MP-1410

Mormon Flat Dam
Name of Property

Maricopa, AZ
County and State



**United States Department of the Interior**
National Park Service

# National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations for individual properties and districts. See instructions in National Register Bulletin, *How to Complete the National Register of Historic Places Registration Form.* If any item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, architectural classification, materials, and areas of significance, enter only categories and subcategories from the instructions. **Place additional certification comments, entries, and narrative items on continuation sheets (NPS Form 10-900a).**

## 1. Name of Property

Historic name Mormon Flat Dam

Other names/site number

## 2. Location

street & number On the Salt River, approximately 50 miles east-northeast of Phoenix, AZ ☐ not for publication

city or town Phoenix ☒ vicinity

State Arizona code AZ county Maricopa code 013 zip code

## 3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act, as amended,

I hereby certify that this X nomination ___ request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60.

In my opinion, the property X meets ___ does not meet the National Register Criteria. I recommend that this property be considered significant at the following level(s) of significance:

**___ national** **_X_ statewide** **___local**

George Toft — Signature of certifying official

11/22/2016 — Date

Federal Preservation Officer — Title

BOR, DDI — State or Federal agency and bureau

In my opinion, the property ___ meets ___ does not meet the National Register criteria.

Signature of commenting official

Date

Title

State or Federal agency and bureau

**United States Department of the Interior**
National Park Service

# National Register of Historic Places Registration Form

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___ national ___X___ statewide ___ local

George T. Torbert — 11/22/2016
Signature of certifying official — Date

Federal Preservation Officer, Bureau of Reclamation, DOI
Title — State or Federal agency and bureau

In my opinion, the property X meets ___ does not meet the National Register criteria.

Kathleen Kenned — 17 Feb 2017
Signature of commenting official — Date

SHPO — Arizona State Parks
Title — State or Federal agency and bureau

Mormon Flat Dam
Name of Property

Maricopa, AZ
County and State

## 4. National Park Service Certification

I, hereby, certify that this property is:

Signature of the Keeper — Date of Action

✓ entered in the National Register — 8/7/2017

___ determined eligible for the National Register

___ determined not eligible for the National Register

___ removed from the National Register

___ other (explain:)

## 5. Classification

**Ownership of Property**
(Check as many boxes as apply)

| | |
|---|---|
| | public - Local |
| | public - State |
| X | public - Federal |
| | private |

**Category of Property**
(Check only **one** box)

| | |
|---|---|
| | district |
| | site |
| X | structure |
| | building(s) |
| | object |

**Number of Resources within Property**
(Do not include previously listed resources in the count.)

| Contributing | Noncontributing | |
|---|---|---|
| | | sites |
| 1 | 1 | structures |
| | | objects |
| 1 | | buildings |
| 2 | | **Total** |

**Name of related multiple property listing**

Salt River Project, Arizona

**Number of contributing resources previously listed in the National Register**

0

## 6. Function or Use

**Historic Functions**
(Enter categories from instructions)

Industry, energy facility (power plant)
Industry, water works
Government/Public Works

**Current Functions**
(Enter categories from instructions)

Industry, energy facility (power plant)
Industry, water works
Government/Public Works

## 7. Description

**Architectural Classification**
(Enter categories from instructions)

Other, Early 20th Century

Other/concrete thin arch dam

**Materials**
(Enter categories from instructions)

foundation: Concrete

walls:

roof:

other:

### Narrative Description

#### Summary Paragraph

Mormon Flat Dam is associated with the evolution of the Salt River Project's (Project) aggressive hydroelectric expansion program during the 1920s. Contributing features include the dam and spillway (structure), and its attached powerhouse (building). Non-contributing features include the 1971 pump unit (reversible pump turbine facility). Named after a nearby meadow known as a popular campsite for 19th century Mormon pioneers, Mormon Flat Dam is located on the Salt River in eastern Maricopa County, Arizona, approximately 50 miles east-northeast of Phoenix, about halfway between Theodore Roosevelt Dam and Granite Reef Diversion Dam. The Mormon Flat Dam meets the Registration Requirements set forth in the Salt River Project MPS for Property Type I: Storage-Regulation Dams.

#### Narrative Description

Constructed by the Salt River Valley Water Users' Association (Association) between 1923 and 1925 as the first facility in the Association's privately-funded hydropower expansion program, Mormon Flat Dam generates hydroelectric power and stores approximately 57,000 acre-feet of water in its reservoir, Canyon Lake, for agricultural and urban/commercial uses in the Salt River Valley. As constructed, Mormon Flat Dam, like Horse Mesa Dam to the east, is a concrete, thin-arch structure with a hydraulic height of 224 feet. The dam's crest is 380 feet long, with a top width of 8 feet and a maximum base width of 20 feet. The right (northern) abutment is in the bedrock cliff. The banked spillway is concrete-lined and lies at the left abutment, and is controlled by two 50-foot-square steel fixed-wheel gates. The dam's downriver elevation features a smooth concrete surface, and is topped by a service walkway detailed with a simple, continuous concrete balustrade. Portions of the original spillway apron are visible at the left (southern) abutment adjacent to the new spillway.

Mormon Flat Dam has two hydroelectric generating units: one is a conventional unit located in the dam's attached powerhouse rated at 10,000 kW; the other is a pumped storage unit built in 1971 and rated at 44,000 kW. This pumped storage unit permits water recycling for hydroelectric production and keeps lake levels relatively constant. Nameplate capacity is 54,000 kW. The conventional generator was converted from 25 to 60 Hz in 1971. Maximum head for the conventional is 140.5 feet; for the pumped storage, 151.5 feet. At the base of the dam, a small penstock serves the small classically detailed, concrete powerhouse, which is square in plan with a modern replacement gabled roof. The wall surfaces feature large multi-paned arched windows on the north elevation with segmental arch vents at the roofline and a large roll-up door facing downstream. The larger penstock feeds into the 1971 reversible pump unit. The upriver face of the dam contains a small, multi-gate intake structure also built at this time.

In 1938, Reclamation built a new gatehouse superstructure and a banked, concrete-lined spillway discharge channel to address the inefficient and problematic right-angle-discharge design of the original spillway, and concerns over major flood events. In addition, Reclamation also installed two 50-foot-square regulating gates, hoists, motors, two 25-kilovolt-ampere gasoline engine generators, and built a new road to the powerhouse. The 1938 concrete gatehouse superstructure rises 134 feet above the spillway crest of the dam and has large openings for the raised gates. The gatehouse's working areas are lit by a series of 10 regularly-spaced window openings (two sets of five above each gate), while the remaining surfaces are devoid of any stylistic detailing except for shallow recessed panels on the end walls. A working bridge crosses the spillway span above the lowered gates at the level of the top of the dam.

Its backwater, 10-mile-long, Canyon Lake Reservoir, with 28 miles of shoreline, has a maximum depth of 131.5 feet and a capacity of 57,800 acre-feet. It provides year-round recreational opportunities. Mormon Flat Dam cost $2,497,000 to build and modify.

## 8. Statement of Significance

### Applicable National Register Criteria

(Mark "x" in one or more boxes for the criteria qualifying the property for National Register listing)

- [x] A Property is associated with events that have made a significant contribution to the broad patterns of our history.
- [ ] B Property is associated with the lives of persons significant in our past.
- [ ] C Property embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.
- [ ] D Property has yielded, or is likely to yield, information important in prehistory or history.

### Criteria Considerations

(Mark "x" in all the boxes that apply)

Property is:

- [ ] A owned by a religious institution or used for religious purposes.
- [ ] B removed from its original location.
- [ ] C a birthplace or grave.
- [ ] D a cemetery.
- [ ] E a reconstructed building, object, or structure.
- [ ] F a commemorative property.
- [ ] G less than 50 years old or achieving significance within the past 50 years.

### Areas of Significance

(Enter categories from instructions)

Politics/Government

Engineering

Community Planning and Development

### Period of Significance

1923–1939

### Significant Dates

1923–1925 – Mormon Flat Facility Built

1937–1939 – Spillway improved

### Significant Person

(Complete only if Criterion B is marked above)

### Cultural Affiliation

### Architect/Builder

Charles Cragin

Salt River Valley Water Users' Association

### Periods of Significance (justification)

The period of significance reflects the facility's original construction date (1923–1925), as well as the dates in which the facility was improved (1937–1939).

### Statement of Significance Summary Paragraph

Mormon Flat Dam qualifies for the National Register of Historic Places under Criterion A. It is associated with the evolution of the Salt River Project, one of the first five federally-sponsored western water projects authorized under the National Reclamation (Newlands) Act of 1902. This act created the United States Reclamation Service (Reclamation), whose purpose was to design and construct storage and irrigation projects to aid in the settlement and economic development of western America's arid lands. Previous efforts by individuals and private irrigation concerns were inadequate and often unsuccessful. With the Reclamation Service's creation, the federal government assumed a lead role in developing large-scale western water projects.

**Narrative Statement of Significance**

Under Politics, Government, and Community Planning and Development, Mormon Flat Dam is significant in that it was the first privately-financed dam constructed as part of the Project's ambitious 1920's hydroelectric expansion program, one that contributed to the economic growth and expansion of the Phoenix metropolitan area throughout the remainder of the twentieth century. Along with the Roosevelt, Horse Mesa, and Stewart Mountain facilities, Mormon Flat Dam impounds water on the Salt River for use in generating power and regulating flow for irrigation and domestic use within the Salt River Valley. Mormon Flat Dam, along with Horse Mesa Dam and the Stewart Mountain Dam reflected the increased influence and power of the Association as they attempted to privately build hydroelectric facilities to meet projected demands and consumption, especially in the 1930s and 1940s when the valley experienced its first major growth, and the post-World War II era when the valley witnessed further growth due to the perfection and resultant widespread use of air conditioning technology.

