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Introduction

The rapidly developing communities in the south Denver area include a series of incorporated towns, special purpose (metropolitan and water) districts and unincorporated areas of Arapahoe and Douglas Counties. Recent projections indicate that this area will see a four-fold increase in their water demands at the ultimate build-out level.

These communities lie outside the Combined Service Area of the Denver Water Board and have been developing their own water supplies to meet their municipal demands. Approximately two-thirds of their water supplies are developed from the non-tributary groundwater supplies in the Denver Basin that underlie these communities. Because of the physical nature of this aquifer, it is considered a non-renewable water resource and so the primary water supply is depleting as water is withdrawn for consumptive uses. County commissioners and utility managers have recognized that eventually new and sustainable water resources will have to be developed for this area and have initiated a process to identify when and how those water sources could be developed.

This process is set against the backdrop of a period when the development of new water supplies is managed within a framework of local, state and federal regulations as well as a series of failures to develop major new water supplies in Colorado over the last thirty years. These have included the Two Forks veto, the San Luis Valley groundwater development proposals and the ongoing litigation of water resources in the Gunnison Basin.

The Douglas County Commissioners have supported the development of the South Metro Water Supply Study Board ("Study Board") as the responsible special-purpose district to investigate the alternatives available for developing these new water sources. The Study Board has responded to a series of resolutions that have resulted in a three-way agreement with the Denver Water Board and the Colorado River Water Conservation District. The planning process also responds to the Denver Water Board's 1995 Resource Statement that outlines the terms under which this well-established water utility will consider co-operative efforts or water supply contracts with new areas of demand outside the Combined Service Area..

The Three-Way Agreement describes a number of key protocols that were required to allow the three parties to jointly oversee the analysis of various technical issues and to deliberate on a series of policy issues required for the implementation of any recommended water resource development programs. The requirements of the Three-Way Agreement represent a major change from the traditional development approach to large water resources programs where a "winner-takes-all" approach has often resulted in a "lose-lose" situation for all parties.

The participants in that Agreement have all recognized that the key to successfully addressing the many issues involved will require a level of co-operation and collaboration that has been atypical of water development in the West. Limited and drought-prone water resources coupled with increasingly complex regulatory and decision-making settings have severely restricted the ability of municipalities to structurally develop water resources to meet future consumptive demands. Co-operative planning, development and operation of regional water resources between the basin-of-origin, existing water utilities and the new growth areas as well as regulators and the public interest are seen as a viable way in which water supply infrastructure needs will be met in the future.

The South Metro Denver Setting

This segment of the Denver metropolitan area includes northern Douglas County and south central Arapahoe County and stretches from the South Platte River eastwards to the E-470 corridor and from the Denver Tech Center south to the Town of Castle Rock. The current population served in this area is approximately 160,000 with a build-out population of over 650,000. The area also includes many high value companies with estimates that 25% of the State's annual economy is controlled from those businesses.

The service areas of the various water districts and water providers include approximately 134 square miles of which 37 square miles is currently developed.

Currently Available Water Resources

The water providers currently deliver over 37,000 acre-feet per year of water to customers with this demand expected to increase four-fold at build-out to an annual demand of 146,000 acre-feet per year. Those demands will be met with a combination of

nontributary groundwater, surface water, conservation and reuse. Groundwater supplies theoretically available to the providers amount to 115,000 acre-feet per year, surface water supplies account for 29,000 acre-feet per year and reuse of return flows is estimated to be approximately 27,600 acre-feet per year.

Approximately two-thirds of the available water supplies are to be developed from non-tributary aquifers in the underlying Denver Basin. Of that amount, about 60% of the adjudicated groundwater is found in the more productive and higher quality Denver and Arapahoe aquifers. The other 40% of the adjudicated groundwater is equally divided between the lower quality and less productive Dawson and Laramie-Fox Hills aquifers. The adjudicated volumes are calculated using theoretical assumptions on aquifer properties and the recoverable volumes and the economic life of the aquifers are expected to limit the utility of the aquifers if they are pumped according to current rules. It is known that these aquifers are non-renewable resources and elected officials and water utility managers recognize the need for the eventual need to introduce sustainable water resources.

