitigation within Chatfield State Park is limited by the size of the park and resources available for use to create, restore, or enhance habitats to compensate for all the impacts to the target environmental resources.
3. All the impacts to designated Preble's critical habitat must occur within the critical habitat unit (CHU) in which the impacts occur. Two CHUs occur within Chatfield State Park. The ability to restore or enhance Preble's critical habitat within Chatfield State Park is limited and most of the loss of Preble's critical habitat must occur off-site in either the West Plum CHU or Upper South Platte CHU. The West Plum CHU occurs in the Plum Creek watershed upstream of Chatfield State Park. The remainder of the Upper South Platte CHU occurs on the Pike National Forest about 14 miles south of Chatfield State Park.
4. Much of the off-site compensatory mitigation for impacts to noncritical habitat will need to occur on privately owned lands. Identification of specific private properties prior to implementation of the CMP will likely drive up the price of acquiring property for mitigation or negotiating conservation easements.
5. About 43 acres of mature cottonwood gallery woodland are estimated to be lost. This mature resource takes 30-plus years to develop.

1.1.2 Opportunities

1. There are numerous regional conservation planning processes with which the CMP can be integrated. The collaborative effort of the CMP with these regional conservation processes can potentially provide an environmental benefit greater than if the CMP was not integrated with these regional planning processes.
2. The off-site component of the CMP has an opportunity to provide significant habitat conservation efforts that can support and advance the recovery of Preble's (Appendix D).

Development of the mitigation objectives (Section 5.0 of the CMP) considered these problems and opportunities. The identification of problems and opportunities, as well as information used to develop the CMP, reflect the participation by a broad group of stakeholders in numerous meetings on mitigation (Appendix A). Compensatory mitigation objectives were

informed by these problems and opportunities, stakeholder involvement, and impacts to the target environmental resources.

1.2 Inventory and Forecast

The second step of the planning process is to develop an inventory and forecast of critical resources relevant to the problems and opportunities under consideration. The inventory of critical resources relevant to the CMP was accomplished as follows:

- An inventory of the target environmental resources was developed as part of the draft FR/EIS;
- Early in the mitigation planning process, an inventory of potential on-site and off-site compensatory mitigation actions was developed (Attachment B-1);
- In consultation with the USFS and Service, locations and activities were identified within the Preble's Upper South Platte CHU on USFS lands that could provide compensatory mitigation for impacts to designated critical habitat for Preble's (Section 6.3 of the CMP and Appendix H); and
- An inventory of potential off-site compensatory mitigation properties was developed (Section 6.3.2.5 of the CMP).

The future also was considered in developing the CMP. An important part of the off-site compensatory mitigation component is the perpetual conservation of Preble's habitat on private lands focusing on the long-term benefit to Preble's and its recovery. The region south of Chatfield State Park is rapidly developing and in the future there will likely be less undeveloped lands.

The working draft of the Preble's Recovery Plan specifies strategies for recovery and a key strategy is to protect lands with Preble's habitat. The working draft of the Preble's Recovery Plan states that "protecting additional habitat for Preble's populations will ensure that the subspecies reaches recovery more quickly." The draft plan also states "enough stream miles need to be protected to ensure that numeric population goals for large and medium populations can be maintained" (emphasis added) (Service 2003).

1.3 Formulation of Alternative Plans

The development of CMP alternatives began in 2007 with an inventory of potential on-site and off-site compensatory mitigation activities (Attachment B-1). This inventory preliminarily identified about 50 structural and nonstructural potential mitigation activities. Early in the mitigation development process, it was determined that while each of the potential mitigation

measures had merit, an integrated plan, particularly for off-site mitigation, would be of greater ecological value and could possibly benefit from economics of scale and collaborative integration with other regional conservation plans.

A more integrated approach to formulating a compensatory mitigation plan was therefore used. The formulation of this CMP was based on the following concepts:

1. To the degree feasible, compensatory mitigation will be located on-site (i.e., maximize mitigation on Corps land in the vicinity of Chatfield State Park);
2. All compensatory mitigation for impacts to designated Preble's critical habitat will occur within the Upper South Platte CHU;
3. The remaining off-site mitigation will, to the degree feasible, contribute to the recovery of Preble's; and
4. To the degree feasible, off-site mitigation will occur as close to Chatfield State Park as possible.

The P&G require that each alternative plan shall be formulated in consideration of four criteria: completeness, efficiency, effectiveness, and acceptability. The following describes how the proposed CMP meets these criteria.

1.3.1 Completeness

Completeness is the extent to which the alternative plans provide and account for other actions to ensure the realization of the planning objectives. The CMP, while independently sufficient to mitigate the impacts of reallocation, is designed to integrate with other regional planned conservation efforts (Section 4.0 of the CMP and Appendix D). This integration will help ensure the realization of the mitigation objectives and further overall ecological values. The objectives stated in terms of EFUs, which are measurable, will also help to meet the completeness criterion. The compensatory mitigation objectives are presented in Section 5.0 of the CMP.

1.3.2 Efficiency

The CMP focuses its priorities in a cost-effective manner in the following ways:

1. The first priority for compensatory mitigation is to do as much mitigation as is feasible on-site. In terms of costs, maximizing the amount of on-site mitigation eliminates land transaction costs for mitigation on Corps land in the vicinity of Chatfield State Park and maximizes the benefits of compensatory mitigation to the Park.
2. The second priority for compensatory mitigation is to provide all compensatory mitigation for impacts to designated critical habitat within the Upper South Platte CHU. The

entire unit occurs on federal lands and, therefore, there would be no land transaction costs for critical habitat compensatory mitigation.

3. The off-site mitigation will be integrated with other regional conservation plans that will facilitate the leveraging of conservation funds for regional conservation priorities.

1.3.2 Effectiveness

Effectiveness is the extent to which the alternative plans contribute to achieve the planning objectives. The CMP was developed to meet the objectives for compensatory mitigation as discussed in Section 5.0 of the CMP.

1.3.4 Acceptability

Acceptability is the extent to which the alternative plans are acceptable in terms of applicable laws, regulations, and public policies. As discussed in this appendix, the CMP has been developed to meet the applicable laws, regulations, and public policies on compensatory mitigation.

1.4 Evaluating Alternative Plans

The evaluation of alternatives is presented in the FR/EIS. In the early development of a compensatory mitigation plan an inventory of various potential mitigation activities was prepared (Attachment B-1). These numerous separate actions did not comprise an integrated compensatory mitigation plan. The costs for measures presented in Attachment B-1 have not been determined. A cost effective (CE) analysis of these measures and plans using the measures found to be cost effective were not performed using the IWR Plan. The proposed CMP has an integrated and collaborative approach that is responsive to fully mitigating the impacts to Preble's, birds, and wetlands.

1.5 Comparing Alternative Plans

Two compensatory mitigation plan alternatives have been considered. An inventory of potential mitigation activities was developed early in the compensatory mitigation development process (Attachment B-1). Later, after discussions with the Service, a more integrated and collaborative compensatory mitigation plan was developed (i.e., the proposed CMP). These two plans were not compared using the IWR Plan because only the costs for the CMP measures have been determined.

The proposed CMP more completely meets the mitigation needs and requirements than the nonintegrated list of separate mitigation activities because the proposed CMP:

- Focuses on contributing to the recovery of Preble’s;
- Maximizes the amount of compensatory mitigation that will occur on-site;
- Meets the Service policy for conservation measures for impacts to designated critical habitat;
- Integrates with other regional conservation plans; and
- Is cost effective because it first focuses on compensatory mitigation on federal lands for on-site and Preble’s critical habitat mitigation before moving off-site on private lands for compensatory mitigation.

1.6 Selecting a Plan

The final step in the six-step planning process is selecting a plan. For the reasons stated above in Comparing Alternative Plans, the proposed CMP was selected as the preferred approach to compensatory mitigation for impacts to Preble’s, bird habitat, and wetlands.

2.0 WRDA Policy for Mitigation for Fish and Wildlife and Wetland Losses

The Water Resources Development Act of 2007 (WRDA 07), Section 2036, sets forth mitigation requirements for fish and wildlife resources. The following specifies how the CMP meets the requirements of the WRDA mitigation policy. The CMP:

- Includes a plan for monitoring, including the cost, duration, and responsibility for monitoring, and also specifies that monitoring will continue until it has been demonstrated that the mitigation has met the success criteria (Section 7.4);
- Bases mitigation success criteria on ecological functions (Sections 5.0 and 7.5.1);
- Provides descriptions and locations of lands proposed for compensatory mitigation (Section 6.0 of the CMP; Figure 7 through Figure 15);
- Provides descriptions of the proposed mitigation activities and the ecological functions that will result from the CMP (Section 6.0 of the CMP);
- Provides a plan for taking corrective action when monitoring demonstrates that mitigation measures are not meeting the success criteria (Section 7.5 of the CMP); and
- Provides for annual reporting of monitoring including the ecological success of the mitigation to date, the likelihood that the mitigation will achieve ecological success, the projected timeline for achieving that success, and recommendations for improving the likelihood of success (Section 7.4 of the CMP).

The WRDA mitigation policy establishes a priority for consideration of the use of approved wetland mitigation bank credits to offset impacts to wetlands. The use of approved wetland mitigation bank credits is not a component of the proposed CMP because many of the wetlands

that will be adversely affected by the reallocation are also Preble's habitat. There are currently no approved wetland mitigation banks that also include Preble's habitat.

Preble's habitat overlaps substantially with wetlands and riparian habitat types; however, there are no approved Preble's habitat mitigation banks in Colorado and there are no wetland mitigation banks in Colorado that occur within known Preble's habitat. Therefore, use of an approved wetlands mitigation bank to provide separate compensatory mitigation for impacts to wetlands at Chatfield Reservoir would not compensate for impacts to Preble's habitat (which are similar in total area as impacts to wetlands). The cost of separately mitigating for wetlands through a wetland mitigation bank (at \$50,000 to \$80,000 per acre) and separately mitigating for Preble's and bird habitat would not be cost effective and would involve substantial double counting of mitigation. As such, it is not practicable to singularly pursue wetland mitigation banks that do not compensate for other lost resources (especially Preble's habitat).

On August 31, 2009, the Corps issued a memorandum on Implementation Guidance for Section 2036(a) of the WRDA 07 – Mitigation for Fish and Wildlife and Wetland Losses. This guidance ensures that compensatory mitigation under the Corps Civil Works program is consistent with the standards and policies of the Corps and EPA rule for compensatory mitigation for losses of aquatic resources for activities authorized by Section 404 of the CWA (73 Fed. Reg. 19594 (April 10, 2008)) and Section 2036(a) of WRDA 07. This guidance supplements the existing guidance on mitigation planning in ER 1105–2–100.

This 2009 guidance memorandum emphasizes the following, which the CMP addresses in the sections indicated:

- Monitoring until mitigation is successful (Section 7.4);
- Providing criteria for determining ecological success (Section 6.0);
- Providing a description of available lands for mitigation and the basis for determining availability (Section 6.3.2.5);
- Developing contingency plans (i.e., adaptive management) (Section 7.5);
- Identifying the entity responsible for monitoring (Section 7.2.1);
- Establishing a consultation process with appropriate federal and state agencies in determining the success of mitigation (Section 7.6);
- Planning mitigation in a watershed context (Section 4.0); and
- Providing a closeout plan for monitoring (Section 7.6).

3.0 ER 1105-2-100, Appendix C Environmental Evaluation and Compliance

ER 1105-2-100 (April 22, 2000), Appendix C, addresses the integration of environmental evaluation and compliance requirements, pursuant to national environmental statutes, applicable executive orders, and other federal planning requirements into the planning of Corps Civil Works water and related land resources comprehensive plans and implementation projects. Appendix C-3 addresses ecological resources and provides guidance for mitigation, and directly relates to mitigation. The CMP meets these requirements as follows:

1. Appendix C-3 of ER 1105-2-100 defines mitigation planning objectives as “clearly written statements that prescribe specific actions to be taken to avoid and minimize adverse impacts, and identifies specific amounts (units of measurement, e.g., habitat units) of compensation required to replace or substitute for remaining, significant unavoidable losses.” The CMP presents mitigation objectives in Section 5.0 that follow this guidance.

2. The CMP has been developed at a feasibility level. Appendix C-3 considers the feasibility study phase to evaluate ecological resources at a sufficient scope and detail to effectively quantify impacts on resources, and to justify the mitigation and restoration being recommended.

3. Appendix C-3 calls for the formulation of specific ecological resources mitigation and restoration plans using generally known and established techniques to address specific, clearly defined management objectives. The objectives of this CMP are presented in Section 5.0. Each mitigation action describes the techniques that will be used and that the proposed techniques have been successfully used in the past.

4. Appendix C-3 requires that alternatives involving existing projects, modifications in the structures and operations of such projects be given full consideration for purposes of ecosystem restoration. As described in Section 7.5.2, the Chatfield Water Providers will explore ways to adjust their management and operation of the reallocated storage to further minimize impacts.

5. Appendix C-3 requires that all reports recommending mitigation shall demonstrate that the following steps have been performed and documented under appropriate paragraph headings.

a. **Inventory and Categorize Ecological Resources.** This was accomplished as part of the EFU analysis (Section 4.0 of the CMP and Appendix C). Impacts to Preble’s critical habitat and wetland losses associated with the discharge of dredged or fill material that need to be mitigated in-kind have been identified.

b. **Determine Significant Net Losses.** Losses (permanent impacts) to the target environmental resources and compensatory mitigation for these losses are quantified and summarized in Section 6.3.2.5 of the CMP and Table 6 through Table 9).

c. **Define Mitigation Planning Objectives.** The objectives for the CMP are presented in its Section 5.0. The mitigation objectives reflect the specific resource objectives to be addressed, are clearly stated, and have been used to determine appropriate mitigation management features, and establish benchmarks for evaluating the performance of the CMP (Section 5.0 of the CMP).

d. **Determine Unit of Measure.** The CMP uses the same unit of measure (EFU) to describe the output of the CMP that were used to calculate specific ecological resource losses and define mitigation planning objectives (Section 5.0 of the CMP and Appendix C).

e. **Identify and Assess Potential Mitigation Strategies.** Development of the CMP identified and evaluated a range of suitable activities responsive to mitigation objectives. The locations of mitigation activities on public and private lands are identified (Section 6.0 of the CMP; Figure 7 through Figure 15).

f. **Define and Estimate Costs of Mitigation Plan Increments.** The CMP presents estimated costs for the mitigation activities (Section 8.0 of the CMP). The total cost for implementation is estimated to be \$75.02 million, including capitalized monitoring and management costs. When implemented over time, according to the information in the CMP Table 13, Table 14, and Table 16, the present value of the cost is \$71.03 million.

g. **Display Incremental Costs.** Table B-1 shows the average annual equivalent (AAE) for costs and EFUs. The costs represent incremental annual costs for each mitigation area and the CMP. The EFUs would be gained by implementing measures at the site. The right most column displays the cost per EFU.

Table B-1. CMP in AAE.

	AAE Cost (\$1,000)	Ave EFU	\$1,000/EFU
No Action	\$0	0	NA
Marcy Gulch	\$94.12	13.36	\$7.05
Deer Creek	\$156.29	6.02	\$25.97
Plum Creek	\$475.71	37.66	\$12.63
South Platte River	\$446.36	23.28	\$19.18
Off-Site	\$2,037.06	659.84	\$3.09
CMP	\$3,209.54	740.15	\$4.34

The Corps' discount rate of 3.75 percent, a 50-year planning horizon, and the information in CMP Table 13, Table 14, and Table 16 were used to determine the AAE values.

h. **Timing of Implementation.** The timing of the implementation of the CMP is presented in its Section 7.2. Compensatory mitigation is proposed to occur in phases tied to use of the reallocated storage as discussed in Section 7.2 of the CMP.

i. **Monitoring.** Monitoring of the CMP is presented in Section 7.4 of the CMP.

j. **Allocation and Apportionment of Mitigation Costs.** The allocation and apportionment of mitigation costs are presented in Section 8.0 of the CMP.

k. **Mitigation Cost Sharing; Preconstruction Environmental Protection and Mitigation Fund; Operation, Maintenance, Repair, Rehabilitation, and Replacement of Mitigation Features; and Post-authorization Mitigation.** All of the costs for implementing and maintaining the CMP will be the responsibility of the Chatfield Water Providers (Section 7.6 of the CMP).

4.0 Conservation Activities for Impacts to Designated Critical Habitat for Preble's

The Service has developed a policy for conservation measures to designated critical habitat as part of its policy on the application of the destruction or adverse modification standard under Section 7(a)(2) of the ESA (Service 2004). This policy requires that “conservation activities (e.g., management, mitigation, etc.) outside of critical habitat should not be considered when evaluating effects to critical habitat.” Based on this policy, the Service has required that all mitigation for impacts to designated critical habitat to Preble's on the South Platte River arm of Chatfield Reservoir occur within the Upper South Platte CHU, which is comprised exclusively of federal lands at Chatfield State Park and the Pike National Forest. The Service has strictly interpreted this policy and the mitigation activity must occur within the Upper South Platte CHU and cannot include mitigation actions that occur outside the CHU, but would benefit the CHU (Service 2009).

The CMP is in compliance with Service policy and compensatory mitigation for all impacts to Preble's critical habitat will occur within the same CHU.

5.0 Corps and EPA Rule for the Compensatory Mitigation for Losses of Aquatic Resources for Activities Authorized by Section 404 of the Clean Water Act

As determined in the August 31, 2009 memorandum on Implementation Guidance for Section 2036(a) of the WRDA 07, the Corps Civil Works guidance regarding mitigation planning is consistent with the standards and policies of the Corps Regulatory Program for Wetlands Mitigation. The CMP complies with this guidance and, therefore, is consistent with the Corps and EPA rule for compensatory mitigation for losses of aquatic resources for activities authorized by Section 404 of the CWA (73 Fed. Reg. 19594 (April 10, 2008)).

6.0 References

- U.S. Army Corps of Engineers (Corps). 2000. Engineer Regulation No. 1105-2-100. Planning Guidance Notebook.
- U.S. Fish and Wildlife Service (Service). 2003. Working Draft Recovery Plan, Preble's Meadow Jumping Mouse (*Zapus hudsonius preblei*).
- U.S. Fish and Wildlife Service (Service). 2004. Draft Memorandum from the Acting Director on the Application of the "Destruction or Adverse Modification" standard under Section 7(a)(2) of the Endangered Species Act. December 9.
- U.S. Fish and Wildlife Service (Service). 2009. Personal e-mail communication between Peter Plage of the U.S. Fish and Wildlife Service and Steve Dougherty of ERO Resources Corporation. July 16.

**Attachment B-1
Potential Mitigation Properties for
Chatfield Reservoir Reallocation Project Preliminarily Developed in 2007**

	Property Description	Project Description – Conceptual Planning	On/ Off Site	County	Owner/ Manager	Acres for Pre- ble's	Acres for Birds	Acres for Wetlands	Total Mitigation Acres ¹	Unit Contains Preble's Critical Habitat	Conceptual Design – Water Needs	Water Available ? Provided by Water Users	Cost	Notes	Location (TRS or UTM) – 6 th PM
1	Chatfield State Park - Plum Creek Drainage	Widen riparian by placing corrugated metal check dams with tops at bed elevation, willow plantings, augment existing weed control	On	Douglas/ Jefferson	USACE/ State Parks	20-35	35	0	35	X	Temporary		?	Weed control- enhancement measure that should be in mitigation plans. Service is not interested in "predator control" as means of Preble's mitigation	
2	Chatfield State Park - Plum Creek Drainage	Create and Enhance wetlands along Plum Creek by expanding floodplain and excavation of upland areas to reach ground water or create a substrate at a suitable elevation along the floodplain for wetland plantings	On	Douglas	USACE/ State Parks	0	0	20	20		Temporary if excavation is allowed		?	Series of weirs across Plum Cr. from 5,444 ft. msl and continue upstream w/in Chatfield SP	
3	Chatfield State Park- Marcy Gulch	Floodplain and wetland enhancements in Marcy Gulch downstream of dam	On	Douglas/ Arapahoe	USACE/ State Parks	0	27	20	47		Temporary	Yes	\$2 to 3M	Inc. three to eight 6-acre pond wetland cells	T6S, R68W, Sec6, N1/2
4	Chatfield State Park - Last Chance Ditch	Reconnect Last Chance Ditch through Denver Water Board Property and Discovery Pavilion including highway crossing (culvert) to move water along the ditch to various projects within Chatfield Park. This may include Lockheed Martin Wetlands, adjacent gravel ponds, and wetland creation along Last Chance Ditch by excavating wide areas along the ditch.	On	Jefferson	USACE/ State Parks	0	5 to 10	5 to 10	10 to 20	X	Permanent		?	Point of diversion was changed to below Chatfield.	

COMPENSATORY MITIGATION PLAN

	Property Description	Project Description – Conceptual Planning	On/Off Site	County	Owner/ Manager	Acres for Preble's	Acres for Birds	Acres for Wetlands	Total Mitigation Acres ¹	Unit Contains Preble's Critical Habitat	Conceptual Design – Water Needs	Water Available ? Provided by Water Users	Cost	Notes	Location (TRS or UTM) – 6 th PM
5	Chatfield State Park- W. of S. Platte R. near the S. boundary	Restoration/Enhancement of Lockheed Martin Constructed Wetlands - provide water and new outlet for wetlands not currently being used with the previous project. Apparently, Colo. Dept of Health requested only a part of the wetland acreage be supplied water due to water quality concerns. If a different source (perhaps noneffluent water) were used, the "fallow" wetlands could be enhanced. Last chance ditch is one possible conveyance.	On	Jefferson	USACE/ State Parks	13	0	0	13	X	Permanent – related to #4		?	Proposed that the wetlands be restored and water providers release water into old inflow ditch	
6	Chatfield State Park	South Platte River Riparian Restoration for Preble's - this would include enhancing areas upstream of inundation and along edge of new water levels. Would also include bringing water into mature cottonwood forest to enhance understory and raise habitat quality (see Note i below). Includes work in Critical Habitat	On	Douglas/ Jefferson	USACE/ State Parks	15-30	5-10	0	15-30	X	Permanent but seasonal, likely late spring only			This area would contain substantial acres of critical habitat for the Preble's mouse. These numbers for Preble's habitat restoration /enhancement/creation will likely increase as we gain a better understanding of upstream project potential and this areas' potential to be enhanced.	
7	Chatfield State Park	South Platte River Riparian Restoration for Wetlands - would include small excavations along the new line of inundation to create a suitable substrate for wetlands to establish. Would provide wetland plants from local stock.	On	Douglas/ Jefferson	USACE/ State Parks	0	5	10	15		Permanent but seasonal - spring and mid-summer		?	Riparian plantings above 5,444 ft msl; need to be watered before and after reallocation	
8	Denver Botanical Gardens at Chatfield	Riparian & Upland Habitat Improvement/Mitigation	On	Jefferson	USACE/ Denver Botanic Gardens	0	79.5	5	84.5		Temporary to establish uplands		?	Water rights would be needed to provide water d/t altered flows out of Deer Cr.	

COMPENSATORY MITIGATION PLAN

	Property Description	Project Description – Conceptual Planning	On/Off Site	County	Owner/Manager	Acres for Preble's	Acres for Birds	Acres for Wetlands	Total Mitigation Acres ¹	Unit Contains Preble's Critical Habitat	Conceptual Design – Water Needs	Water Available? Provided by Water Users	Cost	Notes	Location (TRS or UTM) – 6 th PM
9	Highline Canal Corridor - b/t Plum Creek and the S. Platte R.	Habitat Improvement for wildlife corridor - would establish wetlands and shrublands in pockets along the canal that would provide wildlife cover and create a corridor for wildlife movement connecting Plum Creek and South Platte River.	On/Off	Douglas/Jefferson	Multiple: Shea Homes, Lockheed Martin, Ditch Company, Douglas County, Jefferson County	10	10	10	30		Temporary		?	Important site for connectivity between Plum Cr. and the S. Platte	
10	Bell Mountain Ranch-Commercial Properties	Establish Conservation Easement and Enhance existing vegetation thus enhancing connectivity with Columbine Wildlife Area	Off	Douglas	Private Owner	2 to 5	2 to 5	2 to 5	6 to 15		Temporary		?	Commercial Real Estate along East Plum Creek, Undeveloped	R67W,T9S(S4),T8S(S34)
11	Bell Mountain Ranch Metro District	Enhance Riparian mitigation and enhance connectivity with Columbine Wildlife Area	Off	Douglas	Metro District - Private	2 to 5	0	0	2 to 5		Temporary				
12	Castle Rock Rock, Inc (a)	Establish conservation easement and then restoration of mining area by enhancing uplands and restoring floodplain	Off	Douglas	Private Owners	20	10	20	50		Temporary			Active gravel mine area	
13	Castle Rock Rock, Inc (b)	Conservation Easement of 60-80 acres of riparian and upland	Off	Douglas	Private Owners	70	50	20	140		None				
14	Ranch between BMR and CRRock, Inc.	Conservation Easement of 60-80 acres of riparian and upland with potential for restoration/enhancement projects	Off	Douglas	Private Owners	10	10	5	25		Temporary				
15	Unknown Gravel Mine Below BMR	Habitat Improvement for wildlife corridor including shrub plantings and wetland restoration	Off	Douglas	Private Owners	5	5	5	15		Temporary			Old gravel mine area	
16	Private Land below Duke's Steakhouse	Conservation Easement of 35 acres of riparian and upland with potential for restoration/enhancement projects	Off	Douglas	Private Owners	10	20	5	35		Temporary if excavation is allowed				
17	Private Land above Medved Auto Park	Conservation Easement of 20 - 35 acres of riparian and upland with potential for restoration/enhancement projects	Off	Douglas	Private Owners	5	10	5	20		Temporary if excavation is allowed				

COMPENSATORY MITIGATION PLAN

	Property Description	Project Description – Conceptual Planning	On/Off Site	County	Owner/ Manager	Acres for Preble's	Acres for Birds	Acres for Wetlands	Total Mitigation Acres ¹	Unit Contains Preble's Critical Habitat	Conceptual Design – Water Needs	Water Available ? Provided by Water Users	Cost	Notes	Location (TRS or UTM) – 6 th PM
18	Iron Horse - I-25 Corridor	Conservation Easement - Enhancing Connectivity with Columbine Wildlife Area by restoration of riparian areas, wetlands and uplands	Off	Douglas	Private Owners	10	5	5	20		Temporary		?	Current horse property	R67W,T9S,S16
19	Section 36 and Willow Creek - SLB- Roxborough Rd. & Chatfield Farms - includes Denver Water Board Land at Confluence with SPR	Remove grazing and enhance riparian to connection with S. Platte River, will likely need upland areas preserved to provide buffer area along riparian zone. Would also excavate pockets of floodplain to gain more enhancement acres for Preble's	Off	Douglas	State Land Board/ Shea Homes	70	50	10	130	X	Temporary if excavation is allowed		?	Currently grazed - cattle	R69W,T6S,S36
20	Hildrebrand Open Space	Riparian Habitat Improvement - shrub and tree plantings	Off	Jefferson	Jeffco Open Space	0	10	5	15		Temporary		?	Possible use for mitigating adverse effects to riparian and migratory bird habitat	
21	Kennedy Gulch	Conservation Easement - Wildlife Preserve	Off	Jefferson	Jeffco Stormwater	?	?	?	?		None		?	Needs site visit	Combined as one point on map with 13
22	Cathedral Spires	Conservation Easement - Wildlife Preserve	Off	Jefferson	Jeffco Open Space	?	?	?	?		None		?	Needs site visit	Combined as one point on map with 12
23	Lockheed-Martin Prop-along HogBack west of Wadsworth Blvd	Purchase for Conservation	Off	Jefferson	Lockheed-Martin Prop	?	5	5	10		None		?	Purchase for open space need site visit	
24	Denver Mountain Parks - west of Wadsworth Blvd	Maintenance/Weed Control Augmentation	Off	Jefferson	Denver Mountain Parks	?	2	?	2		None		?	Needs site visit	
25	Littleton Turf Farm Buffer1	Purchase for Conservation and enhancement project of riparian areas - shrub plantings and augment weed control program	Off	Douglas	Private, Littleton, So Platte Park	0	22	20	42		Temporary				

COMPENSATORY MITIGATION PLAN

	Property Description	Project Description – Conceptual Planning	On/Off Site	County	Owner/ Manager	Acres for Pre-ble's	Acres for Birds	Acres for Wetlands	Total Mitigation Acres ¹	Unit Contains Preble's Critical Habitat	Conceptual Design – Water Needs	Water Available ? Provided by Water Users	Cost	Notes	Location (TRS or UTM) – 6 th PM
26	Littleton Turf Farm Buffer2	Purchase for Conservation and enhancement project of riparian areas - shrub plantings and augment weed control program	Off	Douglas	Private, Littleton, So Platte Park	0	10	7	17		Temporary				
27	Cherokee Ranch Highway 85 Crossings-Dupont Fee & Cherokee Ridge Estates	Work with CDOT and Douglas County to make better crossings for wildlife - shrub/tree plantings and augment weed control program	Off	Douglas	CDOT, Douglas County Open Space	5	?	5	10		Temporary		?		R68W,T6S,S28,S27,S33
28	East Plum Creek-upstream of Chatfield SP near Titan Road	Habitat Mitigation for Preble's mouse - shrub plantings and augment weed control program	Off	Douglas	Douglas County/ Private Land	2	2	2	6		Temporary		?		497963mE, 4372910mN
29	Massey Draw 1	Enhancing wetlands that were constructed for water quality issues (high phosphorus discharges) north of C-470	On	Jefferson	USACE/ Chatfield Watershed Authority	0	0	2	2		Temporary		?	From conversations with Russ Clayshulte	
30	Massey Draw 2	Restore/Enhance Riparian and wetlands south of C-470 - copy project constructed upstream, north of C470	On	Jefferson	USACE/ Chatfield Watershed Authority	0	2	2	4		Temporary			From conversations with Russ Clayshulte	
31	South Platte Park Riparian Sites	Restore/Enhance Riparian and wetlands in South Platte Park - shrub/tree plantings and augment weed control program	Off	Arapahoe/ Denver	South Platte Park and Recreation District	0	15	15	30		Temporary			From conversations with Ray Sperger	
32	Plum Valley Heights & Moore Rd.	Road crossing corridor for wildlife - shrub/tree plantings and augment weed control program	Off	Douglas	Private/ Douglas County	5	?	5	10		Temporary		?	From conversations with Andy Hough	R68W,T6S,S32NW1/4, S31NE1/4
33	Bagnall Parcel- Sharptail Ridge & DOW Woodhouse	Key property for purchase/conservation easement to complete wildlife corridor from USFS to Cherokee/Highlands Ranch Open Space	Off	Douglas	Douglas County/ Private Land	0	40	0	40		None		?	From conversations with Andy Hough	R68W,T7S,S7,S18
34	Horse Creek at So. Platte River	Stream/riparian restoration due to floods from Hayman Fire area - shrub/tree plantings and augment weed control program	Off	Douglas	Douglas County/ Private Land/ Chatfield Watershed Authority	5	0	0	5	X	Temporary		?	From conversations with Russ Clayshulte	480441mE, 4344825mN

COMPENSATORY MITIGATION PLAN

	Property Description	Project Description – Conceptual Planning	On/Off Site	County	Owner/ Manager	Acres for Pre-ble's	Acres for Birds	Acres for Wetlands	Total Mitigation Acres ¹	Unit Contains Preble's Critical Habitat	Conceptual Design – Water Needs	Water Available ? Provided by Water Users	Cost	Notes	Location (TRS or UTM) – 6 th PM
35	Horse Creek at Trout and West Creek	Stream/riparian restoration due to floods from Hayman Fire area - shrub/tree plantings and augment weed control program	Off	Douglas	Douglas County/ Private Land/ Chatfield Watershed Authority	5	0	0	5	X	Temporary		?	From conversations with Russ Clayshulte	484700mE, 4341231mW
36	Deer Creek Upstream of Hildebrandt	Stream/riparian restoration due to recent flooding. May require reworking floodplain by excavation - shrub/tree plantings and augment weed control program	Off	Jefferson	Douglas County/ Chatfield Watershed Authority	5	0	5	10		Temporary		?	From conversations with Russ Clayshulte - need site visit	486986mE, 4377374mN
37	Sites along South Platte in Pike National Forest.	Stream/riparian restoration due to floods from Hayman Fire area - bank stabilization and tree/shrub plantings	Off	Douglas and Jefferson	South Platte District of Pike National Forest	?	?	?	?		Temporary				
38	River Canyon Reach of the South Platte River	Restoration at existing USACE facilities upstream of Chatfield - - shrub/tree plantings and augment weed control program	Off	Douglas and Jefferson	USACE	?	?	?	?	x	Temporary			100 acres along the river was not supposed to be built in	
39	Highland Ranch Open Space from Future Development	Enhance drainageways by establishing wetlands and shrublands	Off	Arapahoe/ Douglas	Private - Highlands Ranch	0	5-10	5-10	10-20		Temporary			Need an estimate of acres that are available for enhancement - Rod Kuharich	
40	South Platte River Right-of-way Downstream of Chatfield	Enhance right-of-way by establishing wetlands and shrublands	Off	Arapahoe/ Denver	State of Colorado	0	10-20	10-20	20-40		Temporary			Need an estimate of acres that are available for enhancement - Tom Browning	
41	Little Willow Creek	Wetland Creation by expanding existing areas	Off	Douglas	Private	0	3-10	3-10	6-20		Temporary if excavation is allowed			Healthy wetlands exist here currently	
42	Brush Creek	Riparian enhancement of a seasonal drainage	Off	Jefferson	Lockheed-Martin Prop	0	2-5	2-5	4-10		Permanent			Price would be the cost of establishing water right and constructing delivery infrastructure	
43	HGULCH														
44	HGULLY														
45	Willow Creek														

COMPENSATORY MITIGATION PLAN

	Property Description	Project Description – Conceptual Planning	On/ Off Site	County	Owner/ Manager	Acres for Pre- ble's	Acres for Birds	Acres for Wetlands	Total Miti- gation Acres ¹	Unit Contains Preble's Critical Habitat	Conceptual Design – Water Needs	Water Available ? Provided by Water Users	Cost	Notes	Location (TRS or UTM) – 6 th PM
46	Last Chance Ditch														
		TOTALS				300 to 315	457 to 490	240 to 273	996 to 1068						
	Others to Consider:														
a	Mitigation Banks	Buy into existing mitigation banks - CDOT only one and not for sale, but still searching	Off	Douglas and Jefferson	None										

**Appendix C
Ecological Functions Approach**

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Note to reviewers: Subsequent to completion of Appendix C, the estimate of EFUs needed for off-site mitigation was revised, weighting factors were revised in consultation with the U.S. Fish and Wildlife Service and will be applied additively rather than multiplicatively, and critical habitat for Preble's was designated on the Plum Creek arm of Chatfield Reservoir. Therefore, the total impact and mitigation EFU values in Appendix C do not match the final estimates of these values in the final CMP. The values in the final CMP supersede those in Appendix C. The approach and methods discussed in Appendix C have not changed and remain relevant to the CMP. Revisions to the weighting factors and formula for applying the weighting factors to off-site mitigation are presented in Section 4.0 of the CMP. These changes were not made to Appendix C to provide reviewers a comparison. Section 1.1 of this appendix provides a summary of these changes and their effects on the CMP.

1.0 INTRODUCTION

The draft Chatfield Reallocation Feasibility Report/Environmental Impact Statement (FR/EIS) identified Preble's habitat, bird habitat, and wetlands as resources of particular concern and warranting specific mitigation strategies for the estimated adverse impacts to those resources. These resources are referred to as the target environmental resources in the Compensatory Mitigation Plan (CMP). The CMP describes activities that will be undertaken on and off-site to mitigate for unavoidable impacts to the target environmental resources associated with implementing FR/EIS Alternative 3. This appendix describes the approach that was taken in developing the CMP to address these overlapping ecological functions.

Habitat variables in a particular location can provide overlapping ecological functions for each of the target environmental resources. The Ecological Functions Approach (EFA) is used to quantify impacts to the overlapping ecological functions and the target environmental resources and to quantify benefits gained from activities proposed in the CMP. To provide an ecologically meaningful assessment of the overlapping habitats of the target environmental resources, an ecological function index (EFI) was developed for each target resource habitat type. The EFI is a unitless measure similar to rating something on a scale of 1 to 10. In the case of the EFA, the rating scale was 0 to 1.

EFIs were developed for the following habitat types that were mapped as part of the FR/EIS:

Preble's

High quality riparian habitat
 Low quality riparian habitat
 Upland habitat
 Nonhabitat

Birds

Shrub (riparian)
 Trees
 Upland
 Wetland/nonwoody
 Mature cottonwood
 Nonhabitat

Wetlands

Lacustrine emergent
 Palustrine aquatic bed
 Palustrine emergent
 Palustrine forested
 Palustrine scrub-shrub

EFI provides an indication of the relative ecological value provided by the habitat type. For instance, as the habitat type names imply, Preble’s high value riparian habitat would be expected to have a higher EFI than the EFI for low value riparian habitat. Once the EFI for each target resource habitat type was determined, the next step was to create a unit of measure common across habitat types. The unit of measure is the ecological function unit (EFU), which is used to quantify the ecological functions contained within each mapped habitat type for each target environmental resource. The mapped habitat types for the target environmental resources frequently overlap. For instance, a particular location may be mapped as high quality Preble’s habitat, shrub (riparian) bird habitat, and palustrine scrub-shrub wetland. For areas where mapped habitat types overlap, the total ecological functions can be calculated by summing the EFUs for the individual target environmental resources.

The number of target environmental resource EFUs contained within a particular mapped habitat area is calculated by multiplying the acres of the mapped area by the EFI of the habitat type. Impacts to target resource habitat are calculated the same way. For example, if a Preble’s habitat type has an EFI of 0.5 and there are 12 acres of the habitat, the habitat provides 6 Preble’s EFUs. If four of those 12 acres are lost to reallocation, 2 Preble’s EFUs are lost. To compensate for the 2 lost Preble’s EFUs, a compensatory mitigation activity must result in a net gain of 2 EFUs. For example, a mitigation activity that enhanced habitat from a starting EFI of 0.5 to a new EFI of 0.75 would result in a net EFI gain of 0.25. The mitigation activity would have to occur over 8 acres of habitat to provide a net gain of 2 EFUs. The total number of EFUs present or impacted in a particular area is the sum of EFUs provided or impacted in that area for each target environmental resource.

The EFA serves several purposes:

- It will be used to calculate the number of baseline EFUs being impacted for each target resource and the reduction in total EFUs that may occur due to reallocation;

- It will be used to identify how many EFUs would be generated from implementing compensation mitigation activities; and
- The modeling output will allow the Corps to evaluate different mitigation alternatives through the Corps Cost Effectiveness/Incremental Cost Analysis.

The value of the EFA is that it will serve as a foundation for improved decision making in the FR/EIS process because it is based on ecological function, accounts for the overlapping habitats of the target environmental resources, and provides a common unit of measure to quantify impacts and compensatory mitigation for the lost ecological functions of the impacted target environmental resources.

1.1 Revisions

The CMP has been an evolving document – the result of numerous reviews by government agencies, nongovernment organizations, and the public. The main body of the final CMP reflects these revisions. Appendix C has not been revised so that reviewers and those who have participated in development of the ecological functions approach can see how the approach originally developed. The following major changes to the CMP have occurred subsequent to the original development of Appendix C:

- Critical habitat for Preble’s was designated on Plum Creek/West Plum Creek including portions of the Plum Creek arm of Chatfield Reservoir;
- The weighting factors for off-site mitigation for buffers, connectivity, and proximity were revised based on discussions with the Service; and
- The formula for calculating off-site mitigation credits was revised based on discussions with the Service to be additive instead of multiplicative, which resulted in an increased estimate of the acreage of off-site mitigation needed.

The Service believed the formula revisions more accurately captured the benefits of the weighting factors. These revisions affected how off-site mitigation was characterized (i.e., Preble’s critical habitat mitigation now needs to occur in the Plum Creek/West Plum Creek watershed) and how the EFUs associated with off-site mitigation are calculated. The following provides a comparison of this calculation assuming the example protected property has:

- 100 baseline EFUs;
- 15 percent conservation credit applied to baseline EFUs;
- Moderate buffering;
- Connectivity;
- Proximity to Chatfield State Park; and

- 20 percent of the total EFUs can be enhanced.

Previous Formula:

100 baseline EFUs (1.50 for a 200' to 300' buffer) (1.25 proximity) (1.25 minor connectivity) (1.20 enhancement) = 281.25 EFUs

Revised Formula:

[(100 baseline EFUs) (0.50 for a 200'+ buffer) + (100 baseline EFUs) (0.25 proximity) + (100 baseline EFUs) (0.25 connectivity)] + [100 EFUs] x 1.20 enhancement = 240 EFUs.

The revised formula results in a reduction of the weighted EFUs for weightings comparable to the previous formula. The previous formula resulted in an estimate of about 0.92 EFUs per acre of off-site mitigation (see Section 5.2 of this Appendix C) and the revised formula results in about 0.83 EFUs per acre of off-site mitigation (see Section 6.2.2 of the CMP). The lesser amount of EFUs estimated per acre of off-site mitigation increased the estimated off-site mitigation acreage from 796 acres to 853 acres and increased the total estimated costs with contingencies of mitigating impacts to the target environmental resources from about \$75 million to \$78 million (see Section 8.1 of the CMP).

2.0 ECOLOGICAL FUNCTION INDEX MODEL

The EFIs for the habitat types were generated using an ecological function model. The model was evaluated by independent experts as part of the Corps formal model review process and is described in detail in *Ecological Functions Approach for Terrestrial Habitats at Chatfield Reservoir* (ERO 2009). Several existing habitat and functional assessment models that generate ratings similar to EFIs were evaluated for their applicability to the Chatfield Reallocation FR/EIS, including Habitat Equivalency Analysis (HEA), Habitat Evaluation Procedures (HEP) and HEP's associated Habitat Suitability Indices (HSI).

HEA is a damage and compensation assessment method used extensively by the National Oceanic and Atmospheric Administration (NOAA 1997). HEA is designed to determine what amount of mitigation is necessary to compensate for an equivalent loss of ecological services. The ecological services are typically lost as a result of impacts to habitats from human activities. HEA was not well suited for use in the CMP because it focuses on habitat creation and does not address habitat conservation very well.

HEP is used to document the quality and quantity of habitat. It can be used to assess baseline conditions, impacted areas, and impact compensation. HEP uses HSIs to determine the capacity of a given habitat to support a selected fish or wildlife species. HSIs are based on habitat variables for a particular species. Habitat variables include seasonal habitats (winter range, breeding habitat), life requisites (nesting, food, reproductive), life stages (juveniles and adults), and cover types (multistrata, shrub, herbaceous). Extensive knowledge of the target species is necessary to develop an accurate HSI. HSIs have been developed for many common fish, bird, and mammal species, none of which were believed to be adequately equivalent to Preble's, the primary species addressed in the CMP. An HSI could eventually be developed for Preble's, but the current status of scientific literature is not adequate to develop an accurate enough HSI for use in the CMP.

No single existing model was capable of accurately representing the site-specific characteristics of Preble's and bird resources addressed in the FR/EIS; therefore, a site-specific ecological function model was developed. To the extent possible, relevant concepts from evaluated models were included. In accordance with Corps guidance (EC 1105-2-407: Planning Models Improvement Program: Model Certification (CECW-CP, May 31, 2005), the model developed to determine EFUs was reviewed and approved in close coordination with the National Ecosystem Planning Center of Expertise (Appendix I). The Functional Assessment of Colorado Wetlands Method (FACWet) (Johnson et al. 2009) was used to assess wetland functions because it is an existing applicable method for assigning EFIs to wetland habitats.

2.1 Model Approach

The overall approach to developing the model was to convene an Ecological Functions Technical Committee (Committee) of locally recognized experts with expertise in the three target environmental resources. The Committee met on several occasions (ERO 2009; Appendix A) to discuss and reach consensus on a process for evaluating and assigning values to the Chatfield ecological function model. Because FACWet, an established assessment method for wetland functions would be used for developing EFIs for wetland habitats, the Committee focused on a model development and evaluation process for Preble's and bird habitats that included the following:

- Define habitat attributes and their ecological functions for each habitat type mapped for the FR/EIS for Preble's and birds;
- Assign an Ecological Functional Value (EFV) for habitat attributes for Preble's and birds in mapped habitat types used in the FR/EIS;
- Generate an EFI for each mapped habitat type by target environmental resource, using the ecological functional values for habitat attributes;
- Calculate the existing EFU for each area of mapped habitat units; and
- Calculate impacts as EFUs.