Under engineering, Mormon Flat Dam is a good example of a radius concrete thin-arch dam design that departed from the more traditional, massive, and expensive curved gravity design incorporated in Roosevelt Dam. In principal, the structural characteristics of this dam represent a radical approach to engineering in which the shape of the dam is more important than the mass (or weight) of material in the structure. In contrast to Roosevelt Dam, a curved gravity dam where its sheer mass holds back the horizontal forces stored water, a thinner, less massive radius arch relies on the tremendous downward, vertical force of its mass to withstand the horizontal force created by the impounded water. Usually termed as arch dams to distinguish them from curved gravity designs, these materially conservative structures derive their strength from the structural characteristics of their shape, which is basically a bowed wall with the outside curve facing upstream. Thus, radius arch dams represent the structural tradition of dam design, in which the dam's shape, rather than the amount of materials used, is the critical factor in its structural strength. As a result, radius thin-arch dams are less expensive to construct than a curved gravity facility like the Roosevelt Dam. The radius arch dam was preferred by the Association because it allowed them to simultaneously expand their hydropower program and save money in material and construction costs.

**Developmental history/additional historic context information**

While the completion of Theodore Roosevelt Dam hallmarked not only the first storage dam on the Salt River, it was also the Project's first hydroelectric facility. The successful completion of Roosevelt Dam, then the U.S. Reclamation Service's (Reclamation) loftiest icon of engineering achievement, provided Reclamation and the Salt River Valley Water Users' Association (Association) with the confidence to extend their vision as to what their Project, and the valley it served, could become. The first decade of the Project's existence also witnessed rapid growth in Phoenix and its surrounding communities; from 1900 to 1910 Phoenix's population doubled to nearly 11,000 residents. The valley was transforming into a frontier urban center with a wide variety of business interests. Mines, newspapers, hotels, laundries, flour mills, meat packers, machine and lumber companies, processing plants, and other businesses ancillary to agriculture established valley footholds, and all required electric power. Population and commercial factors, along with the production of hydroelectricity by Roosevelt Dam proving its worth in providing thousands of dollars of repayment income, drove the Association and Reclamation to expand the Project's hydropower capacity.

Under a 1910 agreement between Reclamation and the Association, the Association undertook a $900,000 program to build three hydroelectric plants in the Salt River Valley. Following Reclamation's design specifications and under their supervision, the Association constructed three low-head hydroelectric facilities along valley canals, now dependably served by Granite Reef Diversion Dam near Mesa: the South-Con Power Plant at the intersection of the Consolidated and South canals, the Arizona Falls Power Plant along the Arizona Canal, and the Crosscut Power Plant, which used falling water from Reclamation's newly-built Crosscut Canal that joined the Arizona and Grand canals. When completed in 1914, the Association turned them over to Reclamation as part of the integrated Project. Hydroelectric receipts from these plants, along with those earned at Roosevelt Dam, went to defray the Association's operating costs.

The total capacity of all Project power plants amounted to about 8,000 kW. Combined with Roosevelt Dam, which added a sixth unit in 1916, the Project was producing about 18,000 kW of hydroelectricity. About one third of this was sold to Consolidated Copper Company in Miami, east of Phoenix, and another large percentage was being wholesaled to Pacific Gas and Electric Company. Project power was also used to pump groundwater from ten pumping plants. For federal reclamation activities in total, the power produced by the Project between 1916 and 1917 generated nearly two-thirds of all Reclamation power in the West, and returned a gross income of $495,000, or four-fifths of Reclamation's hydroelectric revenue as a credit for Association repayment. >**See Continuation Sheet 8<**

## 9. Major Bibliographical References

### Bibliography

Please see SRP MPL cover document, Section I, for a comprehensive bibliography

**Previous documentation on file (NPS):**

____preliminary determination of individual listing (36 CFR 67 has been requested
____previously listed in the National Register
____previously determined eligible by the National Register
____designated a National Historic Landmark
____recorded by Historic American Buildings Survey #_____
__x__recorded by Historic American Engineering Record # AZ-14

**Primary location of additional data:**

____State Historic Preservation Office
____Other State agency
____Federal agency
____Local government
____University
____Other
Name of repository: Library of Congress on line catalog

Historic Resources Survey Number (if assigned): _____

## 10. Geographical Data

**Acreage of Property** 4.57 acres

**UTM References (See Section 11 Continuation Sheet)**

| | Zone | Easting | Northing |
|---|---|---|---|
| 1 | 12 | 458887 | 3712734 |

### Verbal Boundary Description

The boundary for Mormon Flat Dam is comprised of the dam structure proper from the north to south abutments, including the spillway and powerhouse.

### Boundary Justification

The boundary is defined by the limits of the eligible structure consisting of the dam from the north to south abutments, including the spillway and powerhouse. This is consistent with the boundary delineated for this cultural feature on the attached boundary map (Section 11, Page 2, Map 2).

## 11. Form Prepared By

name/title Jim Bailey, Ph.D., Historian
organization Bureau of Reclamation, Phoenix Area Office date October 1, 2010
street & number 6150 West Thunderbird Road telephone (623) 773-6263
city or town Glendale state AZ zip code 85306
email ljelinek@usbr.gov[i]

[i] All contact information is for the Phoenix Area Office Archaeologist.

**Additional Documentation**

Submit the following items with the completed form:

- **Maps:** An aerial map indicating the property's location.
- **Continuation Sheets:** 8 (context, photos), 11 (site map with UTMs and picture references)
- **Additional items:** None

**Photographs:**

**Photo Log (See Section 8 Continuation Sheet)**

**Current Photographs**

**Name of Property:** Mormon Flat Dam
**City or Vicinity:** Tortilla Flat
**County:** Maricopa
**State:** AZ
**Photographer:** Jim Bailey, Bureau of Reclamation; Salt River Project
**Date Photographed:** March 2010; May 2009
**Location of Original Digital Photographs**: Bureau of Reclamation, Denver; Salt River Project, Phoenix, AZ
**Number of Photographs:** 8

Photo 1 of 8: (AZ_Maricopa County_Salt River ProjectMPS_Mormon Flat Dam_0001)
Mormon Flat Dam and Canyon Lake aerial looking east.

Photo 2 of 8: (AZ_Maricopa County_Salt River ProjectMPS_Mormon Flat Dam_0002)
Mormon Flat Dam looking east.

Photo 3 of 8: (AZ_Maricopa County_Salt River ProjectMPS_Mormon Flat Dam_0003)
Mormon Flat Dam looking northeast.

Photo 4 of 8: (AZ_Maricopa County_Salt River ProjectMPS_Mormon Flat Dam_0004)
Mormon Flat Dam looking south across crest, including powerhouse.

Photo 5 of 8: (AZ_Maricopa County_Salt River ProjectMPS_Mormon Flat Dam_0005)
Spillway gatehouse looking east.

Photo 6 of 8: (AZ_Maricopa County_Salt River ProjectMPS_Mormon Flat Dam_0006)
Spillway gates looking east.

Photo 7 of 8: (AZ_Maricopa County_Salt River ProjectMPS_Mormon Flat Dam_0007)
Mormon Flat Dam spillway and gates.

Photo 8 of 8: (AZ_Maricopa County_Salt River ProjectMPS_Mormon Flat Dam_0008)
Mormon Flat dam spillway from crest.

**Historic Photographs**

**Name of Property:** Mormon Flat Dam
**City or Vicinity:** Tortilla Flat
**County:** Maricopa
**State:** AZ
**Photographer: Unknown;** Mark Durben, Salt River Project
**Date Photographed:** 1923, 1924, 1926, 1988
**Location of Original Digital Photographs**: Salt River Project, Phoenix, AZ
**Number of Photographs:** 12

Historic Photo 1 of 12: Mormon Flat Dam site on Salt River, looking upstream, 1923. Photo courtesy of the SRP.

Historic Photo 2 of 12: Mormon Flat construction camp from road, 1923. Photo courtesy of the SRP.

Historic Photo 3 of 12: Monighan dragline at work in the Salt River at Mormon Flat, 1923. Photo courtesy of the SRP

Historic Photo 4 of 12: Upstream view showing diversion flume at lower left and mixing plant at left center, June 1924. Photo courtesy of the SRP.

Historic Photo 5 of 12: View of upstream face and concrete tower chutes. Photo taken on October 30, 1924. Photo courtesy of the SRP.

Historic Photo 6 of 12: View of downstream face showing section being keyed, January 1925. Spillway apron is at right. Photo courtesy of the SRP.

Historic Photo 7 of 12: Downstream view of spillway Taintor gates, February 1925. Photo courtesy of the SRP.

Historic Photo 8 of 12: View of the power plant under construction on the downstream side of the dam. Photo taken in March 1926. Note location of spillway gates. Needle valves at lower left are for bypass. Photo courtesy of the SRP.

Historic Photo 9 of 12: Mormon Flat Dam, power plant, and reservoir, 1926. Photo courtesy of the SRP.

Historic Photo 10 of 12: Mormon Flat Dam, 1988. HEFU penstock and unit are at center. The original power house is located in the shade behind the HEFU penstock. Transformer is located at center right. Mark Durben photo courtesy of the SRP.

