San Carlos Irrigation Project
North and south of Gila River
Vicinity of Coolidge
Pinal County
Arizona

HAER No. AZ-50

HAER
ARIZ
11-COOL,
1-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
Western Region
Department of the Interior
San Francisco, California 94107

HAER
ARIZ
11-COOL,
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HISTORIC AMERICAN ENGINEERING RECORD
SAN CARLOS IRRIGATION PROJECT
HAER NO. AZ-50

Location: Lands north and south of the Gila River in vicinity of Florence, Coolidge, Casa Grande, and Sacaton. Area includes lands within the San Carlos Irrigation and Drainage District and within the Gila River Indian Reservation. Pinal County, Arizona.

7.5 Minute Quads: Blackwater; Casa Grande East; Chandler Heights; Coolidge; Florence; Florence SE; Gila Butte; Gila Butte NW: Gila Butte SE; North Butte; Picacho Reservoir; Sacaton; Sacaton Butte; Valley Farms.

UTMs:

Ashurst-Hayden Dam:	Z12	N3662300	E477040
Picacho Reservoir:	Z12	N3633680	E455080
End Southside Canal	Z12	N3652860	E415800
End Casa Blanca Canal	Z12	N3658780	E412740
End San Tan Flood-water	Z12	N3673800	E412320

Primary Features: Coolidge Dam; Ashurst-Hayden Dam, Sacaton Dam, Florence-Casa Grande (Main) Canal, Florence Canal; Picacho Reservoir; Pima Lateral; North Side Canal; San Tan Flood-water Canal; San Tan Indian Canal; Casa Blanca Canal; Southside Canal.

Construction Date: Initial project authorization occurred on May 18, 1916 with subsequent passage of San Carlos Act on June 7, 1924. Some project features pre-date 1916; construction continued through mid 1930's with subsequent modifications.

Present Owner: United States Bureau of Indian Affairs

Historic Use: Delivery of irrigation water to Indian and non-Indian lands

Present Use: Delivery of irrigation water to Indian and non-Indian lands

Significance:

The San Carlos Irrigation Project (SCIP) is significant for creating an integrated irrigation system to serve both Indian and non-Indian lands along the Gila River. Prior to project construction, irrigation of area lands was piecemeal and non-Indian agricultural development above the Gila River Indian Reservation had depleted water supplies for the Indians. Initial authorization of the project in 1916 and the passage of the San Carlos Act on June 7, 1924 culminated years of studies and efforts to develop water storage on the Gila River and restore water to the Pima Indians.

The project also incorporates a number of individual features that have engineering significance. These include Coolidge Dam for which HAER documentation has previously been completed (HAER No. AZ-7), Sacaton Dam, and China Wash Flume. Ashurst-Hayden Dam is significant as the primary diversion facility for the entire system. Lastly, the features found on SCIP are significant for demonstrating the evolution of the irrigation project as a dynamic system. The types and methods of construction found span many decades and document changes in design and technology.

Historian:

Christine Pfaff
Denver Technical Services Center
Bureau of Reclamation
March, 1996

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I. INTRODUCTION

Located in Pinal County, Arizona, the San Carlos Irrigation Project (SCIP) is a joint Indian and non-Indian project containing 100,000 acres, of which 50,000 are Indian lands in the Gila River Indian Reservation and 50,000 are private or public non-Indian lands in the Florence-Casa Grande Valley.[1] The SCIP as now organized and operated came into being with the construction of Coolidge Dam which was authorized under what is known as the San Carlos Act (43 Stat.475). Passage of this legislation on June 7, 1924, marked the culmination of many decades of effort to develop water storage on the Gila River and restore water to the Pima Indians. They had suffered increased water shortages as non-Indian settlements had grown along the river above the Pima lands during the latter half of the nineteenth century.[2] Diversions of Gila River water to irrigate non-Indian farms had caused great hardship and widespread poverty among the Pima, who previously had enjoyed a very successful agriculturally-based existence.[3]

As early as December 1899, following investigations conducted by the United States Geological Survey for a storage reservoir on the Gila River as well as several other government studies, an attempt was made to pass legislation authorizing the construction of a dam on the Gila River. The unsuccessful effort led by John F. Wilson, delegate to Congress from the Territory of Arizona, was followed by a series of additional studies and reports, as well as some remedial actions to increase the water supply to the Pimas. Not until the completion of Coolidge Dam in 1928, however, did an integrated irrigation system exist that could store and provide water to both Indian and non-Indian lands.

The Bureau of Reclamation (Reclamation) is proposing to modify portions of the SCIP irrigation system in order to deliver Central Arizona Project water to lands within the Gila River Indian Reservation. This action constitutes a federal undertaking requiring compliance with Section 106 of the National Historic Preservation Act. As a first step in the compliance process, Reclamation completed an overview of the history of SCIP and an inventory and evaluation of significance

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[1] While a majority of sources use the figure of 50,000 acres of Indian project lands, some later sources cite a total of 50,546 acres. The figure of 100,546 total project acres may have originated in the Gila River Decree signed June 29, 1935. The January 1961, Bureau of Reclamation, Report on Buttes Dam and Reservoir, Middle Gila River Project, Arizona states that Indian project lands consist of 49,896 acres of allotted lands and 650 acres of tribal lands.

[2] Diversions by non-Indian settlers occurred in the vicinity of Florence and to an even greater extent further upstream in the Safford Valley.

[3] U.S. Department of the Interior. Office of Indian Affairs. Irrigation Division. Report on Economic Conditions Existing on the San Carlos Irrigation Project and the Gila River Indian Reservation, Arizona. Los Angeles, California, May, 1944. p. 26.

of the irrigation system.[4] Reclamation recommended that the irrigation component (versus the power system) of SCIP is eligible for the National Register of Historic Places as a district.[5] In a letter to the Arizona SHPO dated December 27, 1994, Reclamation requested concurrence on its eligibility assessment. Reclamation also concluded that the proposed CAP delivery system has the potential to adversely affect portions of the existing historic irrigation system. As mitigation, Reclamation proposed to document to HAER standards those features of SCIP that may be adversely impacted by project construction.

On March 9, 1995, Jim Garrison, Arizona State Historic Preservation Officer, verbally concurred with Reclamation's determination of eligibility. Mr. Garrison also agreed that HAER documentation of the features to be impacted by the proposed CAP delivery system would be acceptable mitigation under Section 106 for any adverse impacts.[6] This HAER study represents the fulfillment of Reclamation's committment. While the history presented in Chapters II through VIII provides background information on the development of the entire SCIP project and the construction of all major project features, only those elements that may be impacted are recorded in detail in Chapter IX and in the attached photographs.

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[4] See Bureau of Reclamation, The San Carlos Irrigation Project: An Historic Overview and Evaluation of Significance, Pinal County, Arizona, by Christine Pfaff, October, 1994.

[5] Three individual features that are associated with SCIP are already listed in the National Register. These are Coolidge Dam (October 29, 1981), the Sacaton Dam Bridge and the San Tan Canal Bridge. The latter two bridges were both listed on September 30, 1988 as part of a thematic nomination of vehicular bridges in Arizona.

[6] It was agreed that two features, the China Wash Flume and Sacaton Dam and Bridge, warrant exploration of preservation measures should they be impacted by the proposed project.

II. LOCATION AND OVERVIEW OF SAN CARLOS IRRIGATION PROJECT

The SCIP is located on the Gila River approximately 45 miles southeast of Phoenix in the Casa Grande Valley. This broad valley, which encompasses an area of about 600 square miles, is surrounded by a series of low mountain chains. The fertile project lands are situated on the flood plain of the Gila River and on the broad alluvial fans which slope toward the river. Elevation of the project is 950 to 1,500 feet above sea level. The climate is characterized by low precipitation, low humidity, short, mild winters and long, hot summers. The combination of rich soils and a growing season extending from April to November, make the area well suited to agricultural production so long as there is a dependable and adequate water supply.

Water for SCIP is derived from three sources: the normal flow from the Gila River, the release of stored Gila River water from the San Carlos Reservoir created behind Coolidge Dam, and ground water pumped from project wells.[7] The broad, sandy Gila River is the most southerly of the large tributaries of the Colorado River. Originating on the west slope of the Continental Divide in southwestern New Mexico, the river flows generally westward to its terminus at the Colorado River in Yuma, Arizona, a distance of 654 miles. Below Coolidge Dam, the Gila River travels through narrow mountain valleys before emerging onto the broad plain of the SCIP area. Although the Gila River is the second largest river in Arizona, it's annual yield and volume of flow fluctuate tremendously. At times the river bed can be completely dry while during periods of heavy rain, a raging torrent flows between the banks.

Division of SCIP Into Two Areas

As previously mentioned, SCIP is composed of two areas, one comprising 50,000 acres of non-Indian lands and the other consisting of 50,000 acres of Indian-owned lands within the boundaries of the Gila River Indian Reservation (see Figure 1).

Established by an Act of Congress approved on February 28, 1859, the Gila River Indian Reservation originally contained 10,160 acres located on and about the Pima Villages near Casa Blanca and later around Sacaton.[8] Under a series of executive orders, the area of the reservation has gradually been expanded to its present size of 372,022 acres. Today the reservation extends

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[7] The normal flow of the Gila River exists only above Ashurst-Hayden Dam. Below that diversion point, there is usually minimal or no water in the Gila River.

[8] Discrepancy exists as to the original acreage of the Reservation. Numerous early reports including the Survey of Conditions of the Indians in the United States, Hearings Before a Subcommittee of the Committee of Indian Affairs. Seventy-First Congress, 2nd Session, Part 6, January 21, 1930 (hereinafter referred to as Survey of Conditions of the Indians in the United States) cite 10,160 acres as the original size. Other sources indicate a size of 64,000 acres.

southeast from the confluence of the Salt and Gila Rivers to the vicinity of Coolidge and the Casa Grande National Monument. Indian project lands are located on both sides of the Gila River.

Inhabitants of the reservation are primarily Pima Indians, but also include some members of the Maricopa tribe. A tribal government was formed in May, 1936, under the Indian Reorganization Act (48 Stat. 984). In accordance with provisions of that Act, a constitution and by-laws were adopted on May 14, 1936. The governing body of the reservation is the Gila River Pima-Maricopa Indian Community Council. Agency headquarters for the Gila River Indian Reservation are located at Sacaton, as are the offices for administering the Indian-owned portion of SCIP.

Ownership of project Indian lands falls into two categories: trust-patented to individuals and tribal-owned. A program of individual allotments of land consisting of two ten acre parcels was established in 1914 and discontinued in 1921. Under the allotment program, each Indian man, woman, and child received a ten acre parcel of irrigable land and a ten acre parcel of desert, or non-irrigable, land. In a few cases, twenty acre allotments were made in one tract, with no distinction between irrigable and non-irrigable land. A total of 48,940 acres were distributed in allotments.[9] The program required the registration of the original 20 acre plots and the division of the plots among heirs of the original allottee.[10] The fragmented allotments still exist. Tribal owned lands include the administrative area, a portion of the Gila River Farms, and the School Farm Agricultural Experiment Station.

Irrigation of lands included in SCIP occurred long before the arrival of Euro-American settlers. Traces of pre-Pima canals have been found indicating the practice of diverting Gila River water in prehistoric times (see Figure 2). The Pima Indians also developed an abundant agricultural existence. According to Robert Hackenberg, the Pimas lived on both banks of the Gila River and quite near the water's edge prior to the arrival of Spanish explorers and priests in the 16th century. The maize-bean-squash crops grown by the Pimas on islands in the Gila River did not require irrigation canals or ditches. With the introduction of wheat by the Spanish, new settlement patterns occurred among the Pimas and irrigation became necessary. Hackenberg estimates that by 1775, all Pima villages were growing wheat and using irrigation ditches.[11] Estimates vary as to the amount of land cultivated prior to the coming of the first white settlers

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[9] Survey of Conditions of the Indians in the United States. p. 2464. A discrepancy exists in the information provided. On page 2450 of the same report it is stated that 4,894 allotments aggregating 96,000 acres were established.

[10] Pablo, Sally. "Contemporary Pima." Handbook of North American Indians, Southwest, Volume 10. Edited by Alfonso Ortiz. Washington, D.C.: Smithsonian Institution, 1983. p. 213.

[11] Hackenberg, Robert. "Pima and Papago Ecological Adaptations." Handbook of North American Indians, Southwest, Volume 10. Edited by Alfonso Ortiz. Washington, DC: Smithsonian Institution, 1983.

soon after the Civil War but range from about 13,000 to 28,000 acres, and even higher according to one source.[12] Remnants of early Pima irrigation ditches survive, in fact some were incorporated in SCIP.[13]

The non-Indian portion of the project is referred to as the Florence-Casa Grande Unit. This area comprises the valley lands on both sides of the Gila River east of the Gila River Indian Reservation and also includes lands south of the reservation in the vicinity of Casa Grande. The towns of Florence, Coolidge and Casa Grande are located in the Florence-Casa Grande Unit. Administrative offices for this unit are located in Coolidge.

Irrigation in the Florence-Casa Grande Valley began with the initial arrival of Euro-American settlers.[14] The first judicially recognized diversion from the Gila River by non-Indians occurred in the vicinity of Florence in 1868. As the number of settlers increased, the desire for an adequate irrigation system also grew. A mining boom in the mountainous areas to the northeast created a demand for supplies and fresh produce. Numerous canals and ditches were constructed by individuals and private companies to bring water to the dry but fertile soils. Some of these early irrigation features including the Florence Canal, the Casa Grande Canal, the partially completed Florence-Casa Grande Canal, and Picacho Reservoir were later incorporated into SCIP.

The non-Indian lands passed from public ownership into private hands by way of homesteading and, to a greater extent, by desert entry under the Desert Land Act of March 3, 1877 (19 Stat 377). Following the passage of the San Carlos Act in 1924, those still holding desert claims and

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[12] The figure of 12,920 acres is cited in Irrigation Data, Long Range Program, Gila River by Herbert Clotts, Los Angeles, California, January 29, 1944 and is based on a 1914 survey. The figure of 28,000 acres is taken from Survey of Conditions of the Indians in the United States. Yet another source, U.S. Congress. House. Report to the Secretary of War of a Board of Engineering Officers., 63rd Congress, 2nd Session, 1914, p. 14, states that the total area cultivated by the Pimas at one time or another was between 30,000-52,000 acres.

[13] Due to the erratic flows and meandering path of the Gila River, it was surmised that many of the ditch headings constructed by the Indians were routinely washed out and relocated, and that the acreage cultivated by the Indians was reduced over time by river flooding. See Survey of Conditions of the Indians in the United States . p. 2461. and "History of Irrigation on the Gila River" by C.H. Southworth contained in Appendixes A, B, and C. Indians of the United States, Hearings Before the Committee on Indian Affairs on the Condition of Various Tribes of Indians. 66th Congress, 1st Session, Washington, D.C., 1919. p. 120.

[14] U.S. Congress. House. "History of Irrigation on the Gila River" by C.H. Southworth contained in Appendixes A,B, and C, Indians of the United States, Hearings before the Committee on Indian Affairs on the Condition of Various Tribes of Indians. 66th Congress, 1st Session. Washington, DC, 1919, p. 144. Early settlers also included Mexicans who moved north to make their homes along the Gila River.

homestead entries were apparently relieved of having to comply with the usual improvement requirements.[15] Under the Desert Land Act, individuals would have had to build their own irrigating systems to reclaim and cultivate lands.

Division of SCIP Into Two Classifications

In addition to being divided between Indian and non-Indian lands, the features of SCIP fall into two classifications: the irrigation system and the power system. The irrigation system consists of storage reservoirs, storage and diversion dams, canals, distribution systems, irrigation wells, and pumping plants. The power system is made up of generating stations, transformer stations, transmission lines, and distribution lines.

Today the project irrigation system includes a storage dam, 2 diversion dams (one non-operational), 500 miles of canals, laterals, and sub-laterals, and 98 irrigation wells. The power system is comprised of 1 hydro-electric plant at Coolidge Dam (currently non-functional), 152 miles of transmission lines, 3 switchyards, 26 power substations, and 1200 miles of electric power distribution lines.[16]

Although information on the development of the power system is provided in this report, the focus is the irrigation component of the project. This is due to two factors: the power system will not be impacted by the modifications proposed by Reclamation and most of the primary features are located outside the irrigation project boundaries.

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[15] "Homestead Requiremets (sp) San Carlos Project Suspended". Arizona Blade-Tribune. July 12, 1924. p.1.

[16] Figures provided by Bill Sibley, SCIP, Foreman, Power Division on 1/27/94

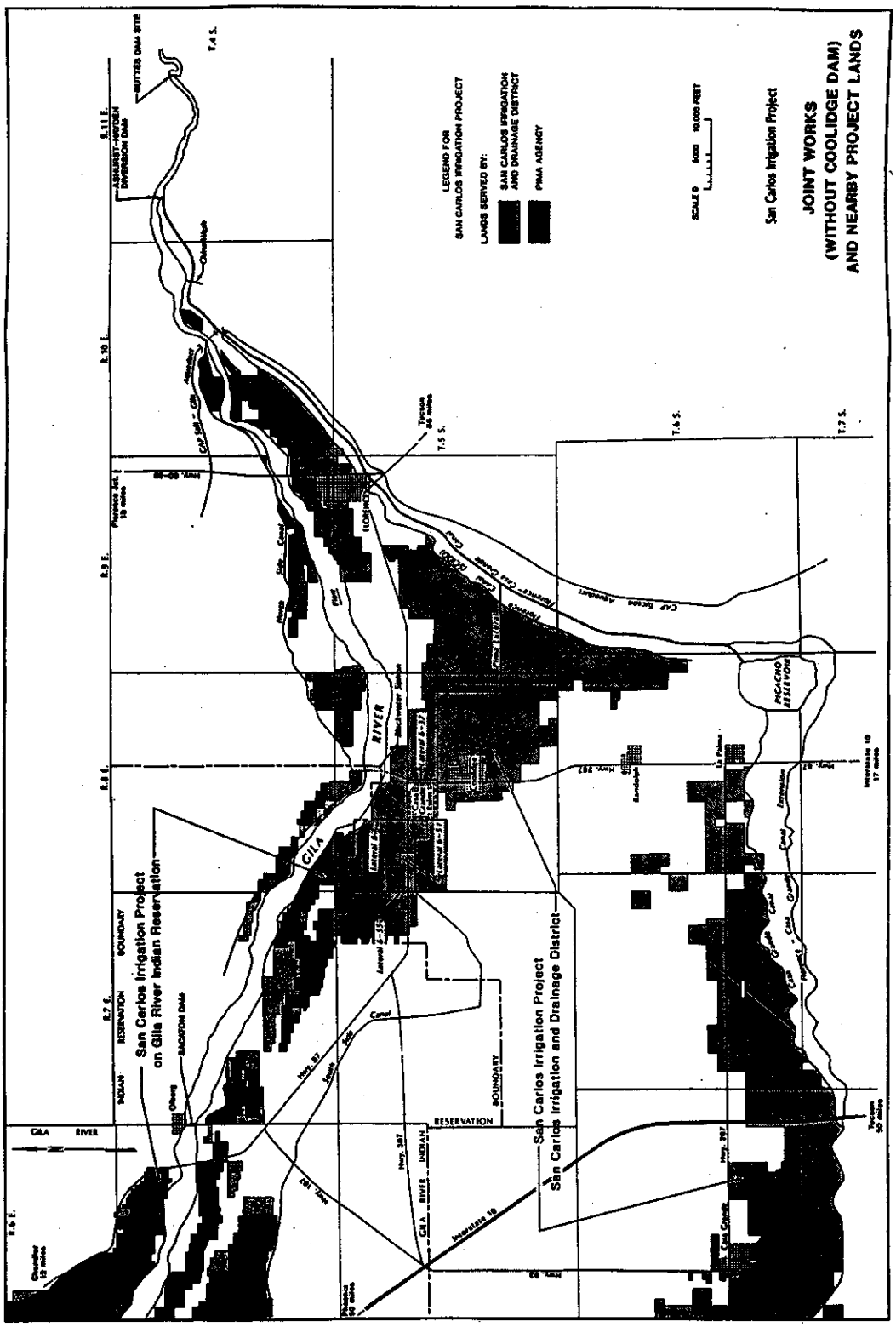
JOINT WORKS
(WITHOUT COOLIDGE DAM)
AND NEARBY PROJECT LANDS
San Carlos Irrigation Project
LEGEND FOR
SAN CARLOS IRRIGATION PROJECT
LANDS SERVED BY:
SAN CARLOS IRRIGATION AND DRAINAGE DISTRICT
PIMA AGENCY
SCALE 0 5000 10,000 FEET
San Carlos Irrigation Project
on Gila River Indian Reservation
San Carlos Irrigation Project
San Carlos Irrigation and Drainage District
GILA RIVER
INDIAN RESERVATION BOUNDARY
PICACHO RESERVOIR
BUTTES DAM SITE
Interstate 10
Hwy. 87
Hwy. 287
Hwy. 84
Hwy. 282
T. 4 S.
T. 5 S.
T. 6 S.
T. 7 S.
R. 6 E.
R. 7 E.
R. 8 E.
R. 9 E.
R. 10 E.
R. 11 E.

Figure 1

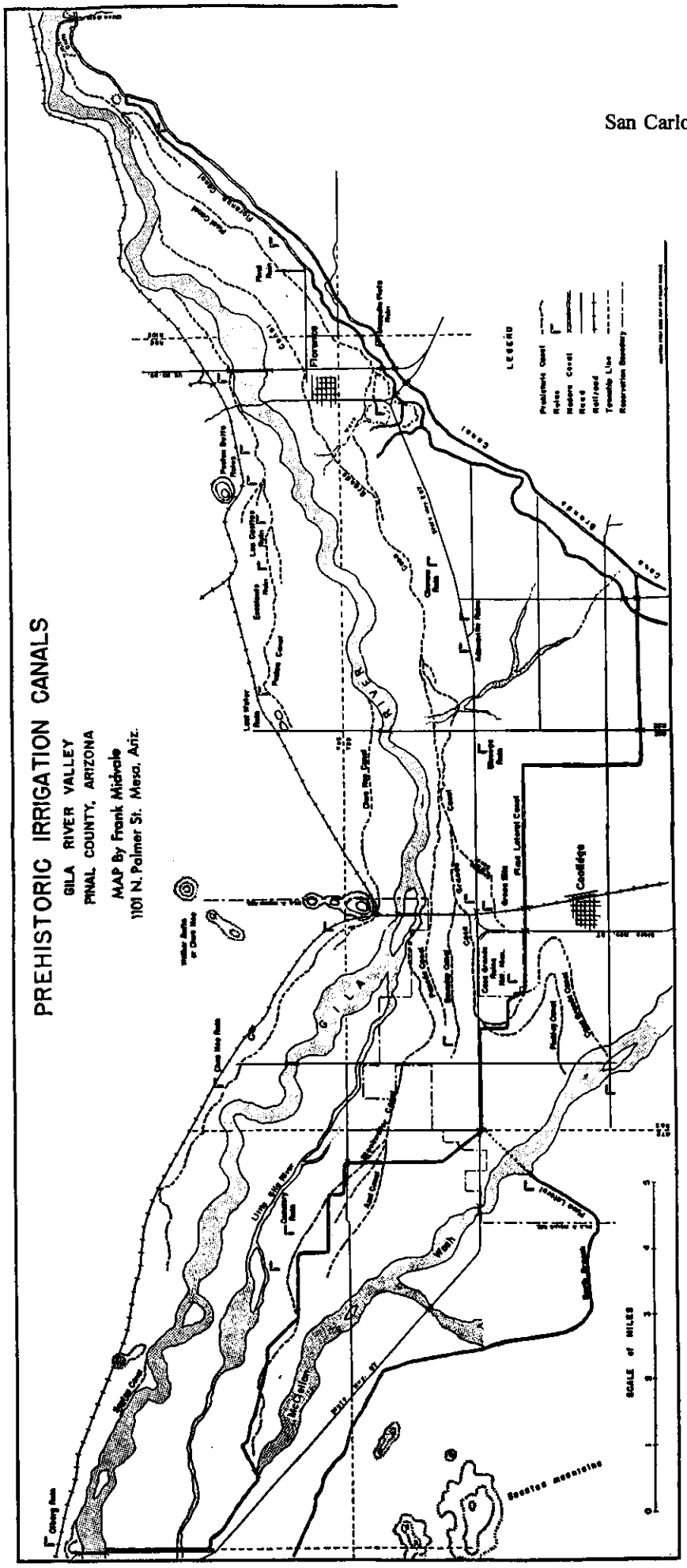
PREHISTORIC IRRIGATION CANALS
GILA RIVER VALLEY
PINAL COUNTY, ARIZONA
MAP By Frank Midvale
1101 N. Palmer St. Mesa, Ariz.
LEGEND
Prehistoric Canal
Ruins
Modern Canal
Road
Railroad
Township Line
Reservation Boundary
Florence
Coolidge
GILA
RIVER
Little Gila River
McClellan
Wash
Casa Grande Ruins Nat. Mon.
Sacaton Mountains
SCALE of MILES
0
1
2
3
4
5

Figure 2

III. REVIEW OF PROJECT BEGINNINGS[17]

From the time the Gila River Indian Reservation was established until 1903, government efforts to alleviate the Pima Indian water shortages consisted of numerous investigations as well as repairs to some old ditches. The first effective step to improve the situation occurred in 1903 when the Bureau of Indian Affairs (BIA) drilled five wells at Sacaton.[18] Based on the success of this endeavor, the first appropriation for extensive irrigation work on the reservation was included in the federal Indian Appropriation Act of March 3, 1905. The Secretary of the Interior was authorized to spend not more than $540,000 to plan and develop an irrigation system for lands in the vicinity of Sacaton.[19]

The resulting project was designed to irrigate about 10,000 acres on the north side of the Gila River, including lands under an existing Indian canal, known as the old San Tan Indian Canal.[20] Plans called for the construction of a flood-water canal and a number of wells and pumping plants connected by a ditch. Acting under the direction of the BIA, the U.S. Reclamation Service (Reclamation Service) began construction of the project in April, 1908. By January 1909, eight of ten proposed wells had been drilled and in October of that year, work on the San Tan Flood-water canal started.[21] By 1911, nine miles of canal, including headgates in the Gila River, had been finished. Objections to the project were raised by the Pimas who complained about the high cost of the project for relatively little benefit and the detrimental alkali levels in the pumped

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[17] See Coolidge Dam HAER report by David Introcaso, historian with the Salt River Project, for full account of events leading up to passage of San Carlos Act. It is the intent of this document to supplement that earlier effort and to discuss in more detail the construction of features other than Coolidge Dam.

