

Central Utah Project Bonneville Unit

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The Central Utah Project (CUP) is a massive and complicated water development project. It is the largest in the State of Utah. The ultimate plans for the CUP were among the largest and most complex contemplated by the Bureau of Reclamation. To make the project more manageable, Reclamation broke the initial phase of the CUP into four independent projects which could be united by the ultimate phase. Of the four units authorized by Congress as the initial phase, the largest and most complex is the Bonneville Unit, which itself is broken into interconnected parts. Reclamation's plans called for ten new reservoirs; enlargement of two existing reservoirs; 140 miles of aqueducts, tunnels, and canals; three power plants; nine pumping stations; and 200 miles of pipe drains. Because of its size and complexity, it is the Bonneville Unit that people most frequently associate with the CUP, sometimes to the exclusion of the Vernal and Jensen Units, which have been constructed to benefit communities in the Uinta Basin.¹

The history of the CUP is as large and complex as the project itself. And as with the project, the popular notion is that the history of the Bonneville Unit is the history of the CUP. There is some validity in this assumption. Certainly the history of the other units of the CUP, particularly those that were not built, includes colorful stories of the struggles to push forward a vision—engineering challenges, political intrigue, battles with opponents, courtroom drama, and the like. But the history of the CUP is filled with all of these. The history of the CUP is a microcosm of the large history of the battles over the Colorado River, wrapped with a thick layer of its own unique history.

Project Location

Because of its size and complexity, Reclamation divided the planning for the CUP into six units. The Bonneville Unit is the largest and most complex of the six. Reclamation designed the unit to provide irrigation water for the Uinta Basin *and* to collect, store, and divert water from the Uinta Basin into the Bonneville Basin. The areas served by the Bonneville Unit included lands within eleven counties in central and eastern Utah—Duchesne, Garfield, Juab, Millard, Piute, Salt Lake, Sanpete, Sevier, Summit, Utah, and Wasatch Counties. The project proposed the development of water in the Colorado, Bonneville, and Sevier River Basins.

The Bonneville Unit essentially proposed enlarging Reclamation's Strawberry Valley Project by developing additional water supplies in the Colorado River Basin on the Duchesne River and its major tributaries; Strawberry River, Currant Creek and Rock Creek. The original Strawberry Reservoir would be enlarged. A new diversion tunnel would convey Strawberry water into the Spanish Fork River drainage in the Bonneville Basin. A series of dams, tunnels and pipelines on Diamond Fork Creek, a tributary of the Spanish Fork River, would regulate the flows and would provide hydropower generation.

Water delivered into the Bonneville Basin would be used for irrigation in Utah, Juab, Millard and Sevier Counties, and by exchange in Garfield, Piute, Sanpete, and Salt Lake Counties. Additional water supplies would be developed by the construction of dikes across two shallow bays on Utah Lake. Pumping would convey part of the water to project lands on the southwestern shores of the lake. The balance of the water saved by diking would be stored upstream on the Provo River at a dam above Heber City. This water would be used as a municipal supply for northern Utah and Salt Lake Counties.

Historical Setting

Ages ago an inland sea teeming with aquatic life covered most of what is now the Uinta Basin. Dinosaurs prowled the tropical swamps. Today, the one-time abode of the dinosaurs has been set aside by the Federal government as the Dinosaur National Monument where paleontologists pick away to free rock-embedded bones. Additionally, rich deposits of coal, gas, oil, and oil shale are found in the area. In successive geologic periods, the collision of land masses resulted in massive uplifts creating the Wasatch and Uintah Mountain Ranges.

In more recent geologic time, the regional uplift of much of the western North American continent raised Utah to its present elevation, on average about one mile above sea level. Steepened river gradients greatly accelerated erosion, and several rivers still sculpt the great canyons of the Colorado Plateau. The different rates of movement between the tectonic plates separated by the Wasatch Mountains formed the terminal basins and mountain ranges of the Great Basin. Because these basins have no outlet to the sea, intermittent lakes fill the lowest elevations of these basins during periods of heavy precipitation. Permanent lakes fill some of these basins, the largest being the Great Salt Lake.

During past geologic periods, climatic changes have resulted in cycles of dramatically fluctuating levels of the lake filling the Great Salt Lake Basin. During the most recent cycle, a lake began filling the basin 25,000 years ago. This filling led to the creation of Lake Bonneville, a huge lake over 1,000 feet deep. Extending over most of northwestern Utah and portions of southern Idaho and eastern Nevada, the lake covered 20,000 square miles. Geologists have concluded that the lake level dropped 15,000 years ago when the waters overflowing the basin near Red Rock Pass in southeastern Idaho breached the sediments forming the pass, catastrophically flooding the Snake River. The level of the lake remained stable at two separate

lower elevations for 5,000 years before climate changes reduced the inflow into the lake allowing its slow retreat and the creation of the Great Salt Lake.²

Archeologists believe that from 10,000 or more years ago, until A.D. 400, the human inhabitants of Utah practiced a single common culture termed the Desert Archaic. Characterized by hunting-gathering, the flexible, highly adaptive lifeway generally mirrored the gathering phases of most of man's cultural development. However, beginning around A.D. 400, a new unique culture began to emerge throughout most of Utah. The Desert Archaic culture emerged as the people archeologists now refer to as the Fremont blended their historic gathering practices with the new ideas and technologies transmitted across the Southwest from Mexico. Specifically, the Fremont adopted the cultivation of corn, squash, and beans; the making of pottery; and the concept of permanent housing. South of the Colorado River, archeologists have found little evidence of the Fremont culture; thus, they conclude the river seems to form a sharp southern boundary between the Ancient Puebloan (formerly known as Anasazi) and the Fremont. However, a recently revealed Fremont site suggests that a greater interaction may have existed between the Ancient Puebloan and the Fremont than was formerly believed. Like the Ancient Puebloan, archeologists have found no evidence that Fremont inhabited their settlements after A.D. 1250-1300.³

While the issue remains a subject of debate, most archeologists agree that a combination of war and drought-induced famine forced the Fremont to relocate. Upon the disappearance of the Fremont in the Thirteenth Century A.D., the Numic-speakers (Piute, Gosiute, and Ute) took over the territory. They practiced the Archaic lifeway that had remained characteristic of the Intermountain West (except Utah) from the beginning. It seems that the Shoshoni-speakers who were in possession of Utah upon first white contact were migrants from Southern California and

Nevada. They may have been a factor in the disappearance of the Fremont, or they may have expanded eastward into a territory already empty of human occupants by the Fourteenth Century. Linguistic evidence has confirmed the time and direction of expansion of the Numic-speakers; what is lacking is knowledge of the nature of the contact, if any, with the Fremont.⁴

The expedition of Franciscan Friars Francisco Dominguez and Silvestre Velez de Escalante contained the first Euro-Americans known to visit the Uinta Basin. Traveling from Santa Fe, the group arrived at the Uncompahgre Plateau in Western Colorado in August. While there, they met two Utah Utes of the *Tumpanuwac* or Timpanogos band—known to the Spaniards as Lagunas—who were visiting the Uncompahgre lodges. They convinced the two men they named Silvestre and Joaquin to help guide the expedition. The party crossed the Green River near present-day Jensen, Utah, on September 13, 1776. The expedition continued west, reaching the shores of Utah Lake before turning southward to return to Taos.⁵

The Uintah Band resided in the Uintah Basin and the Timpanogos Band in Utah Valley. The Salt Lake Valley was an intermediate ground between the Ute and the Shoshone to the north. The Spaniard's expedition opened trade with the Utes and introduced both the horse and the slave trade. These developments forced the consolidation of the small family units into social units living in the Uinta Basin and their withdrawal to "safer, less accessible territory" with the *Tumpanuwac* near Utah Lake.⁶

Some years later, the Uinta Basin became an important area to the fur trade. Following the route of Dominguez and Escalante, Etienne Provost and other trappers from Taos operated in the area during 1824. The following year, General W. M. Ashley, owner of the Rocky Mountain Fur Company, and a party of trappers visited the area, giving his name to the creek and valley. Recognizing the importance of the area as a crossroads, William Reed, James Reed, and Denis

Julien established a trading post at the confluence of the Uintah and Whiterocks Rivers in 1828. Four years later, Antoine Robidoux, who had established a successful trading post near present day Delta, Colorado, purchased the operation from Reed and his partners.⁷

Fort Robidoux operated successfully for a number of years until 1844 when Utes burned the fort during a confrontation. The destruction of the fort and the decline of the fur trade in the 1840's resulted in a temporary withdrawal of Euro-Americans from the Uinta Basin. However, the first wave of Mormon pioneers reached the Salt Lake Valley in the nearby Great Basin in 1847. Because they first settled in the intermediate zone between the Ute and Shoshone, the Mormons enjoyed affable relations with their American Indian neighbors.

Under the direction of Brigham Young, the settlers began colonizing the region, spreading out primarily along the north-south axis of the Wasatch Range. As the Mormons spread they strained their cordial relations with the Utes. An altercation between Mormon settlers in the Utah County town of Springville in July 1853 resulted in the short Walker (or Wakara) War. Named for Ute Chief Wakara who led raids on Mormon settlements, the two sides reached a peace agreement the following May. But the continued spread of Mormon settlers, and the subsequent increase in confrontations resulted in Interior Secretary Caleb B. Smith recommending the removal and consolidation of the Utah Utes to a reservation in the Uintah Basin.

By executive order, President Abraham Lincoln established the Uintah Reservation in October 1861. During the later summer, before Lincoln acted on Smith's recommendation, Brigham Young sent an expedition into the Uintah Basin to investigate its potential for Mormon settlement. Perhaps unduly influenced by the dry, brown grass of the late summer, the party reported the area to be "one vast contiguity of waste...valueless excepting for nomadic purposes,

hunting grounds for Indians and to hold the world together.” In 1864 the Utes signed a treaty ceding their traditional lands and agreeing to relocate to the reservation in exchange for just compensation for their lands, agricultural assistance, and education for their children. However, after they moved onto the reservation, the Senate refused to ratify the treaty leaving them without the promised compensation and assistance.⁸

The growth of mining in Western Colorado, and the friction between the Native Americans and miners precipitated the Meeker Massacre in 1877. As a result of the incident, federal authorities pressured the Colorado Utes to accept a treaty for removal to a reservation. By treaty, the government moved the White River Utes onto the Uintah Reservation. In January 1881 President Chester A. Arthur issued an executive order creating the Ouray Reservation on adjacent lands for the resettlement of the Uncompahgre Utes. By August, the Uncompahgres had all been moved to their new home. The reservations excluded the Ashley Creek and Brush Creek drainages.⁹

The completion of the transcontinental railroad in 1869 accelerated the settlement of Utah and increased the numbers of non-Mormons settling in the State. The discovery of gold and silver by California State Militia stationed at Fort Douglas during the Civil War helped lure prospectors, and later immigrant laborers to Utah’s mines. The growth of the mining industry bolstered the farming and ranching economy of the territory. This economic stimulation contributed to the white settlement in the Uintah Basin. Agricultural development of the Uintah Basin differed from other settlements in Utah. The distance to markets limited the profitability of many farm products. Further, the scarce amount of water late in the growing season made these crops difficult to grow. Instead, the cattlemen primarily grew additional cattle feed.¹⁰

The continued immigration of new Mormon converts, the influx of non-Mormons, the shift away from subsistence agriculture, and periods of drought all strained Utah's original communal water systems. The territorial legislature began enacting new water legislation, adopting the principles of prior appropriation and beneficial use. After achieving statehood, the new Utah State Legislature further refined the water laws, and established the office of State Engineer.

Inspired by a severe drought at the turn of the Twentieth Century, Utah State Engineer Abraham Fairbanks Doremus prepared an ambitious plan for future water development in 1902. His plans have served as a blueprint for much of the water development in Utah undertaken during the Twentieth Century. Among the many concepts in his plan, Doremus anticipated diverting the Duchesne River and its tributaries to the Strawberry Reservoir, and irrigation canals to divert Strawberry water from Spanish Fork Canyon to Salt Lake County.¹¹

In 1904, Reclamation undertook investigations of other potential projects, largely outlined by State Engineer Doremus, to supply water to Cache, Salt Lake, Utah and Ashley Valleys, and Uintah Indian Reservation. W. P. Hardesty conducted investigations of the development of the Bear River in southern Idaho and northern Utah. District Engineer, George L. Swendsen led investigations on the conversion of Utah Lake into a storage reservoir and the construction of dikes to reduce evaporation in the shallow Provo and Goshen Bays. Howard S. Reed conducted surveys of potential dam sites in the Uinta Basin on the reservation and in the Ashley Valley. In the Strawberry Valley, Assistant Engineer E. F. Tabor surveyed the potential dam site and investigated the possibility of augmenting the reservoir with water diverted from the Duchesne and its tributaries to the east.¹²

Based on all these investigations, Reclamation chose to build the Strawberry Project as its first in Utah. But due to economic and practical limitations noted by Tabor, Reclamation opted not to incorporate plans for diverting additional water into Strawberry. Reclamation began construction of the Strawberry Valley Project on March 6, 1906. As the Project neared completion over a decade later, local interests, state water planners, and Reclamation began contemplating the next Federal project in Utah. After Reclamation began water deliveries to southern Utah County, farmers outside the project boundaries began petitioning Reclamation to be included in the project.¹³

These petitions came because it appeared at the time that the Strawberry Project had developed a surplus supply. And, because at this same time Secretary of the Interior Frank Lane envisioned a great expansion of the reclamation program to provide jobs and homes for veteran returning from the First World War, Reclamation actively considered these projects and others to further water development in Utah.

Farmers in the communities of Elberta and Mosida—begun by private, speculative irrigation schemes which were failing—petitioned for Strawberry water. One resident, George F. Price, proposed the height of the Strawberry Dam be raised eighteen feet and hydropower plants built in Diamond Fork Canyon to power irrigation pumps that would lift Strawberry Water and release it in Utah Lake onto lands in Elberta and Mosida.

Farmers in eastern Juab County paid for the Reclamation Service to conduct investigations in 1919 and 1920 to construct a gravity canal to deliver water over the York Ridge separating Utah and Juab Counties. A board of engineers reported on June 11, 1920 and deemed such a canal economically impractical. It would be too long and expensive, needing to begin

four miles up Diamond Fork Canyon. While Reclamation did not act on either proposal at the time, the engineers designing the CUP incorporated both concepts into their plans.¹⁴

Reclamation officials considered another option for utilizing the surplus storage in Strawberry tied to a new project in the Uinta Basin. J. L. Lytel, Strawberry Valley Project Manager, headed the investigations in Utah. Lytel directed Harry Duberstein to survey potential projects on the Duchesne River in the Uinta Basin. Duberstein developed plans for the Castle Peak Project, which Reclamation proposed as the next project for Utah to Secretary Lane.

Duberstein proposed to supply water to 60,000 acres of Myton and Leland Bench through a canal from a new reservoir at the Starvation site. In addition, Duberstein located reservoir sites for additional storage on Rock Creek at the Upper Stillwater site and the Currant Creek site. To protect the reservoir sites, and water supply, Lytel filed with state engineer for water rights and also filed to withdraw the reservoir sites from settlement. While the Castle Peak Project died because Congress did not fund Lane's proposal, these reservoir sites were later incorporated into the CUP.¹⁵

Despite the cold reception to new Reclamation projects in Congress, Utah interests continued to petition for a second project. In the years that followed, the Utah Water Storage Commission entered into a contract in 1922 to cooperatively fund investigations into the next Reclamation project in Utah. As a result of these investigations, Reclamation selected the Weber River Project in 1924 as its second project in Utah. Reclamation later constructed several other projects identified in these investigations. In response to the Great Depression and a severe drought which devastated Utah's agriculture and threatened municipal supplies, President Franklin D. Roosevelt authorized additional "emergency" Reclamation projects. These projects

included the Hyrum Project near Logan, the Ogden River Project, the Provo River Project, the Moon Lake Project on the Lake Fork River in the Uintah Basin, and the Sanpete Project.¹⁶

During this same time, Reclamation undertook additional investigations of potential projects in Utah cooperatively funded by the Utah Water Storage Commission. Reclamation conducted these investigations in conjunction with a survey of potential projects in the Upper Colorado River Basin authorized by the Boulder Canyon Project Act. The Boulder Canyon Adjustment Act of 1939 provided additional funding for the surveys. In 1939, Reclamation began investigation of the Colorado River-Great Basin Project. This massive project contemplated construction of the Echo Park Dam below the confluence of the Green and Yampa Rivers. Hydropower generated at the dam would power a series of massive pumps to divert one million acre feet from the reservoir and lift it 1,025 feet into Strawberry Reservoir for diversion to multiple points in the Bonneville Basin.¹⁷

As the investigation moved from technical possibility to economic reality, it became apparent that the amount of power needed for pumping the water and the subsequent loss of power revenues to offset operation and maintenance costs rendered the project economically infeasible. Before the concluding report had been printed, Reclamation began investigating an alternative project, named the CUP, which eliminated the need for high pump lifts.

Reclamation's evolving plans for the CUP remained as ambitious as those contemplated under the previous plan.