Current efforts to minimize pumping of the deep aquifers include aggressive water conservation programs, down zoning of platted areas, open space acquisitions, non-potable reuse programs and augmentation plans that maximize the use of the available local water supplies.

Need for Long-Term, Reliable Water Supplies

The primary water supplies available to the South Metro area are found in the non-renewable Denver Basin aquifers. This water resource is an extensive aquifer system that stretches from Colorado Springs to Greeley and includes an estimated 150 million acre-feet of recoverable groundwater in the five county metropolitan area. Approximately 40 million acre-feet of groundwater has been estimated to be in storage below Douglas County – there are, however, major questions about the economically recoverable amounts and whether the aquifers should be considered as resources to be mined as allowed by current State regulations.

Stresses on the aquifers have been seen after 20 years of pumping and recent State reports on the aquifer have noted drops in water levels of several hundred feet as well as the drying of small domestic wells and wells along the fringes of the aquifers. These large drops in some municipal wells are thought to be primarily a result of reductions in water pressure as opposed to withdrawal of large volumes of water from unconfined aquifers. Those same studies also quantify the lack of natural recharge to the aquifers so over the long term, the aquifers are considered to be non-renewable resources. The value of the aquifers should be established as a long-term water resource that is available as a drought reserve (to be compared with alternative surface water reservoirs that may be proposed) as well as a lower cost water supply to lower demand areas. These key policy questions will be considered as a part of the ongoing evaluations.

The Douglas County Water Resource Authority (DCWRA) and the South Metro Water Supply Study Board.

As a result of growth-related concerns identified by the Douglas County Commissioners in the early 1990's, a series of initiatives were started including open space planning and identification of long term, sustainable water supplies. After a series of meetings between the commissioners and the water districts and municipalities in the county, the Douglas County Water Resource Authority was formed in September 1995. The stated purpose of DCWRA is to "effect the planning and development of water resources, systems and facilities for the benefit of its members and their inhabitants and to integrate surface waters, well waters, wastewater effluent, and stormwaters under the guidance of the Authority". DCWRA acts as the umbrella entity that represents the collective interests of its 18 members until such time as a project-specific initiative is identified and supported.

The South Metro Water Supply Study Board ("Study Board") was formed in 1999 for the specific purpose of supporting the study of the conjunctive use opportunity described in this paper. The Study Board includes 12 water and sanitation districts and municipalities in northern Douglas County as well as adjacent areas of Arapahoe County. The board also includes representatives from Douglas County, Denver Water, Colorado River Water Conservation District and the State of Colorado in a role of technical peer review.

Denver Water Board's 1995 Resource Statement

One of the outcomes of the Denver Water Board's Integrated Resource Planning process was a Resource Statement that describes how current and future water supply obligations should be met. On October 15, 1995, the Denver Water Board issued their Board Resource Statement to provide guidance on how that water utility would allocate water resources to customers within their service area. It also described how the Board would promote productive interactions with entities outside the Board's service area while protecting the core infrastructure and water rights that constitute the Denver Water system. Specifically, for the Board to co-operatively participate in the South Metro Water Supply Study the following factors had to be considered:

1. Provide a significant water yield or water saving for use within the Combined Service Area, improve the operational efficiency of the Board's water system or make better use of the Board's water rights;
2. Minimize the Board's regulatory, financial, legal and political risk;
3. Limit the Board's obligations to provide water outside the Combined Service Area;
4. Presumes that an aggressive water conservation program will be implemented;
5. Efficient use of water resources will include pursuit of non-potable reuse alternatives;
6. The Board's existing water rights will be used rather than having to develop new rights;
7. Consolidation of actions within a geographic area;
8. Fosters environmental protection;
9. Initiates a process that gains acceptance of those outside the Denver metro area who could be impacted by the proposal;
10. Ensures that groundwater uses are sustainable;
11. Provides visible benefits to the citizens of Denver.