[18] The Bureau of Indian Affairs was created in 1824 and was situated in the War Department until 1849 when it was moved to the Department of the Interior where it remains today. The Bureau was usually known as the Office of Indian Affairs until 1947, or sometimes referred to as the Indian Service. For consistency, the title Bureau of Indian Affairs will be used for the agency throughout this document except when referring to official documents or titles that make use of one of the other names.

[19] U.S. Department of Interior. Office of Indian Affairs. Indian Irrigation Service. History, Gila River Reservation, San Carlos Irrigation Project. by H.V. Clotts. 1939. p.3.

[20] There is no consistency in the spelling of San Tan when referring to the San Tan Indian or San Tan Flood-water canals; sometimes it is spelled as one word, other times as two. In this document, it will appear as two words as frequently shown on maps.

[21] Several sources, including History Gila River Reservation, San Carlos Irrigation Project, ca. 1938, state that 8 of 10 wells had been completed by Jan 15, 1909. Another source, Hearings Before the Committee on Indian Affairs, House of Representatives, Sixty-Sixth Congress, 1919 asserts that drilling of the ninth and last well was completed by Jan 15, 1909. See page 135.

water. The lack of suitable diversion works made the canal ineffective. Further construction by the Reclamation Service was halted and work resumed again in 1913, this time by the U.S. Indian Irrigation Service, a division of the BIA responsible for irrigation activities. Known as the Sacaton Project, it included the San Tan Flood-water Canal and other project features that were later absorbed into SCIP.

Other efforts by the BIA to improve the supply of irrigation water to the Pimas followed between 1913-15. Projects included the Little Gila Project, the Agency Project at Sacaton, the Blackwater Project, the Casa Blanca Canal Project, and the Sacaton Flats Project. Most of the irrigation features constructed in conjunction with these projects were later incorporated into SCIP and have since been expanded and modified. Descriptions of the primary features and associated history are provided in Chapter IV (See Photo No. AZ-50-1 of Gila River Indian Reservation, 1916).

In 1914, there were 14,356 acres of land being irrigated by Gila River water on the reservation. That same year, there were 7,563 acres under irrigation by Gila River waters in the Florence-Casa Grande Unit.[22] An additional 12,217 acres had been previously irrigated. A variety of crops were being cultivated of which the primary ones were alfalfa, wheat, barley, corn and vegetables.

While the BIA continued to take incremental steps to increase water supplies to the Pimas, further studies were supporting the concept of a large scale irrigation system including storage and diversion dams. The results of an investigation by a board of Army Engineers were submitted in a report to the Secretary of War on February 14, 1914. The document concluded that a San Carlos irrigation project would be feasible and should be carried out by the United States. Furthermore, the board recommended that a dam be built in a box canyon on the Gila River called the San Carlos site; a suit be initiated to adjudicate water rights; acquisition of additional water rights be prohibited; and that in the event construction of the San Carlos Dam were delayed, a diversion dam on the reservation be developed.

Under the Indian Appropriation Act of August 1, 1914 (38 Stat. 937), $50,000 was made available to further investigate the recommendations made by the board of Army Engineers. The scope of the study consisted of compiling data on existing water rights along the Gila River to determine the extent of water available for an irrigation project. A second purpose was to estimate maximum and minimum costs of the "San Carlos irrigation project".

Results of the investigations were included in a document entitled "Report on the San Carlos Irrigation Project and the History of Irrigation Along the Gila River" dated November 1, 1915

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[22] U.S. Congress. House. "San Carlos Irrigation Project." by C.R. Olberg, Superintendent of Irrigation, dated December 1915 contained in Appendixes A,B, and C. Indians of the United States, Hearings Before the Committee on Indian Affairs on the Condition of Various Tribes of Indians. 66th Congress, 1st Session. Washington, DC, 1919. pp 54 & 57.

and submitted to the Commissioner of Indian Affairs, by Charles R. Olberg, Superintendent of Irrigation for the Los Angeles District Office of the BIA. Based on the information gathered the report concluded, among other things, that: construction of the San Carlos Dam be deferred but that two diversion dams on the Gila River be built along with a distribution system to irrigate a total of 80,000 acres. The Florence Diversion Dam would be located about 12 miles above Florence and the Santan Diversion Dam would be situated about 2 miles above Sacaton. Designs and cost estimates were developed by the BIA for both structures.

As study after study concluded that an integrated irrigation system of one configuration or another was needed to rectify the inequitable distribution of Gila River water and provide a steady supply to both Indians and non-Indians, Arizona U.S. Representative Carl Hayden became the champion in promoting passage of a federal San Carlos project bill. Elected to Congress in 1912, Hayden immediately became an aggressive advocate for constructing a storage dam on the Gila River.[23] It was due to his persuasion that Congress authorized the 1914 board of Army Engineers' feasibility study which favored construction of the San Carlos dam. On June 3, 1914, Hayden made his first attempt to introduce a San Carlos Project Bill.[24] Passage of the bill was unsuccessful due to lack of support from the Reclamation Service and from western congressman who felt Arizona had already reaped its fair share of reclamation projects. The Salt River Project and Yuma Project in Arizona were both early federal irrigation projects constructed by the Reclamation Service.

Undeterred by the defeat, Carl Hayden developed a new strategy for gaining project support-publicizing the plight of the Pimas. Dubbed his "Indian Card" by Jack August, Hayden "very early orchestrated a skillful campaign to shape public perceptions that the San Carlos Project would benefit the Pimas".[25] The Indians themselves became vocal supporters for the project, producing brochures and other promotional literature.

Passage of May 18, 1916 Act Creating Florence-Casa Grande Project

Hayden continued to vigorously pursue support for the San Carlos Project and in 1916 attained a major victory towards that goal with passage of the Indian Appropriation Act on May 18 (39 Stat. 129). Together with his Senate colleague, Henry Ashurst, Hayden had convinced Congress to include initial funding for the two diversion dams on the Gila River that had previously been

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[23] The pivotal role that Carl Hayden played in the passage of the San Carlos Act is described in "Carl Hayden's Indian Card: Environmental Politics and the San Carlos Reclamation Project" by Jack L. August, Jr., published in the Journal of Arizona History, Winter, 1992. p. 397-422.

[24] August, Jack, Jr. "Carl Hayden's Indian Card: Environmental Politics and the San Carlos Reclamation Act". p. 402.

[25] see August, Jack, Jr. p. 403. The author contends that historians have ignored the important role Pima Indians played in gaining congressional and public support for the San Carlos Project.

recommended. The Santan dam, which was later named Sacaton, was to be built by the BIA for the irrigation of Indian lands on the Gila River Indian Reservation. The Florence dam, later appropriately dedicated Ashurst-Hayden, was to be constructed by the BIA to serve both Indian and non-Indian lands. The Act also provided for developing a distribution system to both Indian and non-Indian lands but only after an agreement could be reached between owners of water rights in the project area and the Secretary of the Interior. The 1916 Indian Appropriation Act was the start of the Florence-Casa Grande Project and the first step towards an integrated irrigation system designed to serve both Pima and non-Indian lands.

As called for in the Act, an agreement among the various owners of water rights was finally reached following lengthy and sometimes difficult negotiations. On April 22, 1920, the Secretary of the Interior designated 35,000 acres of irrigated land for Indians and 27,000 acres of irrigated land for non-Indians to be included in the project.

Meanwhile, following the 1916 appropriation, Congress continued to fund the Florence-Casa Grande project on an annual basis due to continued lobbying by Hayden and Ashurst. The BIA proceeded to develop final plans for the diversion dams and distribution system. The project as developed by the BIA included the construction of Florence and Santan dams and a distribution system that combined some existing irrigation features with new ones. The main components of the delivery plan consisted of completing the partially constructed Florence-Casa Grande or Main Canal, extending from Florence diversion dam south for 21.6 miles on non-Indian lands to the existing Picacho reservoir; constructing a small North Side Canal from Florence Dam to the eastern edge of the Reservation; and constructing a Pima Lateral heading west from the Main Canal to the Gila River above the Santan Dam. Although originating on non-Indian lands, the Pima Lateral was intended to primarily serve the Reservation.

By Harding's inauguration as President on March 4, 1921, funding in the amount of $1,670,000 had been appropriated for the design and construction of the diversion dams and delivery system of the San Carlos Project.[26] The only piece missing was authorization for construction of the storage dam. Ashurst and Hayden continued to press ahead with their lobbying efforts. Additional studies conducted by the Reclamation Service provided support for the larger storage project. In a report dated 1920 by C.C. Fisher, Reclamation Engineer, a project capable of irrigating 108,000 acres in the Florence-Casa Grande unit and 40,000 acres in the Reservation unit was outlined.[27] To achieve these results, the San Carlos storage dam and a groundwater pumping system were necessary elements. It was projected that with the dam, 80,000 of the total 148,000 acres could be irrigated by surface water.

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[26] August, Jack, Jr. p. 407

[27] Department of the Interior. United States Reclamation Service. Report on San Carlos Project, Arizona. by C.C. Fisher. 1920. p. 1-2.

Passage of San Carlos Act on June 7, 1924

Completion of structures authorized under the May 18, 1916, Act encountered significant delays due to the overriding preoccupation with World War I. Ashurst-Hayden dam was not dedicated until May 10, 1922, and only preliminary work had been conducted on Sacaton Dam by that date. Nonetheless, by 1923, Congress had committed so much funding for the San Carlos Project that the time was ripe to introduce legislation to authorize completion of the system with the long-advocated storage dam. On December 11, 1923, Arizona Senator Ralph Cameron introduced a bill (S.966) "to continue construction of the San Carlos Federal Irrigation Project." The bill received unanimous approval by the Senate on April 23, 1924. The action then moved to the House where Hayden campaigned intently for support from his fellow Representatives. Hayden's persistence paid off on June 4, 1924, when the House approved an amended San Carlos Bill unanimously. The House and Senate versions contained such different language that Hayden ended up rewriting the entire bill.[28] The final hurdle in passage was signature by the President. Never an enthusiastic proponent for the project due to the cost, then President Calvin Coolidge nonetheless signed the bill on June 7, 1924. Finally, twenty-five years after the first introduction of a bill to construct a storage dam on the Gila River, the project would come to fruition.

News of the passage of the San Carlos Bill was received with jubilation by Indians and non-Indians in the project area. On the Fourth of July, 1924, hundreds of residents from Florence and Casa Grande gathered with Pima Indians in Sacaton to participate in a triple celebration: National Independence Day, the San Carlos Bill, and the recently enacted legislation which granted citizenship rights to previously unfranchised Indians. Louis Nelson, a prominent member of the Pima tribe, presided over the three hour long program which included speeches by both Indians and non-Indians. The recurring theme among Pima presentations was the "justice which had come to them in passage of the San Carlos Bill and of the increased prosperity which is to be theirs when the canals are built".[29]

Carl Hayden's proclaimed victory for the Pimas appears to have been motivated at least as much by a desire to satisfy non-Indian interests. David Introcaso wrote in the Coolidge HAER document that "Carl Hayden lobbied Congress for ten years for the "Hayden Bill" simply as a response to his non-Indian constituency." In fact, Hayden did not attribute the acute water shortages suffered by the Pimas to withdrawals by non-Indian settlers further upstream. His assessment of the situation, as expressed in a "History of the Pimas" compiled in 1924, was that the major damage to the Pimas was due to another cause -- overgrazing. "The Gila River", he wrote, "has been so changed by overgrazing that, without reseservoirs to store its flood waters,

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[28] August, Jack, Jr. p. 412

[29] "Big Double Celebration Brings Hundreds to Sacaton on 4th". Arizona Blade-Tribune. Vol 35, No. 25. Saturday, July 12, 1924. p.1.

that stream is no longer dependable for irrigation."[30]

Another assessment made several years later and included in a Survey of Conditions of the Indians in the United States presented to a U.S. Senate Subcommittee of the Committee of Indian Affairs took quite a different view: "The construction of the San Carlos Reservoir is for the purpose of furnishing water to the same lands that the Indian formerly irrigated by direct flow from the Gila River. Had the government taken the proper steps to protect these Indian water rights as guardian of the Indians, it would not now be necessary to build the San Carlos Reservoir to furnish the Indian lands a water right..."[31] The authors Porter J. Preston and Charles A. Engle made the further astute observation that the size of the project should not exceed 80,000 acres to insure that the Indians would receive water for a full 50,000 acres. They predicted that if the non-Indian lands were to receive water for a projected 45,000 acres, their rights would be satisfied first leaving the Indians only a partial supply of water.

The June 7, 1924 Act, commonly referred to as the San Carlos Act, authorized the BIA to "construct a dam across the Canyon of the Gila River near San Carlos, Arizona, as a part of the San Carlos irrigation project". Water impounded by the dam was intended to first satisfy the needs of the Pima Indians on the Gila River Reservation and then to irrigate other public or private lands. Another provision of the act required the construction costs of the project to be divided equally based on the acreage of Indian and non-Indian lands served by the project. The construction charges assessed against Indian lands were to be paid to the U.S. Treasury on a per acre basis under rules and regulations established by the Secretary of the Interior.

The treatment of private lands under the project was more explicitly spelled out. Construction costs chargeable to irrigable lands in private ownership were to be amortized at 5% per year with an interest rate at 4%. Operation and maintenance charges for private lands and Indian lands operated under lease were to be paid on an annual basis. A repayment contract approved by the Secretary of the Interior covering the project lands in private or public ownership was to be executed by an irrigation district established under Arizona law. Lastly, project lands in private ownership were limited to parcels of 160 acres. Lands in excess of that were to be returned to the federal government prior to the expenditure of any federal monies on account of any lands in private ownership. The acreage limitation clause was a revision by Carl Hayden that reflected

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[30] U.S. Congress. Senate. A History of the Pima Indians and the San Carlos Irrigation Project. Compiled in 1924 by Carl Hayden. 89th Congress, 1st Session, 1965. Document No. 11. p.59

[31] Part 6 of the Survey of Conditions of the Indians in the United States includes a "Report of Advisers on Irrigation on Indian Reservations" prepared in June 1928 by Porter Preston, Engineer, Bureau of Reclamation, and C.A. Engle, Supervising Engineer, Bureau of Indian Affairs. In addition to containing an excellent description of SCIP and its problems, the report also includes an insightful depiction of the inefficiencies and poor management of the Irrigation Division, Bureau of Indian Affairs.

the influence of the newly appointed Bureau of Reclamation commissioner, Elwood Mead.[32] He espoused a reclamation philosophy based upon an agrarian ideal of small, self-sufficient family farms. Hayden was a strong supporter of Mead and had, in fact, assisted in his appointment.

While the San Carlos Act provided the Pima Indians with a priority to the project water for the irrigation of their allotted lands, the Act did not spell out the proportion of Indian lands to non-Indian lands that would be served by the project. The proportions were determined later by the amount of irrigable Indian allotments in need of water, which totalled about 50,000 acres, and the quantity of non-Indian lands for which there would be sufficient water. To be included were the 27,000 acres of private lands under the Florence-Casa Grande Project. This distribution of water is defined in the 1926 "Landowners' Agreement with the Secretary of the Interior, San Carlos Project: Act of June 7, 1924".[33]

Other legislation followed which further defined and expanded the San Carlos Irrigation Project. On March 7, 1928, an act was passed (45 Stat. 200) that merged the Florence-Casa Grande Project with the San Carlos Project. The same legislation authorized hydro-electric development at Coolidge Dam and the construction of a complete distribution, pumping and drainage system.

On July 31, 1928, an irrigation district comprising project lands in private or public ownership was organized under Arizona state law in compliance with the San Carlos Act. Known as the San Carlos Irrigation and Drainage District, the organization was confirmed by decree of the Federal Court on July 16, 1931.

Appropriations for construction of the San Carlos Project continued to be made following passage of the Act. The Department of Interior Appropriation Act for fiscal year 1926 provided the initial $450,000 for construction of Coolidge Dam.[34] Sacaton Dam was completed in June, 1925, and Coolidge Dam, including the power house, was finished by December, 1928. The reconstruction and expansion of the distribution system for Indian and non-Indian lands was

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[32] August, Jack. p. 412. In a letter of opinion written by Nathan Margold, Solicitor for the Department of Interior to the Secretary of the Interior on April 4, 1938, Margold expressed his belief that the 160 acre limitation was intended to exist only prior to the expenditure of federal funds on the project. With the completion of the project, he felt that the force of the provision "is exhausted and of no further effect."

[33] Memo entitled "San Carlos Project" written by John F. Truesdell, Chief Field Counsel, Indian Irrigation Service, October 12, 1933.

[34] U.S. Congress. House. "Construction of San Carlos Reservoir." Extracts from Hearings before Subcommittee of House Committee on Appropriations. 69th Congress, 1st Session. Washington, May 23, 1926.

largely completed between 1929 and 1933. Some extensions and improvements were made between 1933-36. By the mid 1930's, the San Carlos Irrigation Project as it now exists, had been completed with the exception of an expanded power delivery and groundwater pumping system, and the reconstruction of Picacho Reservoir (see Photos No. AZ-50-2, AZ-50-3, AZ-50-4).

IV. PLANNING AND CONSTRUCTION OF MAJOR IRRIGATION-RELATED FEATURES OF SCIP

The description of the planning and construction of major irrigation-related features associated with SCIP is organized as follows: storage and diversion structures are dealt with first. This is succeeded by a discussion of the distribution system, with canals heading at or receiving water diverted at Ashurst-Hayden Dam preceding those originating on Indian lands. Following the description of the primary canals is a summary of the lateral distribution system. The last feature addressed is the construction of project headquarters.

Coolidge Dam

The principal storage feature of SCIP is Coolidge Dam located on the Gila River about 90 miles upstream from Ashurst-Hayden Dam. Behind the concrete multiple dome dam, water from the Gila, San Carlos, San Simon, and San Francisco Rivers is impounded in San Carlos Reservoir, with a storage capacity of 1,200,000 acre feet. The first water was stored in the reservoir in November, 1928 and the first release for irrigation took place during October, 1929.[35] Coolidge Dam is significant for its unique multiple dome design invented by Charles Real Olberg. The design was developed by Olberg in an effort to reduce construction expenses due to the increased cost of labor and materials following World War I. The construction history and physical description of Coolidge Dam are included in David Introcaso's HAER document on Coolidge Dam and will not be repeated here.

Ashurst-Hayden Diversion Dam

Water from Coolidge Dam is carried down the Gila River to the primary diversion feature of the project, Ashurst-Hayden Dam. Located about 12 miles east of Florence in Township 4S, Range 11E, Section 8, (future references will be shortened as T4S, R11E, S8) this dam diverts water that irrigates both Indian and non-Indian lands.

Construction of Ashurt-Hayden Dam was authorized under the May 18, 1916 Act with an initial appropriation of $75,000. By that time the BIA had already conducted surveys and developed preliminary designs for the structure. The site selected for the dam was where the Gila River flows between two solid lava rock walls about 400 feet apart. While these provided solid end abutments for a dam, it was found that the river channel between them was actually a deep filled-in canyon. Diamond drill borings indicated that bedrock could not be reached even at 100 feet. Given these conditions, the most suitable design was that known as an "Indian weir" or "floating" dam. British engineers had developed the design formula for this type of dam at the end of the nineteenth century for projects in India.

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[35] Clotts. History, Gila River Reservation, San Carlos Irrigation Project. p.9

Unlike other dams that depend on the rigidity of their foundation for stability, an "Indian weir" is designed to overcome problems of destructive percolation beneath the base, damaging scouring below the dam, and unbalanced water pressure below the weir. Such dams consist of a broad, heavy, impervious slab of concrete that is secured to solid end abutments and "floats" on the sand of the river channel. Proportions developed by British engineers dictate the width of the slab in relation to the height of the weir located at the slab's upper end. If correctly designed, water flowing through the sand under the dam has no velocity and therefore can not cause erosion and eventual structural failure. Underneath the slab are one or more cut-off walls that assist in preventing destructive percolation. An expanse of heavy rock known as talus at the downstream end of the weir protects the dam from erosion and a rear apron at the upstream side of the weir prevents cross currents from undermining the slab.[36] The Indian weir design was first used in the United States by the Reclamation Service for the construction of Laguna Dam. Located on the lower Colorado River outside of Yuma, Arizona, Laguna Dam was built between 1905-09. On the Salt River, the Reclamation Service constructed Granite Reef Dam between 1906-08, another early example of the Indian weir.

Charles Real Olberg and the U.S. Indian Irrigation Service

The man placed in charge of the initial planning and then later the construction of Ashurst-Hayden Dam was Charles Real Olberg, an engineer with the U. S. Indian Irrigation Service who was also well acquainted with Reclamation Service projects. Like most engineers of the U.S. Indian Irrigation Service, Olberg had spent time working for Reclamation.[37]

Olberg was born in St. Paul, Minnesota on August 19, 1875. After graduating from Columbian University with a degree in civil engineering, he spent two years as an "instrument man" for irrigation projects on the Crow Indian Reservation in Montana. From there he went to work as a draftsman in the Supervising Architect's Office in the Treasury Department in Washington DC. In 1900, he joined the United States Geological Survey as an assistant hydrographer and in that position was in charge of field parties conducting topographic and transit work. Olberg joined the newly established Reclamation Service as an assistant engineer in 1902 and was in charge of field work on the Salt River Project from 1902-03.[38] During that time, he also conducted

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[36] U.S. Department of Interior. Office of Indian Affairs. Indian Irrigation Service. Revised Report on Proposed Sacaton Diversion Dam and Bridge, Gila River Project, Arizona. by Charles R. Olberg, Asst. Chief Engineer. Sacaton, Arizona, May, 1923.