2.2 Defining Ecological Functions

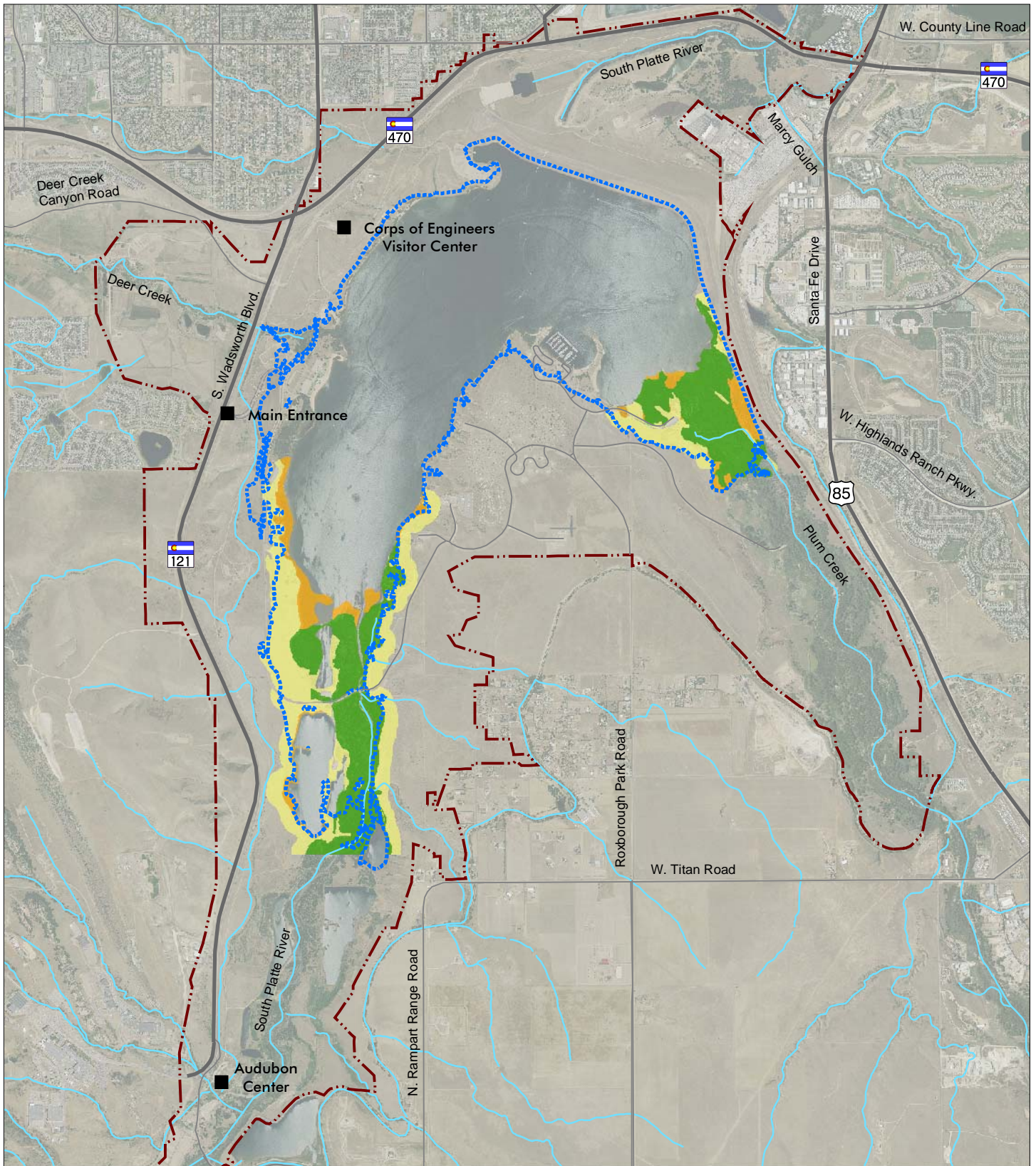
Although the same location may provide habitat for Preble's and birds, it does not necessarily provide a similar level of ecological value for them. For instance, a willow-dominated wetland is of high value to Preble's for foraging and cover, but is of lower value to ground-nesting birds that spend most of their time in uplands, even though the birds may occasionally use the willow-dominated wetland for foraging. In another instance, a grove of mature cottonwoods with a sparse understory is of high value to tree-nesting birds but is of moderate value to Preble's. The functional value that a particular habitat type provides for Preble's and birds was calculated by developing a system that quantitatively rates how various attributes of the habitat contribute to the overall survival of Preble's and birds.

Defining habitat attributes that are important to birds and Preble's, such as structural diversity and plant species composition, focused on identifying how the habitats provide support for breeding, over-wintering and migration, forage, and cover. Once the habitat attributes were defined for Preble's and birds, Ecological Functional Values (EFVs) were assigned to each by the Committee.

Wetlands were evaluated using FACWet (Johnson et al. 2009). The Corps Denver Regulatory Office was involved in developing FACWet and recommended its use in assessing wetland functional impacts and mitigation for the FR/EIS.

2.2.1 Preble's Habitat Attributes

Preble's habitat functions are defined in terms of quality (high or low) and habitat type (riparian or upland) as mapped for and described in the FR/EIS (Figure C-1). Typical Preble's habitat consists of well-developed plains riparian vegetation with adjacent, undisturbed grassland communities and a nearby water source (67 Fed. Reg. 47154 (July 17, 2002)). Well-developed



Chatfield Reallocation Study

- High Value Riparian Habitat
- Low Value Riparian Habitat
- Upland

- 5444 Pool Elevation (Maximum Pool Elevation of Alternative 3)
- Chatfield State Park

0 1,750 3,500 feet
 1 inch = 3,500 feet



Imagery Source: Landiscor©, June 2008
 Pool Elevations: Tetrattech

**Figure C-1
 Preble's Habitat**

File: 4048 Figure C-1 PMJM Habitat.mxd (GS)
 November 2009



plains riparian vegetation typically includes a dense combination of grasses, forbs, and shrubs; a taller shrub and tree canopy may be present (Bakeman and Deans 1997). Preble's have rarely been trapped in uplands adjacent to riparian areas (Dharman 2001). However, in detailed studies of Preble's movement patterns using radio telemetry, Preble's has been recorded in upland habitat more than 330 feet beyond the 100-year floodplain (Shenk and Sivert 1999; Schorr 2001). Preble's has also been recorded moving more than 1 mile in one evening (Ryon 1999; Shenk and Sivert 1999).

As described in the FR/EIS, Preble's habitat within the FR/EIS study area was defined, segregated, and mapped using the following four habitat types based on habitat quality:

1. High Quality Riparian Habitat;
2. Low Quality Riparian Habitat;
3. Upland Habitat; and
4. Nonhabitat.

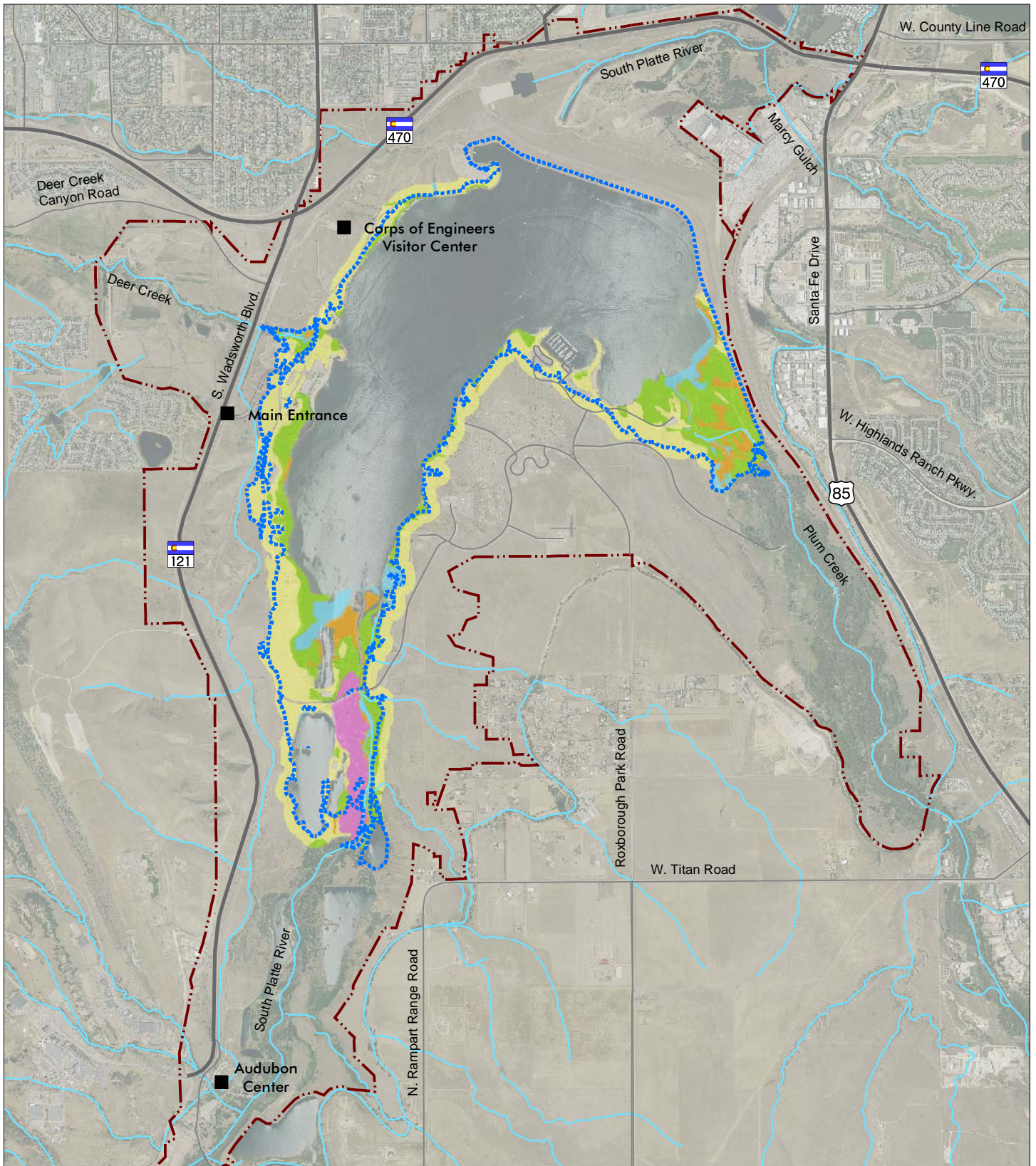
Habitat needs of Preble's are generally described by the Service in documents used during the process to list the subspecies as threatened under the ESA (63 Fed. Reg. 26517 (May 13, 1998)) and the Colorado Division of Wildlife (CDOW) (Shenk and Eussen 1998). The working draft of the Preble's Recovery Plan (Service 2003) states that delineation of Preble's habitat "needs to include all the necessary resources for Preble's to nest/breed, find cover, travel, feed and hibernate." Based on this information, Preble's habitat attributes in the study area are:

- Breeding;
- Hibernating;
- Foraging; and
- Protection from predators (cover).

These habitat attributes also include the primary constituent elements as described by the Service for proposed designated Preble's critical habitat that include riparian corridors and additional adjacent floodplain and upland habitat (74 Fed. Reg. 52072 (October 8, 2009)).

2.2.2 Bird Habitat Attributes

Biologists created a habitat map for the FR/EIS of the following six bird habitats below the proposed maximum inundation area of 5,444 feet (Figure C-2):



Chatfield Reallocation Study

Imagery Source: Landiscor©, June 2008
Pool Elevations: Tetrattech

- Mature Cottonwood
- Shrub
- Trees
- Upland
- Wetland/Nonwoody
- 5444 Pool Elevation (Maximum Pool Elevation of Alternative 3)
- Chatfield State Park

0 1,750 3,500 feet
1 inch = 3,500 feet



**Figure C-2
Bird Habitat**

File: 4048 Figure C-2 Bird Habitat.mxd (GS)
November 2009



1. Wetlands (nonwoody);
2. Woodlands;
3. Mature cottonwood;
4. Shrub (riparian);
5. Upland; and
6. Nonhabitat.

The bird habitats provide the ecological functions necessary to support breeding, wintering, and migrating birds. The Committee determined that, for the purposes of the CMP, the assessment of bird ecological functions would focus on four specific attributes of bird habitats within the South Platte River and Plum Creek watersheds. These attributes are:

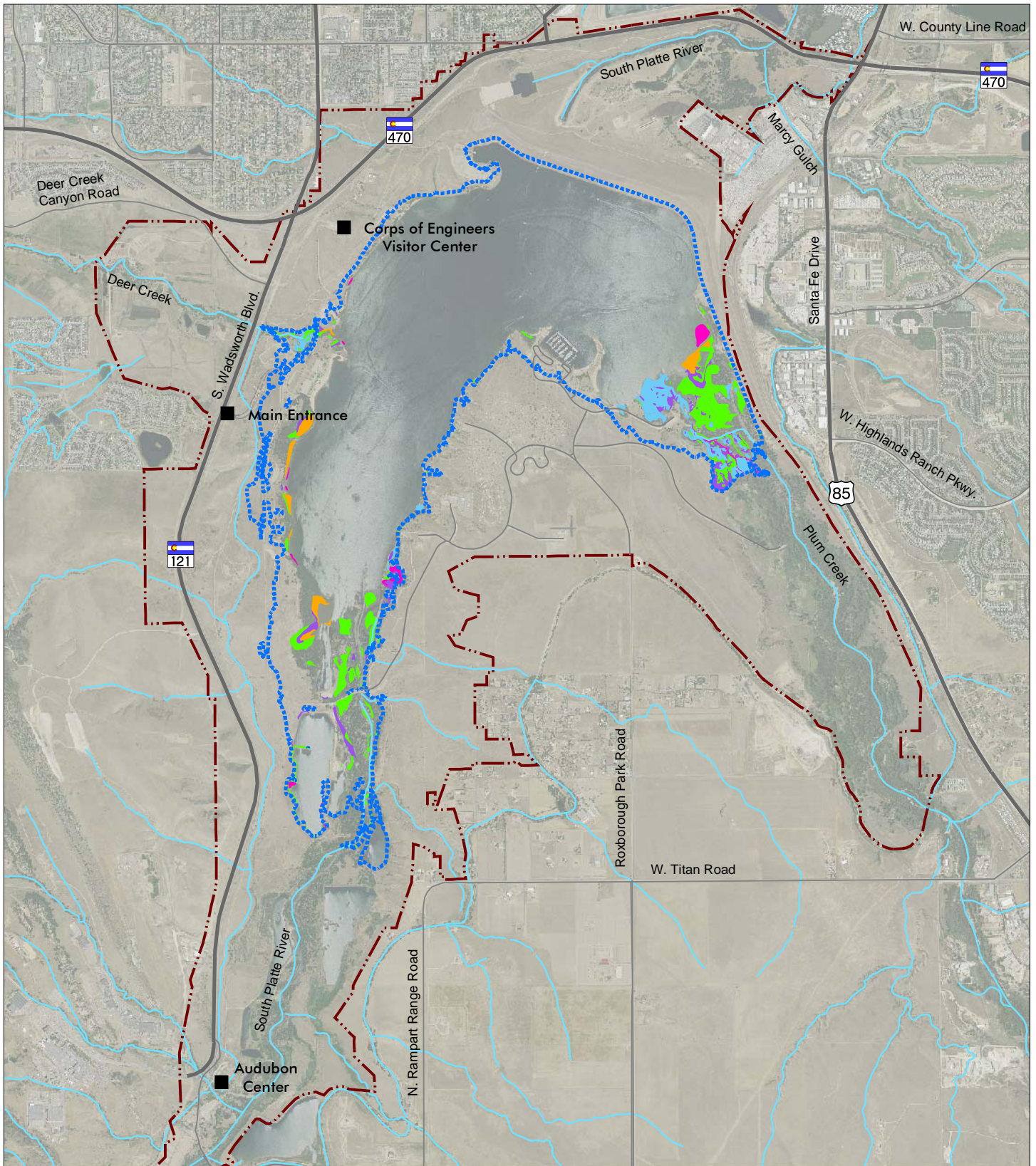
1. Supports diverse bird species (species richness);
2. Supports large numbers of birds (abundance);
3. Provides seasonal habitats for sensitive species; and
4. Provides habitats that are limited or rare on a local or regional scale.

2.2.3 Wetlands

Within the project area, biologists mapped areas for the FR/EIS that had indicators of the three characteristics that the Corps considers necessary to be present for an area to be determined a wetland (hydrophytic vegetation, supportive hydrology, wetland soils) (Figure C-3).

Wetland areas mapped for the FR/EIS were grouped into five main habitat types according to Cowardin et al. (1979): palustrine aquatic bed, palustrine emergent, palustrine scrub/shrub, palustrine forested, and lacustrine emergent. These habitat types were developed with input from the Corps and include natural or man-made wetlands.

Biologists assessed functions provided by the wetlands using the FACWet method (Johnson et al. 2009). FACWet is a Colorado-specific, qualitative rapid assessment method that relies on professional judgment to assess the functional conditions of wetlands and riparian areas. The functions assessed by FACWet are:



Chatfield Reallocation Study

Imagery Source: Landiscor©, June 2008
Pool Elevations: Tetratech

- Lacustrine Emergent
- Palustrine Aquatic Bed
- Palustrine Emergent
- Palustrine Forested
- Palustrine Scrub-Shrub

- 5444 Pool Elevation (Maximum Pool Elevation of Alternative 3)
- Chatfield State Park

0 1,750 3,500 feet
1 inch = 3,500 feet



**Figure C-3
Wetland Habitat**

File: 4048 Figure C-3 Wetland Habitat.mxd (GS)
November 2009



1. Wildlife habitat
2. Fish/aquatic habitat
3. Flood attenuation
4. Short- and long-term water storage
5. Nutrient/toxicant removal
6. Sediment retention/shoreline stabilization
7. Production export/food chain support

2.2.4 Assigning EFIs

Once the habitat attributes were defined for Preble’s and birds, the Committee held a series of workshops and email exchanges to reach consensus on assigning EFVs for Preble’s and bird habitat attributes (Table C-1). An EFV was assigned to each attribute on a 0.0 to 1.0 scale. The EFVs for each habitat type were then summed and scaled to 1 to obtain an EFI for each habitat type (Table C-1). EFVs for wetland functions were developed using FACWet.

Table C-1. Ecological Functional Values for Habitat Attributes and Ecological Functional Indices for Habitat Types.

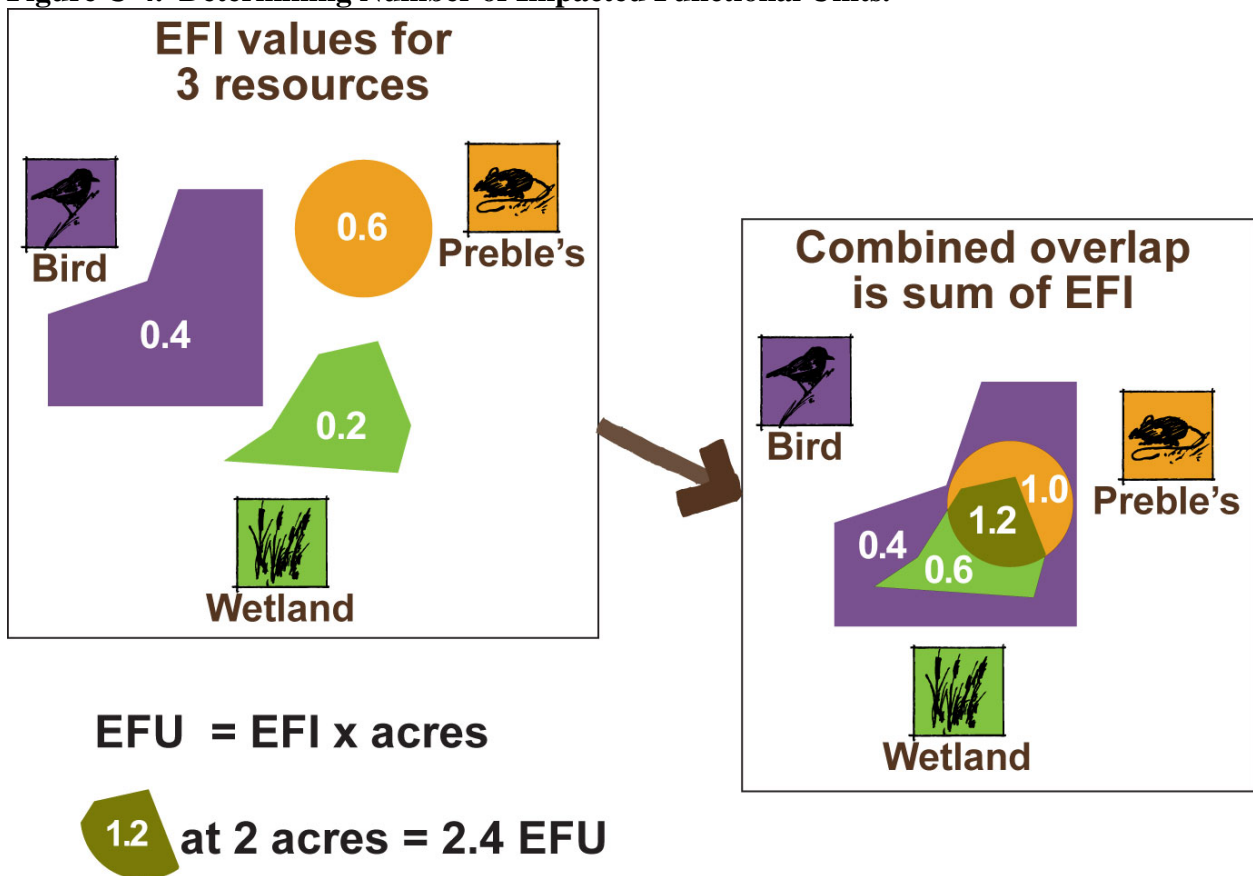
Chatfield EIS Mapping Habitat Unit	Preble’s Habitat Attributes and EFVs				Bird Habitat Attributes and EFVs				EFI
	Breeding	Winter	Forage	Cover	Species Richness	Species Abundance	Supports Sensitive spp.	Limited Habitat (local or regional)	EFI=Average of EFV for each target resource
Preble’s Habitat					Not Applicable to Preble’s Habitat				
High Value Riparian	1	1	1	1					1
Low Value Riparian	0.50	0.50	0.75	0.75					0.63
Upland	0.25	0.25	0.75	0.50					0.44
Nonhabitat	0	0	0	0					0
Bird Habitat	Not Applicable to Bird Habitat								
Shrub (riparian)					0.75	1	0.25	0.75	0.69
Trees					0.75	0.75	0.50	0.75	0.69
Upland					0.50	0.50	1	0.50	0.63
Wetland/Nonwoody					1	0.75	0.25	1	0.75
Mature Cottonwood					0.75	0.75	0.50	1	0.75
Nonhabitat					0	0	0	0	0
Wetland Habitat	Wetland Habitat EFIs Were Developed Using FACWet (Appendix A)								
Lacustrine Emergent									0.67
Palustrine Aquatic Bed									0.75
Palustrine Emergent									0.79
Palustrine Forested									0.82
Palustrine Scrub-Shrub									0.79

3.0 CALCULATE IMPACTS AS FUNCTIONAL UNITS

The number of EFUs for a particular resource in a particular area is the product of the EFI of the habitat type and the acreage of the area. For instance, if a particular area of Preble’s habitat has an EFI of 0.63 and the area is 12 acres, the area provides 7.56 EFUs (0.63 x 12) for Preble’s. If four of those 12 acres are inundated, 2.5 EFUs (4 x 0.63) would no longer be available.

The total number of functional units that would be impacted by Alternative 3 was calculated based on the sum of impacted EFUs provided for each target resource. For example if 2 acres are inundated and those 2 acres provide 0.6 EFUs for Preble’s, 0.4 EFUs for birds, and 0.2 wetland EFUs, a total of 2.4 EFUs would be impacted (Figure C-4).

Figure C-4. Determining Number of Impacted Functional Units.



Based on the EFA model, a total of 790 EFUs would be lost due to inundation below the elevation of 5,444. An additional 356 EFUs would be impacted by activities associated with relocating recreation facilities.

4.0 ASSIGNING EFUS FOR OFF-SITE MITIGATION

The CMP and supporting EFA set forth a process for identifying, quantifying, and mitigating the ecological functions associated with impacts to the target environmental resources. The CMP's first priority is to maximize on-site mitigation to the degree practicable. However, it is recognized that mitigation requirements will exceed what is available on Corps land in the vicinity of Chatfield State Park. Therefore, additional off-site mitigation will be needed.

On-site mitigation will consist of habitat enhancement or conversion. In many instances, upland grasslands will be converted to shrublands or wetlands. Because on-site mitigation would take place on property that is currently under the control of the Corps, agreements would be in place that would assure the mitigation areas are managed to benefit the target environmental resources in perpetuity. Additionally, because on-site mitigation would take place in what are generally natural areas, there would be no risk of future encroachment by development or significant changes in land use adjacent to the mitigation areas. For on-site mitigation, calculation of EFUs gained by mitigation activities such as wetland creation, would be a relatively straightforward process of determining the number of EFUs in the area prior to mitigation activities and the number of EFUs in the area after mitigation activities. The difference in EFUs would be credited to offset impacts.

Calculating mitigation credits for off-site mitigation is not as straightforward as that for on-site mitigation. Mitigation sites would consist of numerous areas surrounded by various land uses. Unlike on-site mitigation, development may be in close proximity to off-site mitigation areas and there is no certainty that adjacent land uses will not significantly change. Also, unlike on-site mitigation areas, most off-site areas would require legal real estate instruments such as conservation easements or title restrictions to ensure perpetual management of the mitigation sites to benefit the target environmental resources. Finally, the protection of existing habitat from future development or adverse land uses is a mitigation measure available off-site that is not possible on-site. In these cases, initial credit would be given for the benefit gained by ensuring the habitat would not be lost or degraded in the future. In many cases, additional credit would be gained by also enhancing the protected habitat as described for on-site mitigation.

Because of the differences from on-site mitigation, the following standards were established to define and select ecologically suitable habitat for off-site mitigation and to appropriately calculate EFU mitigation credits for off-site mitigation areas:

- Geographic boundaries of ecologically suitable habitat that can be targeted for mitigation;
- Baseline value of EFUs contained within ecologically suitable habitat in a mitigation parcel; and
- Weighting factor values.

4.1 Geographic Boundaries of Ecologically Suitable Target Habitat

To effectively identify potential mitigation properties, criteria for defining or setting boundaries on ecologically suitable mitigation habitat must be established. In other words, what defines the target habitat containing the EFUs that can be credited toward mitigation? Because Preble's has substantial geographic overlap with the other target environmental resources and suitable Preble's habitat is the most geographically limited of the target environmental resources, Preble's habitat was used to define the target habitat. However, there is no absolute standard for defining the spatial extent of Preble's habitat. For trapping survey purposes, the Service recommends that surveys be conducted in suitable habitat within 300 feet of Federal Emergency Management Agency (FEMA)-designated 100-year floodplains associated with rivers, creeks, and their tributaries (Service 2004). In 2002, the Service proposed critical habitat within the Upper South Platte River Drainage, including West Plum Creek (67 Fed. Reg. 47163 (July 17, 2002)). The width of proposed critical habitat was based on the size of the stream or stream order. For streams of orders 1 and 2 (the smallest streams), the Service delineated critical habitat as 110 meters (360 feet) outward from the stream edge; for streams of orders 3 and 4, the Service delineated critical habitat as 120 meters (400 feet) outward from the stream edge; and for stream orders 5 and above (the largest streams and rivers), the Service delineated critical habitat as 140 meters (460 feet) outward from the stream edge. Douglas County (County) created a Riparian Conservation Zone (RCZ) as part of the Douglas County Habitat Conservation Plan (DCHCP). The RCZ includes riparian areas and adjacent upland habitats on nonfederal lands with a high likelihood of supporting Preble's within the three major watersheds in the County (Plum Creek, Cherry Creek, and South Platte River upstream of Chatfield Reservoir). The RCZ was developed to include habitat attributes needed for all aspects of Preble's life cycle (e.g., water, cover, nesting, breeding, foraging, movement, and hibernation), including:

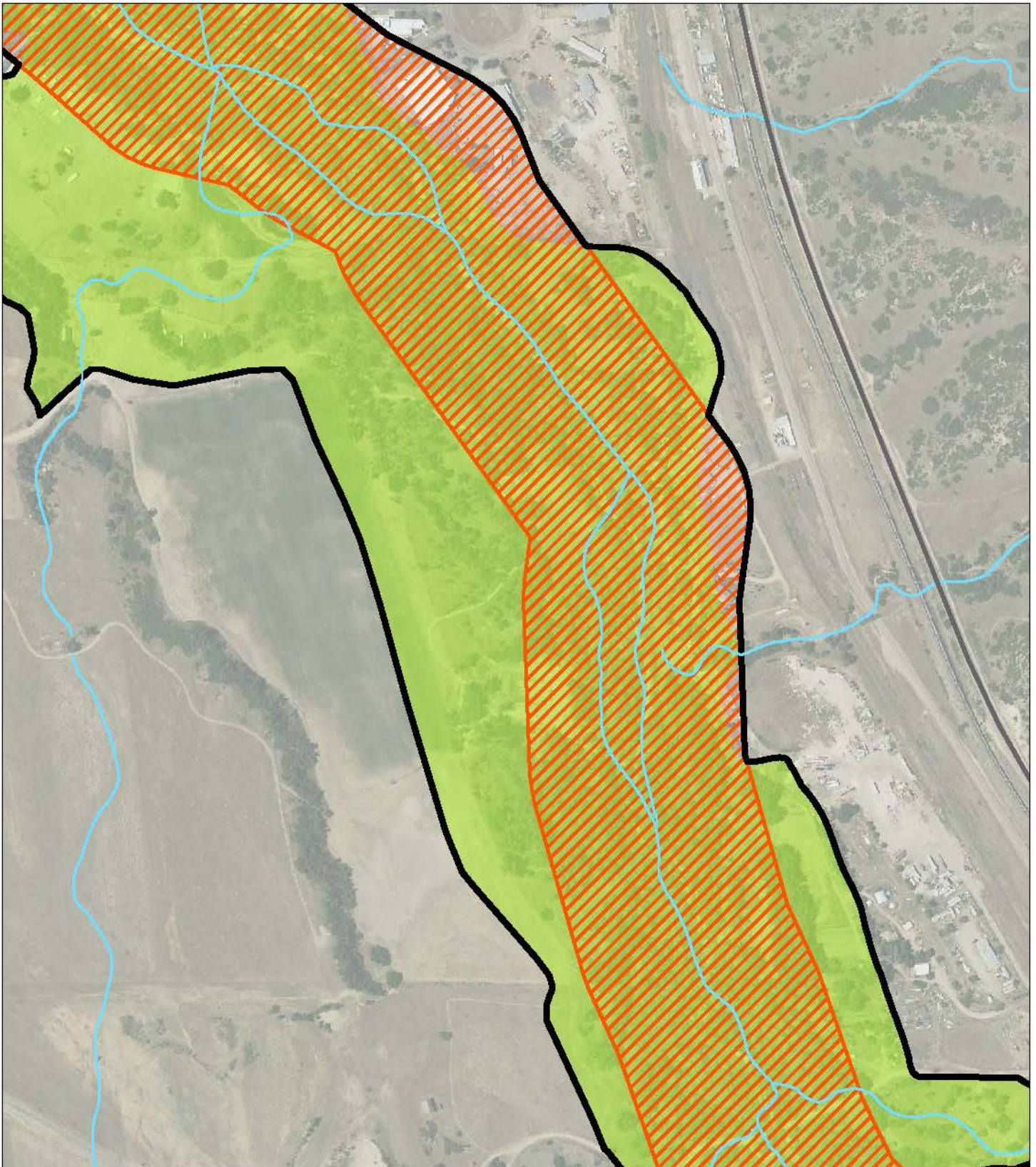
- The active channel;
- Alluvial floor;
- Upland side slopes adjacent to the channel or alluvial floor; and
- A component of the upland vegetation adjacent to the upland side slopes (generally 25 feet to 100 feet wide depending on potential habitat quality).

A side-by-side comparison of the proposed critical habitat and the RCZ revealed that the RCZ generally captures a larger area of potential Preble's habitat on larger order streams, whereas the proposed critical habitat captures more potential Preble's habitat on smaller streams (Figure C-5). To maximize the opportunity to conserve and enhance riparian corridors, an inclusive approach was used by overlaying the RCZ and proposed critical habitat and using whichever boundary was wider as the outer boundary of target habitat.

4.2 Baseline Credits for Preservation

While local, state, and federal regulations provide governmental entities the ability to restrict uses on private land, no regulation or combination of regulations prohibits all land use activities with the potential to negatively affect EFUs on target habitat. For example, local floodplain regulations are often considered among the most restrictive land use regulations; however, under such regulations, land uses such as the following are allowed:

1. Water-related recreational facilities;
2. Agricultural uses such as general farming, pasture, truck farming, sod farming, grazing, and crop harvesting;
3. Recreational uses not requiring structures or fences, including parks, golf courses, driving ranges, picnic grounds, wildlife and natural reserves, game farms, target ranges, trap and skeet ranges, hunting, fishing, and hiking areas;
4. Lawns, gardens, parking areas, and other similar uses accessory to the residential use of the land; and
5. All-terrain vehicle use.



Chatfield Reallocation Study

-  Primary Target Habitat
-  Critical Habitat Proposed in 2002
-  Riparian Conservation Zone

Imagery Source : Landiscor©, June 2008
Pool Elevations: Tetratech

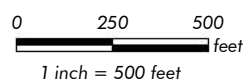


Figure C-5
Example Off-Site Mitigation
Target Habitat

File: 4048 Figure C-5 Off-Site Mit Target Hab.mxd (GS)
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Several authors have identified land uses such as grazing, agricultural openings, trails, and recreationists as having detrimental effects on wildlife species and communities (Knight and Gutzwiller 1995; Rodewald 2003; Knopf et al. 1988a and 1988b; Popotnik and Giuliano 2000). Most or all of these land uses are currently allowed within riparian areas of Douglas and Jefferson counties under existing local, state, and federal regulations. The working draft of the Preble's Recovery Plan lists the inadequacy of existing regulatory mechanisms, habitat conversion, habitat destruction, and habitat fragmentation through housing, commercial, recreational, and industrial development as a threat to recovery (Service 2003).

In recognition of the value of protecting existing target habitat from loss or degradation by allowable changes in land use in or near target habitat, conservation of existing habitat would generate some amount of mitigation credit. Credit would be given with the requirement that conserved areas be managed to ensure at least the existing number of EFUs are maintained in perpetuity. Land preservation with specific legal encumbrances to prevent activities that may negatively impact the long-term viability of the identified EFUs provides an ecological benefit that will be realized throughout and beyond the lifespan of typical zoning ordinances or the permit period of the DCHCP. The protection would persist even if Preble's is delisted in the future.

Giving credit for preserving existing habitat provides incentive to protect existing areas of high quality habitat that would not benefit from enhancement activities and that might otherwise not be considered a mitigation area. Because the value of conservation comes from protecting habitat against somewhat speculative and future events, instead of quantifiable increases in EFUs from enhancement activities, full credit would not be given for existing EFUs on conserved parcels—a fraction of existing EFUs, or a baseline credit, would be given instead.

Legal measures such as acquisition, conservation easement, or other conservation tools would protect habitat for the benefit of the target environmental resources. All parcels preserved for mitigation credit would meet a threshold level of management and land use restrictions to make certain the protected lands would continue to benefit the target environmental resources. Restrictions would be site-specific and could include limits on livestock grazing, agricultural activities, and access by humans and domestic pets.

The objective of determining the baseline credit for preservation is to find a level of credit that reasonably values the benefit of protecting existing habitat in perpetuity. Part of determining baseline credit includes determining a level of credit that balances incentives for both preserving high quality habitat and enhancing degraded habitat. Two primary perspectives were considered for assigning baseline credit to mitigation parcels:

1. Assign moderate value for preservation and restrictive easement/contract. The modest EFU credits for preservation without enhancement would likely provide fewer EFU credits per dollar spent or acre preserved, compared to protecting degraded areas and enhancing them. This encourages acquisition of degraded habitat that would benefit most from active restoration/enhancement. Supporters of this perspective feel that many of the habitat values of a property are already protected by governmental regulations such as floodplain restrictions, county zoning ordinances, the RCZ, and ESA.
2. Assign high value for preservation and encourage the acquisition of the best remaining habitat. Supporters of this perspective seek to encourage preservation of the best available remaining habitat, pointing out that once a property is degraded, it may never fully recover and that existing regulations do not fully protect the target habitat or are inadequate to prevent habitat degradation.

A baseline credit of 15 percent of existing EFUs is proposed for all parcels that are preserved in perpetuity. Additional credits could be generated by restoring or enhancing habitat. Allowing credit for 15 percent of the EFUs provided by existing habitat could be viewed as saying that preservation will prevent the loss or degradation in perpetuity of at least 15 percent of the existing EFUs. In fact, without preservation, the ecological value of habitat could be reduced by much more than 15 percent if land use changes to heavily grazed pasture or if development encroaches with no restrictions. If Preble's is eventually delisted and Preble's habitat is no longer protected under the ESA, there could be significant losses of riparian habitat similar to that experienced in other riparian corridors that do not contain Preble's habitat, unless adequately protected as part of the delisting action.

A 15 percent credit value is also consistent with large habitat conservation plans in Douglas County. The Meadows development in Castle Rock mitigated 8.63 acres of permanent habitat loss by preserving approximately 43 acres and preserving and enhancing an additional 10 acres of Preble's habitat; a preservation value somewhere between 14 and 16 percent (about 6.5:1 preservation-to-impact ratio). The DCHCP uses a preservation value of 33 percent as mitigation for permanent impacts to the RCZ (3:1 preservation to impact ratio).

4.3 Weighting Factors

Because EFUs are calculated solely on the basis of target habitat within a particular area, the ecological effects of the landscape context in which the EFUs are located are not captured. In other words, the actual ecological values of EFUs in two identical riparian areas are different if one of the areas is abutted by dense development (e.g., East Plum Creek through Castle Rock) and the other is surrounded by undeveloped grasslands (e.g., East Plum Creek north of Meadows Parkway). The values would also be different if one area is isolated from similar habitat (functionally an island) and the other is part of a larger, unfragmented, system of similar habitat. Landscape attributes can increase the ecological value of EFUs by reducing the indirect effects of development and other activities (stressors) that occur outside of the riparian corridor. Landscape attributes can also increase EFU values by enhancing the overall services provided by an area beyond the functions of the resources or habitats contained within that parcel. Because these attributes affect the actual ecological values of EFUs on a parcel, they should be addressed by using weighting factors. The following attributes directly increase the value of EFUs and will be incorporated as weighting factors into off-site target habitat EFU calculations:

- Proximity (P);
- Buffers (B); and
- Connectivity (C).

The basic formula for calculating off-site EFUs is $\sum \text{Baseline EFU} \times B \times P \times C = \text{Weighted EFUs for target habitat}$.

4.3.1 Proximity

Proximity, or how near the mitigation habitat is to the impacted habitat, enhances the value of the target environmental resources in varying ways. In general, it is preferred to mitigate for impacted resources as close to the impact areas as possible. However, for some resources, the functional value of mitigation may not be directly related to proximity. For example, more distant mitigation areas may provide more value to Preble's by connecting protected fragmented habitat or reducing imminent threats to a large population. Similarly, the ecological functions provided by impacted wetlands could produce added value if wetland mitigation is done in a reach of highly degraded stream channel or where surface runoff carries contaminants from adjacent developed areas.

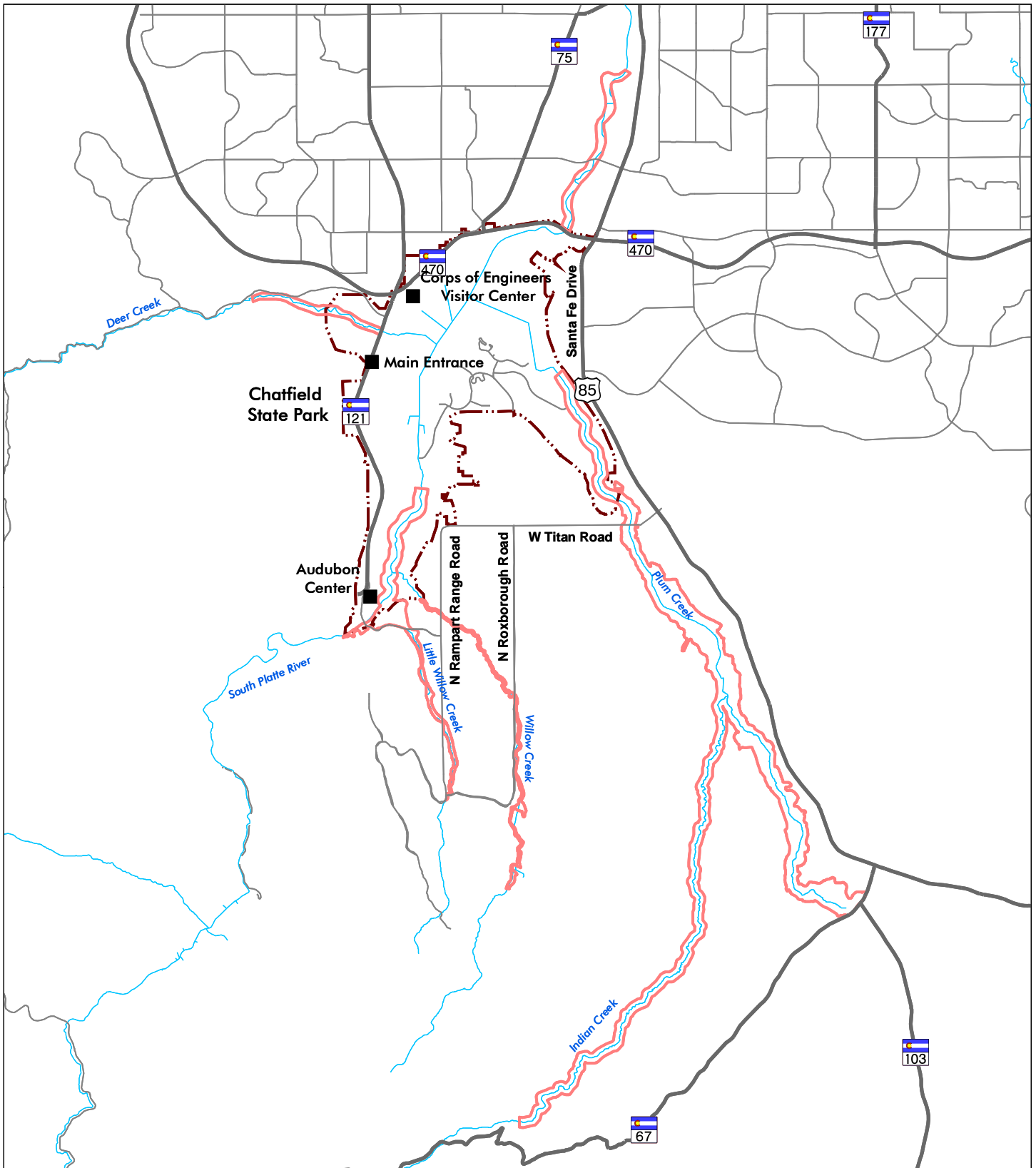
On the other hand, the type and structure of bird habitat impacted by the Chatfield Reservoir reallocation is limited by both space and structure to areas in close proximity to Chatfield Reservoir. Much of the bird habitat impacted by reallocation consists of a multistory, multistructure habitat of mature cottonwood, diverse shrub community, and a herbaceous understory. Similar bird habitat structure near Chatfield Reservoir is restricted to a habitat complex that occupies a relatively small geographic area that is defined by urban development to the east and north, by foothills and canyons to the west, and by a distinct change in vegetation communities to the south of Sedalia. Specific areas that contain the habitat complex that has similar habitat attributes as impacted habitat described above includes the following reaches of riparian habitat (Figure C-6):

- South Platte River and Plum Creek in Chatfield State Park;
- South Platte River from Chatfield Reservoir to the mouth of Waterton Canyon;
- Willow and Little Willow creeks from Chatfield Reservoir to Roxborough State Park;
- Plum Creek from Chatfield Reservoir to Sedalia (Highway 67);
- Indian Creek from the confluence with Plum Creek to the U.S. Forest Service boundary;
- Deer Creek west to the mouth of Deer Creek Canyon; and
- South Platte River through South Platte Park.

Because mitigating Preble's and wetland habitats in close proximity to impacts is not as ecologically beneficial as for bird habitat, a weighting factor for proximity will only be applied to bird habitat EFUs at off-site mitigation sites.

The weighting factor for bird habitat will be a two-tiered factor based on vegetation communities and enhancement opportunities. The two tiers are:

- Within the specified areas described above, the bird EFU component receives a 0.25 weighting factor (multiply by 1.25); and
- Outside the specified area bird EFU component receives a 0 weighting factor (multiply by 1.0).



Chatfield Reallocation Study

- Bird Habitat Complex Boundary
- Chatfield State Park

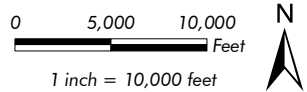


Figure C-6
Bird Habitat Complex Targeted
for Cottonwood Regeneration
and Mature Cottonwood
Conservation

File: 4048 - Figure C-6 Bird Hab CW Regen Target.mxd (GS)
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4.3.2 Buffers

A riparian buffer is a linear band of permanent vegetation adjacent to a riparian area intended to maintain or improve ecological functions such as water quality and wildlife habitat.

Vegetation in buffer areas improves the quality of water as it moves across a buffer by trapping and removing various pollutants (e.g., contaminants from herbicides and pesticides; nutrients from fertilizers; and sediment from upland soils) from both overland and shallow subsurface flow through the buffer. Wildlife habitat can be improved when a buffer provides distance and a separation between human disturbance and riparian habitat. A study by Peak and Thompson (2006) found that wide, forested riparian areas provided breeding habitat for more bird species and that the addition of grassland-shrub buffer strips along narrow riparian habitat increased breeding bird species richness.

Minimum buffer widths recommended in the scientific literature to meet specific environmental objectives vary from only a few feet to more than 300 feet. Water quality functions can generally be protected with a 100-foot buffer to trap sediments and reduce nitrate concentrations Wenger (1999). Aquatic habitat can be protected with forest riparian buffers between 35 and 100 feet and terrestrial riparian wildlife communities require minimum buffers of 300 feet from the stream edge and extend beyond 660 feet (NRCS 2003; Wenger 1999). An extensive literature review and analysis conducted by the Environmental Law Institute (ELI 2003) found that a 300-foot buffer was the most consistent and scientifically supported buffer width reported in the literature. Based on this information, an incremental buffer up to 300 feet from the edge of target habitat is an area that provides added value to the EFUs contained within that habitat. This added value is accounted for by applying a weighting factor to the baseline EFUs.

