

THE ALL-AMERICAN CANAL LINING PROJECT: INTERAGENCY TEAMWORK FOR CONSERVING WATER

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ABSTRACT

The All-American Canal Lining Project (AACLP) is one of the largest water conservation efforts in the United States saving 67,700 acre-feet of Colorado River water per year. This conserved water assists California in remaining within its Compact allocation of Colorado River Water without jeopardizing its agricultural or urban economies. It also contributes to the settlement of a long-standing San Luis Rey River water rights dispute in Southern California. Total project costs are projected to be over \$300 million including design, construction, environmental mitigation, supervision, administration and litigation costs.

The United States Bureau of Reclamation (Reclamation) completed construction of the unlined All-American Canal (AAC) in 1942. This 83-mile-long canal is operated and maintained by the Imperial Irrigation District (IID). As the largest irrigation district in the United States, with a total service territory encompassing nearly 1.1 million acres, IID supplies approximately 3.1 MAF of water per year to over 500,000 acres of highly productive agriculture farmland and nine communities. IID is the lead agency for the AACLP being responsible for project management, design, construction, and environmental compliance. Project funding is provided by the California Department of Water Resources (DWR) and the San Diego County Water Authority (SDCWA). As a result of this conservation, SDCWA will receive 56,200 acre-feet per year and the San Luis Rey Settlement Parties (SLRSP) 11,500 acre-feet. A Project Coordinating Committee (PCC) was established to provide project oversight, facilitate project decision making and provide a mechanism for structured communication among the participating entities and interested parties.

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HISTORICAL PERSPECTIVE

Authorized and constructed pursuant to the Boulder Canyon Project Act, construction of the 83-mile long All-American Canal (AAC) began in 1934 with the first irrigation water being delivered in 1940. The AAC is operated and maintained by the Imperial Irrigation District (IID) under contract with the United States Bureau of Reclamation (Reclamation). A 23-mile-long segment of the canal, delineated in Figure 1, was excavated primarily in sand which resulted in relatively high seepage rates through this section of the canal. Because of this high water loss, this segment was selected for lining and formed the basis of the project.