Project Authorization

Following World War II, planning for the CUP picked up speed. Reclamation engineers proposed making additional water available from Strawberry Reservoir by an elaborate scheme to exchange the water in the Uinta Basin. They proposed using a reservoir on the Green River at

either Flaming Gorge or Echo Park. Using gravity and a long tunnel from Flaming Gorge, or the hydroelectricity generated at Echo Park to power pumps, they planned to divert water directly from the Green River to an expanded network of reservoirs, canals, and pipelines to supply the cities and farms of the Uintah Basin. The existing water from virtually every stream and river along the southern slope of the Uinta Mountains could then be diverted through a series of pipelines into an enlarged Strawberry Reservoir, and then to the farms and cities of the Bonneville Basin.¹⁸

Following World War II, citing a need for jobs and homes for returning veterans, Reclamation proposed massive new Reclamation projects throughout the West. Reclamation included the CUP on the list of contemplated projects. But the complicated and expensive project—first proposed to Congress by Utah Senator Abe Murdock in 1946—quickly encountered several obstacles. Reclamation officials felt that before the project could be authorized, the Upper Colorado River Basin states needed to make a formal division of their share of the river under the 1922 compact. The four states began negotiations later that year, reaching an agreement in 1948 which granted Utah a 23 percent share of the Upper States portion of the river. During the negotiations, the CUP became a point of considerable debate, as Utah preferred the Echo Park site because of water quality and because it wanted to capture additional water from the Yampa River.¹⁹

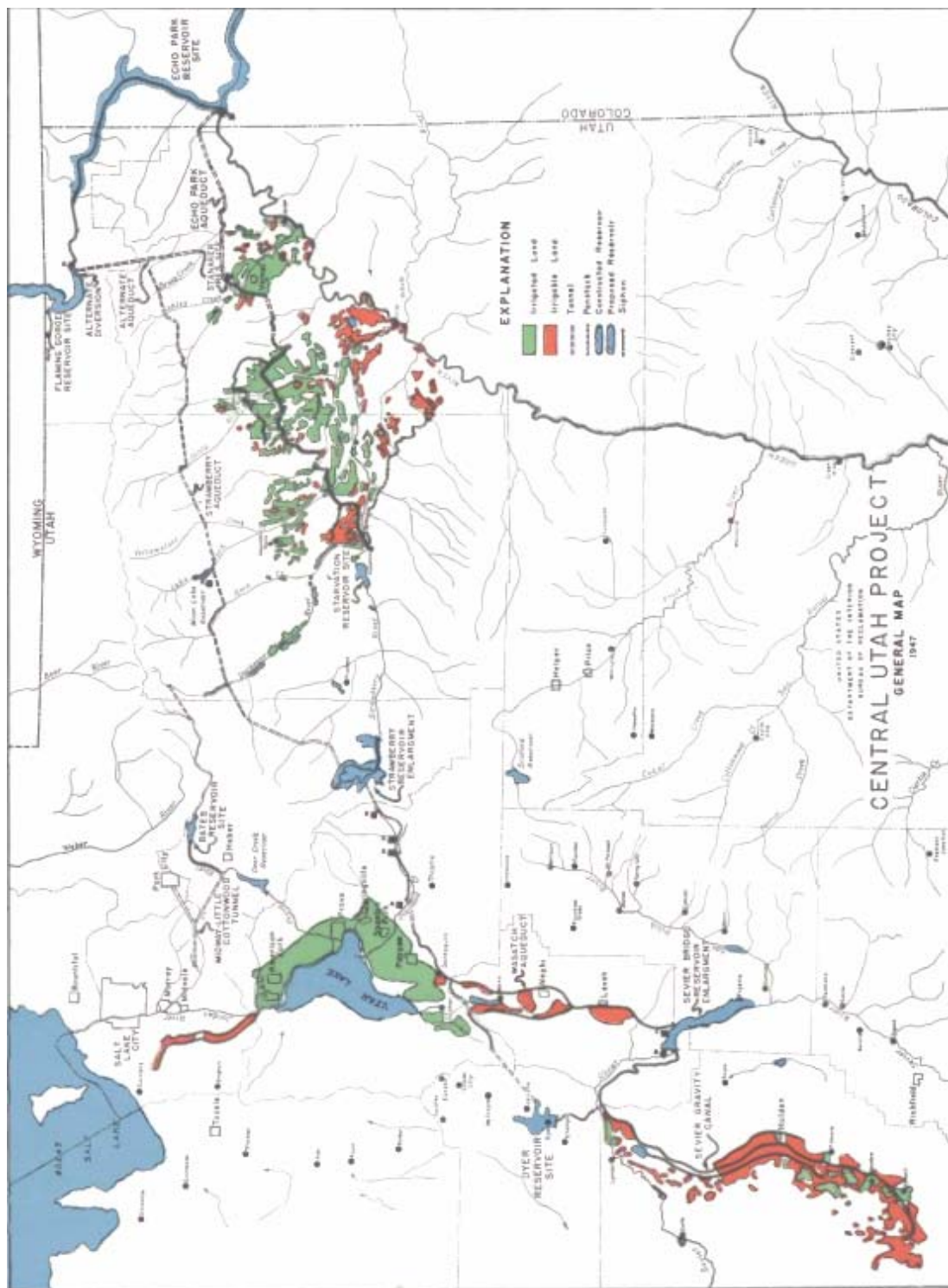


Figure 1 Map of Proposed Central Utah Project as proposed in 1947.¹

The selection of the Echo Park site—located within Dinosaur National Monument—caused additional controversy. Utah officials felt the selection of Echo Park was critical. In

addition to providing a quality and quantity of water from the Yampa River, they also saw the dam as critical to meeting obligations to the lower basin and to Mexico. Additionally, they needed the hydropower revenues generated at the dam to make the irrigation water provided by the CUP affordable. While Reclamation determined that the project had a favorable cost benefit ratio, it would take irrigators more than the mandated maximum of fifty years to repay the full costs at an affordable rate. The dilemma led Regional Director Eugene O. Larson to propose a repayment formula similar to that authorized by the Pick-Sloan plan on the Missouri River. The Pick-Sloan authorization had provided that the sale of hydroelectric power from the large dams could be used to repay a portion of the irrigation projects. Using this Pick-Sloan prototype, Larson's office developed plans for the Colorado River Storage Project (CRSP).

The CRSP included plans for several large storage reservoirs on the Colorado and its principal tributaries. The "mainstem" dams would also produce vast quantities of hydroelectric power which Reclamation would sell to offset the costs of numerous "participating [irrigation] projects" throughout the Upper Basin States. The largest project in size and cost was the CUP, but the inclusion of projects to benefit all the upper basin states helped build support for the package in Congress. Additionally, the mainstem reservoirs would provide holdover storage to meet the obligations to the lower basin states under the Colorado River Compact.²⁰

The successful negotiation of the Upper Colorado River Compact in 1948 cleared the way for introduction of the CRSP. Despite the support for the CRSP among the Upper Basin States, the opposition of President Truman, along with congressional politics and a large price tag combined to cause strong opposition to the legislation. After the election of President Dwight D. Eisenhower, who supported the CRSP, Utah Senator Arthur V. Watkins reintroduced the CRSP in 1952.

A tough political battle ensued. Much of the controversy now centered on the proposed dams within Dinosaur National Monument at Echo Park. Utahns generally strongly supported the Echo Park Dam as it was perceived to be in their best interest and a critical part of the CUP. But, despite local support for the Dam, national opposition to the dam at Echo Park continued to sour the debate over CRSP. In addition to the opposition of conservationists to the Echo Park Dam, an array of other interests plotted against the legislation. Efforts to secure passage of the CRSP stretched out over several years.²¹

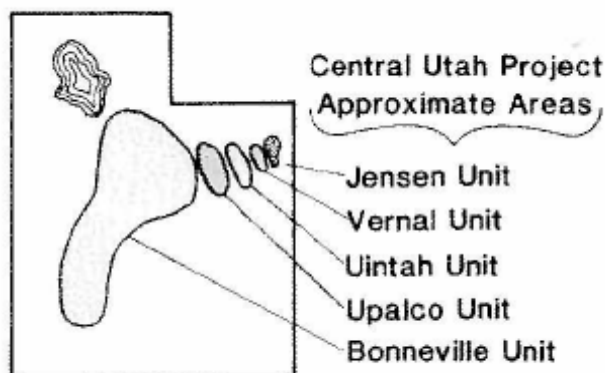
The turning point came in 1955 when Colorado Congressman Wayne Aspinall, chairman of the House Interior Committee, removed the Echo Park Dam from the House version of CRSP. Aspinall had supported the dam, but felt the passage of the entire CRSP package was more important than including the dam at Echo Park. In exchange for dropping plans for a dam within the National Park System, conservationists, led by the Sierra Club's David Brower, agreed to support the new legislation which would build the dam at an alternate site, Glen Canyon. With the major opposition neutralized, the CRSP finally passed Congress, and on April 11, 1956, President Dwight Eisenhower signed the bill.²²

The CRSP authorized construction of "main stem" dams along the Colorado and its significant tributaries in the Upper Basin States. The power stations at these dams would develop hydroelectricity to generate revenue to offset the cost of irrigation projects, and water stored in the reservoirs would guarantee water deliveries to the lower basin. Additionally, the CRSP authorized thirteen participating irrigation projects including the CUP, the largest of them all. The initial phase of the CUP broke the ambitious plans into four independent units—Jensen, Vernal, Upalco, and Bonneville—which could later be unified in the ultimate phase. The first three units proposed construction of reservoirs to increase water supplies in the Uintah Basin.

The Bonneville Unit proposed additional storage in the Uintah Basin and a transbasin diversion to the Bonneville and Sevier River Basins.²³

Following the passage of the CRSP, Reclamation moved quickly on the main-stem dams at Flaming Gorge and Glen Canyon. Construction began on the CUP in 1959 at the nearby Vernal Unit. In addition to the Vernal Unit, Reclamation moved forward with detailed planning for the largest unit of the project, the Bonneville Unit.

While scaled back from the ultimate phase plan, the Bonneville Unit was still large and ambitious. Plans called for construction of the first 37 miles of the Strawberry Aqueduct and Collection System, reaching from the Strawberry Reservoir to Rock Creek. The collection system would intercept the flows of twenty-three streams and rivers, diverting a portion of their flow. The system also included two small diversion dams and two larger dams. The reservoirs behind the two larger dams, Currant Creek Dam in the middle and Upper Stillwater Dam on Rock Creek at the top of the system, would help regulate the water flows in the system. To compensate for lost stream fisheries on the Uintah and Ouray Reservation caused by the Strawberry Collection System, Reclamation proposed construction of the Lower Stillwater Reservoir and Bottle Hollow Reservoir.



The water diverted through the Strawberry Collection System would be stored in the enlarged Strawberry Reservoir behind the new Soldier Creek Dam. Even though Reclamation scaled back the original designs for the dam, it still would quadruple the storage capacity of the enlarged reservoir. To

compensate for water diverted by the Strawberry Collection system, Reclamation planned the Starvation Complex. The Starvation Reservoir would store flows of the Strawberry and Duchesne Rivers behind the Starvation Dam on the Strawberry River. The Knight Diversion Dam would direct the flows of the Duchesne River into the Starvation Feeder Conduit, a tunnel and pipeline, to the Starvation Reservoir.

To deliver the water stored in the enlarged Strawberry Reservoir to the Bonneville Basin, Reclamation planned for a new diversion tunnel linked to the Diamond Fork Power System. To take advantage of the 2,000 foot drop in elevation for power generation, Reclamation planned a system of hydroelectric plants tied together by tunnels, pipelines, and regulating reservoirs. A portion of the power generated in Diamond Fork would be used to pump irrigation water in Utah and Jaub Counties. However, Reclamation also planned for year round generation by storing water released during the winter in Utah Lake, an enlarged Mona Reservoir, and Sevier Bridge Reservoir. The same canals used to connect Mona and Sevier Bridge would deliver irrigation water during the summer.

Reclamation planned the long contemplated diking of the Goshen and Provo Bays on Utah Lake. The water saved from evaporation would be used for irrigation and would also enable a water exchange on the Provo River. Evaporation savings, project return flows, and water from Strawberry delivered to Utah Lake would be used to supply irrigators in Salt Lake. In exchange, their water would be stored in the Bates Reservoir above Heber and be used for municipal use in the fast growing communities in northern Utah County and the Salt Lake Valley.

As detailed plans for the Bonneville Unit progressed, the project received a boost when the Salt Lake County Water Conservancy District (SLCWCD) committed to subscribe for a large

block of CUP water in 1959. In response to the population boom in Salt Lake Valley, Reclamation altered its plans, shifting the reservoir from the Bates to the Jordanelle Site. This provided additional hold-over storage for use during drought years and increased the annual yield of the reservoir to 102,000 acre feet.

As Reclamation continued its advance planning in preparation for a Definite Plan Report (DPR), the agency also worked with state and local interests toward completion of several additional important steps prior to project construction—formation of a repayment district and execution of a repayment contract, acquisition of water rights and settlement of conflicting claims, and securing congressional appropriations. To facilitate this work, Reclamation created the CUPs Office on July 23, 1959. It named John J. Hedderman as the new Project Manager. A few months later, on March 2, 1960, it moved the office from Spanish Fork to a new office located at 168 West 100 North in Provo.

Reclamation officials required that the repayment contract for the CUP be executed with a single agency. Utah would need to create a new “master district.” Reclamation officials from the area office in Provo and the regional office in Salt Lake worked closely with Utah’s Governor, George Dewey Clyde, the Utah Water and Power Board, headed by Jay Bingham, and local officials to begin the process to create the new district. The Utah Water and Power Board played a key role in pushing the CUP forward and building support for both the project and the new water district. The board, in conjunction with Reclamation officials, held informational meetings during 1960 to educate water users, concerned citizens, and elected officials.²⁴

As Jay Bingham and the Water and Power Board moved forward, the creation of a new master district required an amendment to state law. Since three water districts existed within the project boundaries, the new master district would need to be superimposed over the local

districts.²⁵ The initial phase of the CUP encompassed all or part of seven counties—Salt Lake, Utah, Uintah, Duchesne, Wasatch, Juab, and Summit Counties. The process of creating the new master district began with a meeting of officials from the seven counties involved on March 27, 1961. The Utah County Commission had sponsored the meeting, which they held in their chambers. At the meeting, citizens and politicians from each of the counties readily agreed on the need for the CUP, but it seemed that is where the agreement stopped. A menagerie of concerns blocked consensus as each group watched out for their best interests. A long and complicated process began as all concerned worked out compromises and found solutions agreeable to all. Edward W. Clyde, a prominent water attorney in Salt Lake County, greatly facilitated this process.

Clyde recommended the organization of individual county groups and the appointment of a single representative from each county to a central committee. During subsequent negotiations, Clyde's knowledge and experience proved invaluable. He had assisted in the drafting of the original 1941 Water Conservancy District Act, the Utah law that outlined the mechanics of organizing Water Conservancy Districts. He had also handled the paperwork creating the SLCWCD. He would perform a similar, crucial role in formation of the Central Utah District.²⁶

By the end of May, the seven counties had selected a delegate in preparation for the first meeting of the seven-county board. Jay Bingham, Director of the Utah Water and Power Board, was appointed to chair the committee which met for the first time on May 26, 1961 in the Governor's room of the State Capitol. The committee continued to meet for over two years to negotiate many issues. On December 16, 1963, Ed Clyde filed the forty-eight separate petitions with the Utah Fourth District Court in Provo which covered the largest portion of the seven-

county district. After a requisite review period, District Judge Maurice Harding presided over a hearing on March 2, 1964. Under the provisions of Utah law, he authorized incorporation of the Central Utah Water Conservancy District (CUWCD), and appointed its seventeen directors.²⁷

Creation of the CUWCD was an essential prerequisite for construction of the CUP. Reclamation fulfilled another important prerequisite that same year. The agency completed and published the Bonneville Unit Definite Plan Report (DPR) in August. Reclamation modified the report two years later after five central Utah counties petitioned the CUWCD to join the District. Reclamation had anticipated including these counties within the ultimate phase, however, the CUWCD accepted their petition, and based on the recommendation of the CUWCD and the Utah Water and Power Board, Reclamation altered the Bonneville Unit plan to deliver 36,000 acre feet to the Sevier Bridge Reservoir. This reduced the land which would have received full service water by 10,840 acres. The greater part of the acreage was eliminated in the Mosida area, which reduced the amount of water to be delivered to Utah Lake by 22,000 acre feet and reduced the projected projects costs by \$4,430,000.²⁸

With creation of the CUWCD and publication of the DPR, Reclamation pressed forward toward construction. During 1965 Reclamation worked with the CUWCD and the state engineer to solve water rights challenges. The state engineer completed adjudication of the Duchesne River, which affirmed the Bonneville Unit. The decision also placed Reclamation and the CUWCD on firm footing to negotiate with the Ute Tribe of the Uintah and Ouray Reservation. Under the Winter's Doctrine, the tribe held substantial water rights in Uinta Basin. However, they had been unable to make full productive use of the water due to a lack of storage facilities. For that reason, the tribe became a participant in the CUP. They negotiated to allow the use of 70,000 acre feet of water in the Duchesne River for the Bonneville Unit supply for forty years in

exchange for water from future units of the CUP. Reclamation, CUWCD, State of Utah, and the Ute Tribe formalized the agreement on September 20, 1965.²⁹

While not a prerequisite for construction, 1965 saw the negotiation of another agreement which would have a significant impact on the history of the CUP. The Utah Wildlife Foundation, the Utah State Department of Fish and Game, and the United States Forest Service had raised concerns about the impact of Bonneville diversion on Uinta streams and rivers. To address the concerns, the Utah Department of Fish and Game and Utah Water and Power Board had jointly negotiated a resolution. Governor Calvin Rampton concurred with the resolution and sent copies to the CUWCD, the Commissioner and Regional Director of Reclamation, members of the Utah Congressional Delegation, the Upper Colorado River Commission and other interested parties. The CUWCD board approved the resolution and Reclamation modified the DPR.³⁰

The resolution recommended the incorporation of 28 specific fish and wildlife measures in the DPR for the Bonneville Unit. These included 6,500 acre feet of fishery releases or “in-stream flows” to keep streams from completely drying up, the rehabilitation of lakes on the Provo River drainage in the Uinta mountains in conjunction with the construction of Jordanelle, minimum stream flows between Jordanelle and Deer Creek, a minimum stream flow of 60 cubic feet per second (cfs) between Deer Creek Dam and the Olmstead Diversion Dam, a Goshen Bay wildlife management area, and a maximum drawdown of 9.3 feet on Utah Lake. The board unanimously endorsed the resolution with the clarification that Reclamation review the drawdown of Utah Lake and give “further consideration to a practical solution to the problem.”³¹

The final major event of 1965 was negotiation of the Bonneville Unit repayment contract. On January 15, 1965 Reclamation Regional Director Frank M. Clinton presented a rough draft of

the repayment contract for the Bonneville Unit to the CUWCD board. The CUWCD worked with Reclamation and its customer agencies to resolve concerns. The Metropolitan Water District of Salt Lake City (MWDSLCL) wanted *ad valorem* taxes to only be used to repay the municipal and industrial project costs. Additionally, MWDSLCL wanted Reclamation to construct a water treatment plant as a part of the project. Reclamation refused this point and the CUWCD agreed to construct the treatment plant instead.