Assuming that as buffer width increases, the gain in ecological benefits to habitat incrementally diminishes, the buffer area to which a weighting factor would be applied consists of three 100-foot-wide bands that approximately parallel target habitat. Because 100 feet was reported most often as the buffer width required to meet water quality objectives, a buffer that averages 100 feet in width, that at no point is less than 50 feet wide, is established as the minimum buffer threshold to receive any weighting credit. The 50-foot limit was established because this is the minimum reported in the literature to provide water quality benefits. In

recognition of the decreased ecological benefits, a weighting factor of decreasing value would be applied to each subsequent 100 feet (on average) of buffer included within a protected mitigation parcel. For example, the EFU value within a mitigation area that included the target habitat and an adjacent 100-foot buffer (on average) would be increased by 30 percent. Increasing the buffer width to 200 feet (on average) would increase the EFU value by an additional 20 percent, for a 50 percent total increase in value. Increasing the average buffer width to 300 feet or more would increase the EFU value by an additional 10 percent, for a maximum increase in EFUs of 60 percent. The values of increasing buffers widths are as follow (Figure C-7):

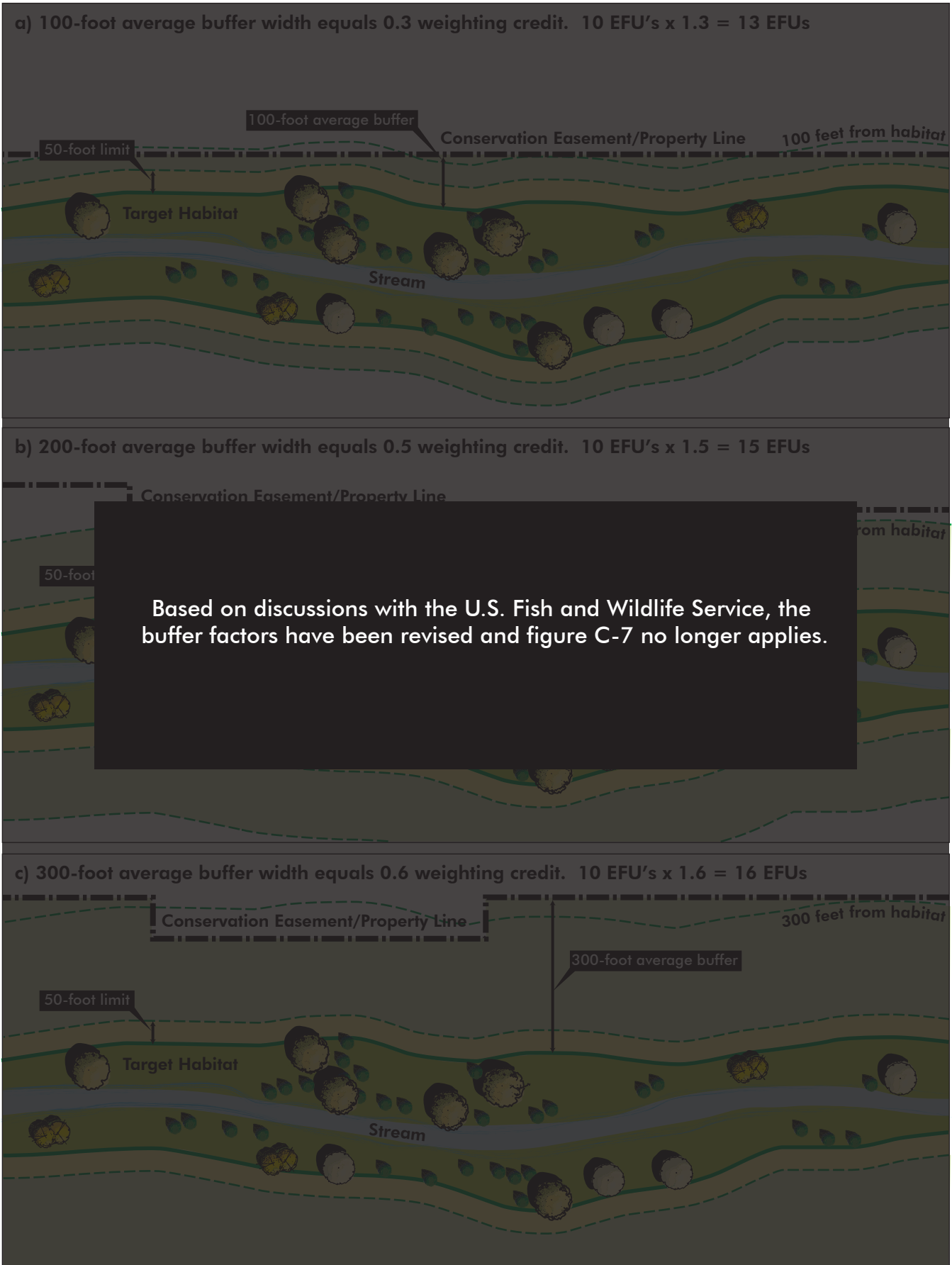
- Average buffer width less than 100 feet = no increase in value (no multiplier);
- Average buffer width between 100 and 200 feet = EFU multiplied by 1.3;
- Average buffer width between 200 and 300 feet = EFU multiplied by 1.5; and
- Average buffer width greater than 300 feet = EFU multiplied by 1.6.

Situations may exist where target habitat may be able to be buffered only on a single side, or buffers may be of unequal widths on the opposite sides of target habitat. To address these situations, target habitat will be split at the stream channel centerline, and the average width of the buffer will be calculated and credited separately to the EFUs for the protected property on each side of the stream.

4.3.3 Connectivity

Riparian areas tend to be linear in shape and, therefore, are more susceptible to being fragmented than other types of habitat. Habitat fragmentation has a negative impact on wildlife, including Preble's populations, either through the creation of two or more small, isolated populations or the reduction of viability in larger populations. Providing connectivity by permanently protecting corridors is one of the most effective tools for increasing the viability of threatened populations.

Figure C-7. Chatfield Reallocation Buffer Weighting Approach
Examples below assume target habitat provides 10 EFUs



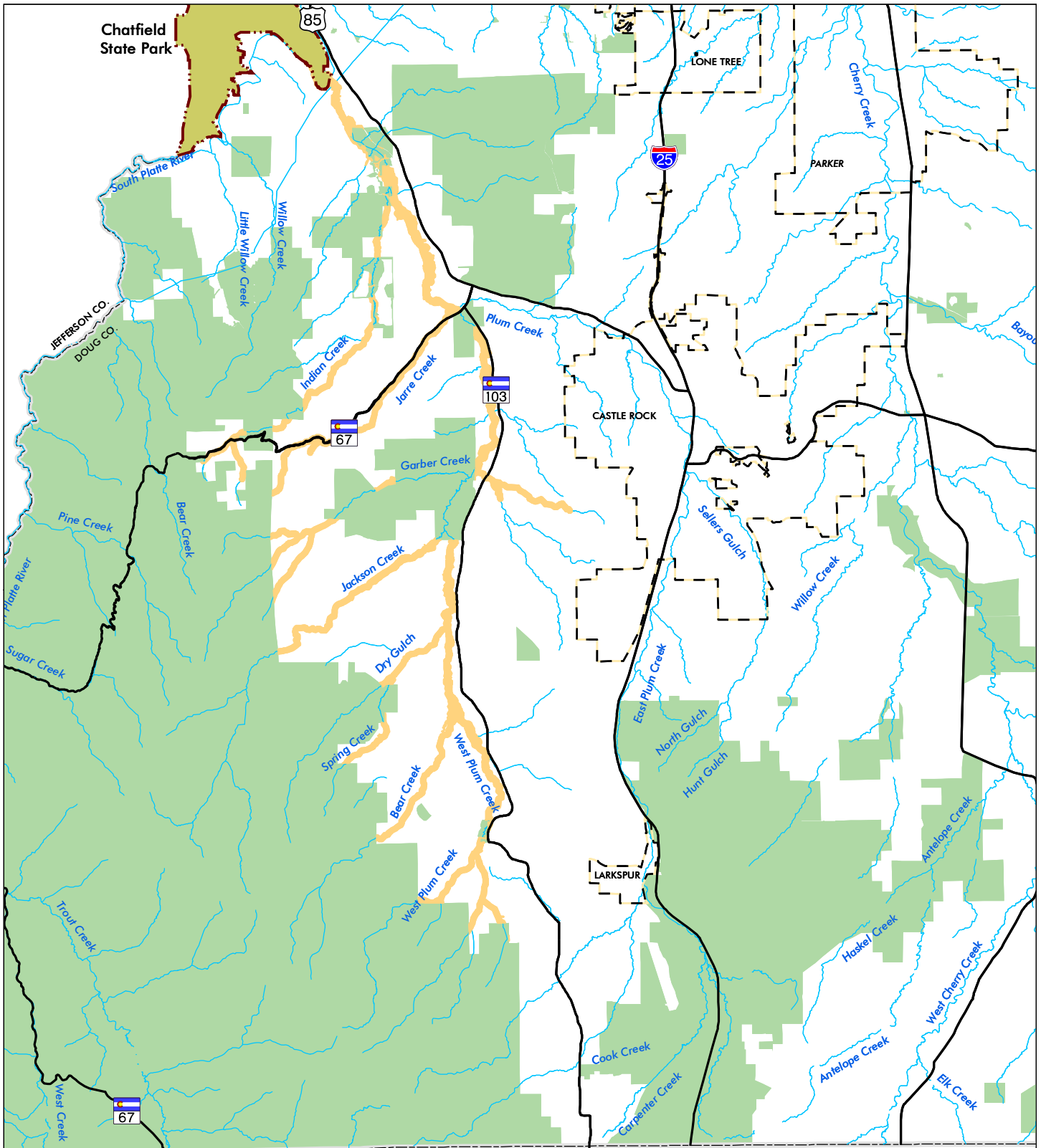
Species using corridors can be categorized into “passage species” and “corridor dwellers” (Beier and Loe 1992). Passage species, such as elk, need connections between two or more areas for discrete events of short duration. Corridor dwellers also move between two or more habitats or reserves, but need several days or generations to complete the passage. These species must live within the corridor for extended periods or entire lifetimes (Beier and Loe 1992). Although individual Preble’s often move relatively lengthy distances (more than 1 mile) between habitats, the population as a whole is a corridor dweller. As such, effective connections between protected areas that provide habitat for populations of Preble’s must contain high-quality habitat that satisfies all life requirements.

Conservation biologists researching species viability and the design and configuration of conservation reserves have found that connectivity between reserves increases dispersal, allows genetic interchange, provides avenues for nearby meta-populations to recolonize reserves, and improves overall population viability (Beier and Noss 1998; Beier and Loe 1992; SONDGERATH and SCHRODER 2002). The loss or modification of unprotected habitat outside reserves often reduces the probability of sensitive species occurring within the reserve (Cabeza 2003).

To conserve important natural resources and agricultural areas, the County has worked to protect and/or connect a vast network of open space. These open space parcels support entire intact communities or act as buffers and connections to other federal, state, and municipal protected lands (Figure C-8). Although extensive, many protected parcels within this network are isolated and there is no complete connectivity of an entire riparian corridor at the watershed, drainageway, or even tributary scale.

The importance of habitat connectivity is reflected in one of the goals of the working draft of the Preble’s Recovery Plan, which is to protect at least 57 connected stream miles in the proposed Plum Creek recovery unit. This importance can be reflected in EFU credit calculations by incorporating a weighting factor based on two concepts:

1. Removing physical obstacles; and
2. Providing legal protection and preservation of contiguous stream miles of habitat.



Chatfield Reallocation Study

-  Primary Target Off-site Mitigation Area
-  Protected Lands
-  Incorporated Towns
-  Chatfield State Park

Unshaded areas are unprotected lands in Douglas County

Imagery Source : Landiscor©, June 2008
Pool Elevations: Tetratich

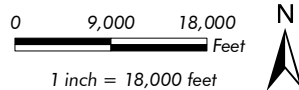


Figure C-8
Off-Site Mitigation Target
Habitat within Private
Douglas County Parcels

File: 4048 - Figure C-8 Off-Site Mit Target.mxd (GS)
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Removing physical obstacles to wildlife movements improves habitat connectivity by removing physical barriers, improving design of replacement structures, or modifying existing physical barriers to allow movements. The removal of physical barriers would occur on a site-specific basis and the value, or weighting factor, applied to EFUs would be evaluated on a case-by-case basis as they occur.

The value of the connectivity weighting factor will be tied to the working draft of the Preble's Recovery Plan. The working draft of the Preble's Recovery Plan targets a large (at least 2,500 adults), self-sustaining, naturally occurring population of Preble's in the Upper South Platte River watershed, with a focus on Plum and West Plum creeks (Service 2003). The working draft of the Preble's Recovery Plan estimates that the following number of protected, connected stream miles would be necessary to support large, medium, and small self-sustaining populations of Preble's:

- 57 connected stream miles (at about 44 mice/mile) to support a large population (at least 2,500 adults);
- 11 stream miles to support a medium Preble's population of at least 500 adults; and
- A minimum of 3 stream miles to support the smallest self-sustaining Preble's population (approximately 150 adults).

The value of the connectivity weighting factor is based on the literature presented above. Although none of the scientific literature quantifies the relationship between connectivity and increases in population viability, it is clearly demonstrated that the greater the connectivity, the greater the species viability. Thus, using the population sizes described in the working draft of the Preble's Recovery Plan, the connectivity weighting factor values are based on the assumption that a connected population of 2,500 Preble's (large population) is three times more likely to remain viable (survive) than several isolated, nonsustainable populations that in total equal at least 2,500 individuals. Likewise, 11 miles of protected connected habitat supporting a medium population is twice as viable as 500 individuals in isolated, nonsustainable habitat patches. Increasing habitat connectivity to the minimum of 3 miles would only minimally increase population viability. Based on literature research and the assumptions above, the weighting values of increasing connectivity in the West Plum and Plum Creek watershed or along the South Platte River upstream of Chatfield Reservoir are as follow:

- Negligible – Provides increased connectivity to less than 3 protected stream miles; EFU value remains the same
- Minor – Provides connectivity to 3 protected stream miles to support a small population; EFU is multiplied by 1.25
- Major – Provides connectivity to 11 protected stream miles to support a medium population; EFU is multiplied by 2
- Substantial – Provides connectivity to 57 protected stream miles to support a large population; EFU is multiplied by 3

The newly protected stream miles would either be added to existing protected stream miles or would be stand-alone miles. For example, if 1.5 stream miles that abut Chatfield State Park on Plum Creek are newly protected, a 3-mile reach of protected habitat capable of supporting a small Preble’s population would be created. Or, if the currently unprotected 6.4 stream miles between Duncan Ranch Open Space and Pinecliff Open Space, which abuts U.S. Forest Service land, were protected, there would be a total of 13.3 protected stream miles capable of supporting a medium Preble’s population.

The mitigation approach described in the CMP and the weighting factors and values detailed above provide the mechanism to achieve effective connections and long-term viability of Preble’s populations in the Chatfield Basin. This approach encourages protection of existing high quality habitat, promotes enhancement of degraded habitat, encourages corridor protection, and protects the ecological services that provide sustainable habitat for a corridor dweller by encouraging large buffers. Implementation of the CMP through the Chatfield Reallocation FR/EIS process not only fully mitigates the impacts of reallocation to Preble’s, birds, and wetlands, but also integrates with regional conservation planning (Appendix B).

4.3.4 Hypothetical Examples of Weighting Factors

To test the effectiveness and applicability of the weighting factors, several hypothetical mitigation scenarios were developed based on an assumed standard 10-acre mitigation area with 15.5 existing EFUs. The baseline number of mitigation credits for off-site areas assumes a conservation credit of 15 percent for protecting the existing EFUs in perpetuity. An example of an on-site standard parcel is provided for comparison purposes. The following combinations of weighting factors were applied to the standard parcel:

- On-site with no weighting factors;
- Off-site with no weighting factors;

- Off-site with major connectivity and proximity;
- Off-site with minor connectivity, large buffer, and proximity;
- Off-site with major connectivity, large buffer, and proximity;
- Off-site with a medium buffer; and
- Off-site with minor connectivity, medium buffer.

The results of the hypothetical scenarios show that when the weighting factors are applied, off-site mitigation parcels that are in close proximity, have large buffers, and increase connectivity provide the greatest number of EFUs available for mitigation credit (Table C-2). Also, connectivity, closely followed by buffers, has the greatest positive impact on EFU values. This is consistent with ecological theory, which suggests that connectivity or unfragmented habitat plays a more important role than buffers in sustaining populations.

The ratio of EFUs available for credit to the initial EFUs contained within the parcel ranges from 15 percent to 60 percent for preservation and legal protection alone based on the weighting factors applied (Table C-2). Not until EFUs are increased through 20 percent enhancement does any scenario exceed 100 percent credit. Given current patterns of property ownership and land use, it is likely that parcels most commonly available for mitigation will be those with minor connectivity and medium buffer widths. In those cases, preservation alone would result in a mitigation-to-baseline EFU ratio of 28 percent. With enhancement of 20 percent, the ratio would be 66 percent.

Table C–2. Hypothetical Mitigation Scenarios using On- and Off-Site Parcels with Various Values for Weighting Factors.

Hypothetical Mitigation Scenarios and Applied Weighting Factors	Mitigation Area Characteristics			Weighting Factors			EFUs Without Enhancement		EFUs with 20% Enhancement		
	Acres of Target Habitat	Existing EFUs	Existing Baseline EFUs ¹	Connectivity ² (C)	Buffer ³ (B)	Proximity ⁴ (P)	Mitigation EFUs w/out Enhancement ⁵	Ratio of Mitigation Credits to Baseline EFUs	EFUs Gained by Enhancement	Total EFUs with Enhancement ⁶	Ratio of Mitigation Credits to Baseline EFUs
1) On-site - None	10	15.5	15.5	0.00	0.00	0.00	0.00	0%	3.10	3.10	20%
2) Off-site - None	10	15.5	2.33	1.00	1.00	1.00	2.33	15%	3.10	5.43	35%
3) Off-site – Major Connectivity, Proximity	10	15.5	2.33	2.00	1.0	1.25	5.81	38%	3.10	13.56	88%
4) Off-site Minor Connectivity, Large Buffer, Proximity	10	15.5	2.33	1.25	1.60	1.25	5.81	38%	3.10	13.56	88%
5) Off-site - Major Connectivity, Large Buffer, Proximity	10	15.5	2.33	2.00	1.60	1.25	9.3	60%	3.10	21.70	140%
6) Off-site - Medium Buffer	10	15.5	2.33	1.00	1.50	1.00	3.49	23%	3.10	8.14	53%
7) Off-site – Minor Connectivity, Medium Buffer	10	15.5	2.33	1.25	1.5	1.00	4.36	28%	3.10	10.17	66%

1. Baseline value for preservation and legal protection of off-site mitigation parcels is 15 percent of existing EFUs
2. Connectivity weighting factors are Negligible = 1.0, Minor = 1.25, Major = 2.0, and Substantial = 3.0
3. Buffer weighting factors are 0 to 100 feet = 1.0, 100 feet to 200 feet = 1.3, 200 feet to 300 feet = 1.5, Greater than 300 feet = 1.6
4. Proximity weighting factors are in specified bird habitat complex = 1.25, out of bird habitat complex = 1.0
5. Mitigation EFUs w/out Enhancement = Baseline EFUs x C x B x P
6. Total EFUs with enhancement = Baseline EFUs + Enhancement EFUs x C x B x P

5.0 MITIGATION FEASIBILITY AND ADEQUACY

Based on current information and assumptions, on-site, noncritical habitat compensatory mitigation activities will generate 91 EFUs to partially offset the 796 permanently impacted EFUs (Section 6.3.2.5 of the CMP). This number will be refined as more information becomes available during detailed design of the on-site mitigation areas, but it is not likely to be significantly lower because the size of the proposed on-site mitigation areas is estimated conservatively. The current EFU estimate is likely the minimum number that will be generated on-site because, under adaptive management, additional EFU credits can be gained as habitat below the 5,444-foot elevation stabilizes over time (Section 7.5 of the CMP).

If 91 EFUs is a conservative estimate of the minimum number of anticipated on-site EFUs, then a conservative estimate of the maximum number of EFUs required from off-site activities to fully offset the 796 permanently impacted EFUs is 690 EFUs. If more EFUs credits are generated on-site, fewer are necessary off-site.

Implementation of the CMP is only feasible if there are enough off-site EFUs within target habitat to provide 690 EFU mitigation credits. The method used for estimating the baseline number of potentially available off-site EFUs is similar to that used to quantify on-site baseline EFUs. The difference is that off-site habitat was not mapped as part of the FR/EIS, so there were no mapped habitat categories to which EFIs could be applied to estimate EFUs. In order to estimate off-site EFUs, comparable off-site mapping had to be used. Extensive riparian mapping, based on satellite imagery, has been conducted in the entire South Platte River/Plum Creek watersheds by CDOW (2006). As described below, the CDOW riparian mapping proved to be reasonably comparable and was used to estimate off-site EFUs.

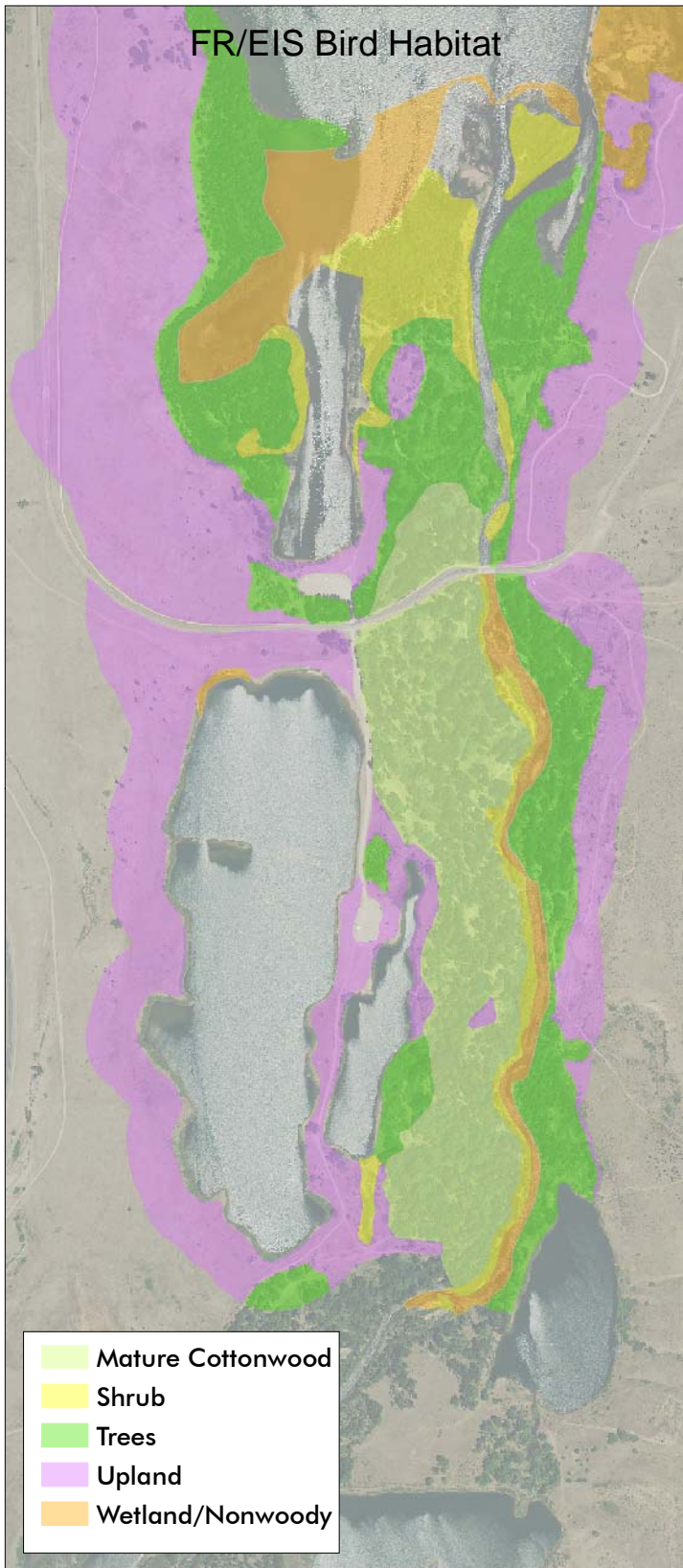
5.1 Standardizing Habitat Mapping

Habitat mapping for the three target environmental resources was done as part of the FR/EIS. The upper limit of wetland mapping was the maximum proposed pool elevation of 5,444 feet. Preble's and bird habitat mapping extended approximately 50 feet above the maximum proposed pool elevation of 5,444 feet, but did not include all areas within Chatfield State Park or any off-site areas. Because the geographic extent of the mapping was limited to potential areas of inundation, the potential for on- and off-site mitigation area EFUs was unknown. A method based on existing data was developed to estimate potential mitigation EFUs.

Extensive riparian mapping, based on satellite imagery, has been conducted in the entire South Platte River/Plum Creek watersheds by CDOW (2006). Comparison of the FR/EIS habitat mapping and CDOW riparian mapping revealed considerable similarities between the two efforts (Figure C-9). In order to use the CDOW mapping to estimate EFUs, the CDOW mapping categories had to be assigned EFIs. Assigning EFIs involved three steps:

1. Establish equivalencies between CDOW vegetation mapping categories and Chatfield vegetation and habitat mapping categories (Table C-3);
2. Generate GIS overlay of expected overlap between site-specific Chatfield mapping categories and CDOW mapping categories for each of the target environmental resources; and
3. Correct inconsistencies.

Data tables and GIS layers were created to correlate the similarities between habitat mapping of the target environmental resources and CDOW riparian data. The data table and GIS mapping were verified with aerial photos to identify inconsistencies in the two mapping efforts and possible reasons for the inconsistencies. Most inconsistencies were related to the different dates of aerial photo/satellite imagery used for the two mapping efforts. Many areas identified as wetlands in the earlier CDOW mapping had developed into riparian shrublands at the time of the FR/EIS mapping. Once inconsistencies were reconciled, the correlation between FR/EIS mapping and CDOW riparian mapping was 95 percent for Preble's, 78 percent for birds, and 74 percent for wetlands.



Chatfield Reallocation Study

Imagery Source : Landiscor©, June 2008

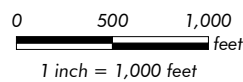


Figure C-9
FR/EIS Bird Habitat Mapping
and Comparable CDOW
Riparian Mapping

File: 4048 Figure C-9 Bird Mapped and CDOW.mxd (GS)
November 2009

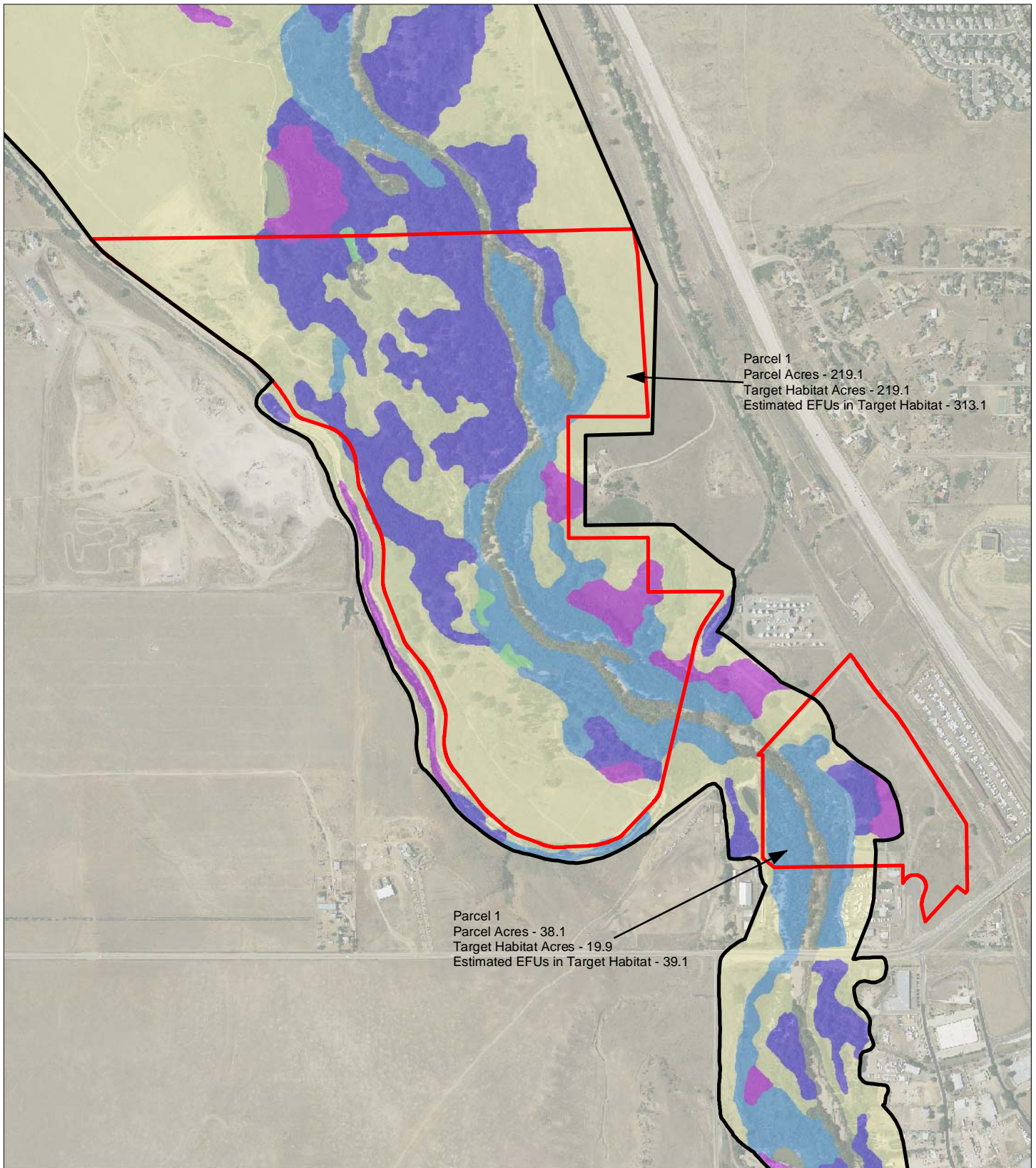


Table C-3. Mapping Category Equivalencies between CDOW Riparian Mapping and FR/EIS Target Resource Mapping.

CDOW Riparian Mapping Category (CDOW Map Code)	Chatfield Equivalent Habitat (Preble's)	Chatfield Equivalent Habitat (Birds)	Chatfield Equivalent Habitat (Wetlands)
Riparian Deciduous Trees			
Cottonwood (RT2)	High Value Riparian	Mature Cottonwood	Palustrine Forested
Riparian Shrubs			
General (RS)	High Value Riparian	Wetland/ Nonwoody	Palustrine Scrub-Shrub
Willow (RS1)	High Value Riparian	Shrub	Palustrine Scrub- Shrub, Palustrine Forested
Riparian Herbaceous			
Cattails/Sedges/Rushes (with permanent standing water) (RH1)	Nonhabitat	Wetland/ Nonwoody	Lacustrine Emergent
Sedges/Rushes/Mesic Grasses (waterlogged or moist soils) (RH2)	High Value Riparian	Wetland/ Nonwoody	Palustrine Emergent
Other Riparian			
Unvegetated (NV)	Nonhabitat	Nonhabitat	Palustrine Aquatic Bed
Nonriparian			
Upland Grass (UG)	Upland	Upland	None
Upland Grass (Subirrigated Fields) (UG1)	Low Value Riparian	Upland	None
Irrigated Agriculture (AI, IA, IR)	Low Value Riparian	Upland	None








5.2 Estimating Off-Site Mitigation EFUs



With equivalencies established between FR/EIS and CDOW mapping, the existing number of EFUs present in off-site target habitat was estimated (Figure C-10). Estimates of off-site EFUs were used to determine if there are adequate potential mitigation EFU credits available on private parcels with target habitat in Douglas County.



Chatfield Reallocation Study

Imagery Source : Landiscor©, June 2008

CDOW Mapping Combined EFI	
	1.13
	1.44
	1.48
	1.75
	2.5
	2.57
	2.6

 Target Habitat
 Douglas County Parcel

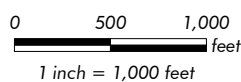


Figure C-10
Example of CDOW Mapping
with Off-Site Target Habitat
and Estimated EFUs

File: 4048 Figure C-10 Off-Site CDOW.mxd (GS)
 November 2009

Potentially available off-site mitigation EFUs were estimated using a number of conservative assumptions. First, about 6,075 acres of target habitat is available on private parcels in the Plum Creek and West Plum Creek watersheds in Douglas County. Assuming that EFUs are evenly distributed throughout the 6,075 acres, there are an estimated 8,477 existing EFUs potentially available for conservation.

Not all private property owners would be willing to sell or enter into conservation easement agreements. Anecdotal information from three large mitigation efforts associated with the conservation of federally listed species and their habitat suggest that 15 percent is a reasonable estimate of the number of acres that would be available from willing landowners. An objective for a multiple-species recovery plan on the Platte River calls for the protection of about 29,000 acres of land along the Platte River that contains riparian habitat somewhat similar to that targeted along Plum Creek. Over the last 2 years, the land acquisition effort has assessed 69 parcels of suitable habitat, nine of which, or 13 percent, were purchased. More of the parcels could have been purchased, but because of funding priorities only the highest quality parcels were acquired. Habitat conservation plans for multiple species along the Salt and Verde rivers in Arizona committed to protecting and managing about 2,000 acres of habitat for off-site mitigation. To date, all but 150 acres have been acquired. In areas targeted for acquisition, from 10 to 50 percent of the available land has been acquired.

If 15 percent of the existing acreage and EFUs are opportunistically available on properties with owners willing to sell or enter into conservation easement agreements, 911 acres and 1,272 EFUs would be conserved. With a baseline conservation credit of 15 percent, conservation alone of the 911 acres would generate 191 EFU credits. Assuming that all available mitigation areas will have weighting factors applied for minor connectivity (1.25) and a medium buffer (1.5), applying weighting factors to the baseline credits would increase the mitigation credits to 358 EFUs. Finally, if habitat enhancement and conversion activities increase existing EFUs by 20 percent on average, and if the same weighting factors are applied to the new EFUs, there would be an additional 477 EFUs. With conservation, weighting, and enhancement, off-site mitigation activities would result in an estimated minimum of 835 EFUs.

The following is a summary of calculations used to estimate the number of off-site EFUs potentially available for mitigation and the number of EFUs that would be gained per acre of

potential target habitat (numbers have been rounded to whole numbers). In the calculations below, 15 percent (0.15) is used twice for independent calculations. As described above, it is estimated that 15 percent of the potential off-site target habitat acreage can be successfully protected. The protected habitats will receive a 15-percent conservation credit (i.e., a mitigation credit equal to 0.15 times the existing baseline EFUs):

Total of off-site target habitat 6,075 acres
 Total of EFUs in off-site target habitat 8,477 EFUs

- Acres of target habitat and EFUs available assuming 15 percent will be on property of willing owners:

Available Acres $6,075(0.15) = 911$ acres
 Available EFUs $8,477(0.15) = 1,272$ EFUs

- Number of baseline EFUs assuming 15 percent conservation credit:

Baseline EFUs $1,272(0.15) = 191$ EFUs

- Number of weighted baseline EFUs using assumed weighting factors of 1.25 for minor connectivity and 1.5 for medium buffer width:

Weighted baseline EFUs $191(1.25)(1.5) = 358$ EFUs

- Number of weighted EFUs generated by enhancing 20 percent of the total available EFUs:

Weighted enhancement EFUs $1,272(0.2)(1.25)(1.5) = 477$ EFUs

- Total estimated weighted baseline and weighted enhancement off-site EFUs:

Total estimated minimum off-site EFUs $358+477 = 835$ EFUs

- The amount of EFUs generated on average per acre of protected target habitat:

$$\frac{835 \text{ EFUs}}{911 \text{ acres}} = 0.92 \text{ EFUs/acre} \qquad \frac{911 \text{ acres}}{835 \text{ EFUs}} = 1.09 \text{ acres/EFU}$$

The minimum of 835 EFU credits available off-site exceeds the 690 EFU credits that will be needed to fully offset impacts after on-site mitigation activities have been completed and create a minimum of 91 EFU credits. Based on estimates of available on- and off-site mitigation EFUs, it will be feasible to achieve the primary goal of the CMP, which is to adequately compensate for impacts to ecological functions that would result from implementing Alternative 3 of the FR/EIS.

6.0 HABITAT FIELD EVALUATION

The CDOW riparian mapping is appropriate to use to estimate the number of potentially available on- and off-site EFUs, but its use will not be appropriate once implementation of the

CMP begins. To accurately and consistently track mitigation EFUs credits, implementing the CMP will require that potential mitigation areas be mapped based on existing conditions and using the FR/EIS habitat categories. The mapping will need to be applied consistently to potential mitigation areas with a variety of vegetation communities, including some that are not present in areas mapped for the FR/EIS. The mapping must also recognize variation in the quality of mapped habitat. For example, one area of riparian shrubs may have fewer EFUs because its shrub density is lower than another area. The remainder of this section describes a method proposed to consistently map habitat on potential on- and off-site mitigation areas and to evaluate the quality of the habitat.

6.1 Habitat Field Evaluation Method

A key component of the EFA is classification of habitat, both on- and off-site, in order that EFIs can be assigned to specific habitat polygons. Classification is defined as a systematic arrangement of items into groups or categories according to established criteria. Mapping criteria used to map Preble's and bird habitat for the FR/EIS were generally based on very broad categories of vegetation communities and did not include specific metrics to differentiate between habitat types. As a result, it would be difficult to obtain consistent and defensible mapping if it was done by different people. Several riparian and wetland classification systems were evaluated for their ability to including Proper Function Condition (PFC) analysis (BLM 1998), Hydrogeomorphic (HGM) approach (Hauer et al. 2002), a Field Guide to the Wetland and Riparian Plant Associations of Colorado (Carsey et al. 2003), and U.S. Forest Service monitoring guidance (Winward 2000). As stated by Gebhardt et al. (2005) "in all likelihood, a combination of elements from several systems may be needed to develop the appropriate tool." To best address the objectives of the CMP, the above listed systems were combined and modified to address the specific resources and habitat attributes of the target environmental resources in the Upper South Platte River basin.

6.1.1 Purpose

The purpose of classification for the CMP is to permit comparison and reproducibility of impact estimates, mitigation estimates, and measure of success or failure of compensatory mitigation. A proposed classification protocol has been developed to conduct site-specific baseline evaluations of perspective mitigation properties and then subsequently reevaluate and

monitor the success of habitat enhancement and mitigation. The data gathered during mitigation monitoring will be incorporated into the CMP's adaptive management process (Section 7.5 of the CMP) that will be able to adjust habitat enhancement techniques, property management objectives, habitat acquisition processes, etc., to meet success criteria outlined in the CMP.

The protocol was developed to meet the following objectives:

1. Develop a classification system that is consistent with the various systems used in impact assessment during the FR/EIS.
2. Develop a classification system that is well defined so that it can be understood and implemented by any qualified ecologist.
3. Develop quantitative and semi-quantitative metrics that correspond to the definitions of target resource habitat in the EFA.
4. Use metrics that are scientifically sound, based on standard methods, and consistently repeated over numerous monitoring periods.
5. Use metrics that can be rapidly assessed and that are adequately precise to be able to detect meaningful changes in target resource habitat.

The following assumptions were used to develop the proposed protocol:

1. The functional evaluation of all three target environmental resources should start from a broadly applicable, vegetation community based classification system.
2. Target resource functions can be coarsely determined using biotic and abiotic parameters found on the landscape.
3. Biotic and abiotic parameters of target resource functions can be measured in the field using standard and relatively rapid techniques.
4. Many of the biotic parameters are reflected in vegetation community types, structure, and species composition.
5. Attributes measured during field measurement can be combined to coarsely characterize target resource functions.

6.1.2 Methods

Mitigating impacts to the three target environmental resources is based on the ecological functions of the habitat lost through reallocation and the ecological functions gained through mitigation of those impacts. This field assessment of ecological functions is a step-down approach based on commonly accepted riparian functional assessments. The step-down approach starts at evaluating general landscape characteristics (e.g., hydrology, geomorphology, and vegetation class) and then steps down into more specific sub-classes of vegetation community, structure, and species composition.

Field assessment of terrestrial functions will consist of a step-down approach starting with evaluating general habitat characteristics of the assessment parcel and how the area fits into the larger landscape. Further refinement of habitat within the assessment area will focus on the vegetation communities existing within the assessment area, and finally on habitat attributes of the three target environmental resources. The following sections describe items on the draft field form developed for data collection (Attachment C-1).

6.1.3 General Habitat Characteristics

General habitat characteristics will be gathered for the assessment area as a whole and will be used to provide an overall characterization of the ecological functions of the area within a landscape context. The field assessment for overall habitat characteristics is a series of yes or no questions and will be useful in evaluating overall trends in the ecological functioning of the area. For example, the hydrology/geomorphology of an assessment area is functioning properly if the stream is sinuous, aggrading, and capable of natural overbank flooding. It is degraded if the stream is down cut or confined within the channel. Tracking stream characteristics over time will indicate trends toward healthy or degraded ecological functions.

6.1.4 Target Resource Assessment

The next step in the step-down assessment is to evaluate the existing target environmental resource functions of the assessment area. This step starts with mapping (or remapping) target environmental resources in a classification system consistent with the mapping used in the FR/EIS. The FR/EIS mapped the three target environmental resources independently of each other based on three slightly different classification systems. Wetlands were mapped following Cowardin (1979); bird habitat was mapped based on vegetation class (wetland/nonwoody, upland, trees, and shrubs) and age class (mature cottonwood); and Preble's habitat was mapped based on habitat quality (upland, high, and low value riparian). Although Preble's habitat is based on quality, it is fundamentally based on vegetation communities and structure; thus, the field assessment starts by mapping the three target environmental resources using a standard classification system based on the vegetation communities described below:

Wetlands: - All wetlands will be mapped according to Cowardin and their EFIs generated according to the EFA (ERO 2009). Appropriate wetlands will then be combined to correspond to the wetland nonwoody bird habitat. Within the wetland

mapping will be the subclass sparsely vegetated (**SV**) to account for sandbars, mudflats and shorelines that are variably exposed and inundated by reallocation.

Nonwetland vegetation communities will be mapped into the broad vegetation classes described below to correspond to bird habitat. These classes will be further divided into subunits to meet the following objectives of both impact assessment and mitigation monitoring:

1. Corresponds to Preble's habitat mapping
2. Accounts for structural differences within a vegetation community
3. Allows for detecting changes in habitat structure and function over time

Trees:

- CW:** Cottonwood/willow tree
CW-M: Cottonwood tree – mature
Oth: Other tree

Hydric-mesic shrubs:

- W, HD:** Willow high density
W, LD: Willow low density
MR, HD: Mixed riparian high density
MR, LD: Mixed riparian, low density

Upland:

- NWN:** Nonwoody native vegetation
NWEx: Nonwoody exotic vegetation
UPWD: Upland wooded deciduous
UPWC: Upland wooded conifer
UPS: Upland Shrub (mesic-xeric)
SV: Sparsely vegetated

Agricultural:

- Cp:** Crop/hay
IP: Irrigated pasture
NP: Nonirrigated pasture

Nonhabitat:

- NH:** Road, parking lot, structure, impervious surface, and unvegetated areas.

6.1.4.1 Wetlands Field Evaluation

Wetlands will be defined and mapped according to Cowardin (1979) as described above and their EFIs will be generated according to the EFA (ERO 2009).

6.1.4.2 Bird Evaluation

Bird habitat will consist of mapping vegetation communities as describe above. Additional age-class and structural characteristics will be recorded to monitor for long-term trends. EFIs will be assigned to the mapped communities as described in the EFA (ERO 2009).

6.1.4.3 Preble's Evaluation

The Preble's evaluation will gather additional site information and vegetation age-class and structural information that corresponds to the four functions of Preble's habitat identified in the EFA:

1. Hibernacula potential
2. Breeding
3. Cover
4. Forage

Some habitat characteristics and the corresponding metric to measure those characteristics apply to more than one habitat function. For example, riparian shrub structure provides for both breeding habitat and cover functions. In these cases, the evaluation metric was included in the function that it predominantly serves.

In addition to the evaluation of the four functional components listed above, the evaluation also accounts for the presence and magnitude of human disturbance, both within the assessment area and in the immediately surrounding area.

6.1.5 Classifying Preble's Riparian Habitat Quality

Once the field evaluation of Preble's is completed, each of the field metrics contains a range of quantitative or semi-quantitative measures that are placed into one of the three habitat quality classes; High Value Riparian, Low Value Riparian, and Nonhabitat. These classes are scored 0-2 and all metrics are summed for an individual habitat polygon. The overall value of the combined metrics then determines which quality class the polygon fits into. A score of zero equates to nonhabitat. It is assumed that any area with a score above zero provides some value as habitat. A score between 1 and 16 equates to low-value riparian habitat; a score of 17 to 32 equates to high value riparian habitat.

6.1.6 Classifying Preble's Upland Habitat

The primary function of Preble's upland habitat is to provide forage and cover for Preble's moving between foraging/breeding sites during the summer active season. Upland habitat is

based solely on vegetation community and not on the quality of the vegetation. Preble's upland habitat will be identified based on the upland vegetation category described above. Additional specific information on vegetation diversity and species composition will be recorded to monitor for long-term trends.

6.2 Human Disturbance

Human disturbance will be evaluated over the entire assessment area by identifying the type and magnitude of disturbance. Types of disturbance include the presence of structures, storage/debris, agriculture (livestock grazing/crop cultivation), trails (formal and social), recreation facilities, and roads. The magnitude of each type of disturbance will be described as: 1) no disturbance, 2) minimal, 3) moderate, and 4) high. The overall magnitude of human disturbance will be estimated by combining disturbance magnitudes for all types of disturbance and describing it as: 1) no disturbance, 2) minimal, 3) moderate, and 4) high.

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Attachment C-1
Chatfield Reallocation Field Form for Target Environmental Resources

DRAFT
CHATFIELD REALLOCATION FIELD FORM
FOR TARGET ENVIRONMENTAL RESOURCES

SURVEYOR'S NAME: _____ SITE NAME: _____ PATCH # _____
DATE(S) OF VISIT(S): _____

1.0 GENERAL HABITAT CHARACTERISTICS OF ASSESSMENT AREA

1.1 Hydrology/ Geomorphology:

1. Stream Class _____ Percent of assessment area within floodplain: _____
2. Floodplain above bankfull is inundated in "relatively frequent"¹ events Yes ___ No ___
3. Beaver dams present Yes ___ No ___; Active Yes ___ No ___; Stable Yes ___ No ___
4. Stream is sinuous Yes ___ No ___; Aggrading Yes ___ No ___; Down-cutting Yes ___ No ___;

¹**Relatively frequent** – evidence that overbank flooding occurs on relatively frequent basis includes recent deposits of sand or silt with little or no vegetation, early serial vegetation, recent woody debris deposits.