Historic Photo 11 of 12: Downstream side of the Mormon Flat spillway gates and superstructure, 1988. Mark Durben photo courtesy of the SRP.

Historic Photo 12 of 12: Upstream face of spillway superstructure at left, and HEFU service tower at right, 1988. Mark Durben photo courtesy of the SRP.

**United States Department of the Interior**
National Park Service

# National Register of Historic Places Continuation Sheet

| Mormon Flat Dam |
|---|
| Name of Property |
| Maricopa, AZ |
| County and State |
| Salt River Project |
| Name of multiple property listing |

Section number 8 Page 1

**Context continued**

With the exception of some spillway work at Roosevelt Dam and some canal lining work, Reclamation proudly declared that the Project would be completed by 1916, and considered its efforts a great success and a model of other proposed western reclamation projects. Having operated the Project for eight years and with it essentially complete, Interior Secretary Franklin Lane decided to convey Project operation and maintenance (O&M) to the Association. In line with the general beliefs shared by President Woodrow Wilson, Lane firmly believed that the government should not extend its paternal role beyond the construction of its reclamation projects. Instead, the Association should be made responsible for the federal government's works, just as it was obligated for remitting the Project's costs. Reclamation, however, balked at the idea. Reclamation's Commissioner, Arthur Powell Davis, thought that relinquishing authority would deny the government receipts from the Project's hydroelectric components and thereby surrender the only security the government had to recover its expenses.

Although the Association had not requested responsibility for the Project's O&M from Reclamation, they were pleased. However, the Association was inadequately staffed to meet this new responsibility. Under the provisions of the National Reclamation Act, the federal government would retain title to the Project, while the Association accepted their O&M responsibilities. Additionally, and critical to the Project's future, the Association also received all profits, revenue, and income from Project facilities. This would help with Project debt repayment, estimated at over $10 million, which was three times more than what was originally estimated (much of this was due to the purchase and building of canals and the construction of Granite Reef Diversion Dam). Other provisions obligated the Association to secure the Secretary's approval if it wished to make any improvements to the Project, and authorized the Secretary to revoke the agreement should the Association not meet its responsibilities. Due to the developing war in Europe, which increased demand for cotton and foodstuffs, combined with a booming farm economy that increased the demand for irrigation and municipal water and hydroelectricity, the Association was on solid economic footing as it assumed control of the Project.

The production of hydroelectric power from the facility was problematic. The Salt River Valley's irrigation demand ran almost entirely from April 1 through October 1, and as a result hydroelectric power could only be produced during this period. From October through March, when irrigation demand dropped appreciably, so too did hydropower generation. Roosevelt Dam could not meet the demand because it was not able to release water for hydropower needs alone. The Association was concerned that outside utility interests might attempt to develop a facility to provide year-round hydroelectric service not dependent on seasonal irrigation delivery. As such, the Association realized it had to devise a plan in order to accommodate both the water and electrical demands of its shareholders, as well as to defer part of the $10 million federal repayment obligation through the sale of hydropower power.

As the 1920s approached, and as the population of Phoenix and its surrounding communities increased, the Association gained new leadership. Frank Reid was elected president and Charles Cragin was named Project General Superintendent and Chief Engineer. Two years later, Cragin released his detailed water inventory study. One conclusion demonstrated that while the Project could count on 1.69 million acre-feet annually, without the ability to manipulate or better manage its use, additional hydroelectric power was impossible. Expansion was possible, but three operational conditions hampered expansion. Roosevelt Dam could generate hydropower, but only when irrigation demands required the water's release. Second, power production was even more limited because all other Project water sources, like the Verde River, were allocated to satisfy irrigation demand. Lastly, the river's erratic flow significantly impacted Salt River hydropower generation. In 1916, 2.3 million acre-feet came down the river. In 1903 (a drought year), flow was limited to 250,000 acre-feet. If the Association expected to develop a year-round hydropower supply independent of irrigation needs, it needed to further regulate or stabilize the flows of the Salt River.

Cragin presented four alternatives to improve the Association's power output. The first was to build a steam plant, one suggested by the previous Association leadership. The second was to build a storage-regulation facility at Mormon Flat, about halfway between Roosevelt Dam and Granite Reef Dam, then build another dam

between Mormon Flat Dam and Roosevelt Dam to be used strictly for hydropower production. The third was to build a storage facility on the Verde River, one that would allow Roosevelt Dam to release water in the winter for power. The fourth was a combination of all the alternatives. Of the four, Cragin suggested the second alternative. If the Association undertook the construction of a dam at Mormon Flat, it could permit Roosevelt Dam to produce hydropower in periods of no irrigation draw. A dam at Mormon Flat could store 90,000 acre-feet of water run for power from Roosevelt Dam, and could capture water from an additional 276 square mile watershed. The construction of Mormon Flat Power Dam (what would become Horse Mesa Dam) between Roosevelt Dam and Mormon Flat would permit the generation of 25,000 kW. Cragin also recommended that Roosevelt Dam's output be expanded by raising its spillways fifteen feet. This would result in 270,000 acre-feet of additional storage that would permit adding a seventh 9,000 kW unit to the dam's power plant.

Cragin estimated the costs of this expansion to be $5.9 million, or $175 per kW. To finance the expense, the engineers recommended that the Association first consider soliciting construction funds in advance from its larger electrical users, such as the copper companies, Central Arizona Power and Light, and irrigation and electrical districts. He estimated that these users totaled a demand approaching 60,000 kW; if these businesses funded construction, the Association would repay them through a credit and reduced rate formula. He preferred this method because the three-quarter majority vote approval for construction bond issuance by Association shareholders would not be required. Cragin's report also looked at potential competition and other private hydropower projects in the planning phase during the early 1920s. One was the Black River above Roosevelt Dam, but this seemed unlikely because the per-Kw costs were twice that of the Project's proposed expansion. Another was from the Paradise-Verde Irrigation District, which wanted to tap into the Verde near (the current) Horseshoe Dam site, but again the costs were prohibitive. Yet another was the speculative development of the Colorado River by California interests, but while the per-Kw costs to build the facilities was lower than the Association's, by the time high transmission lines were built to serve central Arizona's scattered customer base, the per-kilowatt total was over $100 higher than what the Association proposed for their expansion.

The lack of other cheap hydroelectric power seemed to leave central Arizona's power market open to the Association. Market conditions could not have been more favorable. In 1920, Arizona consumed approximately 500 million kilowatt-hours of electricity, with the anticipation that it could double in a decade. About 80 percent of the annual load was within a 100 mile radius of the Project's hydroelectric plants. Since an overwhelming amount of the state's demand was concentrated so closely to the Project's electrical service area, Cragin realized that the Association had a golden opportunity to contribute more to the state's power demand beyond its current 60 to 80 million kilowatt-hour annual share.

Larger global forces were at work to thwart the Association's regional power plans. During World War I, the valley cotton market exploded in an effort to meet wartime demands for clothing and other materials. Production soared during this artificially induced period of high demand, prices, and profits. However, as the war ended in November 1918, the American farming market collapsed. Central Arizona was hit particularly hard by this development because the end of the war meant the end of "King Cotton." Farmers who allocated all of their acreage to grow cotton could not quickly adapt to the changing agricultural market. Additionally, the cessation of the wartime economy also brought a decline, albeit less dramatic, to the copper mining industry. This meant a steep decline in the Association's income because the copper mines were their largest hydroelectric customers. As a result, the Association began to worry that it could not meet its annual debt obligation to the federal government for building the Project. Under the 1917 agreement, the Association was required to pay the government $203,320 annually to remit the government's expense in constructing the Project.

Over the next year or so, despite being granted extensions by Reclamation Commissioner Arthur Powell Davis, the Association did not meet its debt obligation. Although Davis was tolerant in the beginning, because he understood how the War's end created a national agricultural and extractive malaise, as the second and third extensions still yielded no money, he lost patience and ordered a review of the Project's books. Notwithstanding the farm income, he believed the Project could make its payments based on its hydropower receipts alone. Auditors discovered that indeed valley farmers had the means to pay their assessments and the Association had

the funds to make its repayment installments. The report's conclusions led Davis to think that the government should consider withholding water from the Association until the debts could be cleared.

The Association refuted the report, claiming it needed to expend significant monetary resources to remedy drainage problems and repair winter flood damage. As far as hydropower revenues were concerned, the Association claimed that actual revenue from hydroelectric sales, after repaying monies advanced for the construction of the Chandler Falls Power Plant, as well as operation, maintenance and transmission upgrades, amounted to about $75,000 less than the $455,000 the Association owed for two installments plus penalties. Despite the Association's impassioned pleas, Reclamation still thought the Association could make payments and remained unconvinced that power revenues were not significant enough to cover Association debt. It was a classic standoff. The government believed the Association could make payments, the Association felt it more important to address drainage problems and winter flood repairs than repay the government.

In July 1922 both sides reached an agreement concerning repayment. Under the contract's terms, the Association agreed to meet specific repayment deadlines for 1922 and 1923 by assigning all power revenues to the repayment charges until all fees had been collected. After this, the Association could use its power receipts for its own purposes for that year. If the Association was delinquent in its repayment past the 30-day grace period, the United States had the right to take possession of the Project's power plants. The contract had one other provision: under Section 15, the Secretary approved the Association's hydroelectric expansion program. Under this provision, the contract gave preliminary approval for this expansion contingent upon Reclamation's favorable approval of the Association's specific construction plans. Prepared for this possibility, the Association determined that rather than go into further debt to repay construction costs, their hydroelectric expansion would be financed through bond issuance. All the Association needed to do was convince their Board of Governors, which could easily be done given that the postwar malaise had temporarily ended and prosperity had returned to the region. In 1922 the Association received the greatest income from net power revenues in Project history until that point, nearly $448,000, and farming wealth returned, with a gross crop revenue of $15.5 million for 1921-1922.