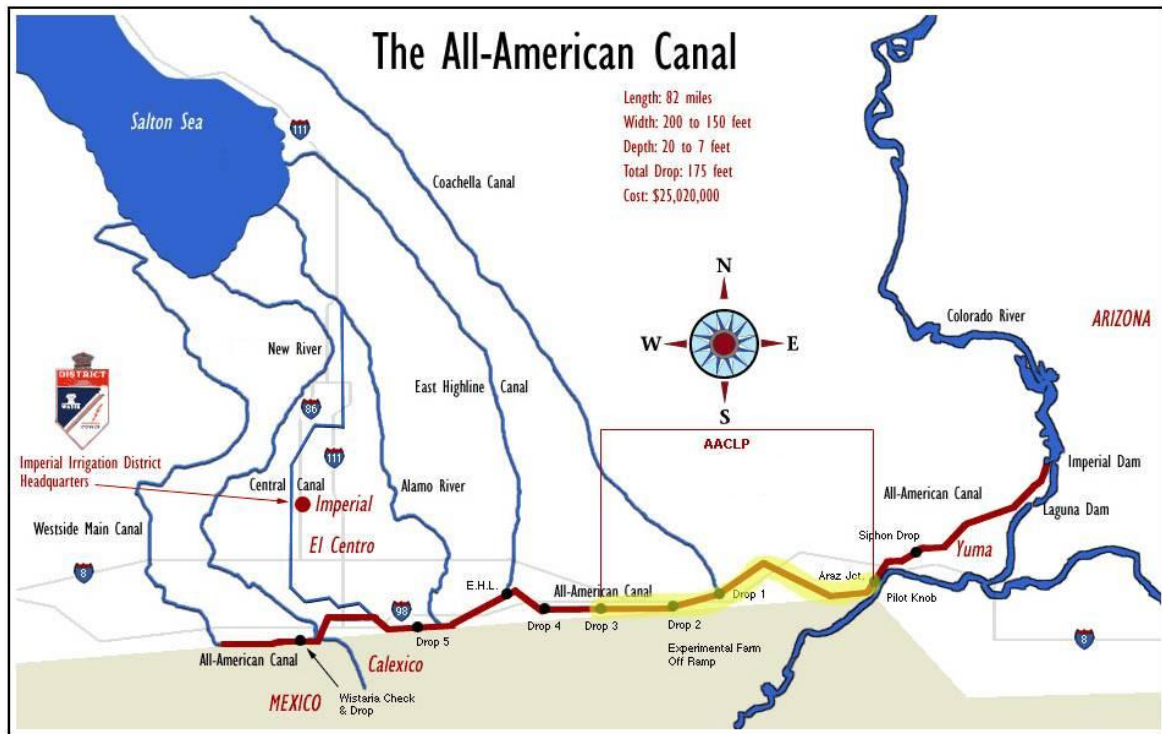


Figure 1. All American Canal Lining Project

The concept of lining the AAC was studied many times over the past 30 years as this project was seen as a means to help California live within its 4.4 million acre-foot Colorado River allocation. As such, the current project was originally conceived and later developed by, IID and the Metropolitan Water District of Southern California (MWDSC) in coordination with Reclamation. Planning studies were completed in the 1990's and Federal and California environmental documents were certified on June 28, 2002. The State of California (California) provided funding for the project based on project scope and cost estimates provided by MWDSC and Reclamation. MWDSC would be required to provide funds to complete the project if State funds were insufficient. As such, this project is included as a strategic element of the Quantification Settlement Agreement (QSA) which codifies California's larger water conservation and water use reduction efforts aimed at reducing the State's overall Colorado River water use to within the its

allocation limit. This larger effort in part involves the implementation of water conservation measures and the facilitation of water transfers which are elements of California's unified approach to resolve water use issues. This unified approach facilitated an end to legal actions among water and government agencies. In 2003, to help facilitate communication among various water agencies and help ensure California's larger conservation goals were met with regard to Colorado River use, San Diego County Water Authority (SDCWA) assumed MWDC's All-American Canal Lining Project (AACLP) responsibilities. Concurrently, MWDC's program manager joined IID to manage the AACLP.

PROJECT DESCRIPTION

The project consists of three distinct reaches, as shown in Figure 2. Reach 1 begins approximately one mile west of Pilot Knob and continues westerly approximately 11 miles to the Coachella Canal and Drop 1 Power Plant confluence. Reach 2 begins at Drop 1 and continues westerly approximately 5 miles to the Drop 2 Power Plant. Reach 3 continues from the Drop 2 Power Plant, approximately 5 miles to the Drop 3 Power Plant.

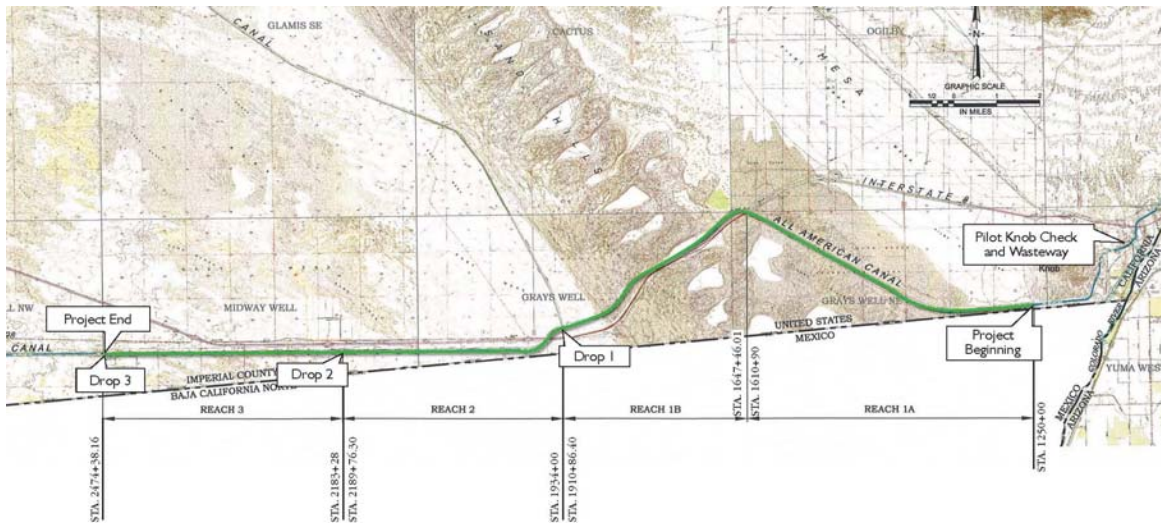


Figure 2. All American Canal Lining Project Reaches

The AACLP consists of a new, concrete-lined canal constructed primarily parallel to 23 miles of the existing AAC. One element of the project, which is intended to mitigate lost storage volume and operational impacts resulting from the reduced cross-section, includes a 5-mile-long, 1,250-acre-foot, PVC-lined, off-line storage (OLS) reservoir. The new canal connects to the existing canal at nine locations, enabling the new system to continue the use of three drop structures with hydroelectric power and two interstate highway bridges.