[37] Olberg, C.R. History of the Construction of Ashurst-Hayden Diversion Dam. Florence, Arizona. March 1, 1922. p. 9.

[38] U.S. Department of the Interior. United States Geological Survey. Proceedings of First Conference of Engineers of the Reclamation Service With Accompanying Papers. compiled by F.H. Newell, Chief Engineer. Washington: Government Printing Office, 1904. p. 336. This source provided the above biographical information.

TABLE I: CONSTRUCTION OF MAJOR PROJECT FEATURES

NAME OF FEATURE	PRE-SCIP CONSTRUCTION	SCIP START	COMPLETION DATE	MAJOR MODIFICA-TIONS
COOLIDGE DAM	NA	1927	1928	In progress
ASHURST-HAYDEN DIVERSION DAM	NA	1921	1922	1930, mid-1950's
SACATON DIVERSION DAM	NA	1923	1926	1928
FLORENCE CASA-GRANDE CANAL	1912-15	1923	1928	
FLORENCE-CASA GRANDE EXTENSION	NA	1928	1930	
FLORENCE CANAL	1886-89	C.1920	1920's	
CASA GRANDE CANAL	1889	C.1920	1920's	
PICACHO RESERVOIR	1889-90	1928 TAKEOVER		1932 1956-57
NORTH SIDE CANAL	NA	1924	1930	
PIMA LATERAL	NA	1925	1928	
SAN TAN INDIAN CANAL	1877-83			
SANTAN FLOOD-WATER CANAL	1909-14		1928	
CASA BLANCA CANAL	1914 on		1928	
SOUTHSIDE CANAL	NA	1934	1935	
DIESEL PLANT	NA	1935		c.1980
PROJECT HEAD-QUARTERS	NA	1931		

foundation investigations at the San Carlos Dam site. Olberg is listed as a participant at the Second Conference of Engineers of the Reclamation Service held in November 1904 and January 1905. His title was still assistant engineer and member of the Hydrographic Branch.

Following his stint with the Reclamation Service, Olberg took a position with the U.S. Indian Irrigation Service within the BIA. Administrative units concerned with irrigation had been set up in that agency as early as the 1890's although it was not until 1924 that an Irrigation Division was formally established. The irrigation force as a whole was known as the U.S. Indian Irrigation Service (Indian Irrigation Service).

There were close ties between the Reclamation and Indian Irrigation Services. Following passage of the Reclamation Act in 1902, the Reclamation Service began constructing a number of irrigation projects on Indian reservations. It soon became clear that the purpose of the Reclamation Act to assist with the development of small commercial farms did not fit the needs of Indians who were primarily subsistence farmers. In fact, in many instances Indian irrigation projects failed to meet the provisions of the Reclamation Act.[39]

Ironically, in the previously cited report by Porter Preston and C.A. Engle included in the January, 1930, "Survey of Conditions of the Indians in the United States", the two authors recommended that a number of Indian irrigation projects, including that on the Gila River Reservation be transferred to the Bureau of Reclamation due to the large amount of non-Indian lands served by the project. They also recommended that many of the design, legal work, and feasibility study functions of the Indian Irrigation Division be transferred to Reclamation due to the inadequate capabilities and poor management of the former agency. In the authors' own words: "It is evident from a comparison of the Indian irrigation service organization with any organization, either Government or private, doing a similar class of work, and comparable in magnitude, that the organization is totally inadequate for properly doing the necessary work."[40]

The exact date of Olberg's entry into the BIA is unknown although beginning in 1908 he served as the Superintendent of Irrigation in the Los Angeles district office of the Indian Irrigation Service. Irrigation districts were gradually created within the Indian Irrigation Service and were permanently established by law in 1918. Each irrigation district had a Superintendent of Irrigation whose responsibilities included general supervision of all of the projects, surveys, and other matters pertaining to irrigation, water resources, and power development on Indian reservations in his respective district. The Los Angeles District Office covered lands in Southern California and Southern Arizona.

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[39] Wathen, Albert L. "Indian Irrigation." The Reclamation Era. December 1941. p. 322

[40] Survey of Conditions of the Indians in the United States. 71st Congress, 2nd Session. Part 6. p. 2255.

Olberg held the position of Superintendent of Irrigation for the Los Angeles office until September 1917, when he resigned to serve in World War I in the U.S. Army Corps of Engineers.[41] His contribution to the Indian Irrigation Service was recognized in the 1917-18 Indian Irrigation Service Annual Report, District #4, as follows: " His intimate knowledge of the irrigation work in this district, gained from his long service, added to his natural ability as an engineer, and his kindly disposition toward all of his associates, made his loss keenly felt by all who have worked with him."[42] After serving abroad in France for about two years, he returned to the Indian Irrigation Service, this time as Assistant Chief Engineer.[43] Given his previous role in supervising the San Carlos Project, it was logical that he be assigned to direct its construction. From about 1919 onwards through completion of Coolidge Dam, Olberg spent much of his career away from Washington, DC., overseeing the design and construction of SCIP features.[44] This included Ashurst-Hayden Dam, Sacaton Dam, and later, Coolidge Dam.

Final Design of Ashurst-Hayden Dam

The final design for Ashurst-Hayden Dam consists of a "floating" concrete slab that is 396 feet in length, 212 feet in width and varying in thickness (See Photos No. AZ-50-A-1 through A-17). The slab is divided into four sections: the rear or upstream apron, the main slab or fore apron, the upper talus, and the lower or downstream talus. The rear apron is 16 feet wide and 12 inches thick and is reinforced with 5/8 inch steel bars spaced 28 inches on center. A 9 inch thick reinforced concrete cut off wall that is 3 feet deep protects the upper edge of the apron. The main slab is 56 feet wide and from 2 to 5 feet thick. It is not reinforced but includes expansion joints every 40 feet. The upper and lower talus are each 70 feet wide and 2 feet thick. The talus sections consist of concrete mixed with a large amount of rock. The upper talus is reinforced with 1/4 inch steel bars spaced every 2 feet both ways and a cut off wall protects the lower edge. The lower talus consists of 2 parts, a 30-foot wide section which is identical in composition to the upper talus, and the lower 40-foot wide section which is composed of large blocks tied together with iron rods. This "articulated section" was designed to be flexible so that it could settle to conform to the river bed. Below the lower talus, a bed of large rocks was laid to

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[41] Annual Report of the U.S. Indian Irrigation Service 1917-1918. District #4. Narrative and Maps. H.V. Clotts, Superintendent of Irrigation. National Archives, Washington, D.C. Record Group 75, Entry 655. Page 1. Following Olberg's departure, engineer H.V. Clotts assumed the title of Superintendent of Irrigation.

[42] Ibid.

[43] The position of Assistant Chief Engineer reported to the Chief Engineer who was stationed in Washington D.C. after 1912. The Office of Chief Engineer was formally established in 1905 and until 1912 was located in the Los Angeles district office. Olberg did not perform the duties of his position as Assistant Chief Engineer for a number of years while placed in charge of construction work on SCIP.

[44] see Survey of Conditions of the Indians in the United States., p. 2255-56.

provide additional protection against erosion.

The main slab rests on 2 rows of wood pilings spaced 30 feet apart and driven to a depth of 16 feet. At either side of the river, the slab is tied into the rock. The slab supports the reinforced concrete weir which is 10 feet high and of the same length as the slab. At the north end, the crest of the dam is extended into the rock bank for 120 feet to provide greater spillway capacity. The concrete dam is reinforced with steel bars and anchored to the slab.

At the south end of the dam and nearly at right angles to it, are located intake gates for the Main or Florence-Casa Grande Canal (see Figure 3). The original intake gates consist of nine 4- by 8-foot regulator gates of the "folding" type which skim water from the surface of the river to prevent silt from entering the canal. The cast-iron gates are separated by 25-foot high and 20-foot wide reinforced concrete piers. Machinery for operating the gates is located on a concrete deck built between the piers about 8.5 feet above the bed of the canal. The top of the piers support a roadway with concrete balustrades. At the upper or east end of the gates a concrete retaining wall protects them from the river. The downstream side of the gates is protected by the retaining wall which forms the south abutment of the dam.

In front of the intake gates and parallel with the dam were originally four 4- by 8-foot sluice gates. These served to sluice out the great quantities of sand and silt carried by the Gila that otherwise would have entered the Main Canal. The cast iron sluice gates were separated by 3-foot thick concrete piers. These gates as well as the intake gates were operated with hydraulic power. Sluicing channels formed by thin reinforced concrete walls guided water to the sluice gates and aided in the sluicing action.

The operating machinery for all of the gates consisted of a pressure tank and heavy duty pump driven by an electric motor. These are located in a small room under the road next to the first or downstream bay of the canal heading gates. Power to operate the pump was provided by a gas engine and generator located in a small building constructed to the south of the dam (see Photos No. AZ-50-B-1 through B-3). The plant also supplied power for lighting.

A unique feature of the dam was the lack of canal headgates at the north end. Instead, a 42 inch cement pipe was enclosed in the dam to carry water from the south intake gates across the river to a small canal planned for the north side. This was done to avoid the difficulty of cutting through large amounts of rock for canal headgates at that end (see Figure 4).

Construction of Ashurst-Hayden Dam

Diamond drilling tests to accurately assess foundation conditions were conducted at the dam site by the BIA in December 1916 and January 1917. Final surveys for the dam were completed in October of that year and detailed construction plans had been drafted by the summer of 1918. The project moved ahead slowly after that as the country recovered from the grip of World War

I. It was a difficult time for such an undertaking. Construction equipment and materials were scarce and prices for both were high. Freight rates were also excessive. A shortage of labor meant more costly wages. Finally, after considerable hesitation, the BIA opted to construct the dam by force account rather than contract it out. Part of the agency's reluctance was due to the fact that they were not equipped with the personnel or machinery for a project of this scale. On January 12, 1921, the Secretary of the Interior approved the work on force account. Fortunately for the project, Arizona was experiencing a slump in the copper and cotton markets so that there was a plentiful supply of labor, including skilled mechanics.

Once authorization was received, the pace of operations quickened. All phases of construction had to be carefully planned to take into account the fluctuations of the river. To avoid high water caused by spring rains, pile driving and foundation excavations were scheduled to begin about May 1 after flooding danger had diminished. Pouring of the concrete was slated to start after June I but had to be completed before the July flood season.

The first priority was to build a side track off of the Arizona Eastern Railroad which paralleled the river on the north side. This would allow for the delivery of freight right to the site. Other immediate needs were for a construction camp and a powder house in which to store dynamite.

Following negotiations with the Arizona Eastern Railroad, a contract was drawn up and by March I, 1921, the 336-foot long spur line had been graded and the track laid. Simultaneously with this work, construction of the camp was underway. Originally intended to be located on the north side of the river near the railroad, the camp was moved to the south side due to the impassable condition of the north side road leading to Florence.

Living quarters constructed included a 3-room superintendent's cottage, 3 sets of framed tents for married quarters, foremen quarters for 12 men, a bunkhouse to accomodate 50 men, and 22 used army tents for 400 men. A mess hall and kitchen equipped to serve 200 men, and lavatories were also important features. Buildings other than the tents consisted of balloon frame structures enclosed by tar paper and covered with corrugated metal roofing. Windows were made of canvas tacked on wooden frames that were hinged at the top. An existing 30-foot by 45-foot adobe building, originally a ranch house, was adapted for use as an office, drafting studio, and commissary. It was covered with a new corrugated iron roof, and supplied with new windows and doors. A small dam operator's cottage was constructed in the "Spanish style, prevalent in this part of the country" (see Photos No. AZ-50-C-1, C-2).[45]

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[45] Olberg, C.R. History of the Construction of Ashurst-Hayden Dam March 1, 1922, p.18. Confusion exists as to the construction date of the existing dam tender's house. A second description of a dam tender's house is included in the Fiscal Year 1924 Annual Report of the Indian Irrigation Service. It states that a five room stucco finish gate-tender's house was completed at Ashurst-Hayden Dam in January, 1924.

Two small powder houses were built on the north bank of the river; an additional powder house was later constructed on the south side for work on the Florence-Casa Grande Canal. Other buildings essential to construction of the dam followed. These included a machine shop, blacksmith shop, sheet metal shop, pipe shop, wood working plant, lighting plant, water tank, fuel tanks, compressed air plant, rock crushing and screening plant, two concrete plants, and a power house. The camp was also equipped with a water supply.

With completion of the side track and the construction camp well underway, excavation of rock for use in building the dam was started. As planned, pile driving and excavation of the dam foundation began on May 1st. The pile driving proved more difficult than anticipated, but after some adjustments in the technique and equipment was successfully accomplished. By June 1st both the pile driving and excavation for the foundation were finished.

The next major hurdle in the race against nature was pouring of the concrete slab. During the excavation process, Olberg had spent "many days and sleepless nights in making preparation for the concentration of all his forces and equipment in the herculaen task of paving the wide stream bed with its massive block of concrete over which the ever threatening flood pass harmlessly."[46] Because of the short time frame in which the pouring of concrete had to be accomplished, a fast and inexpensive method had to be devised. After considering numerous options, it was decided to build a railroad across the river from which the concrete could be poured. A pair of adjacent parallel wood trestles were constructed that were looped at each end. The trestle supported a narrow gauge track over which small dump cars loaded with concrete operated. The cars could be filled at concrete mixers located at both ends of the trestle. Resourcefulness was required to figure out a way to operate the cars. The use of small gasoline locomotives was initially explored but their great expense and long delivery time ruled them out. Instead, locomotives were manufactured using five Ford motors.[47]

By June 10th, the railroad was operational and concrete pouring of the slab began. Progress was quick and the work was completed on schedule by the end of June. Predicted flooding during the summer slowed construction and destroyed the trestle. Fortunately, this occurred only after it had served its purpose. With the end of the rainy season around the first of October, work resumed at full speed. By the end of that month, the foundation and piers for the intake gates had been partially poured and the sluice gate structure was in place. By the end of November the crest of the dam was completed. Completion of the intake gates followed and by March 1st, 1922, all of the concrete had been poured with a few minor exceptions so that the only major

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[46] "Celebration Marks Completion of First Unit in Great Project for Reclamation of Wonderful Empire." The Arizona Republic, May 11, 1922, p.2.

[47] Much of the machinery and equipment used in the dam construction was either rented or purchased second-hand from numerous sources.

work item remaining was installing the gates. Final construction costs for the dam amounted to $244,005..

On May 10, 1922 completion of the dam was celebrated with a grand dedication ceremony. Commissioner of Indian Affairs Charles H. Burke performed the dedication renaming the dam after its leading proponents, Henry Ashurst and Carl Hayden. The governors of New Mexico and Nevada were among the attendees at what was billed the "Biggest Event in the History of Arizona".[48] Among the numerous congratulatory messages read at the ceremony was one addressed to Olberg from President Harding. He wrote "...The construction of this great engineering work exemplifies a signal service in the line of duty of yourself and your able assistants. The great Southwest takes a notable forward stride on the day when this structure is dedicated, for its erection marks the close of many years of strife and disputation between the Indians and the white man regarding the distribution of the waters of the Gila River."[49] The first major step in realizing SCIP was indeed a big event marked by great optimism.

Sacaton Diversion Dam

It would be another several years before completion of the second diversion dam could be celebrated. From the outset, the design and construction of Sacaton Dam were subject to delays, revisions and misgivings.

Sacaton Dam was conceived of as meeting purely Indian needs, its purpose being to deliver Gila River flood waters to both the north and south sides of the river at the Reservation. The 1914 Annual Report of the Indian Irrigation Service asserted that the dam was "absolutely necessary" to the success of the Sacaton and Casa Blanca Projects, two earlier small scale irrigation projects serving Indian lands on both banks of the Gila.

Early planning for the dam included consideration of an alternative consisting of an enlarged north side canal at Ashurst-Hayden Dam that would carry water to the reservation. After comparing both options, it was determined that a dam would be less expensive and would also be capable of diverting greater amounts of flood waters so the BIA proceeded with that plan. The site selected for the structure was a channel about twenty miles below Florence, and three miles east of Sacaton (T4S, R6E, S12). Located immediately below the intake to the San Tan Flood-water Canal, the dam was situated so that use could be made of the existing canal heading to divert water to the north side lands[50].

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[48] August, Jack, Jr.. p. 407.

[49] "Celebration Marks Completion of First Unit in Great Project for Reclamation of Wonderful Empire." The Arizona Republic, May 11, 1922, p.1, 2.

[50] C.R. Olberg. Revised Report on Proposed Sacaton Diversion Dam and Bridge. May, 1923. p. 11.

Preliminary plans and costs for the dam were prepared by the BIA in 1914[51]. The following year, cost estimates and a description were included in Olberg's November 1, 1915, report to the Commissioner of Indian Affairs referred to earlier. The projected cost for the dam was $173,599. Authorization for the dam was granted on May 18, 1916, with an initial appropriation of $75,000. In addition to the dam, incorporation of a badly needed highway bridge was approved. The nearest crossings were 23 miles to the east at Florence or over 100 miles downstream at Wellton[52]. The total cost of the project was not to exceed $200,000..

Planning in earnest for project construction began in 1917 under Olberg's supervision. That summer, surveys and rough drawings for the dam and bridge were completed in the field. The following July, detailed plans and cost estimates were sent to the Washington office.[53] The same type of dam was selected for the site as Ashurst-Hayden Dam. Similar circumstances existed at both sites: abutments on both sides of the river with a very deep channel filled with sand in between. In the case of Sacaton, the north bank consisted of a granite out-crop while at the south side, a less stable silt embankment rose eight feet above the river. These conditions dictated the selection of a "floating" Indian weir resting on sheet piling and with a flexible down stream apron. Due to changes in the width of the meandering river channel between early project planning and construction, the length of the dam had to be extended. Final plans were for a dam measuring 1250 feet long between abutments.

As at Ashurst-Hayden Dam, the impervious concrete "floating slab" is divided into sections, in this case, totalling an overall width of 73 feet: a 15-foot wide rear or upstream apron, a six-foot wide main section underneath the weir, and a 52-foot wide fore apron. The thickness of the slab varies in accordance with the water pressure which it has to resist. The range is from 1.5 feet thick below the bridge piers to 5 feet thick under the weir. Below the fore apron is a wide expanse of talus designed to prevent the river from eroding back and undermining the dam. The height of the weir crest above the average elevation of the river bed is 3 feet. (see Photos No. AZ-50-D-1 through D-8, D-26 through D-32).[54]

To slow the rate of water percolating beneath the dam and to protect the bridge piers from erosion, two rows of wood sheet piling were installed--the first row 12 feet in depth under the weir, and the second row 16 feet deep at the lower edge of the slab. As additional protection,

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[51] 66th congress. p. 86.

[52] C.R. Olberg. Revised Report of Proposed Sacaton Diversion Dam and Bridge. May, 1923. p.11.

[53] Department of the Interior. U.S. Indian Irrigation Service. Annual Report Fiscal Year 1919, Southern Arizona. Herbert V. Clotts, Supervising Engineer. Volume I, p.3.

[54] The description of the dam is excerpted from Olberg's Revised Report of Proposed Sacaton Diversion Dam and Bridge. May, 1923.

2 concrete cut-off walls, 4 feet deep and 1 foot thick, are located at each end of the slab. To insure against cracking due to temperature stresses, expansion joints were an essential design feature for all surfaces that would be exposed to the sun. This excluded the rear apron. All of the individual sections of the slab as well as the weir were reinforced with wire mesh.

Due to the unstable nature of the river's south bank, a "guide bank" was constructed near the center of the river bed at right angles to the dam to form its south abutment. Constructed of earth and covered with heavy rip-rap, the guide bank extends up-stream for 1200 feet and downstream for 200 feet. Both lengths terminate in heavily rip-rapped "islands" or "strong points" that protect the ends of the guide bank from erosion. Incorporated in the top of the guide bank is a 16 feet wide roadway.

The guide bank is connected to the south bank of the river by two 1300-foot long dikes, which form the banks of the Pima-Sacaton Branch Canal. The west or downstream dike carries the 22-foot wide roadway that continues north across the dam. The east dike, on reaching the south river bank, turns to the east and extends up the river as a levee to protect the adjacent lands from flooding.

Unlike Ashurst-Hayden Dam, Sacaton Dam was built with canal headings and sluiceways at both ends. At the south end, six 3-foot by 8-foot cast iron lift gates were installed at the canal intake. Four sluiceway channels led to four 3-foot by 6-foot cast iron lift gates. Similar sluice gates were provided at the north end of the dam. The existing headgates to the San Tan Flood-water were refurbished and retained.[55]

The sluice and canal intake gates were designed to be hydraulically operated. Operating machinery consisted of hydraulic cylinders, high pressure pumps, pressure tanks, electric motors and necessary pipe, valves and fittings. A concrete operating house reached by a short set of steps was constructed at each end of the dam to enclose the equipment.

Like Ashurst-Hayden Dam, a conduit was initially planned through the length of the dam that would carry water from an extension of the Pima Lateral on the south to the San Tan Flood-water Canal on the north. This would assure water delivery during times when flows were low between Ashurst-Hayden and Sacaton dams. Low flows of water at Sacaton were aggravated by extensive seepage in the river bed between the two dams. In the final design, a conduit through the dam was abandoned in favor of an open channel immediately below the weir. Water would be conveyed to and from the channel through short siphons running under the sluiceways at either end of the dam. Both siphons were built of reinforced concrete, measured 5 feet square, and were provided with inlet and outlet gates. The gates were necessary to obstruct mud from entering the

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[55] Department of Interior. U.S. Indian Irrigation Service. Annual Report Fiscal Year 1925. Volume I, p. 81.

siphons when they weren't in operation and to prevent water from flowing in when it was being diverted from the river into the canals.

Construction of Sacaton Dam

Temporary quarters for government employees conducting preliminary work at the site were constructed on the south side of the river in 1917. Originally, the BIA planned to contract out the construction. The first call for bids was set for September 6, 1918, but there was no response. Economic conditions following World War I caused delays in proceeding with the project. Due to the inflated prices of labor and materials, a decision was made to postpone any further bid announcements. A second advertisement was issued with a closing date of June 2, 1919, but the one bid received was considered too high. In the latter part of that year, a small engineer's camp was constructed on the south bank of the river near the dam site. When completed in 1920, buildings consisted of a frame warehouse, two frame cottages, a frame office building and a small power house and pump plant to supply electricity and water. A new road was also constructed that provided the main access to the dam from the south. After an expenditure of $22,000 on preliminary surveys, designs, and construction, it was decided to postpone construction until more favorable economic conditions prevailed.

It was obvious that project costs had been underestimated and in order to move ahead additional funds would be required. A request for an increased budget was approved by Congress in the 1921 Indian Appropriation Act which raised the project limit to $400,000.

Questions about the wisdom of building a dam rather than an enlarged north canal continued to be raised even as additional funds were being requested. In the 1920 Report on the San Carlos Project prepared by the Reclamation Service, the author, CC.Fisher, wrote "The advisability of the construction of Sacaton Dam as a part of the plan of the project, is somewhat questionable in the mind of the writer. This is especially so on account of the fact that the damsite is not very favorable due to the great width of the river and to the sand foundation and to the absence of a good abutment at the south end..."[56]

In spite of these reservations, construction finally started in earnest on Sacaton Dam in the spring of 1923 (see Photos No. AZ-50-D-10 through D-23). Due to the unsuccessful attempts at awarding a contract for the project, it was decided to employ members of the labor force from Ashurst-Hayden Dam. To accomodate the work force and "retain the better class of skilled workmen", it was deemed necessary to provide living quarters with "a fair degree of comfort."[57]

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[56] C.C. Fisher. Department of the Interior. United States Reclamation Service. Report on San Carlos Project, Arizona. 1920. typewritten. p.254.

[57] U.S. Department of Interior. Indian Irrigation Service. Plans for Construction, Sacaton Dam and Bridge. C.R. Olberg. 1922. p. 8.