In November of 1922 Association leaders took their hydroelectric expansion cause to the Board of Governors by proposing the construction of Mormon Flat Dam and improvements to Roosevelt Dam, estimated to cost $1.8 million. They reminded the Board that current power output fluctuated too much from season to season, and that Project electric output needed to be more stable and dependable. Additionally, an expanded and stabilized hydropower system would not only reduce water fees, but the increased output could power the entire Project within a decade. Convinced by these arguments, the Board approved Cragin's hydroelectric expansion program, which it called Mormon Flat Development No. 1, and planned a special election of Association shareholders to vote on issuance of $1.8 million in bonds to fund the construction. On January 4, 1923 the Association' shareholders approved the proposed construction of the Mormon Flat Dam. The Association's leadership promoted the project, which spelled out the advantages of steadier and increased hydropower, as well as the ability of Mormon Flat Dam to store water from an additional 350 mile watershed, thereby increasing irrigated acreage. Between January and March, bids for the bond prospectus were issued, with the Citizen's National Bank of Los Angeles and Amedeo Giannini's Bank of Italy (later the Bank of America) emerging as winners.

While the bond issuance process (and subsequent short-term litigation) played out, the Association started work at Roosevelt Dam. The plan was to develop an additional 10,000 horsepower at the power plant, making the total output 25,000 horsepower. This was accomplished by installing 19 tainter gates, ten in the south spillway and nine in the north spillway. The new gates would increase reservoir capacity by 270,000 acre-feet, and give the power plant a higher head. Additionally the Association constructed a new penstock, and moved the power plant's transformer equipment from the transformer house downstream to the top of the power plant. This was done to avoid service interruptions caused by heavy spray falling across the wires crossing the south spillway when the reservoir was spilling. The total cost of Roosevelt improvements was $563,000.

While the Roosevelt work proceeded, Cragin drafted an arch design for Mormon Flat Dam. A drastic departure

from Roosevelt's gravity dam design, Cragin decided on an arch dam in order to reduce material costs. By the early 1920s, dam design had progressed to arch dams, which curve upstream to use the compressive strength of the structure's construction material, usually concrete, to deflect or transmit water load by arch action or thrust to the dam's abutment walls and foundation. Unlike the gravity design, the arch dam's use of material strength gives it structural merit, for it does not rely on sheer weight and volume of construction materials. Thus, the reduction in materials afforded by an arch dam make it less expensive to construct. Although the use of arch dams had been around since Roman times and used significantly in California in the late 19th century, by the 1920s it became the preferred design for dams slated to be built in narrow "U"- or "V"-shaped canyons. Cragin also decided that Mormon Flat Dam would be what is known as a variable radius design because it was perfect for the site's V-shaped canyon. The design was not only cheaper to construct, but would perform better under full load, holding more water safely than a constant radius arch dam. Although patent infringement litigation between the firm that held patents to the variable radius arch and the Association continued into 1930 (and well into the construction of Horse Mesa Dam) the Association began construction of Mormon Flat Dam in April 1923.

The first construction priorities were building access roads to the dam site and replacing 3.5 miles of the Apache Trail that would be inundated by Mormon Flat's backwater. Other priorities included building transmission lines and a construction camp. Preliminary construction work included building the upstream coffer dam to divert the Salt River and dry out the foundation and abutment areas, as well as excavation of the spillway and penstocks. Diamond drilling exploration of the dam's bedrock was the only work not done by the Association, instead it was contracted out. A total of 225 Association workers labored in the dam's very narrow canyon. Controlling the river's flow was primarily accomplished by closing Roosevelt's new gates; however, some downstream seepage and runoff still occurred below Roosevelt Dam. A 350-foot-long wood and concrete flume was constructed to divert this water around the construction site. Additionally, spoil was used to build a coffer dam downriver to prevent backwater from creeping upstream into the foundation site. With these improvements, construction proceeded.

The narrowness of the canyon, the significant depth of the bedrock, and the presence of seeping and percolating water made foundation excavation very difficult. The Association ran six Kimball pumps to help keep the site dry while excavating the foundation with the same dragline used to construct the upstream coffer dam. Spoil was removed by a small, wooden stiff-legged derrick and small dump cars running across a narrow-gauge track. Material was dumped into the cars, which then transported the spoil to help build the downstream coffer dam. Excavation work for the foundation pit continued until March 1924. By that time, nearly fourteen thousand cubic yards of material had been removed. Concrete aggregate was obtained from the river bed by the dragline, and because the materials were so consistent in size, a crusher was not needed. All aggregate was screened, washed, and trucked over a road that led to storage bins at the upstream approach to the spillway above the small concrete mixing plant.

Concrete was placed using a 240-foot-high Insley steel tower with sixteen-inch steel chutes. Positioned near the mixer, it could reach any portion of the site. Concrete mixed at the plant was sent down a chute that ran from the mixing plant to the tower's base. Materials were then lifted up the tower and distributed by the tower's chutes, supported by skylines. The Association poured the first concrete on March 11, 1924. The plan was to build the dam in four separate arch ring sections with keyed faces. This permitted incorporating three evenly spaced contraction joints. Using this method, the Association avoided the possibility of vertical cracks developing as the structure cured. By June 8 sufficient progress had been made to allow the river to be diverted through a pair of ten-foot openings left at the structure's north end. A bulkhead was then installed to close the diversion intake and the flume was removed to allow concrete placement on the south end. By September 30, nearly 50 percent of the structure's total mass had been placed.

Construction continued into 1925. Beyond pouring the dam face elevations, progress was made on the spillway and river outlet works. The six-foot penstocks were equipped with sliding gates on the uphill side; one of these gates was also given a control valve on the downstream end. Three of the six penstocks were reserved for future power expansion and installation. The 259-foot-long spillway was finished with nine steel Taintor gates. By

February 1925, Mormon Flat Dam had risen to a sufficient height to allow water to collect behind it. The dam was completed two months later, just as the Association envisioned. It was a utilitarian structure constructed efficiently and economically, with no architectural embellishments.

Soon after the dam's completion, the Association reached an agreement with the Central Arizona Power and Light Company (CALAPCO) to add a single 7,000 Kw hydroelectric power plant. In return for providing upfront funding, CALAPCO would receive all of the plant's output. Under the terms of the agreement, CALAPCO agreed to purchase hydroelectricity from the Association for a period of fifty years. The Association began the plant's construction in July 1925. By fall, the excavation and construction of the draft tubes was completed. Through the winter of 1925 and spring of 1926 the two eight-foot penstocks were joined into a single feeder penstock, the power house was erected, and all electrical equipment was delivered and installed. The plant was fitted with a single Westinghouse generator, with a rated installed capacity of 10,000 Kw, and with a Westinghouse alternator, transformers, and switching equipment. The plant was finished in May 1926 at a cost of $472,000.

Several years following the completion of Mormon Flat Dam, some serious technical deficiencies were identified, requiring the modification and reconstruction of important dam features. In 1933, the Association's consulting engineer, William Cone issued a report stating that the spillways for all four Project dams were inadequate to address a major flood event. He cited the major damages to Roosevelt Dam's spillway during the last large Salt River flood in 1916, and claimed if it happened again, the damage would be significantly worse at the four Project dams. At Mormon Flat Dam, the first opening of the spillway in a significant flood event would immediately erode loose fill and cause it to pour into the power house. Cone recommended that Mormon Flat Dam's spillway be reconstructed to not only prevent spill from breaching the power house, but to withstand a 150,000 cfs discharge—Mormon Flat Dam's spillway rating was only 95,000 cfs at that time.

Due to the collapsed American financial market during the Great Depression, it seemed unlikely that the Association, itself facing huge financial difficulties, could afford to spend the estimated $4.3 million to upgrade all four Salt River dam spillways, including Mormon Flat Dam. However, the Association was able to convince Reclamation to complete these modifications as part of the contract to build Bartlett Dam on the Verde River. The project would be financed through an interest-free loan, up to $6 million, made to the Association through the Emergency Relief Appropriation Act of 1935, the Federal Emergency Administration of Public Works, or some other federal public works program.

As it turned out, Mormon Flat Dam was the last dam to undergo spillway upgrades, because the needs were more pressing at Stewart Mountain Dam and Horse Mesa Dam. Similarly to Horse Mesa Dam, Mormon Flat Dam's spillway piers were set athwart to the approach channel and therefore forced the water to make nearly a full right-angle turn to spill. This caused the water to pile up against the piers, impeding the success of the spillway. Reclamation awarded the contract to Gunther and Shirley Company and J.D. Shirley, (contractors), both of Los Angeles, for a bid of $468,000. Generally the work called for the complete removal of the existing spillway, constructing a concrete-lined channel, a gate superstructure, and a pair of 50-by-50-foot gates with all necessary operating machinery.

