# Secondary Water Systems for Landscape Irrigation: Issues and Opportunities

Stephen W. Smith[1]

## ABSTRACT

*Secondary or dual water systems are described as those providing pressurized raw water for landscape irrigation. Often, the native water supply that was historically used for agriculture irrigation can be successfully "repackaged" for landscape irrigation as urbanization occurs. There are numerous examples of secondary systems throughout the western United States, primarily in Utah, Idaho, Washington, and California. Some of these systems have been successfully implemented and continue to expand with new housing projects. Other systems can be shown to be problematic in various ways and might be implemented differently in hindsight. Successes and failures will be generally described to include both engineering and organizational issues. Case studies will be referenced based on personal visits and interviews with system managers.*

## INTRODUCTION

In various regions around the western U.S., secondary water supply systems or dual systems are common and readily acknowledged as a benefit to the region and the community. Often times, the availability of raw water for the landscape is perceived to be an amenity for a housing project because it is considered to be the right thing to do and the cost of raw water is generally lower to the homeowner than the cost of potable, culinary water.

In 2001, the Colorado Water Conservation Board funded a project at Colorado State University to do an in-depth study of dual systems in other states and attempt to understand the benefits of such systems for Colorado. The results of this particular, detailed and comprehensive study of secondary supply systems were completed in the fall of 2003. Both the executive summary and the full report can be found on-line at:

http://waterlab.colostate.edu/DualStudy/dualstudy.htm

The purpose of this paper is not to review or describe secondary supply systems in great detail but to make observations as the underlying reasons why larger regional systems have not come about to date in northeastern Colorado.

[1] Chairman / Vice President, Aqua Engineering, Inc., 4803 Innovation Drive, Fort Collins, Colorado 80525. E-mail address: swsmith@aquaengr.com. Web site address: www.aguaengineering.com.

## CONCEPTS OF SECONDARY SUPPLY

Under the prior appropriation system as utilized by 19 of the western states, water is generally decree for a given use, in a given quantity, and as diverted from a decreed point in the river system. The original decreed use is very commonly "irrigation." As urbanization occurs and farms are turned into housing projects, it makes good sense to continue using the native water supply for the decreed purpose – namely, irrigation, but for landscapes instead of agricultural crops.

The mutual irrigation companies that often hold significant decrees can benefit from secondary supply systems by becoming a participant in some manner. Changes in use wherein a municipality is buying, or being provided with, native water and altering the decreed use to municipal and industrial use are common but these changes are time consuming and costly. In Colorado, it can take three or four years to change a water right and the legal and engineering costs grow in proportion to the number of objectors in the water court case. The return flows on the changed shares are likely accounted for and stay in the canal so there is no injury to other shareholders in the mutual irrigation company or downstream to other water rights.

The hard engineering details of secondary supply systems are many and varied. The resolution of questions and the approach to secondary supply implementation is important but these engineering aspects of the project are, in the author's experience, generally easy to resolve. Organizational and sociological issues may trump engineering issues overall.

Prevalent technical questions and engineering issues include:

- Pipe burial depths.
- Standard installation details for all primary components such as the point-of-connection.
- Standard specifications for equipment and installation for the secondary system (overall system uniformity).
- Landscape irrigation standards and potential for review by the secondary supply system entity.
- Design criteria.
- Suitable water window and approach to scheduling (daytime irrigation allowed or not?).
- Meters versus no meters.
- Potential for self-adjusting irrigation control systems.
- Piping offsets with the potable pipes or any utilities of others.
- Drought response plan.
- Minimum and maximum operating pressure at the point-of-connection.

- Level or primary filtration.
- Demand management plan and prediction of maximum and peak period flows.
- Back of lot versus front of lot points-of-connection.
- Point-of-connection size.

## SUCCESSFUL AND EXEMPLARY BUILT PROJECTS

Projects that have survived the test of time and continue operating effectively are described in the literature (Wilkins-Wells 2003) but two projects are briefly described here as to the elements of those projects that have relevance to the topic at hand. These two projects exemplify what can be and has been accomplished when the sociology, politics, and engineering moons can come into alignment.

### Davis and Weber Counties Canal Company

The Davis and Weber Counties Canal Company in Sunset, Utah was established in 1894. In modern times, the Company delivers agricultural water to shareholders but also secondary water to approximately 8,000 customers in the area around Kaysville, Utah. The secondary supply project is now almost 25 years old and was originally funded via concessionary loans made available by the State of Utah. It is notable that the community accepts and very much appreciates the raw water availability for landscapes since this source of water is so much less costly than the potable, culinary water. Billboards for housing developments in the area often cite secondary supply as a key benefit of that project. Further, it is notable that the Company enjoys a revenue stream from the secondary supply customers that has allowed the Company to make substantial improvements to the canal infrastructure over time. These improvements include canal lining, pump stations, equalizer reservoirs, and supervisory control and data acquisition (SCADA) implementation. An important part of the success of this secondary supply project is that there was strong cooperation between the ditch company supplying the raw water and the municipal water departments supplying the culinary water.