With the MWDSLCL concerns resolved, the Regional Director submitted the contract to the Commissioner's office for approval. Subsequent to this review, the Commissioner's office proposed several minor revisions. The CUWCD objected to two of the revisions and convinced Reclamation to accept its position. With all parties now in agreement, CUWCD approved the final draft and set a special election to test voter approval for Tuesday December 15, 1965, passing by a margin of 93 percent. On December 28, 1965, officials for Reclamation and CUWCD signed the repayment contract at a formal ceremony.³²

The Utah Fourth District Court validated the contract on February 17, 1966. The contract specified the CUWCD would repay \$130 million. This represented a commitment to repay \$54,405,000 toward irrigation costs over an installment period of 50 years without interest and a municipal and industrial repayment obligation of \$76,268,000 over forty years with interest. Based on 1963 prices, Reclamation estimated the total projects costs at \$324 million.³³

Construction History

With all of the construction prerequisites met, congress appropriated funds to begin preconstruction work on the Bonneville Unit. First, Reclamation established the Uinta Basin Field Division in Duchesne on November 15, 1965, and issued contracts for construction of a

government community in Duchesne during 1966. Reclamation developed a logical construction schedule, to first satisfy the rights of Duchesne water users by building the Starvation Complex. It would then enlarge the Strawberry Reservoir and begin the diversion system to fill it. With water in Strawberry, it would then build the Diamond Fork System and the delivery system for the irrigation and municipal water.

Starvation Complex

The Starvation Complex consists of three elements; the dam on the Strawberry River, a diversion dam on the Duchesne River, and a conduit connecting the two. The unusual name for the dam and reservoir is believe to have originated with the cattlemen and homesteaders that attempted to settle the area along the banks of the Strawberry River in the late 1800s and early 1900s. Due to the harsh conditions—long, extremely cold winters, short growing seasons, floods, and other calamities—the back-breaking place to farm became known as “Starvation Flat.” To construct the Starvation Complex, Reclamation acquired twenty-seven tracts totaling 3,360 acres. Reclamation purchased twenty-one tracts from willing sellers as well as three tracts totaling 1,662 owned by one individual through condemnation.³⁴

Starvation Dam

Invitation for bids was issued on December 29, 1966, by the Chief Engineer in Denver. Four supplemental notices dated January 20; February 1, 3, and 9, were issued. Bids were opened on February 16, 1967. Eleven bids were received with the contract awarded to Goodfellow Brothers, Inc., of Wenatchee, Washington on March 7, 1967. Low bid of \$8,182,750. The contractor received the notice to proceed on March 16, 1967. Goodfellow Brothers began preparation at the site on March 29, prior to the groundbreaking.³⁵

Construction officially began on the Bonneville Unit on May 31, 1967, at a groundbreaking ceremony for the Starvation Dam. Reclamation Commissioner Floyd Dominy, Congressman Wayne Aspinall, Utah Governor Calvin Rampton, and CUWCD Vice President Leo Brady simultaneously pressed buttons setting off a dynamite charge.

Starvation Dam is a zoned, rolled earthfill structure rising 155 feet above the stream bed of the Strawberry River and stretching 2,920 feet across its crest. While in the general location of the dam contemplated by the Castle Peak Project of 1918, Reclamation moved the dam to a lower site about three miles upstream from Duchesne to increase the capacity of the Reservoir to 167,300 acre feet.

While the contractor experienced a few minor delays and challenges, construction on the Starvation Dam proceeded ahead of schedule. Winter conditions forced the Goodfellow Brothers' to shut down operations each winter, from November to March. Crews placed the last of the embankment material in August 1969. They began placing soil cement slope protection on August 18 and completed this work on September 25, 1969. During this same period, crews completed all work on the bridges across the reservoir site to relocate US Highway 40. The Utah Department of Transportation opened the road to traffic on October 16, 1969. On November 10, 1969, crews breached the temporary coffer dam and water from Strawberry River began rising behind the newly completed dam. Moments later water from the Duchesne River was diverted at the Knight Diversion Dam into the Starvation Feeder Conduit.³⁶

Knight Diversion Dam

The Knight Diversion Dam redirects surplus winter and spring flows from the Duchesne River into Starvation Reservoir. The diversion dam, located five miles upstream from the town of Duchesne, is a rolled earthfill dike with a concrete overflow section, and headworks with a

sluiceway. Reclamation issued an invitation to bid on January 11, 1967, and opened February 21. Reclamation received thirteen bids. United Structures, Inc., of Dolores, Colorado, submitted the low bid of \$537,335, subsequently winning the contract on March 10.

United Structures began work on April 24, 1967, by clearing for the dam. However, they had to wait for the spring runoff to end in late June to begin major work. Work continued until December 15. After starting up operations on the Knight Diversion Dam after a three month winter shutdown, a fire at 11:00 pm on March 25, 1968, destroyed the concrete forms and damaged fresh concrete in the left sluiceway wall and previously placed concrete of the right sluiceway wall. The contractor repaired these areas during April. The contractor diverted the Duchesne River through the sluiceway on May 27, and it flowed over the spillway on May 29. United Structures Inc. completed work on July 2, 1968.

Starvation Feeder Conduit

The Starvation Feeder Conduit links the Knight Diversion Dam on the Duchesne River to the Starvation Reservoir on the Strawberry River. The conduit consists of a mile-long tunnel and almost another mile of pipeline. Reclamation issued an invitation for bids on January 6, 1967. The agency received ten bids which it opened on February 28. W. W. Clyde, of Springville, Utah, submitted the low bid of \$1,250,035. Reclamation awarded the contract to W. W. Clyde on March 17, 1967, specifying a completion date of November 10, 1968.

Crews from W. W. Clyde began excavating the tunnel using a Robbins boring machine on August 4. On December 5, 1967, crews completed boring the tunnel after 658 hours, averaging 8.1 feet per hour. W. W. Clyde placed the last concrete in the tunnel lining on August 3, 1968. W. W. Clyde's crews finished the final site cleanup work on November 26.

Reclamation used the completed conduit to make the first diversion of water on November 10, 1969.³⁷

Bottle Hollow

With construction of the Starvation complex proceeding, Reclamation initiated construction on the Bottle Hollow Dams and Dike in conjunction with the Bureau of Indian Affairs. Reclamation constructed the reservoir to mitigate anticipated loss of stream fishing following the diversion of water through the Strawberry Aqueduct. Two dams form the reservoir area located near U.S. Highway 40 and the Ute Tribal Headquarters in Fort Duchesne. Bottle Hollow received its unique name because soldiers deposited their empty whiskey bottles in Bottle Hollow out of sight of Fort Duchesne. Six companies of UNITED STATES soldiers established the Fort in 1875, having been ordered there to maintain law and order. Since the enlisted men were not permitted to bring alcohol onto the Fort, many left the base for liquid refreshments and this was a favorite spot to conceal their bottles. The area has been thoroughly searched in quest for antique bottles, which have become valuable collector's items. The local Indians call the lake "Nu-Pah-Gath-Ti-Ket" meaning "Ute Indian Lake."³⁸

Reclamation opened eleven bids on January 14, 1969. W. W. Clyde submitted the low bid of \$674,800 and was awarded the contract on January 31. The contractor began construction on February 27. Embankment construction began on October 1, and continued thru November 18, when it was discontinued for the season. The completed recreation complex, including a forty-two unit motel, swimming pool, arts and crafts store, and restaurant opened in July 1971. The reservoir filled to capacity for the first time in April 1972.³⁹

Strawberry Aqueduct and Collection System

Simultaneous with the construction of Starvation and Bottle Hollow, Reclamation initiated construction on the most challenging part of the CUP, the Strawberry Aqueduct and Collection System. The aqueduct system consists of an elaborate system of tunnels, dams, diversion structures, and pipelines. It begins at the Upper Stillwater Dam on Rock Creek, and traverses 37 miles in a southwesterly direction, intercepting the flows of eight additional streams. The aqueduct delivers water by gravity to the enlarged Strawberry Reservoir. To begin diverting and storing water at the soonest possible date, Reclamation constructed the system from the bottom up.

Water Hollow Tunnel – Channel Number 2

The first tunnel segment and a one mile open channel connect Water Hollow Creek to the Strawberry Reservoir. Because it is the final section of the aqueduct, the 4.1 mile Water Hollow Tunnel has the largest diameter of all the segments of the Strawberry Aqueduct. The tunnel bore is thirteen feet in diameter, but it has a finished diameter of ten feet ten inches providing a capacity of 620 cfs. A one mile section of open canal connects the Water Hollow Tunnel to Strawberry Reservoir. The tunnel connects to Water Hollow Creek a tributary of Currant Creek. A fourteen foot diversion dam on Water Hollow and a short section of pipeline feed water from the creek into the tunnel to join the water diverted from further up the aqueduct.⁴⁰

On December 1, 1967, Reclamation awarded the contract to the joint venture of Boyle Brothers Drilling and Gibbons and Reed for both the Water Hollow Tunnel and Channel No 2. The contractor received notice to proceed on May 1, 1968. They began clearing and excavation at the inlet portal in June. Tunnel excavation using conventional means at both the inlet and outlet portals began in September. The contractor used a Robbins Model 121 tunnel boring

machine (TBM) to drill the tunnel. The same machine had been used to excavate the Azotea Tunnel on the San Jaun-Chama Project.⁴¹

During the latter part of October, the contractor assembled the TBM at the site. The contractor's crews began drilling with the TBM on November 6, 1968, at the outlet portal. Powered by four 100-horsepower 440-volt electric motors, the mole used twenty-eight cutter discs to cut a thirteen foot diameter tunnel. Crews removed excavated material using an eighty inch gauge mining railroad. This material was deposited at a site later inundated by the reservoir.⁴²

During the initial construction period, the contractor's forces encountered difficulty with water, which created mud in the tunnel. The contractor suspended drilling operations during the first two weeks of December to place a concrete sub invert to help remove water. In addition to the water problems, the train derailed several times on several different days, sometimes more than once a day. The derailments, combined with problems with the conveyor system, slowed the operations.⁴³

Once the contractor solved these problems, the tunnel excavation proceeded without major incident, with one exception. A fatal accident occurred on Tuesday, April 15, 1969. During the swing shift, the mining crews stopped the TBM to make some adjustments. Mr. Ivin W. Johnson, an oiler on the Mole, entered the throat of the Mole unnoticed and unannounced. Unaware Johnson was still oiling the machine, crews resumed mining catching Johnson in the bucket section.⁴⁴

After boring for sixteen months, the TBM emerged from the inlet portal at Water Hollow Creek on March 12, 1970. On March 23, 1971, the contractor completed the concrete tunnel lining. On May 28, Reclamation accepted the project as substantially complete. That winter, on

December 8, Reclamation made the first diversions of water through the tunnel marking the first Bonneville Unit diversions into Strawberry Reservoir.⁴⁵

Soldier Creek Dam

As the contractors finished Starvation and Bottle Hollow Dams in 1970, Reclamation made preparations to let two important contracts on the Bonneville Unit for Soldier Creek Dam and the Layout and Currant Tunnels. The Chief Engineer issued an invitation for bids on August 6, 1970. After opening bids, Reclamation awarded the contract for Soldier Creek Dam and Access Road on October 19, 1970, to Burgess Construction Company of Fairbanks, Alaska.⁴⁶

The Soldier Creek Dam is a zoned earthfill dam located seven miles downstream from the original Strawberry Dam. From its foundation, the dam rises to a height of 251 feet and is 1,290 feet long across the crest of the dam. The new dam raises the water level of the reservoir forty-four feet above the top of the old Strawberry Dam, and enlarges the reservoir's surface area from 8,000 to 17,000 acres. This translates into a four fold increase in the actual storage capacity of the reservoir, increasing it from 283,000 to 1,106,500 acre feet.⁴⁷

On November 18, 1970, a month after issuing the contract, Burgess began construction on the access road and preparation of the dam site. On July 10, 1971, Reclamation and the CUWCD sponsored an official groundbreaking ceremony at the site. Following speeches by the assembled dignitaries, Utah Senator Frank Moss, Reclamation Commissioner Ellis Armstrong, CUWCD President Clyde Ritchie, and Gordon Harmston, Executive Director of Utah Division of Natural Resources representing the State of Utah simultaneously pressed buttons setting off an explosive charge.

Earlier that spring, prior to the groundbreaking ceremony, the contractor had completed excavation of the Upper and Lower Outlet Works Tunnels and gate chamber. The contractor's crews began grouting the dam foundation on July 30, and they completed the work on October 27. As crews completed the grout cap, the contractor also began placing embankment materials.⁴⁸

Throughout the fall the contractor made rapid progress. However, during the winter months, the contractors working on the Bonneville Unit had exhausted the congressional appropriations for the year. Anticipating the passage of a supplemental appropriations bill, Burgess continued construction uninterrupted on Soldier Creek Dam. Congress made the supplemental funds available to Reclamation in January. During the spring of 1972, Burgess completed concrete lining of the outlet tunnel and installation of the steel gates. This allowed the contractor to divert the Strawberry River around the dam site on May 1, 1972, and to complete the final excavation and grouting of the dam foundation. Work progressed rapidly on the dam throughout the summer. Crews worked two nine-hour shifts placing embankment materials. In early November, Burgess crews topped out the dam almost a year ahead of schedule. Reclamation declared the project substantially complete the following year in September 1973. Reclamation awarded special recognition to the crews of Burgess Construction Company who worked 450,000 man hours on Soldier Creek Dam without a single lost time accident.⁴⁹

Because Burgess completed the job ahead of schedule, eradication of trash fish in the river between the existing Strawberry Dam and the new Soldier Creek dam had not begun. Burgess had placed the plug a year earlier than expected, and the reservoir filled to the dead storage level. Prior to any additional storage the Utah Division of Wildlife Resources (DWR) wanted to conduct a trash fish eradication program, primarily for the Utah Chub (*Gila atraria*).

During mid-July 1973, Reclamation cooperated with the Utah DWR, and the United States Bureau of Sport Fisheries and Wildlife to chemically treat the water between the two dams with the toxicant Rotenone. Because there were springs immediately upstream from the dam, under the level of the dead storage which the rotenone would not penetrate, the Utah DWR instructed Burgess to use explosive charges to kill the fish. Burgess laid 7,600 pounds of dynamite in a grid pattern to dislodge and kill any fish seeking refuge in the springs.⁵⁰

During the next few years, the reservoir behind the Soldier Creek Dam was allowed to fill to the 7,500 foot level in anticipation of the equalization of reservoirs and the removal of the Strawberry Dam. Following the collapse of the Teton Dam, Reclamation contracted for independent review of all its dams, beginning with those with designs similar to Teton. In 1977 W. A. Wahler and Associates conducted a review of Soldier Creek dam and found several conditions which could result in damage to the dam caused by seepage. Taken individually, these conditions would not cause concern, but collectively the review team felt they could potentially pose a hazard.⁵¹

As a result of a follow up investigation by Reclamation's Engineering and Research Center in Denver, Reclamation engineers developed a plan to upgrade and improve the drainage and seepage control measures in the dam and its abutments. In October 1983, Reclamation awarded a contract to construct a 700 foot tunnel into the right abutment and excavation of a drilling chamber 20 by 27 feet. The contractor then drilled fifty drain holes between 120 and 265 feet in length and installed drainpipes. As a result of this work, any water coming into the abutments from the reservoir enters the drains, and is discharged into the drilled chamber and flows back into the reservoir. Reclamation accepted the contractors work as complete in June 1985.⁵²

As the contractor finished the upgrades to Soldier Creek, Acting Assistant Commissioner D. W. Webber authorized the equalization of the two reservoirs on February 1, 1985. On February 5, Reclamation personnel traveled to the site in over-snow vehicles to open the gates on Strawberry Dam which had been shut since 1912. Local television crews arrived by helicopter—landing on the dam—to record the event. Operation and Maintenance crews from the Utah Project Office in Provo used hydraulic jacks to raise the gates. The two gates opened, allowing an estimated 1,000 cfs to flow from the Strawberry Reservoir to the Soldier Creek Reservoir.⁵³

On March 18, 1985, Reclamation awarded a contract to BECHO for the breaching of the old dam and the Indian Creek Dike. Breaching operations started in May and the merging of the reservoir began June 3. During August and September BECHO conducted blasting operations to remove the concrete core wall of the Strawberry Dam. Breaching of the Indian Creek Dike began on May 16. On June 12 drilling out the core wall at Indian Creek Dike commenced. On November 14, 1985, divers began cutting the rebar flush with the concrete on the dike.⁵⁴

Layout and Currant Tunnels

In addition to the Soldier Creek Dam, the second major contract awarded in August 1970 was for the Layout and Currant Tunnels. These two tunnels extend the Strawberry Aqueduct upstream near the site of the Currant Creek Dam. Layout Tunnel breeches the ridge between Water Hollow and Layout Creeks, while the Currant Tunnel breeches the ridge dividing Layout and Currant Creek. These two tunnels are 3.3 miles and 1.7 miles long, respectively. They have a finished diameter of ten feet ten inches. In addition to the work on the two tunnels, the contract also included construction of small diversion structures and pipelines to divert water from Water Hollow and Layout Creeks into the Strawberry Aqueduct.⁵⁵

On August 20, 1970, two weeks after issuing an invitation for bid on Soldier Creek Dam, the Chief Engineer issued an invitation for bids on the Layout and Currant Tunnels, Diversion and Appurtenant Structures under a single contract. After opening bids on October 15, Reclamation awarded a contract on November 18, 1970, to S. A. Healy Company of McCook, Illinois. The contractor began work in March 1971 by drilling culinary wells at the construction camps.⁵⁶

On April 27, 1971, excavation crews began preparing the Layout Tunnel Outlet Portal-290 feet upstream of the Water Hollow Tunnel inlet. A Robbins Mole arrived on the work site on May 24. After assembling the boring machine, the contractor began tunnel excavation on June 25, 1971. Excavation work continued until September 22, when lack of funds forced the contractor to suspend operations. Prior to the shutdown crews had excavated 5,092 feet.⁵⁷

Congressional approval of a supplemental appropriations bill made funds available in January 1972. After some preparatory work, Healy Construction resumed excavation of the Layout Tunnel on February 28. In April the TBM encountered a void which caused a delay. However, after passing the void, crews set a number of excavation records. On May 5, the three shifts excavated a total of 288 feet. Good progress continued and the miners completed 1,024 feet in a week, pushing the total excavation past seventy percent complete.