This guidance gave clear direction to the newly developing areas of metropolitan Denver on how Denver Water would consider proposals to collaboratively study and develop new water supplies.

State Planning Efforts

Governor Romer and the Colorado General Assembly recognized in 1993 that severe and often crippling conflicts were preventing the development of large-scale water supply infrastructure such as trans-basin diversions. As a result, a Metropolitan Water Supply Investigation (MWSI) was initiated to study supply-side approaches to water supply development and included the cooperative uses, operation and/ or linkage of existing water supply systems in a way that would enhance yields. By design, the MWSI did not consider new projects requiring significant new infrastructure nor the additional savings from major water conservation programs.

The MWSI identified and evaluated cooperative water supply options in the following areas:

- Conjunctive use
- Effluent management
- Interruptible supply arrangements
- System integration opportunities

In the South Denver metropolitan area, the potential benefits of a conjunctive use approach were identified. This concept incorporates the groundwater systems currently serving parts of Arapahoe and Douglas Counties with the existing infrastructure of Denver Water's surface water system.

Conjunctive use is described as:

> *"The coordinated use of surface water and groundwater sources and facilities to produce a larger, more reliable and cost-effective water supply than could be generated from either source alone."*

The operation of the conjunctive use project would deliver water during average and wet years from the Denver Water system to meet demands in the south metro area or to

recharge the Denver Basin aquifers. Groundwater from the Denver Basin would be pumped to meet those demands not satisfied by the surface water sources and during drought periods. Preliminary modeling of the proposed system has indicated that this conjunctive use approach could yield up to 60,000 acre-feet although there are many issues that have to be addressed to confirm those yield estimates.

These early investigations of the conjunctive use potential required making a number of simplifying assumptions that will be tested in subsequent and more detailed investigations. None of the major institutional, legal and regulatory issues associated with the development and operation of a conjunctive use project were addressed. Additionally, the key technical questions related to the feasibility of large-scale recharge projects and the impacts on the cost-of-service effects of paying for a large capital project will affect the timing and phasing of the implementation of any recommended water supply program. Current planning-level tasks have been started to look at these various issues.

The potential for developing a sustainable water supply for the South Metro area that was identified in MWSI was the basis for DCWRA to pursue further discussions with the Denver Water Board and West Slope interests through the Colorado River Water Conservation District.

Resolution No. 998-02 and Responding Joint Resolution

To initiate the more detailed analyses needed to confirm the potential of the conjunctive use approach, DCWRA passed Resolution No. R-998-02. This resolution requests the participation of both Denver Water and the Colorado River Water Conservation District to investigate the conjunctive use concept as well as other alternatives in an approach that is consistent with the Denver Water Board's 1995 Resource Statement.

That resolution identifies a phased approach to considering how the long term water supply needs could be met. Specifically, the approach that has been outlined identifies a collaborative process where the local (South Metro) groundwater, surface water, return flows, conservation, water rights transfers and exchanges and reuse projects would be

maximized to a reasonable level of development. After that level of water supply has been considered, a series of projects that could use the South Platte River water rights and facilities would be investigated as a further level of developing system yield. A final set of alternatives that would include consideration of West Slope water resources would be the ultimate configuration that would be evaluated – this approach would delay and minimize the impact of additional trans-mountain diversions on the West Slope. Interim and overlapping phasing of these three steps of water supply development could also be considered as a way of mitigating the long-term effects of additional trans-mountain diversions.

In response to Resolution No. R-998-02, the boards of Denver Water and the Colorado River Water Conservation District responded with a Joint Resolution. That joint resolution instructs the staff of those agencies to participate in collaborative planning efforts that consider various water supply development strategies that optimize the use of in-basin resources in order to minimize the importation of West Slope water. The resolution also precludes the study of any new large trans-mountain diversion projects but to limit consideration of opportunities that will maximize the use of Denver Water's infrastructure and water rights.