### Kennewick Irrigation District

Another example of an older and successful built and building project is found with the Kennewick Irrigation District in Yakima, Washington. The following quote can be found on KID's home page website:

> "The Kennewick Irrigation District began ninety years ago as an agricultural water supply system. Today it still supplies water, but more and more of it goes to keep lawns green and gardens growing. Farms are turning into residential subdivisions at a surprising rate around the Tri-Cities. More and more cropland is going into vineyards, too. Things keep

changing, but the Kennewick Irrigation District still sticks to its main job: they keep the water moving!"

At present, KID had more than 14,500 customers to which raw water is delivered for landscape irrigation. KID's web site can be found at: http://www.kid.org/

The District has 88 miles of canal, four ditch riders, and a maintenance crew of six. Local improvement districts, known as "LIDs" used to take water from the District at the historic headgate. But as the demands on the KID organization grew they ultimately came to accept the operation and maintenance of the distribution system downstream of the headgate as long as it was designed and built to KID standards. Currently, KID has 153 LIDs to which KID delivers raw pressurized water.

One success of the KID secondary supply system was the staff and Board acceptance of the opportunity to serve the new customer base as a suitable extrapolation of their mission and an opportunity.

## RECENT CIRCUMSTANCES IN NORTHESTERN COLORADO

Following completion of the dual systems study (Wilkins-Wells 2003) in the fall of 2003, several mutual irrigation companies undertook and commissioned more specific feasibility study efforts so that the potential for dual system projects could be fully understood for their circumstance, initial and annual costs estimated, revenues forecast, and so on. These feasibility level studies were accomplished by working directly with the boards of the companies and the study generally resulted in:

- Estimates of construction costs that allowed for an understanding of the loan commitment.
- Analysis of the water right or rights on a seasonal basis.
- A drought response plan.
- Analysis of housing growth rates to understand phasing and growth of the secondary supply system.
- Analysis of rate structures and revenues.
- Analysis of cash flows and cash position over the term of the loan.

## HINDSIGHT ANALYTICAL COMMENTS

From 2003 to the present, the author participated in multiple regional secondary supply feasibility level projects and numerous (several hundred) mutual irrigation company board meetings where options were discussed, analyzed, or debated. As noted earlier, the technical questions, in the author's experience, can likely be solved in a series of workshops. Resolution of the technical questions is not particularly difficult especially when successfully built and operating projects can

be toured and so much can be learned from the successes or failures of others. A key question in this regard for the managers of existing systems is "what would you do differently if you had it all to do again?" Answers to that question are easily obtained.

The difficult lessons learned from participation in various northern Colorado feasibility-level studies can be summarized as follows:

1. **Cooperation between the various players:** the synergy and cooperation between the potable water purveyor and the secondary supply entity is paramount. If these two entities can mutually support one another, then success can be assured. (The concept for one potential secondary supply entity stalled because the intent was to be "for profit" and the potable water entity was "not-for-profit". This philosophical disconnect could not be overcome.)

2. **Development agreements:** generally the housing developer has an agreement with the municipality or the county. This agreement identifies the source of all utilities. If the municipality communicates to housing developers in a directive way as to where the potable versus raw water sources come from, the long term success and expansion of a regional system becomes more predictable.

3. **Project cash flow:** negative cash flow in the early years is probable due to over-sizing of project elements but housing growth tends to create a positive cash flow in a financially reasonable period of time. If state water development money can be obtained at concessionary interest rates, then the negative cash flow period tends to be short and predictable.

4. **Understanding the concept and the future:** many mutual irrigation companies, even though they have been in business for 100 years or more, operate in a low-key and often volunteer way. If the vision of the managing board is to "roll" under the pressures of urbanization and development, then the likely outcome of discussions concerning provision of pressurized raw water delivery are predictable – the no action alternative will likely prevail. Under these circumstances, secondary supply is an "insurmountable opportunity."

5. **Water rates:** financial models can generally predict a successful venture when initial and annual operating costs are known and the intent is to cover those costs and gradually move into a stable and positive cash flow position. The financial aspects of a project can be greatly enhanced when a raw water rate is set more or less artificially as a percentage of the potable water rate. Homeowners in northern Colorado are generally accepting of raw water rates that are 80% of the potable water rates.

6. **Water share ownership and control:** the issue of who actually owns the raw water shares that are dedicated to secondary supply has been a difficult issue. The secondary supply entity wishes to own the shares if the water is to be delivered through a raw water system. The potable water entity may insist on owning the water shares to ensure unequivocally that the water is there into perpetuity. This question is not easily resolved.

## SUMMARY

Successful regional secondary supply or dual system projects can be found in several western states. Provision of raw pressurized water for landscape irrigation is a sound concept and means continued use of the decreed water supply without administrative or water court changes. Pitfalls or fatal flaws associated with intended regional systems are often more related to sociological and political problems as opposed to engineering problems.

## REFERENCES

Smith, S.W. and J. Wilkins-Wells. 2003. Urban Water Issues: Secondary Water System Design Considerations for Landscape Irrigation. Proceedings of the U.S. Committee on Irrigation and Drainage. June.

Wilkins-Wells, J. and T. Podmore. 2003. The Benefits and Costs of Dual Water Systems in Colorado and the Potential Role of Canal Companies and Irrigation Districts in Providing the Pressurized Irrigation Water Supply Portion of Dual Systems. Colorado State University. Project Completion Report. Submitted to the Colorado Water Conservation Board. September (175 pp.). (Chapter 10 was authored by S.W. Smith)