1.2 Vegetation:

1. There is a diverse age-class distribution of riparian-wetland vegetation Yes ___ No ___;
2. There is a diverse composition of riparian vegetation (for maint./recovery) Yes ___ No ___;
3. Species present indicate maintenance of riparian soil moisture characteristics Yes ___ No ___;
4. Streambank vegetation is composed of those plant species or plant communities capable of withstanding high-streamflow events Yes ___ No ___;
5. Riparian wetland plants exhibit high vigor Yes ___ No ___;
6. Adequate riparian-wetland vegetation is present to protect banks and dissipate energy during high flows Yes ___ No ___;
7. Plant communities are an adequate source of coarse and/or large woody material Yes ___ No ___;
8. Regeneration: Yes ___ No ___

1.3 Community Composition:

Estimate percent composition in: Tree ___ Shrub ___ Herbaceous ___ Marsh ___ Upland ___

Riparian herbaceous layer – % composition of herbaceous vegetation:

Hydric ___ Mesic ___ Xeric ___ Weedy ___

Dominant riparian overstory tree species (Circle up to three):

Cottonwood Willow Elm Green ash Russian olive Other (Specify) _____

Dominant riparian shrub species (Circle up to three):

Willow Alder Lead plant Choke cherry/Plum Snowberry Other _____

Dominant riparian herbaceous under-story species (List three): _____

Upland tree species present? Yes ___ No ___ (List Dominants): _____

Upland shrub species present? Yes ___ No ___ (List Dominants): _____

Dominant upland herbaceous species (List three): _____

2.0 TARGET RESOURCE ASSESSMENT

2.1 Vegetation Communities

On an aerial map at a scale of at least 1" = 400', delineate vegetation types within parcel, using the following symbols:

Wetland (from FACWet above)

SV: Sparsely vegetated

Trees

CW: Cottonwood/willow tree

CW – M: Cottonwood tree – mature²

Oth: Other tree

Hydric-mesic shrubs

W, HD: Willow high density

MR, HD: Mixed riparian high density

W, LD: Willow low density

MR, LD: Mixed riparian, low density

Upland

NWN: Nonwoody native vegetation

UPWD: Upland wooded deciduous

UPS: Upland Shrub (mesic-xeric)

SV: Sparsely vegetated

NWEx: Nonwoody exotic vegetation

UPWC: Upland wooded conifer

Agricultural

Cp: Crop/hay

IP: Irrigated pasture

NP: Nonirrigated pasture

Nonhabitat

NH: Road, parking lot, structure

²**Mature Cottonwood** - Cottonwood community within the Upper South Platte River basin that is a contiguous community of relatively old (estimated to be greater than 50 years), tall, stout trees with a large trunk, thick wrinkled bark, and a broad, spreading crown. Branches within the crown are primarily horizontal and stout and the crown may contain numerous dead branches. A mature cottonwood community may contain a mixture of younger-aged trees within the understory, but is predominately a single aged stand.

2.2 Preble's

2.2.1 Preble's – Habitat Specific Attributes

2.2.1.1 Hibernacula Potential

- 1a). Soils: Clay/Silty Loam ___ Sandy Loam/Cobble/Gravel ___ Urban/Rock/Bedrock ___
- 1b). Bench or terrace above ordinary high water mark (OHWM) present? Yes ___ No ___
- 1c). Age of shrubs above OHWM: Mature ___ Multi-age - Mature ___ Multi-age – Yg. ___ Yg. ___
- 1d). Abundance of suitable hibernacula (shrubs with well-developed root structure) above base of first terrace (BFT):
Abundant ___ Sparse ___ None ___
- 1e). Abundance of suitable hibernacula below BFT: Abundant ___ Sparse ___ None ___

2.2.1.2 Vegetation Structure (Breeding)

- 2a). Structural Layers: Tree ___ Shrub ___ Mesic Herbaceous ___ Marsh ___ Other ___ Total # ___
- 2b). Shrub Abundance: Is the shrub/understory component well represented:
Abundant ___ Sparse ___ None ___
- 2c). Woody vegetation uniform across parcel (check): _____ or mosaic of patches _____
- 2d). Age of shrub layer: Mature to Senescent ___ Mature ___ Multi-age ___ Young ___
- 2e). Vigor of riparian shrubs (% senescent):
Riparian: < 40% ___, > 40% ___, No live shrub ___;
Nonriparian: < 40% ___, > 40% ___, No live shrub ___
Total: < 40% ___, > 40% ___, No live shrub ___

2.2.1.3 Vegetation Structure (Cover)

- 3a). Woody vegetation/debris: Abundant ___ Sparse ___ None ___
- 3b). Overall shrub cover: > 40% ___, < 40% ___, None ___
- 3c). Estimate of % vegetation cover: > 60% ___ 20-60% ___, <20% ___
- 3d). Estimate of average height: > 25 cm ___, 10-25 cm ___, <10 cm (mowed or grazed) ___
- Optional:** Vegetation cover of uplands (shrub and herbaceous) > 60% ___ 20-60% ___, <20% ___

2.2.1.4 Vegetation Composition (Forage)

- 4a). Percent noxious weeds in riparian herbaceous understory: < 20% ___, 10-80% ___, >80% ___
- 4b). Riparian Vegetation diversity (# co-dominants): > 3 ___, 2 ___, monoculture ___

Optional - long-term upland trend monitoring

Vegetation cover of upland herbaceous species (all species): _____ %

Estimate percent noxious weeds in upland herbaceous understory: < 20% _____, 10-80% _____, >80% _____

Upland vegetation diversity (# co-dominants): > 3 _____, 2 _____, monoculture _____

2.3 Birds

2.3.1 Habitat Specific Characteristics – Birds

Canopy Layer (check):

Cover: Single age, closed _____, Single age open _____, Multi-age closed _____, Multi-age open _____,

Age: Mature to senescent _____, Mature _____, Multi-age _____, Young _____

Vigor of canopy layer (% senescent) _____ % Cavities Abundant _____, Sparse _____, Absent _____

Regeneration: Yes _____ No _____

Estimate of average canopy height: _____

Estimate of average canopy closure: _____

Predominant tree form (check one): Whip _____ Sapling _____ Large w/ vertical branching _____
Large w/ horizontal branching _____

2.4 Wetlands

Follow Colorado FACWet methodology.

3.0 HUMAN DISTURBANCE

Human disturbance (sign) present within assessment area (Circle and estimate degree -%)?

Structures _____ Storage/debris _____ Livestock _____ Organized trail _____ Social
trail _____ Road _____ Cultivation _____ Recreation _____ Total % _____

What are the major land uses in the surrounding area? (i.e., grazing, housing, irrigated agricultural land, open space etc.) _____

4.0 PHOTO POINTS

Take photos at designated photo points and record GPS coordinates, shot # and photo pt. # for each.

Vegetation Survey Field Equipment Checklist

- 1.) Binoculars
- 2.) Copies of previous data sheets
- 3.) Camera and film
- 4.) GPS
- 5.) Copies of topo. maps
- 6.) 2 pencils, eraser, paper clips
- 7.) Jumper cables, first aid kit, etc.
- 8.) Cell phones or hand-held radios
- 9.) Water jugs, sunscreen, bug spray
- 10.) Blank data forms

Appendix D

Regional Conservation Planning

1.0 Introduction

The conceptual mitigation plan is informed by and has been developed to integrate with regional conservation planning including:

- The working draft of the Preble's Recovery Plan (Service 2003);
- The Chatfield Basin Conservation Network (CBCN) Green Infrastructure System (CBCN and Douglas County 2006);
- Douglas County Habitat Conservation Plan (Douglas County et al. 2006);
- Douglas County 2030 Comprehensive Master Plan (Douglas County 2008);
- U.S. Forest Service Pike and San Isabel Land and Resource Management Plan (1984); and
- U.S. Army Corps of Engineers' Chatfield State Park Master Plan (Corps 2001).

These plans recognize the importance of conserving natural resources on a regional scale, particularly riparian corridors along streams and rivers within the drainage basins in which the Compensatory Mitigation Plan (CMP) occurs.

The CMP is consistent with several regional conservation planning efforts in the Chatfield Reservoir, Plum Creek and South Platte River watersheds, particularly the working draft of the Preble's Recovery Plan and the CBCN's Green Infrastructure Plan. By focusing the CMP actions on conservation efforts that are consistent with these regional conservation plans, it will be possible to participate in multiparty efforts to acquire and maintain conservation parcels. Joining other parties will maximize the benefit of funds allocated for Preble's mitigation.

The CMP focuses on the mitigation of impacts to Preble's habitat because it is a federally listed subspecies and because impacts to Preble's habitat have substantial geographic overlap with the other target environmental resources. Preble's habitat includes riparian areas and adjacent uplands that provide habitat for birds and, in the case of riparian areas, wetlands. The approach to providing compensatory mitigation for impacts to Preble's habitat focuses on contributing to the recovery of Preble's. Therefore, the majority of Appendix B provides a discussion of how the working draft of the Preble's Recovery Plan has informed the CMP and how the compensatory mitigation activities support and advance the recovery of Preble's.

2.0 Working Draft of the Preble's Recovery Plan

Under Section 7(a)(2) of the ESA, federal agencies must ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat (50 CFR § 402). The CMP meets this criterion because it would at least maintain, and would likely increase, the amount of protected habitat and the level of management of riparian habitat available for use by Preble's compared to current levels in the Chatfield Reservoir basin. This would be accomplished in a number of ways, the most important of which would be to contribute to strategies and guidelines developed by the Service that are intended to result in recovery of Preble's. These strategies and guidelines are discussed in the Service's working draft of the Preble's Recovery Plan (Service 2003). A recovery plan identifies, justifies, and schedules the research and management actions necessary to support recovery of a species. The working draft of the Preble's Recovery Plan was used as a source of best available information and guidance in preparing the conceptual mitigation plan.

Because it is generally accepted that Preble's is present throughout the Plum Creek watershed and many locations in the Upper South Platte River watershed, and because it would be consistent with the working draft of the Preble's Recovery Plan, the off-site component of the CMP focuses conservation efforts in privately owned reaches of the Plum Creek and South Platte River watersheds.

2.1 Recovery Strategies

The working draft of the Preble's Recovery Plan identified strategies that, if carried out, would address threats to Preble's and would lead to recovery. The CMP is consistent with the recovery strategies in a number of ways, including the following:

- Increasing conserved areas in the Plum Creek and South Platte River watersheds would aid in achieving conservation of a large self-sustaining and naturally functioning population in that watershed;
- Contributing to the recovery of Preble's in the South Platte River basin, specifically the Upper South Platte River hydrologic unit, by increasing the extent of connected protected habitat along Plum Creek and West Plum Creek, and by enhancing habitat in designated critical habitat in the Upper South Platte CHU;
- Protecting Preble's habitat would include either the 2009 proposed critical habitat boundaries or the limits of the Riparian Conservation Zone (RCZ) mapped as part the

Douglas County Habitat Conservation Plan (DCHCP), whichever is wider in a particular stream reach;

- Many of the areas targeted for conservation by the CMP are currently in private ownership. Through fee simple acquisition, creation of conservation easements, deed restrictions, or by way of some other legal instrument, these private lands would then be managed in perpetuity for Preble's conservation;
- Adaptive management would be a key element of the CMP;
- By following the key principles of the working draft of the Preble's Recovery Plan, the CMP contributes to the goal of genetic management to preserve and conserve the range of unique ecological and behavioral characteristics of the subspecies that are presumed to exist on a population-by-population basis; and
- By protecting habitat, the CMP would lessen threats for a targeted recovery population.

2.2 Conservation Goals

The CMP would contribute to recovery of Preble's through a conservation approach that furthers the biological goals and objectives of the working draft of the Preble's Recovery Plan. The CMP would be implemented to increase the amount of protected connected stream miles of habitat needed to provide for the long-term viability of a large population of Preble's in the Plum Creek watershed.

The working draft of the Preble's Recovery Plan targets a large (at least 2,500 adults), self-sustaining, naturally occurring population of Preble's in the Upper South Platte River watershed, with a focus on Plum and West Plum creeks at their tributaries. The working draft of the Preble's Recovery Plan estimates that it would require protecting about 57 connected stream miles (at about 44 mice/mile) to support a large population. In addition to estimating the number of stream miles necessary to support a large Preble's population, the working draft of the Preble's Recovery Plan also estimated that it would take a minimum of 11 protected connected stream miles to support a medium Preble's population of at least 500 individuals, and a minimum of 3 connected stream miles to support the smallest self-sustaining Preble's population (Service 2003).

Some of the highest quality habitat for Preble's along the Front Range occurs in the Plum Creek watershed. The initially proposed critical habitat designated in the Plum Creek watershed included about 91 stream miles (67 Fed. Reg. 47154 (July 17, 2002)). Of that, about 18 stream miles are currently protected. The longest continuous reach of protected stream miles is about 5 miles, at the Pine Cliff/Allis Ranch Preserve complex. Some of the protected stream miles are

specifically managed to benefit Preble's; others are maintained as open space, which also benefits Preble's.

2.3 The Chatfield Basin Conservation Network

The CBCN refers to the collaborative efforts of a group of interested people and organizations, and a system of conservation and recreation areas, natural resources, and important places within the Chatfield Basin. During the last 10 years, more than 75 public and private agencies, organizations, and companies have worked together to conserve places for wildlife and people in the Chatfield Basin.

CBCN's vision is to: "Conserve Connections for Nature and People." CBCN identified six major goals to help achieve its vision:

1. Conserve and enhance areas of significant wildlife habitat and protect an interconnected system supporting wildlife movement.
2. Conserve and enhance areas of significant vegetation.
3. Conserve open lands and wetlands to protect water quality and help reduce damage from flooding.
4. Create an interconnected, nonmotorized trail system within the Chatfield Basin.
5. Coordinate open space and recreational systems across jurisdictions within the Chatfield Basin.
6. Conserve and restore the native biological diversity of the Chatfield Basin through sound land management including aggressive weed control and active ecological restoration.

The CBCN currently represents an emerging system of more than 51,000 acres of protected open space, hundreds of miles of trails, and numerous places that contribute to the Chatfield Basin's sense of place.

2.3.1 CBCN Green Infrastructure Project

In 2006, the CBCN and Douglas County completed the "Green Infrastructure Project: Conserving Connections for Nature and People" (CBCN and Douglas County 2006). Green Infrastructure within the Chatfield Basin is defined in this report as:

An interconnected network of wildlife habitats, greenways, riparian areas, wetlands, recreation, conservation, and other natural areas. This interconnected network supports biodiversity and native species, maintains healthy natural and ecological processes and services, and provides recreational and other outdoor

opportunities that contribute to the health, quality of life, and sense of place for our communities.

The CBCN’s Green Infrastructure Report refined previous CBCN efforts by prioritizing critical conservation and planning efforts within the Chatfield Basin, and by identifying opportunities and constraints to ensuring a functioning system of interconnected green infrastructure. In addition, the report identified several principles for creating a system of Green Infrastructure within the Chatfield Basin. Of those principles identified, the following are particularly applicable to developing the CMP:

1. A targeted, strategic vision would be more successful than opportunistic conservation. Opportunistic conservation would not likely result in an integrated, interconnected system of green infrastructure and may divert resources from critical areas.
2. Critical areas or alignments needing protection to ensure a functioning system of green infrastructure include: connections between already protected lands, buffers adjacent to already protected lands, identified water resources, and buffer lands adjacent to creeks and streams.
3. Engage stakeholders and users, especially the owners and managers of what may be properties adjacent to current and future protected lands. Work with these people and agencies to identify potential tools for protecting and managing the green infrastructure system.

2.3.2 *CBCN Conservation Priorities*

Through the development of the Green Infrastructure Study, CBCN identified a number of priority conservation areas and critical alignments needed to ensure creation of an interconnected, functioning system of green infrastructure within the Chatfield Basin that consists of wildlife habitat and movement corridors, recreational amenities, water resources, and a sense of place. Of particular interest to the CMP, the Green Infrastructure Study identified the following wildlife habitat and movement corridor priorities:

- Core Conservation Areas;
- Future Study Areas;
- Highway Underpasses—Critical Habitat Links;
- Local Riparian Connections;
- Regional Riparian Connections;
- Stepping Stone Areas;
- Water Resource Protection Areas; and
- Wildlife Habitat Conservation Areas.

The Green Infrastructure Study identifies guidelines to help protect and maintain the identified system of wildlife habitat conservation areas. Guidelines that inform the conceptual mitigation plan include buffering and connecting conservation areas.

Much of the work necessary to identify acquisition priorities for Preble’s habitat mitigation has already been done by CBCN, thus CBCN would be an important resource during implementation of the off-site component of the CMP.

2.4 Other Regional Conservation Planning Efforts

In addition to the working draft of the Preble’s Recovery Plan and work done by CBCN, other regional conservation planning efforts have informed development of the CMP, and will assist in implementation with identifying partnerships, assisting with public outreach, and maximizing benefits to Preble’s. Ensuring the CMP is consistent with these plans would also reduce possible regional competition for resources and would maximize consistent management of the conserved areas.

The CMP has been informed by, is consistent with, and would benefit from other regional conservation planning efforts in the following ways:

Douglas County HCP – The CMP would use the RCZ mapping in the DCHCP in identifying habitat to be conserved along reaches of streams. The RCZ has been reviewed and approved by the Service as a reasonable representation of Preble’s habitat in Douglas County. The DCHCP also includes mapping that depicts conservation areas protected and managed for Preble’s. One of the primary goals of the CMP would be to increase connections between these areas.

Douglas County Comprehensive Master Plan – The Douglas County Comprehensive Master Plan (DCCMP) includes policies related to restricting floodplain development, improving and protecting water quality, maximizing wildlife corridor connectivity, and supporting public and private programs that foster wildlife conservation. The CMP is consistent with these policies and implementing it would aid Douglas County in meeting its planning goals.

Chatfield State Park Master Plan – The Chatfield State Park Master Plan focuses on balancing natural resource conservation with active and passive recreation use. Implementation of the CMP would incorporate this balance in identifying and managing areas of Preble’s habitat conservation in and adjacent to Chatfield State Park.

In addition to the previously described plans, implementation of mitigation measures would be consistent with and support appropriate elements of the following plans:

- Pike and San Isabel National Forests – U.S. Forest Service
- Chatfield Lake Project Management Plan – Corps
- Chatfield State Park Management and Recreation Plan – CO State Parks

3.0 References

Chatfield Basin Conservation Network (CBCN) and Douglas County, Colorado. 2006. Chatfield Basin Conservation Network Green Infrastructure System. 100 pp.

Douglas County, Colorado. 2008. Douglas County 2030 Comprehensive Master Plan.

Douglas County and the Towns of Castle Rock and Parker; ERO Resources Corporation; Brooke Fox; and Trout Raley, Montano, Witwer, and Freeman, P.C. 2006. Habitat Conservation Plan and Environmental Assessment for Douglas County and the Towns of Castle Rock and Parker. October. 297 pp.

U.S. Army Corps of Engineers (Corps). 2001. Design Memorandum PC-46 Master Plan Chatfield Lake, Colorado. Omaha, Nebraska.

U.S. Fish and Wildlife Service (Service). 2003. Working Draft Recovery Plan Preble's Meadow Jumping Mouse (*Zapus hudsonius preblei*), Colorado. Region 6, Lakewood, Colorado. 95 pp.

U.S. Forest Service. 1984. Land and Resource Management Plan – Pike and San Isabel National Forests; Comanche and Cimarron National Grasslands. On file at: Pike and San Isabel National Forests and Cimarron and Comanche National Grasslands, Supervisor's Office, Pueblo, CO. Available at: http://www.fs.fed.us/r2/psicc/projects/forest_plan/forest_plan.shtml. Last accessed: June 11, 2008. 4 vols. plus appendices.

Appendix E

Challenge Cost Share Agreement

The following draft agreement among the U.S. Forest Service, Douglas County, and the Chatfield Reservoir Mitigation Company is the most recent version of the agreement. The parties will finalize and sign the agreement between the final FR/EIS and ROD. Any revisions to this version of the agreement are not anticipated to significantly depart from the terms and conditions of the current version of the agreement.



FS AGREEMENT No. 10-CS-11021211-017
COOPERATORS AGREEMENT No. _____

**CHALLENGE COST SHARE AGREEMENT
BETWEEN
DOUGLAS COUNTY
AND
CHATFIELD RESERVOIR MITIGATION COMPANY
AND THE
USDA FOREST SERVICE
PIKE AND SAN ISABEL NATIONAL FORESTS
CIMARRON NATIONAL GRASSLANDS
PSICC
SOUTH PLATTE RANGER DISTRICT**

This CHALLENGE COST SHARE AGREEMENT is hereby made and entered into by and between the U.S. Forest Service, PSICC, South Platte Ranger District (hereinafter referred to as the U.S. Forest Service); Douglas County; and the Chatfield Reservoir Mitigation Company¹, hereinafter referred to as the Company (collectively, “the Parties”), under the provisions of the Department of Interior and Related Agencies Appropriation Act of 1992, Pub. L. 102-154. The Company is a Cooperator and Douglas County is a Cooperator, and are referred to jointly as the Cooperators.

Title: Sugar Creek Sediment Mitigation Project

I. PURPOSE:

The purpose of this Agreement is to document the cooperation among the parties to establish a framework for implementing the Sugar Creek Sediment Mitigation Project (Project) to substantially reduce sediment inputs into the approximately 4.5-mile reach of Sugar Creek designated as critical habitat for Preble’s meadow jumping mouse (Preble’s) in accordance with the following provisions and hereby incorporate the Operating and Financial Plan (Attachment E-3). The actions to be implemented to reduce sediment inputs to the designated critical habitat of Sugar Creek and the location of the designated critical habitat are presented in Attachment E-1.

This Agreement is intended to facilitate the following mutually accepted goals within the 4.5-mile designated critical habitat reach of Sugar Creek. These goals are not listed in priority order.

¹ The Chatfield Reservoir Mitigation Company is a nonprofit corporation responsible for the day-to-day tasks of meeting the contractual terms and conditions for compensatory mitigation for the Chatfield Reallocation Project for the 12 Chatfield Water Providers.



1. Implement measures that are sustainable and will substantially reduce sediment inputs to the critical habitat reach of Sugar Creek.
2. Improve aquatic and riparian habitat.
3. As opportunities allow, expand and improve woody riparian habitat into previously disturbed areas.
4. Provide mitigation for impacts to Preble's designated critical habitat in the South Platte River arm of Chatfield Reservoir associated with the proposed Chatfield Reallocation Project.
5. Provide a successful and sustainable prototype project for sediment reduction that could apply to other drainages in the Pike National Forest.
6. Encourage cooperative projects among federal and local governments, and special districts to restore and enhance forest resources.
7. Provide needed funding because funding is not currently available to fully implement the Sugar Creek Sediment Mitigation Project. Funding provided by the Company will accomplish, over a relatively short period, an integrated approach to substantially reducing sediment inputs to the critical habitat reach of Sugar Creek that will benefit Preble's designated critical habitat, and promote sustainable management of Sugar Creek and its resources within the designated critical habitat reach. In the absence of funding, the Project would not occur.

This Agreement does not involve the use or transfer of any U.S. Forest Service or other federal funds to the Cooperators, but will involve activities on U.S. Forest Service lands.

II. STATEMENT OF MUTUAL BENEFIT AND INTERESTS:

The combination of road location and design, highly erosive soils and routine road maintenance over many years have contributed sediments to Sugar Creek that have severely degraded and caused the functional impairment of its aquatic and riparian habitats. County Road (CR) 67, a dirt road, runs parallel to Sugar Creek, and for much of the creek's length, CR 67 is immediately adjacent to the creek and its riparian habitats. Sugar Creek and CR 67 occur in areas of highly erosive soils comprised of decomposed granite.

The U.S. Forest Service is responsible for the management of Sugar Creek and its resources that occur within the Pike National Forest. Douglas County is responsible for maintaining CR 67 within Douglas County pursuant to a written agreement with the U.S. Forest Service. Without major changes in road and drainage design, complemented with changes in road maintenance practices facilitated by road and drainage improvements, Douglas County's routine maintenance will continue to contribute significant amounts of sediment to Sugar Creek. Without substantial reductions in sediment inputs to Sugar Creek, the U.S. Forest Service will not be able to favorably manage the aquatic and riparian resources of Sugar Creek. Similar issues occur in other areas of the Pike National Forest and successful implementation of the Sugar Creek Sediment Mitigation Project will provide a template to resolve these similar issues.



The Company needs to provide compensatory mitigation for impacts to Preble's designated critical habitat associated with the Chatfield Reallocation Project. The impacts to the designated critical habitat will occur in the South Platte River arm of Chatfield Reservoir, which is within the Upper South Platte critical habitat unit (CHU). Per U.S. Fish and Wildlife Service (Service) Policy, the Service considers only mitigation actions within the same CHU when determining whether an action will result in destruction or adverse modification of critical habitat. With the exception of the South Platte River within Chatfield State Park, all of the Upper South Platte CHU occurs on drainages within the Pike National Forest. The Company will, to the extent practicable, maximize mitigation of impacts to Preble's designated critical habitat within the critical habitat area of Chatfield State Park; however, there are not sufficient opportunities to mitigate all of the impacts within Chatfield State Park. Therefore, the Company needs to implement the remainder of the mitigation for impacts to Preble's designated critical habitat within the Upper South Platte CHU on the Pike National Forest. Of the drainages and associated riparian areas within the Upper South Platte CHU on the Pike National Forest, Sugar Creek is the most degraded and presents the greatest opportunity to improve Preble's designated critical habitat within the Upper South Platte CHU.

The Sugar Creek Sediment Mitigation Project and Preble's critical habitat mitigation present an excellent opportunity for federal and local governments and special districts to work cooperatively in resolving issues on the Pike National Forest that will benefit natural resources, help resolve maintenance and management issues, and provide an example of how similar issues can be resolved in the future.

In Consideration of the above premises, the parties agree as follows:

III. THE COMPANY SHALL:

- A. **LEGAL AUTHORITY.** The Company has the legal authority to enter into this agreement, and the institutional, managerial, and financial capability to ensure proper planning, management, and completion of the project, which includes funds sufficient to fully meet their funding obligations.
- B. **FUNDING.** Fully fund the design and implementation of the measures listed in Attachment E-1, and ongoing maintenance activities.
- C. **PERMITTING.** Make application for and acquire all needed permits and authorizations not listed in IV.C of this Agreement as the responsibility of the U.S. Forest Service (e.g., Section 404 permits and Endangered Species Act (ESA) compliance). As needed, provide information and support to the U.S. Forest Service environmental documentation process in IV.A of this Agreement.
- D. **NATIONAL HISTORIC PRESERVATION ACT COMPLIANCE.** The Company will coordinate with the U.S. Forest Service to ensure that any needed cultural resource surveys and reports are completed prior to any ground-disturbing activities on National Forest System Lands. The Company will be responsible for contracting with and



paying a U.S. Forest Service-approved historic and cultural resource specialist to perform any needed cultural resource surveys and reporting per U.S. Forest Service requirements.

- E. FINANCIAL MANAGEMENT. The Company will be the Cooperator responsible for meeting the requirements in V.I.L. STANDARDS FOR FINANCIAL MANAGEMENT.
- F. VARIANCES. The Company will request variances from Douglas County for the Project.
- G. FINAL DESIGN. Develop the final design for the measures listed in Attachment E-1, in cooperation with the U.S. Forest Service and Douglas County.
- H. CONTRACTING. Hire a contractor to implement the final design for the measures in Attachment E-1, including preparing bid documents, requesting bids, selecting contractors, overseeing contractors, and conducting field inspections.
- I. COORDINATION. Coordinate monthly with the U.S. Forest Service and Douglas County regarding the status of the Project.

IV. DOUGLAS COUNTY SHALL:

- A. LEGAL AUTHORITY. Douglas County has the legal authority to enter into this agreement, and the institutional, managerial, and financial capability to ensure proper planning, management, and completion of the Project.
- B. MAINTENANCE. Continue maintenance of CR 67 in accordance with the Sugar Creek Sediment Mitigation Project.
- C. REVIEW. Provide expertise to review and comment on the design and specifications for the measures in Attachment E-1. Provide expertise at the project site to periodically review implementation of the measures listed in Attachment E-1.
- D. AUTHORIZATIONS. Act upon any and all requested authorizations from the Company (e.g., GESC and grading permits and variance requests).

V. THE FOREST SERVICE SHALL:

- A. ENVIRONMENTAL DOCUMENTATION. Provide documentation for all environmental compliance reviews associated with U.S. Forest Service actions and Company actions on U.S. Forest Service lands (e.g., National Environmental Policy Act (NEPA) and compliance with the Forest Plan).
- B. REVIEW. Review and approve the final plan for all activities listed in Attachment E-1 prior to implementation of the activities. Provide expertise at the project site to



periodically review implementation of the measures listed in Attachment E-1 on U.S. Forest Service lands.

- C. APPROVALS. Act upon any and all requested approvals to accomplish the activities on U.S. Forest Service lands.

VI. IT IS MUTUALLY UNDERSTOOD AND AGREED BY AND BETWEEN THE PARTIES THAT:

- A. PRINCIPAL CONTACTS. Individuals listed below are authorized to act in their respective areas for matters related to this instrument.

Principal Cooperators Contacts:

Chatfield Reservoir Mitigation Company Contact	Douglas County Contact
Name: Rick McCloud Address: 62 West Plaza Drive City, State, Zip: Highlands Ranch, CO 80126 Telephone: 303-791-0430 FAX: 303-791-037 Email: RMcloud@highlandsranch.org	Name: Frederick Koch Address: 100 Third Street, Suite 220 City, State, Zip: Castle Rock, CO 80104 Telephone: 303-660-7490 FAX: 303-688-9343 Email: fkoch@douglas.co.us

Principal U.S. Forest Service Contacts:

U.S. Forest Service Contact	U.S. Forest Service Administrative Contact
Name: Denny Bohon Address: 19316 Goddard Ranch Ct City, State, Zip: Morrison, CO 80465 Telephone: 303-275-5625 FAX: 303-275-5642 Email: dbohon@fs.fed.us	Name: Rick Maestas Address: 2840 Kachina Drive City, State, Zip: Pueblo, CO 81008 Telephone: 719-553-1443 FAX: 719-553-1435 Email: rmaestas02@fs.fed.us

- B. NON-LIABILITY. The U.S. Forest Service does not assume liability for any third party claims for damages arising out of this instrument.
- C. NOTICES. Any communications affecting the operations covered by this agreement given by the U.S. Forest Service or the Cooperators are sufficient only if in writing and delivered in person, mailed, or transmitted electronically by e-mail or fax, as follows:

To the U.S. Forest Service Program Manager, at the address specified in the agreement.



To Cooperators, at the Cooperators' address shown in the agreement or such other address designated within the agreement.

Notices are effective when delivered in accordance with this provision, or on the effective date of the notice, whichever is later.

- D. PARTICIPATION IN SIMILAR ACTIVITIES. This agreement in no way restricts the U.S. Forest Service or the Cooperator(s) from participating in similar activities with other public or private agencies, organizations, and individuals.
- E. ENDORSEMENT. Any Cooperator contributions made under this agreement do not by direct reference or implication convey U.S. Forest Service endorsement of the Cooperators' products or activities.
- F. MEMBERS OF U.S. CONGRESS. Pursuant to 41 U.S.C. 22, no United States member of, or United States delegate to, Congress shall be admitted to any share or part of this instrument, or benefits that may arise therefrom, either directly or indirectly.
- G. NONDISCRIMINATION. The Cooperators shall comply with all applicable Federal statutes relating to nondiscrimination. This includes all applicable requirements of all other Federal laws, regulations, and policies. These include but are not limited to Title VI of the Civil Rights Act of 1964 as amended, which prohibits discrimination on the bases of race, color and national origin; Title IX of the Education Amendments of 1972 which prohibits discrimination based on sex in educational programs and activities; Age Discrimination Act of 1975, as amended, prohibiting age discrimination; and 504 of the Rehabilitation Act of 1973 as amended, which prohibits discrimination on the basis of disability.
- H. ELIGIBLE WORKERS. The Cooperators shall ensure that all employees complete the I-9 form to certify that they are eligible for lawful employment under the Immigration and Nationality Act (8 U.S.C. 1324a). The Cooperators shall comply with regulations regarding certification and retention of the completed forms. These requirements also apply to any contract awarded under this instrument.
- I. STANDARDS FOR FINANCIAL MANAGEMENT.

1. Financial Reporting

The Cooperator shall provide complete, accurate, and current financial disclosures of the project or program in accordance with any financial reporting requirements, as set forth in the financial provisions.



2. Accounting Records

The Cooperator shall continuously maintain and update records identifying the source and use of funds. The records shall contain information pertaining to the agreement, authorizations, obligations, unobligated balances, assets, outlays, and income.

3. Internal Control

The Cooperator shall maintain effective control over and accountability for all U.S. Forest Service funds, real property, and personal property assets. The Cooperator shall keep effective internal controls to ensure that all United States Federal funds received are separately and properly allocated to the activities described in the agreement. The Cooperator shall adequately safeguard all such property and shall ensure that it is used solely for authorized purposes.

4. Source Documentation

The Cooperator shall support all accounting records with source documentation. These documentations include, but are not limited to, cancelled checks, paid bills, payrolls, contract and subgrant/contract documents, and so forth.

- J. INSTRUMENT CLOSEOUT. The Cooperators shall close out the instrument within 90 days after expiration or notice of termination.

Any unobligated balance of cash advanced to the Cooperators must be immediately refunded to the U.S. Forest Service, including any interest earned in accordance with 7 CFR 3016.21, 7 CFR 3019.22, or other relevant law or regulation.

Within a maximum of 90 days following the date of expiration or termination of this instrument, all financial performance and related reports required by the terms of the instrument must be submitted to the U.S. Forest Service by the Cooperators.

If this instrument is closed out without audit, the U.S. Forest Service reserves the right to disallow and recover an appropriate amount after fully considering any recommended disallowances resulting from an audit which may be conducted later.

- K. PROGRAM PERFORMANCE REPORTS. The Cooperator shall monitor the performance of the agreement activities to ensure that performance goals are being achieved.

Performance reports must contain information on the following:

- A comparison of actual accomplishments to the goals established for the period. Where the output of the project can be readily expressed in numbers, a computation of the cost per unit of output may be required if that information is useful.



- Reason(s) for delay if established goals were not met.
- Additional pertinent information including, when appropriate, analysis and explanation of cost overruns or high unit costs.

The Cooperator shall submit annual performance reports to the Forest Service Program Manager. These reports are due 30 days after the reporting period. The final performance report shall be submitted either with the Cooperator's final payment request, or separately, but not later than 90 days from the expiration date of the agreement.

- L. **RETENTION AND ACCESS REQUIREMENTS FOR RECORDS.** The Cooperators shall retain all records pertinent to this instrument for a period of no less than 3 years from the expiration or termination date. As used in this provision, "records" includes books, documents, accounting procedures and practice, and other data, regardless of the type or format. The Cooperators shall provide access and the right to examine all records related to this instrument to the U.S. Forest Service Inspector General, or Comptroller General or their authorized representative.

If any litigation, claim, negotiation, audit, or other action involving the records has been started before the end of the 3-year period, the records must be kept until all issues are resolved, or until the end of the regular 3-year period, whichever is later.

Records for nonexpendable property acquired in whole or in part, with Federal funds must be retained for 3 years after its final disposition.

The Cooperators shall provide access to any project site(s) to the U.S. Forest Service or any of their authorized representatives. The rights of access in this section shall not be limited to the required retention period but shall last as long as the records are kept.

- M. **FREEDOM OF INFORMATION ACT (FOIA).** Public access to agreement records must not be limited, except when such records must be kept confidential and would have been exempted from disclosure pursuant to Freedom of Information regulations (5 U.S.C. 552).
- N. **TEXT MESSAGING WHILE DRIVING.** In accordance with Executive Order (EO) 13513, "Federal Leadership in Reducing Text Messaging While Driving," any and all text messaging by Federal employees is banned: a) while driving a Government owned vehicle (GOV) or driving privately owned vehicle (POV) while on official Government business; or b) using any electronic equipment supplied by the Government when driving any vehicle at any time. All cooperators, their employees, volunteers, and contractors are encouraged to adopt and enforce policies that ban text messaging when driving company owned, leased or rented vehicles or GOVs when driving on official government business or when performing any work for or on behalf of the Government.



- O. PROPERTY IMPROVEMENTS. Improvements placed on National Forest System land at the direction or with the approval of the Forest Service becomes property of the United States. These improvements are subject to the same regulations and administration of the U.S. Forest Service as would other National Forest improvements. No part of this instrument entitles the Cooperators to any interest in the improvements, other than the right to use them under applicable Forest Service regulations.
- P. NONDISCRIMINATION STATEMENT – PRINTED, ELECTRONIC, OR AUDIOVISUAL MATERIAL. The Cooperators shall include the following statement, in full, in any printed, audiovisual material, or electronic media for public distribution developed or printed with any Federal funding.

"In accordance with Federal law and U.S. Department of Agriculture policy, this institution is prohibited from discriminating on the basis of race, color, national origin, sex, age, or disability. (Not all prohibited bases apply to all programs.)"

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 1400 Independence Avenue, SW, Washington, DC 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal opportunity provider and employer."

If the material is too small to permit the full statement to be included, the material must, at minimum, include the following statement, in print size no smaller than the text:

"This institution is an equal opportunity provider."

- Q. REMEDIES FOR COMPLIANCE RELATED ISSUES. If the Cooperators materially fail to comply with any term of the instrument, whether stated in a Federal statute or regulation, an assurance, the Agreement, or elsewhere, the U.S. Forest Service may take one or more of the following actions:
- (1) Temporarily withhold cash payments pending correction of the deficiency by the Cooperators or more severe enforcement action by the U.S. Forest Service; N/A
 - (2) Disallow (that is, deny both use of funds and matching credit for) all or part of the cost of the activity or action not in compliance; N/A
 - (3) Wholly or partly suspend or terminate the current instrument for the Cooperator's program;
 - (4) Withhold further awards for the program, or
 - (5) Take other remedies that may be legally available, including debarment procedures under 7 CFR part 3017.



R. TERMINATION BY MUTUAL AGREEMENT. This instrument may be terminated, in whole or part, as follows:

1. When the U.S. Forest Service and Cooperators agree upon the termination conditions, including the effective date and, in the case of partial termination, the portion to be terminated.

2. By 30 days written notification by the Cooperators to the U.S. Forest Service setting forth the reasons for termination, effective date, and in the case of partial termination, the portion to be terminated.

If, in the case of a partial termination, the U.S. Forest Service determines that the remaining portion of the instrument will not accomplish the purposes for which the instrument was made, the U.S. Forest Service may terminate the instrument in its entirety.

Upon termination of an instrument, the Cooperators shall not incur any new obligations for the terminated portion of the instrument after the effective date, and shall cancel as many outstanding obligations as possible. The U.S. Forest Service shall allow full credit to the Cooperators for the United States Federal share of the non-cancelable obligations properly incurred by the Cooperators up to the effective date of the termination. Excess funds must be refunded within 60 days after the effective date of termination.

S. ALTERNATE DISPUTE RESOLUTION – PARTNERSHIP AGREEMENT. In the event of any issue of controversy under this agreement, the parties may pursue Alternate Dispute Resolution procedures to voluntarily resolve those issues. These procedures may include, but are not limited to conciliation, facilitation, mediation, and fact-finding.

T. DEBARMENT AND SUSPENSION. The Cooperators shall immediately inform the U.S. Forest Service if they or any of their principals are presently excluded, debarred, or suspended from entering into covered transactions with the Federal Government according to the terms of 2 CFR Part 180. Additionally, should the Cooperators or any of their principals receive a transmittal letter or other official Federal notice of debarment or suspension, then they shall notify the U.S. Forest Service without undue delay. This applies whether the exclusion, debarment, or suspension is voluntary or involuntary.

U. COPYRIGHTING. The Cooperators are granted sole and exclusive right to copyright any publications developed as a result of this agreement. This includes the right to publish and vend throughout the world in any language and in all media and forms, in whole or in part, for the full term of copyright and all renewals thereof in accordance with this instrument. No original text or graphics produced and submitted by the U.S. Forest Service shall be copyrighted. The U.S. Forest Service reserves a royalty-free, nonexclusive, and irrevocable right to reproduce, publish, or otherwise use, and to



authorize others to use the work for federal government purposes. This right must be transferred to any sub-agreements or subcontracts.

This provision includes:

- The copyright in any work developed by the Cooperators under this agreement.
- Any right of copyright to which the Cooperators purchases ownership with any federal contributions.

- V. PUBLICATION SALE. The Cooperators may sell any publication developed as a result of this agreement. The publication may be sold at fair market value, which is initially defined in this agreement to cover the costs of development, production, marketing, and distribution. After the costs of development and production have been recovered, fair market value is defined in this agreement to cover the costs of marketing, printing, and distribution only. Fair market value must exclude any in-kind or federal government contributions from the total costs of the project.
- W. MODIFICATIONS. Modifications within the scope of this instrument must be made by mutual consent of the parties, by the issuance of a written modification signed and dated by all properly authorized, signatory officials, prior to any changes being performed. Requests for modification should be made, in writing, at least 30 days prior to implementation of the requested change. The U.S. Forest Service is not obligated to fund any changes not properly approved in advance.
- X. COMMENCEMENT/EXPIRATION DATE. This instrument is executed as of the date of the last signature and is effective through 5 years, at which time it will expire, unless extended by an executed modification, signed and dated by all properly authorized, signatory officials.
- Y. FUNDING. The Company will provide up to \$3,879,702 to implement the measures listed in Attachment E-1 per the schedule in Attachment E-2, and all of Douglas County's additional annual maintenance costs caused by the Project, and fund and implement maintenance on mitigation measures on NFS lands. The respective responsibilities for the Company and Douglas County are presented in the Operating and Financial Plan Agreement between Douglas County and the Chatfield Reservoir Mitigation Company related to Maintenance of County Road 67 and Adjacent Areas (Attachment E-3).
- Z. SCHEDULE. Within 6 months of receiving a Record of Decision (ROD) from the U.S. Army Corps of Engineers (Corps), the Company will implement the schedule in Attachment E-2.
- AA. BENEFIT TO SUGAR CREEK. Full implementation of the measures listed in Attachment E-1 will substantially minimize sediment impacts to the critical habitat reach of Sugar Creek and provide substantial benefits to the aquatic and riparian habitat and designated Preble's critical habitat along Sugar Creek.



BB. CHANGED CIRCUMSTANCES. The Sugar Creek Sediment Mitigation Project report (CH2M Hill 2009) is based on the best available information and accurately portrays current conditions within the designated critical habitat reach of Sugar Creek. The mitigation measures listed in Attachment E-1 will likely not be implemented for 2 or more years, and conditions in the critical habitat reach of Sugar Creek may change in a way that could require adjustments in the measures listed in Attachment E-1. The measures listed in Attachment E-1 may be adjusted by mutual agreement of the Parties, provided the mutually agreed to adjustments are in accordance with the objectives of substantially reducing sediment inputs to Sugar Creek and benefiting Preble’s and its habitat within the designated critical habitat reach.

CC. DELAY IN RECORD OF DECISION. If the Corps has not issued a ROD by December 31, 2011 addressing implementation of Alternative 3 of the Chatfield Reallocation Project, the U.S. Forest Service and Douglas County will have the option to terminate the Agreement or extend the Agreement to a date mutually agreeable to the Parties.

DD. IMPORTANCE OF CR 67. CR 67 along Sugar Creek provides an essential transportation link between the Platte River Road and Douglas County east of Sugar Creek for area residents and emergency service providers.

EE. NO WORK ON PRIVATE LANDS. The Project does not involve any work on privately owned property.

FF. AUTHORIZED REPRESENTATIVES. By signature below, each party certifies that the individuals listed in this document as representatives of the individual parties are authorized to act in their respective areas for matters related to this instrument. In witness whereof, the parties hereto have executed this instrument as of the last date written below.

FREDERICK KOCH, Engineering Services Director Douglas County _____	Date
CHAIRPERSON, Chatfield Reservoir Mitigation Company _____	Date



RANDY HICKENBOTTOM, District Ranger U.S. Forest Service, PSICC-South Platte Ranger District	Date
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The authority and format of this Agreement has been reviewed and approved for signature.

LUANN WAIDA
U.S. Forest Service Grants & Agreements
Specialist

Date



Burden Statement

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0596-0217. The time required to complete this information collection is estimated to average 4 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income is derived from any public assistance. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at 202-720-2600 (voice and TDD).

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, 1400 Independence Avenue, SW, Washington, DC 20250-9410 or call toll free (866) 632-9992 (voice). TDD users can contact USDA through local relay or the Federal relay at (800) 877-8339 (TDD) or (866) 377-8642 (relay voice). USDA is an equal opportunity provider and employer.



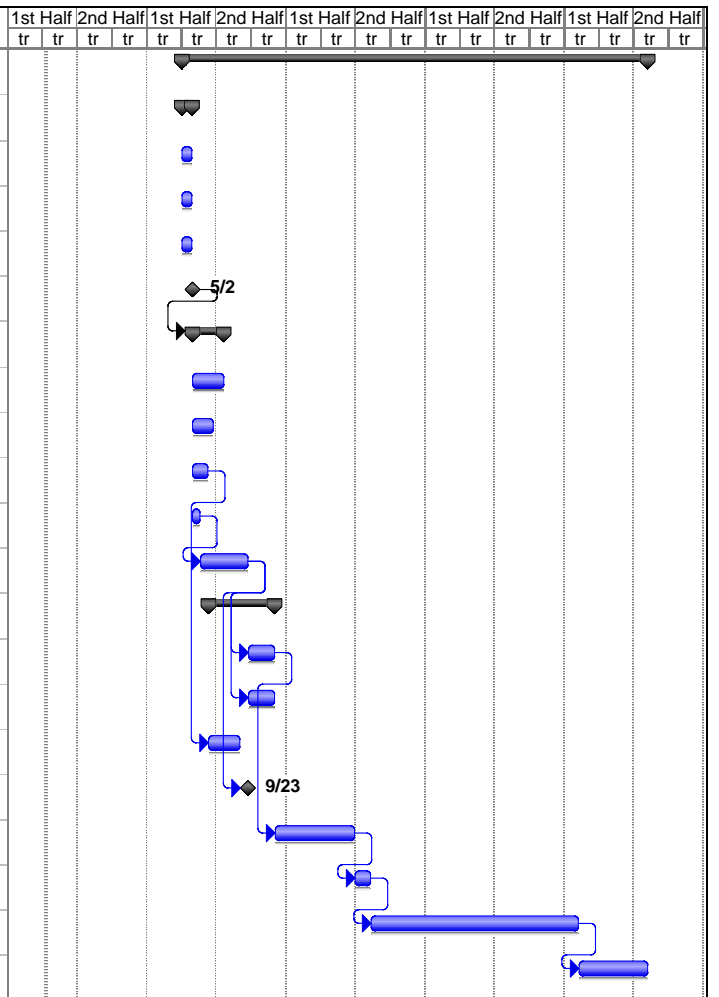
Attachment E-1
Proposed Sediment Reduction and Habitat Mitigation Improvements and Costs



Attachment E-2
Schedule for Proposed Sediment Reduction and Habitat Improvements and Costs

This schedule will be revised to reflect the actual date of the issuance of a Record of Decision (ROD) if and when a ROD is issued. The sequence of tasks and overall duration is expected to be similar to the current schedule in Attachment E-3.