Those collaborative planning efforts are now underway.

Current Activities

The DCWRA has established a special purpose authority (Study Board) to support the planning efforts needed to meet the intent of the various resolutions. The Study Board will also identify how a conjunctive use project and other alternative water supply programs could be developed to provide a sustainable, cost-effective water supply to the south metro area.

A key element of that planning effort is to include the West Slope needs and concerns into the planning effort. The ongoing UPCO (Upper Colorado) studies being supported by West Slope counties, Denver Water and other major water providers is identifying the

consumptive and non-consumptive water needs of the headwater areas of the Colorado river basin. These areas of the West Slope are also facing major increases in consumptive demands for towns and the recreational industry as well as water quality issues related to wastewater discharges. Additionally, instream flows are highly important to the environmental and recreational values on the West Slope. Previous trans-mountain diversions have already significantly reduced the flows of many area streams. These factors will be incorporated as baseline conditions in UPCO as system modeling is used to identify whether existing water rights and facilities could be developed to allow additional transmountain diversions without compromising water needs on the West Slope.

The study team is now starting the evaluation of long-term performance of the Denver Basin aquifers and the other available local water supplies. Once the technical evaluations of the aquifers are completed, a series of evaluations of conjunctive use projects using initially South Platte water will be undertaken. Additionally, other means of meeting water shortages will be considered and compared to the conjunctive use proposal. Finally, a fully integrated conjunctive use program using all of Denver Water's facilities and water rights will be evaluated.

This information will be used by policy makers and elected officials to define a long-term implementation program for the South Metro area.

References:

Metropolitan Water Supply Investigation, completed by Hydrosphere, Inc. for State of Colorado, January 1999

Douglas County Water Resource Authority, Water Resources Inventory – 1996 Demands and Supply, Mulhern MRE, Inc., January 1998

Denver Water Board, Board Resource Statement, October 15, 1996

Denver Water Board, Cooperative Actions With Metropolitan Water Suppliers Outside the Board's Service Area, October 15, 1996.

Douglas County Water Resource Authority, Resolution No. R-998-02, September , 1998

Colorado River Water Conservation District/ Denver Board of Water Commissioners Joint Resolution, November 17, 1998

RESOLUTION NO. R-998-02

WHEREAS, the Douglas County Water Resource Authority (the Authority) was established by contract, executed as of the 29th day of September, 1995 (the "Establishing Contract") to effect the planning and development of water resources, systems and facilities (the "Water Facilities") for the benefit of its members and their inhabitants, and others, and to integrate surface waters. well waters, wastewater effluent, and stormwaters under the guidance of the Authority;

WHEREAS, the Authority has participated in a series of investigations related to a potential conjunctive use approach as a partial means of meeting the stated purposes of the Authority;

WHEREAS, the conjunctive use approach could result from a cooperative venture with Denver Board of Water Commissioners (Denver Water) in which the water supply of the Authority and Denver Water could be increased while reducing the long term dependence on non-tributary groundwater supplies by members of the Authority;

WHEREAS, the Authority recognizes the need to collaboratively and completely explore appropriate alternatives to the conjunctive use approach that meet the Authority's stated purpose as well as the needs of other interested parties to allow definition of a regional and cost-effective approach for meeting the Authority's stated purpose;

WHEREAS, the Authority recognizes that a comprehensive alternatives analysis requires a collaborative approach among interested parties, including at least Authority members, environmental groups, the Western Slope, Denver Water and other Front Range Communities;

WHEREAS, the Authority will work with those other interested parties to develop the alternatives to meeting the Authority's stated purpose through the collaborative process ("The Study") that will include as an initial step the use of continued and maximized reasonable development of local water resources (well water, surface water, return flows, conservation, water rights transfers and exchanges, and reuse) alone, and subsequently conjunctive use using only South Platte River surface water and then other water resources available to the Authority and Denver Water as may be identified by the interested parties as being acceptable and beneficial;

