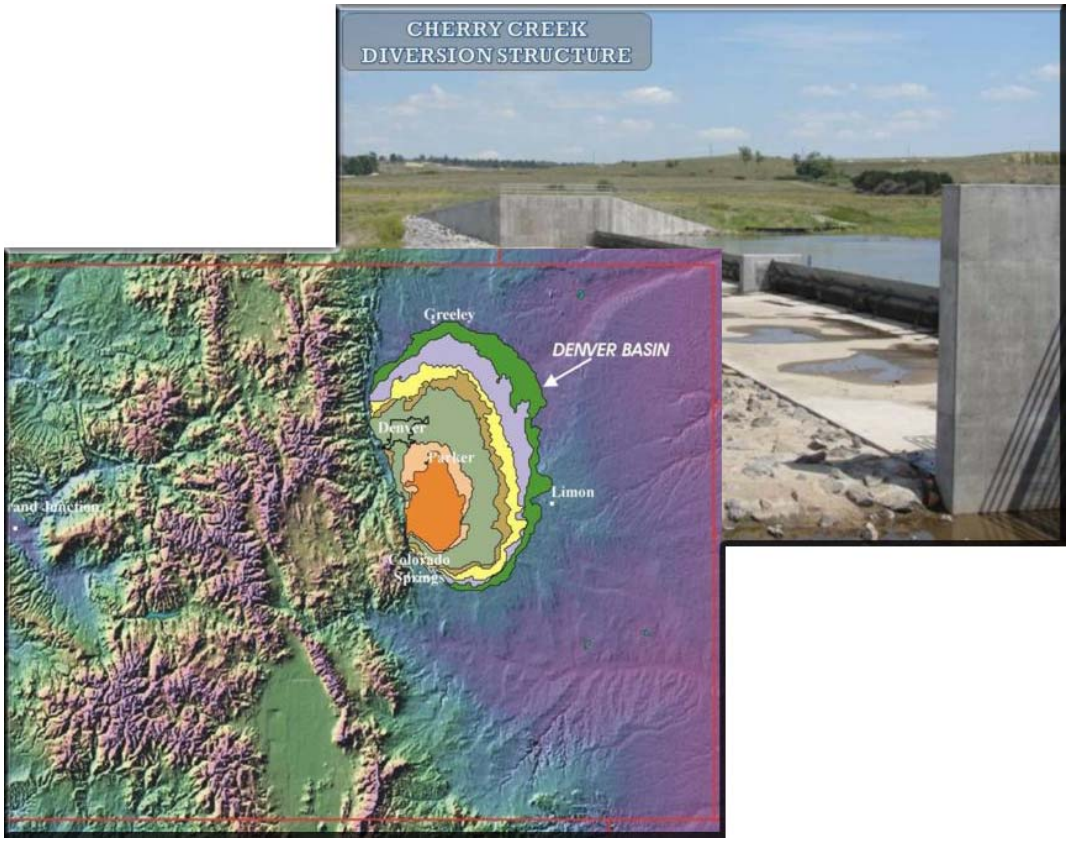
RECLAMATION

Managing Water in the West

Douglas County Rural Water Project Appraisal Report

Rural Water Supply Program



U.S. Department of the Interior
Bureau of Reclamation
Eastern Colorado Area Office
Loveland, Colorado

July 2010

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Douglas County Rural Water Project Appraisal Report

Rural Water Supply Program
Eastern Colorado Area Office, Great Plains Region

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Acronyms and Abbreviations

AF	acre-feet
ASR	aquifer storage and recovery
CFR	Code of Federal Regulations
DCWRA	Douglas County Water Resource Authority
ECCV	East Cherry Creek Valley
FOA	Funding Opportunity Announcement
gpdc	gallons per day per capita
OM&R	operation, maintenance, and replacement
Reclamation	Bureau of Reclamation
Rule	Rural Water Supply Program interim final rule, CFR 404
RWADC	Rural Water Authority of Douglas County
SMWSA	South Metro Water Supply Authority
USDA	U.S. Department of Agriculture
WISE	Water Infrastructure and Supply Efficiency

Contents

Introduction and Background

About this Appraisal Report

Rural Water Supply Program

Reclamation's Rural Water Supply Program addresses rural water needs in the Reclamation States. Given the region's lack of available surface water supplies, existing and ongoing development depend heavily on the aquifers to serve as a permanent water supply.

The Bureau of Reclamation's (Reclamation) Eastern Colorado Area Office and the Technical Service Center prepared this report as required under Title I Section 103 of the Reclamation Rural Water Supply Act of 2006 and Appraisal Criteria promulgated by the Secretary included in Reclamation's Rural Water Supply Program interim final rule (43 Code of Federal Regulations [CFR] 404, 2008) (Rule).

Purpose of the Appraisal Report

The Douglas County Water Resource Authority's Appraisal Investigation entitled *Rural Water Supply for Douglas and Arapahoe Counties, Colorado* is proposed for consideration under Reclamation's Rural Water Supply Act by the Douglas County Water Resource Authority (DCWRA). Regional partners are collaborating to develop a Rural Water Supply Infrastructure Project (referred to as "proposed alternative").

This Appraisal Report is the first step to determine whether at least one viable alternative warrants a more detailed investigation through a Feasibility Study or to terminate the study.

This Appraisal Report was developed for Reclamation (Regional Director, Great Plains Region) to determine whether it is appropriate to recommend that a Feasibility Study be conducted as described in the Reclamation Rural Water Supply Act of 2006 under Rule § 404.44 and Rule § 404.45. This determination is based on information contained in the *Douglas County Water Resource Authority Appraisal Investigation* (2010) as well as addenda and attachments to this report.

Report Authority

This Appraisal Report is being done under the authority of the Reclamation Rural Water Supply Act of 2006 (P.L. 109-451).

Appraisal Report Contents

This report provides a brief explanation of the proposed alternative. In addition, the report gives a determination of eligibility as defined in Rule § 404.2 "Rural Water Supply Project," Rule § 404.6 "Who is eligible to participate in the program," and Rule § 404.7 "What types of projects are eligible under the program." "Additional Required Content for Feasibility Studies" as described in Section IV D.2.b.(3) of the Funding Opportunity Announcement (FOA) No. R10SF80458 is also addressed as part of this Appraisal Report.

Study Sponsors

DCWRA, South Metro Water Supply Authority (SMWSA), and Rural Water Authority of Douglas County (RWADC) were all formed with a regional cooperation charter. The three groups are working closely together with Douglas County government to address the region's water supply challenges. DCWRA, the non-Federal project sponsor, has water management and water delivery authority. DCWRA has already received $600,000 in state grant funds from the Metro Basin Roundtable and Colorado Water Conservation Board to pursue this proposed alternative, which has basin and statewide interest (Douglas County, 2010, Appraisal Investigation, 1). Figure 1 shows the project location and sponsors.

Three organizations are partners with Douglas County government:

- **DCWRA.** DCWRA is a regional joint powers authority formed in 1992 under direction of the Board of Douglas County Commissioners with water management and water delivery authority. The 19 members of DCWRA include water provider districts in Douglas and Arapahoe Counties, municipalities, and Douglas County government. DCWRA provides a regional forum for the discussion of public policy issues surrounding water, and promotes water conservation and water education activities.