Construction involved excavating 22.5 million cubic yards of primarily sandy material, placing 1,910,000 square yards of 4.25-inch-thick, concrete paving, and installing 600,000 square yards of PVC liner in the OLS. Some of the appurtenant features included a two-lane bridge, flow measurement flume, gates, 96-inch diameter reinforced concrete pipe (RCP) and a supervisory control and data acquisition (SCADA) system.

The total project cost is projected to be over \$300 million of which \$170.39 million is provided by California Department of Water Resources (DWR). Total project costs include design, construction, environmental mitigation, supervision, administration and costs associated with litigation.

PROJECT SCHEDULE

Four factors helped drive the establishment of a project completion date: the need for water and for California to comply with its Colorado River allocation, the requirement for agricultural agencies to begin repayment of inadvertent overuse of Colorado River water, the need to complete the project prior to expiration of State funding and the projected duration of work. The design firm was selected in September of 2004 with design beginning in October of that same year. Bid documents were first posted on California's bidding website on February 1, 2006 and bids were received in late March 2006 (Reaches 2 and 3) and mid-April 2006 (Reach 1). Notice to proceed with construction was issued by IID on July 26, 2006. An injunction prohibiting work on the project was issued by United States 9th Circuit Court of Appeals on August 24, 2006, and construction ceased on August 25, 2006. The injunction was lifted on April 6, 2007 with work resuming shortly thereafter. The newly lined canal was in full operation in February 2009 with the exception of a few remaining concrete tie-ins to the existing canal. These tie-ins are projected to be completed in February of 2010. Site clean-up and restoration will be completed by March 30, 2010. Some environmental mitigation activities will continue after construction. All project milestones were met.

PROJECT TEAM, MANAGEMENT STRUCTURE AND ADMINISTRATION

The project team included the Executive Program Director and IID staff, Reclamation, Parson's program and construction management (PM/CM) team, the GEI/MWH design team, Reach 2 and 3 construction contractor Ames/Coffman Joint Venture, Reach 1 contractor Kiewit Pacific Company, environmental consultants EcoSystems Restoration and Associates and RECON, cultural resources consultant ASM, and staff and engineering consultant RW Beck from SDCWA.

Four significant interagency agreements governed execution of the AACLP. In accordance with these agreements, IID's procurement, financial and administrative processes were used for all project elements, except that SDCWA's processes were used for any consultants retained by their agency. IID operates and maintains the AACLP under agreement with the Reclamation and will continue this responsibility after completion of the AACLP. SDCWA will be responsible for additional operation and maintenance costs resulting from the AACLP through the term of the agreement with IID.

A key component of the project team was the Project Coordinating Committee (Committee), which was established by Construction Agreement among Reclamation, IID and SDCWA. The Committee's mission was:

- To secure effective cooperation and interchange of information.
- To provide consultations, reviews, recommendations, and approvals on a prompt and orderly basis among the members/participants in connection with project activities.
- To make recommendations, including project acceptance to Reclamation, the federal agency that holds title to the AAC, for their approval regarding the design and construction of the project.
- To approve contracts awarded by IID and related contract actions.
- To approve the project schedule and validate eligible project costs.

The Committee consists of three voting members; one from the IID, one from the SDCWA, and an independent member selected by the IID and SDCWA. The independent member was the chairman and presided over Committee meetings which were held monthly. Other organizations participated in Committee meetings as non-voting members. These included:

- Reclamation;
- Coachella Valley Water District (CVWD);
- Palo Verde Irrigation District (PVID);
- San Luis Rey Indian Water Rights Settlement Parties, (Five bands of Mission Indians, the San Luis Rey Indian Water Authority, the City of Escondido, and Vista Irrigation District who will receive a total of 11,500 AF per year of the water conserved by the AACLP.);
- DWR; and
- Other invited participants such as U.S. Bureau of Land Management (BLM), Border Patrol of the U.S. Department of Homeland Security (DHS) and California Department of Fish and Game (DFG).