In anticipation of completion of the tunnel, Healy Construction began preparing the inlet for the Currant Tunnel. The TBM emerged from the Layout Tunnel in early July 1972, and crews began renovating the machine and moving it across the canyon to the Currant Tunnel Inlet. By the middle of August the machine was more than 1,000 feet into the mountain. Healy

Construction gave Reclamation a treat when it completed excavation of the 1.7 mile Currant Tunnel on Halloween Day, 1972.

With the excavation of the Layout and Currant Tunnels complete, the contractor began placement of the concrete tunnel lining. The contractor used twelve sections of collapsible arch forms with a total length of 384 feet. They used a form jumbo to move the sections. To transport the concrete from the batch plant, the contractor used four trains made up of three 6 cubic yard agitator cars. Each train hauled approximately sixteen cubic yards of concrete. The lining of the tunnels was completed in November and work at the site shut down for the winter. With the tunnels essentially completed, the only work that remained was completion of a 199-foot siphon across Layout Canyon between the two tunnels and the Layout Diversion Dam and Feeder Pipeline. Healy Construction resumed work on the remaining features of the contract in May 1974 and completed construction by late summer. Reclamation tested the siphon in December and accepted the Currant and Layout Tunnels as complete on January 14, 1975. On January 31, Reclamation made the diversions from Layout Creek into the Strawberry Aqueduct.⁵⁸

Jordan Aqueduct Reach I and II

With construction underway on enlargement of Strawberry Reservoir and the lower portions of the Strawberry Aqueduct, Reclamation began preparations for construction of the delivery system for much-needed municipal water to Salt Lake County. Reclamation had included delivery of additional municipal water supplies to Salt Lake County in the original plans for the CUP. During subsequent years, these plans changed to meet the demands of population growth in the valley. Housing development in the Salt Lake Valley during the 1950s and 1960s centered largely in the western portions of the Salt Lake Valley. To serve these

growing communities, Reclamation worked with the SLCWCD and the MWDSLCL to plan the Jordan Aqueduct.

The plans called for the new aqueduct to connect to the existing Murdock Canal—an irrigation canal of the Provo River Project—at the western edge of a ridge separating Utah and Salt Lake Valley called the Point of the Mountain. The first section of the Jordan Aqueduct included a siphon under the Jordan River and terminated at a new water treatment plant to be constructed by the CUWCD. A second section of the aqueduct would extend northward along the western side of the valley to provide connections to the growing communities. At its northern end, Reclamation planned a third section to extend the Aqueduct northward to a connection with future development planned by Salt Lake City in its northwest quadrant. While it would be several years before water would be delivered from Strawberry Reservoir, Reclamation and the local water district felt that due to the continued rapid development of the area, the aqueduct would be easier and cheaper to build early in the Bonneville Unit Construction. Additionally, the local water districts anticipated that the aqueduct could be used facilitate the delivery of non-project water to the area during the interim period.

On June 29, 1971, Reclamation awarded a contract for the first two sections of the Jordan Aqueduct to S. A. Healy Company. Healy Company employed two subcontractors, Prince Construction and Graven Brothers Company. The subcontractors initiated construction activities during September 1971. Because of the late start, S. A. Healey did not experience an exhaustion of funds during the fall of 1971. Subsequently, Healey did not shut down work on the Jordan Aqueduct as it had on the Layout Tunnel. Work progressed smoothly on the project through 1972. However, the situation changed as winter set in. Between October 1972 and the end of January 1973, ten snowstorms blanketed the valley with two to eighteen inches of snow apiece.

Colder than normal temperatures and heavy snows closed down work on the Jordan Aqueduct on January 19. Cold, wet weather continued to slow work through the spring. With the arrival of spring, the work pace resumed normal levels, and the contractor completed most of the work by July. Reclamation accepted the project as substantially complete September 17, 1973.⁵⁹

NEPA Document and Lawsuit

During the early 1970s, construction on the Bonneville Unit was proceeding at a brisk pace. Contractors labored simultaneously on the Soldier Creek Dam, portions of the Strawberry Aqueduct, and the Jordan Aqueduct. Reclamation was busy preparing designs for the Currant Creek Dam, and the upper portions of the Strawberry Aqueduct. Congress had appropriated funds for construction of these features in the budget for 1973. However, before construction could begin, Reclamation had to complete an environmental evaluation of the project in compliance with new laws.

On January 1, 1970, President Nixon signed the National Environmental Policy Act (NEPA). The new law required federal projects to complete a scientific assessment weighing the potential environmental impacts against anticipated benefits. The law did not interrupt construction under existing contracts. But Reclamation had to complete a document prior to the construction of Currant Creek Dam and the balance of the Strawberry Aqueduct and collection system as well as the other elements of the Bonneville Unit. The study took three years to complete and Reclamation issued the finished Bonneville Unit Environmental Statement (ES) in August 1973. The document addressed the entire Bonneville Unit generally, but focused specifically on the Strawberry Aqueduct and Collection System.

Reclamation held several public hearings after releasing a draft version of the statement. They held the hearings on Friday, September 22, and Saturday, September 23, 1972, in the Orem

High School Auditorium. Over the two days, the hearings lasted thirteen hours and drew 1,300 people. The bulk of the crowds, nearly 1,200 people, attended the Friday session. Supporters of the project from Millard County organized buses to bring hundreds of people to the hearing. Delta and Millard High Schools sent one hundred students each, and one hundred senior citizens from the county also traveled to the meeting by bus. Prior to the hearing, 127 people requested to testify, but only ninety-five actually spoke. Of these, ten expressed opposition to the project. Additionally, Reclamation received 1,450 written comments, which, when counting multiple signatures, represented 1,700 individuals or organizations.⁶⁰

In total, opponents commenting on the ES raised twenty-nine separate issues which Reclamation answered in the final version of the document. The Utah State Division of Natural Resources, the Bureau of Sport Fisheries and Wildlife, the Environmental Protection Agency (EPA), the Sierra Club, Mt. Timpanogos Chapter of the Audubon Society, the Utah Environmental Center, and several individuals all expressed concern that the ES failed to consider the cumulative impacts of the entire Bonneville Unit. In response, Reclamation committed to prepare additional statements for the additional segments of the unit.⁶¹

Reclamation filed the Final ES with the Council on Environmental Quality on August 2, 1973. Later that fall, on November 9, Reclamation issued an invitation for bids on Currant Creek Dam and Vat Tunnel. However, before Reclamation could open the bids, the United States District Court in Utah halted work on these projects with an injunction. Unsatisfied with the Final ES, several environmental groups, including the Sierra Club, Trout Unlimited, and the National Resources Defense Council joined in a lawsuit to stop construction on the Bonneville Unit, claiming that the Final ES was deficient and that the project disrupted the habitat of endangered fish in the Colorado River. While hearing the case, the court granted

an injunction that prevented Reclamation from awarding the contract for the Currant Creek Dam. The court heard arguments through the spring of 1974.

After hearing the testimony, District Court Judge Ritter ruled in favor of Reclamation on June 21, 1974. The Sierra Club appealed the decision to the Tenth Circuit Court of Appeals in Denver and applied for a stay order to prohibit Reclamation from proceeding with work and awarding bids, but Judge Ritter rejected their motion. On November 29, 1974, Circuit Court Judges Hill, McWilliams, and Doyle affirmed the decision of the District Court. The judges ruled in favor of Reclamation stating that the Strawberry Aqueduct and Collection System could be judged as a stand-alone unit of the CUP for consideration in the ES.⁶²

Currant Creek Dam

Reclamation originally scheduled the bid opening for the Currant Creek Dam for March 6, 1974, but it postponed the bid opening four times because of court proceedings. Following the ruling of the District Court, Reclamation opened five bids on June 18 and subsequently awarded the contract for \$18,347,191 to the low bidder, S. J. Groves and Sons, on July 15. The contractor's crews began work July 26 on a road, culverts, the right dam abutment, and boat ramps. Assembly of a crusher in borrow area B was also initiated. The Sierra Club had attempted to stop work at the site by filing a motion with the District Court for an injunction against further work, but the Court denied their motion.⁶³

Currant Creek Reservoir forms an open water connection between the Vat Tunnel and the Currant Creek Pipeline. Additionally, Currant Creek Reservoir diverts water from Currant Creek and five of its tributaries into the aqueduct. The reservoir is located on Currant Creek, seven miles above its confluence with the Strawberry River. The site is entirely within the boundaries of Forest Service lands. Reclamation withdrew the site from the public domain in 1918 in

connection with the proposed Castle Peak Project. Curren Creek Dam rises 130 feet from its base and stretches 1,600 feet along its crest. The dam creates a reservoir with a capacity of 15,500 acre feet. However, because the reservoir is designed for regulation rather than storage purposes, and to maximize recreational use of the reservoir, only the top 1,000 acre feet is used for active storage. This limits fluctuation of the reservoir to four feet.⁶⁴

Throughout 1974, the contractor made good progress on the dam. By year's end, approximately 230,000 cubic yards had been excavated from the foundation area using a backhoe. Originally the contractor attempted to use scrapers and bulldozers, but the foundation materials proved to be too wet, causing the machines to become stuck. The contractor initiated the foundation dewatering plan, and filled two settlement ponds on October 23. However, even after settling the water, the water retained a high turbidity and the contractor had to haul the water in Caterpillar 651 Water Wagons to borrow area B. In the fall, the turbidity levels dropped to a point that the EPA allowed discharge into the creek.⁶⁵

The following spring water continued to be a problem. Reclamation issued a change order allowing the contractor to construct a water treatment plant to deal with high turbidity in the water pumped from the dam foundation. The spring melt also caused problems with the area around the outlet works. The bank slipped approximately 10 feet vertically and slid into the excavation. The contractor resloped the area and continued excavating for the outlet works foundation. However, because the ground was too soft, the contractor had to extend the excavation up to 30 feet to bedrock. An extra fifty cubic yards of material was removed and the area backfilled.⁶⁶

Work progressed simultaneously around the site. The contractor continued excavation of the embankment foundation. Continental Drilling, subcontractor for grouting, began drilling on

June 4. S. J. Groves' crews completed excavation of the foundation in August, and Continental Drilling completed the grout caps September 25, 1975. The contractor completed 63 percent of the work before shutting down for the winter.

Over the winter, limited construction activity took place as the contractor continued concrete placement on the outlet tunnels and control works. Cold temperatures forced the contractor to discontinue this work on February 6, 1976. Work resumed at the site in March as the contractor initiated excavation of the spillway stilling basin on March 16, and began steel work on the outlet works. In April, S. J. Groves and Sons resumed placement of zone two embankment materials and the placement of concrete in the outlet works structures. They had placed fifty percent of the embankment materials by the end of June. By August 31, work had progressed to a point that Currant Creek was diverted into an eighteen inch diversion pipeline, allowing work to begin on the final sections of the dam. The contractor also worked on completing the 3,860-foot long Currant Creek Pipeline, a ten foot buried pipeline which connects the outlet works of the dam to the Currant Tunnel. By the end of the year, the contractor had completed this pipeline and placed all but a small portion of zone two materials and essentially completed the placement of all concrete.⁶⁷

In May 1977, S. J. Groves and Sons Company mobilized equipment and resumed earth work to complete zone two embankment and adjacent earthwork. By the end of July, the contractor's crews completed placing all embankment, topsoil, and riprap.

During the spring runoff of 1978, Reclamation began testing the Currant Creek Pipeline. The tests showed the pipeline had developed major leaks. Subsequent inspections revealed that sections of the pipeline had developed major cracks. Studies later determined that these cracks resulted when loaded scrapers drove over the shallowly buried pipeline. Reclamation anticipated

repair work to be done by the contractor in 1979. On January 5, 1979, Reclamation began working with the contractor to develop a plan for pipeline repairs. It sent a letter outlining three alternatives: first, remove and replace the entire pipeline; second, line the pipeline with mortar-coated steel pipe; or, third, propose another alternative. However, the contractor felt it was not to blame for the cracks and filed a lawsuit.

The UNITED STATES District Court determined the contractor was not responsible for the cost of the pipeline repair at Currant Creek. With an agreement reached, Reclamation sent a letter dated June 10, 1980, directing the contractor to proceed with the repair by lining the pipeline with mortar-coated steel pipe. The contractor began work in August 1980 by removing three sections at five locations in order to insert the liner. Work continued through October 16, 1980, and then resumed in spring of 1981. The contractor completed the installation of the steel lining in the concrete pipeline on September 16, 1981. Reclamation conducted filling and testing of the repaired pipeline between September 28, and October 2. Reclamation agreed to a settlement to cover the costs of the repair work, paying the contractor an additional \$5,808,516, and bringing the total cost for the Currant Creek Dam and Pipeline to \$27,865,000.⁶⁸

After many delays, Reclamation finally closed the gates at Currant Creek Dam on October 4, 1982, to begin filling the reservoir. Reclamation signed an agreement transferring the operation of the recreational facilities at Currant Creek to the UNITED STATES Forest Service on August 21, 1984. The Forest Service operated visitor facilities at Currant Creek including a 4-loop, 100-site campground, boat launch, day use area, dump station, playground, and horse loading facility.⁶⁹

Vat Tunnel

Although Reclamation had initially issued the invitation for bids on both Currant Creek Dam and Vat Tunnel on the same day in November 1973, the EIS lawsuit and subsequent budgetary issues caused longer delays for the Vat Tunnel. Following the delay, on May 16, 1975, Reclamation reissued an invitation for bids on Vat Tunnel. Reclamation opened four bids on July 17, and subsequently awarded a contract on August 29 for almost \$30 million to the low bidder, J. F. Shea of Walnut, California.⁷⁰

The Vat Tunnel is the second longest tunnel of the Strawberry Aqueduct. The 7.4 mile tunnel conveys water from the West Fork of the Duchesne through Red Creek Mountain to the Currant Creek Reservoir. The tunneling machine excavated a bore eleven feet in diameter and crews applied a concrete lining to a finished diameter of 8.25 feet. Vat Tunnel has a capacity of 475 cfs.

Because of winter weather, construction on the tunnel did not begin until May 1976 when the contractor began site preparations at the outlet portal. In June J. F. Shea Company crews began excavating the tunnel portal. This work continued through July and August. By the end of August, the miners had excavated 52 feet of the tunnel. Crews outside the tunnel began assembling the TBM which arrived at the site on August 20. On October 4, the contractor's crews began excavation with the mechanical mole. By year's end the mining crews had excavated a total of 2,807 feet, averaging ten feet per hour.⁷¹

Work progressed relatively smoothly on the Vat tunnel through 1977. During that year, crews excavated nearly three miles bringing the total excavation past the halfway mark. Crews continued to make good progress through 1978 as well. By the middle of December, the crews had excavated 85 percent of the tunnel with only about one mile remaining. This rapid progress came to a halt on December 23 when the TBM hit an underground river. Water flows exceeded

1,830 gallons per minute, far exceeding the capacity of the dewatering and treatment systems, forced the crews to discontinue excavation.⁷²

To deal with the water, the contractor added an additional twelve inch discharge line and injected concrete grout into the face of the tunnel in an attempt to seal off the tunnel. J. F. Shea's crews used 8,146 sacks of grout, and completed the operation on March 31. On April 2, crews resumed excavation with the TBM. But, within a week increased water flows forced them to stop to extend the grout "cork" further. The drilling of the tunnel face and injection of another 7,703 bags of cement continued into May.⁷³

After the flow of water from the tunnel dropped, the contractor resumed excavation with the TBM on June 20. The mole moved forward 172 feet before being forced to stop again because of high water flows and pressures. Test holes drilled ahead of the mole showed water pressures in excess of 600 **psi**. What followed was a prolonged and slow battle against the water. Over a period of several weeks the contractor drilled the tunnel face and injected grout. This allowed excavation to move forward a few hundred feet only to be stopped again. The contractor pumped an additional 1,976 sacks of cement grout in July, 1,742 sacks in August, 4,263 in September, 2,344 sacks in October, 2,239 sacks in November, and 2,422 sacks in December 1979.⁷⁴

Water and the instability of the geologic formation of blocky shale continued to cause problems through 1980. This translated into slow progress in the tunnel. Crews excavated a total of 814 linear feet by the end of the year—bringing the total to 34,897 feet or about 90 percent complete. As excavation continued in early 1981, water flows continued to reach levels between 1,259 to 1,730 gallons per minute. Relief finally came in May as the excavation moved out of the shale and into a layer of Navajo sandstone. The sandstone allowed rapid

progress. and the TBM excavated 3,072 feet in a single month. However, on May 28, with only 85 feet remaining, the machine encountered a layer of loose sandy material, making moling impossible. In June, Reclamation authorized the contractor to begin excavating from the inlet portal using conventional methods. On July 28, 1981, crews completed the excavation of the tunnel, and preparations began for the concrete lining.⁷⁵

Reclamation had originally scheduled the Vat Tunnel for completion in November 1979, but due to the continued excessive flows of water, the tunnel was not completed until mid-February 1983.⁷⁶

Stillwater Tunnel

With the Currant Creek Dam nearing completion and work progressing on the Vat Tunnel, Reclamation issued an invitation for bids on September 30, 1976, for the longest tunnel section of Strawberry Aqueduct, the 8.1 mile Stillwater Tunnel. The tunnel at the top of the aqueduct system links Rock Creek with the North Fork of the Duchesne River. The tunnel transitions from 7.5 to 8.25 feet in diameter between the inlet and outlet. The tunnel drops 80.5 feet in the 8 miles, is free flow, and has a maximum cover of 2600 ft.⁷⁷

Because of its length and because of the depth of the tunnel under the mountain, it presented special construction challenges. In 1971, Reclamation proposed that the Stillwater Tunnel be used as a research project to experiment with an intent to provide a breakthrough in the United States on deep tunnel construction technology. The research program incorporated into the construction project was intended to overcome the uncertainties of predicting rock conditions for deep tunnels. While lack of funding reduced the research program, Reclamation moved forward with an experimental design for a tunnel boring machine and precast tunnel liner. The Office of Design and Construction issued invitations for bids on September 30, 1975.