ID	Task Name	Duration	Start	Finish	Predecessors	1st Half		2nd Half		1st Half		2nd Half		1st Half		2nd Half	
						tr	tr	tr	tr	tr	tr	tr	tr	tr	tr	tr	tr
1	Sugar Creek - Chatfield Mitigation Implementation	875 days	Mon 4/4/11	Fri 8/8/14													
2	Contracting (Prior to Anticipated R.O.D. Date)	20 days	Mon 4/4/11	Fri 4/29/11													
3	Design Firm	20 days	Mon 4/4/11	Fri 4/29/11													
4	Survey Firm	20 days	Mon 4/4/11	Fri 4/29/11													
5	Cultural Resources Firm	20 days	Mon 4/4/11	Fri 4/29/11													
6	Record of Decision Issued	0 days	Mon 5/2/11	Mon 5/2/11													
7	Data Collection	60 days	Mon 5/2/11	Fri 7/22/11	6												
8	Topographic Survey (depends on snow depth)	60 days	Mon 5/2/11	Fri 7/22/11													
9	Environmental Surveys (depends on snow depth)	40 days	Mon 5/2/11	Fri 6/24/11													
10	Cultural Resources Survey (depends on snow depth)	30 days	Mon 5/2/11	Fri 6/10/11													
11	Define Design Criteria and Needed Variances	15 days	Mon 5/2/11	Fri 5/20/11													
12	Preliminary Design and Drawings	90 days	Mon 5/23/11	Fri 9/23/11	11												
13	Permitting	125 days	Mon 6/13/11	Fri 12/2/11													
14	Douglas County Variance Approvals	50 days	Mon 9/26/11	Fri 12/2/11	12												
15	Douglas County Grading and Erosion Control	50 days	Mon 9/26/11	Fri 12/2/11	12												
16	Cultural Resources Approvals	60 days	Mon 6/13/11	Fri 9/2/11	10												
17	Other Permitting - Done via NEPA Process	0 days	Fri 9/23/11	Fri 9/23/11	12												
18	Final Design, Drawings, and Specifications	150 days	Mon 12/5/11	Fri 6/29/12	14												
19	Construction Bidding and Contracting	30 days	Mon 7/2/12	Fri 8/10/12	18												
20	Construction Period	390 days	Mon 8/13/12	Fri 2/7/14	19												
21	Construction Period Contingency (depends on snow depth)	130 days	Mon 2/10/14	Fri 8/8/14	20												



Sugar Creek - Chatfield Mitigation Schedule - Draft
Date: Fri 4/9/10

Task		Milestone		External Tasks	
Split		Summary		External Milestone	
Progress		Project Summary		Deadline	

Attachment E-3

Operating and Financial Plan Agreement between Douglas County and the Chatfield Reservoir Mitigation Company related to Maintenance of County Road 67 and its Adjacent Areas

The following draft agreement between Douglas County and Chatfield Reservoir Mitigation Company is the most recent version of the agreement. The parties will finalize and sign the agreement between the final FR/EIS and ROD. Any revisions to this version of the agreement are not anticipated to significantly depart from the terms and conditions of the current version of the agreement.

OPERATING AND FINANCIAL PLAN AGREEMENT BETWEEN DOUGLAS COUNTY AND THE CHATFIELD RESERVOIR MITIGATION COMPANY RELATED TO MAINTENANCE OF COUNTY ROAD 67 AND ITS ADJACENT AREAS

This Agreement (the “Agreement”) is made and entered into this ____ day of _____, 20__ by and between the Board of County Commissioners of the County of Douglas, State of Colorado (the “County”) and the Chatfield Reservoir Mitigation Company (the “Company”), collectively referred to as the Parties.

Recitals

- A. The Company consists of various special districts and units of local government.
- B. The Project Area is from the intersection of County Road 67 (“CR 67”) and County Road 97 (South Platte River Road) to a point approximately 4.5 miles upstream along Sugar Creek. The location of the Project Area is as shown on the map, Exhibit 1 hereto.
- C. The Sugar Creek Sediment Mitigation Project (the “Project”) calls for certain work to be performed in the Project Area.
- D. The County currently provides routine periodic maintenance to CR 67 in the Project Area.
- E. In its current condition, CR 67 is a gravel road.
- F. The Project requires various capital construction actions as described in Attachment E-1 of the Challenge Cost Share Agreement. Such construction includes 4,400 linear feet of CR 67 to be paved with asphalt or chip seal for traction control and may require or entail other changes to the condition or configuration of CR 67.
- G. Once the 4,400 linear feet of CR 67 are paved with asphalt and chip sealed for traction control and any other changes are made to CR 67 from its current condition and configuration, the maintenance requirements for the 4,400-linear-foot section of CR 67 will be different from and more expensive than the current maintenance requirements for the same stretch of CR 67, because, among other things, the paved CR 67 will need treatment for cold weather maintenance to combat icing and will need periodic repaving to repair deterioration of the asphalt.
- H. The estimated useful life of the pavement that is to be laid on the paved stretch of CR 67 is 5 to 7 years, after which time the 4,400 linear feet of CR 67 will need to be resurfaced.
- I. About 21,050 linear feet of unpaved road will require application of road stabilization and dust suppressant annually that will be different from and more expensive than the current maintenance requirements for the same stretch of CR 67, which is in addition to the maintenance work the County is currently performing on CR 67.

J. County regulations require persons working on County roads and areas adjacent to or in the vicinity of County roads to obtain a County Annual Access Permit prior to performing such work. For the County Annual Access Permit the Company will need to provide hours of operation and a traffic control plan. There will be no payment by the Company to the County to obtain an Annual Access Permit.

K. U.S. Forest Service regulations may require persons performing work on National Forest land to obtain a Special Use Permit and/or other federal permits prior to performing such work. The U.S. Army Corps of Engineers may require one or more permits to perform work with respect to the Project. Other federal and state regulations may require permits before the work described in this Agreement or work with respect to the Project can be performed.

Agreement

NOW, THEREFORE, the Parties agree to the following:

I. LINE OF AUTHORITY

The Douglas County Director of Public Works - Operations (the “Authorized Representative”) is designated as Authorized Representative of the County for the purpose of performing, administering, and coordinating the work called for in this Agreement.

The Chairperson of the Chatfield Reservoir Mitigation Company (the “Authorized Representative”) is designated as the representative of the Company for the purposes of this Agreement.

II. SCOPE OF WORK AND PAYMENT

A. Location. The Work shall be performed in the Project Area.

B. County Maintenance and Permitting Responsibilities. The specific improvements (i.e. capital construction) to CR 67 and its adjacent areas to be made as part of the Project be undertaken by the Company or others pursuant to the separate Challenge Cost Share Agreement and are not a part of this Agreement. This Agreement covers only the subsequent maintenance of those improvements that is in addition to the normal maintenance which the County has routinely been providing to the applicable portions of CR 67 and its adjacent areas, and shall be referred to as the “Reimbursed County Maintenance Work.”

The Reimbursed County Maintenance Work to be performed by the County is focused on maintaining the structural integrity of the road. The limits of the County’s maintenance responsibilities shall be as shown on Exhibit 2 (Typical Cross Section) and Exhibit 3 (Typical Cross Section with Cross Culvert). Maintenance work to be performed by the County under this Agreement shall consist of:

- (1) Perform all work required to maintain proper function and stability of the roadway surface;
- (2) Perform snow removal;
- (3) Maintain roadway signage and related features;
- (4) Apply annually (or as needed) road stabilization and dust suppressant on about 21,050 linear feet of unpaved road;
- (5) Resurface the 4,400 linear feet of paved road (estimated to occur every 5 to 7 years);
- (6) Maintain and clean the roadway ditch; and
- (7) Repair or replace the roadway cross culverts as required.

The County may perform maintenance activities beyond the limits indicated on Exhibits 2 and 3 to maintain the proper function and stability of the roadway. Examples include, but are not limited to: (a) the repair of roadway fill slopes that have eroded and undermined (or have the potential to undermine) the road, and (b) the repair of roadway cut slopes that may erode and fill the roadside ditch and/or reduce the width of the roadway.

Additional details for the maintenance activities are described in Exhibit 4.

It is recognized that the frequency of the County maintenance activities will vary as needed in order to maintain proper function and stability of the improvements associated with the Project. Based on the County's substantial experience and expertise in roadway maintenance, the County shall determine (a) the timing of the application of road stabilization and dust suppressant on about 21,050 linear feet of unpaved road; (b) the frequency and timing of the asphalt resurfacing or chip seal for the 4,400 linear feet of paved roadway; (c) the frequency and timing of cleaning the roadside ditch, which will be monitored after storm events and cleaned as needed to maintain roadway integrity; (d) what tasks it performs with in-house staff and what tasks it has outside contractors perform; (e) what outside contractors it hires to perform tasks under this Agreement; (f) the price it pays such outside contractors; and (g) the terms and conditions of the contract under which it hires such outside contractors. However, the County shall consult with the Company on the matters described in the immediately preceding sentence. The Company will timely pay the invoices submitted by the County even if it disagrees with the County's decision(s) under this paragraph.

Maintenance and repair of areas not associated with the Project and historically maintained by the County will remain the responsibility and expense of the County.

C. Company Maintenance Responsibilities. The Company is responsible for:

- (1) Periodic removal of sediment from sediment traps;
- (2) Disposal of all sediment removed from sediment traps;
- (3) Maintenance, repair, and replacement of sediment trap structures;
- (4) Maintenance, repair, and replacement of rundown culverts and culvert restraints;
- (5) Maintenance, repair, and replacement of stilling basins;

- (6) Cleaning roadway cross culverts if they become plugged; and
- (7) All other maintenance, repair, and replacement needed to maintain proper functioning of the Project that are not the responsibility of the County as presented in Section II.B.

Additional details for the maintenance activities are described in Exhibit 4.

Before the Company performs any work in the Project Area and before the Company accesses CR 67, the Company shall at its own expense obtain any and all required county, state and federal permits. Any work the Company performs on the slopes, ditches, and culverts must be approved in advance by the County's Department of Community Planning and Sustainable Development as part of the Annual Access Permit to ensure that the work is satisfactory from an engineering standpoint and does not compromise the integrity of the CR 67 travel way or endanger the safety of persons and vehicles using CR 67.

So that the Company can perform their maintenance responsibilities, the County will provide a renewable Douglas County Annual Access Permit to the Company. At its own expense, the Company shall be required to follow all requirements of the permit including traffic control and work hour limits. The requirements of the Annual Access Permit can be revised by the County annually if required with input from the Company. As part of the Annual Access Permit, the County shall be given access to inspect and review the work done by the Company on a daily basis if required.

D. Coordination with U.S. Forest Service. Since the U.S. Forest Service owns the majority of the land associated with the applicable reach of CR 67, the County and the Company will coordinate their maintenance activities with the U.S. Forest Service, as needed, to accomplish the maintenance activities in a manner satisfactory to the U.S. Forest Service. This coordination shall include the securing of all permits, studies, designs, plans, Right-of-Way (ROW) agreements, and approvals for any work related to U.S. Forest Service ROWs. As described in Section II.B, these costs incurred by the County constitute part of the maintenance work to be reimbursed by the Company. The County and the Company shall keep each other informed of the coordination between the Parties and the U.S. Forest Service related to the Project.

III. FUNDING

A. Payment of Invoices. The Company shall pay the County for all of the Reimbursed County Maintenance Work that the County invoices to the Company. The Reimbursed County Maintenance Work is limited to:

- (1) Annual application of road stabilization and dust suppressant to about 21,050 linear feet of unpaved road;
- (2) Periodic resurfacing of about 4,400 linear feet of paved road (estimated to occur every 5 to 7 years); and

- (3) Douglas County staff time; contractor or consultant staff time, costs, or charges; fees or charges paid to federal or state agencies; and out-of-pocket costs devoted or incurred by Douglas County in applying for, obtaining, renewing, maintaining, defending, or complying with any permit, license, or agreement issued or to be issued by any federal or state agency associated with paragraphs (1) and (2) above.

If the County chooses to perform the Reimbursed County Maintenance Work in-house, such reimbursement shall be at the County's actual costs for materials and the County's established rates for labor and equipment, plus 5% for general overhead. Acceptable accounting and invoicing procedure will be used by the County. If the County chooses to use an outside contractor to perform all or a portion of the Reimbursed County Maintenance Work, the Company shall reimburse the County the amount that the County pays the outside contractor.

Each invoice shall include a detailed description of the work performed and documentation supporting that work. Payment shall be made based on an invoice or invoices submitted by the County to the Company as frequently as quarterly, but at least annually. The Company shall pay the invoices in full to the County within 30 days from receipt of the County's invoice. If the County realizes any savings or credits in maintenance costs as a result of the Project, such savings or credits shall be appropriately credited to the Company.

B. Provision of Funds. The Company agrees to budget and set aside funds for payment to the County in an initial amount of \$48,750 per year, which reflects the initial estimate of annual invoices for the Reimbursed County Maintenance Work, plus a 25 percent contingency. These amounts may be adjusted in the future based upon actual expenses and inflation, upon agreement of both Parties.

If the Company fails to pay the County for Reimbursed County Maintenance Work, the County shall have the right to halt all future Reimbursed County Maintenance Work until the Company has paid it for all invoiced Reimbursed County Maintenance Work.

Since the asphalt resurfacing of the lower segment of CR 67 is anticipated to occur every 5 to 7 years, and will require increased funding, the Company shall set aside \$20,000 per year in additional funds for this work. These funds shall be escrowed in a separate account and may not be expended for any other purpose. The Company shall be entitled to the interest earned on such escrowed funds. The figure of \$20,000 per year will be inflation-adjusted annually based on changes in the Consumer Price Index for the Denver-Boulder-Greeley Metropolitan Area.

Any and all financial obligations of the County set forth in this Agreement are subject to annual appropriation by the County pursuant to C.R.S. Section 29-1-110, as amended.

IV. TERM

The term of this Agreement shall commence as of 12:01 a.m. on _____, 20____, and terminate at 12:00 a.m. on _____, 20____ (a 5-year term). This Agreement, at the option of both Parties, may be renewed for successive 5-year terms, if written agreement to that effect is signed by both Parties on or before ___(date)_____ of the current term. This Agreement and/or any extension of its original term shall be contingent upon annual funding being appropriated, budgeted, and otherwise made available for such purposes by both the County and the Company.

V. INDEMNIFICATION

The County cannot and by this Agreement does not agree to indemnify, hold harmless, exonerate, or assume the defense of the Company or any other person or entity whatsoever for any purpose whatsoever. The Company does not agree to defend, indemnify, or hold harmless the County, its commissioners, officials, officers, directors, agents, or employees from claims, demands, suits, actions, or proceedings of any kind or nature whatsoever, in any way resulting from or arising from this Agreement; however, the Company shall include the County as an additional insured under all general liability insurance policies pertaining to the Project.

VI. NOTICES

Notices concerning termination of this Agreement, notices of alleged or actual violations of the terms or provisions of this Agreement, and all other notices shall be made as follows:

Douglas County Contact:

Director of Public Works – Operations, Douglas County Department of Public Works -
Operations
P.O. Box 1390, 3030 North Industrial Way
Castle Rock, CO 80109
Telephone: 303-660-7480
FAX: 303-814-3319
Email:

Chatfield Reservoir Mitigation Company Contact:

Chairperson, Chatfield Reservoir Mitigation Company
62 West Plaza Drive
Highlands Ranch, CO 80126
Telephone: 303-791-0430
FAX: 303-791-0437
Email: Rmcloud@highlandsranch.org

Said notices shall be delivered personally during normal business hours to the appropriate office above, or by prepaid first class U.S. mail, via facsimile, or other method authorized in writing by the Authorized Representative. Mailed notices shall be deemed effective upon receipt

or five (5) business days after the date of mailing, whichever is earlier. The parties may from time to time designate substitute addresses or persons where and to whom such notices are to be mailed or delivered, but such substitutions shall not be effective until actual receipt of written notification.

VII. TERMINATION

Either Party shall have the right to terminate this Agreement, with or without cause, by giving written notice to the other Party of such termination and specifying the effective date thereof, which notice shall be given at least thirty (30) days before the effective date of such termination. In such event, the County shall be entitled to receive compensation, including the 5% allowance for overhead, in accordance with this Agreement for any work performed prior to the date of notice of termination. Notwithstanding the above, the Company shall not be relieved of liability to the County for damages sustained by the County by virtue of any breach of the Agreement by the Company. In the event of termination of this Agreement by the Company, the Company shall be entitled to perform the work that was the responsibility of the County under this Agreement, at its own direction and cost, provided that the Company applies for and is granted all applicable County and federal permits and complies with the terms and conditions of such permits.

VIII. UNFORESEEN EVENTS

Nothing herein contained shall be construed to obligate the County or the Company to address damage to CR 67 or its adjacent areas caused by unforeseen events (such as, by example and not limitation, flooding, fire, or heavy rain) of a magnitude not repairable by routine maintenance procedures. The maintenance work does not contemplate major repairs to storm or fire damaged areas.

IX. RELATIONSHIP TO CHALLENGE COST SHARE AGREEMENT

Nothing herein contained is intended to conflict with the Challenge Cost Share Agreement. If any conflicts arise between the Challenge Cost Share Agreement and this Agreement, the terms and conditions of the Challenge Cost Share Agreement shall prevail.

X. NO WAIVER OF GOVERNMENTAL IMMUNITY ACT

The Parties hereto understand and agree that the County, its commissioners, officials, officers, directors, agents, and employees, are relying on, and do not waive or intend to waive by any provisions of this Agreement, the monetary limitations or any other rights, immunities, and protections provided by the Colorado Governmental Immunity Act, C.R.S. §§ 24-10-101 to 120, or otherwise available to the County.

XI. ASSIGNMENT

The Parties' rights and obligations hereunder may be assigned only with the prior written consent of the non-assigning Party.

XII. HEADINGS

The headings contained herein are for information purposes only and shall not be deemed to limit or restrict the rights and obligations created hereunder.

XIII. BINDING EFFECT

This Agreement and the rights and obligations created hereunder shall be binding upon and inure to the benefit of the Parties and their successors in interest.

XIV. GOVERNING LAW; VENUE

This Agreement shall be deemed to have been made in, and construed in accordance with the laws of the State of Colorado. Venue for any action hereunder shall be in the District Court, County of Douglas, and State of Colorado. The Parties expressly waive the right to bring any action in or to remove any action to any other jurisdiction, whether state or federal.

XV. NO JOINT VENTURE CREATED

This Agreement shall not be construed to create a joint venture or partnership between the Parties hereto, nor shall either be the principal or agent of the other.

The County shall not be a signatory on any permit issued by the U.S. Fish and Wildlife Service, the U.S. Environmental Protection Agency, the U.S. Army Corps of Engineers, the Colorado Department of Public Health and Environment, the Colorado State Engineer, or any other federal or state agency, nor shall the County be, or be deemed to be, a permittee on or of any such permit.

The County is not, and shall not be, a party to, or member of, the Chatfield Reallocation Project or any reallocation contract between the U.S. Army Corps of Engineers and the State of Colorado or to the Chatfield Reallocation Project. The County's duties are limited to those contained within this Agreement and within the Challenge Cost Share Agreement.

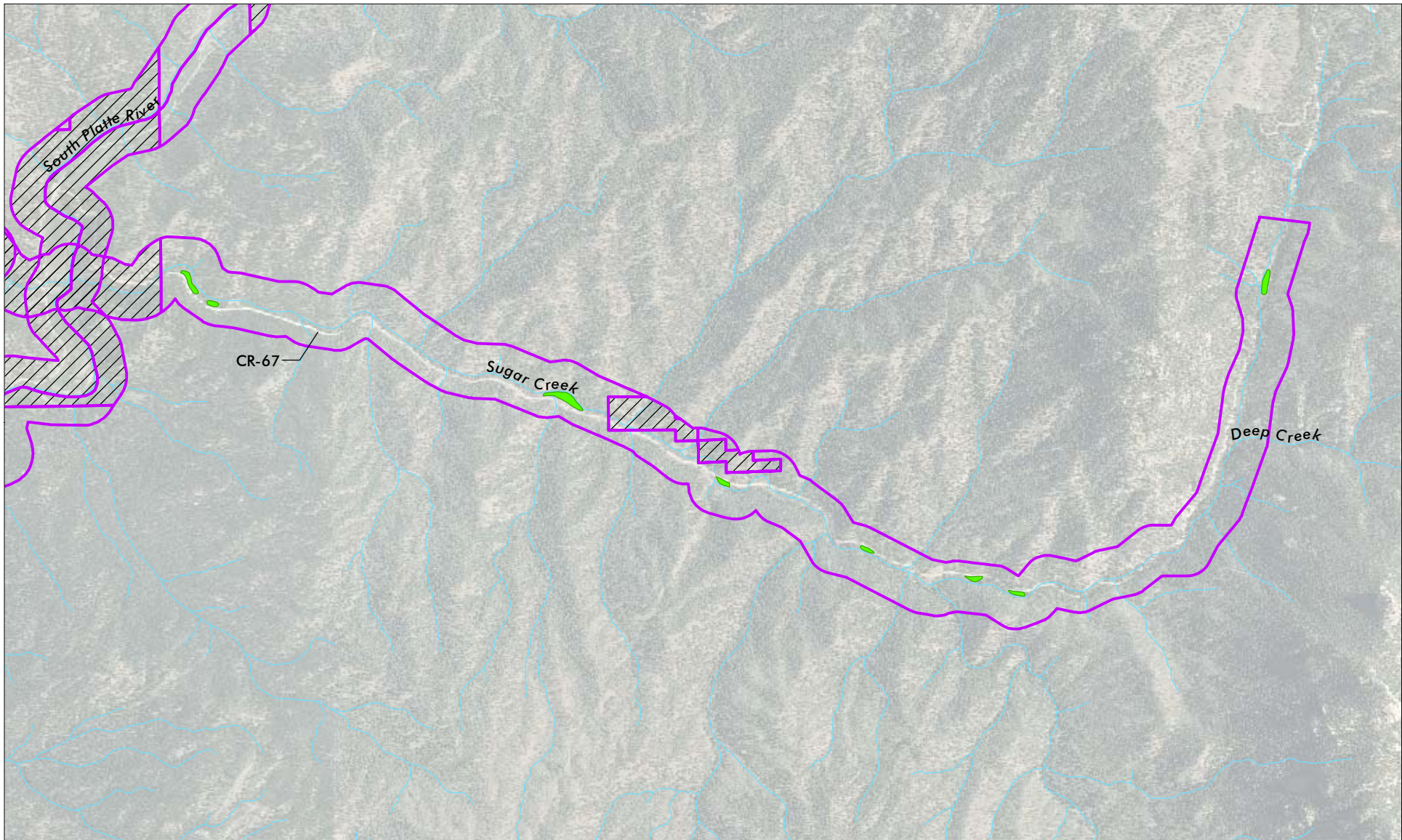
XVI. NO THIRD PARTY BENEFICIARIES

The enforcement of the terms and conditions of this Agreement and all rights of action relating to such enforcement, shall be strictly reserved to the County and the Company, and nothing contained in this Agreement shall give or allow any such claim or right of action by any other or third person under such Agreement.

XVII. ENTIRE AGREEMENT

The Parties acknowledge and agree that the provisions contained herein constitute the entire agreement and that all representations made by any commissioner, official, officer, director, agent, or employee of the respective parties unless included herein or in the Challenge

Exhibit 1
Sugar Creek Sediment Mitigation Project Location



- Preble's Designated Critical Habitat
- Proposed Habitat Restoration Area
- Private Land
- River or Stream

Note: All work to occur on Pike National Forest Lands and the CR-67 right-of-way. No work is proposed on private land.

Image Source: USDA NAIP 2005

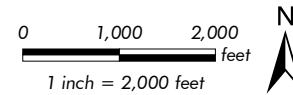
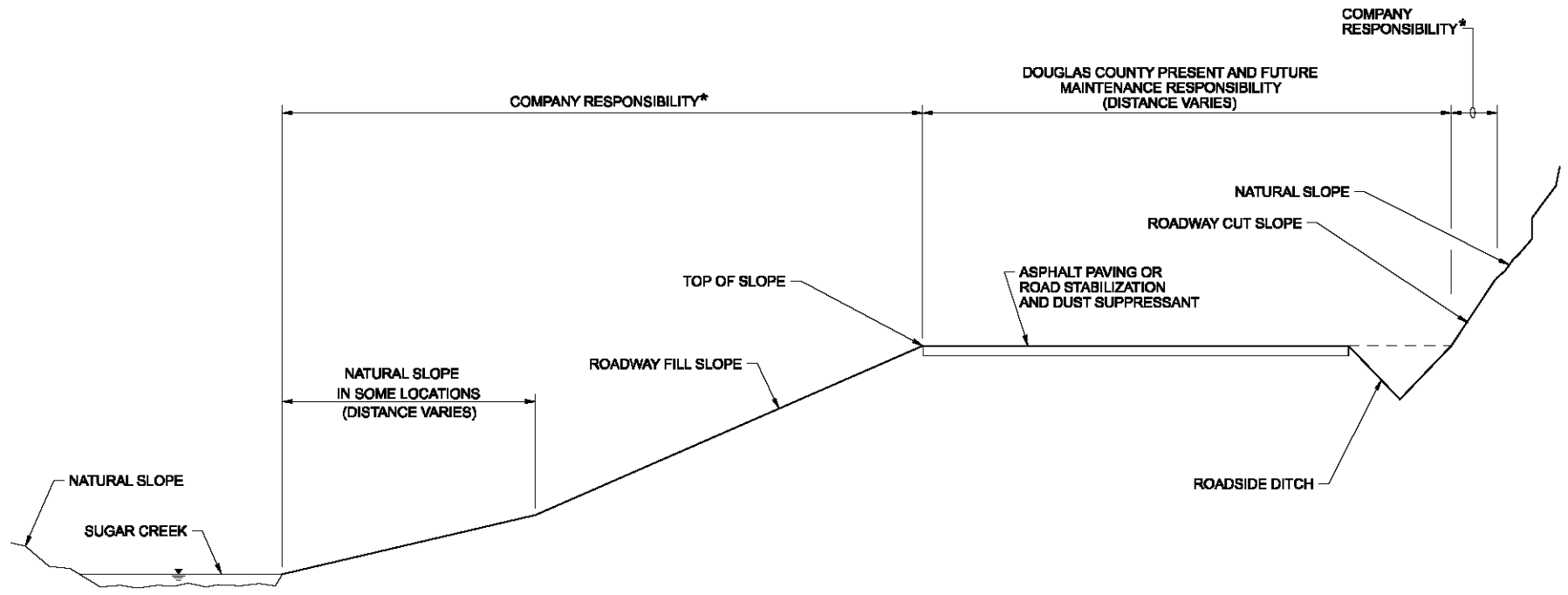


Exhibit 1
Sugar Creek Sediment
Mitigation Project Location

File: 4048 Fig E-1 sugarcreek sed mit loc.mxd (WH)
 February 2010



Exhibit 2
Maintenance Limits – Sugar Creek Sediment Mitigation Project (Typical Cross Section)

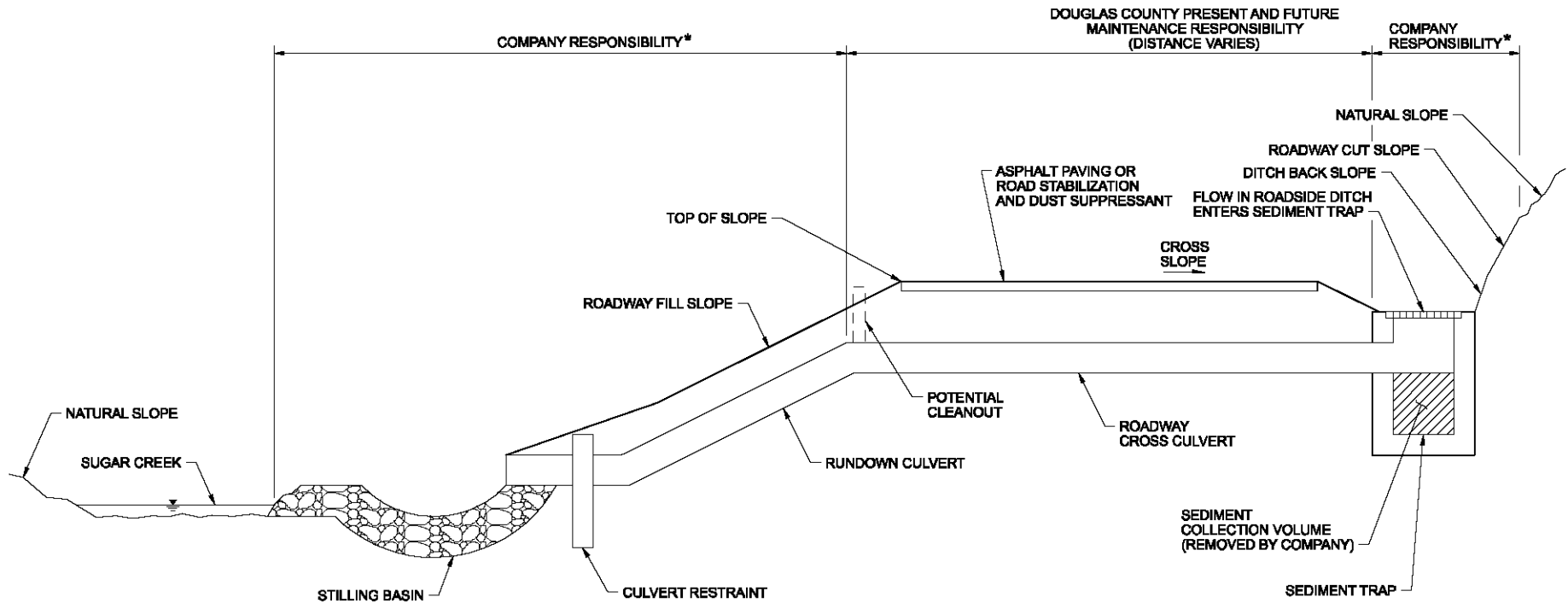


NOTE: "COMPANY" REFERS TO THE CHATFIELD RESERVOIR MITIGATION COMPANY.

* EXCEPTION - COUNTY WILL MAINTAIN ROADWAY CUT SLOPES AND FILL SLOPES AS NEEDED TO MAINTAIN ROAD INTEGRITY AND SAFETY.

EXHIBIT 2
MAINTENANCE LIMITS - SUGAR CREEK SEDIMENT MITIGATION PROJECT
TYPICAL CROSS SECTION

Exhibit 3
**Maintenance Limits – Sugar Creek Sediment Mitigation Project (Typical Cross Section
with Cross Culvert)**



NOTE: "COMPANY" REFERS TO THE CHATFIELD RESERVOIR MITIGATION COMPANY.

• EXCEPTION - COUNTY WILL MAINTAIN ROADWAY CUT SLOPES AND FILL SLOPES AS NEEDED TO MAINTAIN ROAD INTEGRITY AND SAFETY.

EXHIBIT 3
MAINTENANCE LIMITS - SUGAR CREEK SEDIMENT MITIGATION PROJECT
 TYPICAL CROSS SECTION WITH CROSS CULVERT

Exhibit 4

Summary of Maintenance Activities

The anticipated maintenance activities and the party responsible for performing the activity associated with keeping the Project improvements in proper working order are described below. The anticipated maintenance frequencies noted below are only estimates. Maintenance shall be performed as often as needed to maintain proper function of the improvements and to minimize sediment from entering Sugar Creek or Preble's habitat.

1. Roadway Cross Slope [County]:
 - a. For roadway reaches that are intended to slope away from the creek, maintain the roadway cross slope so that it drains accordingly. During final design, a minimum cross slope will be defined that shall be maintained.
 - b. Instruct operational crews conducting washboard grading and similar activities to grade sediment away from the creek. Excess sediment shall be removed and disposed of properly to prevent introduction into Sugar Creek.
 - c. Anticipated Frequency: As needed.
 - d. Note Regarding Snow Plow Operations: It is acknowledged that snow plow operations will need to plow snow towards the creek, due to the lack of storage area for snow.

2. Roadway Ditches (paved and unpaved) [County]:
 - a. Maintain ditches so that ditch erosion is minimized.
 - b. Repair any damage to ditches.
 - c. Remove sediment from ditches, and dispose of sediment properly to prevent introduction into Sugar Creek.
 - d. Anticipated Frequency: Twice per year.

3. Roadway Surface - Asphalt (From Station 0+00 to 92+00) [County]:
 - a. Repair potholes or pavement damage.
 - b. Minimize undermining of the asphalt, especially at the edges of the pavement, which could lead to erosion and asphalt failure.
 - c. Resurface the asphalt consistent with County practices.
 - d. Anticipated Frequency: Determined by the County, resurfacing is anticipated to be needed every 5 to 7 years.

4. Roadway Surface – Road Stabilization and Dust Suppressant (From Station 92+00 to 242+50) [County]:
 - a. Apply treatments as needed to maintain a drivable and erosion resistant surface.
 - b. Instruct operational crews conducting washboard grading and similar activities to grade sediment away from the creek. Minimize overcutting of the roadway surface during grading operations. Excess sediment shall be removed and disposed of properly to prevent introduction into Sugar Creek.
 - c. Minimize overspray of the road stabilization and dust suppressant treatment in order to protect Preble's habitat, vegetation, and water quality.

- d. Anticipated Frequency: Determined by the County, treatments are typically needed more frequently in early years, and less frequently in later years. The initial anticipated frequency is once per year.
5. Sediment Trap Maintenance [Company]:
- a. Remove debris from the trash rack, as needed.
 - b. Inspect sediment trap to see if there is any damage, and repair if needed.
 - c. Inspect the sediment level. Sediment shall be removed from the sediment collection volume area as frequently as needed in order to minimize sediment from entering the upstream end of the culvert. At a minimum, remove sediment from the sediment trap when 80% of the collection volume has been filled.
 - d. Remove sediment using a vacuum truck, manual methods, or approved mechanical devices.
 - e. Haul sediment to a temporary storage location, as approved by the U.S. Forest Service, County and Company.
 - f. Haul sediment from the temporary storage location to a permanent disposal area, as approved by the U.S. Forest Service, County and Company.
 - g. Anticipated Frequency:
 - i. Trash Rack Cleaning: Quarterly, or as needed to keep trash racks clear of debris.
 - ii. Sediment Trap Cleaning: Quarterly, or as needed to keep the sediment accumulation volume below the 80% filled elevation.
 - iii. Transfer of sediment from the temporary storage location to the approved permanent location: At least once per year.
6. Roadway Cross Culverts (under the road) [Shared, as follows]:
- a. Inspect for blockages or problems, and remedy as needed. [Company]
 - b. If sediment is found, it shall be removed in a manner that does not allow the sediment to enter the stilling basins, Sugar Creek, or the overbank areas of Sugar Creek. Sediment shall be disposed of properly. [Company]
 - c. Inspect the ground surface above the culvert for signs of culvert joint problems, including piping, settling, or movement of the pipe. [Company]
 - d. Anticipated Inspection Frequency: Twice per year. [Company]
 - e. Repair or replace failed roadway cross culverts as needed. [County]
7. Culvert Rundowns [Company]:
- a. Inspect for blockages or problems, and remedy as needed.
 - b. If sediment is found, it shall be removed in a manner that does not allow the sediment to enter the stilling basins, Sugar Creek, or the overbank areas of Sugar Creek. Sediment shall be disposed of properly.
 - c. Inspect the ground surface above the culvert for signs of culvert joint problems, including piping, settling, or movement of the pipe.
 - d. Anticipated Frequency: Twice per year.

8. Culvert Restraint and Stilling Basin Maintenance [Company]:
 - a. Inspect and repair any damage to the stilling basins, such as relocating or replacing riprap or boulders in order for the basin to function properly.
 - b. Due to the location of the stilling basins, and the potential for additional erosion to occur during access to the basins, access to the basins should be limited.
 - c. Sediment in the stilling basins may be from the culvert, or from natural sedimentation due to storm flows in the creek. The sediment in stilling basins does not need to be removed, unless the basin is unstable or not functioning due to the sediment.
 - d. Inspect culvert restraint for signs of movement or problems, and repair as needed.
 - e. Anticipated Frequency: Once per year.

9. Small Mammal Passage Culverts [Company]:
 - a. Inspect for erosion, blockages, or problems, and repair as needed.
 - b. Ensure that exposed soil exists inside the culvert (adjacent to the creek flow) to promote mammal passage within the culvert during base flow conditions.
 - c. Anticipated Frequency: Once per year.

10. Riprap Bank and Rundown Stabilization [Company]:
 - a. Anticipated Location of Improvements:
 - i. Riprap Bank Stabilization: Located at the bottom of the roadway fill slope at the creek's edge to minimize erosion of the toe of the slope from the erosive forces of the creek.
 - ii. Riprap Rundown Stabilization: Located along rundowns (gullies or swales) that connect roadway runoff to the creek (for areas where placing the flow in a rundown culvert is not needed or practical).
 - b. Inspect and repair damage as needed, including relocation or replacement of riprap, erosion control blanket, or vegetation.
 - c. Anticipated Frequency: Once per year.

11. Roadway Fill Slope and Cut Slope Erosion (For Areas Not Associated with the Project) [County and Forest Service]:
 - a. This maintenance is already part of the County's ongoing maintenance, and the County will continue to manage and fund these repairs.
 - b. Inspect and repair damage as needed, including placement of fill, erosion control blanket, and seeding.
 - c. Repair the roadway surface, as needed.
 - d. Anticipated Frequency: As needed in accordance with available funding and resources.

12. Tree Thinning and Preble's Habitat Planting Areas [Company]: It is anticipated that maintenance will be minimal. The areas shall be monitored for weeds and invasive species, and if found, will be controlled as needed in coordination with the U.S. Forest Service.

13. Drop Structures [Company]: It is anticipated that maintenance will be minimal. The drop structures shall be monitored for proper function, and if any concerns occur, the Company will correct the issues in coordination with the U.S. Forest Service.

POSSIBLE CHANGES TO THE PROPOSED IMPROVEMENTS:

At the time of this agreement, the proposed Sugar Creek Mitigation Improvements have not been designed or finalized. If the proposed improvements change or are deemed to be infeasible (for example, due to shallow bedrock), alternative improvements may be identified. Also, during design, the improvements may be modified in order to decrease maintenance requirements. Therefore, the needed maintenance activities may change as the design evolves.

A pilot project may be implemented to construct a select group of the improvements in order to monitor them, determine the amount of sediment that is collected, and better determine the maintenance needs. Lessons learned from the pilot project may impact the final design, the needed maintenance activities, and the anticipated maintenance frequencies.

Appendix F

Guidelines for the Restoration and Revegetation of Temporarily Disturbed Upland Areas at Chatfield State Park

Upland areas within Chatfield State Park will be disturbed associated with the relocation of recreation facilities (e.g., borrow areas, temporary access and haul roads relocation of utilities, and construction of the relocated recreation facilities). The following revegetation guidelines are consistent with general revegetation requirements for disturbances in Chatfield State Park. Each disturbance of a vegetated upland within Chatfield State Park will require the restoration and revegetation of the disturbance per these guidelines. Detailed, construction-level specifications that follow these guidelines will be required to be included in the construction plans for any activity that temporarily disturbs upland vegetation and/or soil. These plans will be subject to review by State Parks.

1.0 SOIL PREPARATION

- **Topsoil Salvage** – Determine the depth of salvageable topsoil (typically the upper 6 to 12 inches of soil) and salvage the maximum depth of topsoil in area to be temporarily disturbed prior to the disturbance.
 - Store the salvaged topsoil in a designated upland area approved by State Parks.
 - If the topsoil is to be stored for longer than 3 weeks during the growing season, seed with a sterile cover crop.
- **Fertilizer or Soil Amendments** – No fertilizer or soil amendments shall be used.
- **Topsoil Placement** – After the site is roughly graded to approximately 6 to 12 inches (depending on soil depth salvaged) below the final elevations shown on the construction plans, loosen the soil and place salvaged topsoil on top of the graded surface. Grade areas to a smooth, even surface with a loose uniformly fine texture. Limit fine grading to areas to be promptly seeded.
- **Ripping** – Temporarily disturbed areas subject to heavy soil compaction (e.g., temporary access roads, haul roads, and staging areas) shall be ripped to a depth of at least 12 inches prior to other soil preparation and seeding.
- **Borrow Pits** – Prior to any placement of salvaged topsoil and seeding, the edges of the excavated borrow areas shall be graded and sloped no steeper than 5 feet horizontal to 1 foot vertical. The shaping of the borrow pit edges shall, to the maximum extent practicable, blend the excavated borrow pit edges to the adjacent topography.

2.0 SEEDING

- **Seed Materials** – All temporarily disturbed upland areas that adversely affect vegetation shall be revegetated using the seed mix listed in Table F-1, which is the approved Chatfield State Park upland seed mix. No substitutes of species or amounts will be

allowed without written authorization of State Parks. Subject to approval from State Parks, wildflower and shrub seed may be added to the mix.

Table F-1. Chatfield State Park Upland Seed Mix.

Common Name and Variety	Scientific Name	% Mix (PLS) by Weight	PLS/lb Acre*
Western wheatgrass, Arriba	<i>Pascopyrum smithii</i>	30	3.6
Sideoats grama, Vaughn	<i>Bouteloua curtipendula</i>	15	1.8
Blue grama, Lovington	<i>Bouteloua gracilis</i>	15	1.8
Needle-and-thread	<i>Hesperostipa comata</i>	10	1.2
Streambank wheatgrass, Sodar	<i>Elymus lanceolatus psammophilus</i>	10	1.2
Indian ricegrass, Paloma	<i>Achnatherum hymenoides</i>	10	1.2
Buffalo grass, Texoka	<i>Buchloe dactyloides</i>	10	1.2
TOTALS		100	12.0

*Rate for drilling, double for hand broadcasting.

All seed shall be furnished in bags or containers clearly labeled to show the name and address of the supplier, the seed name, the lot number, net weight, origin, the percent of weed seed content, the guaranteed percentage of purity and germination, pounds of pure live seed (PLS) of each seed species, and the total pounds of PLS in the container. All seeds shall be free from noxious weed seeds.

- **Seeding Season** – Seed either in the spring, from spring thaw to May 1; or in the fall from September 15 until consistent ground freeze.
- **Seeding Application** – Seeding equipment must be designed to regulate the application rate of native grass seed. Apply with a mechanical power drawn drill seeder (not Brillon) followed by packer wheels or drag chains.
 - Plant seed at 1/4" to 1/2" depth.
 - Operate the drill in two passes, applying one-half of the seed in each pass.

No hydroseeding is allowed without the permission of State Parks.

3.0 MULCHING

Use either certified weed-free hay or hydromulch with tackifier within 4 hours after seeding:

- **Certified Weed-Free Hay** – Crimp certified weed-free hay. Apply at a rate of 2 tons per acre.
- **Hydromulch with Tackifier** – Hydromulch using a slurry of Cellulose fiber mulch and tackifier.

4.0 MONITORING AND MAINTENANCE

The revegetated sites will be monitored annually, during the growing season. The first 2 years of monitoring will be qualitative to determine if revegetation is progressing. The first two full growing seasons following seeding, monitoring will consist of the following:

- A visual inspection to determine if the areas seeded have germinated and are becoming established;
- A determination of the presence and distribution of bare areas¹ greater than 400 square feet;
- A determination of the presence and distribution of noxious weeds comprising 10 percent or more of the estimated vegetative ground cover or any area greater than 400 square feet dominated by noxious weeds²; and
- Photographic documentation of the revegetated area taken from fixed points for year-to-year comparisons.

The presence of bare areas greater than 400 square feet will require reseeding the bare areas per the revegetation guidelines. The presence of noxious weeds greater than 400 square feet will require weed control measures. C-list weed species will be controlled in the revegetation areas consistent with Chatfield State Parks management of C-list weed species.

Best management practices (BMPs) will be used to effectively minimize the spread of noxious weeds (List A, B, and C species). Implementing these BMPs would minimize the dispersal of noxious weeds, and the need for weed future control actions would be reduced. The following BMPs will be implemented with compensatory mitigation actions that involve land disturbance:

- Major equipment (e.g., track equipment, rubber tire loaders, and backhoes) should be cleaned by high pressure air or water spray before being delivered to the project area to avoid introducing undesirable plants and noxious weeds.
- Topsoil containing any noxious weeds (List A, B, or C species) should not be used or otherwise strictly managed to preclude the spread of seeds and noxious weed species.
- Fertilizer or other soil amendments will not be used unless recommended by a revegetation specialist based on site-specific conditions. The use of fertilizers will be restricted because they can promote noxious weeds and can be detrimental to the native species in the seed mix.

¹ For the purposes of the qualitative monitoring, “bare areas” are defined as areas where seed has not germinated or on average there is less than one desirable plant per square foot.

² For the purposes of the Compensatory Mitigation Plan, “noxious weeds” are those weeds listed in the Colorado Noxious Weed Act.

- Disturbed areas will be reclaimed as soon as practicable after completion of construction and seeded with an appropriate native seed mix (certified as noxious weed-free).
- Certified weed-free mulch will be used for revegetation. Weed-free straw bales will be used for sediment barriers.
- Locally or regionally available seed and mulch will be used when practicable.
- The project area will be monitored to determine if noxious weeds have invaded. Any noxious weeds found will be controlled as soon as practicable to prevent establishment.