- **SMWSA.** The SMWSA is a group of 14 municipal water providers located on the south side of the Denver metropolitan area in Douglas and Arapahoe Counties. SMWSA has entered into an intergovernmental agreement with two large neighboring water providers, Denver Water and the City of Aurora, to collaborate on solutions for a sustainable water supply.

- **RWADC.** The RWADC is the newest of the three regional entities, created in October 2008 as a governmental entity similar to DCWRA and SMWSA. This group represents the smaller rural water providers in the region (less than 500 taps), and as many as 10,000 additional homes. (Appraisal Investigation, 1).

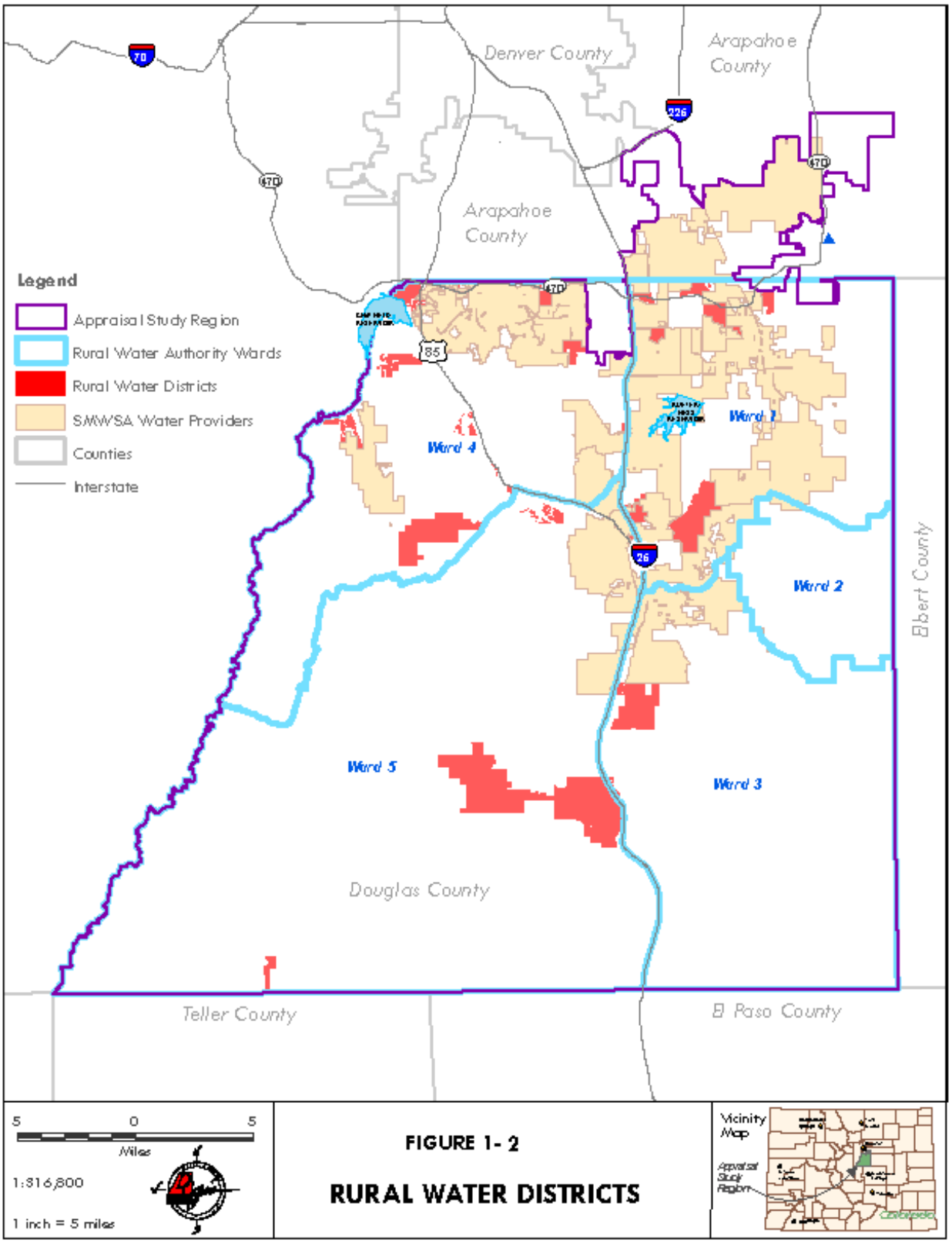

Figure 1. Project and sponsor location (Appraisal Investigation, Figure 1-2)

Study Location and Description

The watershed is situated near the center of Colorado, along the Front Range, extending from southeast of Denver toward Colorado Springs. Douglas County, comprising most of the region, is 540,000 acres of mountains, foothills, and plains. Elevations range from 5,400 feet in the northeast to 9,836 feet at Thunder Butte in the Pike National Forest. The portion of the region in Arapahoe County consists of small communities and a state park between Denver and Aurora.

Over 40 water providers serve the watershed, plus as many as 10,000 rural properties on domestic wells in the Denver Basin aquifers. The Denver Basin aquifers serve as the chief supply for residential, commercial, and business development, although some limited surface water sources are also available.

The Denver Basin is made up of four separate aquifers; with the Dawson Aquifer the uppermost followed by the Denver, Arapahoe, and Laramie-Fox Hills aquifers.

Due to their extremely low recharge rates and large withdrawal amounts, the Denver Basin aquifers are a naturally nonrenewable source, and therefore, an unsustainable long-term option for the region's current and future populations. While an effort by a consortium of the region's water providers has secured some renewable water supplies, the vast majority of water providers in Douglas County still pull nearly all of their supply from the nonrenewable Denver Basin aquifers system, in effect mining this finite resource. Over 500 square miles of the Denver Basin aquifers underlie the study region. A cross-section of the Denver Basin is shown in Figure 2. This figure shows the bowl-like shape of the Denver Basin, demonstrating why the outer edges of the formation are experiencing the greatest loss of water production. Well data indicate that static pressure levels within the watershed are declining rapidly due to the amount and breadth of pumping. This reduction in water levels has also resulted in reduced well pumping rates, affecting the ability of some providers to meet peak water demands (Appraisal Investigation, 6-7).

Project Purpose

DWCRA describes the project purpose as:

> "***The purpose of the project is to lessen reliance upon non-renewable Denver Basin groundwater supplies in the project area. A need exists to plan, fund, and construct - on an urgent and expedited basis - a regional watershed based infrastructure system to provide more sustainable water supplies throughout the project area.*** Goals and objectives of the project include lessening project