The construction camp was moved to a better location at the north side of the Gila River just to the northwest of the rock outcrop by the river bank. The structures from the existing camp were transported to the new site. Other buildings constructed included an office, mess building, two bunkhouses, twelve tent houses, a carpenter shop and machine shop. A water supply was installed and lighting was provided to all buildings. Most of this construction took place in the spring and summer of 1922 (see Photo No. AZ-50-D-33).

The project was buoyed by an additional appropriation of $300,000 secured in May of 1924. By October, 1924, considerable progress had indeed been made on the dam. Most of the sheet piling had been driven in place, the south embankment was almost finished; one third of the main weir section had been excavated, the talus or lower rock section of the main apron was virtually complete, most of the major equipment needed was on site, and the shop was set up and well supplied.[58] A quarry had been established at the north end of the dam and a large amount of rock had been extracted. No concrete had been poured yet and quite a bit of additional excavation was required. A change in supervision occurred at the beginning of October, 1924 when Olberg was detailed to Los Angeles to begin preparing plans for Coolidge Dam.[59] Almost all of the remainder of the construction was carried out under Earl Patterson.

Work proceeded as quickly as possible after that in anticipation of winter floods that fortunately never occurred. Excavation continued until completed. Twenty-two additional workers, all of them Navajos, were hired to help out. Their presence encouraged more Pimas and Papagos to join the work force. Pouring concrete was the next major task and by February 14, 1925, this had been accomplished for the dam proper. This was followed by pouring the highway bridge piers, deck, spans, railing and lamp posts. A reinforced concrete girder design was selected for the bridge over structural steel due to the higher material and maintenance costs of the latter.

The bridge design consists of the road deck supported by 25 concrete piers set 50 feet apart on center, making the total length 1250 feet.. The piers rest on their own independent foundations and not on the dam slab to prevent any cracking or settling. The width of the roadway is 18 feet, 4 inches and concrete guardrails with decorative panels protect either side of it. As the bridge neared completion in 1925, the Arizona Highway Department built a 3-span skewed concrete girder at its north end to span the San Tan Flood-water Canal. Another concrete bridge had been constructed at the south end of the dam to span the Pima-Sacaton Branch Canal. By June 30, 1925, all concrete work was completed and the dedication plaque for Sacaton dam and bridge

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[58] Department of the Interior. U.S. Indian Irrigation Service. Annual Report Fiscal Year 1925, District #4. Vol. 97, p. 80

[59] U.S. Department of Interior. Office of Indian Affairs. Annual Report Fiscal Year 1925, District #4. p. 77. There appears to be an error in the date given for Olberg's departure in the Annual Report. It is given as September 29, 1925 although the report was submitted prior to that in June, 1925.

bears that date (see Photo No. AZ-50-D-9). The inscription includes the following: "This structure was built largely with the efficient labor of the Pima and Papago Indians of Southern Arizona". Apparently, no great fanfare accompanied the dedication of Sacaton Dam- no front page newspaper articles heralded the event as with the earlier celebration at Ashurst-Hayden Dam.

Other work completed by the end of June included the dikes and levee at the south end of the dam. Only the installation of the gates and operating machinery was required to make the dam fully operational. These had been ordered but had not yet arrived. Between January and March, 1926, the gates were placed in position; only the operating machinery and hydraulic connections to the gates required installation. Due to delays in receiving some of the parts, completion was not accomplished until the fall. Water was diverted into the San Tan Flood-water Canal at the north side prior to completion of the sluice gates, but resulted in such large silt deposits that diversion was discontinued until completion.

A late addition to the project was a concrete transformer house, measuring 12-feet by 12-feet by 10-feet. It was constructed at the east end of the San Tan Flood-water Canal regulating gates to house the transformers used to transform the power for operating the gates and lighting the dam. It was completed in June 1927.[60] By that time, project construction had ballooned to a rather staggering $719,793.. Almost half of that amount ($346,200.) was attributed to the bridge, which was an experimental rather than standard BIA design and ended up costing far more than anticipated.[61]

Also experimental in design and entirely ineffective from the outset was the open channel built across the river to carry water from the Pima Lateral extension on the south side to the San Tan Flood-water canal on the north. Mud and debris quickly filled the channel and collected in the siphons. To take its place, a reinforced concrete conduit approximately 3 feet high and six feet wide with a capacity of 180 c.f.s was installed below the weir in the spring of 1928 (see Photos No. AZ-50-D-24, D-25, D-34).[62] It was projected that the use of the conduit would allow water to be carried across the river from the south side at the same time that surface flows were being diverted.

Even with the modifications to Sacaton Dam, it failed early on to serve its original function as a diversion structure for several reasons. With the completion of Coolidge Dam for storage, there was insufficient water for diversion in the river below that point. Furthermore, extensive water losses in the river bed due to seepage and the accumulation of large amounts of silt contributed

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[60] 1927 annual report. p. 93.

[61] Survey of Conditions of the Indians in the United States. Part 6. p. 2466.

[62] 1930's history. p. 8

to Sacaton Dam's ineffectiveness. Lastly, the crest of the dam was too low to divert water.[63] In the end, delivery of water to the north side of the river was accomplished through the conduit connected to Pima Lateral on the south.

Florence-Casa Grande or Main Canal and Florence-Casa Grande Extension

The primary canal of the project is the Florence-Casa Grande or Main Canal which serves non-Indian lands between Florence and the east boundary of the reservation as well as Indian lands through the Pima Lateral. The earth canal has its heading at the Ashurst-Hayden Dam and flows in a southwesterly direction for about 22 miles to its terminus on the east side of Picacho Reservoir. From there, water can be either diverted into Picacho Reservoir through a "Y" connection or can continue south and around the reservoir in the Florence-Casa Grande Extension canal which starts on the south line of S19, T6S, R9E and runs west for 5 miles towards Casa Grande. The Florence-Casa Grande Extension has a capacity of 328 second feet.

The origins of the Main Canal predate either the Florence-Casa Grande Project or SCIP. On April 8, 1911, a group of non-Indian settlers in the Florence-Casa Grande Valley formed the Casa Grande Water User's Association (CGWUA) with the stated purpose of irrigating and developing lands in the valley. They proposed to build a 25 mile long canal that would carry water diverted from the Gila River and irrigate a large tract of about 70,000 acres. The canal would parallel the existing Florence Canal and would serve the same lands as the earlier one was originally intended to. Funds to build the new canal were raised through the sale of stocks to homeseekers.

Construction of the Casa Grande Valley Canal, later called the Florence-Casa Grande Canal, was started in April, 1912 and by May, 1914 nine miles had been completed. On July 1, 1915, the CGWUA ran out of funds and was forced to abandon the project after finishing just 12 miles. Following passage of the Florence-Casa Grande Act in 1916, the BIA surveyed the partially completed Florence-Casa Grande Canal for inclusion in the project's distribution system. It was determined that improving and completing the canal and incorporating headgates at the Ashurst-Hayden Dam would serve the project well. On March 16, 1920 the government purchased the canal for $50,000.

Initial plans to concrete line the entire canal were scaled back to an earth-lined canal except for the drop into Picacho Reservoir and the turnout and control structures. Proposed features along the canal included a wasteway 800 feet below the dam, a sand sluice with 5 gates three miles below the dam, and six 54-foot span Howe truss bridges. At a distance of about 14.5 miles from

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[63] "Old Construction on the Gila River Indian Reservation From Reimbursable Funds, Showing Approximate Original Costs and Estimated Present Value to Project". No author. No date. Early 1930's ? p.9.

the head of the canal, a turnout for the Pima Lateral was planned.[64] Two other turnouts, one to the nearby Florence Canal, were also to be built (see Photos No. AZ-50-E-14 through E-18).

Construction by the government began in July, 1923. Progress is recorded in the Annual Reports of the U.S. Indian Service. In 1926, the canal and associated features had been completed as far as station 960 and partially finished to Picacho Reservoir (see Photos No. AZ-50-E-4 through E-9). By 1928, the canal reached from Ashurst-Hayden dam to its terminus at Picacho Reservoir (see Photos No. AZ-50-E-10 through E-13). Numerous concrete regulating and measuring structures, and automatic wasteways were built in conjunction with the canal (see Photos No. AZ-50-E-1 through E-3). The turnout at Picacho Reservoir incorporated radial gates as did the check structure across the Main Canal at the Pima Lateral heading. Originally, two of the gates were hand operated; two were controlled automatically by means of concrete counterweights (see Photos No. AZ-50-E-5 through E-8).[65]

A departure from standard BIA designs was used for the China Wash Flume located 2.6 miles from the head of the canal. The flume was constructed where the canal crosses a major drainage wash. Olberg developed final plans for the unique reinforced concrete structure which consists of 4 semi-circular flume barrels, each 12 feet in diameter, suspended from 5 rib arches (see Photos No. AZ-50-F-1 through F-7). The arches were reinforced with steel bars spaced at 1 foot intervals. Substantial footings constructed to support the flume reached 21 feet below the grade of the canal and were 2 feet thick.[66] As with the experimental features at Sacaton Dam, the cost ran high. Total expenditures for China Wash Flume, without overhead, amounted to $37,627.

The Florence-Casa Grande Extension was constructed between 1928 and 1930. It was tentatively laid out as early as 1920 to provide water to an additional 20,000 acres of non-Indian lands in the Casa Grande area. At the time, the canal was not recommended for inclusion in the project due to an inadequate water supply. With the increased availability created by Coolidge Dam storage, the extension became feasible. Plans and estimates for the new canal were submitted to the Commissioner of Indian Affairs for approval in June 1928. The total cost of $104,000 included surveys, excavation and the construction of highway bridges, culverts, turnout gates, and automatic spillways. As designed, the earth canal and its distributing system provided water for 22,488 acres in the Casa Grande District.

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[64] 1920 Fisher p. 260.

[65] U.S. Department of Interior. U.S. Indian Irrigation Service. Annual Report, Fiscal Year 1925. District #4, Vol. 97, p. 75.

[66] Department of the Interior. U.S. Indian Irrigation Service. Annual Report, Fiscal Year 1925. District #4. Vol. 97. p. 71-73. This reference includes information that Olberg completed final designs. A drawing of the China Wash Flume included with this report indicates Neuffer as the designer.

Florence Canal and Casa Grande Canal

The Florence Canal is one of the oldest features of SCIP, having been constructed between 1886-88. Originally built to divert water at the Gila River, the earth canal now takes out of the Main Canal at a point about 3.5 miles below Ashurst-Hayden Dam. From there it runs west and parallel to the Florence-Casa Grande Canal at a distance varying from 1/4 to 1/2 mile before terminating about one mile north of Picacho Reservoir (originally the canal ended at Picacho Reservoir). The Florence Canal turns water into a lateral system that irrigates non-Indian lands in the northeastern part of SCIP, known as the Florence-Coolidge District.

Beginning at Picacho Reservoir and extending west towards Casa Grande is the earth-lined Casa Grande Canal which conveys water to non-Indian lands in the Casa Grande District. This canal is only a short distance to the north of the Florence Casa Grande Extension. The two canals merge together about 5 miles southeast of Casa Grande.

The origins of the Florence Canal are tied to the Florence Canal & Land Company, which was organized in March, 1886. One of the incorporators was Mr. J.M. Hurley who that same month had acquired a water right to 100,000 miner's inches of Gila River water. Following its establishment, the company went through several name and ownership changes as it attempted to develop an irrigation canal serving non-Indian lands. In July 1886, the enterprise became the Florence Canal & Water Company. Beginning that year and continuing into the next, the Company spent $60,000 constructing the first ten miles of a canal starting at the point of diversion in the Gila River. The diversion structure was a rock and brush dam at the site of what later became the Ashurst-Hayden Dam (see Photo No. AZ-50-A-10).[67] The canal was 25 feet wide at the bottom, 30 feet wide on top, and had a capacity of 125 second feet. Unable to proceed due to a lack of additional funds, the Florence Canal & Water Company conveyed the partially finished canal to the Florence Canal Company on November 12, 1887. The latter organization had been formed on September 1, 1887. The company sold water rights at prices ranging from $3.00 to $15.00 an acre, each acre being covered by one share of stock and each share representing enough water to irrigate one acre. The new owners quickly moved forward with construction. By 1889, the 50 mile long Florence Canal was completed (see Photo No. AZ-50-Q-1). This included a distance of about 22 miles from the canal heading south to McClellan Wash where a reservoir was built behind an earthen dike. Known as Picacho Reservoir, it will be described in more detail below. From Picacho Reservoir, the canal was extended in a westerly direction towards Casa Grande. This portion of canal is called the Casa Grande Canal.

During the construction of the Florence Canal and for a few years thereafter, there was a great

[67] The presence of rock and brush debris from numerous dams at the site that had been washed out by floods made the foundation excavation and pile driving for Ashurst-Hayden more difficult than anticipated. Olberg, C.R. History of the Construction of Ashurst-Hayden Dam. March 1, 1922. p. 57.

influx of people into the area. Eager to profit from farming opportunities, optimistic settlers filed claims on 52,160 acres, of which 30,000 acres were desert entries. Title to much of the land was not perfected until many years later when the government took over the project. For several years the new canal was well maintained but due to lack of sufficient funds thereafter, the condition deteriorated. Disillusionment followed for many as the promised water failed to reach their lands due to silting of the canal. Another cause cited for the canal's decline was a reduction in the water supply due to an increase in irrigated acreage upstream near Safford.[68]

Due to a failure to pay off a bond, title to the canal and associated property was transferred from the Florence Canal Company to the Casa Grande Valley Company on December 19, 1894. The new organization, under the leadership of Oren B. Taft, Oren E. Taft, and Charles Hood, fared no better. Due to excessive costs to keep the canal silt-free, the Casa Grande Valley Company was not able to keep up with maintenance and was forced to sell its holdings for taxes on April 6, 1900. The property went through a number of complicated transactions thereafter including a transfer back to Frances E.Taft, wife of Oren B. Taft, in May, 1901. That same month, Oren B. Taft wrote a letter to convince the Commissioner of Indian Affairs to purchase the canal in order to deliver water to the neglected Pima Indians.[69] The government declined the unfavorable offer and the canal went through a series of additional transfers. It eventually came under the ownership of the San Carlos Canal and Irrigation Company in July 1914. At about that time, the canal irrigated only 3,531 acres. The maximum area that had received water under the Florence Canal was about 7,000 acres. Much of the once cultivated land had reverted back to its desert state. In the 1914 Army engineers report the canal was described as "faulty in alignment and grade, and to correct and enlarge it would cost more than to make a new canal".[70]

Despite the government's initial refusal to purchase the canal, it was later taken over for inclusion in the San Carlos Project. Intitially, plans were to abandon the Florence Canal above Picacho Reservoir as it was considered too close to the Florence-Casa Grande Canal to be of any value. The Casa Grande Canal was to remain operable and would serve about 46,000 acres.[71]

As the project evolved, the upper portion of the Florence Canal was incorporated into the project. With the construction of Ashurst-Hayden Dam, the canal heading was moved from the Gila River to a reinforced concrete turnout in the Florence-Casa Grande Canal about 2.5 miles from Ashurst-

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[68] U.S. Congress. House. Report to the Secretary of War of a Board of Engineering Officers, U.S. Army.. 63rd Congress, 2nd Session. 1914. p. 48.

[69] See Intracaso, HAER document, page 32.

[70] U.S. Congress. House. Report to the Secretary of War of a Board of Engineering Officers, U.S. Army... 63rd Congress, 2nd Session. 1914. p. 48

[71] Fisher, C.C. Report on San Carlos Project. 1920. p. 263.

Hayden Dam (border of S11 and 14, R10E, T4S). This had been completed by 1926. Both the Florence and Florence-Casa Grande Canals were improved and enlarged by the government and provided with concrete control and turnout structures. In addition, several cross-cut canals were built carrying water from the Main Canal to the Florence Canal, and from the Casa Grande Extension to the Casa Grande Canal. This water was then delivered into the lateral system serving the Florence-Coolidge and Casa Grande Districts. Lands lying between the two parallel canals were not included in the irrigation project so that the Florence Canal and Casa Grande Canal in effect formed the project boundaries in that area.

Picacho Reservoir

Picacho Reservoir is an off-stream reservoir formed by an earthen embankment along the north, south, and west sides. Originally used to store and regulate water supplied from the Florence Canal, the Main Canal, and desert runoff, the reservoir now serves as a control structure for only the latter two sources. The reservoir is located about 21.5 miles below Ashurst-Hayden Diversion Dam and originally was the terminus of the Florence Canal. Water enters the reservoir at the northeast corner through a three-bay turnout from the Florence-Casa Grande Canal.

As mentioned above, Picacho Reservoir was constructed by the Florence Canal Company between 1889-90 as a storage and regulating structure for the Florence Canal (see Photo No. AZ-50-G-2). The reservoir was built at a cost of $125,000 and was paid for through a bond issue.[72] It is presumed that the services of an engineer were employed for the design and construction supervision of the project.

The reservoir was formed by building an 8,000-foot long earth dam or dike across McClellan Wash. Covering an area of 1800 acres, the reservoir had a capacity of about 15,000 acre feet. A spillway was not included in the original design. As with the Florence Canal, ownership of the reservoir was plagued by legal and financial difficulties. Following formation of the Florence-Casa Grande Project, the government included Picacho Reservoir in its plans for an irrigation system. The reservoir was considered valuable in that it would act as an equalizer for the Florence Canal by providing a steady head and would function to a limited degree as a wasteway for the Main Canal. The reservoir's use as a storage facility was deemed less significant due to silt accumulation.

Takeover of Picacho Reservoir by the government occurred in 1928. A break in the dam in 1931 precipitated repairs and improvements to the structure (see Photo No. AZ-50-G-3). A 100-foot wide concrete spillway was added to the west side and the earthen embankment was strengthened. As completed, water entered the reservoir from the Florence Canal in T6S, R8E, S25 and through the "Y" connection from the Main Canal. Floodwaters from the desert also drained into the reservoir through six spillway structures incorporated into the Main Canal along the east side of

[72] 1914 War Report. p. 19. Excerpt from Schuyler Report which is reprinted therein.

the reservoir. The reservoir included a concrete outlet structure to discharge water into the Casa Grande Canal. The reservoir measured about 3 miles long north and south by 1.5 miles east and west.[73]

Silting up of the reservoir caused problems from the start. By 1932, the capacity of the reservoir was reduced to 8,000 acre feet. By 1944, that figure had dropped by half to 4,000 acre feet. The reservoir site was largely covered by willows and tules.[74]

Pima Lateral

Pima Lateral is the principal lateral of SCIP and serves both Indian and non-Indian lands. It provides water to property in the vicinity of Coolidge and is the principal source of water delivery to the Gila River Indian Reservation. The Pima Lateral starts at a turnout on the Main Canal in S8, T5S, R9E and runs west for the first few miles and then in a northwesterly direction for the remainder of its approximate 23 mile length. The lateral ends at Sacaton Dam where it delivers water to the north side Santan Flood-water Canal through the dam conduit. The last mile of canal between the Little Gila Canal (often referred to as Casa Blanca) heading and Sacaton Dam is sometimes referred to as the Pima-Sacaton Branch Canal. Pima Lateral was designed with a capacity of 750 cfs. at the start, reducing to 600 cfs. at the reservation line (see Photos No. AZ-50-H-1 through H-11).

Construction of Pima Lateral began in 1925. At the head of the canal, a concrete turnout incorporating six 4-foot by 4-foot cast iron slide gates with pedestal-type lifts was constructed (see Photo No. AZ-50-E-16, H-16). The first three miles of the canal were concrete-lined; intitial studies suggested lining the entire lateral[75]. By July 1926, Pima Lateral had been completed as far as the heading of the Blackwater Lateral. By March 1927, construction had reached the heading of the Sacaton Flats Lateral.[76] A concrete conduit was then constructed to carry Pima Lateral under McClellan Wash. The conduit consisted of two barrels, each measuring 5 feet by 5 feet. In 1928, the Pima Lateral was finished including a division gate at the end that directed water either into the Little Gila Canal to the west or into the Pima-Sacaton Branch leading up to Sacaton Dam. Numerous structures including turnouts, check-drop structures, and bridges were constructed in association with the lateral (see Photos No. AZ-50-H-12 through H-15). At Station 1088+ 86, just south of the heading to the Little Gila Canal, a siphon was built (see Figure 5). Due to the large amounts of seepage in the Gila River above Sacaton Dam, and the

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[73] 1944 Economic Report. p.70

[74] June 5, 1943 report from C.J. Moody

[75] Fisher, C.C. Volume I, p. 258.

[76] U.S. Indian Service, 1931 Annual Report. p. 101

ineffectiveness of that diversion structure, Pima Lateral assumed the role of primary distributor of water to Indian lands.

North Side Canal

The North Side Canal delivers water to both Indian and non-Indian lands on the north side of the Gila River. The earth canal has its heading in the Main Canal in T4S, R10E, S15 and crosses under the Gila River opposite its point of diversion by means of a concrete pipe siphon 36 inches in diameter and 1,700 feet long. The high line canal travels in a westerly direction roughly parallel to the Gila River to the east edge of the reservation and then continues for about another four miles in a northwesterly direction. Total length of the canal is about 19 miles and the recorded design capacity is 80 cfs.

As originally laid out by the BIA, the North Side Canal extended from a heading at Ashurst-Hayden Dam to the east line of the Reservation. The canal was intended to irrigate a total of 4,300 acres, and to replace at least two older ditches. It was designed to carry 60 cfs. Water for the canal was to be delivered through the conduit built into the length of the dam. Construction of the canal, starting at the dam, was commenced during Fiscal Year 1924 but was halted after about the first mile and a half. Priorities had shifted to work on the south side of the Gila and, apparently, north side lands had suffered some damage as a result of operating Ashurst-Hayden Dam.[77]

Some time prior to 1927, the decision was made to switch the heading of the North Side Canal from Ashurst-Hayden Dam to a point on the Florence Canal about 1.5 miles downstream from its original diversion from the Main Canal. This change necessitated the design of a siphon to carry the water under the Gila River (see Figure 6).[78] By 1929, 14 miles of canal had been completed including the Gila River siphon. A year later, the entire canal was finished. From comparing maps it appears that the portion of the North Side Canal inside the reservation was located along an earlier ditch known as the Cholla Mountain Ditch. This ditch has been given a construction date of around 1866.[79]

When the heading for the Florence Canal was later moved south to its present location on the Main Canal, the heading for the North Side Canal was apparently relocated to the Main Canal. Incorporated into the North Side Canal are numerous checks, drops, weirs, culverts, bridges, and

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[77] Letter from Herbert Clotts, Supervising Engineer, to Commissioner of Indian Affairs, Washington, D.C. Nov. 18, 1925.

[78] While Figure 6 shows the proposed pipeline beginning at the Main (Casa Grande) Canal, later project maps indicate the heading of the siphon on the Florence Canal.

[79] 66th Congress. p. 129.

cross drainage structures (see Figure 7, Photos No. AZ-50-I-1 through 1-13).

San Tan Flood-water Canal

The San Tan Flood-water Canal originates at the north end of Sacaton Dam and serves the project Indian lands in the San Tan District on the north side of the Gila River. The earth canal runs in a northwesterly direction for about 16 miles, ending in T3S, R5E, S6 near the north boundary of the reservation (See Photos No. AZ-50-J-1 through J-7).

As described in Chapter III, Review of Project Beginnings, the San Tan Flood-water Canal was constructed by the Reclamation Service as part of an irrigation project designed to serve about 10,000 acres on the north side of the Gila River. Known as the Sacaton Project, it involved the construction of the San Tan Flood-water Canal and a line of wells and pumping plants connected by a ditch. The pumps were intended to supplement the canal water supply during the low-water season. The well ditch was located parallel to and just to the south of the Flood-water canal. The ditch was joined to the flood canal at its upper end.