The final success criteria for upland revegetation are:

- Average ground cover is 90 percent or greater than the selected reference area;
- The relative cover of native species is 90 percent or greater than the reference area;
- Noxious weeds comprise less than 20 percent of the average estimated vegetated ground cover; and
- No area greater than 800 square feet is dominated by noxious weeds.

Reference areas will be established by the Chatfield Water Providers prior to disturbance of the borrow areas. The reference areas will be representative of the current conditions of the borrow areas. Reference area locations will be coordinated with and reviewed by the Advisory Technical Committee and State Parks (Section 7.2.2 of the CMP).

All monitoring will be subject to the monitoring reporting requirements, including the submission of an as-built report no later than 60 days following completion of the mitigation activity (see Section 7.4 of the CMP).

Appendix G

Assumptions and Calculations for On-Site Mitigation Gains in EFUs and Costs

(EFU estimates will be updated based on field evaluations and mitigation costs will be updated based on final site-specific plans)

Existing EFIs and EFUs and Proposed Gains in EFUs in Proposed On-site Mitigation Areas																
Mitigation Site ID of GIS Habitat Polygons	Existing Conditions in Proposed Mitigation Areas									Proposed Conditions in Mitigation Areas						
	Exist-ing Pre-ble's EFI	Exist-ing Wet-land EFI	Exist-ing Bird EFI	Existing Com-bined EFI	Acres	Exist-ing PMJM EFUs	Exist-ing Wet-land EFUs	Exist-ing Bird EFUs	Total Exist-ing EFU	Differ-ence between miti-gation Bird EFI (0.69) and existing Bird EFI (Column D)	Esti-mated Gain in Bird EFUs (Column F times Column K)	Differ-ence between miti-gation Preble's EFI (1.0) and existing Preble's EFI (Column B)	Esti-mated Gain in Preble's EFUs (Column F times Column M)	Differ-ence between miti-gation Wetland EFI (0.79) and existing Wetland EFI (Column C)	Esti-mated Gain in Wetland EFUs (Column F times Column O)	Total Gain in EFUs
LMG-1	0	0	0.63	0.63	9.20	0.00	0.00	5.80	5.80	0.06	0.55	0	0	0.79	7.27	7.82
LMG-1	0	0.82	0.75	1.57	0.02	0.00	0.02	0.01	0.03	-0.06	0.00	0	0	-0.03	0.00	0.00
LMG-1	0	0.79	0.81	1.6	1.30	0.00	1.03	1.05	2.08	-0.12	-0.16	0	0	0	0.00	-0.16
LMG-1 Total					10.52	0.00	1.04	6.87	7.91		0.39		0		7.27	7.67
LMG-2	0	0	0.63	0.63	6.84	0.00	0.00	4.31	4.31	0.06	0.41	0	0	0.79	5.40	5.81
LMG-2	0	0.82	0.75	1.57	0.05	0.00	0.04	0.04	0.08	-0.06	0.00	0	0	-0.03	0.00	0.00
LMG-2 Total					6.89	0.00	0.04	4.35	4.39		0.41		0		5.40	5.81
DC-1	0	0	0	0	1.95	0.00	0.00	0.00	0.00	0.69	1.34	0	0	0.79	0.31	1.65
DC-1	0	0	0.63	0.63	0.67	0.00	0.00	0.42	0.42	0.06	0.04	0	0	0.79	0.11	0.15
DC-1	0	0.67	0.81	1.48	1.07	0.00	0.72	0.87	1.58	-0.12	-0.13	0	0	0.12	0.03	-0.10
DC-1	0	0.67	0.81	1.48	0.31	0.00	0.21	0.25	0.46	-0.12	-0.04	0	0	0.12	0.01	-0.03
DC-1 Total					4.00	0.00	0.93	1.55	2.47		1.22		0		0.45	1.66
DC-2	0	0	0	0	1.33	0.00	0.00	0.00	0.00	0.69	0.92	0	0	0.79	0.21	1.13
DC-2	0	0	0.63	0.63	1.08	0.00	0.00	0.68	0.68	0.06	0.06	0	0	0.79	0.17	0.24
DC-2	0	0.67	0.81	1.48	1.65	0.00	1.11	1.34	2.44	-0.12	-0.20	0	0	0.12	0.04	-0.16
DC-2 Total					4.07	0.00	1.11	2.02	3.13		0.79		0		0.42	1.21
DC-3	0	0	0	0	2.46	0.00	0.00	0.00	0.00	0.69	1.70	0	0	0.79	0.39	2.09
DC-3	0	0	0.63	0.63	1.28	0.00	0.00	0.81	0.81	0.06	0.08	0	0	0.79	0.20	0.28
DC-3 Total					3.74	0.00	0.00	0.81	0.81		1.78		0		0.59	2.37
DC-4	0	0	0	0	0.49	0.00	0.00	0.00	0.00	0.69	0.34	0	0	0.79	0.08	0.42
DC-4	0	0	0.63	0.63	1.32	0.00	0.00	0.83	0.83	0.06	0.08	0	0	0.79	0.21	0.29
DC-4 Total					1.82	0.00	0.00	0.83	0.83		0.42		0		0.29	0.71

COMPENSATORY MITIGATION PLAN

Existing EFIs and EFUs and Proposed Gains in EFUs in Proposed On-site Mitigation Areas																
Mitigation Site ID of GIS Habitat Polygons	Existing Conditions in Proposed Mitigation Areas									Proposed Conditions in Mitigation Areas						
	Existing Preble's EFI	Existing Wetland EFI	Existing Bird EFI	Existing Combined EFI	Acres	Existing PMJM EFUs	Existing Wetland EFUs	Existing Bird EFUs	Total Existing EFU	Difference between mitigation Bird EFI (0.69) and existing Bird EFI (Column D)	Estimated Gain in Bird EFUs (Column F times Column K)	Difference between mitigation Preble's EFI (1.0) and existing Preble's EFI (Column B)	Estimated Gain in Preble's EFUs (Column F times Column M)	Difference between mitigation Wetland EFI (0.79) and existing Wetland EFI (Column C)	Estimated Gain in Wetland EFUs (Column F times Column O)	Total Gain in EFUs
PC-1	0.44	0	0.63	1.07	0.38	0.17	0.00	0.24	0.41	0.06	0.02	0.56	0.21	0.79	0.06	0.30
PC-1	0.44	0	0.63	1.07	15.28	6.72	0.00	9.63	16.35	0.06	0.92	0.56	8.56	0.79	2.41	11.89
PC-1 Total					15.66	6.89	0.00	9.87	16.76		0.94		8.77		2.47	12.19
PC-2	0.44	0	0.63	1.07	5.10	2.24	0.00	3.21	5.45	0.06	0.31	0.56	2.85	0.79	0.81	3.96
PC-2 Total					5.10	2.24	0.00	3.21	5.45		0.31		2.85		0.81	3.96
PC-3	1	0.81	0.63	2.44	0.05	0.05	0.04	0.03	0.11	0.06	0.00	0	0.00	-0.02	0.00	0.00
PC-3	0.44	0	0.63	1.07	1.67	0.73	0.00	1.05	1.78	0.06	0.10	0.56	0.93	0.79	0.26	1.30
PC-3	0.44	0	0.63	1.07	0.06	0.03	0.00	0.04	0.06	0.06	0.00	0.56	0.03	0.79	0.01	0.05
PC-3	0.44	0	0.63	1.07	0.15	0.07	0.00	0.09	0.16	0.06	0.01	0.56	0.08	0.79	0.02	0.12
PC-3	1	0.79	0.81	2.6	0.18	0.18	0.15	0.15	0.48	-0.12	-0.02	0	0.00	0	0.00	-0.02
PC-3	1	0.79	0.81	2.6	0.30	0.30	0.23	0.24	0.77	-0.12	-0.04	0	0.00	0	0.00	-0.04
PC-3	1	0.79	0.81	2.6	0.31	0.31	0.24	0.25	0.80	-0.12	-0.04	0	0.00	0	0.00	-0.04
PC-3 Total					2.71	1.66	0.66	1.85	4.17		0.02		1.05		0.30	1.37
PC-4	0.44	0	0.63	1.07	0.04	0.02	0.00	0.03	0.04	0.06	0.00	0.56	0.02	0.79	0.01	0.03
PC-4	0.44	0	0.63	1.07	0.38	0.17	0.00	0.24	0.41	0.06	0.02	0.56	0.21	0.79	0.06	0.30
PC-4	1	0.82	0.75	2.57	0.87	0.87	0.71	0.65	2.22	-0.06	-0.05	0	0.00	-0.03	-0.01	-0.06
PC-4 Total					1.29	1.05	0.71	0.91	2.67		-0.03		0.24		0.06	0.27
PC-5	0.44	0	0.63	1.07	2.43	1.07	0.00	1.53	2.60	0.06	0.15	0.56	1.36	0.79	0.38	1.89
PC-5	0.44	0	0.63	1.07	3.53	1.55	0.00	2.22	3.77	0.06	0.21	0.56	1.97	0.79	0.56	2.74
PC-5 Total					5.96	2.62	0.00	3.76	6.38		0.36		3.34		0.94	4.64
PC-6	0.44	0	0.63	1.07	5.03	2.21	0.00	3.17	5.38	0.06	0.30	0.56	2.82	0.79	0.79	3.91
PC-6 Total					5.03	2.21	0.00	3.17	5.38		0.30		2.82		0.79	3.91
PC-7	0.44	0	0.63	1.07	3.51	1.54	0.00	2.21	3.75	0.06	0.21	0.56	1.96	0.79	0.55	2.73
PC-7 Total					3.51	1.54	0.00	2.21	3.75		0.21		1.96		0.55	2.73
PC-8	0.44	0	0.63	1.07	5.40	2.38	0.00	3.40	5.78	0.06	0.32	0.56	3.02	0.79	0.85	4.20
PC-8 Total					5.40	2.38	0.00	3.40	5.78		0.32		3.02		0.85	4.20
PC-9	0.44	0	0.63	1.07	4.19	1.85	0.00	2.64	4.49	0.06	0.25	0.56	2.35	0.79	0.66	3.26
PC-9	1	0.79	0.81	2.6	0.02	0.02	0.02	0.02	0.06	-0.12	0.00	0	0.00	0	0.00	0.00
PC-9 Total					4.22	1.87	0.02	2.66	4.55		0.25		2.35		0.66	3.26
PC-10	0.44	0	0.63	1.07	5.19	2.28	0.00	3.27	5.56	0.06	0.31	0.56	2.91	0.79	0.82	4.04
PC-10 Total					5.19	2.28	0.00	3.27	5.56		0.31		2.91		0.82	4.04
SPR-1	0.44	0	0.63	1.07	11.09	4.88	0.00	6.98	11.86	0.06	0.67	0.56	6.21	0.79	1.75	8.62
SPR-1	1	0.81	0.63	2.44	0.02	0.02	0.01	0.01	0.04	0.06	0.00	0	0.00	-0.02	0.00	0.00

COMPENSATORY MITIGATION PLAN

Existing EFIs and EFUs and Proposed Gains in EFUs in Proposed On-site Mitigation Areas																
Mitigation Site ID of GIS Habitat Polygons	Existing Conditions in Proposed Mitigation Areas									Proposed Conditions in Mitigation Areas						
	Exist-ing Pre-ble's EFI	Exist-ing Wet-land EFI	Exist-ing Bird EFI	Exist-ing Combined EFI	Acres	Exist-ing PMJM EFUs	Exist-ing Wet-land EFUs	Exist-ing Bird EFUs	Total Exist-ing EFU	Differ-ence between miti-gation Bird EFI (0.69) and exist-ing Bird EFI (Column D)	Esti-mated Gain in Bird EFUs (Column F times Column K)	Differ-ence between miti-gation Preble's EFI (1.0) and exist-ing Preble's EFI (Column B)	Esti-mated Gain in Preble's EFUs (Column F times Column M)	Differ-ence between miti-gation Wetland EFI (0.79) and exist-ing Wetland EFI (Column C)	Esti-mated Gain in Wetland EFUs (Column F times Column O)	Total Gain in EFUs
SPR-1	1	0.79	0.81	2.6	33.41	33.41	26.39	27.06	86.87	-0.12	-4.01	0	0.00	0	0.00	-4.01
SPR-1 Total					44.51	38.30	26.41	34.06	98.77		-3.34		6.21		1.75	4.62
SPR-2	0.44	0	0.63	1.07	1.11	0.49	0.00	0.70	1.18	0.06	0.07	0.56	0.62	0.79	0.17	0.86
SPR-2	0.44	0	0.63	1.07	4.58	2.02	0.00	2.89	4.90	0.06	0.27	0.56	2.56	0.79	0.72	3.56
SPR-2	1	0.81	0.63	2.44	0.00	0.00	0.00	0.00	0.01	0.06	0.00	0	0.00	-0.02	0.00	0.00
SPR-2	1	0.82	0.75	2.57	0.05	0.05	0.04	0.04	0.13	-0.06	0.00	0	0.00	-0.03	0.00	0.00
SPR-2 Total					5.74	2.56	0.04	3.62	6.22		0.34		3.18		0.90	4.42
SPR-3	0.44	0	0.63	1.07	2.67	1.17	0.00	1.68	2.85	0.06	0.16	0.56	1.49	0.79	0.42	2.08
SPR-3	0.44	0	0.63	1.07	1.34	0.59	0.00	0.84	1.43	0.06	0.08	0.56	0.75	0.79	0.21	1.04
SPR-3 Total					4.01	1.76	0.00	2.52	4.29		0.24		2.24		0.63	3.12
SPR-4	1	0.81	0.63	2.44	1.08	1.08	0.87	0.68	2.63	0.06	0.06	0	0.00	-0.02	0.00	0.06
SPR-4	1	0.81	0.63	2.44	0.69	0.69	0.56	0.44	1.69	0.06	0.04	0	0.00	-0.02	0.00	0.04
SPR-4	0.44	0	0.63	1.07	1.53	0.67	0.00	0.96	1.64	0.06	0.09	0.56	0.86	0.79	0.24	1.19
SPR-4	0.44	0	0.63	1.07	0.43	0.19	0.00	0.27	0.46	0.06	0.03	0.56	0.24	0.79	0.07	0.34
SPR-4	1	0.81	0.63	2.44	0.09	0.09	0.07	0.06	0.21	0.06	0.01	0	0.00	-0.02	0.00	0.00
SPR-4 Total					3.82	2.72	1.51	2.41	6.64		0.23		1.10		0.30	1.63
SPR-5	0.44	0	0.63	1.07	1.16	0.51	0.00	0.73	1.24	0.06	0.07	0.56	0.65	0.79	0.18	0.90
SPR-5	0.44	0	0.63	1.07	3.27	1.44	0.00	2.06	3.50	0.06	0.20	0.56	1.83	0.79	0.52	2.54
SPR-5	1	0.79	0.81	2.6	0.07	0.07	0.06	0.06	0.19	-0.12	-0.01	0	0.00	0	0.00	-0.01
SPR-5 Total					4.50	2.02	0.06	2.85	4.93		0.26		2.48		0.70	3.43
SPR-6	0.44	0	0.63	1.07	1.71	0.75	0.00	1.08	1.83	0.06	0.10	0.56	0.96	0.79	0.27	1.33
SPR-6 Total					1.71	0.75	0.00	1.08	1.83		0.10		0.96		0.27	1.33
SPR-7	1	0.81	0.63	2.44	0.04	0.04	0.03	0.03	0.10	0.06	0.00	0	0.00	-0.02	0.00	0.00
SPR-7	0.44	0	0.63	1.07	5.59	2.46	0.00	3.52	5.98	0.06	0.34	0.56	3.13	0.79	0.88	4.35
SPR-7	0.44	0	0.63	1.07	2.78	1.22	0.00	1.75	2.98	0.06	0.17	0.56	1.56	0.79	0.44	2.17
SPR-7	1	0.79	0.81	2.6	0.14	0.14	0.11	0.11	0.35	-0.12	-0.02	0	0.00	0	0.00	-0.02
SPR-7 Total					8.55	3.86	0.14	5.41	9.41		0.49		4.69		1.32	6.50
SPR-8	1	0.81	0.63	2.44	0.04	0.04	0.03	0.02	0.09	0.06	0.00	0	0.00	-0.02	0.00	0.00
SPR-8	0.44	0	0.63	1.07	1.44	0.63	0.00	0.90	1.54	0.06	0.09	0.56	0.80	0.79	0.23	1.12
SPR-8 Total					1.47	0.67	0.03	0.93	1.62		0.09		0.80		0.23	1.12
SPR-9	0.44	0	0.63	1.07	0.95	0.42	0.00	0.60	1.01	0.06	0.06	0.56	0.53	0.79	0.15	0.74
SPR-9	1	0.79	0.81	2.6	0.00	0.00	0.00	0.00	0.01	-0.12	0.00	0	0.00	0	0.00	0.00
SPR-9 Total					0.95	0.42	0.00	0.60	1.02		0.06		0.53		0.15	0.74
SPR-10	0.44	0	0.63	1.07	1.74	0.77	0.00	1.10	1.86	0.06	0.10	0.56	0.98	0.79	0.28	1.36

COMPENSATORY MITIGATION PLAN

Existing EFIs and EFUs and Proposed Gains in EFUs in Proposed On-site Mitigation Areas																
Mitigation Site ID of GIS Habitat Polygons	Existing Conditions in Proposed Mitigation Areas									Proposed Conditions in Mitigation Areas						
	Existing Preble's EFI	Existing Wetland EFI	Existing Bird EFI	Existing Combined EFI	Acres	Existing PMJM EFUs	Existing Wetland EFUs	Existing Bird EFUs	Total Existing EFU	Difference between mitigation Bird EFI (0.69) and existing Bird EFI (Column D)	Estimated Gain in Bird EFUs (Column F times Column K)	Difference between mitigation Preble's EFI (1.0) and existing Preble's EFI (Column B)	Estimated Gain in Preble's EFUs (Column F times Column M)	Difference between mitigation Wetland EFI (0.79) and existing Wetland EFI (Column C)	Estimated Gain in Wetland EFUs (Column F times Column O)	Total Gain in EFUs
SPR-10 Total					1.74	0.77	0.00	1.10	1.86		0.10		0.98		0.28	1.36
SPR-11	0.44	0	0.63	1.07	0.81	0.36	0.00	0.51	0.87	0.06	0.05	0.56	0.46	0.79	0.13	0.63
SPR-11	1	0.79	0.81	2.6	0.11	0.11	0.09	0.09	0.29	-0.12	-0.01	0	0.00	0	0.00	-0.01
SPR-11 Total					0.92	0.47	0.09	0.60	1.16		0.04		0.46		0.13	0.62
SPR-12	0.44	0	0.63	1.07	1.44	0.64	0.00	0.91	1.54	0.06	0.09	0.56	0.81	0.79	0.23	1.12
SPR-12 Total					1.44	0.64	0.00	0.91	1.54		0.09		0.81		0.23	1.12
SPR-13	1	0.81	0.63	2.44	0.11	0.11	0.09	0.07	0.27	0.06	0.01	0	0.00	-0.02	0.00	0.01
SPR-13	0.44	0	0.63	1.07	0.85	0.38	0.00	0.54	0.91	0.06	0.05	0.56	0.48	0.79	0.14	0.66
SPR-13 Total					0.97	0.49	0.09	0.61	1.18		0.06		0.48		0.13	0.67
Grand Total					165.45	80.19	32.88	107.42	220.49		6.74		54.22		29.70	90.67

Assumptions:

- Existing EFIs and EFUs are based on CDOW Riparian Habitat Mapping
- There is no Preble's habitat on Deer Creek or Lower Marcy Gulch because they are out of known Preble's occupied habitat.
- With exception of Lower Marcy Gulch, final habitat will be 20% scrub/shrub wetland, 60% riparian shrubs, 20% riparian trees
- Mitigation in Lower Marcy Gulch will be 100% scrub/shrub wetlands

COMPENSATORY MITIGATION PLAN

Detailed On-Site Mitigation Cost Estimates											
Proposed On-Site Mitigation Area	Quantity					Cost					
	Acres	Square Yards	Earthwork ³ (cubic yards)	Sheet Pile (linear feet)	Sheet Pile ⁴ (square ft.)	Earthwork at \$14/cy ⁵	Sheet Pile at \$25/square foot	Native Seeding and Crimped Mulching \$3,000/ac	Tree Planting at \$200 per tree ⁶	Design and Mobilization (20% of cost)	Total Cost
LMG-1 ¹	10.5	50,820.0	50,820	0	0	\$711,480	\$0	\$31,500	\$18,295	\$152,255	\$913,530
LMG-2 ¹	6.9	33,396.0	33,396	0	0	\$467,544	\$0	\$20,700	\$12,023	\$100,053	\$600,320
DC-1	4.0	19,360.0	19,360	485	9,700	\$271,040	\$242,500	\$12,000	\$6,970	\$106,502	\$639,012
DC-2	4.1	19,844.0	26,459	467	9,340	\$370,420	\$233,500	\$12,300	\$7,144	\$124,673	\$748,037
DC-3	3.7	17,908.0	23,877	395	7,900	\$334,282	\$197,500	\$11,100	\$6,447	\$109,866	\$659,194
DC-4	1.8	8,712.0	11,616	438	8,760	\$162,624	\$219,000	\$5,400	\$3,136	\$78,032	\$468,192
PC-1 ²	15.7	75,988.0	0	0	0	\$0	\$0	\$47,100	\$27,356	\$14,891	\$89,347
PC-2 ¹	5.1	24,684.0	32,912	0	0	\$460,767	\$0	\$15,300	\$8,886	\$96,991	\$581,944
PC-3	2.7	13,068.0	17,424	750	15,000	\$243,935	\$375,000	\$8,100	\$4,704	\$126,348	\$758,088
PC-4	1.29	6,243.6	8,325	540	10,800	\$116,547	\$270,000	\$3,870	\$2,248	\$78,533	\$471,198
PC-5	6.0	29,040.0	38,720	791	15,820	\$542,079	\$395,500	\$18,000	\$10,454	\$193,207	\$1,159,240
PC-6	5.0	24,200.0	32,267	935	18,700	\$451,732	\$467,500	\$15,000	\$8,712	\$188,589	\$1,131,533
PC-7	3.5	16,940.0	22,587	640	12,800	\$316,213	\$320,000	\$10,500	\$6,098	\$130,562	\$783,373
PC-8	5.4	26,136.0	34,848	453	9,060	\$487,871	\$226,500	\$16,200	\$9,409	\$147,996	\$887,976
PC-9	4.22	20,424.8	27,233	505	10,100	\$381,262	\$252,500	\$12,660	\$7,353	\$130,755	\$784,530
PC-10	5.19	25,119.6	33,493	688	13,760	\$468,898	\$344,000	\$15,570	\$9,043	\$167,502	\$1,005,013
SPR-1 ²	44.5	215,380.0	0	0	0	\$0	\$0	\$133,500	\$77,537	\$42,207	\$253,244
SPR-2 ¹	5.7	27,588.0	36,784	0	0	\$514,975	\$0	\$17,100	\$9,932	\$108,401	\$650,408
SPR-3	4.0	19,360.0	25,813	427	8,540	\$361,386	\$213,500	\$12,000	\$6,970	\$118,771	\$712,626
SPR-4	3.8	18,392.0	24,523	728	14,560	\$343,316	\$364,000	\$11,400	\$6,621	\$145,068	\$870,405
SPR-5	4.5	21,780.0	29,040	530	10,600	\$406,559	\$265,000	\$13,500	\$7,841	\$138,580	\$831,480
SPR-6	1.7	8,228.0	10,971	339	6,780	\$153,589	\$169,500	\$5,100	\$2,962	\$66,230	\$397,381
SPR-7	8.5	41,140.0	54,853	1,188	23,760	\$767,945	\$594,000	\$25,500	\$14,810	\$280,451	\$1,682,706
SPR-8	1.5	7,260.0	9,680	275	5,500	\$135,520	\$137,500	\$4,500	\$2,614	\$56,027	\$336,160
SPR-9	0.9	4,356.0	5,808	217	4,340	\$81,312	\$108,500	\$2,700	\$1,568	\$38,816	\$232,896
SPR-10	1.7	8,228.0	10,971	346	6,920	\$153,589	\$173,000	\$5,100	\$2,962	\$66,930	\$401,581
SPR-11	0.9	4,356.0	5,808	193	3,860	\$81,312	\$96,500	\$2,700	\$1,568	\$36,416	\$218,496
SPR-12	1.4	6,776.0	9,035	297	5,940	\$126,485	\$148,500	\$4,200	\$2,439	\$56,325	\$337,949
SPR-13	1.0	4,840.0	6,453	237	4,740	\$90,346	\$118,500	\$3,000	\$1,742	\$42,718	\$256,307
Total	165.2	799,568.0	627,585	11,864	237,280	\$8,786,195	\$5,932,000	\$495,600	\$287,844	\$3,143,694	\$18,862,165

Assumptions

1. LMG-1, LMG-2, SPR-2 mitigation sites created by excavation only. No sheet pile.
2. PC-1 and SPR-1 mitigation sites created from previously excavated borrow pits. No sheet piles. Assume earthwork, seeding, and mulching included in borrow pit excavation cost
3. Volume of earthwork assumes 1 foot of topsoil stockpile and 2 feet of excavation
4. All sheet pile will be 20 feet tall
5. All excavated material will be hauled off to an off-site location at a cost of \$14/cubic yard
6. 20 percent of each mitigation area will be planted with trees spaced at one tree per thousand square feet
7. All mitigation areas receive the same seeding and planting treatments
8. Except as described in spreadsheet footnotes, mitigation areas will require excavation and use of sheet piles

Appendix H
Review of Designated Preble's Critical Habitat in the Pike National Forest

September 23, 2009

Memo

To: Peter Plage, U.S. Fish and Wildlife Service
Denny Bohon, U.S. Forest Service

From: Steve Dougherty, ERO Resources Corporation

CC: Mary Powell, ERO Resources Corporation
Rick McLoud, Centennial Water and Sanitation District

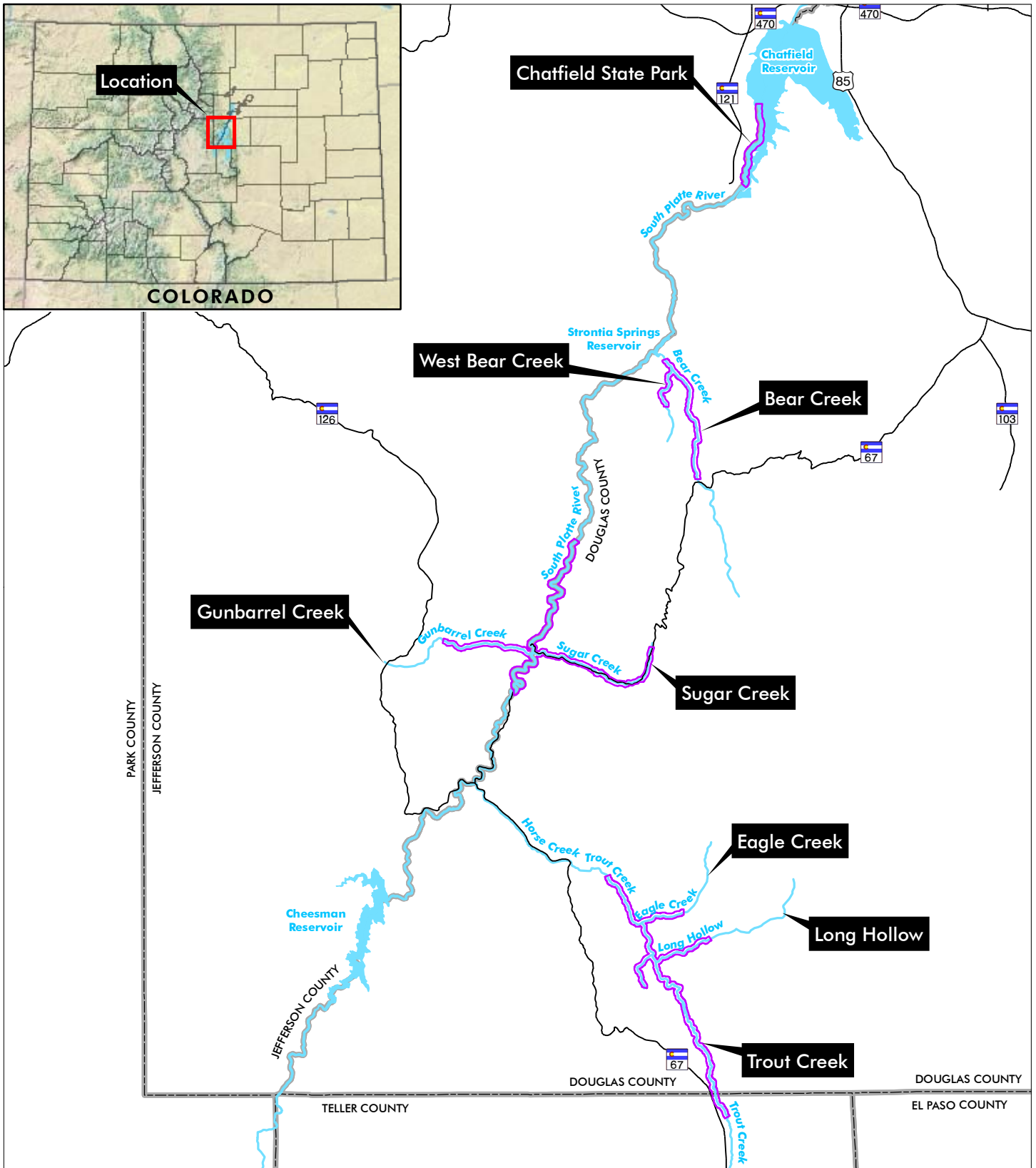
Re: Proposed Preble's Critical Habitat Mitigation on Pike National Forest Lands

This memo summarizes my review of designated Preble's critical habitat on the Pike National Forest (PNF). The review was prompted by the need to mitigate impacts to designated Preble's meadow jumping mouse (Preble's) critical habitat associated with the proposed reallocation of storage at Chatfield Reservoir. The proposed reallocation would inundate up to 86.5 acres and 1.3 stream miles of critical habitat along the South Platte River arm of Chatfield Reservoir.





The U.S. Fish and Wildlife Service has determined that the compensatory mitigation of impacts to designated Preble's critical habitat must occur within the same critical habitat unit (CHU); in this case, the South Platte CHU. All of the South Platte CHU occurs on federal lands and with the exception of the South Platte River within Chatfield State Park, all of the South Platte CHU occurs on drainages in the PNF.

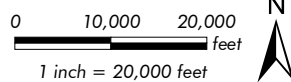
On-site mitigation within the designated critical habitat in Chatfield State Park will be maximized. However, there are not enough opportunities to accomplish all of the compensatory mitigation for impacts to critical habitat within Chatfield State Park. Therefore, much of the compensatory mitigation for impacts to Preble's critical habitat will need to occur within the South Platte CHU on the PNF (Figure H-1).

Substantial portions of all of the critical habitat reaches were reviewed in the field on August 24, 28, and 31, 2009, except for Eagle Creek, Long Hollow, and the unnamed tributary of Trout Creek. Based on a review of aerial photography and topographic maps, the habitat in these drainages is narrow, occurs in steep canyons and has poor access, similar to Bear Creek, West Bear Creek, and Gunbarrel Creek that were reviewed. These drainages were determined to provide little or no feasible opportunities for mitigation.



**Chatfield Reallocation Study - Upper South Platte River
Critical Habitat**

-  Preble's Critical Habitat
-  Stream
-  Major Road
-  County Boundary



**Figure H-1
Location Map**

File: 4048 - Figure H-1 loc map upspr ch.mxd (WH)
May 2012



Prior to review of the drainages, it was thought that the following activities could potentially be implemented for mitigation:

- Construct drop or water control structures to provide supportive hydrology to expand the riparian zone:
- Excavate elevated areas next to the riparian zone to the elevations of the riparian zone to expand critical habitats.
- Control and/or remove sediments from riparian areas contributed by roads, fires, and other disturbances.
- Remove or thin trees from the upland portions of critical habitat to encourage development of upland shrubs next to the riparian habitats.

Although there are more than 3,298 acres and 36.5 stream miles of critical habitat within the PNF, feasible opportunities for mitigation on PNF lands is very limited due to high quality existing habitat, steep topography, and poor access. Additionally, for the drainages most of the areas of actual Preble's habitat (riparian areas and areas of adjoining upland shrubs) comprise a minor portion of the designated critical habitat, because most of the designated critical habitat is Ponderosa pine-Douglas-fir forest. Much of the forest within the designated critical habitat occurs on dry slopes of decomposed granite. Therefore, there are limited opportunities for forest management activities to improve Preble's habitat.

Based on this review, it appears that Sugar Creek provides the most feasible opportunities for mitigation for impacts to designated critical habitat for Preble's. The proposed mitigation within the critical habitat reach of Sugar Creek would be in addition to any management activities by the USFS.

The following is a review of the eight drainages within the South Platte CHU on the PNF (Trout Creek, Long Hollow, Eagle Creek, Sugar Creek, Gunbarrel Creek, South Platte River, Bear Creek, and West Bear Creek).

TROUT CREEK

Trout Creek is a perennial tributary to Horse Creek, which is a tributary of the South Platte River. Trout Creek occurs on a mix of private and national forest lands. Reaches within the PNF typically support high quality riparian habitat. The upper reaches of critical habitat on Trout Creek extend to the upper elevation limits for Preble's in Teller County. Trout Creek above Rainbow Falls Park North to about Eagle Creek and the upper reach above Rainbow Falls Park South provide some of the most extensive and widest areas of Preble's habitat of any of the tributaries in the South Platte CHU.

Acres of Critical Habitat: 829

Stream Miles of Critical Habitat: 9.6

Access: Upper Trout Creek can be readily accessed by Highway 67 (H-67) and Forest Road 350 (FR350). Trout Creek above Rainbow Falls Park North (private property) can be accessed by a narrow unimproved trail between Rainbow Falls Park North and Eagle Creek.

Mitigation Opportunities: There are limited mitigation opportunities for compensatory mitigation on PNF lands on Trout Creek due to the high quality of the habitat. On the approximately 1.25-mile reach upstream of Rainbow Falls Park North, there are localized areas of erosion associated with past fires and the decomposed granitic soils. Minor drainages have deposited sediments that encroach into the riparian zone of Trout Creek. These sediments could be removed, allowing a gain in the riparian communities and Preble's habitat. Historically there has been some channel downcutting and erosion in the very upper reach of Trout Creek in Teller County. However, the steep eroded banks and point bars formed from the eroded banks are now well vegetated.

Mitigation Constraints: The greatest constraint to using Trout Creek for compensatory mitigation is the current high quality habitat. The one reach with some mitigation potential (above Rainbow Falls Park North) lacks suitable access to bring in equipment to remove sediment from the riparian zone. The steep west-facing slopes in this reach would also present challenges to securely storing the removed sediment and ensuring sediments would not be redeposited in the future.

Mitigation Proposal: No compensatory mitigation activities are proposed for Trout Creek due to the lack of feasible opportunities and access.



Photo H-1. Overview of upper Trout Creek.



Photo H-2. Trout Creek above Rainbow Falls Park North.



Photo H-3. Historically eroded and downcut streambanks on upper Trout Creek.

LONG HOLLOW AND UNNAMED TRIBUTARY

Long Hollow and the unnamed tributary are perennial tributaries to Trout Creek. They support narrow riparian corridors in steep, narrow canyons.

Acre of Critical Habitat: 153

Stream Miles of Critical Habitat: 1.8

Access: There are no maintained trails along Long Hollow or the unnamed tributary. There is an off-road vehicle trail into Long Hollow.

Mitigation Opportunities: Based on a review of aerial maps and topography (but not including an on-site review), the riparian corridors in Long Hollow and the unnamed tributary are narrow and steep, similar to Bear Creek, West Bear Creek, and Gunbarrel Creek. The narrow riparian corridors and steep canyon-like topography do not present suitable mitigation opportunities.

Mitigation Constraints: Limited access and topography limit the opportunities for mitigation.

Mitigation Proposal: No compensatory mitigation activities are proposed for Long Hollow or the unnamed tributary due to lack of opportunities and access.

EAGLE CREEK

Eagle Creek is a perennial tributary to Trout Creek. Similar to neighboring Long Hollow, it supports a narrow riparian corridor in a steep, narrow canyon.

Acre of Critical Habitat: 108

Stream Miles of Critical Habitat: 1.3

Access: There is an off-road motorized vehicle single-track trail from the Rampart Range Road that follows Eagle Creek.

Mitigation Opportunities: Based on a review of aerial maps and topography (but not including an on-site review), the riparian corridor in Long Hollow is narrow and steep, similar to Bear Creek, West Bear Creek, and Gunbarrel Creek. The narrow riparian corridor and steep canyon-like topography do not present suitable mitigation opportunities.

Mitigation Constraints: Limited access and topography limit the opportunities for mitigation.

Mitigation Proposal: No compensatory mitigation activities are proposed for Eagle Creek due to lack of opportunities and access.

SUGAR CREEK

Sugar Creek is a perennial tributary of the South Platte River. It occurs mostly on PNF lands, but there are scattered parcels of private property on Sugar Creek. Sugar Creek supports a riparian corridor that is constrained by the adjoining mountain slopes and Highway 67.

Acre of Critical Habitat: 381

Stream Miles of Critical Habitat: 4.5

Access: Highway 67 parallels most of Sugar Creek.

Mitigation Opportunities: Sediment from Highway 67 affects most of the critical habitat portions of Sugar Creek. Sediment from Highway 67 fills the channel and buries portions of the riparian zone, which degrades the quality and quantity of Preble's habitat. Historically, pullouts between Highway 67 and Sugar Creek destroyed vegetation and further exacerbated erosion. Most of these pullouts have been fenced off by the USFS. These situations present opportunities to improve and expand the riparian habitats along Sugar Creek.

Mitigation Constraints: Short reaches of Sugar Creek do not occur adjacent to Highway 67 and are narrow and canyon-like, which limit access and opportunities for improvements to stream and riparian habitats. The USFS and Douglas County are currently developing plans to minimize the sediment input into Sugar Creek. Mitigation activities need to be above and beyond activities that would be undertaken by others.

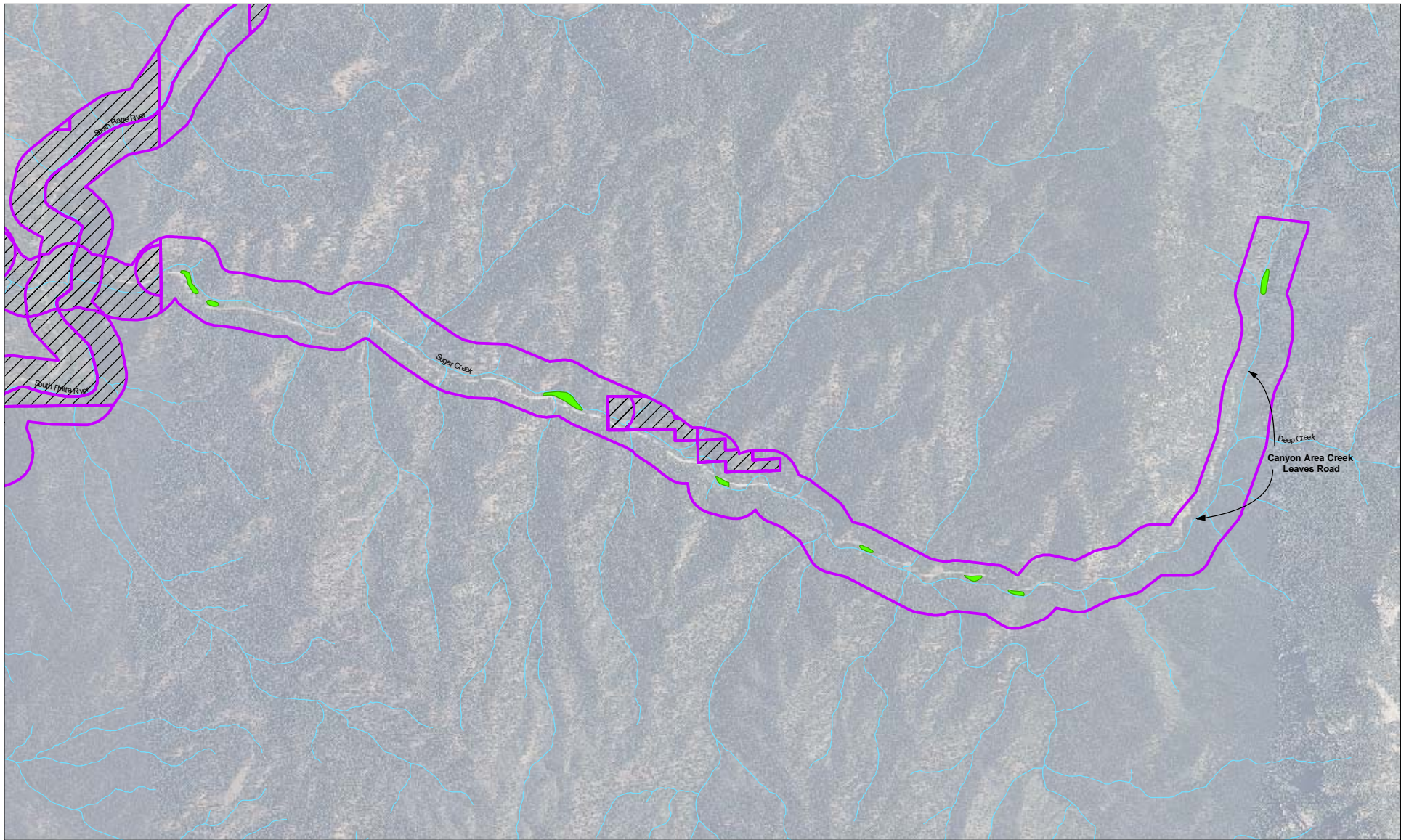
Mitigation Proposal: The stream and riparian habitats within the critical habitat reach of Sugar Creek would be improved by:

- Better defining the streamside road edge of Highway 67 to minimize the continued introduction of sediment into the riparian and aquatic habitats;
- Constructing sediment traps to control sediments before the sediment reaches the riparian zone and creek;
- Revising the drainage to maximize the control of stormwater runoff on the off-stream channel side of the Highway 67, including properly sized culverts and channels to route stormwater flows;
- Reshaping the tilt of the Highway 67 roadbed to drain away from Sugar Creek; and
- Where practicable, removing sediment that has spilled into riparian vegetation.

Additionally, several opportunities occur in the critical habitat reach to expand the riparian corridor. The riparian corridor can be expanded into the historical pullouts along Sugar Creek, as previously described. On the downstream end of each of the pullouts, a drop structure would be created. The drop structure would slow and spread surface and ground water upstream of the structure. As ground water levels rise and spread, a supportive hydrologic regime for an expanded riparian corridor will occur in the fenced-off pullout area. The expansion of woody riparian vegetation into the pullouts will be assisted by planting shrubs native to the Sugar Creek riparian corridor. Planting would occur once a supportive hydrologic regime was established.

The shallow pools that will form behind the drop structures will help capture sediments that are currently mobile within the Sugar Creek system. As these pools fill with sediment, they will be colonized by riparian vegetation, further expanding the riparian habitat.

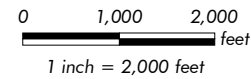
The compensatory mitigation proposal would need to be integrated with the plans and efforts of the USFS and Douglas County (Figure H-2). The Chatfield Water Providers would fund the work that occurs within the critical habitat reach. This could be done separately by the Chatfield Water Providers or as part of an integrated project with the USFS and Douglas County.



Chatfield Reallocation Study

- Preble's Proposed Critical Habitat
- Potential Mitigation Area
- Private Land
- ~ River or Stream

Image Source: USDA NAIP 2009



**Figure H-2
Potential Preble's Critical
Habitat Mitigation, Sugar
Creek, Pike National Forest**

File: 4048 Fig H-2 Pot CH Mit sugarcreek.mxd (WH)
May 2012





Photo H-4. A fenced-off pullout between Sugar Creek and Highway 67 into which riparian vegetation could be expanded.



Photo H-5. Highway 67 eroding into Sugar Creek riparian zone.

GUNBARREL CREEK

Gunbarrel Creek is a perennial tributary of the South Platte River. Most of Gunbarrel Creek supports a narrow high quality riparian corridor in a steep canyon-like topography.

Acres of Critical Habitat: 230

Stream Miles of Critical Habitat: 2.8

Access: There is no improved access to Gunbarrel Creek other than hiking the drainage. There is an old unmaintained mining road that comes to the Kelsey Creek confluence, a tributary of Gunbarrel Creek.

Mitigation Opportunities: Limited mitigation opportunities occur in a couple of short reaches that are less confined by topography where excavation and planting next to the riparian corridor could expand the riparian corridor.

Mitigation Constraints: Access is limited to foot or pack animal traffic. It would not be feasible to get earthmoving equipment to potential mitigation sites.

Mitigation Proposal: No compensatory mitigation activities are proposed for Gunbarrel Creek due to lack of feasible opportunities and access.



Photo H-6. Narrow steep canyon of Gunbarrel Creek above Kelsey Creek.



Photo H-7. Overview of the steep Gunbarrel Creek Canyon.



Photo H-8. Example of an area along Gunbarrel Creek that is poorly vegetated that could be excavated and planted to expand the riparian corridor.

SOUTH PLATTE RIVER

The critical habitat reaches of the South Platte River are centered in the Oxyoke area. The South Platte River supports the widest reaches of Preble's habitat within the designated critical habitat on the PNF. Although the riparian habitats along the South Platte River are wide, they are less diverse than the canyon-like riparian habitats in the tributaries designated as critical habitat.