WHEREAS, the Authority generally feels that the development of renewable supplies could be successfully met by a variety of elements, both structural and non-structural, some of which depend solely on East Slope water while other options draw on resources from other river basins, but all of which must be evaluated fully and objectively in a collaborative alternatives analysis involving all interested parties before identifying preferred approaches to achieving the stated purpose of the Authority;

WHEREAS, the Authority desires to proceed with further joint investigations with Denver Water and other interested parties for the purpose of identifying potential alternatives and establishing the feasibility of constructing and operating those alternatives identified in The Study for the mutual benefit of members of the Authority, Denver Water and others;

WHEREAS, Denver Water has promulgated a policy to encourage regional water initiatives, and The Study is a clearly defined regional approach to be undertaken by the Authority;

WHEREAS, because of the historic and projected rates of growth in those areas served by members of the Authority, the Authority desires to proceed with The Study to address the need for a sustainable potable water supply system and to take advantage of opportunities for developing cooperative projects to fulfill the renewable supply needs of members of the Authority;

NOW THEREFORE, the Authority resolves to work with Denver Water and all interested parties to cooperatively establish the feasibility of the preferred options through The Study, and requests Denver Water to recognize the Authority as the regional entity to accomplish these purposes through participation in The Study, provided, however, that nothing set forth herein shall preclude individual members from pursuing, outside the auspices of the Authority and the Study process, options other than those identified in the Study.

IN WITNESS HEREOF, the undersigned PARTIES have caused this instrument to be executed as of the _____ day of September, 1998.

DOUGLAS COUNTY WATER
RESOURCE AUTHORITY

By: _____
James R. Sullivan, President
Douglas County Water Resource Authority

ATTEST:

_____

Colorado River Water Conservation District/Denver Board of Water Commissioners Joint Resolution

WHEREAS, the Colorado River Water Conservation District and the Denver Board of Water Commissioners, collectively referred to as "the Boards," met on October 7, 1998, to discuss common issues and to explore possible solutions for those issues;

WHEREAS, one of the primary issues for the Boards is to assure that any Southern Cooperative Action Proposal by the Douglas County Water Resource Authority considers a broad range of options in a collaborative process with the goal of optimizing the use of in-basin resources in order to minimize the importation of water from the Western Slope;

WHEREAS, the Douglas County Water Resource Authority has adopted Resolution No. R-998-02, which proposes a collaborative study ("the Study");

WHEREAS, the Boards believe that the first task for the Study should be collaborative development of a comprehensive work scope for the Study that includes objective analysis of water supply, conservation, and reuse options including those that will optimize the use and distribution of Denver Basin groundwater resources and those that postpone or minimize the importation of water from the Western Slope;

WHEREAS, the Boards believe that the scope of work for the Study should include mitigation options for any Western Slope impacts caused by any identified water supply approaches that use Western Slope water;

WHEREAS, the Boards have no interest in including in the Study new large transmountain diversion projects;

WHEREAS, the Douglas County Water Resource Authority's Resolution supports the goal, process, and intent described above for the development of the scope of work for the Study;

NOW THEREFORE, the Boards resolve: (1) to have their staffs work with the Douglas County Water Resource Authority and others to develop collaboratively a comprehensive scope of work for the Study that embraces the above goals and, assuming an acceptable study scope is designed, to commit staff resources to the completion of the Study; and (2) that the Boards' commitments and actions pursuant hereto shall not modify or interpret the Boards' rights and obligations concerning the use of Colorado River basin water or South Platte River basin water nor limit the Boards' actions in regard to those rights and obligations, and shall not evidence the approval of any specific project or means of providing future water supplies on the Colorado Front Range.

IN WITNESS HEREOF, the undersigned Boards have caused this instrument to be executed as of the 17th day of November 1998.

DENVER BOARD OF
WATER COMMISSIONERS

By: _____
Joe Shoemaker, President
Denver Board of Water Commissioners

COLORADO RIVER
WATER CONSERVATION DISTRICT

By: _____
Wesley E. Signs, President
Colorado River Water Conservation District