

**UINTA BASIN REPLACEMENT PROJECT:
A SCADA CASE STUDY IN MANAGING MULTIPLE INTERESTS
AND ADAPTING TO LOSS OF STORAGE**

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ABSTRACT

Section 203(a) of the Central Utah Project Completion Act authorized a replacement project--the Uinta Basin Replacement Project (UBRP)—to replace the Uinta and Upalco Units of the Central Utah Project (CUP) which were not constructed. The UBRP will provide: 2,000 acre-feet of irrigation water; 3,000 acre-feet of municipal and industrial water; reduced wilderness impacts; increased instream flows; and improved recreation.

On the Lake Fork River, UBRP must be integrated into a complex water environment. The SCADA information generated by UBRP will play a key role in reducing uncertainty for water users—which is expected to have an economic impact.

Construction delays in enlarging Big Sand Wash Dam and Reservoir eliminated the ability of the Moon Lake Water Users Association (Association) to store any substantial amount of water behind the old dam during the 2005 irrigation season. In response to this crisis, the partners in the project expanded the planned installation of SCADA monitoring and automation at key sites and required the installation to be completed over a period of weeks instead of years. The objective was to mitigate the effect of the lost storage by increasing flexibility and fine-tuning operations. The effort was largely successful.

DESCRIPTION OF THE UINTA BASIN

Any fourth-grader in Utah can tell you that the Uinta Mountains are the only major mountain range running east to west in North America. The Uinta Basin lies to the south of the Uinta Mountains and is fed by creeks and rivers flowing south from those mountains. Many of the principal rivers (Strawberry River, Currant Creek, Rock Creek, Lake Fork River, and Uinta River) flow into the Duchesne River which feeds the Green River.

The Basin is the location of the Ute Tribe of the Uinta and Ouray Reservation (Tribe) which is commonly referred to as the Northern Ute Tribe, as well as the

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cities of Duchesne, Roosevelt, and Vernal. When oil prices are sufficiently high to overcome the cost of transportation to areas outside the Basin, the area's oil industry roars to life (as it has in the past two years). Ordinarily, agriculture (chiefly cattle operations) is the lifeblood of the Basin economy; and, in the Basin, irrigation is the lifeblood of agriculture. It is important to note also that wilderness designation protects much of the Uinta Mountains. The mountains and associated steams are an important ecological resource.

This summary establishes the competing interests in Uinta Basin Water: non-Indian irrigators, the Tribe, the cities, the oil industry, and the natural environment. All water development in the Basin has been intended to serve one or more of these interests.

WATER DEVELOPMENT IN THE UINTA BASIN

The current incarnation of UBRP is founded on and entwined with other water development in the Basin. Key stages in that development are: the establishment of the Northern Ute Reservation, homesteading and early water development, the Uinta Indian Irrigation Project, the Moon Lake Project, the CUP as originally planned (with the Uinta and Upalco Units), and the current UBRP.

The Northern Ute Reservation

The Northern Ute Reservation was established in 1861 and tribal water rights associated with the creation of the reservation share that filing date. To date, the Tribe has not fully asserted its water right claims. An adjudication of Uinta Basin water rights begun by the Utah State Engineer in 1956 was placed in abeyance while the Tribe, the State of Utah, and the Secretary of the Interior negotiated a water rights compact. These negotiations, in one form or another, have continued for over forty years, although promising progress has occurred within the past year.

Homesteading and Early Water Development

The reservation was opened for homesteading by non-Indians in 1905. During the early decades of the twentieth century, both Indian and non-Indian irrigation systems were constructed, including the construction of the High Mountain Lakes.

The Uinta Indian Irrigation Project

The principal Indian irrigation project in the Basin is the Uinta Indian Irrigation Project. The Bureau of Indian Affairs (BIA) designed and constructed this project. By 1935, it was irrigating over 77,000 acres of Indian land. Today, the UIIP continues to serve Indian and non-Indian irrigators in the Lake Fork drainage and elsewhere in the Basin. It continues to be owned and operated by BIA.