Reclamation received six bids, and awarded a contract to the low bidder, Harrison Western/Cowper joint venture on January 6, 1977.⁷⁸

The contractor began site preparations in the spring and began excavating the outlet portal by conventional drill and blast methods on May 23, 1977. The design called for the first 6,000 feet of tunnel to be excavated using conventional materials. This process took approximately one year. On May 30, 1978, crews delivered the TBM to the outlet portal. This TBM, a Robbins model 92-192, was designed specifically to excavate the outlet end of the Stillwater Tunnel. It incorporated a full-circle telescoping rock shield twenty-four feet long and 9.6 feet in diameter. The TBM used gripper pads to push the machine forward and an auxiliary thrust system to assist in moving precast concrete liner segments. The machine was not designed to accommodate backing operations and it had a very long shield.⁷⁹

Unlike the Vat Tunnel, water was not a major problem during tunnel excavation. The contractor had been instructed to provide a water treatment plant, but this was never activated as the drainage rates were low enough that the settling ponds could be used. Instead, the major problem proved to be the operation of the experimental TBM and tunnel lining system. From the beginning, the project was fraught with difficulties and hardships created by the host rock—red pine shale—squeezing the TBM, buckling the tunnel supports, and failure of the precast tunnel liners.

The TBM stalled several times due to power failures, weekend shutdowns, equipment failures, rock pressures, and dust. The large shield resulted in excessive friction when the machine stalled. To free the TBM, it was necessary to push the TMB against the installed segments of tunnel liner. The pressure caused damage to the tunnel segments which had to be

replaced. On several occasions hand mining was necessary to free the TBM. The TBM stalled 14 times.⁸⁰

As a consequence of these engineering difficulties, further tunneling with the TBM was considered infeasible and the contract was terminated in September 1979 for the convenience of the government. The contractor had excavated 1.45 miles of tunnel using the mole for a total of 2.65 miles. On January 13, 1981, a contract was awarded to Mole Construction Co. for backfill grouting on Stillwater Tunnel. Work began on February 16, and over the next two and one-half months 380 concrete crown segments were removed and replaced with structural steel. The contractor used 357 tons of cement in May and June to complete the backfill grouting.⁸¹

In February 1982, after a delay of twenty-nine months, the Bureau awarded a \$34 million contract to a joint venture of two Evansville, Indiana, firms, Taylor Brothers, Inc., and Fruin-Colnon Contracting Company, for completion of the remaining 5.4 miles of the Stillwater Tunnel. In an attempt to speed construction and lower costs for completing the tunnel, Reclamation changed the bid structure on the completion contract. Rather than use unit price and linear foot pricing as in the first bid, Reclamation solicited a fixed-price incentive contract. As a result the contractor benefited from the inclusion of incentive payments, thus negating the need to make claims for changed conditions. The contract also provided room for innovations and incentives that are necessary to overcome surprises during tunneling projects.⁸²

The government-owned TBM was completely dismantled for modification. The completion contractor modified the TBM by reducing the shield area and increasing the overall thrusting capacity. They installed 12 thrust cylinders, six were used during excavation, and the alternate six were moved forward for a new cycle. The teardown, repair, and rebuilding took nine months.

During this time period the contractor began excavation from the inlet portal using a second TBM, a Robbins model 93-203. In January 1983 the contractor resumed excavation of the outlet tunnel. The modified TBM still experienced trouble and was plagued with grade, alignment, and steering problems. Near the end of the process the main bearings failed and, as a result, the contractor completed the remainder of the tunnel using the smaller inlet TBM.⁸³

Under the completion contract, the outlet TBM only excavated 3,883 feet and averaged only thirty feet per day over a six month period. The completion contractor excavated with the inlet TBM for a longer period, approximately one year, and averaged 135 feet a day. The contractor completed the excavation of the tunnel on September 15, 1983. Tunnel lining proceeded over the next year and a half. Reclamation accepted the completed tunnel on May 31, 1985.⁸⁴

“Hit List”

Following the court victory, construction had resumed at a brisk pace on the Bonneville Unit. In the next few years, Reclamation’s contractors essentially completed the Currant Creek Dam and began work on the two longest tunnels of the Strawberry Aqueduct. However, a small group of environmentalists, outdoorsmen, and fiscal conservatives continued to criticize the project.

One of the most outspoken critics was newly-elected President Jimmy Carter. On February 21, 1977, Carter’s list of the nineteen water projects he wanted stopped, including eight Reclamation projects in the West, came to light. Those supporting the projects on Carter’s list quickly branded it the “hit list.” Near the top of the list, Carter had placed the CUP.⁸⁵ President Carter gave four reasons for eliminating the Bonneville Unit of the CUP that closely followed the arguments long used by project opponents of the CUP. First, he stated that the project posed

serious environmental damage through the depletion of stream fisheries and the loss of habitat through the diking of Utah Lake, and that the exportation of Colorado River water would aggravate salinity problems in the Colorado River. He further argued that the CUP complicated Ute Indian Claims to water. He calculated that the project was not economically sound since it could not be completed under authorized ceilings established in the original program. The “hit list” also argued that using current interest rates the project no longer had a positive cost-benefit analysis. Finally, the list claimed alternative sources of municipal water existed for the Salt Lake Valley.⁸⁶

The Department of the Interior held special hearings on the Bonneville Unit in the Salt Palace Little Theater on March 24, 1977.⁸⁷ As a result, Carter revised his recommendations for cuts in April 1977, but the CUP remained on the list targeted for substantial revisions and reevaluation. As the summer progressed, Carter reached a compromise with Speaker of the House Tip O’Neil which eliminated funds for nine projects and modified three others. Carter signed the compromise bill on August 7, 1977.⁸⁸

West Fork Pipeline- Vat Diversion Dam and 404 permits

The West Fork Pipeline extends approximately four miles in the center of the Strawberry Aqueduct and Collection System. It connects the outlet of the Rhodes Tunnel to the inlet of the Vat Tunnel. The pipeline which runs along the north side of the West Fork of the Duchesne River Canyon consists of a buried six and one-half-foot diameter pre-cast concrete pipe. Flows from the West Fork are diverted into the pipeline by the Vat Diversion Dam and feeder pipeline. The dam is located about seven miles west of the confluence of the West Fork of the Duchesne River and Wolf Creek. The structure diverts flows for the river to the Strawberry Aqueduct. The dam is thirty-eight feet at its highest and rises twenty-two feet above the stream bed. The

zoned earthfill dam stretches 575 feet. A 615 long foot pipeline connects the dam to the West Fork Pipeline near the inlet of the Vat Tunnel.⁸⁹

Reclamation opened bids for the West Fork Pipeline-Vat Diversion Dam on March 8, 1979. On April 27 it awarded a contract to the low bidder, W. W. Clyde of Springville, Utah, in the amount of \$11,763,892.50. The contractor's crews began clearing the dam site in June and continued through the summer. Excavation for the pipeline began in September and continued through November 11, when weather forced the winter shutdown.⁹⁰

As the contractor began construction, CUP opponents mounted another attack on the project. The Utah Chapter of the Sierra Club and a small group calling itself Citizens for a Responsible CUP filed protests with the Army Corp of Engineers (COE) seeking the denial of a the "404 Permit" which allows alteration to a stream. While that agency had previously granted permits for other project features, officials at the COE regional offices in San Francisco responded to the complaints by initiating a full review of the Strawberry Aqueduct's impacts on stream flows. The review prompted the Utah Division of Wildlife Resources to criticize the CUP impacts on trout habitat. Sympathetic to both sides, Utah Governor Scott Matheson intervened to renegotiate the 1965 stream flow agreement. On February 7, 1980, Reclamation, the CUWCD, and State of Utah signed an agreement making up to 44,000 acre feet of water available annually for in-stream flows. As a result of the agreement, the COE issued a permit in the spring of 1980.⁹¹

Construction moved forward. During the summer and fall, W.W. Clyde Company's crews installed over half of the four mile West Fork Pipeline and initiated construction on the Vat Diversion Dam before shutting down for the winter. As spring weather returned, the contractor resumed work on the project. By early fall 1981, crews had laid 96 percent of the

pipeline and begun preparations to tie the pipeline into the Vat Tunnel. Concrete crews also worked to complete the sluiceway on the Vat Diversion Dam. Work continued on these projects until the onset of winter weather.

The winter of 1981-82 brought heavy snow and subsequent flooding during May and June of 1982. Heavy runoff in the West Fork of the Duchesne River resulted in erosion at the site of Vat Diversion Dam and washed sand and gravel into the portions of the West Fork Pipeline. As a result W.W. Clyde's crews spent considerable time repairing the damage. Heavy runoff in 1983 caused additional problems and delays. However, by the end of the year the contractor's crews had completed 65 percent of the Vat Dam. Work resumed again in 1984 and W.W. Clyde completed the dam in November 1984. The Vat Diversion Dam and Vat Tunnel were used for the first time on March 27, 1986.

Hades and Rhodes Tunnels

With construction moving at a snail's pace on the Vat Tunnel and completely stopped on the Stillwater Tunnel, Reclamation determined to move forward on the Strawberry Aqueduct and Collection System. On Feb 19, 1980, Reclamation issued an invitation for bids on the Hades and Rhodes Tunnels. These were the last two tunnel segments of the Strawberry Aqueduct system. The Hades Tunnel runs 4.2 miles under the mountain, dividing the North Fork of the Duchesne River from Wolf Creek. The .8 mile Rhodes Tunnel runs under the ridge dividing Wolf Creek from the West Fork of the Duchesne River where it connects with the West Fork Pipeline. The Wolf Creek Siphon, a 237 foot pipeline, connects the two tunnels.⁹²

Reclamation opened seven bids for the two tunnels on June 5. Harrison Western Corporation submitted the low bid of \$34,681,703 and Reclamation awarded a contract to the company on June 24, 1980. The contractor received notice to proceed July 21, and began

construction of an access road to the Rhodes Tunnel. By September, the contractor's crews had stabilized the area of the outlet portal with shotcrete and the TBM began excavating on September 23.

Simultaneously, the contractor employed crews to construct an access road up Wolf Creek to reach the inlet portal of the Rhodes Tunnel and the outlet portal of the Hades Tunnel. By mid-November the TBM had nearly completed the excavation of the Rhodes Tunnel. Harrison Western's crews used an Alpine Miner to cut through from the inlet portal. Crews holed through on November 21, completing excavation of the 4,110 foot tunnel. The TBM was moved out of the tunnel and across the river to begin excavation of the Hades Tunnel. By the end of December, the TBM crews had cut 1,412 feet on the Hades Tunnel.⁹³

As work on the Rhodes and Hades Tunnels continued into 1981, crews continued to make rapid progress. The TBM completed the Hades Tunnel on November 30, 1981, two months ahead of schedule. The contractor began lining the Hades Tunnel at the end of March 1982 and had essentially completed the job by November. The crews then began lining the Rhodes Tunnel which they finished that month. With the tunnels lined, the contractor prepared the site for winter. During 1983, the contractor began work on the Wolf Creek Siphon to connect the two tunnels with a 237 foot long pipeline, seven feet in diameter. Reclamation accepted the contract as complete June 25, 1984.⁹⁴

Supplemental Repayment Contract Jordan Aqueduct-Reach III and IV-TPA Lawsuit

During the late 1970s, construction on the Bonneville Unit moved forward on several fronts. Contractors worked on completing the Currant Creek Dam, Vat Tunnel, Stillwater Tunnel, and began work on the West Fork Pipeline, Vat Diversion Dam, Hades Tunnel, and

Rhodes Tunnel. As this construction work continued, the CUP faced several new political hurdles as Reclamation attempted to move forward with construction on other project features.

The first hurdle was the increasing costs of the projects due to inflation. Beginning in 1980, Reclamation and the District began negotiating a supplemental repayment contract to increase the District's repayment costs to cover the increases in the Bonneville Municipal and Industrial System. At the District's November 13, 1980, board meeting, the Board unanimously passed a resolution supporting the contract and favored submitting it under the current Administration to prevent delays in bringing the new members of the Reagan administration up to speed.⁹⁵ However, Assistant Secretary of the Interior, Guy Martin, wrote a scathing review of the supplemental repayment contract. In the memo, Martin called the proposed contract flawed. "As drafted, the contract contains several provisions which are clearly illegal, others that have questionable legal basis, and several provisions which are not fiscally prudent. Moreover, the contract masks costs of hundreds of million of dollars from the clear view of the people who must pay for the project and the taxing public." Additionally, he labeled the project as environmentally unsound.⁹⁶

Instead of revising the contract, Reclamation agreed to the District's proposal to invoke the Water Supply Act of 1958. The agencies designated 60,000 acre feet of the 99,000 acre foot anticipated municipal supply from Jordanelle as "future supply." This exempted two-thirds of the Bonneville M&I supply from a repayment contract. Project critics and the General Accounting Office later questioned the legality of the use of the Water Supply Act because, in the case of Jordanelle Reservoir, Reclamation had not actually changed the plans. The change had been made previous to execution of the 1965 repayment contract. As a result, Reclamation and the District later renegotiated a repayment contract in 1985.⁹⁷

However, in the interim period, the use of the Water Supply Act allowed the project to move forward. Reclamation continued to study the site of and the design for the Jordanelle Dam. They also moved forward with construction and planning to deliver CUP water to the Salt Lake Valley. Work began again on Jordan Aqueduct Reach 3, which extended the aqueduct further north to a connection to Salt Lake City's water system at 2100 South Street. Contractors finished major construction on this portion of the line in April 1982.

As construction moved forward on Reach 3, the Bureau continued planning for Reach 4, which would connect Reach 1 at the Point of the Mountain to the Olmstead Flow line at the mouth of Provo Canyon. Citing concerns over the safety of the existing Murdock Canal, and objecting to another right of way bisecting their communities, the mayors of Lindon, Pleasant Grove, American Fork, Alpine, Highland, and Lehi—organized as the Timpanogos Planning Agency (TPA)—opposed the proposal. Led by Alpine Mayor Don Christiansen, the mayors felt that neither Reclamation nor the CUWCD had given their concerns a fair hearing, TPA launched a legal battle against the CUWCD. Citing the separation of powers doctrine, the TPA argued that appointment of its board members by the courts was illegal.

TPA lost in district court on August 17, 1983, when Judge Kenneth Rigrup ruled in favor of the CUWCD. However, on appeal the Utah Supreme Court reversed the decision on October 10, 1984, vacating the seats of six directors. While the Governor reappointed four of the six directors under the new process, he appointed Don Christiansen to fill one of the vacancies. Within a year, the District's General Manager resigned and in a split decision the Board selected Christiansen as the replacement. These changes proved significant as Christiansen became much more active in pushing Reclamation to move the CUP forward.

One of the first orders of business was negotiating a supplemental repayment contract. Reclamation negotiated with the District's legal counsel, General Manager, and representatives of the Board. After many months, both sides finally reached an agreement. The negotiations resulted in a draft, presented to the District Board on July 8, 1985, which raised the repayment amount by \$335 million.⁹⁸ Following final approval of the contract by Reclamation, the CUWCD scheduled a special election for November 19, 1985. Despite a heavy snow storm that day, over 93,000 voters cast votes. This amounted to nineteen percent of the registered voters within the district. Some CUP critics have since complained that this amounted to a poor voter turnout. However, special elections during this time had averaged ten to twelve percent voter turnout. District wide voters approved the contract by a margin of 73 percent, and carried a majority in favor in 290 of the 307 voting districts.⁹⁹

In December, following the successful election, the board's executive committee drafted a strongly worded resolution proposing that the District take a greater role in decisions needed to complete the project. The resolution also called for the expedited and simultaneous construction of both the Bonneville Municipal and Industrial, and Irrigation and Drainage Systems. The board unanimously adopted the resolution on December 12, 1985. In response, Reclamation formulated a new ten year plan to complete construction of the entire Bonneville Unit, including expedited construction of the Jordanelle Dam, which it formally announced in October 1986.¹⁰⁰

At a special ceremony on May 16, 1986, in advance of the construction of Jordanelle, Reclamation and several local water districts implemented the Deer Creek-Strawberry Exchange to allow early delivery of much needed Bonneville Unit Municipal water. Reclamation and the five local agencies signed the enabling contracts at the ceremony. In addition, Reclamation Commissioner C. Dale Duvall also accepted ceremonial checks marking the beginning of the

repayment of CUP costs. The ceremonies concluded with remarks from Ed Clyde, who then closed a large knife switch, opening the valves to make the first CUP water deliveries to Salt Lake County.