After setting up a construction camp, in March 1937, the contractors began by removing the nine spillway gates, their concrete piers and deck, the spillway's west retaining wall, and other smaller associated features. Excavation of the spillway channel began in early summer. The new spillway was designed to curve roughly along the same radius as the dam. It was built 450 feet long, 100 feet wide at the crest, and tapered to a width of 45 feet. The sidewall lining was sloped and rose fifty feet above the channel floor. About 10,000 cubic yards of concrete were used to reconstruct the spillway crest and build the gate superstructure. It rose 134 feet above the spillway crest and supported the two 50-by-50-foot spillway gates. Additionally, the dam's south abutment was strengthened. These modifications at Mormon Flat Dam were completed in June 1938. The total cost for spillway work amounted to $938,000, twice the contractor's bid. Much of the additional $299,000 was in material furnished by the government. Despite the cost overrun, the work paid off. During 1940-1941, Mormon Flat Dam and the other Salt River dams safely passed all flood waters produced as a result of an unusually wet winter.

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Additional work was undertaken at Mormon Flat Dam in the 1960s as part of the Hydro Expansion and Frequency Unification program (HEFU), to upgrade the increasingly obsolete (and flicker-generating) twenty-five cycle output to a more dependable sixty cycle output. Bechtel Corporation, in contract with the Association, completed the sixty-cycle upgrade to Mormon Flat Dam power plant in 1973. All three existing hydraulic turbines, spiral cases, draft tubes, penstocks, and ancillary equipment were rebuilt for service at sixty cycles rated at 10,000 Kw. Subsequently, a new 50,000 Kw reversible pump turbine facility was constructed in 1971 below the power plant. This was controlled using a wheeled gate on the upstream face of the dam. The existing penstock and scroll case was rehabilitated and repaired. Its intake was modified using two more wheeled gates, which were installed with a hydraulic hoist located at the top of the dam. The existing twenty-five cycle turbine was rebuilt for service at sixty cycles. This pumped storage unit permitted water recycling for hydroelectric production, and kept Canyon Lake reservoir levels relatively consistent. [1]

[1] Text (and following photos) excerpted primarily from David Introcaso, *Mormon Flat Dam, HAER no. AZ-14* (San Francisco: Historic American Building Survey, 1989). Please see cover document Section I for a more comprehensive bibliography.

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**Current Photographs**

**Name of Property:** Mormon Flat Dam
**City or Vicinity:** Tortilla Flat
**County:** Maricopa
**State:** AZ
**Photographer:** Jim Bailey, Bureau of Reclamation; Salt River Project
**Date Photographed:** March 2010; May 2009
**Location of Original Digital Photographs**: Bureau of Reclamation, Denver; Salt River Project, Phoenix, AZ
**Number of Photographs:** 8

Photo 1: Mormon Flat Dam and Canyon Lake aerial looking east.

Photo 2: Mormon Flat Dam looking east.

Photo 3: Mormon Flat Dam looking northeast.

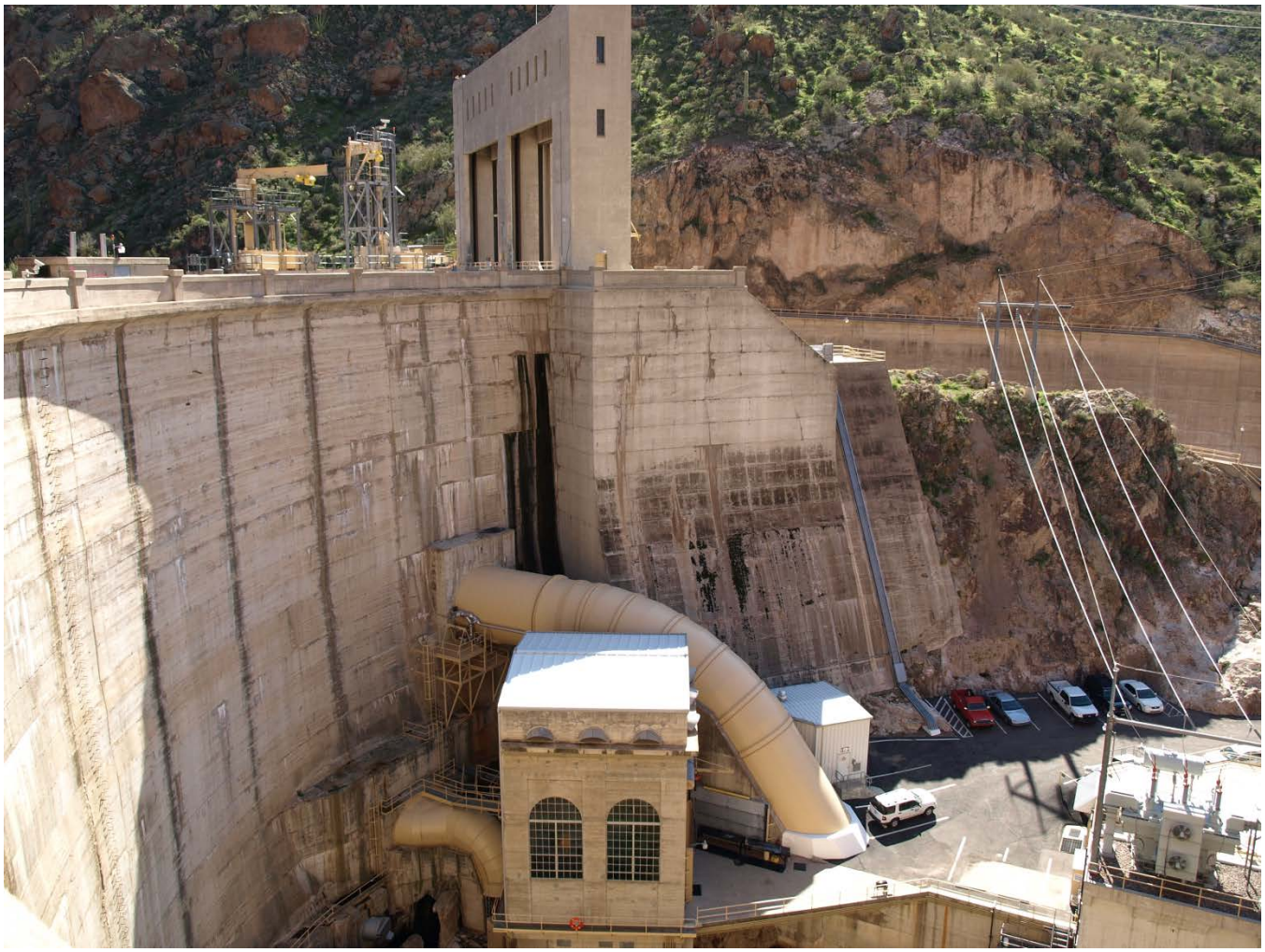

Photo 4: Mormon Flat Dam looking south across crest, including powerhouse.

Photo 5: Spillway gatehouse looking east.

Photo 6: Spillway gates looking east.

Photo 7: Mormon Flat Dam spillway and gates.

Photo 8: Mormon Flat dam spillway from crest.

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**Historic Photographs**

**Name of Property:** Mormon Flat Dam
**City or Vicinity:** Tortilla Flat
**County:** Maricopa
**State:** AZ
**Photographer:** Unknown; Mark Durben, Salt River Project
**Date Photographed:** 1923, 1924, 1926, 1988
**Location of Original Digital Photographs**: Salt River Project, Phoenix, AZ
**Number of Photographs:** 12

Historic Photo 1: Mormon Flat dam site on Salt River, looking upstream, 1923. Photo courtesy of the SRP.

Historic Photo 2: Mormon Flat construction camp from road, 1923. Photo courtesy of the SRP.

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Historic Photo 3: Monighan dragline at work in the Salt River at Mormon Flat, 1923. Photo courtesy of the SRP.


Historic Photo 4: Upstream view showing diversion flume at lower left and mixing plant at left center, June 1924. Photo courtesy of the SRP.


Historic Photo 5: View of upstream face and concrete tower chutes. Photo taken on October 30, 1924. Photo courtesy of the SRP.