The Moon Lake Project

In the 1930’s, the Bureau of Reclamation (Reclamation) designed and constructed the Moon Lake Project on the Lake Fork River. The Association operates and maintains the Moon Lake Project on behalf of Reclamation and will operate and maintain the enlarged Big Sand Wash Dam and Reservoir.

The Central Utah Project

In 1956, the Colorado River Storage Project Act became law. The Act authorized the CUP (as well as other Reclamation projects). The CUP provided for the trans-basin diversion of Uinta Basin water to the Wasatch Front. The Wasatch Front is the most populous area of Utah and includes Provo City and Salt Lake City. The project mitigated for the trans-basin diversion by creating the Uinta and Upalco Units. These units would have provided new storage in the Uinta Basin--on the Uinta and Lake Fork Rivers respectively.

For a variety of reasons, the Uinta and Upalco Units were never constructed. Section 203 (a) of the Central Utah Project Completion Act authorized funding for UBRP—a project intended to provide similar benefits, in some measure, to those that were promised by the units that were not constructed. Originally, the UBRP project planned under the authority of Section 203 (a) was to serve both Indian and non-Indian needs using Indian and non-Indian water. Although planning continued for several years, the Tribe withdrew its support at the eleventh hour--as contracts were being executed. The departure of the Tribe made a reformulation of the plan necessary. Eventually, a scaled-down version was developed. The scaled-down project intentionally avoided interference with tribal water rights, lands, and interests.

The Central Utah Water Conservancy District (District) is the sponsor and entity responsible for repayment of the federal obligation associated with the Bonneville Unit of the CUP and UBRP. One example of the complications involved in layering the UBRP on top of pre-Moon-Lake-Project irrigation facilities and the Moon Lake Project involves SCADA; the Association and the District have established different SCADA platforms. To ensure that both entities have equal access to UBRP information, the UBRP SCADA system has been designed so that the SCADA information can be displayed on both the Association’s system and the District’s system.

THE UINTA BASIN REPLACEMENT PROJECT

In the paragraphs above, five separate stages in the development of Uinta Basin water were discussed. Each of these stages brought with it new water development facilities. Each stage served a different bundle of water right interests and a different set of constituents. The result is a complex layering of

economic interests, water rights, land ownership, management objectives, and politics.

Perhaps nowhere in the Basin is this layering and the accompanying actual and potential conflict more focused than the Lake Fork River. The river begins in the High Uintas wilderness area and feeds thirteen small, high-elevation lakes-turned-reservoirs (High Mountain Lakes). It then provides early-priority Tribe flow rights though a portion of the UIIP, feeds Reclamation's Moon Lake Project (serving non-Indian irrigators), and provides additional irrigation water by exchange with Starvation Reservoir (a CUP feature). Because it diverts Lake Fork River water, integrating UBRP into this already complex and contentious water environment has been difficult and problematic.

The Feasibility Study and Environmental Assessment for UBRP were published in 2001. As a partial replacement for the Uinta and Upalco Units, UBRP is intended to serve the following purposes: stabilizing the aging and unsafe High Mountain Lakes on the Lake Fork River drainage and restoring ecological values compatible with the High Uintas Wilderness; providing replacement water for the late season irrigation water stored in the High Mountain Lakes; providing 3,000 acre-feet of water per year to Roosevelt City for municipal and industrial (M&I) purposes; providing 2,000 acre-feet of water per year to Lake Fork River irrigators; facilitating improved water resources management and water conservation in the Uinta Basin by increasing water efficiency, enhancing beneficial use, and developing water storage; and enhancing environmental, fish, wildlife, and recreation resources.

The project purposes are to be accomplished by construction (or upgrade) of the following facilities.