Upper Stillwater Dam

As construction continued on the other elements of Strawberry Aqueduct, Reclamation worked to resolve lingering environmental concerns, and negotiate a supplemental repayment contract. During this time, planning moved forward for the finishing pieces of the Strawberry Aqueduct and Collection System on the Upper Stillwater Dam. The dam site is located approximately thirty-one air miles northwest of Duchesne. The reservoir behind the dam has a capacity of 29,500 acre feet, regulates the flow of Rock Creek, and fills by catching surplus spring flows and is kept full throughout the summer for recreational purposes. In the late summer and fall, water is passed through the aqueduct to Strawberry Reservoir for long term storage.

Because of the unique geological formations at the site, Reclamation engineers felt that the dam should be built using concrete rather than earth fill. However, due to the high elevation of the site, the construction season is very short. This would have stretched the construction schedule of a traditional concrete dam several years. As an alternative, Reclamation's engineers determined to utilize a new construction technique, Roller Compacted Concrete (RCC). To date, Upper Stillwater Dam is Reclamation's only experiment with this type of construction. At the time of its construction, Upper Stillwater was the largest RCC dam in the world with a volume of approximately 470,000 cubic yards. The dam's hydraulic height is approximately 200 feet and has a crest length of 2,700 feet and a width of 29.5 feet.¹⁰¹

To construct the dam, “lean” concrete—concrete that is drier than normal—is placed in horizontal layers between facing elements or curbs. The curbs are formed horizontally by a laser-guided paving machine which creates curbs similar to highway median barriers to create the faces of the dam. The concrete is delivered to the dam site from the batch plant by dump truck rather than a traditional cement truck. After being placed between concrete curbing elements, the concrete is then compacted by vibrating rollers. The use of highly increased rates of fly ash (a by product of coal fired power plants) produces concrete which generates less heat as it cures, alleviating the need for additional cooling. Because the artificial cooling pipes used in traditional concrete dams are not needed, construction is sped up, reducing construction time by one-third and cutting the price over traditional concrete dam construction by half. Additionally, the design featured an integrated spillway, which saved the need for the conventional spillway of an earthen dam, while using one-third the volume of materials.¹⁰²

On September 9, 1980, Reclamation awarded a contract to W.W. Clyde for the excavation of the foundation for Upper Stillwater and a concrete test placement at the dam site. Between May and August W.W. Clyde conducted the test placement of RCC. The contractor’s crews placed 513 cubic yards in July and 823 cubic yards in August, completing the tests on August 26. The results showed the use of form paving machines to be effective and the tests helped determine the formula for the concrete mix.¹⁰³

Excavation and a dewatering program continued over the next several construction seasons in preparation for the second phase of the construction. By the end of the 1984 construction season, the contractor had completed most work on foundation excavation and abutment stabilization.

The first placement of RCC for Upper Stillwater Dam occurred on September 18, 1985. The contractor placed limited amounts of concrete before shutting down for the winter. With arrival of the 1986 construction season, the contractor began major construction on the Upper Stillwater Dam. During construction, the use of RCC attracted visitors to Upper Stillwater from around the world. Several large groups of civil engineers from Japan as well as others from Australia, Chile, and Brazil visited the site. Placement of RCC proceeded faster than expected. Even though the contractor was constrained by the five month construction season in the Uintas, it managed to complete placement of concrete within two seasons. On August 12, 1987, construction crews placed the last load of concrete on the Upper Stillwater Dam. Filling of the reservoir behind the dam began November 22. The first diversions from Upper Stillwater into the Strawberry Aqueduct occurred May 24, 1989.¹⁰⁴

North Fork Siphon

As Reclamation and the CUWCD worked through the issues surrounding the Jordan Aqueduct and the repayment contract, construction continued on the final pieces of the Strawberry Aqueduct and Collection System. As crews placed the finishing touches on the Vat Dam; Rhodes, Hades, and Stillwater Tunnels; and Wolf Creek Siphon, Reclamation prepared to solicit bids for the North Fork Siphon. This 1.2 mile pipeline crosses under the North Fork of the Duchesne River about four miles upstream from its confluence with the West Fork. The six foot buried steel pipeline connects the outlet of the Stillwater Tunnel to the inlet of the Hades Tunnel. Because of the steep mountain slopes, the design called for the use of special construction techniques.¹⁰⁵

Reclamation opened bids for the North Fork Siphon in May 1984. Harrison Western submitted the low bid of \$5,658,091—well below the engineer's estimate. The contractor began

work that summer and completed 28 percent of the project before shutting down for the winter.

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Because the valley between the two tunnels is 700 feet deep, Harrison Western used helicopters to carry concrete to the North Fork Siphon where concrete invert forms were being installed on the steep slopes of the mountain. Regular delivery methods were difficult on that terrain. A switchback road midway on the mountain allowed the concrete mixer truck closer access to the construction area but did not get it close enough to place the concrete in the trench for the concrete invert. The helicopter's bucket held less than ¼ cubic yard, making progress slow. But the procedure proved to be the most expedient. Placement on the Stillwater Tunnel side of the mountain took eight weeks.¹⁰⁷

During the 1985 construction season, the contractor completed the crossing of the North Fork. The pipeline is composed of 72-inch diameter pipeline sections. Each pipe section weighs 23 tons. To facilitate final installation of each pipe section, three air bags were placed under the pipe to support it on line and grade while a sand and cement grout was placed between the concrete pad and the pipe for final support. The contractor completed the project during the early fall of 1986 and the siphon was filled with water for the first time on October 10, 1986, for testing. Reclamation transferred the siphon from construction to operation and maintenance status on June 11, 1987.¹⁰⁸

Doc's, Hades, Win, and Rhodes Diversions and Feeder Pipelines

As work moved forward on the Upper Stillwater Dam and the North Fork Siphon neared completion, Reclamation solicited bids and issued contracts for final elements of the Strawberry Aqueduct and Collection System, three separate diversion structures and feeder pipelines.

The Doc's Diversion and Feeder Pipeline captures excess flows of the South Fork of Rock Creek—which joins the main branch of Rock Creek just below the Upper Stillwater Dam—and passes them through the 4,157 foot pipeline to the inlet of the Stillwater Tunnel. The pipeline has a capacity of 100 cfs. On July 21, 1986, Reclamation awarded a contract for Doc's Diversion and Feeder Pipeline to Western Utility Contractors of Pleasant Grove, Utah. The contractor completed the project on September 21, 1988, at a cost of \$1.5 million, and Reclamation made the first diversions on May 24, 1989.¹⁰⁹

The Hades Diversion captures flows from Hades Creek, a tributary of the North Fork of the Duchesne River. Because the inlet to Hades Tunnel is high above the valley floor, the diversion is made 2.6 miles upstream. The 2.5 foot feeder pipeline has a capacity of thirty cfs. On June 20, 1986, Reclamation awarded the contract for the Hades Feeder Pipeline to Osberg Construction of Seattle, Washington. The contractor began construction on July 10, and completed construction on December 19, 1987, at a cost of \$4.2 million. Reclamation made the first diversion from Hades Creek on December 28, 1987.¹¹⁰

The Rhodes Diversion Dam and Feeder Pipeline is located on Wolf Creek. The dam diverts water from Wolf Creek into a 706 foot, 2.5 foot diameter pipeline which connects to the Wolf Creek Siphon. The Win Diversion intercepts the flows of Twin Creek, a tributary of Wolf Creek, and feeds them into the 1.5 foot diameter Feeder Pipeline. The line runs 3,400 feet to join the Wolf Creek Siphon located west of the diversion. Reclamation issued a contract for construction of both the Rhodes and Win Diversions and Feeder Pipelines to Western Utility Contractors on September 5, 1986, for \$3 million. The first diversions were made on May 25, 1988, and Reclamation accepted the project as complete on July 15, 1988.¹¹¹

Jordanelle Dam

Reclamation included plans for a dam on the Provo River above Heber City in the original proposals for the CUP. The proposed reservoir would develop additional municipal water supplies for portions of Salt Lake and Utah Counties. Originally, Reclamation anticipated construction of a dam at the Bates Site. However, rapid population growth in these counties motivated the local water districts to increase the amounts of water requested from the project. Reclamation responded by altering plans, moving the reservoir downstream, and enlarging the size of the proposed dam. Reclamation named the new reservoir site “Jordanelle,” after an early pioneer in the Heber Valley, John Jordan, who settled his family near the proposed dam.¹¹²

Reclamation now planned a 320,000 acre foot reservoir behind a 300 foot (hydraulic height) zoned earthfill dam. The Upper Colorado Region completed an Environmental Impact Statement for the Bonneville Unit, Municipal and Industrial System in 1979. However, as Reclamation attempted to move forward with the advanced planning of the dam, it encountered strong opposition from environmental groups. Additionally, mine operators in Park City feared the reservoir would flood their mines. Citizens in the Heber Valley and in Provo feared a dam break, similar to that of the Teton Dam, would cause massive devastation to their communities. Their fears were inflamed by Leon Hansen, an independent geologist employed by the mining companies, who claimed the dam site rested over an active earthquake fault.

In October 1986, Reclamation officials formally announced plans for the expedited construction of Jordanelle Dam. The Upper Colorado Region anticipated the simultaneous excavation of the dam’s foundations and the relocation of U.S. Highway 40, shaving years from the construction schedule.¹¹³ To allay public concern over claims the site was unsafe, Reclamation initiated a fourth geological study of the dam site, drilling hundreds of additional test holes to determine the stability of the dam’s foundations. Reclamation published the results

in a 20 volume geology report in 1986. The new study validated three previous investigations, concluding the site was suitable for a dam, and finding no evidence of an active earthquake fault. A panel of three independent, internationally recognized geologists who reviewed the document concurred, declaring the dam site geologically sound.¹¹⁴

Initial construction at the site began shortly after the announcement of the expedited construction schedule. Crews began preparing the site and rerouting U.S. 40 around the reservoir site. In January 1987 Reclamation began the bidding process on Stage 1 construction of the dam--excavation and preparation of the Dam's foundation. That spring Reclamation completed the final draft of the Environmental Impact Statement(EIS) for the dam receiving final EPA approval on March 16. Reclamation and the CUWCD began making preparations for the groundbreaking ceremony scheduled for June 27.¹¹⁵

The sun was already high in the sky by late morning as a large crowd assembled. Dignitaries, politicians, water officials, CUWCD and Reclamation employees, news reporters, television crews, and the public began taking seats in front of the temporary stand built at the site. Several guests of honor and program participants sat upon the rostrum, including Utah Senator Jake Garn and Reclamation Commissioner Dale C. Duvall. Others who addressed the crowd included CUWCD District Manager Don Christiansen, District Board Chair Bob Hilbert, and Reclamation Regional Director Clifford Barrett. Two individuals who had been closely affiliated with the CUWCD and the CUP since its founding also gave brief remarks. Ross Garrett, who had been on the District's board since its founding, and Ed Clyde, the District's legal counsel, each commented on the personal significance of the occasion as the culmination of a lifelong effort. The event climaxed as the crowd watched Senator Jake Garn push down the plunger of an old-time mining detonator, setting off a blast to mark the groundbreaking.¹¹⁶

As the Utah Department of Transportation began relocating the highways around the dam site, Reclamation's contractor, Torno America, of San Francisco, began excavating the dam abutments and foundation. The contractors had done some preparation work prior to the groundbreaking, but following the ceremony they began in earnest. The process would stretch over several construction seasons. In April 1988 they began operating the materials processing plant and began separating and stockpiling materials for use in the dam. Reclamation planned to complete the dam in 1995.¹¹⁷

Reclamation withheld decision on the final dam design until the contractor completed the excavation of the foundation. By November 1988 Torno America finished the \$13 million excavation contract. After evaluating the exposed bedrock, the three independent geological consultants agreed that an earth embankment dam was the best design. Reclamation then issued a request for bids for Stage 2, the construction of the dam. Rather than use a sealed bid process, Reclamation engaged in active negotiations between the competing contractors to secure the best price. In early April, several contractors vied for the contract to construct the dam. On April 26, 1989, Reclamation awarded a \$79.8 million contract to Granite Construction.¹¹⁸

As work continued on Jordanelle Dam, the CUWCD moved forward with plans to buy water rights in Utah Lake from Salt Lake Valley irrigators. The original CUP plans called for Jordanelle to be filled by conserving water lost to evaporation by constructing dikes across two shallow arms of Utah Lake. Because the State of Utah now opposed this plan, the CUWCD needed to acquire additional water rights in Utah Lake. The move reinvigorated a brewing controversy with Provo City. On August 9, 1989, the CUWCD approved the purchase of 25,000 acre feet from Salt Lake City to augment 60,000 acre feet previously purchased from Kennecott Copper Corporation. The purchases concerned both environmentalists and officials in

Provo. They worried that the exchange would severely diminish the flows in the lower Provo River as the CUWCD held water back in Jordanelle, impacting the endangered June Sucker. Further, Provo water officials believed that Reclamation and the CUWCD would also “steal” water to which Provo held rights. They believed that there was not enough water to satisfy Provo’s rights and fill the reservoir.¹¹⁹

Reclamation and the CUWCD believed there was enough water to fulfill Provo’s rights and fill the reservoir, and they attempted to negotiate an agreement with Provo officials. However, by March 1989, Utah County Commissioner Brent Morris and Provo Mayor Joe Jenkins began to doubt the agreements and called the entire CUP a liability. They organized a meeting with Governor Norman Bangerter and other officials on April 3. In addition to the continued worry that the reservoir could not be filled without impinging upon Provo’s rights, they also now feared the plan would increase the salinity in Utah Lake, harm fish habitat, and impede groundwater recharge.¹²⁰ The dissent also offered long time opponent Leon Hansen a fresh audience. Hansen spoke before officials and continued to maintain the site was unsafe. Now he also stated that the reservoir would sit atop additional ore deposits that could be worked by the Park City mining companies which employed him.¹²¹

Through the spring, Morris worked to build opposition to Jordanelle. However, he lost a political ally in July when Mayor Jenkins negotiated a deal with CUWCD General Manager Don Christiansen to not move forward with threatened litigation until the state engineer completed his adjudication of water rights on the river. The two further agreed that the city would be allowed to store excess flows in the reservoir.¹²² The District also initiated additional efforts to defuse the brewing opposition. On July 13, the CUWCD board approved a cooperative study of salinity in Utah Lake.¹²³

An opinion study conducted that fall showed that 67 percent of Utah County residents still supported the CUP.¹²⁴ Despite the strong support in Utah County and by Utah's elected officials, some remained doubtful of Reclamation's claims regarding the safety of the site. In November 1989, Wasatch County voters elected a new County Commission Chairman, Moroni Besendorfer. He immediately began to question Reclamation about Jordanelle. His criticism provided Leon Hansen a forum to again air his complaints in the press. Besendorfer lead a group of county officials to the highway overlooking the dam site, where the group listened to Reclamation and state geologists refute Hansen's claims, again.¹²⁵

Jordanelle opponents refused to be placated, questioning the independence of the outside geologists, and insisting on further studies. That spring, opponents accused Reclamation of covering up evidence its own scientist found which proved the seismic danger of the dam site. The opponents' claims resulted in a congressional investigation by the General Accounting Office, which concluded in its May 1990 report that it could find no evidence of a cover up.¹²⁶

Despite the almost constant criticism, construction continued. Throughout the 1990 construction season construction crews placed material to form the broad base of the dam and secure its foundation. By October a large portion of the embankment rose above ground level. A month later it had reached twenty-five feet into the air before the contractor shut down operations for the winter. While the danger of frost damage prevented the placement of more material on the dam, crews from Granite Construction continued to work on completing the tunnel system. By mid-March the following year, the tunnel system was essentially complete, and the contractor began placing material in the dam. The contractor placed riprap on the dam's faces as the new construction season began.¹²⁷

But as construction began again in March 1991, so did the opposition to the dam. To help quiet opponents' claims, the entire Utah delegation called for a review by the United States Geological Survey (USGS).¹²⁸ Granite Construction moved forward quickly and was significantly ahead of schedule. By May the dam had risen another twenty feet, to a total height of 45 feet. Reclamation now estimated completion of the dam by December 1992 rather than on its original 1995 completion date. Construction soon reached another milestone on Friday, June 28, as workers diverted the Provo River into the outlet works of the dam. Granite Construction had completed the portions of the dam on either side of the river to a height of eighty feet.¹²⁹

In August 1990 the *Wasatch Wave*, a weekly newspaper in Heber, Utah, published a series of stories containing claims by Leon Hansen that the Jordanelle site was unsafe and Reclamation had covered up the evidence. These articles ignited another firestorm and prompted Congressman Wayne Owens, who stated at the time he felt the allegations contained credible evidence, to call for yet another review. Utah Senators Jake Garn and Orrin Hatch, CUWCD General Manager Don Christiansen, and others called the claims baseless and further reviews wasteful of time and tax dollars. Two weeks later Congressman Jim Hansen toured the site and stated the studies had adequately proven the site's safety.¹³⁰

Later that month, the USGS released the results of its studies, stating that their panel of experts found no safety concerns following their three month inspection. Reclamation Regional Director Roland Robison reported to the CUWCD's board that he felt Reclamation's geologists, as well as the three highly qualified experts, had been vindicated. To do so, the government had spent several millions dollars investigating Hansen's information and allegations. To answer Hansen's latest claims of a cover up, the entire Utah congressional delegation called for a

continued investigation by the USGS into these allegations. Further, the delegation scheduled a hearing in Heber City to complete its re-examination of the dam.¹³¹