Work on the project started April 20, 1908 with the drilling of the first well. By January 15, 1909, eight of ten proposed wells were in place. Survey work and initial placement of the Flood-water Canal was begun in May 1909, and construction started in October of that year. By 1911, the Reclamation Service had completed 9 miles of the Flood-water Canal and Well Ditch. Numerous turnouts, drops and bridges as well as a substantial concrete heading for the canal in the Gila River had also been constructed. The lack of a distribution system made the canal and wells ineffective.[80]

Work by the Reclamation Service was halted following complaints by the Pimas about the high cost of the project and the detrimental alkali levels in the pumped water. The canal was also ineffective because there was no weir across the river to raise the water level high enough for diversion. In March 1913, the BIA resumed construction on the project. The Flood-water Canal was cleaned and repaired, and a distribution and drainage system was built.[81] A ninth well was also drilled. In addition, a brush diversion dam was constructed to divert the flow of the Gila into the canal. By 1914, 10 miles of Flood-water Canal and Well Ditch had been completed. The Flood-water Canal had a bottom width of 26 feet, a water depth of 4 feet, and a design capacity of 300 second feet.

Even with these modifications, the anticipated benefits of the Sacaton Project to the Indians did

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[80] U.S. Department of Interior. Indian Irrigation Service. Annual Report, Southern California and Arizona Reservations, 1915. p. 39. See also C.R. Olberg. Revised Report on Proposed Sacaton Diversion Dam and Bridge. p.4.

[81] History, Gila River Reservation, San Carlos Irrigation Project. , ca. 1938, p. 4.

not materialize. They objected to using the Flood-water Canal, preferring their old system of ditches. The insubstantial diversion works did not function effectively therefore limiting the usefulness of the canal. The only dependable water source were the wells, which irrigated about 5,000 acres of land. The water, however, was somewhat alkaline.

With the completion of Sacaton Dam, water was diverted into the San Tan Flood-water canal from the heading at the north end of the dam. In order for this to be feasible, the canal had to be deepened to conform to the grade of the dam. This was completed in March, 1926. On April 3, 1926, water was turned into the Flood-water Canal at the dam for the first time. Because of the extensive silting and other problems associated with Sacaton Dam, water deliveries to the San Tan Flood-water Canal became fully operational only after completion of the conduit through the dam in 1928. Thereafter, the original river control gates for the canal were abandoned.[82]

San Tan Indian Canal

The San Tan Indian Canal, like the Florence Canal, predates SCIP and was later incorporated into the project. The earth canal heads in the San Tan Flood-water Canal at a point about 1.5 miles from the latter's heading at Sacaton Dam, and terminates just north of the river in S21, T3S, R5E (see Photos No. AZ-50-K-1 through K-4).

The origins of the San Tan Indian Canal are associated with Reverend Cook, the first missionary among the Pimas. In 1871, he established a school for the Indians about 2 miles west of Sacaton.[83] In 1877, he conducted a survey for a ditch on the north side of the river and immediately thereafter construction started on the San Tan Indian Canal. The project took six years to complete. When finished, the canal had its heading in the Gila River in T4S, R6E, S11. The Indian Canal originally had a bottom width of 9 feet near its heading, gradually tapering down to 5 feet near the lower end. By 1914, the canal provided water for 3,319 acres, had been widened to 10 feet at the bottom, and had a capacity of 75 second-feet.[84] The recently completed San Tan Flood-water Canal and Well Ditch ran generally parallel to and about one mile north of the Indian Canal. The heading of the Flood-water Canal at the Gila River was just above the heading of the Indian Canal. A lateral connecting the Flood-water Canal to the Indian Canal supplied the latter with flood waters.

Sometime after construction of Sacaton Dam and apparently prior to 1944, the heading of the San

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[82] "Old Construction on the Gila River Indian Reservation From Reimbursable Funds, Showing Approximate Original Costs and Estimated Present Value to Project." NA, Ca. 1930? p.2.

[83] U.S.Congress. House of Representatives. Hearings Before the Committee on Indian Affairs, Sixty-Sixth Congress, First Session on the Condition of Various Tribes of Indians. p. 123.

[84] Ibid. p. 134.

Tan Indian Canal was moved from the Gila River to its present location on the San Tan Floodwater Canal.[85]

Casa Blanca Canal

The Casa Blanca Canal originates at the Pima Lateral about one mile south of Sacaton Dam in T4S, R6E, S24. This earth-lined canal extends northwest through Sacaton, serving the Casa Blanca District of the Reservation, and ends in S22, T4S, R4E (see Photos No. AZ-50-L-1 through L-8).

The history of the Casa Blanca Canal is closely tied to that of the earlier Little Gila Canal. In fact, the Casa Blanca Canal is actually an extension of the Little Gila Canal, and early (and some later) SCIP maps show the first six miles of the Casa Blanca as the Little Gila Canal.

The Little Gila Canal had its origins in the Little Gila River, a feature that no longer exists as such. The latter channel, south of and roughly paralleling the Gila River, had a heading in the River near the eastern boundary of the Reservation. Although referred to as the Little Gila River, it was presumed to be manmade. The date of original construction is unknown although it was believed to be an "ancient irrigation canal, enlarged by floods".[86] Prior to the development of the Florence-Casa Grande and San Carlos Irrigation Projects, the Little Gila served as a main canal for Indian lands on the south side of the river. During major floods that occurred in 1905, the heading of the Little Gila River was completely washed away and the first mile or so of canal was filled with silt. It remained that way until 1913 when the Indian Irrigation Division reopened the canal and constructed a timber headgate under what was known as the Little Gila Project.[87] At the same time, the BIA also had to change the alignment of an earlier Indian ditch referred to by different names which started about 1 mile east of the reservation line above the head of the Little Gila River. This ditch, which ran in a westerly direction for about 7 miles, served lands lying between the Little Gila and main river. A timber flume was constructed in 1913 to carry the Indian ditch over the newly reopened Little Gila.[88] By the next year, the Indian

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[85] Report on Economic Conditions, 1944 describes the relocated canal heading.

[86] 1914 War Report. p. 47

[87] Department of the Interior. United States Indian Irrigation Service. Annual Report 1913. p. 20.

[88] The project encompassing lands irrigated from ditches which headed in the Gila River above the heading of the Little Gila was called the Blackwater Project. The heading of the ditches changed with various flood events making it difficult to verify their locations. The names are also referred to differently--in the Annual Reports, an Upper and Lower Indian ditch are referred to under the Blackwater Project. In the Hearings Before the Committee on Indian Affairs, Sixty-Sixth Congress, the ditch carrying the flume was referred to as the Island Ditch. A 1914 Gila River Survey map prepared by the U.S. Indian Irrigation Service shows the "New Indian" Ditch crossing the Little Gila River in a flume. Apparently,

Service Annual Report noted that 2,638 acres of land were being cultivated under the Little Gila Canal.

At the conclusion of the Little Gila Project, the BIA began work on the Casa Blanca Canal under the Casa Blanca Project. The latter was designed to irrigate about 35,000 acres of Indian lands, west of Sacaton and south of the Gila River. Some of these lands were already under irrigation by a number of older canals. The heading for the Casa Blanca Canal was installed at the lower end of the Little Gila Canal in T4S, R5E, S12. By the end of 1914, about 3.5 miles of the canal, with a bottom width of 14 feet, had been constructed. During the following year, a number of laterals were developed and a number of concrete structures were built. The primary lateral of the project was designated Casa Blanca Lateral No. 2 and was completed sometime prior to 1918.

Floods in 1914 and 1915 destroyed the headworks and upper end of the Little Gila Canal and also damaged the headgates and banks of the Casa Blanca Canal. Some repairs were done to the Little Gila but it was never restored to full use. With the completion of the new delivery system to Indian lands under SCIP, the only part of the original Little Gila that appears to remain is that which forms the initial segment of the Casa Blanca Canal.

Following the 1915 floods, reconstruction was started of the damaged Casa Blanca Canal. Apparently, repairs were never completed and the canal fell into disuse in 1918 and remained that way until construction of the Pima Lateral in the mid 1920's.[89] At that time, the Casa Blanca Canal was cleaned out and the breaks in the banks were repaired. A heading installed in Pima Lateral one mile below Sacaton Dam diverted water into the remains of the Little Gila Canal. Approximately six miles to the west, at the official beginning of the Casa Blanca Canal, a large concrete flume and canal heading were constructed. Photographs taken in April, 1928, show the completed structure (see Photos No. AZ-50-L-9, L-10). Casa Blanca Lateral No. 2, which had also been abandoned in 1918, was cleaned out and repaired. The 1928 Annual Report of the U.S. Indian Service relayed that water from the Casa Blanca Canal, and Casa Blanca Lateral No. 2 had reached all of the cultivated lands in the Casa Blanca District.[90]

Lateral System

The above completes the description of the original principal irrigation features of SCIP. In addition to the main canals of the project, an extensive lateral system was also planned and developed. Some of the laterals included in the system pre-dated SCIP, the rest were laid out

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the original wood flume was washed out during 1914 flooding and a replacement metal flume was constructed 3,000 feet below the old timber one.

[89] Survey of Conditions of the Indians in the United States. Part 6. p. 2448.

[90] Deparment of the Interior. U.S. Indian Irrigation Service. Annual Report, Fiscal Year 1928. p. 63.

and constructed as part of the project.

Among the pre-SCIP laterals is the Agency Canal, which later apparently became known as Lateral No. 16-8 and is now called the Progressive Ditch. This feature was constructed by the BIA in 1914 under what was called the Agency Project. The Agency Canal and a number of laterals were built to irrigate a strip of land comprising about 2,000 acres between the Little Gila and the main river. Construction included numerous checks, turnouts, wagon bridges, culverts, and foot bridges. Water for the Agency Canal was diverted from the Little Gila about two miles east of Sacaton (see Photo No. AZ-50-N-1).

Another lateral that appears to pre-date SCIP is the Sacaton Flats Lateral, serving the reservation lands close to the south side of the river east of Sacaton Dam. Not much is known about the construction, but in 1915 the BIA initiated the Sacaton Flats Project to reconstruct the Sacaton Flats Canal which had been damaged during flooding.[91] A 1914 Gila River Survey map prepared by the Indian Irrigation Service shows the Sacaton Flats Canal with a heading at a brush diversion dam in the Little Gila River in T5S, R7E, and S21.[92] It appears that this canal was later modified under SCIP to receive water from the Pima Lateral and renamed Sacaton Flats Lateral. The 1927 Annual Report of the Indian Irrigation Service describes construction and completion of the lateral that year. The starting point for the lateral is given at Station 881-75 of the Pima Lateral. Lands watered by the Sacaton Flats Lateral were in the Sacaton Flats and Cottonwood Flats districts. The lateral was renamed Lateral 7-22 at the Pima Lateral takeout and continues into what is now the North Ditch. From there the Sacaton Flats Lateral appears to continue in what is now the Middle Ditch (see Photo No. AZ-50-O-1).

Development of the Florence-Casa Grande Project following passage of the May 18, 1916 Act included a system of laterals. Plans formulated by the Indian Irrigation Service established an unlined lateral system, to be constructed to each farm unit. Passage of the San Carlos Act provided further impetus for developing the system. Construction of Pima Lateral provided water to existing ditches as well as enabled the development of new ones. Blackwater Lateral was completed from its turnout at Pima Lateral to the east end of the reservation in 1926. This lateral provided water to Indian lands in the Blackwater district and also served a few hundred acres of non-Indian lands (see Photo No. AZ-50-P-1). By the late 1930's, the lateral distribution system consisted of about 500 miles of open ditches of varying capacities, and approximately 60 miles of buried concrete pipelines.

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[91] History, Gila River Reservation, San Carlos Irrigation Project. No author, ca. 1938, p.4.

[92] Department of the Interior. U.S. Indian Service. Irrigation. "Gila River Survey." Plane Table Topographic Survey Showing Lands under Ditches Taking Water From Gila River. Surveyed Feb-Mar. 1914. Sheet #4. Map located in Gila River Indian Community files.

Project Headquarters

The development and maintenance of an irrigation system the size and complexity of the San Carlos Project required the ongoing presence of supervisory and maintenance staff. Temporary construction camps had been erected in association with various project features such as the two diversion dams. In 1924, project headquarters were moved from a tent camp near China Wash Flume on the Main Canal to a rented building in Florence. During Fiscal Year 1931, the BIA constructed their own project headquarters in Coolidge (See Figure 8, Photo No. AZ-50-S-1). The complex included a one story brick office building measuring 40 feet wide by 80 feet long, a storehouse and a garage. Originally occupied by both San Carlos Irrigation Project and San Carlos Irrigation and Drainage District staff, the office building is still in use today by SCIP. In addition to the headquarters, permanent project facilities were also constructed in Olberg, in the vicinity of Sacaton Dam. These consisted of machine shops, a garage for repair of motor vehicles, and housing for a number of employees.

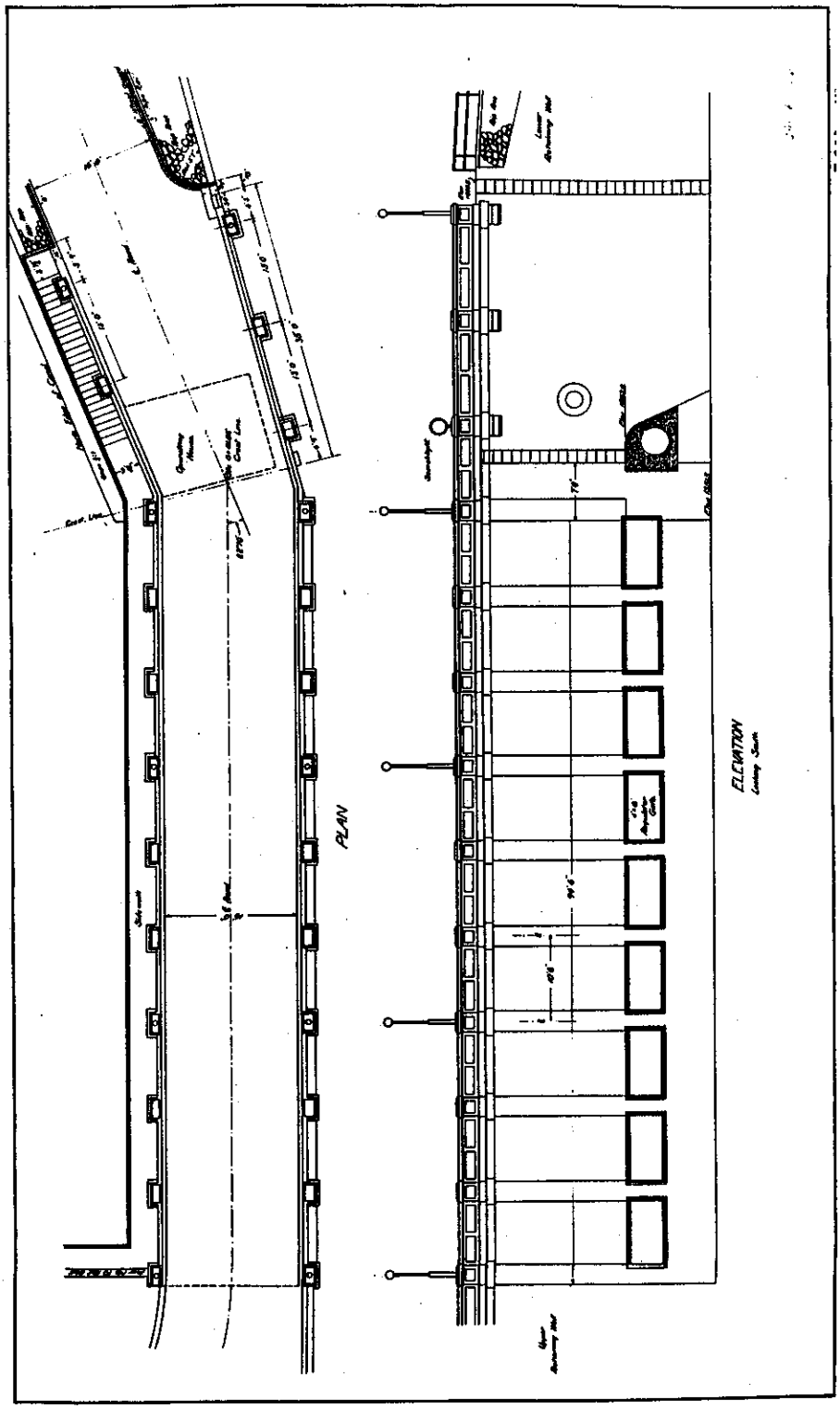

Figure 3

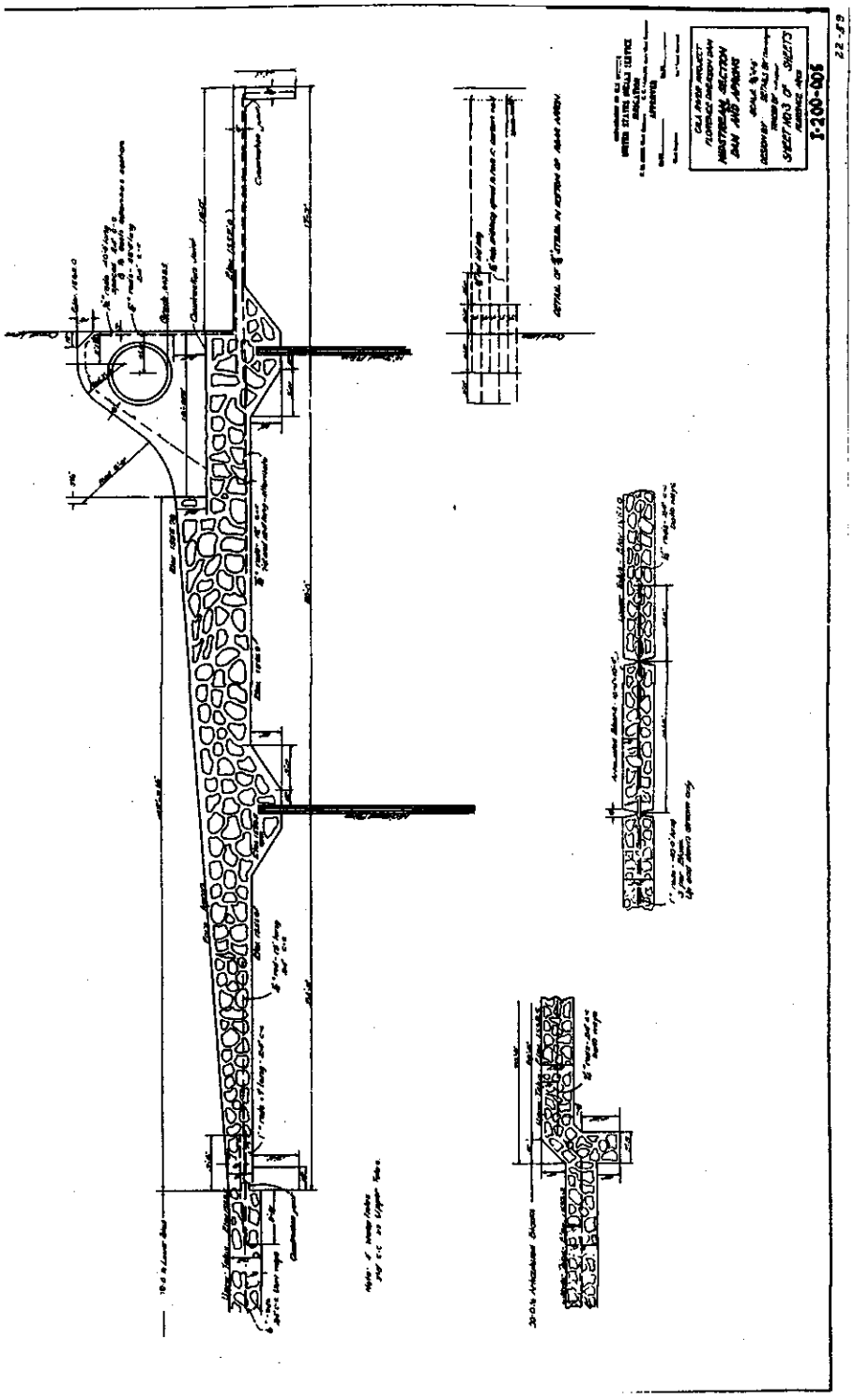

Figure 4

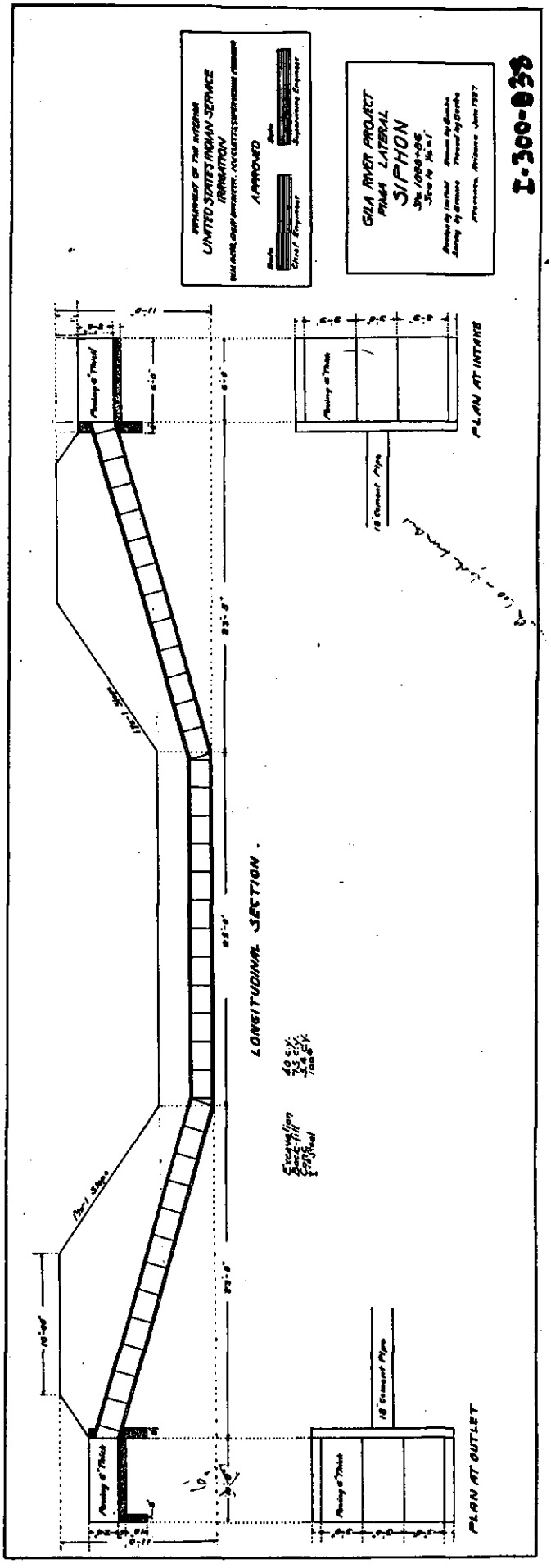
UNITED STATES INDIAN SERVICE
IRRIGATION
APPROVED
GILA RIVER PROJECT
PIMA LATERAL
SIPHON
I-300-038
LONGITUDINAL SECTION
PLAN AT INTAKE
PLAN AT OUTLET
18" Cement Pipe