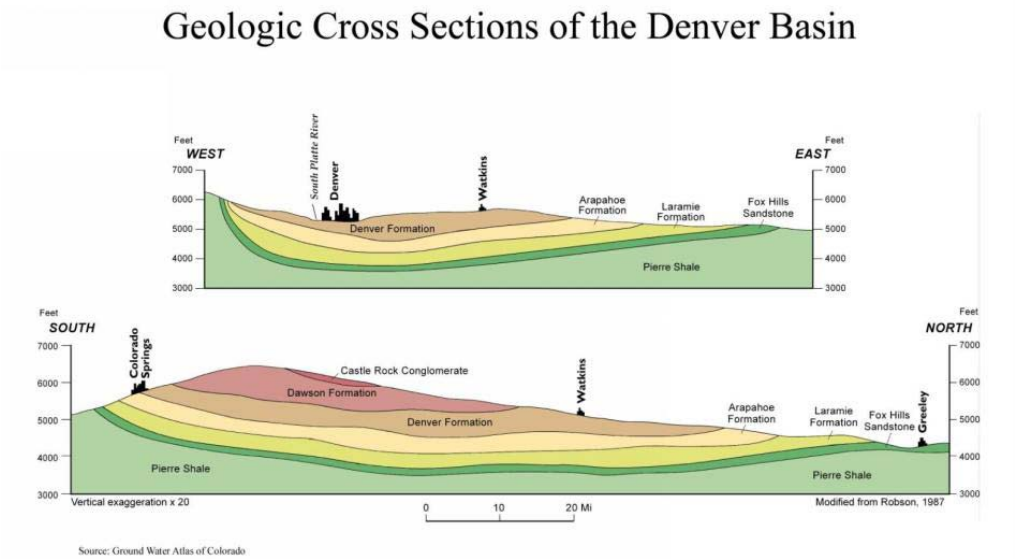

Figure 2. Geologic cross sections of the Denver Basin
(Source: Ground Water Atlas of Colorado, Appraisal Investigation Figure 1-3, 7)

> construction impacts to the habitat of threatened and endangered species in the project area, utilizing aquifer storage and recovery technologies to address drought supply, enlisting renewable energy assets (wind and/or solar) to power the movement and treatment of water supplied by the project, and optimizing the reuse of water supplies in the project area. Exemplary water conservation and water education efforts have been successful and shall be continued" (Addendum, 1).[1]

The project's stated objectives are stated in the Appraisal Investigation, page 24 as:

- Meet the renewable water needs of the region, projected to grow from approximately 5,000 AF in 2010; 35,000 AF in 2030 and over 50,000 AF by 2050

- Develop regional water infrastructure to deliver new supplies to the region from the South Platte River (possibly delivered to the South Platte from other sources in the future)

- Provide adequate firming/carryover and seasonal storage for meeting the reliability and peak seasonal demands with surface water (no major impoundments)

[1] Parenthetical notations are to DCWRA, 2010 materials unless otherwise noted. Note that all direct quotes from DCWRA are shown in teal and indented. Quotes have been changed to indicate the acronyms, figures, and tables as required in this Appraisal Report.

- Provide treatment to meet safe drinking water standards
- Provide adequate finished water storage throughout the study area to meet maximum day demand and emergency conditions (No major impoundments)
- Establish rate and fee structures to fund construction, operation, maintenance, and replacement of the regional water supply system
- Continue to improve on the extensive water conservation practices in the region
- Continue to optimize existing and new resources through reuse

Description of the Proposed Alternative

The proposed alternative will be the key element of an integrated resource management plan by constructing a water system that connects small communities and rural districts throughout the region to allow ready access to renewable supplies available from the South Platte River system.

Infrastructure

The DCWRA description of the proposed alternative is taken directly from the DCWRA description (from Addendum, 6 - 8):

> The proposed alternative is an infrastructure that includes water treatment, raw/finished water transmission, finished water storage, and aquifer storage and recovery (ASR) for delivery of renewable surface water from existing diversions and water impoundments on the South Platte River, to serve a large rural region of central Colorado. Variations of this viable base alternative will constitute a group of alternatives for evaluation during Feasibility. The planned infrastructure will provide safe, reliable drinking water throughout the region using South Platte River-based water supplies through the planning horizon of 2030. Beyond that, the Project can continue to deliver in-basin water supplies that could later be supplemented by water imported from another major river basin(s) if necessary. The infrastructure system may be readily expanded to accommodate future population growth. The proposed alternative will promote stewardship of water, energy, and environmental resources for a sustainable future.
>
> The project elements are presented in Table 1, and the planned infrastructure is conceptually shown in Figure 3. Under terms of the Water Infrastructure and Supply Efficiency (WISE) Partnership agreement, return flows from Denver Water and Aurora will be delivered

to the region as treated water from Aurora's new Binney Water Treatment Plant. The treated water will be conveyed to an existing East Cherry Creek Valley (ECCV) Water and Sanitation District transmission line that moves water west and, at Highway E-470 and Smoky Hill Road, the water would go into ECCV's "Western Pipeline" south and west along Highway E-470. New pipelines can be connected to the Western Pipeline to then convey water throughout the region.

In the western portion of the study area, return flows from most of the Town of Castle Rock, Castle Pines, and Castle Pines North will go into Plum Creek following treatment, along with return flows from other entities along the creek. These return flows can be captured at Centennial Water and Sanitation District's facilities at the confluence of Plum Creek and the South Platte River.

Table 1. Regional Water Supply Infrastructure Plan

Project Element	Function with Respect to Need	Potential Variations	Environmental Considerations
Raw Water Transmission Lines	Convey water from seasonal storage in existing water impoundments to regional treatment facilities	1. Alternative alignments 2. Sizing based on projected demands 3. Sizing based on pump station locations 4. Locations of valve stations	1. Route outside of riparian habitat areas and wetlands where possible 2. Use trenchless construction to minimize impacts at stream crossings
Pump Stations	1. Lift water from lower elevations along S. Platte to higher elevations toward the south of the study area 2. Increase capacity of existing and new transmission lines	1. Number of pump stations 2. Location of pump stations 3. Pressure head added to water at pump stations 4. Consider need to boost chlorine residual at finished water pump stations	1. Locate outside of riparian and wetland areas where possible 2. Use renewable energy to power pump stations, install insulation as possible
Regional Water Treatment Plants	1. Re-treat water received from Aurora and stored seasonally in reservoirs 2. Treat surface water to consistently meet safe drinking water standards 3. Better staffing, training and equipment. vs. numerous local plants 4. Improved health and safety protection	1. Single regional plant 2. Two to four subregional plants 3. Expansion of existing treatment plant(s) 4. Phased need for re-treatment after reservoir storage	1. Locate outside of riparian and wetland areas where possible 2. Accommodate safe handling and storage of chemicals 3. Use renewable energy to power treatment plants, install insulation as possible
Finished Water Transmission Lines	Deliver treated water to delivery points through-out the region	1. Alternative alignments 2. Sizing based on projected demands 3. Sizing based on pump station locations 4. Locations of valve stations	1. Route outside of riparian habitat areas and wetlands where possible 2. Use trenchless construction to minimize impacts at stream crossings

Project Element	Function with Respect to Need	Potential Variations	Environmental Considerations
Finished Water Storage Tanks	1. Provide connection points for local distribution systems 2. Provide emergency storage for fire protection safety 3. Allows transmission lines to be sized smaller for max. day demand vs. peak hour demand 4. Increases service reliability and allows for transmission line maintenance	1. Number of tanks 2. Sizes of tanks 3. Locations of tanks 4. Type of construction 5. Above ground vs. below ground 6. Upgrade and integration of existing local tanks	1. Locate outside of riparian and wetland areas where possible 2. Consider how to mitigate impacts to viewsheds
ASR	1. Allows banking of surface water return flows during wet years 2. Increases drought supply and improves supply reliability 3. Enhances Denver Basin source water protection	1. Number of ASR wells 2. Locations of ASR wells 3. Aquifers used 4. Retrofit existing wells 5. Construct new wells 6. Develop dedicated well field	1. Locate outside of riparian and wetland areas where possible 2. Reduce impacts of climate change and climate variability by establishing drought reserve in aquifer storage
Retrofit irrigation sprinkler heads with rotary sprinkler nozzles throughout the region	1. Improves water conservation 2. Reduces consumptive water use with less evapotranspiration 3. Extends water supplies	How to phase program implementation	1. Demand side efficiencies lessen impacts to our water resources. 2. Water conservation is energy conservation
Energy conservation	1. Promotes project sustainability 2. Reduces long-term costs 3. Minimizes environmental impacts	1. Consider Leadership in Energy and Environmental Design certifiable elements for water plant and pump station design 2. Consider shifting demands to off-peak periods	1. Demand side efficiencies reduce CO2 emissions, carbon footprint. 2. Energy conservation is water conservation
Renewable energy	Promotes project sustainability	1. Consider long-term purchase agreements for wind power from utility company 2. Consider long-term purchase agreements for solar power generated in the area	1. Use of renewable energy to power the project reduces CO2 emissions, carbon footprint of project. 2. Use of renewable energy to treat, & inject reuse water for drought reserve as aquifer storage is highly sustainable.