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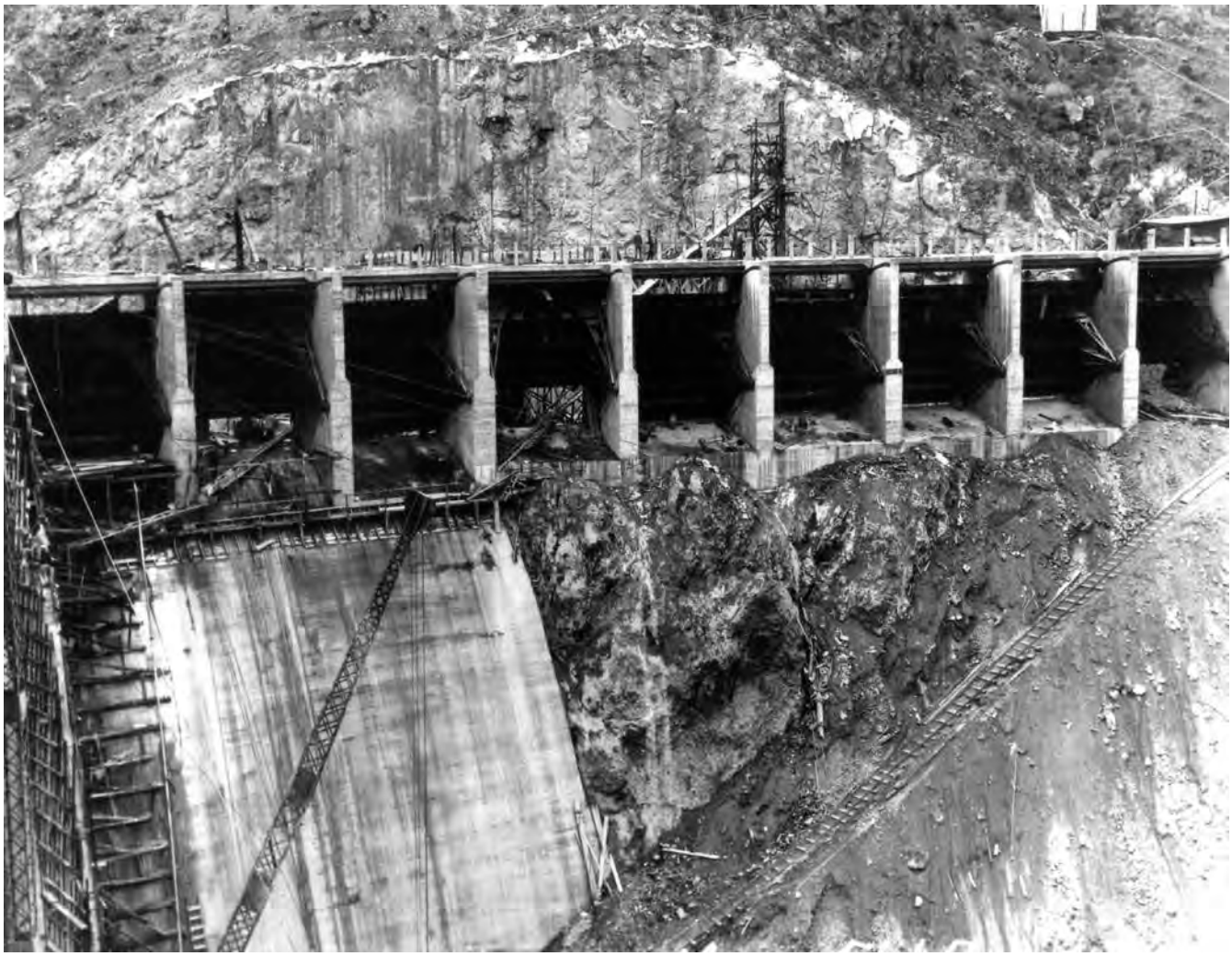
Historic Photo 6: View of downstream face showing section being keyed, January 1925. Spillway apron is at right. Photo courtesy of the SRP.



Historic Photo 7: Downstream view of spillway Taintor gates, February 1925. Photo courtesy of the SRP.

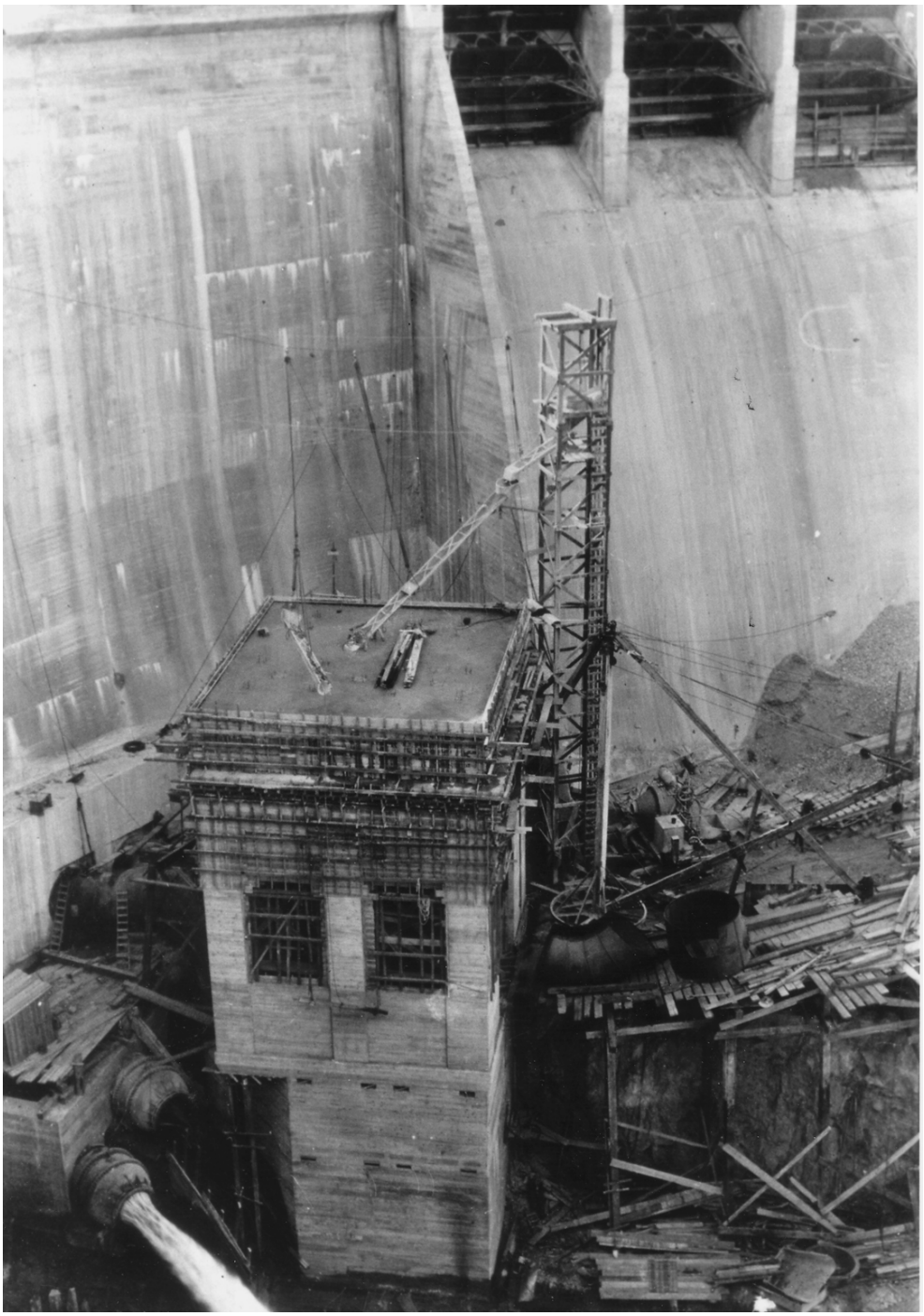


Photo 8: View of the power plant under construction on the downstream side of the dam. Photo taken in March 1926. Note location of spillway gates. Needle valves at lower left are for bypass. Photo courtesy of the SRP.

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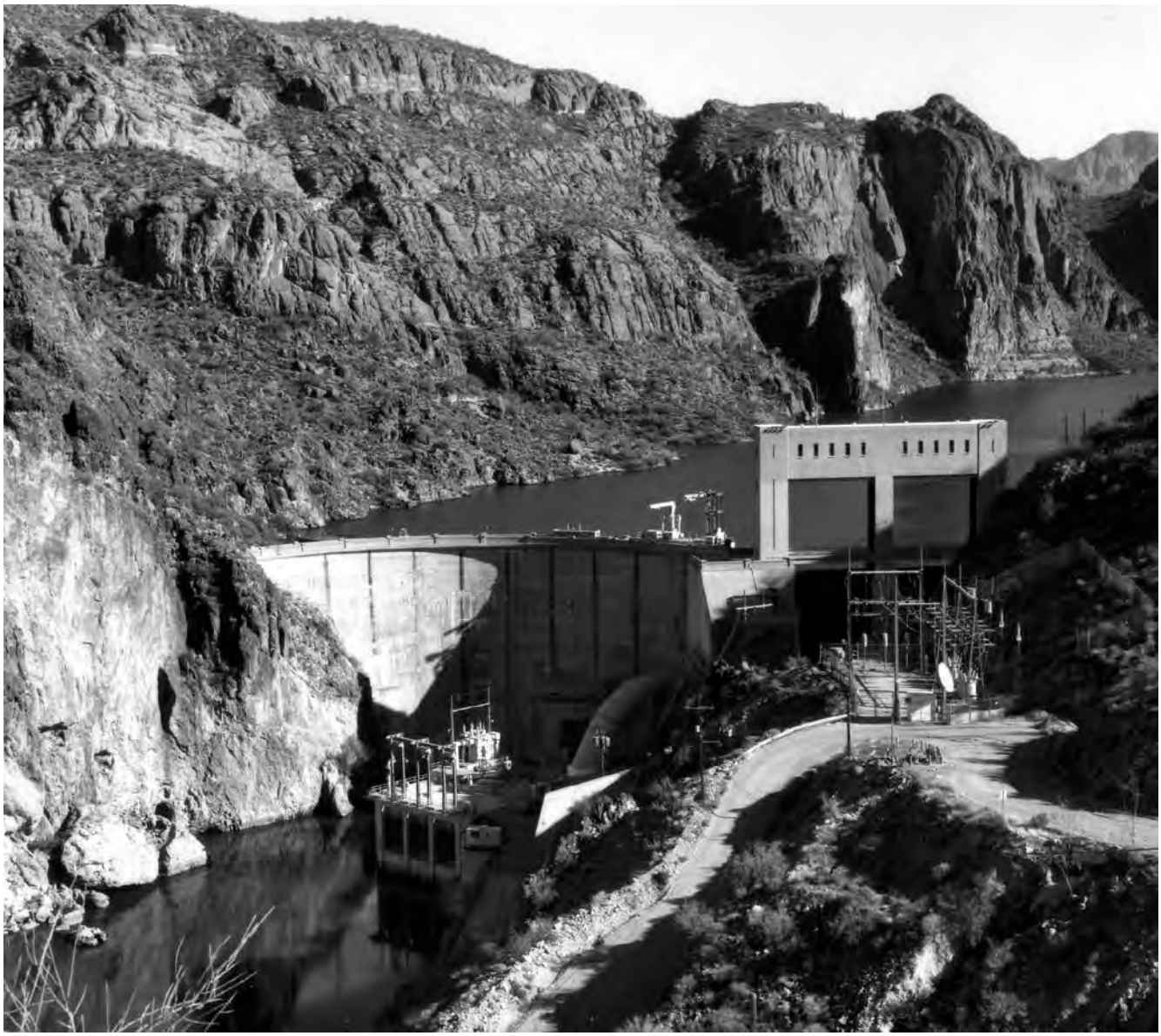
Historic Photo 9: Mormon Flat Dam, power plant, and reservoir, 1926. Photo courtesy of the SRP.



