# Appendix Y
# Project Implementation Costs

# APPENDIX Y. PROJECT IMPLEMENTATION COSTS

The Colorado Water Conservation Board (CWCB) requested that the U.S. Army Corps of Engineers (the Corps) consider reallocating space within Chatfield Reservoir for water supply purposes, on behalf of a group of 12 water users (or water providers) in the Denver metropolitan area. The purpose and need is to increase availability of water, providing an additional average year yield of up to approximately 8,539 acre-feet of municipal and industrial (M&I) water, sustainable over the 50-year period of analysis, in the greater Denver Metro area so that a larger proportion of existing and future water needs can be met. The primary objective of the reallocation is to help enable water providers to supply water to local users, mainly for municipal, industrial, and agricultural needs, in response to rapidly increasing demand.

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

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

2. Least Cost Alternative to Chatfield Reservoir storage reallocation—NTGW combined with Gravel Pit Storage. Normally the No Action Alternative is also the Least Cost Alternative. However, the water providers participating in the Chatfield Reservoir reallocation study are opposed to long-term use of NTGW due to water supply management strategies of becoming less dependent on non-renewable water supplies. For this study, it is assumed that NTGW could provide water to a

significant part of upstream water providers through the 50-year planning period, and downstream water providers would be served by the development of gravel pits for water storage.

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

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

The feasibility phase of this project is cost shared 50-50% between the Corps and the Colorado Department of Natural Resources (CDNR). In the development of the project costs, the sponsor provided the majority of the estimates which were obtained from consulting engineering firms and the water providers. A Corps developed cost appendix was not prepared because a majority of costs for this project were provided by the sponsor. It is anticipated that there is a low risk of cost increases that would jeopardize this project because multi-tiered contingencies that are typical of those used for similar Denver-area projects were included in the cost estimates provided.

Alternatives 1, 2, and 4 were designed to provide the same amount of water as Alternative 3 (an average year yield of 8,539 acre-feet) and thus provide an even basis for comparing costs. The water sources for all of the surface water development alternatives (Chatfield, Penley and the gravel pits) are the same, South Platte River water. Thus, the assumption was made that the same water rights could successfully be changed to store the same water from the river but it is stored in different storage vessels. The water source for the non-tributary groundwater (NTGW) is the groundwater in the aquifers under the metro area, the Denver, Arapahoe and Laramie Foxhills groundwater aquifers, collectively known as the Denver formation.

Costs for Alternatives 1, 2 and 4 were derived from multiple sources. Alternative 1 is the no action alternative that includes the construction of the Penley reservoir, which would be located off-channel near Chatfield Reservoir, and new gravel pit storage for project participants downstream of the metro area. Alternative 2 is a second no action alternative that assumes the continued use of NTGW for the project participants now using NTGW, and new gravel pit storage for other project participants. Alternative 4 includes less reallocated storage space in Chatfield Reservoir combined with some NTGW use and small gravel pit storage for some participants. The primary most costly components of these alternatives are: construction of the Penley reservoir, including appurtenant facilities to deliver the water to and from the reservoir; NTGW usage that includes the drilling and operation of additional NTGW wells and appurtenant facilities to deliver water from the wells; and

new gravel pit construction and the appurtenant facilities related to moving water to and from the new gravel pits. Additional key costs estimated are the costs to operate and maintain these facilities and to repair, rehabilitate, and replace them, when needed.

The Penley reservoir cost estimates were provided by a consultant who had extensive familiarity with costing similar projects. The volume for Penley reservoir is 12,725 acre-feet. The work by the consultant was conveyed in a memo detailing the capital cost components that included a 25% contingency. At the time the cost estimate was made, the consultant was also on the design team developing the Reuter-Hess Reservoir, another off-channel reservoir designed to store 16,200 acre feet in the south Denver metro area. The estimates identified the cost components for the reservoir construction, land acquisition, pump station and pipeline that allow the project to divert from the South Platte River. Also the cost estimates included cost estimates for operation and maintenance (O&M) as well as repair, rehabilitation, and replacement (RR&R) in perpetuity or until the water storage is no longer contracted.