Acres of Critical Habitat: 316

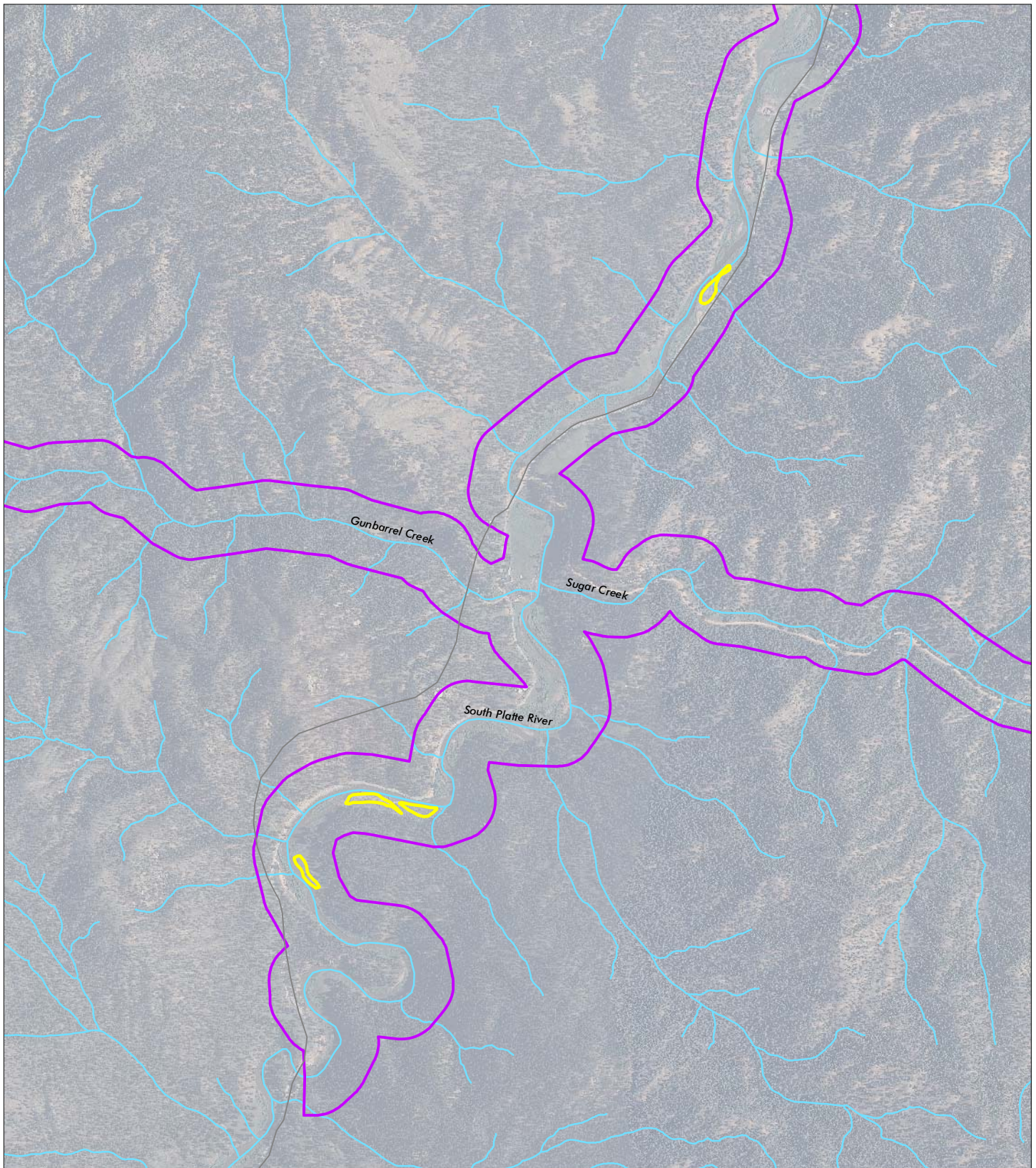
Stream Miles of Critical Habitat: 9.7

Access: Access to the South Platte River is good because Highway 67 parallels the river. However, it may be a challenge to get earthmoving equipment to the side of the river that is away from the road.

Mitigation Opportunities: There are a few areas where sediment has accumulated and is elevated to a degree that inhibits the growth of riparian vegetation, primarily coyote willow. These sediments could be excavated to the elevation of adjacent riparian vegetation and planted with coyote willow (plants or stakes).




Mitigation Constraints: Areas that could benefit from mitigation activities are limited and most occur on the side of the river away from the road; therefore, earthmoving equipment would need to cross the river. Excavated sediment would need to be hauled away, which could be challenging for sites not adjacent to Highway 67.

Mitigation Proposal: As access will allow, remove accumulated sediments from selected and approved areas (Figure H-3). The sediments will be excavated to the elevation of the adjacent riparian community. The excavated area will be planted with coyote willow stakes and/or containerized plants. The excavated sediment will be removed to an approved upland location where it cannot be reintroduced into the South Platte River.



Chatfield Reallocation Study

Imagery Source : USDA NAIP 2009

-  Excavate to near ground water and stake with coyote willow
-  Preble's Critical Habitat
-  River or Stream

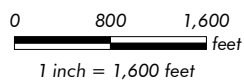


Figure H-3
Potential Habitat Improvements
Along the South Platte River

File: 4048 Figure H-3 PMJM Habitat.mxd (GS)
 May 2012





Photo H-9. Example of potential mitigation area along the South Platte River where sediments could be removed and the adjacent riparian community expanded.

BEAR CREEK

Bear Creek is a perennial tributary to Strontia Springs Reservoir in Waterton Canyon. Most of Bear Creek supports a narrow high quality riparian corridor in a steep narrow canyon.

Acres of Critical Habitat: 345

Stream Miles of Critical Habitat: 4

Access: Lower Bear Creek can be accessed by bike, foot, or horse via the Colorado Trail from the Kassler Trailhead at the mouth of Waterton Canyon. Lower Bear Creek could also potentially be accessed by boat on Strontia Springs Reservoir and then by foot. Upper Bear Creek can be accessed by foot, bike, or horse on Trail 800 from the Indian Creek Trailhead. Between these two access points, Bear Creek occurs in a steep canyon with no defined trail. It would not be feasible to readily access Bear Creek with heavy equipment.

Mitigation Opportunities: Mitigation opportunities on Bear Creek are limited by the high quality habitat, narrow riparian corridor, steep topography, and limited access. Some mitigation opportunities occur in upper Bear Creek where the growth and distribution of upland shrubs adjacent to the riparian corridor, particularly Gambel's oak, could potentially be improved by removing or thinning the overstory trees. These opportunities occur in scattered locations from the upper limit of critical habitat to where the steep canyon begins (about 1 mile downstream).

Mitigation Constraints: Limited opportunities, high quality existing habitat, steep terrain, and limited access greatly limit any mitigation activities on Bear Creek.

Mitigation Proposal: No compensatory mitigation activities are proposed for Bear Creek due to limited opportunities, high quality existing habitat, steep terrain, and limited access.



Photo H-10. Lower Bear Creek, steep canyon with narrow riparian corridor.



Photo H-11. Upper Bear Creek.



Photo H-12. Upper Bear Creek; start of canyon.



Photo H-13. Shrub understory adjacent to upper Bear Creek. Removing or thinning trees could increase shrub cover.

WEST BEAR CREEK

West Bear Creek is a perennial tributary of Bear Creek. West Bear Creek supports a narrow high quality riparian corridor in a steep, narrow canyon.

Acres of Critical Habitat: 110

Stream Miles of Critical Habitat: 1.4

Access: Lower West Bear Creek can be accessed by the Colorado Trail as described for Bear Creek. The upper portion of West Bear Creek can be accessed on foot, but there is no maintained trail.

Mitigation Opportunities: Mitigation opportunities on West Bear Creek are not available because of the high quality habitat, narrow riparian corridor, steep terrain, and limited access.

Mitigation Constraints: High quality existing habitat, narrow riparian corridor, steep terrain, and limited access greatly limit any feasible mitigation activities on West Bear Creek.

Mitigation Proposal: No compensatory mitigation activities are proposed for West Bear Creek due to high quality existing habitat, narrow riparian corridor, steep terrain, and limited access.



Photo H-14. West Bear Creek above the Colorado Trail.

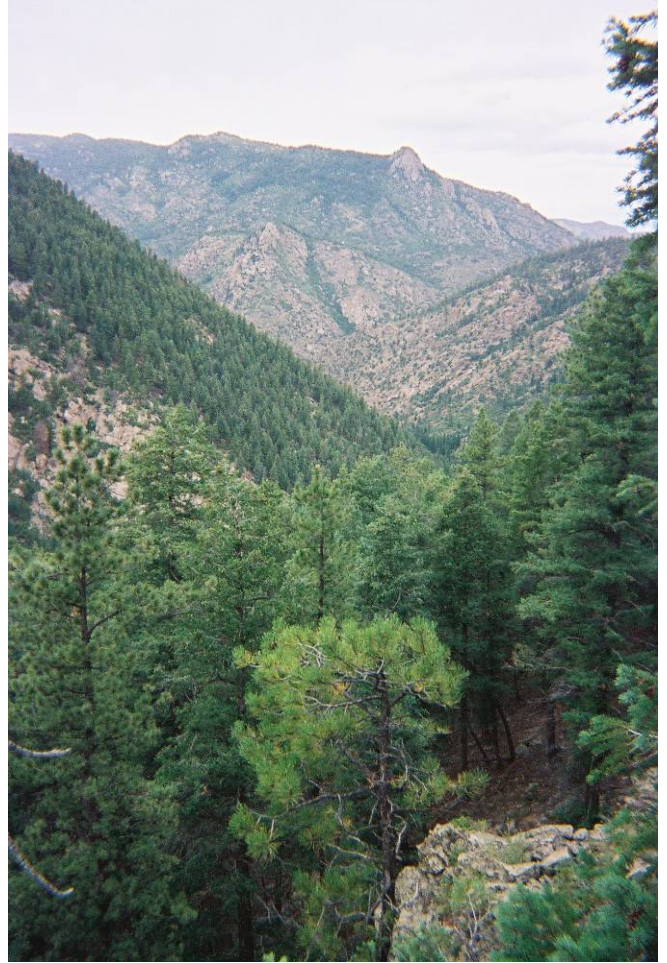


Photo H-15. Overview of West Bear Creek Canyon.

Appendix I
Ecological Functions Approach Model Review Report, Chatfield Reallocation Study

December 21, 2009
Ecological Functions Approach
Model Review Report
Chatfield Reallocation Study
Denver, Colorado



Prepared by:



U.S. Army Corps of Engineers
Omaha District

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Introduction

In section 808 of the Water Resources Development Act of 1986, Congress authorized the Secretary to conduct a reallocation study at Chatfield Reservoir (Chatfield), a Corps of Engineers (Corps) owned reservoir located in the Denver metro area, for joint flood control-conservation purposes, including storage for municipal and industrial water supply, agriculture, and recreation and fishery habitat protection and enhancement. The primary purpose of Chatfield, in conjunction with the Cherry Creek and Bear Creek reservoirs (i.e., Tri-Lakes), are to protect the Denver Metro area from catastrophic floods that devastated the area periodically.

The purpose of and need to reallocate a portion of the flood control pool to water supply 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. From a sustainability standpoint, the sponsor is specifically interested in opportunities to increase surface water supply without the development of significant amounts of new infrastructure in order to reduce their reliance on non-renewable non-tributary groundwater (NTGW). Chatfield has been identified as an important potential source of water storage due to its ideal location on the mainstem of the South Platte River.

The alternatives considered in detail in Chatfield Reallocation Study are:

1. Penley Reservoir (new construction) combined with Gravel Pit Storage
2. NTGW combined with Gravel Pit Storage
3. Reallocation to allow an additional 20,600 Acre-Feet of Water Supply Storage (12 ft increase in top of conservation pool, 587 acres inundated)
4. Reallocation to allow an additional 7,700 Acre-Feet of Water Supply Storage (5 ft increase top of conservation pool, 215 acres inundated)

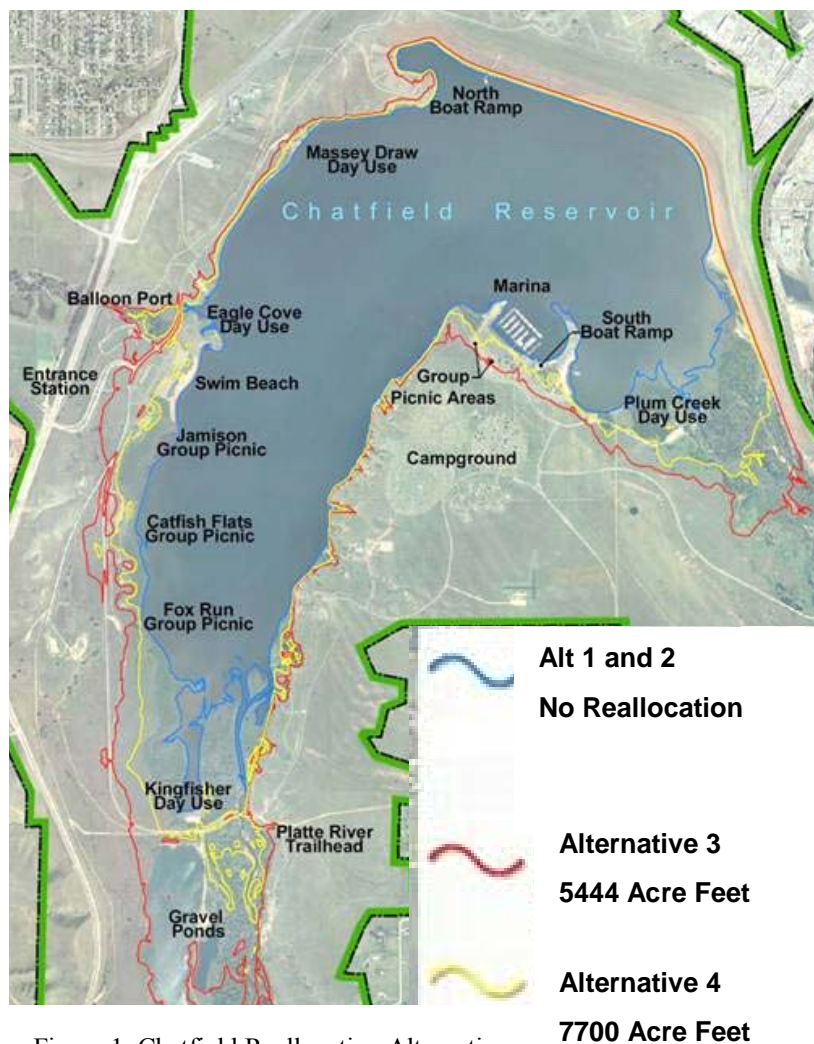


Figure 1. Chatfield Reallocation Alternatives

This additional inundation will impact significant amounts of riparian habitats on the Corps owned lands that surround the reservoir. If a reallocation is implemented, mitigation of these resources would be required.

Model Purpose

The riparian habitats at Chatfield Reservoir (Chatfield) provide shared ecological functions for the primary ecological resources identified during the Chatfield Reallocation Study Feasibility Report/EIS (FR/EIS) process: Preble's meadow jumping mouse (Preble's) habitat, overall wildlife habitat represented by a diverse avian community (birds), and wetlands. Implementing a reallocation alternative at Chatfield that would raise the pool elevation would undoubtedly impact these resources. Such impacts are required to be evaluated, and should a reallocation take place, these impacts would need to be offset through a variety of mitigation measures on Corps owned Chatfield lands and at offsite locations within the local watershed.

As it is very important to ensure that mitigation for the impacts to the above mentioned significant resources is met, it is important to have a method to measure the value of those resources, and the replacement value of sites utilized for mitigation. Several existing models that evaluate habitat functions, such as the Hydrogeomorphic Classification (Brinson 1993), Habitat Equivalency Analysis (NOAA 2000) Habitat Evaluation Procedures and Habitat Suitability Indices (U.S. Fish and Wildlife Service 1980) were evaluated for potential use on this project. Other than incorporating the use of the existing Functional Assessment of Colorado Wetlands (FACWet) Method, (Johnson 2008), no existing models were found to be capable of accurately representing the site-specific characteristics for the Preble's and bird resources being addressed at Chatfield. However, relevant concepts from evaluated models were combined and adapted to develop a site-specific model for Preble's and birds.

By incorporating together the FACWet method, and two site specific models representing Preble's and birds, the Ecological Functions Approach (EFA) provides a process for evaluating baseline conditions, evaluating impacts of raising the pool at Chatfield Reservoir, and identifying mitigation that incorporates the complementary habitat requirements of the target significant ecological resources. The EFA allows a standard unit for evaluating impacts to the three diverse and overlapping target resources that can be used in the Corps' Cost Effectiveness/Incremental Cost Analysis (CE/ICA) for evaluating mitigation alternatives. The EFA will also provide a method of measuring debits and credits throughout the implementation of a mitigation plan, ensuring that ecological resources lost through the implementation of a reallocation action are fully replaced through time.

Model Assessment

The Corps' Planning Models Improvement Program (PMIP) was established in 2003 to assess the state of Corps planning models and to assure that high quality methods and tools are available so that informed decisions on investments in the Nation's water resources infrastructure and natural environment can be made. The main objective of the PMIP is to carry out "a process to review, improve and validate analytical tools and models for Corps Civil Works business programs" (Engineering Circular 1105-2-407, May 2005).

The objective of this model review was to conduct a review of the technical and system quality of the Chatfield modeling developed specifically for the Chatfield Reallocation study. Per the August 2008 Policy Guidance on Certification of Ecosystem Output Models, recommendations 14 and 15 address strategies for the Planning Center of Expertise (PCX) to more effectively execute and prioritize ecosystem output model assessments and certifications. A major implication of the policy changes enacted in that memo is that many ecosystem output models that are site specific can be assessed and documented through the agency technical review (ATR) process rather than through a separate model certification process. The Chatfield Reallocation Study effort fits in this mold, and thus NWO has used its ATR as appropriate. Through this process, NWO is using due diligence to ensure the review is properly scoped, while ensuring quality modeling and coordination with PCX and Headquarters regarding approval of modeling efforts.

With specific regard to the three main resources being evaluated in this model (wetlands, birds, and Preble's), the Preble's mouse is a Federally threatened species. Because specialized knowledge of this species is unavailable within the Corps, the Corps' National Ecosystem Planning Center of Expertise (ECO-PCX) requested that the modeling associated with this species' habitat be evaluated by an independent Preble's expert. The other two resource models (wetlands and riparian) were evaluated by an experienced Corps environmental ATR team member to complete the "approval" (not certification) process. In addition, the Corps ATR member will review the model from an application standpoint to determine appropriate application of the model in the Corps planning process. Review of correct application will ensure that weighting of model variables is carried out in a reasonable fashion, and that the combination of the models to provide one single value of "Ecological Functional Units" is also reasonable.

In terms of theory, the models have been reviewed to ensure they are 1) be based on validated and accepted contemporary theory; 2) properly incorporate this contemporary theory into the spreadsheet computations; and, 3) clearly define the assumptions inherent in the model. Regarding computational correctness, the models have been reviewed to ensure they 1) employ proper functions and mathematics to estimate functions and processes represented; and 2) properly estimate and forecast the actual parameters it is intended to estimate and forecast. Other criteria for model review are efficiency, effectiveness, usability and clarity in presentation of results, and the ability of the model to represent or simulate the processes and/or functions it is intended to represent.

Contribution to Planning Effort

The modeling that has been completed for the Chatfield Reallocation project is only planned to be utilized for this project alone. There are no plans to apply this model on a regional or national basis. The models are meant only to provide an Ecological Functional Index (EFI) for each target resource, allowing Ecological Functional Units (EFUs) to be quantified within the impacted areas, and at the potential on and off-site mitigation sites.

Model Description

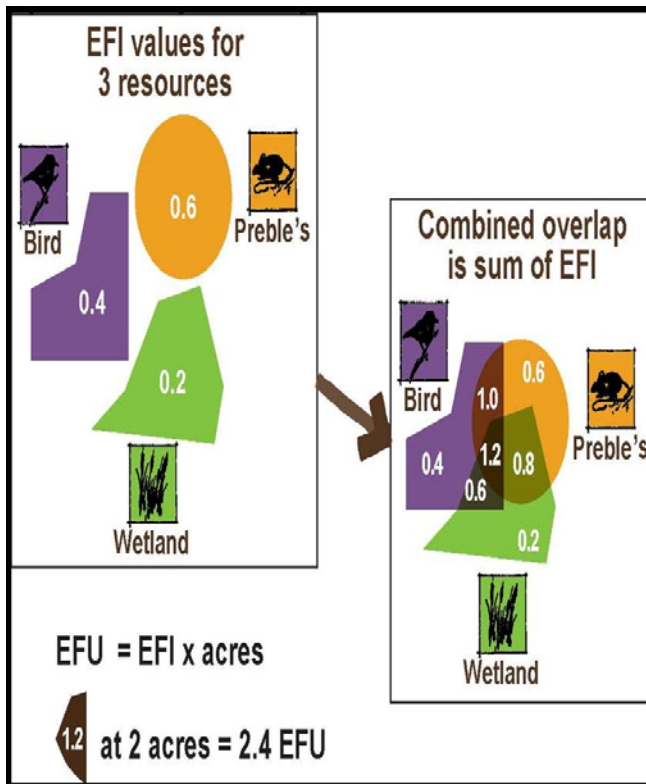
Model Applicability

As mentioned above, the modeling is specific to the Chatfield Reallocation Study, and is not planned to be utilized on a national or regional basis. The model will only be applied to the Chatfield Reallocation planning effort, as well as to the implementation effort if a reallocation alternative be implemented.

Model Summary

The EFA modeling provides a process for evaluating baseline conditions, evaluating impacts of raising the pool at Chatfield Reservoir, and identifying mitigation that incorporates the complementary habitat requirements of the target significant ecological resources— Preble’s, birds, and wetlands. Very little site-specific data exists on the relationships and interaction between the habitats available at Chatfield and the wildlife communities that use those habitats. Thus, it is necessary to rely on the scientific and technical literature and the professional opinions of local experts to evaluate the terrestrial ecological functions impacted by a reallocation. As part of the EFA, there are three models that have been developed or utilized to address the three primary ecological resources identified during the FR/EIS. The three modeling efforts focus on:

1. Creating a model representative of Preble’s habitat;
2. Creating a model representative of riparian wildlife habitat as represented by a diverse avian community
3. Utilization of the Functional Assessment of Colorado Wetlands Method (FACWet, Johnson et al. 2008) to assess Wetlands habitat.



The models should be viewed as hypotheses of species-habitat and habitat-function relationships rather than statements of proven cause and effect relationships. The value of the models being utilized will serve as a foundation for improved mitigation decision making on the basis of habitat function.

As in a Habitat Suitability Index (HSI), the numerical index of functional values is on a 0.0 to 1.0 scale in the EFA, based on the assumption that there is a positive relationship between the index and habitat function. With regard to habitat variables used in the EFA, the focus of habitat variables related to the riparian bird habitat and the mouse revolve around support to life requisites. Current scientific literature and expert knowledge has been utilized to establish the values for the riparian bird and

Preble's habitat model parameters. The FACWet Method focuses on the broad variables of fish and wildlife habitat as well as flood control, groundwater recharge/discharge, and nutrient retention. The models provide an Ecological Functional Index (EFI) for each target resource, allowing Ecological Functional Units (EFUs) to be quantified within the impacted areas, and at the potential on and off-site mitigation sites. In essence, the model provides a unit of measurement for each resource that can be used in determining "debits" and "credits" in feasibility level planning, as well as provides a tool to measure planned outputs during implementation and adaptive management. The EFUs will also be combined with cost data in order to provide a measure of mitigation alternative effectiveness in terms of cost per units gained.

Model Components

Defining habitat variables pertaining to birds and Preble's focused on identifying how the variables provide support to life requisites such as breeding, over-wintering and migration, forage, and cover. Wetlands were evaluated using the Functional Assessment of Colorado Wetlands Method (FACWet) (Johnson et al. 2008). The U.S. Army Corp of Engineers (Corps) Denver Regulatory Office was involved in developing FACWet and recommended its use in assessing wetland functional impacts and mitigation for the Chatfield Reallocation project. Detailed definitions of the ecological functions for birds and Preble's were discussed and defined in the committee and are briefly described below.

Preble's Mouse

EFVs were assigned to each Preble's habitat variable by consensus of the committee based on habitat affinities described in the literature, the Preble's Draft Recovery Plan, and the final designation of critical habitat (68 FR 37276, 2003). The general criteria used in assigning Preble's values include:

- General quality of the habitat unit (e.g., general cover including multi-strata vegetation and plant diversity (Trainor et al. 2007) as an indicator of cover value;
- Importance of habitat to provide general cover and forage including thick understory vegetation and downed woody debris as an indication of forage and breeding value;
- Juxtaposition of riparian habitat to uplands (e.g., adjacent or isolated) and active stream channel (e.g., river, stream, or pond in terms of relative ability to maintain or create new habitat) as an indicator of foraging value;
- Preble's presence as indicator of breeding/foraging value;
- Vegetation structure and habitat unit juxtaposition (location of suitable vegetation structure outside of typical high flood zone) as an indicator of hibernation potential.

Birds

Biologists created a habitat map for the FR/EIS of six bird habitats that would be within the maximum inundation area. The bird habitats that were mapped included wetlands, woodlands (including mature cottonwood forest), shrublands, open water, shorelines, and upland habitats. This area of inundation represents the FR/EIS ecological study area (Study Area). Biologists used high-resolution aerial photography to map habitats in the field. The field maps were digitized into a GIS where they could be further summarized and impacts by alternative analyzed.

The bird habitats described above provide the ecological functions necessary to support breeding, wintering, and migrating avian communities. The committee determined that, for the purposes of this study, the assessment of bird ecological functions would focus on four specific attributes of avian habitats within the South Platte River/Plum Creek watershed:

- Supports diverse bird species (species richness)
- Supports large numbers of birds (abundance)
- Provides seasonal habitats for sensitive species
- Provides habitats that are limited or rare on a local or regional scale

The ecological functional values (EFVs) of these attributes at Chatfield were determined from several data sources, including point counts conducted by TetraTech as part of the FR/EIS baseline inventory, surveys and bird counts conducted by the Audubon Society of Greater Denver, the Colorado Breeding Bird Atlas (Kingery 1998), and the National Audubon Society Christmas Bird Count (CBC) data summarized by USGS (<http://www.mbr-pwrc.usgs.gov/cbc/cbcnew.html>).

Wetlands

Biologists assessed functions provided by the wetlands using the FACWet method (Johnson et al. 2008). FACWet is a Colorado-specific, qualitative rapid assessment method that relies on professional judgment to assess the functional conditions of wetlands and riparian areas. The method was developed as a collaborative effort involving Colorado Department of Transportation, Colorado State University, EcoMetrics, LLC, the NWO Denver Area Regulatory Office (DRO), and the U.S. Environmental Protection Agency. Use of FACWet is currently required by the DRO for all proposed projects where 404 regulatory permits are needed so that DRO may use it as a tool to assist in determining wetland functions potentially impacted, assess the ability of mitigation plans to replace impacted functions, and to assess the success of mitigation wetlands (. The method focuses on determining the degree of departure between existing conditions and natural or reference-standard conditions. The method attributes differences between existing and reference-standard conditions to “stressors” or deleterious, anthropogenic alterations to key physical and vegetational attributes or “state variables” (Johnson et al. 2008). Wetlands are assessed by evaluating and scoring the condition of nine state variables in three categories. The categories and their state variables are:

- Buffer and Landscape Context
 - Habitat connectivity – neighboring wetland habitat loss
 - Habitat connectivity – migration/dispersal barriers
 - Buffer capacity
- Hydrology
 - Water source
 - Water distribution
 - Water outflow
- Abiotic and biotic habitat
 - Chemical environment
 - Geomorphology
 - Vegetation structure and complexity

The method scores the state variables by estimating the extent and severity of stressors that may be impairing wetland functions. Once the state variables are evaluated and scored, an algorithm then relates the scores to functions they influence. The functions assessed by FACWet are:

- Wildlife habitat
- Fish/aquatic habitat
- Flood attenuation
- Short- and long-term water storage
- Nutrient/toxicant removal
- Sediment retention/shoreline stabilization
- Production export/food chain support

Model Review

The Corps requires that planning models be reviewed and certified; however, as mentioned above, many ecosystem output models that are site specific can be assessed and documented through the agency technical review (ATR) process rather than through a separate model certification process. Such is the case with Chatfield. With specific regard to the three main resources being modeled (wetlands, riparian birds, and Preble's), a highly experienced Corps Planning Biologist, and member of the ATR team was asked to provide a review of the wetlands and riparian bird habitat models. With regard to the Preble's modeling, specialized knowledge of this species and its habitat needs was unavailable within the Corps. Because of the lack of availability, and because the mouse is a Federally threatened species, the ECO-PCX requested that the modeling associated with this species' habitat be evaluated by an independent Preble's expert.

As a 501(c)(3) nonprofit science and technology organization with experience in establishing and administering external peer review panels for the Corps, Battelle was engaged to conduct the review for the Preble's modeling. To accomplish the Preble's model review, a peer reviewer was contracted by Battelle based on background, years of experience, and lack of any conflict of interest. A short biography of each expert's experience is provided in Attachment B. The reviewers were provided with the following documents:

- Draft Chatfield Ecological Functions Approach (EFA) (Terrestrial)
- Model Certification Crosswalk. Crosswalk between EC 1105-2-407 model certification requirements and information contained in this report
- Planning Models Improvement Program: Model Certification (EC 1105-2-407, May 2005)
- Protocols for Certification of Planning Models (July 2007)

The peer reviewers were asked to review the models using charge questions provided along with the review documents (Table 1). The charge questions and guidelines are based on the model certification criteria discussed in the Corps PMIP Protocols for Certification of Planning Models (July 2007). The intent of these questions was not to create a set of questions to be directly answered through the review process, but to focus the review on the assessment criteria that are critical in the evaluation of planning models.

Table 1. Model Assessment Criteria Charge Questions
General
<ul style="list-style-type: none"> ▪ Are the project needs/objectives clearly identified? ▪ Are the models described meeting those needs/objectives?
Technical Quality
<ul style="list-style-type: none"> ▪ Are the models based on well-established contemporary theory? ▪ Are the models realistic representations of the actual systems? ▪ Are the analytical requirements of the models properly identified? ▪ Do the models address and properly incorporate the analytical requirements? ▪ Are the assumptions clearly identified, valid, and do they support the analytical requirements? ▪ Are Corps policies and procedures related to the model clearly identified? ▪ Do the models properly incorporate Corps policies and accepted procedures? ▪ Are the formulas used in the models correct and are the model computations appropriate and done correctly?
System Quality
<ul style="list-style-type: none"> ▪ Is the supporting software tool (e.g. Microsoft Excel) appropriate, and does it appear that the tool was used correctly.
Usability
<ul style="list-style-type: none"> ▪ Comment on how useful the information in the results is for supporting project objectives. ▪ Are the models transparent and do they allow for easy verification of calculations and outputs?
Document-Specific
<ul style="list-style-type: none"> ▪ Defining habitat variables pertaining to birds and Preble’s focused on identifying how the variables provide support to life requisites such as breeding, over-wintering and migration, forage, and cover. Comment on the suitability of this basis for assessing ecosystem impacts and benefits for these ecosystems. <ul style="list-style-type: none"> ▪ FACWet is a rapid assessment methodology that has formalized an approach to obtain reliable and consistent professional judgment with regard to functional condition of wetlands. Comment on the suitability of this model as the basis for assessing wetland functional impacts and mitigation for the Chatfield Reallocation project. ▪ Comment on the steps used to develop the models. Were the steps described clearly and in sufficient detail to understand what was done? ▪ Does the approach used in each model sufficiently represent the necessary characters of each ecosystem component for purposes of identifying impacts and benefits of the alternatives? Are they sufficient to respond to significant changes to the local ecological landscape? <ul style="list-style-type: none"> ▪ Does the report sufficiently explain the models and the science behind their development? ▪ Is it clear how change in the variables affect the model results? ▪ Is the rationale for including each of the variables clearly described and scientifically sound? ▪ Does the report explain how model output (ecological functional units) is interpreted?

Following the individual reviews, teleconferences were held between NWO and the reviewers (and Battelle in the case of the Preble’s review). These were conducted to discuss key technical comments and address any conflicting comments and/or address further questions of the reviewers prior to finalizing comments. Upon review of the initial comments, the modelers responded to comments, and provided a response back to the reviewers. Conference calls were then convened by NWO to ensure total understanding between the reviewers and modelers regarding the comments, and how comments would be resolved.

Review Criteria and Results

The main criteria for technical quality, system quality, and usability that were reviewed and the results of the reviews under each criterion are discussed in the following sections.

General Assessment

In total, 15 comments were received in the review of the wetlands and bird modeling, which were resolved on a point by point basis. For the Preble's modeling, 25 general comments and 22 comments directly relating to the review charge were received. Based on discussion of the comments between the modelers and the reviewer, the Preble's comments were boiled down into three overarching summary comments to capture the most important points of the review, as well as the detailed resolution of those points. The specific results and conclusions of the review are discussed below, and the comments and responses are provided in Attachment C. Both model reviewers have found that the proposed response to comments were acceptable and reflective of all the comment resolution discussions. The outlined actions provided in the comment response documentation were determined to be sufficient to resolve all issues that arose.

Technical Quality Assessment

Technical soundness reflects the ability of the model to simulate the processes and/or functions it is intended to represent. The performance metrics for this criterion are related to theory and computational correctness. In terms of theory, the models should: 1) be based on validated and accepted contemporary theory; 2) properly incorporate this contemporary theory into the spreadsheet computations; and, 3) clearly define the assumptions inherent in the model. Regarding computational correctness, the models should: 1) employ proper functions and mathematics to estimate functions and processes represented; and 2) properly estimate and forecast the actual parameters it is intended to estimate and forecast. Other criteria for certification are efficiency, effectiveness, usability and clarity in presentation of results.

Results

Overall, the reviewers comments reflected that that the modeling for the three key resources, as well as the application of EFA appeared to be technically sound and capable of supporting the analytical requirements needed to comply with Corps policies and procedures. The EFA is sufficient for picking up on changes to the local landscape, and comparing effects of alternatives being evaluated in the FS/EIS. Not only is the EFA sufficient to identify impacts of the various alternatives, but the process provides an objective and non-biased method to evaluate impacts and mitigation, which is essential for the FS/EIS process.

The need for model development vs. the use of other available models was confirmed in the review as well. While it was established that the existing model FACWet method would be sufficient, the review reaffirmed the need to develop site specific Preble's and riparian bird models. Other similar existing models (e.g. Hydrogeomorphic Classification (Brinson 1993), Habitat Equivalency Analysis (NOAA 2000) Habitat Evaluation Procedures and Habitat Suitability Indices (U.S. Fish and Wildlife Service 1980)) were either lacking in specificity to address the target resources appropriately, or data availability was a problem.

Document organization was a concern by the reviewers. It was felt that a reorganization of the information contained in the report would help to more clearly describe the model development process and more sufficiently affirm the science behind the modeling. While the necessary information was by and large contained in the report, it was scattered throughout. For example, information regarding assumptions behind the models was not clearly stated in a single location, and the data documentation, while in the document, was unconsolidated. Various sections

throughout the document have been re-organized to provide a more concise and consolidated discussion.

With specific regard to the Preble's model representing the actual system, there was one comment specific to the variable of hibernation habitat. The concern was that the variable representing hibernation potential might be under represented if special conditions existed (i.e. uplands typically unused for hibernation become important for this purpose when spring flood conditions exist along narrow corridors that force Preble's to use higher ground). However, this issue was resolved through discussion and further explanation of the on-site conditions. With resolution of this comment, the reviewer felt that the model was explained adequately, and the variables used in the modeling, while coarse, were scientifically sound.

One other issue of concern regarding Preble's habitat was that the model does not incorporate the idea of connectivity. Because connectivity is considered as a primary constituent element for Preble's habitat, this concern is very reasonable. While habitat connectivity is a major focus of Preble's overall recovery, the EFA primarily addresses ecological functions, measured as EFUs, at a parcel-specific scale. Broader regional scale functions, including connectivity, will be evaluated and addressed as weighting factors in implementation of the Compensatory Mitigation Plan (CMP). For example, in addition to the EFUs contained within a mitigation parcel, the parcel will contain attributes (or services) such as connectivity, proximity, and buffer values that contribute to ecological functions at regional and ecosystem scales. These attributes will be reviewed as an aspect of model application during ATR review of the mitigation plan. However, due to the importance of these variables, they have been clearly recognized in the model documentation report to ensure the reader understands that they were not overlooked, and will be accounted for in the planning of mitigation.

System Quality and Usability

System quality refers to the quality of the entire system used to develop, use, and support the models, including the software and hardware platform. System quality would normally be assessed by testing the hardware and software components, design verification planning for customer acceptance, third party interoperability, compatibility with various hardware and operating systems. Usability refers to how easily model users can access and run the models, interpret the model output, and use the model output to support planning decisions. Because the model will be in spreadsheet form and is designed only for this project, it was not proposed as part of the plan to evaluate system quality or usability criteria in great detail. However, the reviewers were asked to review the spreadsheet for ease of use and transparency so as to enable others local to NWO as well as other districts to use and modify the models if necessary.

Results

Microsoft Excel can provide satisfactory results when being used as the platform for the model computations. It was cautioned in the review that when using Excel for statistical analyses, one should ensure sure that the formulas are checked (variance, standard deviation, small sample size, etc) and rechecked, as the various spreadsheet packages can have some differences in how those computations are done.

A comment was received that the data documentation process was poor, with very little information having been provided in the original document. In response, the model development section was expanded to clearly describe the model selection, data inputs, and desired outputs. Most of the information requested with regard to data documentation has been compiled from various sections throughout the document and re-organized into a concise summary presented up-front in the model development section of the model documentation report.

It was commented that this model is relatively easy to understand, and the calculations and outputs are straightforward. The models should allow for easy verification of calculations and resulting output.

Model Testing

The development of the modeling at Chatfield is limited in scope, and is only planned for use at Chatfield. As such, the development of the modeling associated with the Chatfield Ecological Functions Approach has focused on creation of its basic structure and overall approach, and not on extensive testing, nor is extensive testing anticipated. The wetland modeling component (FACWet) was independently developed outside of this effort, with validation to occur with use through time. The modeling associated with Preble's and bird habitat will not require further testing except as adaptive management may require through project implementation, where the model will be utilized for evaluating mitigation sites in more detail. Based on this, the peer reviewers were not tasked with testing the EFA. While it is emphasized that the modeling approach at Chatfield is not intended to be an exact representation of reality, it is important to ensure that any model performs at an acceptable level of accuracy and precision. Upon review of the mitigation plan for the Chatfield FR/EIS, the ATR reviewer will review the "real world" model results with an eye to the reasonableness of the accuracy and precision.

Conclusions

Overall, the concept and application of the models are sound for planning efforts. Models are simple representations of complex systems and, as such, must balance complexity and reality with simplicity and usability. For the EFA modeling, it appears that the models are transparent enough to allow for both the ability of verifying calculations and results, as well as to allow for a basic understanding of the science behind the models. All comments have been resolved to the satisfaction of the reviewers, and the models are considered suitable for the purposes for which they were intended. The models will do a good job in characterizing and representing the ecosystems of interest for projecting and mitigating changes that will result from any reallocation that may take place at Chatfield Reservoir. Making the connection between habitat variables and life requisites is a sound approach to identifying impacts and mitigation. The Preble's commenter went so far to say that if he was required to come up with an independent assessment for the Chatfield project, he would come up with a similar system. The EFA is capable of producing output that is scientifically defensible, easily explained, and easily repeated by a different team of experts.

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Attachment A: Model Approval Review Plan

Model Approval Review Plan Chatfield Reallocation Study Denver, Colorado

Purpose

Development of high quality, objective, defensible, and consistent planning products requires the use of tested and defensible models. The U.S. Army Corps of Engineers now require that environmental planning models must be coordinated for certification through the Ecosystem Restoration Planning Center of Expertise (ECO-PCX). The purpose of this model approval review is to evaluate the technical quality, system quality and usability of the ecosystem output models that are planned to be used by the Omaha District (NWO) in the Chatfield Reservoir (Chatfield) Reallocation study. It is anticipated that the approval process will take approximately one month once the model is completed. Thus, timely completion of this review is contingent upon timely receipt of the materials specified.

Background

Congress authorized USACE to conduct a reallocation study for Chatfield for joint flood control-conservation purposes, including storage for municipal and industrial water supply, agriculture, and recreation and fishery habitat protection and enhancement. Section 808 of the Water Resources Development Act of 1986 and the River and Harbor Act of 1958 (Title III, Water Supply Act of 1958, as amended) authorized this study. The primary purpose of Chatfield, in conjunction with the Cherry Creek and Bear Creek reservoirs (i.e., Tri-Lakes), are to protect the Denver Metro area from catastrophic floods that devastated the area periodically.

The purpose of and need to reallocate a portion of the flood control pool to water supply 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. From a sustainability standpoint, the sponsor is specifically interested in opportunities to increase surface water supply without the development of significant amounts of new infrastructure in order to reduce their reliance on non-renewable non-tributary groundwater (NTGW). Chatfield has been identified as an important potential source of water storage due to its ideal location on the mainstem of the South Platte River.

The alternatives considered in detail in Chatfield Reallocation Study are:

1. Penley Reservoir (new construction) combined with Gravel Pit Storage
2. NTGW combined with Gravel Pit Storage
3. Reallocation to allow an additional 20,600 Acre-Feet of Water Supply Storage (12 ft increase in top of conservation pool, additional 587 acres inundated)
4. Reallocation to allow an additional 7,700 Acre-Feet of Water Supply Storage (5 ft increase in top of conservation pool, additional 215 acres inundated)

Impacted Ecological Resources

The terrestrial habitat at Chatfield provides shared ecological functions for the three primary ecological resources identified during the Chatfield Reallocation Feasibility Study/EIS process: Preble's meadow jumping mouse (Preble's) and its designated critical habitat, overall wildlife habitat represented by a diverse avian community, and wetlands. Implementing a reallocation alternative, particularly Alternative 3, would impact these resources. Such impacts would need to

be offset through a variety of measures including site specific or project-by-project mitigation activities. It is very important to ensure that mitigation for these significant resources is met upon implementation of a reallocation at Chatfield.

Scope of Model Review

The scope of this review is solely to address the technical and system quality of the models developed specifically for the Chatfield Reallocation study. Per the August 2008 Policy Guidance on Certification of Ecosystem Output Models, recommendations 14 and 15 address strategies for the PCX to more effectively execute and prioritize ecosystem output model assessments and certifications. A major implication of the policy changes enacted in that memo is that many ecosystem output models that are site specific can be assessed and documented through technical review rather than through a separate model certification process.

The Chatfield Reallocation Study effort fits in this mold, and thus we plan to use the ATR to complete the “approval” (not certification) process. This will provide assurance that the planning models used in the Chatfield Reallocation mitigation planning are theoretically sound, compliant with Corps policy, computationally accurate, and based on reasonable assumptions without necessarily being officially “certified”. Through this process, NWO is using due diligence in ensuring quality modeling and coordinated with PCX and HQ regarding approval of modeling efforts.

Models to be Reviewed - Very little site-specific data exists on the relationships and interaction between the habitats available at Chatfield and the wildlife communities that use those habitats. Thus, we must rely on the scientific and technical literature and the professional opinions of local experts to evaluate the terrestrial ecological functions impacted by reallocation. There are three models being developed or used to address the three primary ecological resources identified during the FR/EIS. The three modeling efforts focus on:

Creating a model representative of Preble’s meadow jumping mouse (Preble’s) habitat;

Creating a model representative of riparian wildlife habitat as represented by a diverse avian community

Utilization of the Functional Assessment of Colorado Wetlands Method (FACWet) to assess Wetlands habitat.

The models should be viewed as hypotheses of species-habitat and habitat-function relationships rather than statements of proven cause and effect relationships. The value of the models being utilized will serve as a foundation for improved mitigation decision making on the basis of actual habitat function.

As in a Habitat Suitability Index (HSI), this numerical index of functional values is on a 0.0 to 1.0 scale, based on the assumption that there is a positive relationship between the index and habitat function. With regard to habitat variables used in this Ecological Function approach, the focus of habitat variables related to the riparian bird habitat and the mouse revolve around support to life requisites. Current scientific literature and expert knowledge is being utilized to establish the values for the riparian bird and Preble’s habitat model parameters. The FACWet Method focuses on the broad variables of fish and wildlife habitat as well as flood control, groundwater recharge/discharge, and nutrient retention.

Certification Team Composition

The Model Review team will consist of a highly experienced Corps of Engineers Planning Biologist (Glen Covington) to review the the wetlands and riparian bird habitat models. Another expert external to the Corps of Engineers will be utilized to review and provide comment to the Corps Planning Biologist regarding the model that represents Preble's habitat. This added level of expertise is necessary, as Preble's is a very localized species for which local expert input is needed, as well as the mouse being one of the primary concerns due to it's listed status.

Model Review Focus and Charge

In terms of theory, the models should: 1) be based on validated and accepted contemporary theory; 2) properly incorporate this contemporary theory into the spreadsheet computations; and, 3) clearly define the assumptions inherent in the model. Regarding computational correctness, the models should: 1) employ proper functions and mathematics to estimate functions and processes represented; and 2) properly estimate and forecast the actual parameters it is intended to estimate and forecast. Other criteria for certification are efficiency, effectiveness, usability and clarity in presentation of results. Technical soundness reflects the ability of the model to represent or simulate the processes and/or functions it is intended to represent. The performance metrics for this criterion are related to theory and computational correctness.

Regarding model application, the reviewer will identify that the modeling was used in the correct context of the study. Review of correct application will ensure that weighting of model variables is carried out in a reasonable fashion, and that the combination of the models to provide one single value of "Ecological Functional Units" is also reasonable.

The charge questions and guidelines are based on the model certification criteria discussed in the "Protocols for Certification of Planning Models" from the USACE Planning Models Improvement Program. The intent of these questions is to focus thinking, not to suggest or dictate answers. We want the reviewers to consider several aspects of models during their review, from the inputs to the outputs to the underlying structure. Attached at the end of this Scope of Work is a standard model documentation table that provides model information and a document crosswalk. Background, technical, system and usability information is provided. Please, use this table and the DRAFT CHATFIELD ECOLOGICAL FUNCTIONS APPROACH (EFA) documentation report to address the specific ideas found charge questions below. Both general and specific charge questions are provided for each of the model aspects being evaluated.