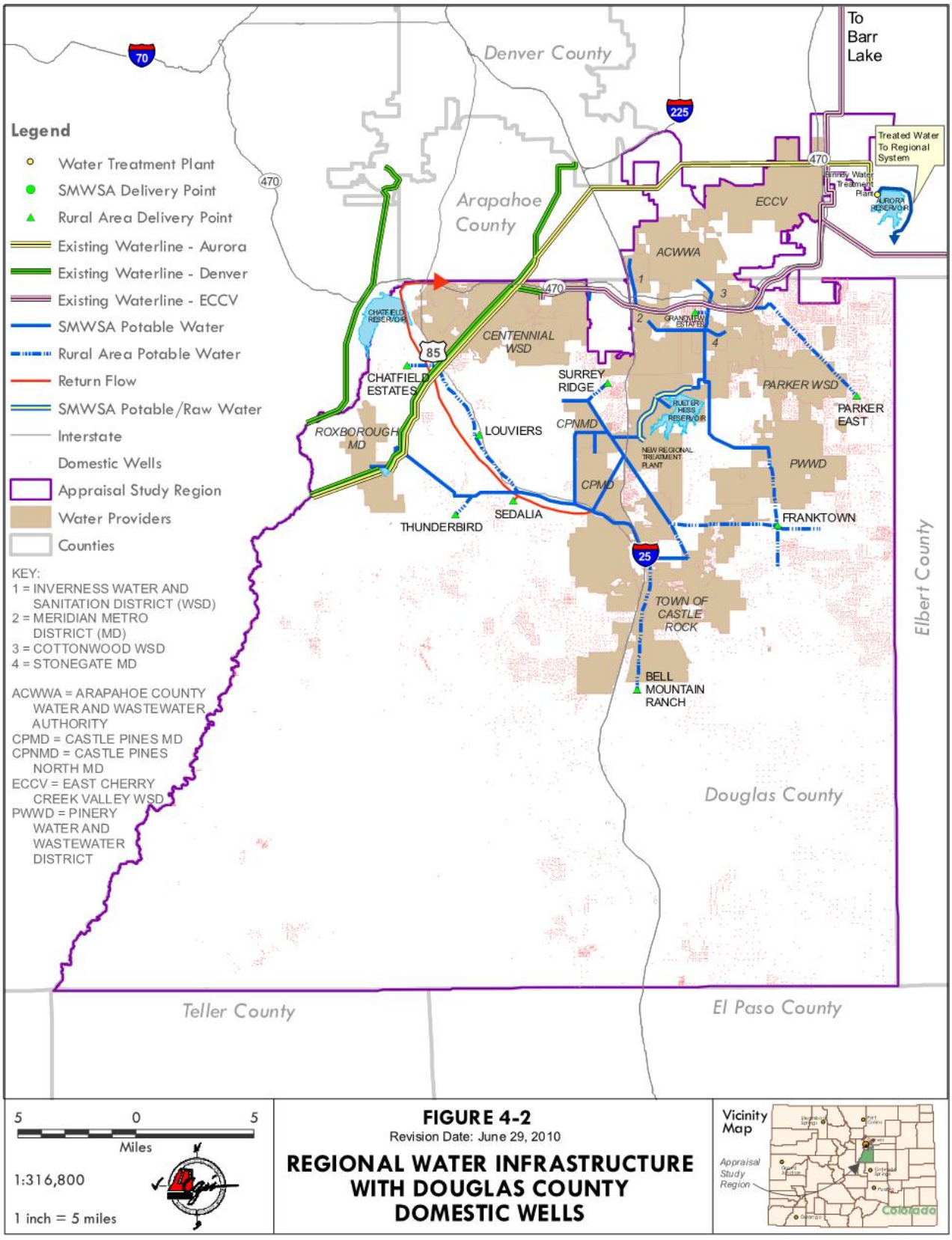

Figure 3. Project Infrastructure location (Revised Figure 4-2 in Addendum, 9)

Water Supply

The DCWRA has entered into a partnership, described in their statements (Addendum, 5):

> "The project participants have engaged in negotiations to purchase renewable water from Denver Water and Aurora that will meet needs through 2030. If needs beyond 2030 exceed the amount of renewable water available from Denver Water and Aurora, additional plans to meet those needs will be considered in the future. Due to the practice of reuse of regional water supplies, no downstream depletions or agricultural to urban transfers are anticipated over the project's twenty-year planning horizon.
>
> In 2009, Denver Water and the City of Aurora approached the SMWSA with an offer to make return flows available in the form of treated water out of the Aurora system. Denver Water, the City of Aurora, and the SMWSA have come together to form the WISE Partnership to provide the water supply for this project contemplated under the Reclamation Rural Water Supply Program. This commitment represents the largest water conservation effort in the American West and will greatly relieve potential impacts to agriculture on the Front Range of Colorado that would otherwise be needed.
>
> The agreement begins with at least 5,000 acre-feet (AF) of water, and can result in yields up to 11,000 AF per year over the first five years of the project. The agreement later grows to provide 37,000 AF of average annual yield. A $425,000 engineering study is now underway to further quantify how this water supply will be made available to the project in eight of every ten years. The worst hydrology on record has been used to model back-to-back drought year conditions in two of every ten years. This study should be completed in September 2010, and weave into the Feasibility Study phase of Reclamation's planning process. Aquifer Storage and Recovery technology will be utilized to store water in four year back-to-back cycles, using some of the 300 high-production wells that are now used for Denver Basin groundwater production in the project area. A $525,000 study is now underway to determine the best ASR sites, and this study will also be timely for the Feasibility effort. Surface water storage will be used in addition to ASR.
>
> The point of connection of this water supply to the $558 million infrastructure contemplated in the project cost estimate is Aurora's Binney Water Treatment Plant, located at the foot of Aurora Reservoir in the northwest portion of Figure 3. Water that goes to storage will need to be re-treated, and that is part of the infrastructure envisioned by the Appraisal Investigation. Total capital costs will be half of what would otherwise be

needed, as there is no need to include costs for water rights. The project will rely upon the Denver/Aurora commitment. The water is already imported to the South Platte Basin and is thus fully consumable. The supplies were mitigated by Denver and Aurora when the resource was developed, and its reuse would not introduce any unaccounted depletions to the South Platte River. During early years, the project will run water directly from Aurora treatment into the region. As more renewable water is used, and reliance upon the Denver Basin groundwater production wells is lessened, there will be a need for additional storage and treatment. Surface water storage will be used in addition to ASR."