Historic Photo 10: Mormon Flat Dam, 1988. HEFU penstock and unit are at center. The original power house is located in the shade behind the HEFU penstock. Transformer is located at center right. Mark Durben photo courtesy of the SRP.

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Historic Photo 11: Downstream side of the Mormon Flat spillway gates and superstructure, 1988. Mark Durben photo courtesy of the SRP.

Historic Photo 12: Upstream face of spillway superstructure at left, and HEFU service tower at right, 1988. Mark Durben photo courtesy of the SRP.

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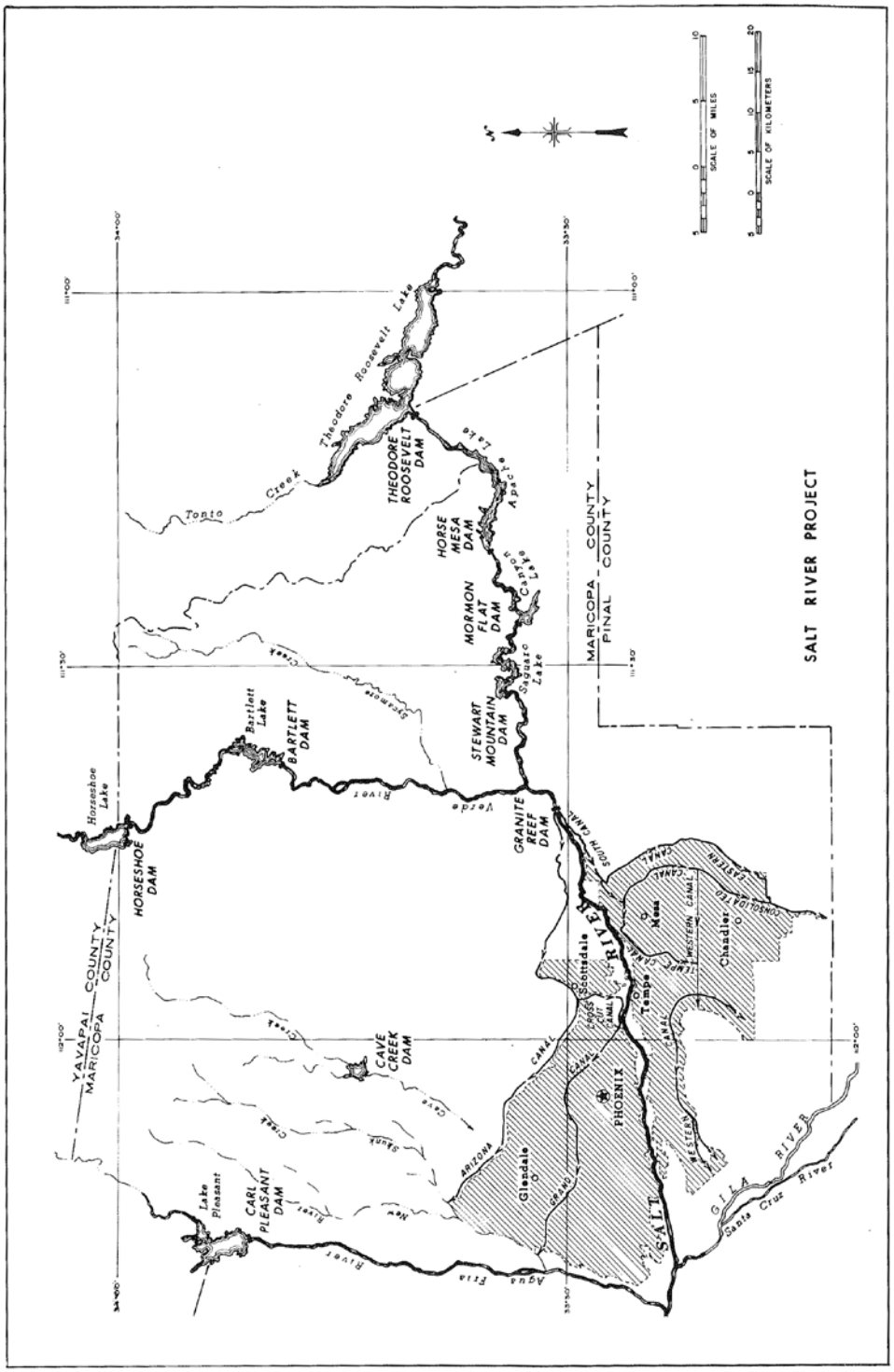


Map 1. Location of dams in the Salt River Project.

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Map 2. Boundary of Mormon Flat Dam.

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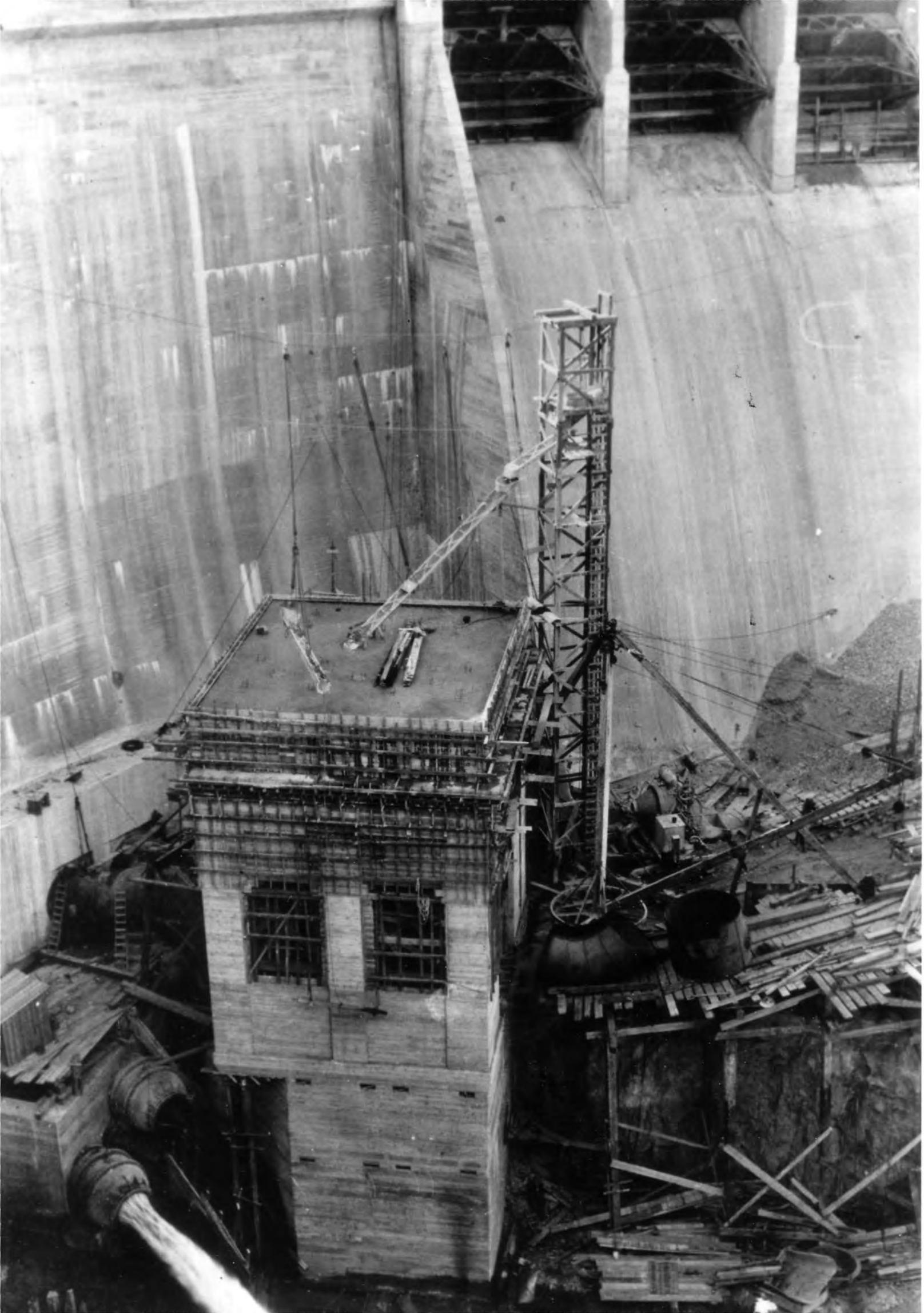
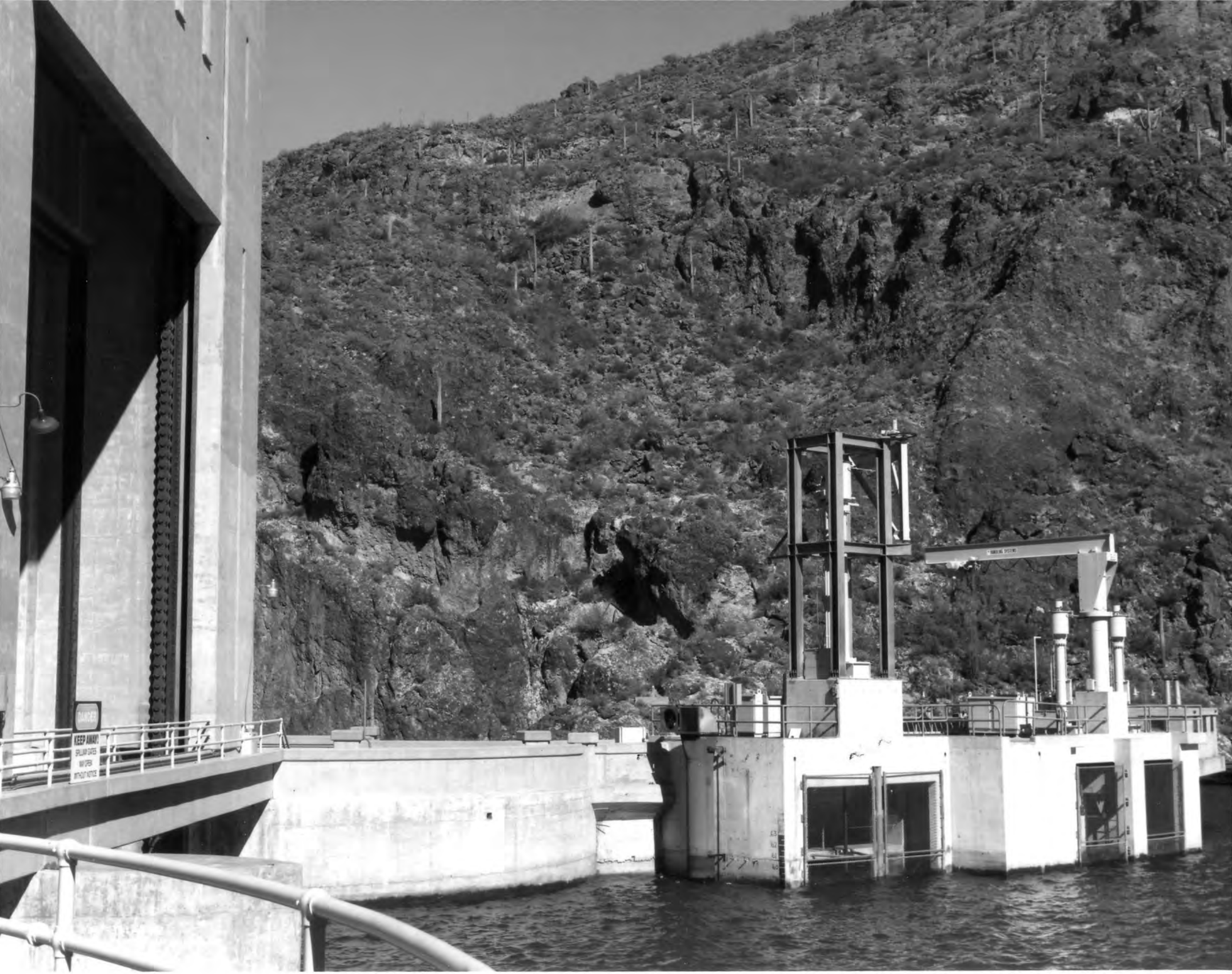
Map 3. Mormon Flat Dam showing the orientation of photographs taken by Jim Bailey in 2009 and 2010.