The NTGW costs were derived from an extensive regional study prepared for the South Metro Water Supply Study Board by five prominent consulting engineering and financing firms in 2004. Douglas County Water Resource Authority, the Denver Water Board, and the Colorado River Water Conservation District requested and financed the study, which assessed the viability of continued NTGW use by the region. The study was extensively reviewed by local agencies. It presented the first of its kind analysis on a regional basis of the costs of additional NTGW use by multiple agencies in the south Denver Metro area. The study had a 50 year forecasting period and developed the most reliable information available on the number of additional wells that entities would most likely need to drill and operate to meet their projected future water supply demands. The costs to drill wells were subsequently updated using information provided by a consulting engineering firm familiar with timely information on well drilling costs. The information was documented in a memorandum supplied to the Corps and its contractor.

The gravel pit cost estimates were developed by a local consulting engineering firm that was representing one of the project participants. As documented in the FR/EIS, in recent decades multiple gravel pits dug in the north Denver metro area near the South Platte River for the mining of gravel have subsequently been converted to viable water supply reservoirs. The consultant supplied cost estimates of recent gravel pit development projects, including the costs for appurtenant facilities (pipelines or ditches) used to transport water to and from the gravel pits. Additional cost information supplied by the consultant included O&M and repair, rehabilitation, and replacement estimates for key facilities. The gravel pit estimates included a 20% contingency.

The recommended alternative is Alternative 3, the reallocation of 20,600 acre-feet of storage. Costs for Alternative 3 are primarily comprised of the cost of recreation facility modifications and the cost of environmental mitigation.

### Summary of Costs of the Alternatives

Table 1 summarizes the first costs of each of the alternatives. These costs summarize costs from the Compensatory Mitigation Plan (Appendix K of the FR/EIS), the Recreation Facilities Modifications Plan (Appendix M of the FR/EIS), the SMWSS study, local experts, and the Corps of Engineers. Table 1 contains entries for Denver Botanic Gardens for each alternative to assist with its water

needs for its facility located at Chatfield Reservoir. Instrumentation cost for Alternatives 3 and 4 include the installation of fifteen piezometers.

Project first costs, as presented below are implementation costs excluding operation, maintenance, repair, rehabilitation, and replacement cost. Construction costs and construction contingency costs are included. These costs for Alternatives 1, 2 and 4 are described above. The major costs for Alternative 3, the recommended plan, are presented in the sections below.

As shown in Table 1, Alternative 3 is the least costly of the alternatives. The Total First Cost for Alternative 3 is approximately $106.6 million, compared to approximately $133.7 million for Alternative 4, $151.9 million for Alternative 2, and $311.8 million for Alternative 1.

**Table 1. Summary of First Costs**

| | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 |
|---|---|---|---|---|
| Specific (Infrastructure) | | | | |
| Chatfield Reservoir | $0 | $0 | $0 | $0 |
| Instrumentation (15 Piezometers) | $0 | $0 | $710,000 | $710,000 |
| Wells | $71,593,235 | $71,593,235 | $0 | $26,672,972 |
| Gravel Pits | $79,666,399 | $79,666,399 | $0 | $60,406,470 |
| Penley Reservoir | $159,953,896 | $0 | $0 | $0 |
| Other User (Denver Botanic Gardens) | $631,514 | $631,514 | $78,519 | $476,440 |
| Total Specific | $311,845,044 | $151,891,148 | $788,519 | $88,265,882 |
| Recreation Modifications | $0 | $0 | $47,303,435 | $23,535,167 |
| Environmental Mitigation | $0 | $0 | $58,545,585 | $21,883,544 |
| Total First Cost | $311,845,044 | $151,891,148 | $106,637,539 | $133,684,593 |

### Development of Costs for Recreation Modifications and Environmental Mitigation

The Recreation Facilities Modification Plan (Appendix M of the FR/EIS), which includes estimated construction costs, was completed by EDAW, later AECOM, under the direction of Colorado State Parks (now Colorado Department of Parks and Wildlife) and the Colorado Water Conservation Board. Estimated costs include work for all in-kind recreation facilities. EDAW/AECOM was selected as a qualified planning firm specializing in planning for recreational facilities. They have experience in developing costs for similar projects, and the costs they used were based on recent, comparable projects.

The Recreation Facilities Modification Plan received multiple reviews by Colorado State Parks prior to being included in the FR/EIS. It details each specific component of the recreational areas at Chatfield that will be impacted by the project and gives estimated costs to complete in-kind replacement (Appendix 1 of Appendix M).

The assumptions used in the cost estimates are described in detail on pages 4-3 and 4-4 in Appendix M. A contingency of 30% was applied to cost estimates prepared by EDAW/AECOM for recreation modification work. The cost contingency and other cost estimate and design services allowances are shown on page A1-1 of Appendix M.