Rural Water Eligibility

Sponsor and Project Eligibility

DCWRA, as a non-Federal project sponsor, is eligible for the Rural Water Program under Rule § 404.6.

The project is eligible under Rule § 404.7.

Program Priorities

This project addresses the priorities as outlined in Rule § 404.13 and the FOA, Section V.A.2. Reclamation finds that the DWCRA has adequately addressed these issues at an appraisal level of detail. The statements from DCWRA in their cover letter, June 30, 2010 provide more information:

> "The project may be prioritized by Reclamation under the following factors found in Rule § 404.13 of the Title I rule:
>
> *a) Whether there is an urgent and compelling need for a rural water supply project that will:*
>
> *1) Address present or future water supply needs.* 325,000 residents currently rely upon the aquifers of the Denver Basin for their water supply. Water levels in producing wells are dropping rapidly. Production rates associated with these wells are also dropping rapidly. Some regions on the fringes of the study area are currently incapable of meeting demand. Left unaddressed, this issue will spread towards the center of the region, impacting ever larger segments of the population. Existing studies demonstrate it is not possible to drill the number of wells needed to meet demand, nor is it economic to expend limited financial resources drilling ever increasing numbers of wells while chasing declining production rates. Instead, the region must design, build, and fund replacement of the existing system of aquifer wells with a renewable surface water system on a timeline that is well within historical planning horizons. This transformation to the new surface infrastructure must take place before the wells run dry, if the economic system to pay for the new system is to remain intact, and if the aquifers are to be preserved as a

facet of regional drought planning efforts. Movement on planning and funding the construction of the infrastructure associated with the renewable surface water supply system is today both urgent and compelling. We must address the situation immediately.

2) Promote public health and safety by addressing present and preventing future violations of drinking water standards. The U.S. Environmental Protection Agency finds most violations of drinking water standards occur in small systems. Constructing a regional watershed based system provides for the training and staffing to meet present drinking water standards, including chlorination of the groundwater system that will be used as part of the ASR features of the project, as well as reuse of effluent from regional treatment facilities.

b) The extent to which a rural water supply project promotes and applies a regional or watershed perspective to water resource management as defined in 404.2 (an approach to rural water supply planning directed at meeting the needs of geographically dispersed localities across a region or a watershed that will take advantage of economies of scale and foster opportunities for partnerships. This approach also takes into account the interconnectedness of water and land resources, encourages the active participation of all interested groups, and uses the full spectrum of technical disciplines in activities and decision-making). The project, includes thirty water providers, and some individual well users, geographically dispersed across two counties, who are working together in a watershed based approach to eliminate dependence upon a non-renewable groundwater source. The regional participants are working together to bring a renewable surface infrastructure system to the region. The cost of the required infrastructure precludes any water provider from acting alone to create a solution, but by working together to create economies of scale, a solution is in fact economic and affordable. Not until this Reclamation Rural Water Supply Program effort have the water users in this watershed come together to make this future possible. The process will take into account the interconnectedness of water and land resources, using new technologies and professional engineering firms to incorporate aquifer storage and recovery, reuse of existing water resources, trenchless construction of pipelines, renewable energy resources, and exemplary water conservation measures to avoid environmental impacts in providing water infrastructure throughout the study area. Public communication will be a hallmark of this project. Currently, approximately forty entities message to the citizens of the project area on water topics. The outreach features of the program will help coordinate this messaging. The intergovernmental agreement that has created a committee to help guide the effort is believed to represent all interested groups in the study area, and new groups will be included in the efforts as they are discovered. The region has made tremendous progress in working with Denver Water and the City of Aurora to make use of their return flows, but

needs Federal assistance to complete the infrastructure needed to deliver that water throughout the region.

c) The financial need of the project sponsor for assistance with the planning, design, and construction of a rural water supply project, as demonstrated by readily available local and regional economic indicators. The Appraisal Investigation illustrates that while the citizens of the study area enjoy high per capita and median household income, without the Reclamation Rural Water Supply Program assistance, structural factors will prevent the water entities in the study area from coming together to perform in a timely fashion. The water users are already paying for one water system, the rapidly declining groundwater based system, at the same time they are being asked to design and construct a new surface based water supply system. Planning and designing this system is a daunting chore for the region to undertake, having never come together before on this sort of regional water project. The Reclamation program really helps the water users come together to plan for a successful future. As for construction, a lot of money is needed in a short period of time in order to build the project. Financial assistance, in the form of Federal loan guarantees, provide the blanket financial instrument that allows the region to come together and perform along a very tight time line, a reflection of the urgency of this situation.

d) The extent to which Reclamation is uniquely qualified to plan, design, and build the project. While the Reclamation Rural Water Supply Project represents a first formal rural water program, Reclamation has significant history building major water projects, and many rural water projects. The water users in the study area have never attempted this sort task, nor a task of this magnitude, and believe Reclamation is uniquely qualified to plan, design, and build the project.

e) Whether a rural water supply project helps meet applicable requirements established by law. The State of Colorado has established the amount of water that was believed to be available to water users from the Denver Basin groundwater systems. We [DCWRA] now know we will not enjoy the water resources from the Denver Basin we believed we would be able to enjoy. This water project will help meet those requirements established under state law to provide an adequate water supply to the communities of the project area.

f) The extent to which a rural water supply project serves Indian Tribes that have inadequate water systems. There is no known Indian Tribe in the service area.

g) The extent to which a rural water supply project is ineligible for comprehensive funding (sufficient to fully fund planning and construction to the entire project) through other assistance programs. U.S. Department of Agriculture (USDA) assistance programs apply to populations under 10,000,

while [Douglas County has] several communities over 10,000, but under 50,000 in population. USDA does not provide pre-development assistance to projects, while the Reclamation program does for planning and design. State revolving fund programs are not large enough to provide the financial assistance needed in the time available for a solution, if ever. In these ways, only the Reclamation Rural Water Supply Program can provide for comprehensive planning and funding assistance.

h) The extent to which a rural water supply project is identified as a priority by state, tribal or local governments. Colorado's statewide water planning process identified the project area as the most water short in all the State. The State has provided $600,000 in funding to the local non-Federal sponsor to pursue this opportunity with Reclamation. The Douglas County Board of County Commissioners has declared water supply its number one priority, and has provided funding and staff time to pursue this opportunity with Reclamation. Regional water organizations representing not only County Government, but also water providers, municipalities, and small and individual water users in the region, have all come together to sign an intergovernmental agreement to pursue this opportunity with Reclamation. Our U.S. Senator [Senator Mark Udall] and Congressmen [Representative Mike Coffman] have furnished letters of support to Reclamation for this opportunity for a rural water supply project in the study area.

i) Whether a rural water supply project incorporates an innovative approach that effectively addresses water supply problems and needs, either by applying new technology or by employing a creative administrative or cooperative solution. Water interests are for the first time coming together, working through the Reclamation Rural Water Supply Program to plan, design, fund, and build a rural water supply project, and to make use of return flows from Denver Water and the City of Aurora in what will be the largest water conservation project in the country. This is decidedly innovative and presents a great opportunity to protect environmental resources and preserve agricultural use of water in the South Platte Basin. It is in fact something we [DCWRA] could otherwise not fathom happening in time to address the water issues facing the study area. There are presently thirty water providers in the region who currently pursue an independent future. They cannot succeed acting on their own. Coming together to address a solution for the future means success for the region. The project will include aquifer storage and recovery, reuse of existing water resources, renewable energy sources to treat and move the water through the regional infrastructure, trenchless construction to avoid environmental impacts, exemplary water conservation measures to assure precious water resources are used efficiently, and fully staffed and trained employees operating a regional water system, come together under one creative and cooperative administrative solution under the Reclamation Rural Water Supply Program in the areas of Douglas and Arapahoe Counties, Colorado. These areas have grown reliant upon non-renewable Denver Basin groundwater. But with the assistance of

Reclamation, a creative, cooperative solution can be planned, designed, funded, and constructed in a timely fashion."