One role of the Committee is its leadership function. The Committee provided guidance and direction to the Executive Program Manager and project management consultant at Committee meetings regarding high level administrative and cost issues during project construction. As such, the construction contractors did not participate in regular Committee meetings. However, the Committee voting members participated in executive level partnering sessions with the construction contractors and in negotiations and discussions regarding potential construction disputes.

TEAMWORK IN DESIGN

To expedite the project, certain design elements were interfaced with construction management services. As such, the first consulting contract established for the AACLP was the PM/CM contract. This contract provided key services, such as air quality impact analyses, geotechnical and groundwater investigations, recreation and transportation planning to support the design and construction phases of the project. A “fast track” design contract was awarded in late 2004 and completed in about one year.

To further expedite the design process, the design engineer prepared 13 design concept papers to establish standards for project elements and assure compliance with Reclamation standards and conformity with project scope and environmental requirements. These papers provided the basis for development of the Concept Design Report. The Design Concepts Report was reviewed by Reclamation, the PM/CM, IID staff, and SDCWA staff and representatives. Design workshops were conducted to help resolve issues and address comments pertaining to the various design concepts. The Concept Design Report was then used as the foundation for the expedited design.

An important element of design review process was the use of day-long workshops involving the entire project team. These workshops provided a forum for the owner and other project participants to work together and provide critical feedback and “real-time” review. The use of this technique helped the design team complete the project design in a relatively short time period.

As a direct result of the design review process, during the pre-design and design phases, numerous innovative and cost-saving ideas were developed and integrated into the final design package. Project cost and schedule savings initiatives included an alignment revision to avoid excavation in the most expansive area of sand dunes, optimization of canal side slopes, and canal section modifications to optimize paving operations.

TEAMWORK IN CONSTRUCTION

With the start of construction, project field oversight activities were required. The PM/CM thus established a consolidated field office near the on-site contractor field offices which also housed representatives of the design firm, Reclamation and SDCWA.

To better address construction phase challenges, the project owner’s team established quarterly partnering and weekly progress meetings with the contractors. Quarterly partnering meetings, facilitated by a third party, permitted candid and timely exchanges regarding concerns and issues. Furthermore, weekly coordination meetings were held in the contractor’s field offices allowing for timely and thorough discussion of pertinent issues and items. These meetings were attended by all key construction personnel, consultants and off-site team members. This teamwork approach allowed for the timely identification of issues which resulted in proactive solutions thus avoiding problems.

As further evidence of the team's commitment to an effective and economical conservation project, an aggressive safety program was established to meet both Reclamation and IID standards. This upfront planning approach paid big dividends as lost accidents were limited to one rather small event for the entire project. Over 22.5 million cubic yards of sand was excavated parallel to, and in close proximity to, Interstate 8 without incident.

Before excavation was permitted, the contractor was required to pre-wet the soil volume corresponding to the canal section to be excavated and provide verification that the sand met the specified moisture content 8-feet below the bottom of the excavation (sometimes as deep as 45 feet below the existing surface). Interstate motorist traveling both east and west and recreational "duners" could observe the large sprinkler systems spraying water over the sand dunes. Water trucks were constantly ensuring construction access roads were dust free.

CHALLENGES AND OPPORTUNITIES

Project Scope and Cost

During the course of finalizing the Construction Agreement, it became apparent that; project costs might significantly exceed DWR's funding authorization even without litigation and delays; elements of the project scope as determined by cost estimates and other project planning documents needed to be clarified; that for the Committee to function as envisioned the contracting authorities for the project would need to be synchronized with the contracting authorities of both IID and SDCWA. Executives from Reclamation, IID and SDCWA accomplished this with provisions contained in the construction agreement. Some examples of these provisions are:

1. The requirement for a unanimous vote of the Committee to approve the project's construction management manual. This would align contract modification authorities of the Committee with IID's Executive Program Manager, the PM/CM and those of the SDCWA.
2. Define the location and size of the off-line regulating storage reservoir and a variation in canal side slopes.
3. Provide an opportunity for SDCWA to omit Reach 3 of the project and IID to seek other funding sponsors for this project element if the projected cost of the project, as determined following bid opening, exceeded DWR funding.

Lawsuit-Related Construction Delays

In August 2006, following award and issuance on notices to proceed for the two construction elements, the United States 9th Circuit Court of Appeals issued an injunction halting work on the project. Executives and legal counsels for Reclamation, IID and SDCWA allied to fight the litigation against the project and eventually prevailed.