General Charge Guidance

Please answer the scientific and technical questions listed below and conduct a broad overview of the Preble's Habitat Model, Avian Community Model, and the Functional Assessment of Colorado Wetlands Method (FACWet) (Johnson et al. 2008).

Evaluate the soundness of models as applicable and relevant to your area of expertise.

Please focus the review on scientific information, including factual inputs, data, the use and soundness of model calculations, assumptions, and results that inform decision makers.

Ecological models are ideally as complex and inclusive as needed for the purposes of project planning, and no more so. Offer opinions as to whether the model parameters and formulas are

sufficient to quantify ecosystem function for planning purposes of the Chatfield Reallocation Study.

Model certification panel members may contact each other and contact the Chatfield Reallocation project manager with any questions or if requesting more information. It may be preferred to discuss model details with the model developers, and this can be arranged. Your comments will be included in the Final Model Approval Report, but will remain unattributed. The Final Model Approval Report is expected to be released to the public by the USACE at some time in the future as an appendix to the Chatfield Reallocation Study and Environmental Impact Statement.

Model Assessment Criteria Charge Questions

General Questions

Are the project needs/objectives clearly identified?

Are the models described meeting those needs/objectives?

Technical Quality

Comment on the overall technical quality of the models.

Are the models based on well-established contemporary theory?

Are the models realistic representations of the actual systems?

Are the analytical requirements of the models properly identified?

Do the models address and properly incorporate the analytical requirements?

Are the assumptions clearly identified, valid, and do they support the analytical requirements?

Are USACE policies and procedures related to the model clearly identified?

Do the models properly incorporate USACE policies and accepted procedures?

Are the formulas used in the models correct and are the model computations appropriate and done correctly?

System Quality

Is the supporting software tool (e.g. Microsoft Excel) appropriate, and does it appear that the tool was used correctly.

Usability

Comment on the availability of the data required by the model. Model review team will not certify the quality of the data (should be done as part of the ITR process); However, model approval requires an examination of the data required by the model and whether the data is readily available and accessible to model users.

Comment on how useful the information in the results is for supporting project objectives.

Are the models transparent and do they allow for easy verification of calculations and outputs?

Document-Specific Charge Questions

Defining habitat variables pertaining to birds and Preble's focused on identifying how the variables provide support to life requisites such as breeding, over-wintering and migration, forage, and cover. Comment on the suitability of this basis for assessing ecosystem impacts and benefits for these ecosystems.

FACWet is a rapid assessment methodology that has formalized an approach to obtain reliable and consistent professional judgment with regard to functional condition of wetlands. Comment

on the suitability of this model as the basis for assessing wetland functional impacts and mitigation for the Chatfield Reallocation project.

Comment on the steps used to develop the models. Were the steps described clearly and in sufficient detail to understand what was done?

Does the approach used in each model sufficiently represent the necessary characters of each ecosystem component for purposes of identifying impacts and benefits of the alternatives? Are they sufficient to respond to significant changes to the local ecological landscape?

Does the report sufficiently explain the models and the science behind their development?

Is it clear how change in the variables affect the model results?

Is the rationale for including each of the variables clearly described and scientifically sound?

Does the report explain how model output (ecological functional units) is interpreted?

References and Guidance

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Attachment B: Biographical Information on Model Reviewers

Wm. Glenn Covington
NWD Regional Technical Specialist
Kansas City District, U.S. Army Corps of Engineers

Related Experience.

Mr. Covington has 30 years of experience working in the field of natural resources, and 25 years of experience working in the Corps of Engineers as an Environmental Resources Specialist in the field of Water Resources Planning for the Corps of Engineers. Currently, he serves as Senior Biological Sciences Environmental Specialist for Environmental Resources Section, Planning Branch, Kansas City District (KCD), responsible for environmental technical review of planning reports, construction activities, and project operation. In addition, since 2003, Mr. Covington has been coordinator for the Monitoring and Evaluation Committee of the Missouri River Bank Stabilization and Navigation Fish and Wildlife Mitigation Project for the Missouri River Recovery Program, working closely with federal and state natural resources agencies withing the KCD. This work has included planning, coordinating, and initiating a habitat classification system, to document the mitigation results of the project and initiating a chute monitoring program to monitor the biological and physical response of chute construction by the project. From 2001 to 2003, his major job responsibly was project manager for preparation of the Supplemental Environmental Impact Statement (SEIS) for the Missouri River Mitigation Project and senior environmental technical coordinator. From 2000 to 2001, he was the project manager for the overall Missouri River Mitigation Project and prepared a Report to Congress for project modification which more then tripled the size of the project. He coordinated this Report to Congress with Division, HQUSACE, and the Assistant Secretary of the Army (Civil Works) for transmittal to Congress. Since 2000, he has also served as KCD's Biological Opinion program manager responsible for compliance with the Endangered Species Act (ESA) for the Missouri River Master Manual, maintenance of the Bank Stabilization and Navigation Project (BSNP), and Kansas River tributary lake operation. He prepared the Biological Assessment (BA) on the Corps' maintenance of the Bank Stabilization and Navigation Project, as required by the ESA. From 1989 to 2000, his primary assignment was working as KCD's technical manager for the Missouri River Bank Stabilization and Navigation Fish and Wildlife Mitigation Project. Major responsibilities included conducting overall project coordination and site specific real estate and habitat development activities. Other job assignments Mr. Covington has carried out include: conducting and writing Biological Assessments on Missouri River commercial dredging and Lisbon Bottoms bank stabilization repair, conducting and preparing numerous environmental assessments and environmental impact statements as required by the National Environmental Policy Act (NEPA), for civil works planning activities; managed contract for feasibility report with incremental analysis for Section 1135 environmental restoration project at Levee Unit L246; provided fisheries and wildlife technical input for operational and HTRW projects; and providing military installation support included preparing scopes of work and overseeing contracts for the preparation of an Integrated Natural Resources Management Plan, Forestry Management Plan, Pest Management Plan, and On-going Mission Environmental Assessment for Fort Riley.

From 1978 – 1985, prior to working with the Corps of Engineers, Mr. Covington held the position of Research Technician for the Missouri Department of Conservation. Mr. Covington

assisted with various research studies including projects on the recreational use of the Missouri River and fisheries information retrieval. Mr. Covington also assisted with field collections for various projects on the Missouri and Mississippi rivers including: a study of the environmental benefits associated with notching river structures on riverine fish and invertebrate populations; a radio-telemetry study of winter catfish activity on the Missouri River; a sand island fish distribution project; and a fish contaminant study. He also assisted on additional research projects involving the determination of stream habitat lost to channelization, collecting fish and freshwater mussels for water quality assessment, and the biological and economic evaluation of low levels of dissolved oxygen at Lake Taneycomo. From 1979 to 1981, Mr. Covington was also a Graduate Research Assistant at the Missouri Cooperative Fishery Research Unit, University of Missouri, Columbia, where he designed and conducted research project on smallmouth bass in the Ozark National Scenic Riverways for M.S. degree program. He completed degree requirements by compiling and analyzing data, writing thesis, and giving oral presentations.

Mark Bakeman, Ph.D.
Ensign Technical Services, Inc
Erie, Colorado

Experience:

Dr. Mark Bakeman has extensive experience with the Preble's meadow jumping mouse (PMJM). When he was the technical lead and manager of the Ecological Monitoring Program at the Department of Energy's Rocky Flats facility, some of the first detailed PMJM distribution and habitat work was performed under his guidance. He was the author, editor, and team leader for the first study on PMJM habitat commissioned by the U.S. Fish and Wildlife Service (USFWS), acted as the Chief Technical Advisor for the Colorado Department of Transportation efforts to establish a PMJM Conservation Bank with USFWS, authored the only PMJM Biological Assessment in Colorado, co-authored the regional PMJM Habitat Conservation Plan, completed a study of highway impacts on PMJM populations, and conducted a riparian restoration research project in PMJM habitat. Dr. Bakeman has been a member of the USFWS PMJM working group since its inception and is also a member of the Preble's Science Team (commissioned by Colorado Division of Wildlife) and of the Nature Conservancy's Preble's Habitat Conservation Team. He is currently the president and owner of Ensign Technical Services, Inc, a consulting firm focusing on (among other issues) population ecology, endangered species permitting and conservation planning, restoration monitoring, and other wildlife/anthropogenic effects studies.

Related Publications:

Bakeman, M.E. and A. Deans. 1997. Habitat of the Preble's Meadow Jumping Mouse at Rocky Flats, Colorado. In: Bakeman, M.E., ed. "Report on Habitat Findings of the Preble's Meadow Jumping Mouse". Report to U.S. Fish and Wildlife Service.

Bakeman, M.E. 2003. Programmatic Biological Assessment: Interstate 25 Corridor, Powers Boulevard North, and Shoup Road Projects in El Paso County, Colorado. Prepared for FHWA and CDOT.

Bakeman, M.E., J. McCurdy and A. Winans. 2003. Habitat Conservation Plan for Preble's Meadow Jumping Mouse (*Zapus hudsonius preblei*) for Denver Board of Water Commissioners.

Bakeman M.E. and B. Lubow. 2006. Preble's Meadow Jumping Mouse 2005 Final Monitoring Report for Dirty Woman Creek, Town of Monument, El Paso County, CO. Submitted to Colorado Department of Transportation Region 2.

Bakeman, M.E. and B. Lubow. 2006. Final Report. Monitoring The Response of a Riparian Ecosystem to Hydrologic Restoration. Submitted to Colorado Department of Transportation Research Branch. (<http://www.dot.state.co.us/publications/PDFFiles/riparian.pdf>).

Attachment C: Comment and Response

Kansas City District provided comments on the wetlands and birds modeling directly within the comment response form, with resolution taking place via conference call and email communication. In total, 15 comments were received in the review of the wetlands and bird modeling, which are resolved on a point by point basis below.

Comment Resolution, Wetlands and Birds modeling. Kansas City District

Mo/Da/Yr	Reviewer's Name	Org	Chapter	Pg-Line	Type	Original Comment	Response 1	Comment 2	Response 2	Closed? (Y/N)
8/18/09	Covington	NWK				Additional refinement of the report text is still needed to clearly state the needs and objectives of the report and to sufficiently explain the Preble and bird models and the science behind them. In general, these models and the FACwet model appear to be technically sound and should be able to support the analytical requirements to comply with USACE policies and procedures.	Thank you for the thoughtful and encouraging comments. We will review the entire document to provide additional refinement and clarification in general and as specifically described below.			Y
8/18/09	Covington	NWK	Background	Page 1, lines 6-12		The main focus of this effort is not to assess "overlapping" resources but to assess resources for mitigation planning.	We will rewrite to reflect comment			Y
8/18/09	Covington	NWK	Model Development	Page 2, lines 3 - 5 of section.		Need to explain why "no existing model is capable of accurately representing the site-specific characteristics".	We will expand on text			Y
8/18/09	Covington	NWK	Standardizing Vegetation/habitat Mapping	Page 5, line 1		Figure numbers need to be in order. This should be Figure 2, however, I'm not sure where this figure is at.	All figures will be reviewed for numbering and appropriate explanations in text.			Y
8/18/09	Covington	NWK	Avian Community	Page 12, line 1		Suggest change "non-habitat" to some other term, possibly "disturbed areas". Parking areas and roadways may not be natural but they are still a form of "habitat".	The term "non-habitat" is used in habitat mapping done for the EIS and is described in the EIS text. In order to be consistent with EIS mapping and text, we will continue to use the previously established habitat nomenclature.			Y
8/18/09	Covington	NWK	Species Richness and Abundance	Page 12		Need to discuss the assumptions behind using point counts in June 2006 to represent bird richness and abundance. Could annual variation effect this?	We will add text explaining why point count data were used.			Y

Comment Resolution, Wetlands and Birds modeling, Kansas City District

Mo/Da/Yr	Reviewer's Name	Org	Chapter	Pg-Line	Type	Original Comment	Response 1	Comment 2	Closed? (Y/N) Response 2
8/18/09	Covington	NWK		Page 13		Need to switch the "Limit Habitat" and "Sensitive Species" paragraphs in the text since they are currently depicted in Tables 4 and 3, respectively.	Change will be made		Y
8/18/09	Covington	NWK		Page 14, line 4		Suggest after the term "summer" put "(breeding)" and after "winter" put "(non-breeding)".	Suggestion will be incorporated		Y
8/18/09	Covington	NWK		Page 22, Table 4		Need some discussion of Table 4 in the text. For the "Limited Habitat" column, suggest adding the numbers from page 13 to clarify the terms "very limited", "limited", "common", and "abundant". Also, suggest deleting the row for the 0.00 rating.	Will add discussion of table to text. Because both Preble's and bird habitat categories include "Non-habitat", which receives 0 for all EFVs, we will leave in the row with 0.00 ratings. This will allow the reader to better make the connection between Table 4 and Table 7		Y
8/18/09	Covington	NWK	Results and Discussion	Page 25.		This chapter needs to be rewritten and reorganized. Suggest discussing the rating criteria first and then how the EFIs were calculated. The same level of detail should be used in the Preble's/Bird Habitat section and the Wetland section (i.e. Suggest showing the math equations for both). There should also be some mention and discussion of sample size. There also needs to be some discussion of how this model is going to be implemented, including discussing average annual habitat units and how different mitigation alternatives will be compared and evaluated.	We will make suggested changes to the degree possible. There will continue to be some inconsistencies between Preble's/Bird and Wetlands because different models are used. The Preble's/Bird model was developed for Chatfield EIS, while FACWet is a state-wide model that is appropriate for use at Chatfield.		Y

Comment Resolution, Wetlands and Birds modeling, Kansas City District

Mo/Da/Yr	Reviewer's Name	Org	Chapter	Pg-Line	Type	Original Comment	Response 1	Closed? (Y/N) Response 2 Comment 2
8/18/09	Covington	NWK	Assigning EFVs for Preble's and Bird Habitats	Page 25. Line 2 of section.		Table 2 only has information on Preble. Need table reference for bird information.	Table 4 contains information relevant to bird functions. We will rename Table 4 to "Bird habitat ecological functions ratings definitions" to make it consistent with Table 2. We will also revise column headings to be consistent.	Y
8/18/09	Covington	NWK	Assigning EFVs for Preble's and Bird Habitats	Page 25. Lines 3 - 5 of section.		Suggest changing this sentence to read as "The average EFVs for each habitat type were then <i>calculated and used as the</i> Ecological Functional Index (EFI) for each habitat type (Table 5)".	We will revise as suggested.	Y
8/18/09	Covington	NWK	Rating Criteria for Preble's and Bird Habitat EFVs	Page 25.		This section needs more explanation. I presume Table "3" should be changed to Table "5". Need some discussion (and references?) explaining why Chatfield is optimal habitat for Preble's.	We will expand text and update table reference. "High Quality" will be deleted. The correct reference is to just Optimal habitat as described in the Preble's habitat section (Table 2).	Y
8/18/09	Covington	NWK	Calculate Impacts as Functional Units	Page 28.		This section needs more explanation, including a discussion summarizing what mapping was used and how "polygons" were assigned or developed. The figure included in this section needs to be discussed in the text.	We will expand this section	Y
8/18/09	Covington	NWK	Calculate Impacts as Functional Units	Page 28, lines 4 and 5 of section.		Show the math for the results of the 4 acres of inundation resulting in 3 EFUs no longer being available.	We will show the math in the example.	Y
8/18/09	Covington	NWK	References	Pages 28 - 34		Need to check references to be sure they are indeed referenced in this report.	We will cross-check references.	Y

For the Preble’s modeling, 25 general comments and 22 comments directly relating to the review charge were received. Based on discussion of these two sets of comments between the modelers and the reviewer, the most significant comments were boiled down into three overarching summary comments to capture the most important points of the review, as well as the detailed resolution of those points.

Summary Comments on Preble’s Mouse Model

Comment 1:
The PMJM Ecological Function Value (EFV) assigned to the Upland Habitat Type for Winter (0.25) may be too low
Basis for Comment:
<p>The concern is that in some instances, hi-value and low-value riparian habitat may not provide winter functions, e.g.: hibernacula locations. In these instances, hibernacula may be located exclusively in upland areas. If this is the case, the EFV of 0.25 assigned to the upland type is too low, and should be between 0.5 and 1.</p> <p>These cases might occur in areas where riparian areas are dominated by herbaceous vegetation, or in narrow stream channels that might be completely inundated by spring floods. In both of those instances, PMJM may select hibernacula in upland locations associated with shrub cover.</p>
Significance – Medium:
If these specific habitat conditions occur in the study area, the impacts associated with taking these special upland habitat areas would be underestimated, and potential mitigation areas with these habitats would be undervalued.
Recommendations for Resolution:
First, verify if these special habitat conditions occur at the study area. A person experienced with PMJM habitat should be able to make this determination. If this habitat situation is present, there are a few alternatives: 1) assign a higher EFV to the upland habitat type polygons in these special situations (EFV between 0.5 and 1), or 2) Split the single upland habitat type into two upland types (as with riparian); hi-value and low-value upland types, with corresponding EFVs.
Resolution:
Ottertall and Tetra Tech used aerial photo interpretation to draw course scale habitat polygons of the study area based on vegetation characteristics. These polygons were then verified and refined in the field by Tom Ryon, an experienced Preble’s meadow jumping mouse (PMJM) biologist. During the field verification, shrub habitat more typical of uplands (chokecherry, American plum, snowberry) that occurred in close proximity to both high and low value riparian habitat were incorporated into the appropriate riparian mapping unit based on its habitat value as both summer breeding/cover and winter hibernaculum habitat. More distant patches of upland shrub habitat were not distinctly mapped, but discussions with Tom Ryon and subsequent review of aerial photography and field reconnaissance by Ron Beane indicates that there is little to no upland shrub patches or other suitable hibernation habitat contained within the upland habitat mapping unit of the Chatfield Study Area. Based on this information it is ERO’s conclusion that the upland habitat within the Chatfield Study Area is accurately mapped and the impacts to upland habitat are not underestimated. 2 It is not feasible to conduct site specific mapping of all potential mitigation properties, both within Chatfield State Park and off-site, within the framework of the DEIS. Therefore, potential mitigation areas were mapped for planning purposes using CDOW riparian mapping as the best available habitat mapping. There is unavoidable uncertainty that some areas eventually selected for mitigation will have the specific habitat conditions described above and some upland mitigation habitat could be undervalued. Given that the impacts of all Chatfield reallocation alternatives are correctly estimated, than the potential to undervalue mitigation properties would error on the side of caution and would not create an additional burden on the resource. Additionally, there is an adaptive management component of the Compensatory Mitigation Plan (CMP) that will incorporate site-specific mapping and evaluation of

mitigation parcels that will be able to address specific upland habitat conditions that provide hibernacula.

Comment 2:
The model does not specifically address the value of habitat corridors or habitat connectivity.
Basis for Comment:
Although the U.S. Fish and Wildlife Service has identified habitat connectivity as a primary constituent element for PMJM habitat, no such habitat type was identified in the model process. The importance of habitat connectivity is mentioned in a few places in: “Draft Chatfield Ecological Functions Approach (EFA) Terrestrial,” including the potential use of weighting factors in the mitigation approach. However, identification of connective habitat should be incorporated into identifying impact and mitigation areas from the start of the process.
Significance – Medium:
Protecting or restoring connective habitat is probably the single most important factor in maintaining small PMJM population persistence. If the significance of this type of habitat is not recognized, project impacts may be underestimated and mitigation areas may be undervalued.
Recommendations for Resolution:
At a minimum, an introduction to the model should indicate that the model does not address the connectivity factor. Because of the importance of this factor, there should be some early discussion on how it will be dealt with (more details in mitigation plan, weighting factors, etc.).
There should also be an up-front cursory analysis that discusses: 1) what do we know about PMJM populations in Chatfield, 2) what do we know about PMJM populations adjacent to Chatfield, and 3) what habitat corridors exist (or have potential for creation/restoration) between these populations. This step will address one of the critical conservation issues for this project.
If there are significant issues that are identified from the above step (presence of important habitat connections), connective habitat could be identified and appropriately valued in the model process.
Resolution:
The report has been revised to provide a better description of the utility and limitations of the model and its relationship with the CMP. Additional background information is also provided on our state of knowledge of PMJM populations within and near Chatfield, the presence of existing or potential habitat connections and a summary of the weighting factors being implemented in the CMP. The weighting factors will account for broader scale ecological services not addressed in the EFU model. For example, in addition to the EFUs contained within a mitigation parcel, the parcel will contain attributes such as connectivity, proximity, and buffer 4 values, that contribute to ecological functions at regional and ecosystem scales. Implementation of the CMP accounts for these services by assigning a credit, or weighting factor, to the parcel EFUs. Greater detail on defining and applying weighting factors will be provided in the CMP.

Comment 3:
Improved documentation of model selection, data inputs, and desired outputs
Basis for Comment:

In the “Draft Chatfield Ecological Functions Approach (EFA) Terrestrial,” there is incomplete information on the issues identified above. Much of this information may be presented in other sections of the EIS document, but it would be helpful to have this organized in one place to facilitate understanding how the model was selected, model uses/limitations, model assumptions, data selection/processing, and model outputs.
Significance – Low:
Much of this information probably exists, but it is scattered and not organized in a comprehensive way at this stage. A more concise and coherent model presentation will not negate how the model was built or will be used, but it will help in understanding the model process.
Recommendations for Resolution:
More information is needed on: <ul style="list-style-type: none"> • Model selection: classes of habitat models, suitability of such models for this study • Model Assumptions • Model Limitations • Baseline information on model data: type of photography, flight dates, how was delineation of habitat types done (field/office?), patch resolution (smallest habitat type area), verification of types. It is difficult to tell from the mapping process if the resolution of the mapping units corresponds well to the definitions of the habitat types. • Definitions (PMJM habitat, habitat types, habitat variable, etc.). • Model outputs: Maps (Potential PMJM habitat by type, PMJM EFUs, Overlap EFUs), tables (habitat type polygons with EFVs, EFUs)
There are more specific comments in “Bakeman Question Sheet PMJM Habitat Model.doc”
Resolution:
The Model Development Section has been expanded to clearly describe the model selection, data inputs, and desired outputs. Most of the information requested in the bullet list above has now been compiled from various sections throughout the document and re-organized into a concise summary presented up-front in the Model Development Section.

General Comments, Preble’s Mouse modeling. Ensign Technical Services

Mo/Da/Yr	Reviewer's Name	Org	Chapter	Pg-Line	Type	Original Comment	Response 1	Response 2	Comment 2	Closed? (Y/N)
8/26/09	M. Bakeman	Ensign Technical Services	Draft Ecological Functions Approach	p 1, lines 6-13		This tells about what the EFA is, but the "why" of using this approach is unclear. Are there other approaches that could be used, e.g.: analyze impacts to the three resources separately and mitigating separately? This is also not explained in the Approach Overview, page 3. More justification needed here.				y

General Comments, Preble's Mouse modeling. Ensign Technical Services

Mo/Da/Yr	Reviewer's Name	Org	Chapter	Pg-Line	Type	Original Comment	Response 1	Response 2 Comment 2	Closed? (Y/N)
8/26/09	M. Bakeman	Ensign Technical Services	Draft Ecological Functions Approach	p 1, line 14		I assume that "comparable results" for each of the three resources means that the functions of that resource are accurately described.			y
8/26/09	M. Bakeman	Ensign Technical Services	Draft Ecological Functions Approach	p 2, lines 6-15 and lines 24-27		Goals and objectives/model development clearly stated. This provides insight into aspects of the previous questions and perhaps could be stated earlier.			y
8/26/09	M. Bakeman	Ensign Technical Services	Draft Ecological Functions Approach	p3, lines 5 and 6		Technical committee helped assign values to model variables: how was general approach (using EFA) decided upon?			y
8/26/09	M. Bakeman	Ensign Technical Services	Draft Ecological Functions Approach	p 3, line 12		Define habitat type and habitat variable			y
8/26/09	M. Bakeman	Ensign Technical Services	Draft Ecological Functions Approach	p 3, line 19		Weighting factors which may be used in mitigation are not part of model review process; model outputs may be "weighted"			y
8/26/09	M. Bakeman	Ensign Technical Services	Draft Ecological Functions Approach	p 4, lines 8-12		It is difficult to understand the habitat standardization process when the original data are not described. It is like comparing two unknowns and coming up with a third "known" variable.			y
8/28/09	M. Bakeman	Ensign Technical Services	Draft Ecological Functions Approach	p 5, line 1		there is no Figure 3			y
8/28/09	M. Bakeman	Ensign Technical Services	Draft Ecological Functions Approach	p 5, lines 1-3		Why was Preble's (PMJM) habitat mapping limited to 50 ft above max pool elevation? Did this encompass all possible habitat? PMJM habitat is defined as being the outer area 300 ft from outer edge of 100 yr floodplain. Mapping should be defined relative to that definition, not 50 ft.			y

General Comments, Preble's Mouse modeling. Ensign Technical Services

Mo/Da/Yr	Reviewer's Name	Org	Chapter	Pg-Line	Type	Original Comment	Response 1	Response 2	Closed? (Y/N)
8/28/09	M. Bakeman	Ensign Technical Services	Draft Ecological Functions Approach	p 5 and 6		Table 1. Again, hard to make sense of the equivalency process. Start with definitions. How many map units in CDOW mapping? 4 map units in Chatfield (hi value riparian, low value riparian, upland, non-habitat). It appears you are going from high-resolution mapping (CDOW, many map units) to low resolution (Chatfield). No Chatfield equivalent listed for Upland Grass (subirrigated fields), and PMJM use these habitats. Sandbar is not necessarily non-habitat.			y
8/28/09	M. Bakeman	Ensign Technical Services	Draft Ecological Functions Approach	p 6, line 5		What were dates of CDOW and Chatfield photographs?			y
8/28/09	M. Bakeman	Ensign Technical Services	Draft Ecological Functions Approach	p 7, line 7		Water source can be ephemeral stream, in-stream ponds, ditches			y
8/28/09	M. Bakeman	Ensign Technical Services	Draft Ecological Functions Approach	p 7, line 14		PMJM have been recorded moving >3 miles on a drainage, this is better reference (Schorr, R. 2001. Presentation to Preble's Technical Working group, December 6, 2001. Presented to USFWS and Colorado Division of Wildlife)			y
8/28/09	M. Bakeman	Ensign Technical Services	Draft Ecological Functions Approach	p 7, lines 26-30		It does not appear that the mapping process accounts for the habitat connectivity primary constituent element (PCE). To account for this, you have to look at relationships between known populations and habitat features in a geographic context. Some possible connective habitat might be classified as non-habitat in this process.			y
8/28/09	M. Bakeman	Ensign Technical Services	Draft Ecological Functions Approach	p8, lines 1-4		It might be noted that the current dams on the S. Platte have reduced the geomorphic and hydrological processes (flooding) that help sustain the early successional habitats favored by PMJM			y

General Comments, Preble's Mouse modeling, Ensign Technical Services

Mo/Da/Yr	Reviewer's Name	Org	Chapter	Pg-Line	Type	Original Comment	Response 1	Response 2 Comment 2	Closed? (Y/N)
8/28/09	M. Bakeman	Ensign Technical Services	Draft Ecological Functions Approach	p 8, lines 11-15		High Quality Riparian Habitat. Inconsistencies in what is called high quality riparian habitat and map units from Table 1. In Table 1, cottonwood called high quality - this is possible depending on understory conditions, but is generally not seen in Colorado (heavy cottonwood galleries often have v small populations). Also riparian herbaceous in Table 1 called high quality, no mention of this condition in page 8 description. This points out that these four habitat types defined for Chatfield are very coarse (may have a very wide range of conditions), but this may be sufficient for planning purposes.			y
8/28/09	M. Bakeman	Ensign Technical Services	Draft Ecological Functions Approach	p 8, lines 16-22		Same comment from line above. The definition seems to contradict itself - it has multi-strata woody vegetation, but is missing the shrub layer? Can you tell this from an aerial photograph?			y
8/28/09	M. Bakeman	Ensign Technical Services	Draft Ecological Functions Approach	p8, lines 23-27		Upland habitat. Location of hibernacula in this habitat type is known from many studies but is not even mentioned? Also, upland habitat often serves to buffer functions of the riparian habitat.			y
8/28/09	M. Bakeman	Ensign Technical Services	Draft Ecological Functions Approach	p 8 and 9, lines 28-29, 1,2)		Non-habitat. Areas that can appear to be non-habitat may have value as corridors between populations (see page 7, lines 26-30)			y
8/28/09	M. Bakeman	Ensign Technical Services	Draft Ecological Functions Approach	p9, line 27		Unclear what "PMJM presence as an indicator of breeding/foraging value" means. PMJM presence indicates a local population or the ability for an individual animal to access that habitat patch from a nearby population. I don't see the connection to "foraging value." But overall, this is a good list of attributes in assigning the PMJM values.			y

General Comments, Preble's Mouse modeling. Ensign Technical Services

Mo/Da/Yr	Reviewer's Name	Org	Chapter	Pg-Line	Type	Original Comment	Response 1	Response 2 Comment 2	Closed? (Y/N)
8/28/09	M. Bakeman	Ensign Technical Services	Draft Ecological Functions Approach	p 10		Table 2 is a reasonable ranking process.			y
8/30/09		Ensign Technical Services	Draft Ecological Functions Approach	p 25, line 15		Appendix A not provided			y
		Ensign Technical Services	Draft Ecological Functions Approach	p 25, line 20		Figures 8,9, 10 not provided			y
		Ensign Technical Services	Draft Ecological Functions Approach	p 28, lines 1-10		I understand the process; it would be made more clear by using a table with data from habitat polygons, assigning an EFV to each polygon, determining the EFI, and then the EFUs.			y
		Ensign Technical Services	Draft Ecological Functions Approach	p 27, Table 2		The EFI for each habitat polygon is determined from 4 values that should represent habitat resources for PMJM to "nest/breed, find cover, travel, feed, and hibernate." (As from draft Recovery Plan, quoted p 9). They range in value from 1 (optimal high value riparian) to 0 (non-habitat). This is reasonable, and probably accurately depicts the vast majority of the habitat at Chatfield. I suggest that you may encounter special (rare) cases of non-habitat areas that could be restored to provide connectivity between populations; the value of such areas would certainly not be 0. The EFIs do not include any quantitative assessment of this connectivity constituent element (page 7, line 26). The idea of assigning weighting factors for connectivity is mentioned on page 3; this should be emphasized more formally in this process?			y

Preble's Mouse review comments received that related to the Charge Questions.

General Questions

1. Are the project needs/objectives clearly identified?

Response: The project needs are discussed on page 1, then goals and objectives are covered on page 2. A brief discussion of the background of developing the EFI approach would be helpful. That is, don't tell me that you have decided to use an EFA right away – develop the issues/problems at hand in more detail (three terrestrial functions were identified as being important here, etc, these resources overlapped, etc), several approaches were evaluated, and the EFI was chosen because.....

2. Are the models described meeting those needs/objectives?

Response: There are three goals/objectives stated on page 2. The goals of identifying impacts and mitigation for the three resources, and developing the EFA are fairly clear once you go through the document. The last goal of “developing a standard unit for evaluating impacts to the three diverse and overlapping target resources that can be used for the Corp's Cost Effectiveness/Incremental Cost Analysis for evaluating mitigation alternatives.” could use some additional explanation. The need for a standard unit to describe impacts/mitigation for each resource is clear, but the need for the CE/ICA process (or what it is) is not made clear here. More information on this was provided in the model crosswalk.

You might also want to make a statement(s) saying what the model does not do, such as:

This modeling process will not identify all possible impacts or mitigation measures to the target resources. It will be used as a planning tool to generally identify impacts and mitigation opportunities; both impacts and mitigation will be further analyzed by specialists in these areas, or something to that effect.

Technical Quality

1. Comment on the overall technical quality of the models.

Response: I believe that the technical aspects of the model were developed adequately: classify habitat units with known area (into four types), assign a quality value (EFVs) to each type, assign a final value based on quality and area (EFUs). Note that I did not have the actual spreadsheet calculations to review.

2. Are the models based on well-established contemporary theory?

Response: Theory indicates a relationship between animal populations and the habitat that supports them. This modeling process should explore the relationships between Preble's meadow jumping mouse (PMJM) occupancy/density and habitat patch type/size. This has been primarily an inductive approach, where habitat variables from known areas of PMJM occupancy have been taken and looked for in other landscapes.

To date, the data linking populations and habitat are sparse. I know of a few studies where these relationships have been explored, primarily White and Shenk's study that found a positive correlation between PMJM abundance and woody vegetation cover, based on a few years of PMJM abundance data at several sites in Colorado (unpublished data). Trainor found that PMJM in high use areas, as determined from radio-collared animals, were near stream centers and areas with high cover of shrub, grass and woody debris (Trainor, A., T. Shenk, and K. Wilson. 2007. Microhabitat Characteristics of Preble's meadow jumping mouse high-use areas. J. Wildlife Mgmt. 71(2) 469-477).

Clippinger (Clippinger, N.W. 2002. Biogeography, community ecology, and habitat of Preble's meadow jumping mouse (*Zapus hudsonius preblei*) in Colorado. Ph.D. Dissertation, Department of Environmental, Population and Organismic Biology, University of Colorado at Boulder.) found that PMJM use areas often had sub-shrub species (such as Wood's rose) near streams.

PMJM are often not live-trapped in upland habitat, but radio-collaring has shown that they will use this habitat type. Most of the more intensive studies show that PMJM habitat has a wide range of features and considerable variability in the physical (stream channels, floodplains) and biotic (vegetation species and structure) characteristics of the system.

I also have a comment on the relationship between PMJM density and habitat. First, I have conducted some of the longer term monitoring studies on PMJM populations in Colorado. Both studies were 8 years in length. In both studies, PMJM population densities were found to vary considerably; variation in some areas was linked to habitat restoration efforts, but at other sites had nothing to do with habitat alteration. For instance, the highest recorded PMJM density was at a site on East Plum Creek (Douglas County CO), on the order of 210 animals/km stream (from 1998-2001). During the state-wide drought of 2002, the density was 0 animals/km stream, with no habitat alterations during this period. This illustrates the tremendous variation in PMJM population density that we have observed, which may not be related to measurable habitat characteristics. In other words, the habitat features that we measure do not explain all factors in determining density and location of PMJM populations.

3. Are the models realistic representations of the actual systems?

Response: This model assesses the amount and type of potential habitat impact for PMJM. This habitat is the plains riparian system with adjacent upland grassland or grassland/upland shrub.

First, I can't tell from the description whether all potential habitat was mapped. References are given to pool elevations, and that is not how PMJM habitat is defined. Judging by the knowledgeable staff that worked on the mapping, I would be surprised if all potential was not mapped. But we need some documentation on methods here.

Let's assume that all potential habitat was mapped. Estimating the type of habitat impact depends on the quality of the mapping process. I think that the mapping conducted from aerial photographs here was sufficient to represent the Chatfield riparian system for the purposes stated for this project. Does it cover all of the possible habitat variables important to PMJM – no. No modeling process will – a model is a representation of reality.

But does this model represent this system for the specific project purposes? The major concern that I have is that the four habitat types identified here (high value riparian, low value riparian, upland, non-habitat) may be too general. I might have added a second upland type of upland/shrub to reflect the ecological service of hibernation in uplands. Also, there may be non-habitat that could be used as connective habitat or restored to the same. I will develop these ideas further along in the responses.

The analysis will evaluate impacts to the three separate resources independently – that is, there will be a separate estimate for PMJM, bird, and wetland impacts. Under the EFA, mitigation units are defined with a common currency, EFUs. When you get to the mitigation part of the application, you may identify a series of EFUs that are equivalent in model terms to impacts, but may not represent the optimal mitigation for one of the resources. That is, a mitigation site with 100 EFUs may offset an equivalent impact of 100 wetland/PMJM/bird EFUs, but may not be optimal for any single resource.

Are there other available models to draw from that would meet the needs of this analysis? I don't think so – I would agree with the statements on Page 2 under model development that the HEA and HIS model procedures are not suitable for this analysis because they do not have the site-specificity needed for this project.

4. Are the analytical requirements of the models properly identified?

Response: It appears that the analytical requirements are as follows:

Map all potential habitat by classifying into four habitat types: high quality riparian, low quality riparian, upland and non-habitat. Each habitat type is assigned a series of 4 ecological functional values (EFIs) based on how that type fulfills PMJM life requirements. The average of those 4 values is the ecological functional index (EFI), scaled from 0-1. This value is multiplied by the acres of that type to yield the ecological functional units (EFUs). In short, the model must calculate accurate EFUs.

I do have a comment about the assignment of a relatively low EFV for upland habitat under the “Winter” habitat variable (the assigned value was 0.25). PMJM hibernate in both upland and riparian areas. In some cases (it appears in narrow channels) they seem to prefer upland areas because the riparian areas are inundated during spring floods. In these cases the upland areas may be essential for completion of the life cycle, and would not be scored so low. Is there such habitat in the study area (I don’t think so on the S. Platte, I don’t know about Plum Creek)?

This process is identified in the document, but the details that went into each step and the development of the spreadsheet to do the analytical calculations of the EFUs is not documented.

5. Do the models address and properly incorporate the analytical requirements?

Response: Again, I have not seen the spreadsheet documentation or output, so I do not know if the analysis stated was properly employed in the spreadsheet.

6. Are the assumptions clearly identified, valid, and do they support the analytical requirements?

Response: The assumptions for model development and use are very underdeveloped and are not clearly stated in a single location. Based on the Approach document, I could offer a few assumptions:

- This analysis is based on all potential PMJM habitat impacts from rising pool elevations measured by quality and area. There may be other impacts to PMJM populations that are not represented by this analysis.
- The EFA used here will approximate impacts to PMJM habitat from changing reservoir levels. (Question: are there some present areas of non-habitat that will change to habitat with rising reservoir levels? – the model should be able to show these areas).
- Mapped habitat areas represent most, but not all potential habitat that PMJM in Chatfield need to fulfill life requirements and sustain on-site populations. Mapping may not cover connective habitat areas that are needed for on-site population persistence.
- The EFVs assigned to PMJM habitat types were determined by an expert panel and are a relative measure of life cycle needs met by that habitat type.
- Mitigation areas that are identified for off-setting impacts using this modeling process may not be optimal mitigation for any single resource (wetland, PMJM, avian).
- The EFA used here will help identify off-site and on-site areas for habitat mitigation. Mitigation opportunities will not be limited solely to those areas identified by this process.

Note that some of these ideas are sprinkled throughout the document, but it would be helpful to pull them together in one place.

7. Are USACE policies and procedures related to the model clearly identified?

Response: Policies and procedures are outlined in the USACE guidance document “Protocols for Certification of Planning Models,” and are also covered in “Model Review Scope of Work Chatfield Reallocation Study Denver, Colorado.” I also assume that model documentation/approval is covered somewhere in the EIS.

8. Do the models properly incorporate USACE policies and accepted procedures?

Response: This review is part of the model “approval” process.

9. Are the formulas used in the models correct and are the model computations appropriate and done correctly?

Response: I was not provided with the spreadsheet and raw data to check on model computations.

System Quality

Is the supporting software tool (e.g. Microsoft Excel) appropriate, and does it appear that the tool was used correctly.

Response: I have used Excel for similar computations on other projects with satisfactory results. Again, I have not reviewed the specific spreadsheet for this model. I would caution that when using Excel for statistical analyses, make sure that the formulas are checked (variance, standard deviation, small sample size, etc) as the various spreadsheet packages can have some differences in how those computations are done.

Usability

1. Comment on the availability of the data required by the model. Model review team will not certify the quality of the data (should be done as part of the ITR process); However, model approval requires an examination of the data required by the model and whether the data is readily available and accessible to model users.

Response: Some of my comments to ERO staff on the conference call of 8/25/09 were related to this issue. Specifically:

The data documentation process was poor. I had no information on the source data (identified as FR/EIS data and CDOW riparian mapping data, page 3).

I assume that the habitat mapping data came from aerial photography. Questions:

- Dates of flights. I believe that there may be a decade or more time difference in flight times (I think CDOW mapping was from 1992 flights). I think this would be ok to identify potential areas of mitigation, but would be too outdated to accurately map habitat types in areas of impact.
- Resolution of map units (smallest area of habitat type that could be mapped)
- Office mapping or field mapping or both? Field verification of mapping?
- Accuracy or precision of mapping?
- I am concerned that mapping was done at a coarse level that might not reveal important ecological services. These might include understory conditions and the presence of shrubs in upland habitat, indicating potential for hibernacula.

2. Comment on how useful the information in the results is for supporting project objectives.

Response: I do not have results per se, other than the ERO comment that there would be approximately 331 acres of impacted EFUs under the maximum pool elevation. I am sure that there is other model “output” information that I am not seeing, but even if you are looking at only the total project habitat impact, this is an extremely critical value when you evaluate alternatives. So it is very useful. I have not seen any data to support the objective of using the modeling process to identify potential mitigation areas, so cannot comment on that objective.

I might add that this impact value is also extremely high (I have never seen a project with PMJM habitat impacts this high), but it must be evaluated within the context of impacts from other alternatives.

3. Are the models transparent and do they allow for easy verification of calculations and outputs?

Response: I do think that this model is relatively easy to understand, and I imagine that the spreadsheet can be set up so that the calculation process would also be easy to follow. The calculations and outputs are straightforward, it is more an issue of documentation.

Document-Specific Charge Questions

1. Defining habitat variables pertaining to birds and Preble’s focused on identifying how the variables provide support to life requisites such as breeding, over-wintering and migration, forage, and cover. Comment on the suitability of this basis for assessing ecosystem impacts and benefits for these ecosystems.

Response: Making the connection between habitat variables and life requisites is a sound approach to identifying impacts and mitigation. If I had to come up with an independent assessment for the Chatfield project, I would come up with a similar system.

A few more thoughts. When I assess a project with PMJM impacts, I consider the following issues:

- What is happening to riparian habitat? PMJM populations always have a riparian habitat component. Breeding, nesting, foraging, hibernation and movement take place in this zone. Water sources can be permanent or ephemeral. What will happen to riparian habitat as a result of this project? The habitat mapping/EFA at Chatfield should adequately assess current conditions and impacts in this zone.
- What is happening to upland habitat? Foraging, socialization, hibernation and movement take place here. PMJM appear to have more flexibility in upland habitat needs – we find populations with extensive or very limited upland habitat areas. Upland shrubs appear to be important in selection of hibernacula. Upland habitat in forested areas (Ponderosa pine/Douglas-fir) may differ considerably from upland habitat in the Colorado Piedmont, a factor that may affect selection of mitigation areas. The habitat mapping/EFA at Chatfield should adequately assess current conditions and impacts in this zone, but note upland areas with shrubs and forested habitat conditions may be lost in the coarse mapping process.
- Where are the nearest PMJM populations to the project area, what do we know about them (size, geographic distribution in watershed), and what habitat features are between that population and the project site? These factors are especially important for PMJM population persistence, and are the essential mitigation factors that are outlined in the draft PMJM Recovery Plan. The current EFA approach does not specifically address these important issues, although there are caveats in the document, such as assigning “weighting factors” for habitat connectivity. I also understand that additional site-specific information would be collected for potential mitigation sites. I encourage you to follow this line of thought when pursuing mitigation possibilities. It does not quite follow the objective of replacing impact EFUs with mitigation EFUs on a 1:1 basis. For instance, mitigating for a severe habitat bottleneck is worth much more than the EFUs that it represents. The Chatfield Dam itself is the most severe PMJM habitat bottleneck on the South Platte River. There are PMJM populations above the dam, and there once were PMJM populations below the dam in the Denver area; those populations have been extirpated on the South Platte in that region. PMJM populations on the South Platte are now only found north of Denver near the confluence with the Big Thompson near Milliken. You might have the discussion of creating a habitat corridor on the South Platte around the Chatfield Dam. There are many reasons why you would not do it, but good reasons to do it as well (it could potentially satisfy much of the required mitigation for PMJM).

2. FACWet is a rapid assessment methodology that has formalized an approach to obtain reliable and consistent professional judgment with regard to functional condition of wetlands. Comment on the suitability of this model as the basis for assessing wetland functional impacts and mitigation for the Chatfield Reallocation project.

Response: Not within the scope of this review.

3. Comment on the steps used to develop the models. Were the steps described clearly and in sufficient detail to understand what was done?

Response: Model development was discussed very briefly in the EFA document. There was brief discussion on how HEP and HIS models were not suitable for this project, but little more. I suspect that there is additional discussion (or should be) in the EIS.

4. Does the approach used in each model sufficiently represent the necessary characters of each ecosystem component for purposes of identifying impacts and benefits of the alternatives? Are they sufficient to respond to significant changes to the local ecological landscape?

Response: The EFA outline here is sufficient to identify impacts of the various alternatives. The process is objective and non-biased, which are essential features in the discussion of alternatives. Are the measured ecosystem

characters sufficient to respond to significant changes to the local ecological landscape? Yes, if considering the alternatives.

5. Does the report sufficiently explain the models and the science behind their development?

Response: The model itself is explained adequately. The background and development of the model could use additional documentation.

6. Is it clear how change in the variables affect the model results?

Response: Again, I have not seen the model results, but am interested in the habitat impacts for each alternative. Results should show a table of habitat type impacts for each alternative and resource, a map of those impacts, and maps and tables for the overlap of the three resources. In the additional materials that I received from ERO, I did see maps of PMJM habitat.

Impacts to high value riparian habitat of given size should result in more impact units (EFUs) than impacts to upland habitat of the same size. I don't know what the mix is, but judging by the maps I have seen, there is more riparian habitat than upland that will be affected, yielding greater EFU impact than if the effects of the impact had been primarily in upland habitat.

7. Is the rationale for including each of the variables clearly described and scientifically sound?

Response: Yes. The use of four habitat types (High value riparian, low value riparian, upland and non-habitat) is coarse but sufficient for planning purposes. They do cover the range of habitat types found in PMJM habitat. Note that these types do not consider geographic position (connectivity), which is addressed in other ways.

8. Does the report explain how model output (ecological functional units) is interpreted?

Response: The report explains that EFUs will be used to compare potential impacts of the various alternatives. It also states that the same process used to determine the EFUs for impact areas can be used to determine the EFUs of potential mitigation sites; EFUs are the common currency that allows you to compare impacts and mitigation on an objective basis.

The overlap of EFUs for the three resources is also explained sufficiently. The details on devising a mitigation plan for all three resources was not covered in this document.