High Mountain Lakes

The stabilization of the thirteen High Mountain Lakes will eliminate the reservoir storage and will return the lakes to their natural levels. As a result, flows originating in the High Mountain Lakes' watersheds will return to natural hydraulic runoff patterns and thereby restore fishery and recreational resources in the High Mountain Lakes. In addition, the wilderness impacts associated with operation and maintenance of the High Mountain Lakes will be eliminated.

Big Sand Wash Diversion and Feeder Pipeline

Construction of the Big Sand Wash Diversion and Feeder Pipeline has been completed. The Diversion diverts flows from the Lake Fork River into the Feeder Pipeline. The Feeder Pipeline transports the water to Big Sand Wash Reservoir—an existing off-stream reservoir that is being enlarged as part of the project.

Enlarged Big Sand Wash Reservoir

The enlargement of the Big Sand Wash Reservoir (by raising the level of the dam and associated dikes and saddle dams) will provide additional water storage capacity and regulation capability. The enlarged reservoir will allow for the storage of water that had been stored in the High Mountain Lakes. This transfer also results in improved instream flow in certain reaches of the Lake Fork River and its principal tributary—the Yellowstone River. The water stored in the enlarged reservoir will serve irrigation and M&I purposes.

Increasing the height of the new dam is being accomplished by removing about two-thirds of the downstream side of the old dam, excavating a new keyway immediately downstream of the remaining structure, constructing the new dam, and integrating the remnants of the old dam into the upstream fill of the new, taller structure.

Big Sand Wash – Roosevelt Pipeline

The Big Sand Wash – Roosevelt Pipeline will deliver project M&I water to Roosevelt City as well as project irrigation water to the lower portions of Lake Fork drainage systems.

THE ROLE OF SCADA IN UBRP

The commitments to SCADA instrumentation and the monitoring of UBRP operations are contained in the UBRP Environmental Assessment. The obvious purpose for the installation and operation of SCADA instrumentation at UBRP is to ensure that both federal/non-federal water and tribal/non-tribal water are delivered in accordance with law, water rights, water supply contracts, environmental requirements, and delivery commitments. If this most-apparent purpose is met, the secondary purposes will also likely be achieved: improved efficiency in deliveries from Lake Fork facilities; conservation of water; greater confidence that the river is being managed fairly; and assurance that environmental commitments are being met. Of course, the installation of SCADA instrumentation makes eventual automation possible, resulting in reduced operation and maintenance costs, improved conservation, more finely-tuned operation, etc.

SCADA AND UNCERTAINTY

In addition to the achievement of the primary and secondary purposes of SCADA, there is a tertiary economic benefit that should not be ignored; by providing timely and reliable information, the SCADA system will reduce uncertainty and increase efficiency among water-users and associated businesses.

In the paragraphs above, the layering of interests in water and the accompanying complexity was introduced. The Lake Fork River is one site in the Uinta Basin where all of these layers and the associated interests of groups and individuals intersect. The Lake Fork is perhaps the most over-subscribed stream in the Basin. Among those groups or individuals whose interests are served by the Lake Fork, the complexity of the situation has, over decades, led to excessive caution, suspicion, mistrust, and conflict.

This outcome is not unreasonable; the complexity of the Lake Fork milieu creates a level of uncertainty about the operation of facilities, deliveries of water, and priorities for deliveries of water, etc. In situations of uncertainty, individuals and groups take actions to ensure against loss. These actions in response to uncertainty are costly. Basic economics tells us that uncertain processes are less efficient than certain ones. In other words, the measures that Lake Fork water users must take to assure themselves that they are receiving their share of Lake Fork water are a source of inefficiency (if only because these measures distract each water user from his primary focus—farming, ranching, oil, etc.).

The installation of SCADA sites, the collection of data, and moreover the wide dissemination of that data via the Internet has the potential to ease (to some degree) the uncertainty surrounding water deliveries in the Lake Fork Drainage. Certainly, the SCADA system cannot solve the entire problem but for a range of deliveries, the SCADA system will provide an accurate, credible record of some of what is occurring on the system.