By November construction crews had placed one-half of the total embankment material. As they finished their work for the winter, Jordanelle Dam rose one hundred feet above the valley floor.¹³² That same month USGS issued the balance of its report. The USGS determined that contrary to critics' claims, they could find no evidence of a cover up. Further, they determined that the river contained enough water to fill the reservoir. The report also cast doubt on claims that the reservoir would cause seepage into nearby mines, calling the data behind these claims "questionable." Leon Hansen reacted by calling the report "paper rhetoric" and claimed that not only would there be seepage, but the water seepage would encounter heavy metals from the mines and contaminate the groundwater.¹³³

The controversy culminated on February 1, 1992, as Senator Garn opened a formal hearing of the Senate Energy and Natural Resources Committee at Wasatch High School in Heber. The entire Utah congressional delegation participated in the hearing scheduled for three hours on a Saturday morning. Numerous witnesses testified before the hearing. Senator Garn allowed the meeting to stretch over six hours to hear all the comments. Numerous expert technical witnesses testified that the site was safe. Leon Hansen provided a lengthy testimony, but offered no arguments other than those which he had made for years. Other witnesses answered and explained Hansen's claims. Further, Hansen and other critics failed to produce any hard evidence to support their claims of a cover up. In an effort to insure a balanced hearing, and assuage the concerns of those in opposition to the dam, the CUWCD had offered to pay the travel expenses of any independent expert witnesses that they could find who could offer

substantive testimony concerning the dam. The Wasatch Commissioners took advantage of the offer and brought in three witnesses. All three failed to offer any opposition.¹³⁴

The hearing seemed to deflate the opposition. Crews from Granite Construction began working again on the dam that spring. Favorable weather allowed the work to continue at a brisk pace. By mid June, the dam stood at 175 feet and 88 percent complete. With just 120 feet remaining, construction was three months ahead of schedule. By summer's end, only thirty feet remained. By the beginning of October the dam lacked only three feet. On Monday, October 19, a large dump truck emptied the final load of earth atop the dam in a ceremony attended by elected officials and representatives of Reclamation and the CUWCD. Over 14.5 million cubic yards of clay, gravel, and rock had been strategically placed to form the total height of 400 feet from the foundation. Granite Construction finished the work on the dam ahead of schedule and on budget. Work continued on the water intake and outlet structures to prepare the dam for filling and a dedication ceremony the following year.¹³⁵

Even though construction crews continued some finish work, Reclamation engineers certified the dam as ready to begin storing water. The early completion of the dam proved fortuitous. Heavy snowfall over the winter and spring rain had many areas of northern Utah worried about flooding. The new dam helped check what would have otherwise been catastrophic flooding. The dam began filling in late April. Engineers estimated the reservoir would fill at a rate of a foot a day. But, following several warm days at the end of May, it filled at a rate of two to three feet per day with two days topping out at over four feet. While these rates were faster than the engineers considered optimal, twenty-four hour monitoring during the filling ensured safe conditions. By the first weekend in June, the reservoir had reached stage one level of 108 feet.¹³⁶

With water partially filling the new reservoir, a large crowd of over 500 people gathered atop the dam on a blustery day, on September 13, 1993. Culminating over six years of construction and decades of planning, the mood of the ceremony reflected the gratitude of those assembled to have the project completed, despite ardent opposition. CUWCD Board Member Claude Hicken noted in his remarks that “Water has the tendency to bring out the worst and the best in people, both conflicts and cooperation. And Jordanelle has had its share of both.” Senator Orrin Hatch noted that, “Five years ago, there was a significant question whether this dam would be built,” as he recounted the list of challenges and problems encountered during the project. But perhaps the most striking comments came from the keynote speaker, Reclamation Commissioner Daniel P. Beard. Beard, as an official in the Carter Administration, had participated in attempts to cancel the CUP. His comments echoed Senator Hatch, “They made the right choice five years ago.” He went on to describe the dam as an example of state-of-the-art construction, the result of collaboration by national and international consultants.¹³⁷

Reclamation filled the reservoir in stages over several years. Continued heavy winter snows and rain during these years allowed the reservoir to fill in the minimum amount of time allowed by federal regulations. The reservoir reached the full mark on June 9, 1996, a year ahead of what the critics had called an impossibly optimistic schedule.¹³⁸ Further, the reservoir helped check flood conditions on the Provo River that surpassed those which produced devastating flooding in 1983 and 1984. In May 1995 Reclamation officials estimated that without Jordanelle, the Provo River would have had to carry twenty percent more water than during the 1983 flooding. Over subsequent years, the Jordanelle Dam and Reservoir have proved not only highly valuable for flood control, but have also met their primary mission of drought

relief. Utah began to experience a prolonged drought in 1999. The multi-year supply in Jordanelle ensured sufficient water for cities in Utah and Salt Lake Counties during the multi-year drought.¹³⁹

Diamond Fork Power System – Syar Tunnel and Sixth Water Flow Control Structure

Despite delays and political challenges during the late 1970s and early 1980s, Reclamation moved construction forward on key aspects of the CUP. Multiple contractors worked on completing the long tunnels to connect Currant Creek and Upper Stillwater Reservoirs. Reclamation completed: repair work at Soldier Creek and Currant Creek; construction of the Upper Stillwater Dam using innovative RCC design; and the controversial Jordanelle Dam. During this period of very active construction, Reclamation moved forward on planning for the Diamond Fork Power System and the Bonneville Unit Irrigation and Drainage System.

While preparing the environmental documents, Reclamation considered several alternatives for the Diamond Fork Power System. The plans ranged from a simpler version to generate power from irrigation flows released during the summer months to more elaborate plans to develop power for commercial consumption throughout the year. The most elaborate of these plans called for a pumped storage system with a one mega-watt generating capacity. At different points in the 1980s, Reclamation selected different plans as the preferred alternative for various reasons.

The plans for the Diamond Fork Power System became entwined with the debate over the supplemental repayment contract and the realities of the western power market. As Reclamation and the CUWCD negotiated a supplemental repayment contract, CUWCD officials pushed the larger system in the hope that power revenues could be used to defray the increased costs of the

entire Bonneville Unit, instead of only underwriting the costs of irrigation. In an attempt to keep the total costs of the Bonneville Unit under the congressionally authorized limits, CUWCD even petitioned to transfer the construction and operation of the Diamond Fork Power System to the private power sector. This attempt failed to gain support because the private power companies showed little interest, as they felt the power market to be glutted at the time. Further, both proposals sparked the old debate between public and private power. As a result, Reclamation moved forward with the simplified flow-through power system.

The simplified plans cut the number of power plants from six to three, and the number of reservoirs from six to one. In 1990, Reclamation completed a final supplement to the final EIS. To maximize the production of power, Reclamation retained plans to replace the original open flow Strawberry Tunnel with the new Syar Pressure Tunnel. The outlet of the 5.7 mile tunnel between the Colorado River and Bonneville Basin is in Ray's Valley. The name Syar is Rays spelled backwards. The tunnel has a finished diameter of 8.5 feet and a capacity of 660 cfs. Reclamation designed the tunnel's capacity to accommodate flows for both the new Bonneville Unit and the existing Strawberry Valley Project.¹⁴⁰

At the Syar Tunnel outlet, the water would pass into the Sixth Water Aqueduct. The aqueduct's plans called for a pipeline of 4,224 feet, a vertical shaft 575 feet deep and a 3,168 foot tunnel connecting the shaft to the outlet at Sixth Water Creek, a tributary of Diamond Fork Creek. At the outlet of the Sixth Water Aqueduct, Reclamation planned the Last Chance Power Plant with a capacity of 48 Megawatts (MW). After passing through the power plant, the water would enter Sixth Water Creek and flow downstream to the proposed Monks Hollow Reservoir, a few miles west of the confluence of Sixth Water and Diamond Fork Creeks. At the outlet of Monk's Hollow Reservoir, the water would enter the 6.8 mile Diamond Fork Pipeline.

Reclamation's ultimate plans allowed for construction of small power plants at Monk's Hollow and at the terminus of the Diamond Fork Pipeline.

On August 10, 1988, Reclamation awarded a contract for \$43.7 million to Morrison Knudsen (M-K) for construction of the Syar Tunnel. M-K began preparation for construction at the outlet portal during the fall and made the initial excavations using conventional means the following spring. The contractor had completed 450 feet by mid-April, 1989. Delivery of the TBM was delayed for two months, but the machine arrived on site in June. The contractor assembled the machine and excavation began in July. Working a three shift operation, the contractor's crews were averaging 400 feet a day during the first month of operation. By the middle of August, they had excavated 7,200 feet. Geological conditions were not always that favorable, but the miners never encountered serious problems such as those experienced in the Vat or Stillwater Tunnels. The contractor's crews completed excavation of the tunnel on April 17, 1990. Concrete lining of the tunnel began in July 1990. The contractor completed the tunnel lining in August 1991, and Reclamation accepted the tunnel as completed on February 20, 1992.¹⁴¹

As noted above, Reclamation simplified the plans for the Diamond Fork System in 1990 to reduce project costs, speed construction, and reduce the environmental damage caused to the canyon. As a result of this decision, Reclamation now prepared to solicit bids for the Sixth Water Aqueduct and Flow Control Structure. Reclamation awarded a \$25.6 million contract to C. R. Fredric Inc. in May 1992 for construction of this feature of the Diamond Fork System. Fredric began mobilizing and site preparation in August and September. In October they began preparing the tunnel portal and excavation using conventional drill and blast methods. The

contractor chose to use this method for the entire 3,200 foot tunnel. By year's end they had completed 84 feet of the tunnel.¹⁴²

Construction continued through the early months of 1993. Working three shifts, the miners averaged thirty to forty feet per day. By April they had completed the tunnel, began lining the tunnel, making preparations to begin the 700 foot vertical shaft. The contractor's crews completed the tunnel lining in June and the shaft in July. By the end of August the contractor completed excavation and lining of the tunnel and shaft. Over the next year, the contractor completed the 4,244 foot pipeline to connect the vertical shaft to the Syar Tunnel and completed construction of the Sixth Water Flow control structure. Reclamation made the first diversions to test the Syar Tunnel into the Sixth Water Aqueduct and Flow Control Structure on June 4, 1996. Reclamation subsequently accepted the contract as complete on October 26, 1993.¹⁴³

CUP Completion Act

In the late 1980s Reclamation worked vigorously on the Bonneville Unit of the CUP. Contractors put the finishing touches on the Strawberry Aqueduct and Collection System. Reclamation began storing water behind the Soldier Creek Dam and moving construction forward on the Jordanelle Dam and the first stages of the Diamond Fork System. The Sixth Water Aqueduct and Flow Control Structure was the last structure that Reclamation could build without exceeding the cost ceiling authorized by Congress. In November 1985, voters within the CUWCD overwhelmingly approved a supplemental repayment contract which increased the local repayment amount. However, an increase in the congressionally authorized price tag was also needed.¹⁴⁴

Reclamation worked with Utah's Congressional delegation to obtain the necessary approval. Initially both thought Congressional approval could be quickly obtained. In 1987 Senator Jake Garn introduced legislation to increase the total authorized project cost by \$750,000,000. When Democratic leaders Senator Bill Bradley (D-New Jersey) and Congressman George Miller (D-California), who controlled the key House and Senate subcommittees, refused to move the bill forward without addressing the lingering environmental and economic concerns, it quickly became apparent that the CUP now faced its largest hurdle.¹⁴⁵

Determined to keep the project alive, the entire Utah delegation continued to work on reauthorization of the CUP. Congressman Wayne Owens, a Democrat representing the Salt Lake City area, served as a majority member of the House Subcommittee on Water and Power Resources. Because of his assignment, and because he was the only Democrat from Utah serving in Congress, Owens took the lead in the effort to draft new legislation that met the demands of Chairman Miller.

In February 1988, Owens began spending a great deal of time developing a plan that would address the fiscal and environmental concerns. The task was daunting, but one Owens accepted with enthusiasm. If he succeeded, he could earn a great deal of political capital in Utah. But more importantly, Owens felt strongly about the environmental damage the project had caused in Utah. In response to Owens's efforts, the Sierra Club of Utah, Utah Wildlife Federation, Utah Wilderness Association, and sixty additional environmental, conservation and sportsman's groups organized the Utah Roundtable of Sportsmen and Conservationists.

The Utah Roundtable quickly identified problems they had fought for many years. First, the Strawberry Aqueduct and Collection System diverted the entire stream flows of twenty-three streams and rivers in the Uintah Basin—dewatering a total of 245 miles of stream. Wildlife

specialists estimated that 78 percent of the fish population in the streams would be lost. Despite the 1980 stream flow agreement brokered by Utah Governor Scott Matheson, wildlife biologists felt that the full 44,000 acre feet needed to maintain 50 percent of the fish population should be made permanent. To meet the demands of the stream flow agreement, Reclamation proposed a series of pumping plants to recirculate water in key streams.¹⁴⁶

In addition to the impact on fish streams, project opponents also worried about the loss of habitat on diverted streams and the further riparian and wetlands habitat lost under project reservoirs. The loss of habitat would impact both game animals and endangered species. The diversion of water from Utah Lake also posed a threat of increasing the salinity level in the lake to the detriment of its native plants and animals. Specifically, environmentalists and wildlife advocates worried about the impact on the endangered June Sucker in Utah Lake.¹⁴⁷

While environmental groups lobbied to increase minimum stream flows, they also sought to set maximum flows on other rivers. Several streams saw increased flows because of project diversions. For example, the Strawberry Tunnel emptied directly into Sixth Water Creek and Diamond Fork Creek. During the peak irrigation season, the flows in the creeks were ten times the normal amount. A large quantity of water in a narrow stream bed caused erosion of the stream banks, scouring of the stream bed, and washing of cottonwood saplings from the banks of the river. Because the saplings did not survive the irrigation season, the trees did not replenish themselves, and much of the cottonwood forests along these creeks had died away. Owens, along with environmental groups, also expressed concern over a similar situation in the Provo River, particularly between Deer Creek Dam and the Olmstead Diversion near Upper Falls.¹⁴⁸

Owens found additional criticism of the manner in which Reclamation had constructed the project. He argued that little had been done to mitigate the damage caused by the project.

Owens complained that of the \$1.2 billion that had been spent on the project, only \$10 million had been expended for Section 8 mitigation to repair the environmental, fish, and wildlife damages caused by the projects. Owens and others criticized the Bonneville Unit's irrigation component as economically unjustified. Reclamation's cost benefit analysis showed that the project's benefits slightly exceeded its costs. But some economists, using different formulas, claimed that the costs actually exceeded the benefits. Finally, Owens and others felt the legislation needed to address the water rights claims of the Uintah and Ouray Ute Tribes. In 1965 they had been promised water development projects in exchange for a forty year deferral of their water rights. It had now become apparent that the promised projects would not be completed before 2005, and thus it appeared that the Bonneville Unit could not legally divert any Ute Tribal water after 2005.¹⁴⁹

With the cooperation of the CUWCD, Owens began to prepare the new legislation in March and April 1988. The draft legislation included alternative plans for the irrigation project, cutting some components. Additionally, Owens worked with environmental groups and proposed increasing the stream flow requirements and that mitigation move forward simultaneously with all future construction under the oversight of an independent agency.¹⁵⁰

Despite the significant environmental concessions in the bill, serious objections still remained over unresolved environmental issues and over the fiscal issues surrounding the irrigation unit. Unsatisfied with the bill, Miller again refused to let it out of committee. Undaunted, the Utah delegation and CUWCD General Manager Don Christiansen moved forward with more negotiations to further resolve the concerns over the project. National environmental and wildlife groups represented by Ed Osann, Director of the National Wildlife Federation's Water Resources Program, and David Conrad, Friends of the Earth Water Resource

Specialist, also became involved in the negotiations. Their concerns over the environmental issues surrounding Jordanelle, the irrigation projects, and the water rights of the Ute Indians prompted Chairmen Miller and Bradley to scuttle another attempt to move a bill forward in the spring of 1990.¹⁵¹

Failing again, the Utah delegation, CUWCD, and the national environmental groups met for another round of negotiations. Reclamation officials in Washington had been invited to participate in the early negotiations. However, Congressman Miller, the Utah Congressional Delegation, and the representatives of the CUWCD felt that Reclamation had not fully cooperated in these negotiations. Frustrated by continued delays and unwillingness to compromise, Miller left Reclamation completely out of the negotiations. Further, after listening to the CUWCD about lack of cooperation from Reclamation, Miller also proposed that control of future project construction be taken from Reclamation and given to the local water district. After several long weeks, a revised bill began to emerge that met the concerns of Miller, Bradley, and the environmental groups.¹⁵²

As negotiation moved forward, Ed Osann continued to oppose the project until the legislation mandated water conservation. All sides finally reached a compromise which provided that through cost-effective and environmentally sound means, the local water districts had to first make “prudent and efficient use of currently available water prior to importation of additional water into Salt Lake County.”¹⁵³ This language challenged the old conceptions of water development, focused on increasing supply in favor of conservation by decreased demand. The water districts balked at the proposal because conservation of water posed the threat of decreased revenues and potential difficulty repaying its bonds. But, in the end, the districts were able to compromise.¹⁵⁴

The conservation compromise cleared the way for a version of the legislation Miller and Bradley would let out of their respective committees following hearings in February and September 1990, respectively. The new version, officially titled the Central Utah Project Completion Act (CUPCA), contained four main sections. The CUPCA raised the authorized costs by \$924,206,000. It also implemented a local cost sharing agreement which mandated that the CUWCD pay thirty-five percent of the reimbursable project costs. The legislation deauthorized several features of the original CUP plan including the diking of Utah Lake, irrigation projects in the Mosida area southwest of Utah Lake and on the Leland Bench in the Uinta Basin. The legislation deauthorized construction of the Lower Stillwater Reservoir which had been planned to compensate for lost stream habitat. The legislation transferred title to the land to the Ute Tribe. CUPCA also affected other units of the CUP by deauthorizing the Ute Indian Unit which proposed the diversion of water directly from the Green River and scaled back plans for the Uintah and Upalco Units.