Because project partners anticipated project delays associated with potential lawsuits, a 60-day suspension clause was included in the contract documents. Nonetheless, it became

clear shortly after the injunction that the 60-day contract provision would not be sufficient. As such the project team began termination negotiations with the contractors. As the litigation progressed it became apparent that the duration of the delay could be up to two years with the need to coordinate certain construction activities during low flow periods in the canal. At that point the project team approached the construction contractors about negotiating an extended delay as well as possible termination.

Following the initial discussion with the contractors, the PM/CM, with IID and SDCWA participation, negotiated a contract modification with both contractors. This effort resulted in a contract modification that provided a delay payment to the contractors and allowed the project to proceed with the original contractor after a one year delay if a decision to move forward was made by April 2007. The contract modifications also outlined termination costs for various time periods in the event that a decision to terminate was necessary prior to that date.

In December 2006, Congress passed legislation declaring that the project was in compliance with Federal environmental laws. As such the courts ruled in favor of the project with regard to water rights and other matters allowing the project to resume prior to the required termination notification date.

Severe Construction Conditions and Non-Interruptible Canal Flows

As described above, the project's complexity was magnified by the legal challenges. Even without the legal challenge, the combination of harsh desert working conditions, no impacts on water deliveries during construction, and the relatively remote location and its proximity to the border with Mexico alone would have made AACLP a challenging project. Temperatures exceeding 120 degrees were addressed with night placement of concrete, on-site production plants, chillers, and the use of high strength concrete. As a result of these efforts, water deliveries were never interrupted. Start-up planning and meetings with operations, construction contractors and construction management allowed for coordinated net changes in water flows. This was accomplished in part by diverting flows into new facilities while terminating water flows in reaches of the original earthen canal.

Recreational Use of the Area

One interesting aspect of the project was the need to accommodate, during winter months, the annual massive influx of recreationists. Several hundred thousand snowbirds and dune buggy enthusiasts (duners) descend on the area from late fall through spring. To ensure continued use of the area, for recreation, while allowing for construction of the AACLP, the project team and Federal, State and County agencies prepared a detailed transportation and recreation plan for the protection of visitors and construction personnel. The plan featured extensive signage and an aggressive public outreach program and provided construction progress updates. This information was available on the project's web page. A total of four newsletters were produced and distributed at various recreational trade shows and events and at four kiosks located throughout the

recreational area. The program proved to be very successful in minimizing construction and public access conflicts in heavy recreation use areas, many of which were adjacent to active construction zones. As a result of these efforts there were no recreational accidents linked to construction activities.

Environmental Compliance

The responsibility of the AACLP team was to successfully construct the canal while protecting the environment and natural resources in accordance with Federal and State laws and associated project permit requirements. To help ensure compliance with these requirements, an Environmental Training Handbook and a Worker's Environmental Education Program (WEEP) Video were developed. All persons involved with the AACLP were required to be WEEP-trained and were issued hard hats with decals indicating that required environmental training had been received. This was also sufficient for DHS security requirements.

Protecting special status wildlife was one of the most important responsibilities faced during AACLP construction. Special-status animals potentially in or near the project included: the Yuma Clapper Rail and 17 other bird species; the Flat-tailed Horned Lizard and two other reptiles; and the razorback sucker fish. Special-status plants located in the project area included: Algodones dunes sunflower and Peirson's milk-vetch. Several species of doves, all of which are protected under the Migratory Bird Treaty Act, reside within the study area.

Environmental mitigation includes 43 acres of wetland habitat and one acre of open water marsh, 30 acres of dune restoration, fish salvage operations, mitigation for the loss of canal fisheries, compliance with Cultural Treatment Plan, which included negotiations with the local Tribes, and the acquisition of 1,025 acres of flat-tailed horned lizard habitat. Actions taken to avoid and/or mitigate environmental impacts included conducting a detailed survey for bird nests during the Migratory Bird Treaty Act nesting Season and prior to construction grubbing of vegetation. All active nests that were found were protected with buffer zones until nesting was completed and the nestlings fledged. After the nestlings fledged the area was cleared for construction.