Reclamation's Findings

This section summarizes Reclamation's findings on how the proposed project meets each of the requirements of Rule § 404.44. Reclamation found that the items required under the Rule and FOA were adequately addressed in DCWRA's Appraisal Investigation and that it was technically sufficient.

Project Objective, Purpose, and Need

Objectives and Purpose

The project's objectives and purpose (defined in the Introduction and Background) are appropriately defined and found to be adequate. If the sponsor's purpose and need is to procure and deliver an affordable, sustainable water supply to meet projected needs until 2030, the alternative suggested is viable enough to move to the Feasibility Study phase.

Need

The *Statewide Water Supply Initiative* (CDM, 2004) identifies the study area as part of the region having the greatest unmet water supply need (gap) in the State. The future for this area includes a projected 409,700 acre-feet (AF)/year increased demand for water resources (50 percent over current demands) through 2030.

Water providers in the study region rely primarily upon nonrenewable groundwater to supply the area's needs. Groundwater underlying the region is being mined from non-tributary, nonrenewable aquifers, thus the supply is unsustainable. A need exists to plan, fund, and construct—on an urgent and expedited basis—a regional watershed based infrastructure system to provide more sustainable water supplies throughout the project area.

Alternative Evaluation

Reasonable Range

A reasonable range of alternatives (structural or nonstructural) has been formulated and evaluated (Rule § 404.44 [a[). Possible variations are shown in Table 1 in the Introduction and Background Section as part of the alternative description for each of the elements.

At Least One Viable Alternative

The recommendation for further study of one or more alternatives is clearly supported by the analysis in the Appraisal Investigation (Rule § 404.44 [b[).

The proponent has described a single proposed alternative with multiple infrastructure and water options, depending on the quantity and location of future water supplies. The proposed alternative would build an infrastructure that includes water treatment, raw/finished water transmission, finished water storage, and ASR for delivery of renewable surface water from existing diversions and water impoundments on the South Platte River, to serve a large rural region of central Colorado. This single option is very open-ended and not specific about locations, sizing, and components of the project. At the appraisal level of investigation, no fatal flaws have been identified.

Reclamation has reviewed the report and determined that, from an engineering standpoint, Douglas County water report met this Reclamation-wide appraisal standard as outlined in Reclamation Manual, Design Data Collection Guidelines, Chapter 2 – Appraisal Investigations (Reclamation 2007).

Water supply

The project participants have engaged in negotiations to purchase renewable water from Denver Water and Aurora that will meet needs through 2030. If needs beyond 2030 exceed the amount of renewable water available from Denver Water and Aurora, additional plans to meet those needs will be considered in the future.

A typical minimum planning use is an average of 165 gallons per day per capita (gpdc) in an area without heavy industry. Denver Water was about 211 gpdc but this was reduced to about 165 during a recent drought. Denver Water has about a 22 percent conservation goal for year 2016. (Denver Water 2010). If Douglas County has a similar goal, the average daily demand may be about 130 gpdc. Table 2 provides some estimates on population and use.

Table 2. Population and use projections

Year	Population	Daily use (gallons per day)	Water (AF/year)
2010	325,089	165	60,125
2030	440,000	165	81,378
2030 With conservation (22%)	440,000	130	64,116

While the water supply would need to be acquired, it is possible to do so. The sponsors have identified sources of water as listed in the WISE partnership in the alternatives description.

Environmental

While environmental issues will need to be evaluated, there are no identifiable "showstoppers."

Design and costs

The pipeline infrastructure has been planned to meet the water demands provided by the partnering water districts. Water treatment, storage, and pumping plants have been tentatively identified. The project is technically viable from an

engineering standpoint and from an engineering cost estimate standpoint. Reclamation did not perform an independent cost estimate but reviewed the sponsor's cost estimates for infrastructure. Table 3 provides these cost estimates from DCWRA. As noted in recommendations, costs for water supplies would need to be clarified at a feasibility level. Estimates of water supply costs seemed adequate for an appraisal level. Note that water supply costs are not part of the alternative proposed for Federal loan guarantees under the Rural Water Supply Program.

Table 3. Conceptual Design-Project Cost Estimates (From DCWRA Addendum, 13)
($M, June 2010)

Description	Total Cost ($M)
Construction Pay Items	
SMSWA Conveyance	
Northern/Western Line Retrofit	$2.8
Capacity - Pipelines	$67.6
Capacity - Pumps	$24.6
SMSWA Storage and Treatment	
SMSWA Storage	$3.0
SMSWA Treatment	$129.0
Rural Area Conveyance	
Capacity - Pipelines	$15.7
Capacity - Pumps	$15.4
Rural Area Storage and Treatment	
Rural Area Storage	$12.0
Rural Area Treatment	$21.5
Subtotal Estimated Construction Pay Items:	**$291.6**
Allowance for Unlisted Items (15% of Construction Pay Items)	$43.7
Mobilization (5% of Subtotal Construction Pay Items)	$14.6
Permits (2% of Construction Pay Items)	$5.8
Bond (2% of Construction Pay Items)	$5.8
Estimated Construction Contract Cost:	**$361.6**
Construction Contingency (30% of Construction Contract Cost)	$108.5
Estimated Total Field Cost:	**$470.0**
Non-Contract Costs	
Design Engineering Services (8% of Total Field Cost)	$37.6
Construction Management Services (5% of Total Field Cost)	$23.5
Geotechnical Services (2% of Total Field Cost)	$9.4
Survey Services (2% of Total Field Cost)	$9.4
Feasibility Study	$1.5
Land Acquisition	$6.6
Estimated Total Project Capital Costs ($M, June 2010):	**$558.0**

Annual Treated Water Costs ($, June 2010)	
WISE Partnership, Phase I	$6M-$21M
WISE Partnership, Phase II	$44M-$72M

Conceptual Design-Estimated Project Operations, Maintenance, and Replacement (OM&R) Costs ($M, June 2010)	
Project Operation & Maintenance Costs	$23.0
Project Replacement Costs (2% of Project Capital Costs)	$11.2
Total Estimated Project OM&R Costs ($M, June 2010):	**$34.2**

Economic and Financial

The project appears to be economically and financially viable.

Alternative Evaluation

Reclamation found that the Appraisal Investigation adequately addressed the criteria in Rule § 404.44 (c). Table 4 summarizes Reclamation's findings.