Figure 5

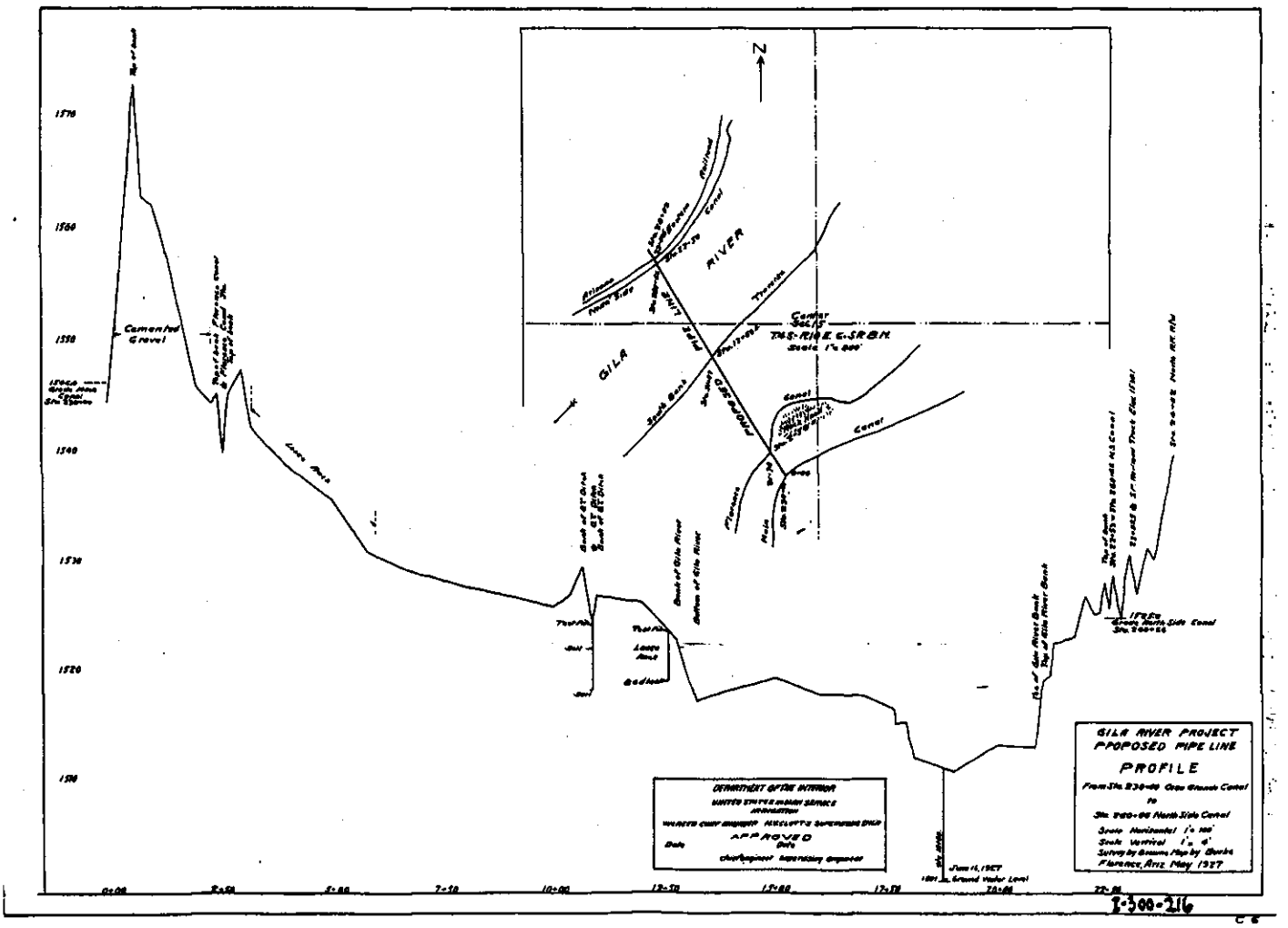
GILA RIVER PROJECT
PROPOSED PIPE LINE
PROFILE
RIVER
GILA
Cemented Gravel
Canal
Railroad
Ground Water Level
I-300-216

Figure 6

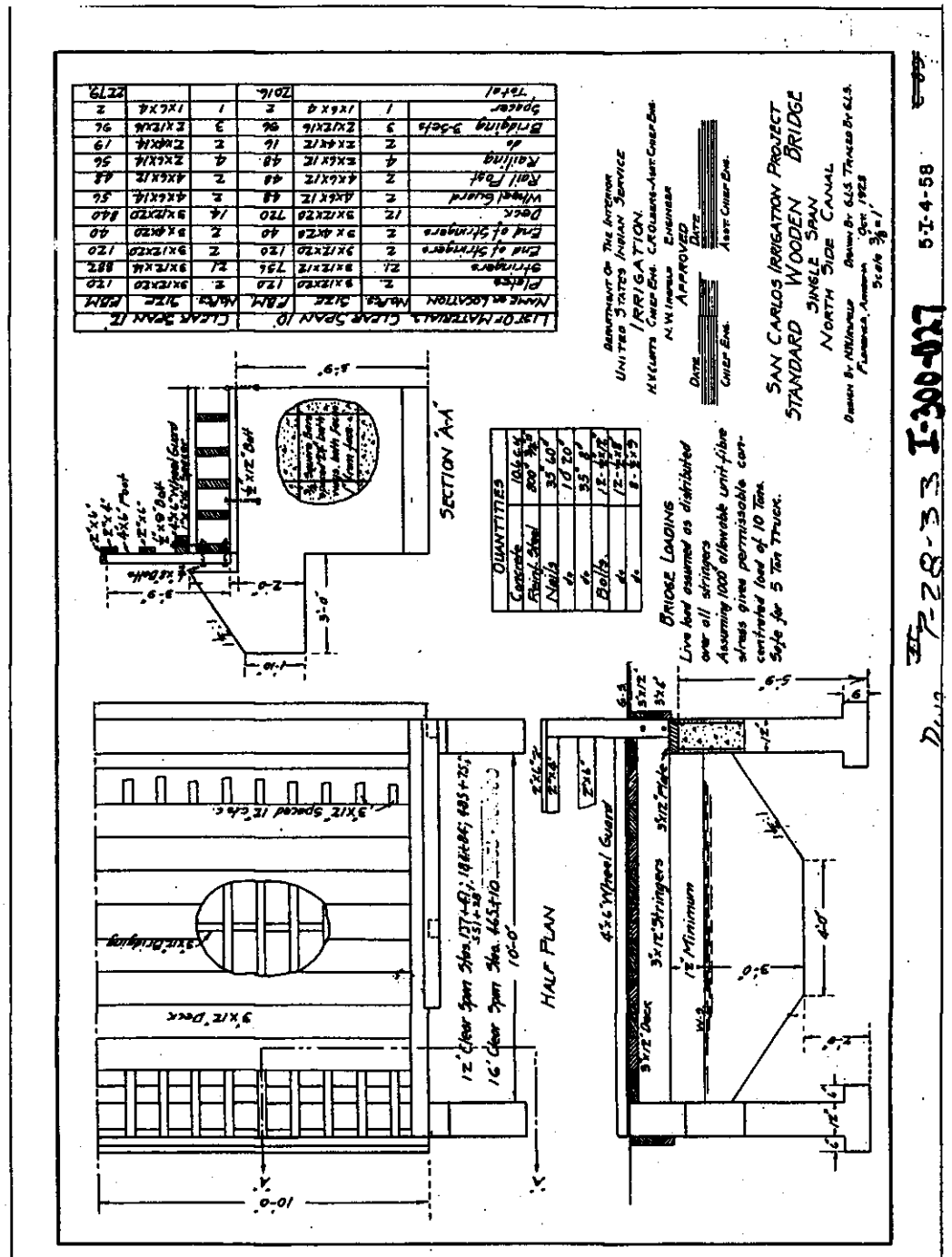
SAN CARLOS IRRIGATION PROJECT
STANDARD WOODEN BRIDGE
SINGLE SPAN
NORTH SIDE CANAL
UNITED STATES INDIAN SERVICE
IRRIGATION
BRIDGE LOADING
Live load assumed as distributed over all stringers
Assuming 1000 elbrecht unit-fibre stress gives permissable concentrated load of 10 Ton.
Safe for 5 Ton Truck.
QUANTITIES
SECTION "A-A"
HALF PLAN
9"x12" Deck
3"x12" Stringers
4"x6" Wheel Guard
5-I-4-58
I-300-037
F-28-33

Figure 7

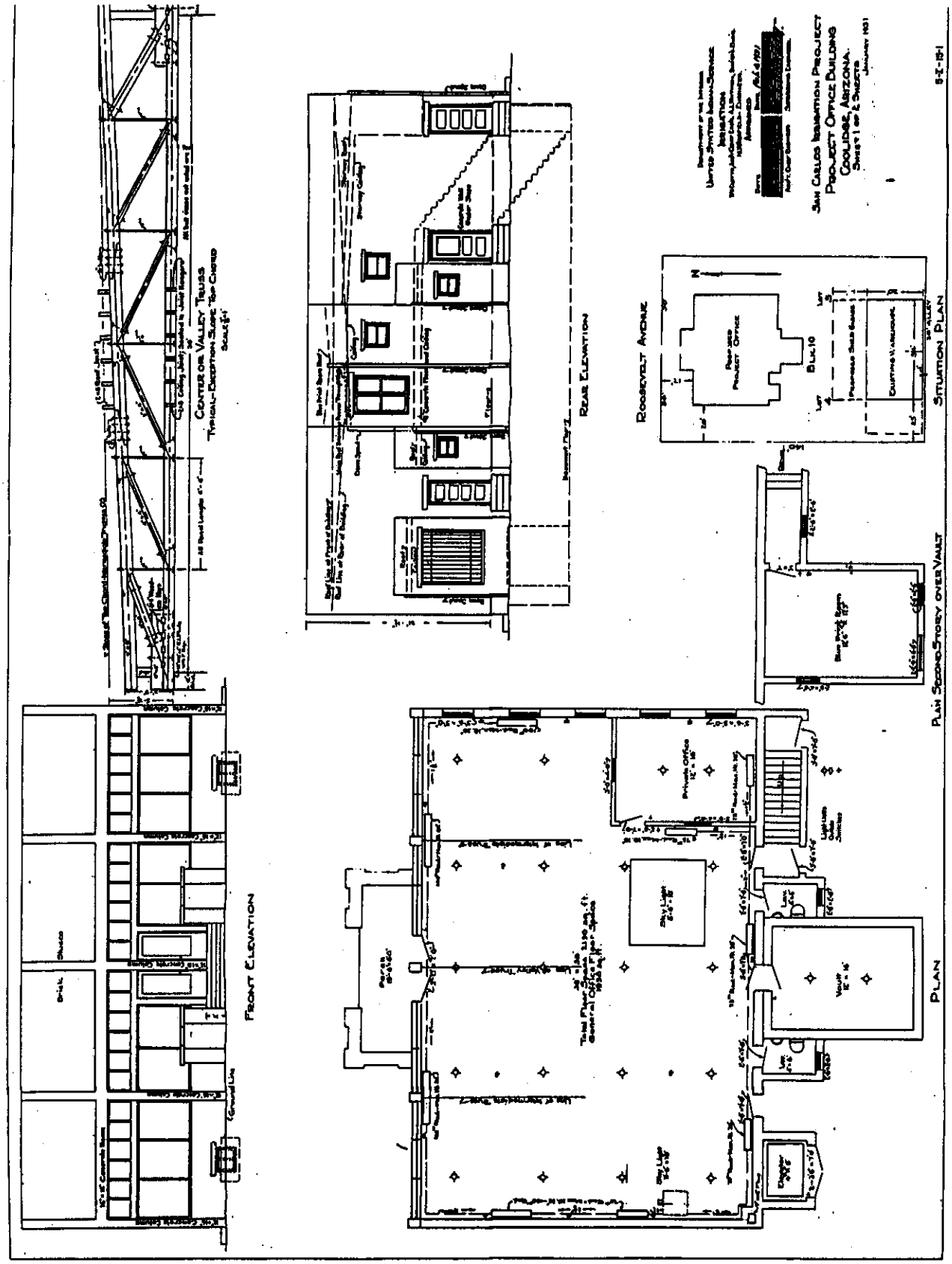
Center or Valley Truss
Typical-Deception Slope Top Chord
Scale 1/4"
Front Elevation
Rear Elevation
Roosevelt Avenue
Bldg. 10
Present Project Office
Situation Plan
Plan Second Story over Vault
Plan
San Carlos Irrigation Project
Project Office Building
Coolidge, Arizona.
Sheet 1 of 2 Sheets.
January 1931

Figure 8

V. EARLY ADDITIONS TO THE SAN CARLOS IRRIGATION PROJECT

Power Development

The Act of March 7, 1928, which authorized the merger of the Florence-Casa Grande and San Carlos Projects also authorized the development of hydropower at Coolidge Dam. Congress approved the expenditure of $350,000 for this purpose, to which was added $62,500 under the Act of March 4, 1929, (Stat.45, 1607) and $87,500 under the Act of March 26, 1930 (Stat. 46, 90). The 1928 Act specified that power generated was for the use of the Apache Indians on the San Carlos Reservation. The Secretary of the Interior was authorized to sell surplus power developed at Coolidge Dam "in such manner and upon such terms and for such prices as he shall think best". Circumstances surrounding the compensation of the Apache Indians for damages caused by construction of Coolidge Dam, and the design and development of the Coolidge Dam Powerhouse, are described in David Introcaso's HAER report on Coolidge Dam.

The Coolidge Dam hydro-electric plant went into service in October, 1929. For the first five years all of the power generated was sold, the principal purchaser being the Nevada Consolidated Copper Corporation at Hayden, Arizona[93]. In addition to the transmission line built from the dam to Hayden, lines were constructed to the San Carlos Indian Agency at Rice, from Hayden to Mammoth, and from Casa Grande to the Papago Indian Reservation.[94] The installation of groundwater pumps as part of SCIP in 1934 created a need for additional power which the Coolidge plant was not capable of supplying. A drought that year made it clear that the facility at the dam was not a dependable source of energy. Low water levels were used first to meet irrigation needs leaving little available for electric power. In 1935, a diesel-electric power plant was constructed just outside of Coolidge to supply additional power (See Figure 9, Photo No. AZ-50-R-1). In addition to the diesel plant, the facility included an automotive shop, equipment shop, numerous maintenance buildings and garages, as well as two residences. Power was generated from two 1,300 horsepower engines. A third 2,700 horsepower unit was added in 1939 at which time the diesel plant was enlarged.

By the late 1930's the foundation of the Project's power system had been completed. In addition to the two power plants, a diesel plant at the Christmas Copper Corporation in Christmas, Arizona, provided energy when needed by the project. Transformer stations at Coolidge Dam, Hayden, Christmas, Florence, Coolidge, Arizola, Sacaton, Casa Grande, and Schultz delivered power to distribution lines serving area domestic and municipal needs, commercial enterprises and project pumps. In addition, many small sub-stations had been built to assist in the delivery of power. Almost 300 miles of transmission lines, 120 miles of which were 11,950 voltage, carried

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[93] Department of the Interior. Office of Indian Affairs. Report on Economic Conditions Existing on the San Carlos Irrigation Project and the Gila River Indian Reservation, Arizona. May, 1944. p. 71.

[94] Intracaso, David. Coolidge Dam HAER Report p.87.

power. A majority of the lines were on wooden poles; a 20 mile, high voltage line from Coolidge Dam to the transformer station at Hayden was on steel towers. An additional 140 miles of low voltage distribution lines were constructed by the San Carlos Irrigation and Drainage District as sponsors for an Rural Electrification Adminstration project. Power carried through these lines was delivered to project farming communities.[95]

Revenues from the sale of power were used to operate and maintain the power system and to repay its construction costs. Power furnished to operate the project groundwater pumps and for power and lighting in project shops and offices was provided without charge against the irrigation system.[96] Abnormally low water levels in San Carlos Reservoir throughout the late 1930's greatly reduced the ability to generate power at the Coolidge power plant. The demand for electrical energy for project and other uses exceeded the project's available supply. Some additional power was obtained from the Coolidge diesel plant and the remainder was purchased from private plants when obtainable. The cost to the project was great and other sources of power were explored. In 1942, the project purchased the Christmas Copper Corporation's small generating station at Christmas and a year later, the project began buying power generated at the Bureau of Reclamation's Parker Dam. This involved constructing a line from the end of the Parker line near Phoenix to the project area.

Construction of Southside Canal and Stormwater Channel

Early on in the development of Indian lands under SCIP, it became apparent that a portion of the acreage was non-irrigable due to excessive alkali and other unfavorable soil conditions. As was the case with numerous early Indian irrigation projects, there had been inadequate investigations of soil and drainage conditions prior to project construction.[97] In April 1931, a preliminary soil study of Reservation lands served by project canals was conducted by A.T. Strahorn, Bureau of Chemistry and Soils, U.S. Department of Agriculture. A more in-depth analysis was begun by the same individual in November 1931 and presented in a report entitled "Irrigable Area Classification, Gila River Indian Reservation, Arizona, 1932". Of the 51,404 acres of Indian lands within the original project boundaries (of which 50,000 were to be irrigated), less than half were actually suitable. Mr. Strahorn classified 23,424 acres as irrigable; the remainder were either temporarily irrigable, temporarily nonirrigable or permanently nonirrigable. Lands lying adjacent to the project were also examined and it was found that of the 106,142 surveyed, 32,995 were irrigable. As a result of this study, a plan was proposed to revise the distribution system

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[95] History, Gila River Reservation, San Carlos Irrigation Project. p. 13-15.

[96] Letter to Mr. Walter E. Packard from C.J. Moody, Project Engineer, Coolidge, Arizona, December 26, 1939.

[97] Survey of Conditions of the Indians in the United States. 71st Congress, 2nd Session. Part 6. January 21, 1930. p.2222.

to include some of the adjacent irrigable lands. It was recommended that the most desirable expansion area was the Southside where 19,000 acres could be irrigated.[98] The remaining lands recommended for development were along the river-bottom within the project boundaries.

The estimated cost for the proposed gravity canal and lateral system to irrigate the Southside area was $758,000. Construction was carried out in 1934 and 1935. The takeout for the new canal was in the Pima Lateral about 3 miles west of Coolidge. A 5,600-foot long, 84-inch diameter concrete siphon was built to carry water from the canal heading at Pima Lateral across McClellan Wash. A deep trench was excavated and then lined with drain tile and a gravel and sand base. Sections of pipe were lowered into the trench one at a time and joined to the adjacent pieces. The last section of pipe was lowered into the trench in February, 1935 (see Photos No. AZ-50-M-2, M-3, M-6 through M-9).

The Southside Canal flowed generally in a westward direction for 24 miles and delivered water to Indian lands through 60 miles of concrete pipe laterals running north at approximately one half mile intervals for about eight miles. The first 3.4 miles of the canal traversed non-Indian lands. Capacity of the canal was about 350 second feet.[99] Unlike the earlier project canals, the Southside was concrete-lined for most of its length (See Photo No. AZ-50-M-5).

In conjunction with the Southside Canal, a 12 mile long stormwater channel was excavated on Indian lands to protect the new canal and irrigable lands in the area from floods. The Southside Stormwater Channel was built along the north side of, and roughly parallel to the Southside Canal.

With the completion of the Southside Canal, the amount of irrigable Indian lands increased significantly. However, by the late 1930's, the total still fell short of the 50,000 acres allowable under the project. In 1939, there were 40,000 acres of Indian land under constructed works that were suitable for cultivation and another 10,000 that had passed out of cultivation on account of poor soils.[100]

Groundwater Pumping

In addition to the non-irrigable Indian lands that required project adjustments early on, the

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[98] U.S. Department of the Interior. Indian Irrigation Service. "Plan and Estimated Cost of Revamping Canal System, Indian Lands, San Carlos Project, Arizona" Submitted by A.L. Wathen, Supervising Engineer. January 31, 1933. pp 1-5.

[99] Letter from C.J. Moody, Project Engineer, to Mr. C.A. Engle, Supervising Engineer. Coolidge, Arizona, April 10,1934. p.3.

[100] Letter from C.J. Moody, Project Engineer, to Mr. Walter E. Packard, Consultant, Farm Security Administration. Coolidge, AZ, December 26, 1939.

amount of available surface water also soon became an issue requiring action. It was originally estimated that about 80% of the irrigable lands would be supplied by stored and natural flows from the Gila River and that the remaining 20% would be irrigated through groundwater pumping. Although a small amount of pumping had been initiated in 1905 under the Sacaton Project, it was not until 1934 following a few years of serious shortages in the surface supply, that major expansion of pumping capabilities began. That year, the number of wells was increased to provide sufficient water to irrigate about 9,600 acres. By the late 1930's, eighty-one wells had been drilled in all parts of the project lands and were producing enough water to irrigate over 25,000 acres. Through the early 1940's the number of wells continued to climb. By 1943, there were 100 irrigation wells, of which 86 were operational. The projected 20% of all lands that were to be irrigated by groundwater had reached 26% (see Photo No. AZ-50-T-1).

Public Works Funding

During the 1930's, improvements to project lands were aided by the availability of Public Works Funding. Following completion of San Carlos reservoir in 1929, federal funds were appropriated and authority given the Superintendent of the Gila River Reservation to level and prepare for irrigation allotted Pima lands that were within the San Carlos Project. This work continued until 1932 when funds ran out. A total of 8,033 acres had been subjugated. Between 1933-1937, progress was resumed with Public Works Funds. Under this program, 10,604 acres of tribal lands were leveled and bordered, farm laterals constructed, and the land seeded to alfalfa. By 1936, 39,265 acres of Indian lands had been subjugated.[101]

[101] Clotts, Herbert. Irrigation Data, Long Range Program, Gila River. Los Angeles, Calif. January 29, 1944. p. 7.

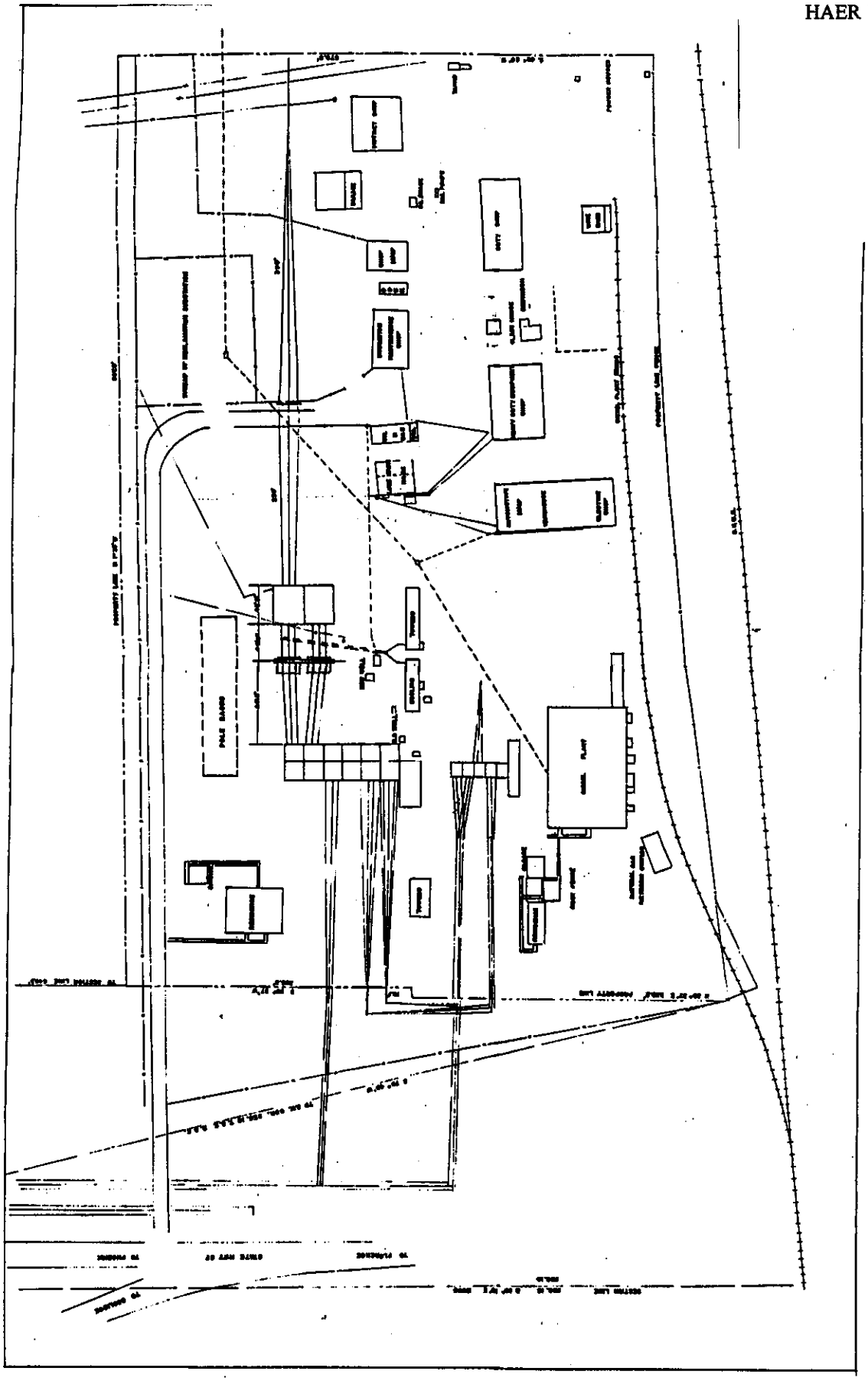

Figure 9

VI. COSTS AND PAYMENT OF PROJECT CONSTRUCTION AND OPERATION

Repayment of Construction Costs

As specified in the San Carlos Act, repayment of the construction costs of the San Carlos Project was to be divided equally between Indian and non-Indian lands served by the project. On June 8, 1931, a repayment contract was entered into by the San Carlos Irrigation and Drainage District (SCIDD) and the United States. The contract spelled out the construction costs, the terms of repayment, and the obligations of SCIDD to assess and collect both construction and operation and maintenance costs. Construction costs were to be repaid over a period of 20 years at 4% interest on deferred payments. The contract also provided that public notice of construction costs should be issued on December 1, 1931. This was postponed for a year by the Secretary of the Interior. The public notice of December 1, 1932, issued by the Secretary of the Interior announced the per acre construction cost of the project as being $95.25, including the operation and maintenance charges for the calendar year 1933. It also stipulated that construction repayments were to begin three years from that date.