Cost estimates for specialized aspects of the project, such as roadways, dikes, the marina, and soils work were made using sub consultants with specialized expertise in those areas. Cost information was compiled by the water providers into Excel spreadsheets using the same unit values for each of the project participants and documenting the cost assumptions, and other assumptions in footnotes on each spreadsheet. Additional assumptions included the estimated life of key facilities, the cost for required legal transactions, project components, and related information. The spreadsheets were sent to the Corps' contractor for further use in overall cost determinations for each alternative. The Compensatory Mitigation Plan (Appendix K of the FR/EIS) was prepared by ERO Resources Corporation (ERO) under the direction of the water providers and the U.S. Army Corps of Engineers (Corps). The Compensatory Mitigation Plan includes estimated design, construction, property acquisition, and maintenance costs for on-site and off-site mitigation for project-related impacts to the target environmental resources of Preble's meadow jumping mouse, wetlands, and birds. ERO was selected to prepare the Compensatory Mitigation Plan as a qualified environmental consulting firm with expertise in environmental impact analysis and mitigation.

ERO has experience in developing and reviewing costs for environmental mitigation projects, including wetland mitigation and riparian habitat enhancement projects associated with compensatory mitigation requirements for Clean Water Act Section 404 permit requirements and for Endangered Species Act Incidental Take Permits. In addition to the Chatfield Reallocation FR/EIS, ERO is working on several other large Colorado water supply projects that include reviewing various cost estimates for construction and mitigation. Also, as part of its on-call services contract with Urban Drainage and Flood Control District (UDFCD), ERO assists with the design, construction, and monitoring of dozens of mitigation projects. In addition to its internal experience, ERO developed the FR/EIS Compensatory Mitigation Plan line-item unit costs based on average unit costs for 35 recent Denver metropolitan-area channel improvement projects with UDFCD funding in the UDFCD Bid Tabulation software (available at the UDFCD website). ERO also consulted with local individuals who have specialized expertise in mitigation construction and management costs and land management costs and are employed by another environmental consulting firm, two consulting engineering firms, and Douglas County Open Space.

The Compensatory Mitigation Plan was reviewed multiple times by the water providers, Colorado State Parks and the Corps prior to being included in the FR/EIS. The assumptions used in the cost estimates are described in detail in sections 6.1.3 and 8.1 of the Compensatory Mitigation Plan and in Attachment E-1 of Appendix E and Appendix G of the Compensatory Mitigation Plan. A contingency of 15 percent was applied to construction, 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 of Appendix E of the Compensatory Mitigation Plan. Each project participant reviewed the cost estimate information described for their entity. Participants agreed to the use of the various local sources and agreed to the reasonableness and applicability of the estimates. The sponsor and participants are aware that the costs reflected are estimates and they shall be responsible for any costs over and above those

estimated in the report necessary to meet the requirements of the Recreation Facilities Modification Plan and the Compensatory Mitigation Plan. The Corps of Engineers does not endorse nor certify the estimated costs reflected in this appendix. The sponsor is responsible for funding any cost increases. Costs in this appendix were escalated to Fiscal Year 2013 dollars and, as stated, included contingencies.

### Recreation Modification Costs for Alternative 3

Alternative 3 requires recreation modification due to the storage reallocation at Chatfield Reservoir. Appendix M presents the modifications required. Table 2 summarizes these costs.

**Table 2. Alternative 3 Recreation Modification Costs**

| Recreation Modification Area* | Cost |
|---|---|
| North Ramp | $1,286,172 |
| Massey Draw | $723,417 |
| Eagle Cove | $449,658 |
| Deer Creek Day Use & Balloon Launch Area | $1,575,487 |
| Swim Beach | $10,329,151 |
| Jamison | $2,021,336 |
| Catfish Flats | $1,824,676 |
| Fox Run | $324,611 |
| Kingfisher Area | $311,886 |
| Gravel Ponds Area | $229,730 |
| Platte River | $118,413 |
| Marina Point | $2,613,462 |
| South Ramp Including Marina | $9,563,095 |
| Roxborough Cove | $432,510 |
| Plum Creek | $505,274 |
| Roads and Bridges | $13,283,583 |
| SUBTOTAL, INITIAL/IMPLEMENTATION COSTS | $45,592,461 |
| SUBTOTAL, Additional Tree Removal Costs^ | $1,710,975 |
| TOTAL, REC. MOD. INITIAL/IMPLEM. COSTS | $47,303,435 |

^ Costs not in Appendix M; specific tasks, estimated calendar year 2010 cost of each task, and assumptions regarding unit pricing are provided in Section 4.0 of Appendix Z.