The situation of the Tribe provides an excellent example of how SCADA can engender greater certainty. The Lake Fork River commissioner is paid by the Association, the Dry Gulch Irrigation Company, and the BIA—two non-Indian entities and one Indian-related entity. As a result, Tribal members are continually skeptical about accuracy of the printed, after-the-fact data provided to them from the River Commissioner. Many Tribal members suspect that the data has been doctored to hide the theft of Tribal irrigation water. Following the initiation of operation of the UBRP and Moon Lake SCADA sites, the Tribe now has access to current delivery information. This has not answered all of the Tribe's concerns but it has focused them on those areas in which there is a real potential that they may not be receiving their fair share of Lake Fork water.

RESPONSE TO LOSS OF STORAGE: INSTRUMENTATION AND AUTOMATION

The UBRP construction schedule called for SCADA instrumentation to be installed on the diversion structure, pipelines, and dam as each individual feature was completed. Those SCADA sites needed to monitor instream flows would only be installed after work was well underway on the stabilization of the High Mountain Lakes. As a result, only the SCADA site at the diversion structure was

complete and operating by spring of 2005.

Under the construction schedule, a substantial portion of the new dam (integrated into the remains of the old dam that would be left in place) would be constructed by the beginning of the 2005 irrigation season. This would allow the accumulation of about 40 feet of storage behind the partially constructed dam. The limited, interim storage would have eased the situation for irrigators who would not be able to make full use of the reservoir during the 2005 construction season.

By February, slower than anticipated progress on the grouting made it clear that no part of the new dam would be constructed by the beginning of the irrigation season. Any interim storage in Big Sand Wash Reservoir would have to be backed up behind the remnants of the old dam alone because about two-thirds of the old dam structure had been removed. Early results had shown that a well point system or drain-rock embankment could be used to dewater the old dam structure, thereby maintaining slope stability and allowing storage of the full forty feet in the reservoir.

After additional slope-stability studies by the Project Engineer and verification by the Reclamation, it was determined that it would be infeasible (if not impossible) to store any sizable amount of water and stay above Reclamation's stability risk threshold of 1.30. It would only be possible to store perhaps two feet in the reservoir—enough to deliver 190 cubic feet per second (substantially less than could be delivered with over 40 feet of head).

In a meeting held in March, the parties involved in the UBRP project met to discuss the new restriction on storage behind the remainder of the old dam and how the impact on irrigators might be eased. The parties decided that flows would be controlled at the diversion structure (where the SCADA equipment had already been installed). It was also the consensus of the group that accelerated installation of SCADA instrumentation and automation at a number of additional Moon Lake Project and UBRP sites would help fine-tune deliveries and thereby avoid unnecessary loss of water.

The District relied on Roger Hansen (the elder statesman of Reclamation's SCADA automation efforts) and his crew to design and assist in installing SCADA equipment at the new sites. The schedule for design and installation was accelerated to attempt to have the work completed before the beginning of May.

CONCLUSION

The installation was completed largely on time and is regarded by the irrigators as a success. Factors contributing to the success include the following.

1. Commitment and Cooperation. All parties involved (the District, the Association, Reclamation, and Interior) were committed to easing the plight of the irrigators. They showed that commitment in a willingness to search for solutions, provide funding, and work long hours.
2. Funding. The District was immediately willing to commit substantial funding to the SCADA solution.
3. Familiarity with Facilities on the Lake Fork. Because the Reclamation crew had worked with the Association on a number of other sites, it was familiar with the personnel, the SCADA platform, and the system (dams, diversions, and canals).
4. Adaptable Technology. The SCADA technology used is highly adaptable to a variety of situations and uses. As a result, it was somewhat easier to customize it quickly to a variety of situations.
5. Advance Solution to Two Platforms. Finally, the effort was successful because the issue of providing data on two platforms had largely been solved before the loss of the irrigation storage problem had arisen.