It was not long before contract terms were modified for the non-Indian lands. Under the Act of June 5, 1934, the repayment period was extended from twenty to forty years and interest charges were dropped. The first payment was due on December 1, 1935. Other amendments to the repayment contract followed. SCIDD paid about $86,000 in construction costs up to 1937, when the district was granted a deferment of payments. Due to continued water shortages, another deferment was approved by Congress on August 5, 1939, pending completion of a study on the economic conditions of the project. The resulting report entitled Report on Economic Conditions Existing on the San Carlos Irrigation Project produced by the Office of Indian Affairs in May 1944 proposed that construction repayment charges be based on the quantity of stored water available to the project rather than on a flat per-acre fee. This change was effected under the Act of July 14, 1945.[102] That same year, the moratorium of repayments was lifted.

Repayment for project construction costs on Indian lands followed a different course. Under the Act of July 1, 1932 (47 Stat.564), the collection of construction costs for Indian-owned lands was dropped until such time that the lands left Indian ownership.

By June, 1943, the federal government had spent $9,830,077. of reimbursable funds on construction of the project irrigation system, along with an additional $1,657,984. of reimbursable funds on the power system. Since then, indebtness of SCIDD has increased due to rehabilitation projects undertaken by the federal government. At present, SCIDD has not yet paid out their reimbursable costs.

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[102] Gookin, W.S. & Associates. Report on San Carlos Indian Irrigation Project. October, 1969. p. 19.

Division of Project into Three Operating Units

Under the project repayment contract, the project works and improvements requiring operation and maintenance were separated into three different classes. This was done in order to divide operating costs between the various entities involved. The three classes are known as the Joint Works which benefit both Indian and non-Indian lands, the Indian Works which serve Indian lands, and the District Works which are used exclusively for irrigation service to District lands.

Definitions of the three classes of features were fully set out in the Secretary of the Interior's Order dated June 15, 1938. Included in the Joint Works, to be operated and maintained by the United States, were Coolidge Dam and San Carlos Reservoir; the electrical power generating, transmission, and distribution system; Ashurst-Hayden Dam; the Florence-Casa Grande Canal to Picacho Reservoir; Picacho Reservoir; the North Side Canal from the Main Canal to the reservation boundary; Pima Lateral to the reservation boundary; Pima sublaterals serving both Indian and non-Indian lands; drainage and irrigation pumping works, regardless of their location; and all project buildings and equipment used for the upkeep of the Joint Works. Costs for operating and maintaining the Joint Works were to be charged one-half against Indian lands and one-half against non-Indian lands. The Bureau of Indian Affairs, out of their Coolidge office, has been the federal agency responsible for the Joint Works.

The District Works began at the turnout from Joint Works features and included all project works, including canals, that served District lands. The Florence-Casa Grande Extension, the Casa Grande Canal, the old Florence Canal, and the distribution facilities for district lands were all in this category. In the June 15, 1938 Secretarial Order, SCIDD, which had been operating the distribution system serving non-Indian lands for many years, was also charged with maintaining that system. The new responsibility went into effect on July 1, 1938.

Indian Works consisted generally of irrigation canals and laterals used exclusively for irrigation of Indian lands. They began at the reservation boundary. The San Tan Flood-water Canal, the San Tan Indian Canal, the Casa Blanca Canal, portions of the North Side Canal and Pima Lateral, as well as the South Side Canal fell under Indian Works. Also included was Sacaton Dam. Operation and maintenance of the Indian Works was assigned to the United States, in this case the Pima Agency of the Bureau of Indian Affairs, with offices in Sacaton.

Initially, operation and maintenance of the Indian Works was to be assessed against Indian landowners. Payment was scheduled to begin on December 1, 1933, but a deferment was granted extending the starting date to 1937. Upon expiration of the deferment, some Indians objected to paying their charges which were then assumed by the tribal authorities. They agreed to pledge part of the income from the newly subjugated Southside tribal-owned lands. An agency farm consisting of 12,000 acres of tribal lands was created and operated by the BIA. Returns from the farm fell short of expectations so that beginning in 1937 Congress appropriated sufficient funds to supplement the tribe's operating and maintenance contribution. In 1952, control of the agency

farm was transferred to the tribe. Since then, the farm has generated substantial income although much has been used to pay for the costs of tribal government and a variety of services provided to farmers.[103]

Water Rights

One of the major issues that needed to be resolved in developing SCIP was that of water rights. Although the doctrine of prior appropriation was adopted by the Territory of Arizona before statehood and should have given the Indians priority water rights, implementation was largely ignored.[104] Non-Indian settlers continued to withdraw more and more water from the Gila River above the reservation. Although there were numerous proposed law suits as early as the beginning of the twentieth century to regain water rights for the Indians, it was not until passage of the San Carlos Act in 1924 that a Court Decree adjudicating water rights for lands along the Gila River was sought.

On October 3, 1925, a suit was filed in the district court of the United States in and for the district of Arizona for the purpose of defining the water rights of the Gila River Indian Reservation and other lands. Over 400 defendants all claiming water rights on the Gila River were named in the suit. Following years of surveys, studies, litigation, and lengthy negotiations, a settlement was finally reached on June 29, 1935, in a decree called the Globe Equity No. 59. It was signed by Albert M. Sames, United States district judge in Tucson. This decree defines all water rights on the Gila River from its headwaters to its junction with the Salt River.[105] In summary, the decree grants a priority water right for 35,000 acres of Indian lands within the San Carlos Project; a water right for 1,000 acres in the San Carlos Reservation, with a priority second only to that of the 35,000 acres of Pima lands; water rights with varying priorities to privately owned lands in the San Carlos Project and upper valleys; and a priority right to the San Carlos Project to store 1,285,000 acre feet in the San Carlos Reservoir at all times. The decree also provides for the division of the natural flow of the Gila River at Ashurst-Hayden Dam, between Indian and non-Indian lands. All of the water rights for the San Carlos Project lands are owned and held in trust by the United States.

Although the decree was intended to clearly define the project water rights and assure the Indians

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[103] Hackenberg, Robert A. "Pima and Papago Ecological Adaptations". Handbook of North American Indians. Volume 10, Southwest. Washington: Smithsonian, 1983. p. 176.

[104] The doctrine of prior appropriation is a method of distributing water based on the principle of "first come, first served".

[105] This information on the Gila River Decree was obtained from History, Gila River Reservation, San Carlos Irrigation Project. p. 12. According to a Report on San Carlos Indian Irrigation Project, prepared by W.S. Gookin & Associates, October 1969, users on the main stream of the Gila above a point 10 miles east of the eastern boundary of Arizona were excluded from the decree.

priority, the outcome has been criticized. In developing the decree, the U.S. government excluded all users on the tributaries of the Gila and all users on the main stream of the river above a point 10 miles east of the eastern boundary of Arizona.[106] As development has occurred along the tributaries, less water has been available to the Indian project lands. The decree also allowed for junior appropriators in the upper valleys to divert water in excess of their entitlements. According to Gookin's report "this latter concession has had the practical effect of negating the purposes for which the suit was filed, i.e., protecting the rights of the San Carlos Indian Irrigation Project by application of the legal principles governing water rights".[107]

All of these stipulations were apparently devised without any input from the Indians. They were not included as participants in the development of the Gila River Decree. When they became aware of the contents of the decree as it was being finalized, a group of Pimas traveled to the Tucson federal court to object. Entry was denied and when the Indians asked a local attorney to present a petition on their behalf, this request was rejected after consideration by Judge Sames. On that same day, the decree was signed.[108]

The reasons for the unique allowances made by the government in the Gila River Decree are unknown. It is conjectured that government officials perhaps anticipated that more water would be available than has been the case and there would be enough for everyone. In reality, the result has been that the San Carlos project has never received the amount of water intended by Congress.

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[106] See Report on San Carlos Indian Irrigation Project. referred to in previous footnote.

[107] Report on San Carlos Indian Irrigation Project. p. 63.

[108] The above information is taken from "The Pimas: A Century of Dishonor". Indian Affairs. No. 89, June-August, 1975. p. 8. Minutes taken at a Pima Indian Tribal Council meeting held in Sacaton, Arizona, June 27, 1935, record comments provided by Mr. Geraint Humphreys, Chief Field Counsel, Department of Interior two days prior to the signing of the Gila River Decree. He was invited to attend the meeting and explain the Gila River Adjudication Suit and Decree. The denial of consideration of the petition presented by the Pima Indian Tribal Council was based on the theory that the Indians, under the guardianship of the United States, were already represented in the litigation.

VII. AGRICULTURAL DEVELOPMENT AND ECONOMIC CONSEQUENCES OF SCIP

Although it is not the intent of this document to provide an in-depth analysis of the socio-economic development and consequences of SCIP, some consideration of the topic is important in order to be able to evaluate the significance of the project under criterion A of the National Register of Historic Places.

Effects of Water Shortages

The lack of sufficient irrigation water following construction of SCIP curtailed the anticipated agricultural production on project lands. Up until 1937, the largest acreage irrigated in any one year occurred in 1937, when a total of 80,108 acres received water. Of that total, 33,889 acres were Indian lands, the remaining 46,219 acres were in the District. Between 1937-57, the acreage irrigated averaged only 62% of the project area and the maximum acreage ever irrigated in one year was 80% of the total project lands. Indian lands irrigated averaged around 25,000 acres, while non-Indian lands receiving water averaged about 37,000 acres. During that same twenty year span, only abut 62% of the project water came from surface sources, the rest was all from wells. Even with the supplemental groundwater, the amount of available water was inadequate to irrigate all project lands. In fact, not all project lands were prepared for farming and provided with water distribution facilities. While the full 50,000 acres of non-Indian lands were largely developed for irrigation by 1967, only about 41,000 acres of Indian lands were readied. The project fared no better between 1970 and 1988 when total lands irrigated fell far short of the original projections. During that time span, the reported area irrigated on both Indian and non-Indian lands ranged from 37,715 to 66,282 acres.[109]

Several reasons have contributed to water shortages. San Carlos Reservoir, which was built with a 1,285,000 acre-feet capacity, has rarely reached that figure. Factors of nature were beyond the control of the project planners. Prior to 1967, annual runoff into the reservoir was less than half of what was anticipated. The highest level of water had been reached in 1942 with 814,510 acre-feet. Other years were dismal when the reservoir stood virtually empty at certain times. In fact, it has only been within the last decade or so that the reservoir has been full, the first time in 1983 and more recently in 1993. Both of these occasions were the result of heavy rains that caused extensive flooding and damage to the project.

Shortages in surface water led to an increase in the amount of water pumped from wells. Between 1934 when heavy pumping began, and 1967, pumping averaged 91,106 acre feet instead of the expected 60,000 acre feet. An average of 36 percent of the total water supply for the project was derived from wells during that period. At times when the reservoir was empty,

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[109] U.S. Department of Interior. Bureau of Indian Affairs. Rehabilitation and Betterment of the San Carlos Irrigation Project-Joint Works. p.III-2.

farmers had to rely totally on groundwater. An increased demand for groundwater led to the addition of more wells. Thirty-one new irrigation wells were drilled between 1957-67. As a consequence of increased pumping, the water table dropped and wells had to be drilled deeper, adding to the pumping costs. Between 1970 and 1988, the portion of the water supply from wells ranged from nine to sixty percent.[110] Today there are 98 project wells in operation, of which 52 are off-reservation.

The design and maintenance of the system itself contributed to water shortages. Between 1937 and 1957, an estimated 35 percent of all water diverted or pumped into project canals and laterals was lost due to seepage, evaporation and waste. In recent years, the total project conveyance system loss has been estimated at about 52 percent.[111]

Trends in Farming Practices

According to the previously cited 1944 economic report on SCIP prepared by the Office of Indian Affairs, considerable differences evolved in the farming practices on Indian and non-Indian lands under the project. To begin with, two very different types of farmers existed. Many of the non-Indian farmers migrated to the project from other states, largely from cotton-producing areas, while the Indians inherited the long-standing farming traditions of their ancestors who grew corn, cotton, and wheat.[112]

With the development of SCIP, the non-Indian farmers planted large acreages of cotton. The crop produced relatively high returns and required less water than other crops. This was especially important given the water shortages in drought years. Between 1930-42, almost 60 percent of the total cropped acreage was devoted to cotton production. Alfalfa accounted for another 25 percent of crops grown during that time. Almost three-fourths of the non-Indian lands were operated by tenant farmers.

During that same time, Indians produced mainly grains and alfalfa on their lands, with an increasing amount of acreage devoted to the latter crop. A small amount of cotton was grown. Indians had difficulty obtaining credit to conduct farm operations while non-Indians had little trouble in gaining credit for financing crop production, especially cotton. Total crop values for Indian and non-Indian lands differed substantially. A figure of $313,025 represents total crop

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[110] U.S. Department of Interior. Bureau of Indian Affairs. Rehabilitation and Betterment of the San Carlos Irrigation Project-Joint Works. August, 1993. p. III-2.

[111] U.S. Department of Interior. Bureau of Indian Affairs. Rehabilitation and Betterment of the San Carlos Irrigation Project-Joint Works. August, 1993. p. III-4

[112] U.S. Department of the Interior. Office of Indian Affairs, Indian Division. Report on Economic Conditions Existing on the San Carlos Irrigation Project and the Gila River Indian Reservation, Arizona. Los Angeles, California: May, 1944

value on Indian lands in 1938 while on non-Indian lands the total was $1,280,175..

Indians farmed their individual allotments and beginning in 1937, 12,000 acres of tribal land were set aside for use as an agency farm under government supervision. Proceeds from the farm were to help defray the costs of operating and maintaining the irrigation system. These lands were initially planted almost entirely with alfalfa as were a large percentage of the allotted lands. During World War II, the War Relocation Authority leased almost 7,000 acres of reservation lands in the Southside area for use as a Japanese relocation center for Japanese-Americans.

Even though the San Carlos Project brought irrigation water to an increasing amount of Indian lands during the 1930's and was intended to bring new prosperity to the Pimas, their economic status did not reflect new gains. In fact, between 1935-40, the average family annual income declined from $708 to $484.[113] A number of reasons accounted for this. Between 1925-34, many Pima Indians had taken construction jobs on SCIP and received a steady income. Upon completion of the project in the mid-1930's, they could no longer rely on the regular wages and the return to subsistence farming was not appealing. Many sought employment among off-reservation cotton growers. Another factor that probably contributed to a decline in income was the loss of Depression-related government jobs such as those with the Civilian Conservation Corps-Indian Division or Emergency Conservation Corps.[114]

An additional factor that interfered with economic success was the bureaucratic complexity of the project. There were several layers of management including watermasters and ditch riders between the government and the Indian farmers. Farming practices and the types of crops grown also had an impact on Indian prosperity. The maximum acreage irrigated in any one year until 1944 was about 34,000, which includes the 12,000 acre agency farm. The Indians began planting alfalfa following the government's similar practice on the agency farm. This crop provided feed for livestock that were pastured on Indian lands. Alfalfa production was outside traditional farming customs of the Pimas and was unsuccessful especially during the drought years of the late 1930's. Agricultural methods employed by the Indians were not up to modern standards. The need for an education program to teach efficient and improved irrigated farming practices was recognized early on by Preston and Engle and was urged again in the 1944 Report on Economic Conditions Existing on the San Carlos Irrigation Project and the Gila River Indian Reservation Arizona.

Another impediment to farming prosperity on the reservation was the pattern of allotments. Over

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[113] Hackenberg, Robert A. "Pima and Papago Ecological Adaptations." Handbook of North American Indians. Volume 10, Southwest. Washington: Smithsonian Institution, 1983. p. 175.

[114] Tamir, Orit et al. Return to Butte Camp: A Japanese-American World War II Relocation Center. Archaeological Consulting Services, Ltd. Report #82. Tempe, Arizona, 1993. p. 5-9.

the years, the original allotments were divided among heirs creating small parcels that were uneconomically viable farm units.

Thus, despite the great hopes initially attached to SCIP by the Indians, the reality was quite different. By the early 1950's, the median family income from farming for reservation residents was $750.; for families relying on off-reservation work, the median income was twice as much. The amount of land under irrigation by Indians did not differ substantially from that prior to Euro-American settlement beginning after the Civil War. The difference in total crop value between Indian and non-Indian lands continued to persist. The total on Indian lands in 1952 was $3,309,867. while on non-Indian lands the total was $10,502,469.

Even though farming proved a financially difficult livelihood, especially for the Indians, irrigated agriculture and related industries continued to be the economic base for the San Carlos Project area in the following decades. Between 1955-1966, an average of 45,997 acres of project lands were irrigated and cropped. Cotton, grains, and alfalfa were the primary crops grown, in that order.[115]

Present Day Economic Conditions

The early failure of SCIP to deliver the projected water supplies to project lands has continued up to the present. On the reservation, a maximum of about 33,000 acres have been farmed due to an inadequate, poorly maintained delivery system combined with insufficient water. Only about one quarter of the 230 miles of canals and laterals are lined and the associated concrete structures are mostly original and in varying states of deterioration.[116] Present-day criticisms about inadequate staffing of irrigation positions to properly manage and maintain the system on the reservation echo the opinions of Preston and Engle.

On the 12,000 acre Gila River Farms, the Gila River Indian Community undertook a major rehabilitation project with funds secured through two Small Reclamation Projects Act loans. Beginning in the late 1970's, fields were leveled, and field ditches and laterals were concrete-lined. The abandoned buried concrete pipe that formerly served the area was removed. Even with these improvements, the Farms is still limited by the SCIP system and its losses.

Virtually all allotted lands farmed today on the Reservation are leased out to non-Indians. This represents a marked change from earlier project days when no Indian lands were leased out to non-Indians.

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[115] Young, Marvin. History of the San Carlos Irrigation Project. March, 1967. Typewritten. p. 8.

[116] "Testimony on Irrigation of Gila River Farms, An Entity of the Gila River Community". N.D. (ca. 1990) N.A. p. 1.

On the project lands operated by SCIDD, acreage irrigated in the past few years has ranged from 22,627 in 1990 to 36,223 in 1992. Currently about one half of the farms are owner operated, the remainder are rented out. The predominant crop grown is cotton followed by alfalfa, wheat, and barley.

Today, the SCIP area in Pinal County is one of the most economically depressed areas in Arizona. In 1979, about fifty-three percent of the Indian families had incomes below the federally defined poverty level of $7,000. As other parts of the state experience rapid growth, there has actually been an outmigration from the project communities of Coolidge and Eloy.[117] As when SCIP was first conceived, agriculture continues to play a central role in the economic base of the area.

[117] U.S. Department of Interior. Bureau of Indian Affairs. Rehabilitation and Betterment of the San Carlos Irrigation Project-Joint Works. Final Report. August 1993. p. III-1.

TABLE II: ACRES OF LAND IRRIGATED ON INDIAN AND NON-INDIAN PROJECT LANDS[118]

Year	Indian Lands	Non-Indian Lands	Total Acreage
Pre Non-Indian Settlement	Between 13,000-28,000 acres		
1885	ca. 15,800 acres	unknown	
1914	14,356 acres	7,563 acres	21,919 acres
1926	14,422 acres	unknown	
1937	33,889 acres	46,219 acres	80,108 acres
1938	31,475 acres	35,685 acres	67,160 acres
1930-42 Average Total Irrigated Acreage: 64,123 acres			
1943	33,969 acres	46,923 acres	80,892 acres
1952	20,680 acres	39,853 acres	60,533 acres
1934-55 Average	25,517 acres	37,195 acres	62,712 acres
1970-75	16,800 acres	unknown	
1992	unknown	36,223 acres	

[118] Numerous sources of information were used to compile this table.

VIII. MODIFICATIONS TO THE PROJECT AND PRESENT DAY OPERATIONS

Since its completion in the mid-1930's, the SCIP system has remained largely unaltered although some modifications to individual features have occurred and there have been some operational changes. These are discussed below.

Ashurst-Hayden Dam

Since completion in 1922, Ashurst-Hayden Dam has undergone several modifications. The first of these occurred in 1930, when the crest was raised 1 foot by the addition of a concrete cap and 2 foot high metal flashboards were installed along the raised crest. The purpose of this was to provide more diversion capacity as silt accumulated behind the dam. During the mid-1950's, a number of other changes were made to the dam. The conduit running through the dam was plugged with concrete as it was non-functional. A more major change was the reconfiguration of the sluice gates at the south end (see Figure 10). Due to the heavy siltation behind them, they had become inoperable. Two of the four sluice gates were removed and the opening in the dam was filled with concrete while the other two sluice gates were replaced with one 20-foot wide by 13-foot high tainter gate.[119] The gate is electrically operated. There have also been modifications to the canal intake gates--nine reinforced concrete slide gates were added to the river face of the intake openings. They are raised and lowered manually by steel cables. The original hydraulically operated gates are still in place but are not fully operational. Today the dam leaks a considerable amount of water and is in need of further repairs.

Picacho Reservoir

By the mid-1950's the silting problems of Picacho Reservoir necessitated another major rehabilitation. The firm of Headman, Ferguson, and Carollo, Consulting Engineers was issued a contract in 1955 to prepare plans and specifications for the project. Reconstruction of the reservoir to its present configuration followed in 1956. The reconstruction involved the taking of about 868 acres to enlarge the reservoir to a storage capacity of 18,000 acre feet. A new earthfill dam embankment measuring 27,800 feet long and a maximum of 30 feet high was constructed, in part along the same alignment as the old one. The northern part of the reservoir was abandoned and it was extended to the south. The crest width of the new embankment is generally between 12 to 16 feet. A new spillway and outlet works for the Casa Grande Canal were also included in the design. The concrete spillway, which is in the same location as the previous one, is a 100-foot long ungated concrete overflow weir with an unlined outlet channel. The outlet works consist of two 36-inch diameter concrete culverts controlled by individual

[119] Named after Burnham Tainter, a tainter gate is a type of radial gate.

vertical sluice gates.[120] Water passes through the outlet works into the Casa Grande Canal. Despite the improvements, silting still remains a problem at Picacho Reservoir. The shallow waters have encouraged dense vegetation growth and attracted wildlife. Today, Picacho Reservoir is considered a significant wetland worthy of protection.

Florence Canal

It appears that in the late 1950's, the canal heading was moved to its present location on the Florence-Casa Grande Canal, about one mile southwest of its previous position. In more recent years, the canal terminus has been moved north of Picacho Reservoir.