^ No contingencies were added because costs are for removing all trees below 5439 ft msl, but some trees below 5439 ft msl will not be cut (Adaptive Mgt. Plan, Appendix GG).

* The summary costs and contingencies/markups above as well as the detailed costs for each area are in Appendix 1 of Appendix M.

*These "Other" allowances are 12% Contractors General Conditions, 7% Contractors Overhead and Profit, and 2.4% (6% of 40% of Subtotal) Federal Wage Rate Factor.

* Does not include Owners Construction Phase Contingency of 5% because CDNR (non-Federal sponsor/owners of the reallocated storage), not Corps, is the contractor.

### Environmental Mitigation Costs for Alternative 3

Alternative 3 requires mitigation to address the effects of storage reallocation. Appendix K provides detail of the environmental mitigation plan. Table 3 presents the costs from Appendix K.

**Table 3. Alternative 3 Mitigation Costs**

| Compensatory Mitigation Plan Sites | Concept Plan Cost | Contin-gencies++ | 25% Design & Mobiliza-tion Cost+ | Subtotal | 20% Contingency (Offsite Non-CHU)+++ | 20% Conting. (Onsite Const. Activities)+++ | FY13, Q1 Cost |
|---|---|---|---|---|---|---|---|
| Onsite Mitigation, Marcy Gulch Sites 1 & 2+ | 1,211,080 | 0 | 302,770 | 1,513,850 | 0 | 302,770 | 1,816,620 |
| Onsite Mitigation, Deer Creek Sites 1-4+ | 2,011,548 | 0 | 502,887 | 2,514,435 | 0 | 502,887 | 3,017,322 |
| Onsite Mitigation, Plum Creek Sites 1-10+ | 6,121,794 | 0 | 1,530,448 | 7,652,242 | 0 | 1,530,448 | 9,182,690 |
| Onsite Mitigation, S. Platte R. Sites 1-13+ | 5,745,311 | 0 | 1,436,328 | 7,181,639 | 0 | 1,436,328 | 8,617,967 |
| SUBTOTAL, ONSITE MITIGATION | 15,089,733 | 0 | 3,772,433 | 18,862,166 | 0 | 3,772,433 | 22,634,599 |
| Offsite Critical Habitat (CHU) Mitigation, Sugar Creek | 2,473,890 | 1,405,812 | 0 | 3,879,702 | 0 | 0 | 3,879,702 |
| Other Offsite Mitigation, Real Estate Costs | 13,477,400 | 0 | 0 | 13,477,400 | 2,695,480 | 0 | 16,172,880 |
| Other Offsite Mitigation, Enhancement | 15,183,400 | 0 | 0 | 15,183,400 | 3,036,680 | 0 | 18,220,080 |
| SUBTOTAL, OTHER OFFSITE MITIGATION | 28,660,800 | 0 | 0 | 28,660,800 | 5,732,160 | 0 | 34,392,960 |
| TOTAL, INITIAL ENV. MITIGATION COSTS | | | | | | | 60,907,261 |

+Detailed quantities, unit pricing, labor costs, design/mobilization, and assumptions for each on-site mitigation site are included in Appendix G to Appendix K.

++Attachment E-1, Appendix E of Appendix K shows most tasks have contingencies of 15% (capital costs), 21.5% (other construction costs), and 18% (implementation costs).

+++Table 16 of Appendix K indicates that contingencies of 20% were added to real estate costs and enhancement activities (construction, planting, fencing, etc.).

## SUMMARY

Recreation modification costs and environmental mitigation costs were provided by the state and providers. Firms with expertise in these areas developed the costs. Costs were reviewed and approved or certified as appropriate. Costs in this appendix were escalated to Fiscal Year 2013 dollars and include contingencies. Project first costs are implementation costs including construction costs and construction contingency costs, and excluding operation, maintenance, repair, rehabilitation, and replacement cost. The recommended alternative is Alternative 3 and is the least costly of the alternatives. The Total First Cost for Alternative 3 is approximately $106.6 million, compared to approximately $133.7 million for Alternative 4, $151.9 million for Alternative 2, and $311.8 million for Alternative 1. Costs for Alternative 3, are primarily comprised of the cost of recreation facility modifications and the cost of environmental mitigation.

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