Table 4. Reclamation's findings for alternative evaluation

Evaluation criteria	Citation	Reclamation's findings
Has sufficient water supplies	Rule § 404.44 (c) (1)	The project participants have engaged in negotiations to purchase lower quality "reuse water"—i.e., renewable water from Denver Water and Aurora that will meet needs through 2030. If needs beyond 2030 exceed the amount of renewable water available from Denver Water and Aurora, additional plans to meet those needs will be considered in the future. Satisfying the need for water supplies after 2030 has significant additional risks as they will likely need to come from outside the Platte Basin.
Has positive effect on health and safety	Rule § 404.44 (c) (2)	The DWCRA states that "the project proposed under the Reclamation Rural Water Supply Program is expected to reduce these types of violations by at least 20 percent through training, consistency guidance, and infrastructure construction." (Addendum, 18). Reclamation concurs with this statement, given the appraisal level of analysis.
Will meet water demand, including future needs	Rule § 404.44 (c) (3)	The need for the project presented in the Appraisal Investigation and South Metro Water Supply studies is based on meeting the need of future growth. Assuming that the water supplies (discussed above) are procured, the project is sized to meet this demand.
Provides environmental benefits	Rule § 404.44 (c) (4)	Environmental benefits may include greater use of surface water from return flow obligations in Cherry and Plum Creek. Return flows in the creeks could benefit important riparian habitat areas and wetlands along the two creeks. The project may protect the Denver Basin groundwater from over-pumping as well as other source water protection measures. It is unknown whether these benefits may be offset by potential depletions in the Platte River and other potential imported sources in the long term (beyond 2030).
Provides source water protection	Rule § 404.44 (c) (4)	After additional renewable water supplies are located and acquired, the proposed distribution system and ASR would provide benefits to the Denver basin aquifer.

Evaluation criteria	Citation	Reclamation's findings
Applies a regional or watershed perspective	Rule § 404.44 (c) (5)	This project will foster opportunities for partnerships (e.g., creating financial blanket, working together.) Without this cooperation, long-term planning for water in this region is difficult and unlikely. DCWRA is working with South Platte River users and organizations.
Promotes benefits in the region	Rule § 404.44 (c) (5)	The largest benefit is promoting both infrastructure and financial coordination among the Front Range water communities, including the greater metro Denver area.
Implements an integrated water resources management approach	Rule § 404.44 (c) (6)	The project would have a high likelihood of: **Managing water resources at the basin or watershed scale.** This project proposes to integrate multiple sources of water for multiple uses and provide a regional or basin infrastructure. **Optimizing supply**. The proposed alternative is based on a previously assessed water system from Centennial to analyze imbalances and supplies. Managing demand. Water conservation efforts are lowering demand. Project proposes to adopt new water efficiency measurements to manage demand regionally. **Providing equitable access to water resources through participatory and transparent governance and management.** More than 40 water providers in the region are coordinating and are interacting with the public through meetings, questionnaires, and websites. **Establishing improved and integrated policy, regulatory, and institutional frameworks.** The project is envisioned to help meet regulatory requirements administered by the Colorado Department of Public Health and Environment. One objective is to establish rate and fee structures to fund construction and OM&R. **Utilizing an intersectoral approach to decision-making, where authority for managing water resources is employed responsibly and stakeholders have a share in the process**. The project has public involvement and coordinates with other communities to ensure stakeholders. **Land and environmental resources.** The region is expected to use land stewardship responsibilities to maintain the rural character.
Enhances water management flexibility	Rule § 404.44 (c) (7)	The project envisions augmenting the current groundwater supply with future surface water supplies and incorporates aspects of ASR.
Provides for local control of water supplies and, where applicable, encouraging participation in water banking and markets	Rule § 404.44 (c) (7)	DCWRA states that "The ASR efforts are envisioned on a regional basis with numerous water providers, and do represent a water banking opportunity. The thought is to deposit wet-year water, and then withdraw water from the aquifers during periods of drought. This practice is already piloted with one water provider, and the goal is to expand that capability as part of this project." (Addendum, 12). Coordinated local controls could provide more flexibility within the region.
Promotes long-term protection of water supplies	Rule § 404.44 (c) (8)	The project proposes to provide reasonable assurances for water supplies from the present until 2030. However, beyond 2030, if out-of-basin water supplies are required, those water supplies are yet unknown.

Evaluation criteria	Citation	Reclamation's findings
Includes preliminary cost estimates that are reasonable and supported	Rule § 404.44 (c) (9)	In general, it appears the cost estimate was prepared within accordance with applicable Reclamation Manual Directives and Standards for cost estimating. Construction pay item costs reviewed appeared reasonable for this appraisal level cost estimate based on preliminary conceptual system layouts and the level of detail and cost information provided for this review.
Is cost-effective and generates national net economic benefits (P&Gs)	Rule § 404.44 (c) (10)	Economic justification is provided in the Appraisal Investigation in terms of providing the same level of benefit at reduced cost compared to no action and other possible alternatives. However, this assumes that meeting estimated future demands (growth projections) is considered a sufficient need and other measures (such as conservation) could not balance supply and demand.
Ability to pay 100% of OM&R	Rule § 404.44 (c) (11)	The basic financial requirement is to demonstrate that 100% of OM&R cost can be paid by the project sponsor and a minimum of 25% of construction cost can be paid by non-Federal sources. The information in the Appraisal Investigation addresses this requirement. It is clear from the cost estimates provided in the Appraisal Investigation and supporting documents as well as the repayment capacity discussion on pages 38 and 39 of the Appraisal Investigation that the project sponsor will be able to pay 100% of OM&R costs and more than 25% of project construction costs.

Other Appraisal Investigation Requirements

Reclamation found that the sponsor adequately addressed the other factors that Reclamation deems appropriate under Rule § 404.44 (c) (12) and that are outlined in the FOA Section IV.D.2. At an appraisal level, it is difficult to determine the alternative configurations needed to judge the effectiveness of these measures. However, Reclamation staff have reviewed the DCWRA material and find that there is a wide range of opportunities to:

- Minimize or reduce energy use and minimize or reduce water consumption (as water sources would be from re-using and re-conserving Denver Water and Aurora Metro water waste)
- Use renewable energy (as DWCRA are examining the potential for solar and other renewable energy sources within Colorado)
- Provide environmental benefits and reduce impacts to critical habitat (through additional reuse surface flows or groundwater recharge)
- Provide innovative technologies (through water reuse and ASR)
- Provide creative administrative or cooperative solutions (through creating institutional approaches for region-wide infrastructure and cooperation).

The sponsor statements are summarized in Table 5.

Table 5. Applicant statements for other Appraisal Investigation requirements

Administration program requirements	Citation	Applicant Statements
Minimize or reduce energy use	FOA IV.D.1(1)	By virtue of the proposed renewable water supply, energy use will be capped at a finite demand vs. the alternative of an ever-increasing number of wells pumping diminishing water from very deep aquifers. The treatment plants and pump stations can be designed with energy saving features. We [DCWRA] propose to project and compare energy usage for the new supply vs. the existing groundwater supply at the Feasibility stage, but anticipate that the new supply will be more efficient. A robust water conservation effort is now in place in the region. (Written communication).
Minimize or reduce water consumption	FOA IV.D.1(2)	The region's water providers lead the state in water conservation efforts. As an example, the Town of Castle Rock has achieved a usage rate of just 127 gpdc on a five-year rolling average, system wide. That is down from 170 gpdc before the Town implemented its water conservation plan. Last year, usage dropped to 117 gpdc, but it was a relatively cool, wet year. All but one of the water providers in the region with annual demands in excess of 2,000 AF have submitted water conservation plans to the State; the one remaining plans to submit their plan in July 2010. Douglas County is assisting 20 of the smaller water providers in developing their own water conservation plans. These individual plans will be compiled into Colorado's first regional water conservation plan, and that plan will be submitted for state approval. Plans feature tiered pricing, elimination of system leaks, rebates, and education. Drought planning is tied to the ASR studies being pursued by SMWSA. For additional information, please visit <http://www.DCWater.org> (Appraisal Investigation, 27 - 28).
Use renewable energy	FOA IV.D.1(2)	The applicant [DCWRA] is focused on a sustainable future for the region, and there are several options for including sustainable energy as part of the Project, including purchase of wind generated electricity. This will be described further in the Feasibility application [FOA]. (Written communication).
Provide environmental benefits[1]	FOA IV.D.1(3)	The proposed project will promote protection of Denver Basin groundwater from over-pumping as well as other source water protection measures. Greater use of surface water will tend to result in more flow in Cherry Creek and Plum Creek, benefitting important riparian habitat areas and wetlands along the two creeks. (Addendum, 16)