Air Quality Analysis and Permitting

In the fall of 2007, it seemed that the AACLP might fall victim to what appeared to be evolving interpretations of construction air quality permitting requirements. The situation may have been exacerbated by the actions of one of the contractors, who sought to defend his interpretation of statewide permits. Permit violation notices were issued to both contractors which delayed certain aspects of the project. Imperial County threatened legal action to ensure that the IID would resolve their concerns. During this process it appeared likely that construction would be delayed with yet another injunction. As a proactive approach to keep the project on its current schedule, the project team agreed that the most prudent course of action was to oppose the legal action by Imperial County or seek a combined settlement with the regulatory agencies. This agreement was with the understanding that there may be later disputes among project participants regarding violation responsibilities. As such, legal counsels for IID, SDCWA and the two

construction contractors joined forces. As a result of this approach a settlement was reached with the local air quality management district. The project proceeded while good faith settlement negotiations took place. Following the settlement the contractors and the project team negotiated payment of settlement costs among the parties.

Sediment in the Canal

In the fall of 2008, large quantities of sediment were found in Reach 1 of the canal. The source and cause of the sediment was a matter of dispute between the owner's team and the Reach 1 contractor. Although a disputed item, there was recognition of the potential severe impact to canal operations and associated maintenance if a protective solution was not taken by the project team. If a project solution could not be devised, the potential consequences ranged from extensive silt removal maintenance in expansive reaches of IID's canal system if large quantities of the sediment washed downstream to potential crop and economic damages to the community if silt accumulation caused obstructions/interruptions of water delivery during the high demand periods.

The resulting proactive and coordinated response by the project team involved realignment of portions of the canal, revised crossover and canal tie-in schemes, revised paving techniques (this design modification increased the paving machine's utilization by allowing for its use within the canal transitions and a reduced remobilization for continued paving), some acceptance of accelerated cure techniques for some joint sealants, and expedited inspections of completed reworked paving by the PM/CM and Reclamation.

The result of this effort was the successful transfer of flows to the new lined canal prior to the onset of the high flow season. A side benefit was the availability of conserved water for about half of Reach 1 several months earlier than originally scheduled.

Coordination with Other Projects and Activities

Close coordination of construction activities was required with DHS because the project is parallel to the Mexican border. Soon after the injunction was lifted the IID requested that the AACLP Committee review DHS plans to install additional steel barriers. This included the addition of a pipe gate on the canal's south O&M road and at the AAC crossings under Interstate 8. As a result of this recommendation, DHS agreed to remove the new pipe gate during AACLP construction and to re-install the gate once construction was completed. This requirement was incorporated into the IID Encroachment Permit subsequently issued to DHS for this work.

Although not planned for during the Design Phase, DHS constructed a new Primary Border Fence along the U.S./Mexican Border from east of Sidewinder Road to west of Drop 3 while AACLP construction was under way in the same area. Once again the IID requested that the AACLP Committee review DHS plans pertaining to this construction effort. AACLP project team leads hosted a coordination meetings with the DHS contractor (Granite construction), AC Joint Venture and Kiewit Pacific to develop schedules allowing the DHS project and AACLP construction to proceed simultaneously

without impacting either project. This coordinated effort resulted in the successful completion of the border fence during construction of the AACLP without incidents to either construction project. Completion of the border fence eliminated high speed chases incidents involving drug runners crossing the border through the AACLP construction site. DHS periodically provided AACLP project representatives with aerial photographs of the construction site as a cooperative effort to help maintain project safety and security.

Another opportunity to facilitate conservation of Colorado River water arose with the approval of the Drop 2 Reservoir Project. This is a separate project funded by others who will receive its benefits. However, because it connects to the AAC in the Reach 3 of the AACLP opportunities for cost savings arose. As such, agreements were coordinated among IID, SDCWA, Reclamation and the funding agencies to allow IID's Reach 2/3 contractor to construct the reservoir element that would connect to the AACLP (prior to turning water into the newly lined canal section). This coordinated effort resulted in lower costs for the Drop 2 Reservoir Project, fewer impacts to canal operations and the newly constructed concrete lined canal, and no cost impacts to the AACLP project.

Loss of Key Project Leaders

Within about a six-month period of 2006, four senior leaders of the project passed away. They were: Kirk Dimmitt, Executive Program Manager first representing MWDSC then IID ; Joe Summers, Chairman of the Committee; Clyde Romney, long time supporter and SLRSP representative; and James "Pat" Green Reclamation's Environmental Manager for the project. While their passing represented a significant loss of both project institutional knowledge and leadership, their service to the project set the tone of teamwork and dedication that led to the project's successful completion.

CONCLUSION

The AACLP was officially dedicated on April 30, 2009. The dedication ceremony focused on and was a testament to what can be accomplished when agencies work together with a goal of conserving water for today and tomorrow.