Murphy Flat Dam
10/30/24




DANGER
KEEP AWAY!
SPILLWAY GATES
MAY OPEN
WITHOUT NOTICE

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

NATIONAL REGISTER OF HISTORIC PLACES
EVALUATION/RETURN SHEET

Requested Action: Nomination

Property Name: Mormon Flat Dam

Multiple Name: Salt River Project MPS

State & County: ARIZONA, Maricopa

| Date Received: | Date of Pending List: | Date of 16th Day: | Date of 45th Day: | Date of Weekly List: |
|---|---|---|---|---|
| 6/23/2017 | 7/18/2017 | 8/2/2017 | 8/7/2017 | |

Reference number: MP100001410

Nominator: State

Reason For Review:

__X__ Accept _____ Return _____ Reject **8/7/2017** Date

Abstract/Summary Comments: The Mormon Flat Dam is of statewide significance under National Register Criterion A in the areas of Politics/Government, Community Planning and Development, and Engineering. Constructed in 1923-1925, with historic modifications to the spillways in 1938, the concrete, thin-arch dam is an excellent illustration of the innovative irrigation and municipal water storage infrastructure resources built under the supervision of the Bureau of Reclamation as part of the Salt River Project (SRP)--one of the first five federally sponsored western water projects. Directly commissioned by the Salt River Valley Water Users' Association, the dam represents the Salt River Project's aggressive hydroelectric expansion programs of the post-WWI era in service of increased hydro-power, irrigation, and municipal supply operations. The resources reflect the Association's design and engineering expertise and growing proficiency in managing the engineering aspects of the SRP. The resource meets the Registration Requirements of the SRP MPS. [While the nomination highlights the resources as good examples of period dam design, Reclamation has determined not to nominate this property under Criterion C at this time.]

Recommendation/ Criteria: Accept National Register Criterion A.

Reviewer Paul Lusignan Discipline Historian

Telephone (202)354-2229 Date 8/7/2017

DOCUMENTATION: see attached comments : No see attached SLR : No

If a nomination is returned to the nomination authority, the nomination is no longer under consideration by the National Park Service.

# United States Department of the Interior

BUREAU OF RECLAMATION
P.O. Box 25007
Denver, CO 80225-0007

**JUN 20 2017**



IN REPLY REFER TO:

84-53000
ENV-3.00

MEMORANDUM

To: J. Paul Loether, Chief, National Register of Historic Places Program, National Park Service, 1201 Eye Street, NW (2280), Washington, DC 20005
Attn: Mr. Paul Lusignan

From: Roseann Gonzales
Director, Policy and Administration

Subject: Nomination of the Salt River Project (Project), Maricopa County, Arizona, as a Multiple Property Listing (MPL) in the National Register of Historic Places (National Register), and Nominations of Associated Properties under the MPL

The Bureau of Reclamation is pleased to nominate the Salt River Project as an MPL on the National Register. We are concurrently individually nominating five associated Project dams, and nominating the Project's diversion and conveyance system as a historic district. The multiple property documentation (MPD) form and associated property registration forms, with supporting information, are attached. All forms are submitted in electronic format on the two enclosed compact disks, with the required hard copy of the original signature sheet for each of the six property nomination forms. In order to provide an original signature for both the Federal Preservation Officer (FPO) and the State Historic Preservation Officer (SHPO), two copies of each signature page is attached. As is also required, I confirm that the enclosed compact disks contain the true and correct nomination forms for the Salt River Project MPD; for the Salt River Project Diversion and Conveyance System Historic District; and for Bartlett Dam, Horse Mesa Dam, Horseshoe Dam, Mormon Flat Dam, and Stewart Mountain Dam.

The nomination forms were submitted for review to the Arizona SHPO and the SHPO signed the forms without comment. In Arizona, the State Review Board does not review Federal nominations. Reclamation provided all seven forms to Maricopa County for review by their Board of Supervisors, who are the chief local elected officials. The 45-day comment period closed on May 25 without Reclamation receiving comment from the County. Although not required for Federal nominations, Reclamation also provided the MPD and historic district forms to the six Certified Local Governments (CLG) established within the greater Phoenix metropolitan area; they were not provided with the dam nomination forms because the Project dams lie outside of the jurisdictional boundary of a GLG. The comment period closed with only the City of Glendale responding to say they had no comment at this time, and that they found the "materials were very well put together."

The Project and the associated properties are important pieces of Western reclamation history. Although some modifications have occurred to keep the structures operational, in large part the nominated properties retain levels of design, materials, workmanship, feeling, and overall integrity sufficient to convey their historic character and function. They demonstrate the historic importance of this irrigation and hydropower system that was instrumental in the transformation of the Phoenix basin into one of the great regional centers of the West.

If you have any questions, please contact Mr. George Herbst, FPO, at 303-445-3311, or gherbst@usbr.gov, or Ms. Lynne MacDonald, cultural resources specialist, at 303-445-3206, or lmacdonald@usbr.gov.

Attachments - 14

cc: Archeologist, Bureau of Reclamation, 500 Fir Street, Boulder City, NV 89006-1470, Attn LC-2633 M. Slaughter
Archeologist, Bureau of Reclamation, 6150 W Thunderbird Road, Glendale AZ 85306-4001 Attn: PXAO-1500 D. Gifford
Supervisory Environmental Protection Specialist, Bureau of Reclamation 6150 W Thunderbird Road, Glendale AZ 85306-4001 Attn: PXAO-1500 S. Heath
Archeologist, Bureau of Reclamation, 6150 W Thunderbird Road, Glendale AZ 85306-4001 Attn: PXAO-1500 L Jelinek,
(all w/o att)