Administration program requirements	Citation	Applicant Statements
Reduce impacts to critical habitat for Federally-listed threatened or endangered species	FOA IV.D.1(3)	In addition to Preble's meadow jumping mouse (*Zapus hudsonius preblei*), the U.S. Fish and Wildlife Service lists several species that are affected or have critical habitat downstream that may be affected by depletions to the South Platte River. The proposed alternative's system will generally be constructed along roadways and in previously disturbed areas. (adapted from Appraisal Investigation, 11).
Provides innovative technologies	FOA IV.D.1(4)	**ASR** The proposed project will embrace regional ASR efforts for drought supply, a relatively new technology in the Denver Basin aquifers that will allow the water providers to bank surface water that is available in wet years for later pumping during dry years. (Addendum, 10).
Provides creative administrative or cooperative solutions.	FOA IV.D.1(4) Rule §404.13 (i)	**Financial** It is crucial to note that another benefit to success of the Project is the creation of a unique blanket financial instrument that provides water users the ability to come together at the same time on the financial commitments associated with building the regional water infrastructure. Without the loan guarantees, a coordinated financing approach among the many water provider boards and councils would be very difficult and unlikely. (Appraisal Investigation, 10) **Cooperation** The Project is also one that exemplifies a cooperative solution. The regional project partners represent more than 40 water providers and 10,000 rural homeowners who have come together to move forward with developing a sustainable water future. The region is also working closely with two of the three largest water providers in the state, Denver Water and Aurora, to cooperate on water supply and infrastructure development. (Appraisal Investigation, 10)

Source water protection is also a requirement under FOA IV.D.1(3) but it is discussed in Table 4.

Recommendations

As required under Rule §404.45 and the Draft Directives and Standards for Rural Water (Section 11), Reclamation has determined that it is appropriate to proceed to a Feasibility Study based on the criteria in Rule § 404.13 and Rule § 404.44.

The Feasibility Study should address the following issues:

Planning
Objectives need to be narrowed and focused in the Feasibility Study.

Cost share partners will need to determine individual cost share needs and financial needs. Douglas County acknowledges this: "As the planning process evolves under Feasibility, there will be resolution as to who pays what. Feasibility greatly benefits the task of pulling all these factors together into a unified planning process." (Addendum, 11)

There needs to be an evaluation of environmental benefits and impacts from potential depletions in the Platte River and other potential imported sources in the long term (beyond 2030).

The required permits, licenses, compliance processes will need to have a clear purpose and need and will need to show how the Feasibility alternatives meet that purpose and need, including water supply acquisition.

Design
The Feasibility stage will require examining multiple configurations of the basic components of the Project.

Contruction and OM&R cost estimates
OM&R costs and assumptions for each alternative configuration will also need to be provided in more detail.

Costs for acquiring an adequate water supply will need to be refined.

Risks and uncertainties will also need to be addressed for both OM&R and construction for all alternatives considered at the Feasibility stage.

Population projections also depend on many factors, including the wider front Range populations. In the Feasibility Study, multiple development scenarios may need to be developed and examined to determine the cost effectiveness of the alternatives if the future population projections in the Appraisal Investigation are not met.

Water supply
Water supply and acquisition will need to be examined at a Feasibility level of detail.

Additional investigations to determine how new infrastructure can help the various suppliers provide water that meets safe drinking water standards is needed.

The project would reduce the demand for high magnesium iron and radionuclide groundwater. However, additional study of the radionuclide risk from "localized risk of Denver Basin wells" (Appraisal Investigation, 19) is needed.

DCWRA may need to coordinate in the future with potential source waters outside of the basin.

Environmental
Each future source of new water supplies will need additional National Environmental Policy Act documentation, as required.

For both Denver Basin and South Platte River throughout Colorado through 2030 and after 2030 any other imported water location, consultation will be needed with:

- Agencies and stakeholders for source water, transmission, treatment, and conveyance.
- Regional entities and initiatives (e.g., the South Platte Recovery Implementation Plan)
- Environmental (e,g., Endangered Species Act, Fish and Wildlife Coordination Act)
- Cultural (e.g., National Historic Preservation Act)
- Local non-governmental organizations, water districts, tribes, states, local governments

Issues to address regarding the extent of transfer of water from agriculture (either avoided through WISE or needed for additional supplies) include:

- Uses to meet the water needs associated with urban population growth Economic impact of water transfers
- Social impacts of this conversion

Risks and uncertainties to address include:
- Climate change
- Acquisition of possible future water rights
- Future water supply sources or needs

References

CDM, 2004. Statewide Water Supply Initiative, Phase I Report. <http://cwcb.state.co.us/IWMD/SWSITechnicalResources/SWSIPhaseIReport/> and Phase II Report <http://cwcb.state.co.us/IWMD/SWSITechnicalResources/SWSIPhaseIIReport/SWSIPhaseIIReport.htm> Prepared for: State of Colorado, Colorado Department of Natural Resources, Colorado Water Conservation Board. Prepared by CDM, 1331 17th Street, Suite 1200, Denver, Colorado 80202.

Code of Federal Regulations, 2008. "Reclamation Rural Water Supply Program." Interim Final Rule. *Code of Federal Regulations*, Title 43, Pt. 404, 2008 ed.

Denver Water, 2010. Denver Conservation Plan. <http://www.denverwater.org/Conservation/ConservationPlan/>. Accessed July 2, 2010.

Douglas County Water Resources Authority, 2010. Written Communication. Notebook containing cover letter (tab 1), Appraisal Investigation (tab 2), Appendices (tab 3), Addendum (tab 4), Other written materials (tab 5). (Submitted with Appraisal Report).

Reclamation, 2007. Reclamation Manual, Design Data Collection Guidelines, Chapter 2 – Appraisal Investigations. <http://intra.usbr.gov/~tsc/guidance/design/Chap%202-NEW.pdf>

Reclamation, 2010. Reclamation Manual. Draft Directives and Standards: Rural Water Supply Program.

Reclamation, 2010. Funding Opportunity Announcement, Funding Opportunity Number: R10SF80458, May 15, 2010. <http://www.grants.gov/search/search.do;jsessionid=64v0MnVT2X7NYqT5YVXY06frtnK2HwXs58fPCK8Xk01ykgK1GVl2!-1198434493?oppId=54594&mode=VIEW>.

Water Resources Council, 1983, Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. March 10, 1983.