The CUPCA took further steps which changed longstanding Reclamation policy. It allowed counties that had not received project water to withdraw from the CUWCD and receive a rebate of property taxes paid toward the project. It took oversight of the project from Reclamation and gave control to the CUWCD. Further, the legislation addressed the environmental critics by stipulating that environmental mitigation would proceed concurrently with construction. The act created a new federal agency to oversee environmental mitigation and established a fund to complete mitigation efforts. The CUPCA mandated that the CUWCD and its customer agencies meet goals for water conservation and that the District fund water conservation efforts. Finally, it provided a monetary payment to the Northern Ute Tribe to settle the environmental justice claims and satisfy their water rights.¹⁵⁵

Utah's congressional delegation again had a difficult time moving the bill out of committee. But, this time it was larger water issues that held up passage. Congressman Miller became determined to pass similar reform measures on the Central Valley Project (CVP). To help push those reforms through, his chief aid, Dan Beard, proposed rolling twenty-two different water bills into a single omnibus bill. Further, Reclamation officials and the George H. W. Bush administration opposed the reforms to both the CUP and the CVP. After an additional two years of debate, Congress passed the bill in October 1992. Despite veto threats, President George H. W. Bush signed the bill on October 30, 1992.¹⁵⁶

Post Construction History

After the passage of the CUPCA, Reclamation continued to oversee the ongoing construction of the Sixth Water Aqueduct and Flow Control Structure and operate Jordanelle Reservoir during the development period. However, planning and oversight for future construction had been moved to the CUWCD with oversight provided by the CUPCA Office reporting directly to the Secretary of Interior through the Assistant Secretary for Water and Power. As the CUWCD took over, they first had to complete a number of studies.

Bonneville Irrigation and Drainage System – Utah Lake System

The CUWCD also faced a serious challenge. Unable to kill the Bonneville Unit Irrigation and Drainage System outright, Congressman Owens and his environmental allies determined to kill the project by making the new requirements as unpalatable as possible, and then providing an escape hatch. As anticipated, farmers in Millard and Sevier counties felt that due to the new provisions of CUPCA, the amount of water available to the two counties had decreased, the local cost share had risen, and accepting the water under the new law would bring unwanted Federal regulation. Thorpe Waddingham, a water rights attorney representing the

farmers, told a newspaper reporter, “We are big supporters of the CUP. But the CUP has steadily deteriorated from the 1970s to the 1980s until now in the 1990s it’s gone completely to hell.”¹⁵⁷

As a result, Millard and Sevier Counties withdrew from the project and the CUWCD. The CUWCD scaled back the plans for the Bonneville Irrigation System to deliver water to Juab County via a truncated version of the original conveyance system termed the Spanish Fork-Nephi Pipeline.¹⁵⁸ However, during review of the Draft EIS for the pipeline in 1999, the Strawberry Water Users Association withdrew their support of the CUWCD’s plans. The Association felt it could get more CUP water if the pipeline remained un-built. With the Strawberry Users no longer supporting the EIS, Interior would not approve the project.

As a result, the entire project was sent back to the drawing board as the Utah Lake System and the project was modified significantly. The CUP no longer provides irrigation water to Juab County and the CUWCD split the 60,000 acre feet of water developed under the old Bonneville Irrigation System between Salt Lake County and southern Utah County. In exchange, Juab County has received assistance through water conservation programs to offset the loss of project water. R. Thomas Weimer, Acting Assistant Secretary of Interior – Water and Science, signed the Record of Decision Utah Lake System Final EIS on December 22, 2004. The CUWCD is scheduled to begin construction on portions of the Utah Lake-Mapleton Springville Pipeline-Phase I, and Spanish Fork Canyon Pipeline–Reach 1, in 2007. Construction on Reach 2 of the Spanish Fork Canyon Pipeline is anticipated to begin in 2009, and is planned as a joint construction contract with the Utah Department of Transportation to concurrently widen State Route 6.¹⁵⁹

Diamond Fork System

While the CUWCD dealt with the changes to the Bonneville Unit Irrigation System, it moved forward on planning and construction of the balance of the Diamond Fork System. Initially the CUWCD chose to keep the Monk's Hollow Dam to help regulate the supply of water to downstream users. Because the road in the canyon would need improvements to handle the heavy truck traffic to the dam site, and because the Diamond Fork Pipeline downstream of the dam would be placed under the road, the CUWCD first began construction of the pipeline. The District awarded the construction contract for the pipeline to PCL Civil Contractors, Inc., of Tempe, Arizona, on October 16, 1995. The Board selected Reclamation to provide construction management services over the project on November 8, 1995.¹⁶⁰

PCL Civil Contractors began site preparation in March 1996. Construction proceeded quickly and smoothly. In a few instances, site conditions deviated from those expected during planning. As construction closed down for the winter in December 1996, the contractor had completed 62 percent of the pipeline. Construction of the pipeline leading to the dam site continued at a brisk pace, and the contractor placed the last section of pipe on June 27, 1997. Work continued through the summer and fall on the road reconstruction and the revegetation of the project area.¹⁶¹

In June, as the contractor completed the pipeline--the joint-lead agencies on the Spanish Fork-Nephi (SFN) EIS described above—released for review a revised SFN System Preliminary Draft EIS. Reacting to strong objections of the environmental community, the revision included replacing the Monk's Hollow Dam with a direct connection between the existing pipeline and the Sixth Water Aqueduct via pipeline and tunnels.¹⁶²

After receiving positive feedback from these reviewing agencies and touring the site, the CUWCD's board officially endorsed the pipeline alternative at their October 15, 1997, meeting. The resolution called for a pipeline alternative to the Monk's Hollow Dam. In addition to eliminating the dam, the proposal offered an opportunity for environmental enhancement and restoration. For almost a century, Diamond Fork Creek had been used by the Strawberry Water Users Association to deliver irrigation water during the summer months through the original Strawberry Reservoir and Tunnel. These high flows scored the stream bed and caused excessive erosion. The flows also came late in the summer, instead of during the normal spring runoff. This disrupted plants and animals adapted to seasonal high flows during the late spring and early summer. The proposal for placing the irrigation water into a pipe system allows an optimal stream flow to be maintained and damaged habitat to be restored while extending the stream flow requirements outlined in CUPCA further upstream.¹⁶³

The CUWCD released the revised Draft EIS on March 31, 1998. As a result of the controversy caused by the Strawberry Water Users Association described above, the District subsequently separated the Diamond Fork Tunnel System into a new document prepared as the Final Supplement to the Diamond Fork System EIS. The District proceeded rapidly with preparation of the Final EIS for the Diamond Fork System. During the spring of 1999, the District and other Joint-Lead Agencies submitted the environmental document to the public for comment and then submitted it to Interior for approval on July 1, 1999. On September 29, 1999, Mark Schaefer, Interior's Deputy Assistant Secretary - Water and Science signed the Record of Decision approving the document.¹⁶⁴

The approval acknowledged that the CUWCD planned to submit the plan to a value engineering study which could reduce the cost and further reduce the environmental impacts.

During the fall of 1999, the engineering team conducted their review and found that a single long tunnel would save money and reduce the environmental impacts of the plan for two tunnels and a connecting pipeline. The CUWCD placed the project to bid. They opened the bids on December 23, 1999. The bidders had been required to bid on the designed tunnel and pipeline option and encouraged to bid on the single tunnel option which would be a design-build option. The low bidder was Obayashi-Clyde joint venture's bid of \$53 million on the design-build option. The CUWCD awarded the contract to Obayashi-Clyde on January 26, 2000.¹⁶⁵

Construction began in August and September of 2000 as crews prepared the tunnel portal using conventional mining techniques. On October 23, 2000, the TBM arrived on the construction site. The TBM was the same one used to bore the Syar Tunnel and had been refurbished and rebuilt in Seattle before being purchased by the contractor for the Upper Diamond Fork Tunnel. Boring operations began later that week. The work proceeded rapidly for the first several months. After only five months the contractor had excavated over two miles of tunnel and was fast approaching the halfway mark and a crossing of Diamond Fork Creek at the beginning of April 2001.

The point where the tunnel crossed under the creek was the closest the tunnel would come to the surface—163 feet below ground. Both the engineers and the contractor anticipated some problems from springs in the area and water from the creek. As the TBM proceeded, the problems were worse than expected. The machine encountered water and large voids in the rock, which collapsed and allowed sand, gravel and large stones to fall around the machine. During May, construction slowed as crews injected concrete grout into the rock to fill the voids ahead of the TBM. The voids required over 200 cubic yards of concrete to fill.

The contractor continued to experience problems with voids, water, and hydrogen sulfide gas. The contractor increased the capacity of the ventilation system and the mining crews pressed forward, stabilizing the tunnel face with injected grout. The contractor also installed a water treatment plant to treat the water before it could be discharged into Diamond Fork Creek. Despite the problems, the contractors managed to push the tunnel ahead thousands of feet further into the mountain. At several points, they hit water sources which required further grouting and delays to the project. After hitting another water source in August, Obayashi-Clyde expanded the treatment plant. By the end of October the tunnel stretched nearly four miles and was quickly approaching eighty percent complete.

But once again, almost like clockwork, the TBM hit another large water source. At the end of the graveyard shift on October 24, the teeth on the mining machine chewed into a rock formation containing water. Between 100 and 200 gallons per minute sprayed from the rock. Engineers estimated the water to be under 100 pounds of pressure per square inch. The water also contained high levels of hydrogen sulfide prompting evacuation of the tunnel until the ventilation system could catch up. During the following weeks, crews tried to seal the fissure with a chemical grout. They pumped 275 gallons of sealant into the cracks with no results. Because the TBM could not be backed up without disassembling it, Obayashi-Clyde was left with little option but to continue to mine ahead to clear the 300 feet of trailing gear of the machine. During November and December, with great difficulty, crews succeeded in moving ahead a total of 404 feet.

During the graveyard shift on January 3, 2002, as crews drilled grouting holes, an eight foot section of tunnel wall blew into the tunnel because of the water pressure. Meters at the pond

outside the tunnel measured the surge of water at 4,600 gallons per minute. With the increased flow of water in the tunnel after the collapse, the gas levels rose to a lethal concentration.¹⁶⁶

In response to the partial collapse, and the hydrogen sulfide, the CUWCD and contractor choose to leave the TBM in the mountain because of the difficulty involved in mounting a salvage operation. They reverted to the original two tunnel plan identified in the EIS, choosing to abandon 5,390 feet of tunnel and backtrack to the crossing of Diamond Fork Creek. At that point, they began drilling a new vertical shaft to connect to a pipeline and new tunnel at a higher elevation through Tanner Ridge to connect to the Sixth Water Flow Control Structure.¹⁶⁷

The new tunnel boring machine for Tanner Ridge arrived on November 18, 2002. The contractor quickly assembled the machine and began tunneling on December 9. Tunneling proceeded quickly and crews holed through at the vertical shaft at the Sixth Water Flow Control Structure on March 10, 2003. Crews worked to complete the concrete lining of the tunnels and place the pipe lines. Fiber optic cables were placed for electronic monitoring and control of the system. Work progressed at the flow control structures to regulate water in the system. At both the Sixth Water and Upper Diamond Fork Flow Control Structures, crews placed connections for future hydroelectric plants to capture the energy in the water due to the drop in elevation from Strawberry Reservoir.

In the vertical shaft of the Upper Diamond Fork Flow Control Structure, crews installed a unique vortex energy dissipater. To dissipate the force of the water falling down the 133 foot vertical shaft, the water is slung out against the wall of the pipe and spirals down the vertical pipe.

Despite the setbacks encountered in the original tunnel, the crews of Obayashi-Clyde completed the project six months ahead of schedule. CUWCD crews began testing the system

during the second week of April 2004, just in time for the 2004 irrigation season and a sixth year of drought. Officials, construction crews, and others gathered for the official dedication of the Diamond Fork System on June 1, 2004. Utah Governor Olene Walker welcomed the 300 guests at the event. Mark Limbaugh, Reclamation Deputy Commissioner, and Bennett Raley, Interior's Assistant Secretary - Water and Science, participated in the events as did members of the Utah Congressional Delegation and CUWCD officials. The CUWCD sponsored an open house the following day to allow members of the public to view displays and ask questions about the project.¹⁶⁸

Completion of the Diamond Fork System allowed the CUWCD to begin making delivery of additional CUP water in Strawberry Reservoir-water from the Colorado River Drainage-into the Bonneville Basin. It provided the full amount of water needed to complete the exchange between Utah Lake and Jordanelle Reservoir, thus allowing full delivery of CUP water from Jordanelle to water users in Salt Lake and northern Utah Counties, completing the original Bonneville Unit Municipal and Industrial supply.

Settlement of Project Lands

Early studies anticipated providing water for new lands, but over time, the amount of new lands was reduced for various reasons. In 1968, the Utah Water and Power Board petitioned to include the five counties in the Sevier River Basin in the CUP by providing supplemental water to these farms in lieu of developing a commensurate amount of new farm land in Utah and Juab Counties. In 1984, the State of Utah withdrew support of the development of new lands by reclaiming Provo Bay on Utah Lake. CUPCA deauthorized the diking of Provo and Goshen Bays and the pumping project to develop new farm lands in the Mosida area southwest of Utah Lake. Currently the project provides supplemental irrigation water to lands below Starvation

Reservoir in Duchesne County, and in the Heber Valley below Jordanelle Reservoir. Because of the demands of existing farms, and because the best lands within the project boundaries were already under cultivation, the project made no new lands available in these areas for settlement. The project provides supplemental irrigation to 15,391 acres. In 1992, over 85 percent of the acreage was utilized on 67 full-time farms with a population of 282. Another estimated 279 people lived on the 67 part-time farms comprising 2,241 acres.¹⁶⁹

Uses of Project Water

The Bonneville Unit provides supplemental irrigation water to 15,391 acres in the project area. In 1992, the most recent data available, 14,864 acres were under cultivation with 84 percent of the acreage in production devoted to forage crops (alfalfa, pasture, and silage). Cereal grains—barley, corn, oats and wheat—grew on just under 2,413 acres, with very small additional amounts devoted to corn and wheat. The gross value of all crops grown on project lands was over \$4 million in 1992.¹⁷⁰

Perhaps the greatest benefit of the Bonneville Unit is the supply of municipal water. The Bonneville Units currently supplies 104,360 acre feet of municipal water to communities in Salt Lake, Utah, Wasatch, and Duchesne Counties. When the Utah Lake System is completed, the project will provided an additional 60,000 acre feet divided equally between Salt Lake and Utah County. Together this provides a significant portion of the municipal water supply to nearly 1.3 million people.¹⁷¹

The recreation facilities at Starvation, Currant Creek, Strawberry, and especially Jordanelle Reservoirs remain popular. The reservoirs are a popular venue for fishing, boating, swimming, water skiing, hiking, and camping. Construction is now underway on three hydroelectric plants using non-federal funds. These plants are located at the Jordanelle Dam

(12 MW), the Sixth Water Flow Control Structure (45 MW), and the Upper Diamond Fork Flow Control Structure (5 MW).

The Bonneville Unit also provides important flood control benefits. These benefits are provided by Jordanelle and Starvation Reservoirs. Benefits will also occur around the perimeter of Utah Lake and along the Jordan River through the combined operation of these facilities. One estimate based on COE estimates of possible flood damage that will be avoided (using 1996 price levels) estimated the current benefit at \$1,395,000 annually. This also includes the average annual cost of 10,000 acre feet of reservoir capacity dedicated to flood control in Jordanelle Reservoir and 3,000 acre feet in Starvation Reservoir.¹⁷²

Conclusion

The history of the Bonneville Unit of the CUP is as complicated as the project itself. Spanning seven decades, the project has undergone numerous changes. Conceived as a plan for the State of Utah to fully utilize its share of the Colorado River, technical challenges, political compromises, environmentalists' demands, and economic reality have forced the project away from its original plan to supply hundreds of thousands of acre feet of irrigation water to thousands of acres of new farm lands. The purpose of the project has shifted predominantly to providing municipal water to Utah's growing urban corridor. In this respect, the Bonneville Unit is a microcosm of similar shifts throughout the west. Thanks in part to the changes made by the CUPCA, the Bonneville Unit is also unique in many respects. The environmental mitigation, local cost sharing, and the shift in construction oversight away from Reclamation set the project apart from its peers. Today, after decades of planning, monumental construction challenges, and fierce political battles, the completion of the project is in sight. For the millions who depend upon its water, the end has come not a moment too soon.

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143. CUWCD Board Minutes April 21, June 16, July 21, and October 13, 1993; *CUWCD Facility Data Book*, 20.
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145. Two key individuals engaged in the "hit list" fight later used the data they gathered to attack reclamation and the CUP. Journalist Marc Reisner, who served as Communications Director for the National Resource Defense Council during the hit list controversy, wrote a best-selling book, *Cadillac Desert*, published in 1985 which helped reshape opinion. Additionally, Dan Beard, who served as Deputy Assistant Secretary of the Interior for Land and Water for President Carter, now served as the chief legislative aide to California Congressman George Miller. Miller was seeking major reforms for the Bureau of Reclamation. Later, as Bureau Commissioner during the Clinton Administration, Beard would lead the charge to divert its mission away from large-scale construction projects to environmentally and economically sound water management.
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149. Congress, House, Committee on Interior and Insular Affairs, Subcommittee on Water and Power Resources, *Proposals to Raise the Authorized Cost Ceiling for the Colorado River Storage Project: Hearings before the Subcommittee on Water and Power resources of the Committee on Interior and Insular Affairs*, 100th Cong., 2nd sess., 18 April 1988 and 4 May 1988, 40, 422-6. For a critical analysis of the economics of the Bonneville Irrigation Unit see, Jon R. Miller, "The Political Economy of Western Water Finance: Cost Allocation and the Bonneville Unit of the Central Utah Project," *American Journal of Agricultural Economics* 69 (May 1987): 303-310.

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