Coolidge Diesel Plant and Power System

The diesel plant at Coolidge was taken out of service about fifteen years ago and the diesel engines removed. The power plant at Coolidge Dam is also no longer operational as a result of the damages sustained in the 1983 flood. Today, power for the project is purchased from Parker-Davis Dam, the Salt River Project, Arizona Public Service and the Colorado River Storage Project. According to Bill Sibley, foreman with the SCIP power division, power is distributed through three switchyards, one in Maricopa County, one at the Coolidge Diesel Plant, and one at Coolidge Dam. There are 26 substations, 152 miles of transmission lines and about 1200 miles of distribution lines. The service area extends beyond the project boundaries.

Blackwater Siphon Project

The North Blackwater district is located inside the Reservation on the north side of the Gila River and contains about 1,300 acres of designated SCIP land. It was originally served by the North Side Canal, but water deliveries were not adequate for even half of the land. This was due to seepage losses, insufficient water supplies, and extreme water fluctuations. Pumping ground water was not an option due to declines in the water table. In the early 1980's, a delegation from the Gila River Indian Community successfully sought a special appropriation from Congress to build a pipeline running north and east from Pima Lateral under the Gila River to the Northside Canal[121]. The pipeline, known as the Blackwater Siphon, was constructed in 1987.

Coolidge Dam

Coolidge Dam is currently undergoing a rehabilitation to correct structural weaknesses and signs of deterioration that had developed over the years. In 1983, flooding of the Gila River upstream from Coolidge Dam caused the shutdown and evacuation of the dam, including the electrical switchyard which was seriously damaged. Inspections afterwards revealed deterioration in the

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[120] U.S. Department of the Interior. Bureau of Indian Affairs. Rehabilitation and Betterment of the San Carlos Irrigation Project-Joint Works. Phoenix Area Office. August 1993. p. IV-10.

[121] Memo to Ralph Esquerra, San Carlos Irrigation Project, from Superintendent, Pima Agency, re: Blackwater Siphon Project. April 8, 1983. On file at SCIP Office, Coolidge.

left abutment and in the spillways. Repairs include constructing a stability buttress under the left dome, concrete overtopping protection on the downstream rock abutments, and partial resurfacing of the concrete spillways. Work is to be completed in 1995.[122]

The Quest for Additional Water: Buttes Dam and the Central Arizona Project

Even before the San Carlos Project was authorized, preliminary studies suggested that an additional water supply would be beneficial at some future date. In his 1920 Report on San Carlos Project, C.C. Fisher suggested that two reservoirs above the proposed San Carlos Reservoir could provide supplemental storage and beneficial sluicing. By the 1930's, as it became apparent that the newly constructed San Carlos project could not provide sufficient water, the concept of building another dam was again explored. Numerous investigations were conducted over the ensuing years by the Bureau of Reclamation, the Corps of Engineers, the Bureau of Indian Affairs and others. The focus of the studies was a site known as the Buttes, located in a bend on the Gila River four miles above the Ashurst-Hayden Dam. This site had been identified and surveyed as early as 1895 by Arthur P. Davis, hydrographer for the U.S. Geological Survey.[123]

Between the early 1940's and early 1960's, the Buttes was included in plans by the Public Works Administration, the Bureau of Reclamation, the Southwest Water Plan and the Middle Gila River Program.[124] The dam was intended to solve numerous problems associated with SCIP. First, it would store flood water from the San Pedro River and other streams entering the Gila below the San Carlos reservoir to form a supplemental irrigation supply. Second, it would store large quantities of silt that were flowing downstream and accumulating at Ashurst-Hayden Dam, causing expensive sluicing operations there. Third, it would allow for generation of power at Coolidge Dam as needed rather than as secondary to meeting irrigation needs. Obtaining additional power through the drop at the new dam would also be a benefit. Lastly, Buttes Dam would provide flood control.

It would be another project and another river that would eventually be destined to provide additional water for the Indian lands under SCIP. The Central Arizona Project authorized for construction under the Colorado River Basin Project Act on September 30, 1968, allowed for the use of Colorado River water on Indian lands. Former Secretary Udall made the following statement on CAP during a public meeting held in Phoenix on January 6, 1969: "The Central

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[122] Conversation on March 21, 1994 with Gary Ditty, Project Field Engineer, Bureau of Reclamation.

[123] "A History of the Pima Indians and the San Carlos Irrigation Project". Compiled by Sen. Carl Hayden. 1924. 89th Congress. p. 55.

[124] Script of presentation by Howard Holland, President, Board of Directors, SCIDD, to Governor's Executive Committee, on CAP Financing. April 16, 1985. On file at SCIP, Coolidge. p. 4

Arizona Project legislation provides us with the opportunity to improve and stabilize, at least for a substantial period of time, the water supply for this (San Carlos) project and to provide the Indians the acreage of irrigated land which they anticipated when the project was authorized"[125]. Also authorized under the CAP legislation was the construction of Buttes Dam.

In the twenty-five years that have elapsed since Udall made the above speech, the CAP has gone from paper to reality. Hundreds of miles of concrete canals have been constructed to deliver Colorado River water to the thirsty expanding populations of Phoenix and Tucson. The system has been extended to bring water to the Gila River Indian Reservation through the Salt-Gila Aqueduct. It originates at the terminus of the Granite Reef Aqueduct and crosses under the Gila River just downstream from the Northside Canal siphon. It then traverses parallel to the Florence Casa Grande Canal and alongside Picacho Reservoir before turning to the east. A link connects the Salt-Gila Aqueduct to Pima Lateral. Still to be constructed is a new and improved distribution system on Indian lands. Other changes to the system are proposed including a new Florence Casa Grande Canal paralleling the old one, a new regulating reservoir adjacent to Picacho Reservoir, and new settling basins below the headworks to the Florence-Casa Grande Canal. At present, construction of the long-proposed Buttes Dam seems uncertain given its host of environmental impacts and the lack of economic feasibility.

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[125] "Statement by San Carlos Irrigation and Drainage District At Meeting With Assistant Secretary Harrison Loesch Of Public Land Management On Supplemental Water For San Carlos Indian Irrigation Project." Washington, DC. August 27, 1969. p.3.

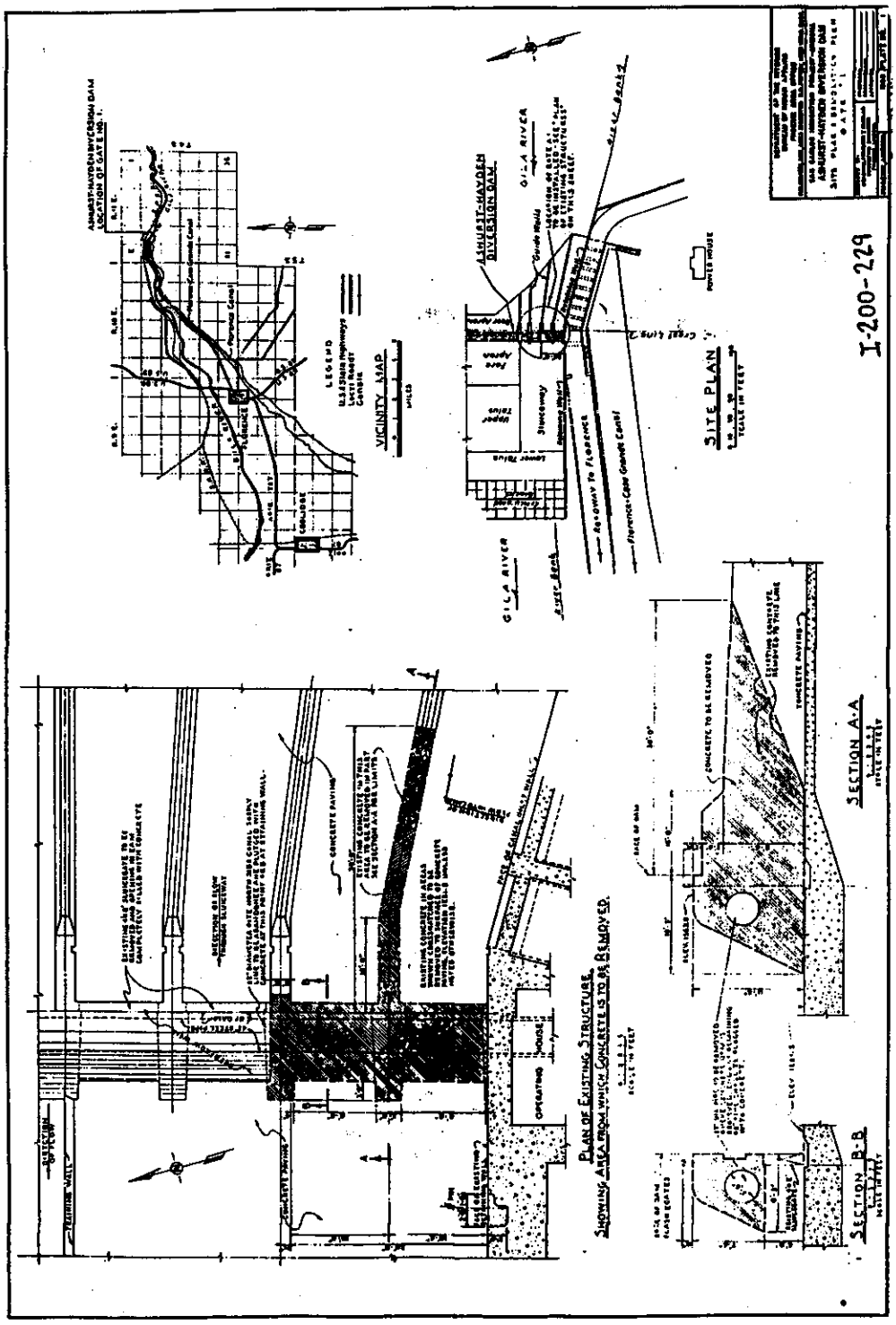
VICINITY MAP
SITE PLAN
GILA RIVER
ASHURST-HAYDEN DIVERSION DAM
POWER HOUSE
I-200-229
PLAN OF EXISTING STRUCTURE
SHOWING AREA FROM WHICH CONCRETE IS TO BE REMOVED.
SECTION A-A
SECTION B-B

Figure 10

IX. CURRENT PHYSICAL DESCRIPTIONS OF FEATURES TO BE POTENTIALLY IMPACTED

Ashurst-Hayden Diversion Dam

Ashurst-Hayden Dam consists of a "floating" concrete slab that is 396 feet in length, 212 feet in width and varying in thickness. The slab is divided into four sections: the rear or upstream apron, the main slab or fore apron, the upper talus, and the lower or downstream talus. The rear apron is 16 feet wide and 12 inches thick and is reinforced with 5/8 inch steel bars spaced 28 inches on center. A 9 inch thick reinforced concrete cut off wall that is 3 feet deep protects the upper edge of the apron. The main slab is 56 feet wide and from 2 to 5 feet thick. It is not reinforced but includes expansion joints every 40 feet. The upper and lower talus are each 70 feet wide and 2 feet thick. The talus sections consist of concrete mixed with a large amount of rock. The upper talus is reinforced with 1/4 inch steel bars spaced every 2 feet both ways and a cut off wall protects the lower edge. The lower talus consists of 2 parts, a 30-foot wide section which is identical in composition to the upper talus, and the lower 40-foot wide section which is composed of large blocks tied together with iron rods. Below the lower talus, a bed of large rocks provides additional protection against erosion.

The main slab rests on two rows of wood pilings spaced 30 feet apart and driven to a depth of 16 feet. At either side of the river, the slab is tied into the rock. The slab supports the reinforced concrete weir which is 11 feet high, including the 1 foot concrete cap added in 1930. Two-foot high metal flashboards span the top of the weir crest. At the north end, the crest of the dam is extended into the rock bank for 120 feet to provide greater spillway capacity. The concrete weir is reinforced with steel bars and anchored to the slab. Embedded in the main slab is a 42 inch diameter concrete pipe that is plugged so that it no longer carries water to the north side.

At the south end of the dam, and nearly at right angles to it, are located intake gates for the Main or Florence-Casa Grande Canal. On the intake wall, there are nine rectangular reinforced concrete slide gates that are raised and lowered by steel cables attached to the top of the gates. The gates are suspended from a steel beam that sits on top of the roadway balustrade. Metal trash racks are in place in front of several gates. The gates are separated by 25-foot high and 20-foot wide reinforced concrete piers. The top of the piers support a roadway with panelled concrete balustrades. A stairway leads down from the roadway to the operating house and original hydraulic regulating gates on the canal side. The hydraulic gate-lifting equipment is located in 9 bays on a concrete deck built between the piers about 8.5 feet above the bed of the canal. Not all of the hydraulic gates are fully operational anymore. At the west end of the bays is the operating house which contains the pressure tank and pump driven by an electric motor. The pump is identified as manufactured by the "Worthington Pump and Machine Company, Holyoke, Mass". No date was located. On a wall inside the operating house is a steam gauge and valve identified as an "American Bourdon Gauge".

At the upper or east end of the gates a concrete retaining wall protects them from the river. The downstream side of the gates is protected by the retaining wall which forms the south abutment of the dam. In front of the intake gates and parallel with the dam is a single 20-foot wide by 13-foot high tainter sluice gate. The gate is power operated by equipment located on a concrete deck above the gate.

Power House

Located to the south of the dam is a small power house built in 1921 to contain a gas engine and generator to run the pump at the dam. The power house is a simple, rectangular plan, one story structure with a flat roof concealed behind a parapet wall. The exterior surface of the building is heavy stucco over wood siding. On the north and primary elevation, the center bay extends forward and contains a multi-pane rectangular wood window. The parapet wall of the center bay is arched. To the east side of the center bay is a wood, panelled double door; to the west side is a boarded up, broken out window. Pilasters terminate the corners of the north facade. On the west elevation is a five panel wood door; the east elevation contains no openings. At the rear or south elevation, a corrugated metal, shed roof addition extends half way across. The interior consists of one room which contains a newer back-up generator; the original has been removed.

Operator's House

The operator's house is located on a rise to the south and west of the power house. The residence is a simple, rectangular plan structure with a side gable roof covered with asphalt shingles. The building sits on a concrete foundation. Exterior walls are stucco over what may be adobe. The gable ends contain horizontal wood siding. Windows are wood one-over-ones. The north and primary elevation contains a center doorway with a small shed-roof wood canopy over it. The corners of the house are terminated with pilasters. At the rear, it is apparent that the center section has been altered. By comparing the present footprint to the 1922 one, it appears that the area was filled in at some point. A partially enclosed, shed roof addition now extends off the center of the rear elevation.

Sacaton Dam and Bridge

Sacaton Dam is an Indian weir type dam that measures 1250 feet long between abutments. The concrete "floating slab" is divided into sections totalling an overall width of 73 feet: a 15-foot wide rear or upstream apron, a 6-foot wide main section underneath the weir, and 52-foot wide fore apron. Below the fore apron is a wide expanse of talus. The thickness of the concrete slab ranges from 1.5 feet below the bridge piers to 5 feet under the weir.

Two rows of sheet piling are in place underneath the slab--the first row below the weir is twelve feet deep, the second row at the lower edge of the slab is sixteen feet deep. Another component of the dam is the rectangular reinforced concrete conduit in place just below the weir on the east side of the bridge. This conduit delivers water from the Pima Lateral to the Santan Flood-water Canal on the north side of the dam.

Incorporated in the dam is a reinforced concrete girder highway bridge. The design consists of the road deck supported by 25 concrete piers set 50 feet apart on center, making the total length the same as the dam, 1250 feet. The width of the roadway is 18 feet, 4 inches, and concrete guardrails with decorative panels protect either side of it. Evenly spaced concrete brackets on the outside faces of the bridge "support" and embellish the solid guardrail.
Concrete lightposts that were originally spaced along the top of both guardrails are no longer in place. A metal engraved dedication plaque is located on the bridge at the north end of the dam.

At both ends of the dam the operating houses are still in place although they have been stripped of all the gate-lifting equipment, and have been vandalized with graffiti. The south end intake canal gates and sluiceway are overgrown with vegetation. At the north end, remnants of the original headgates to the San Tan Flood-water Canal are still visible. Parts of two of the original five gate hoists are in place.

Also located at each end of the dam is a short concrete bridge whose design matches the longer span over the Gila River. At the south end, the single span bridge crosses over the end of the Pima Lateral (known as the Pima-Sacaton segment). At the north end, the 3-span bridge extends over the Santan Flood-water Canal.

Florence-Casa Grande or Main Canal
The Main Canal has its heading at the intake gates at Ashurst-Hayden Dam and flows in a southwesterly direction for about twenty-two miles to its terminus on the east side of Picacho Reservoir. From there, water can either be diverted into Picacho Reservoir through a"Y" connection or can continue south a short ways to a measuring weir delivery point to the Florence-Casa Grande Extension Canal. The Main Canal is an earth canal for its entire length. The canal has a capacity of 1250 c.f.s. at its heading and a bottom width there of about 40 feet. At its end, the Main Canal has a bottom width of about 15 feet.[126] A dirt roadway exists along both canal banks.

Associated with the canal are numerous measuring structures, automatic wasteways, turnouts, checks, and bridges (see Figure 11). Some of the features are original, others appear to be later modifications or replacements.

Regulating structures include lateral turnouts and check structures (see Photo No. AZ-50-E-18). The small turnouts consist of light and medium duty cast iron slide gates. Major checks and turnouts exist at the head of Pima Lateral and at Picacho Reservoir. Both of these structures appear to be original with modifications. At Pima Lateral, the 4-bay concrete check structure on the Main Canal incorporates radial gates. The original counterweight to operate the east gate is

[126] All of the information on the bottom widths and capacities of the canals included in this section was provided by Rexford Stone, Gila River Indian Community, Land and Water Division.

still in place. The cable hoists and gates for the center 2 bays have been removed. Embedded into the check structure is a U.S. Indian Irrigation Service benchmark dated 1936. The "Y" connector or turnout to Picacho Reservoir is a concrete 3-bay structure incorporating radial gates that are manually operated. A U.S. Indian Irrigation Service benchmark is also embedded in this feature. At Station 876 & 00, there is a concrete check-weir and turnout structure with a handwheel pedestal lift manufactured by the Hardesty Company. Embedded in the concrete is a Bureau of Reclamation benchmark with no date on it.

There are 5 automatic spill wasteways with hydraulic radial gates. Three of the wasteways are inoperative and two are operated manually.[127] At Station 10 there is a concrete wasteway structure with a pair of radial gates. The feature includes a historic metal lamppost similar to that at Ashurst-Hayden Dam. No other historic lampposts were noted on the Main Canal or elsewhere on the irrigation system.

In addition to a number of controlled and uncontrolled inlets that drain water into the canal, there is one major drain crossing flume at China Wash known as the China Wash Flume. This unique reinforced concrete structure consists of 4 semi-circular flume barrels, each 12 feet in diameter, suspended from 5 rib arches. Each concrete arch is reinforced with steel bars spaced at 1 foot intervals. Substantial footings constructed to support the flume reach 21 feet below the grade of the canal and are 2 feet thick. Associated with China Wash Flume is a Parshall Flume used to measure water. A recent addition is the fish barrier built just upstream from China Wash Flume.

There are several bridges that cross the Main Canal, one of which appears to be original or early to the project. It is located on Florence-Kelvin Road and is constructed of reinforced concrete. The 2-span bridge displays the same decorative panels as are found at Ashurst-Hayden and Sacaton Dams. The integrity of the bridge has been seriously compromised by several pipes that are attached to the outside face. No construction date was found on the bridge.

Picacho Reservoir

Picacho Reservoir is an off-stream reservoir located about 21.5 miles below Ashurst-Hayden Dam. The present configuration reflects a major rehabilitation completed in 1956. Water enters the reservoir through the "Y" connector on the Main Canal. The reservoir is formed by an earthen embankment along the north, south and west sides. Maximum height of the 27,800-foot long embankment is about 30 feet. The crest width generally varies between 12 to 16 feet. On the west side of the reservoir is a 100-foot long ungated concrete overflow weir with an unlined outlet channel. The spillway crest is at elevation 1507. To the north of the spillway structure are the outlet works for the reservoir. They consist of two 36-inch diameter concrete culverts

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[127] U.S. Department of Interior. Bureau of Indian Affairs. Rehabilitation and Betterment of the San Carlos Irrigation Project-Joint Works. Final Report. August, 1993. p. IV-6.

controlled by individual vertical lift sluice gates at the upstream end.[128] Outflows from the reservoir enter the Casa Grande Canal. The reservoir is heavily silted and overgrown with vegetation.

Pima Lateral

Pima Lateral starts at a concrete turnout on the Main Canal in T5S, R9E, S28 and runs west for the first few miles and then in a northwesterly direction for the remainder of its approximate 23 mile length. The lateral ends at Sacaton Dam where it delivers water to the north side San Tan Flood-water Canal through the dam conduit. The last mile of the Pima Lateral between the Little Gila Canal (often referred to as Casa Blanca) heading and Sacaton Dam is sometimes referred to as the Pima-Sacaton Branch Canal. The bottom width of the canal varies from about eight (Sta 32 +00) to forty feet (Sta. 190 +00). A dirt road exists on both canal banks.

The concrete turnout to the Pima Lateral off of the Main Canal is original although it has been modified. Two pairs of slide gates have been replaced with two manually operated radial gates; the other two slide gates are still in place although they appear inoperable. All of the original pedestal lift devices for the slide gates have been removed. The radial gates are operated by cable hoists with handwheels.

The first three miles of the canal are concrete lined, the lining having been patched and repaired many times. The remainder of the canal length is earth. Typical features along the canal include turnouts, check-drops, drops, bridges, and wells. The small turnouts utilize light duty cast iron slide gates. At the turnout to Blackwater Lateral there is a sloped metal slide gate with a handwheel lift. The date of this feature is unknown. Major turnouts are more substantial. These include the Southside Canal and the Little Gila (Casa Blanca) Canal.

The turnout to the Southside Canal dates to the mid-1930's when the canal was constructed. The concrete feature consists of two bays, each one containing a roller slide gate. A short flight of concrete steps at each end of the turnout leads to the platform containing the hoisting mechanisms which consist of geared pedestal lifts manufactured by the Hardesty Manufacturing Company of Denver, Colorado. Numerous other features along the Pima Lateral were produced by the same company.

The turnout to the Casa Blanca Canal is probably original given the appearance and condition. It consists of a six-bay concrete structure with each bay containing a slide gate. The gates are operated by handwheel pedestal lifts that bear the "Hardesty" manufacturing stamp. One lift is missing the handwheel. As is typical of other early concrete features within SCIP, the impression left by the formwork (horizontal boards) is visible in the concrete. Where the concrete has

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[128] Rehabilitation and Betterment of the San Carlos Irrigation Project-Joint Works. p. IV-10.

eroded, steel rebar is visible. Incorporated in the structure is a single slide gate with a pedestal lift located at right angles to the turnout on Pima Lateral.

The check structures typically include a radial gate with manual hoists. An example of what appears to be at least a partially original check structure is located in T5S, R8E, S14 at Station 292. It is known that this check structure was rehabilitated in 1940. The concrete structure consists of 3 bays; the center one contains a radial gate with a cable hoist and handwheel lift. The radial gate is part of the 1940 reconstruction. Embossed on the handwheel is USRS for United States Reclamation Service. This indicates a pre-1924 manufacturing date since the name of the agency changed to the Bureau of Reclamation in that year. The arm of the radial gate bears the inscription "Hardesty" for the Hardesty Manufacturing Company. The two side bays each contain grooves for the placement of stoplogs. The concrete is deteriorating and the steel reinforcing rebar is exposed in places.

What appears to be an early bridge, although probably not original (it is not shown on a 1927 map) is located on Pima Lateral at Christensen Road. The structure is similar to a bridge design for the North Side Canal dated 1928. The two span bridge has a center concrete pier support and concrete side abutments. The rest of the structure is wood including the stringers and the decking. The latter consists of 2-inch by 6?-inch planks laid vertically. At some point, asphalt was poured over the decking. Wood guardrails are bolted into wood beams attached to the sides of the bridge.

North Side Canal

The North Side Canal has its heading at a turnout in the Main Canal in T4S, R10E, S15. It crosses under the Gila River by means of a concrete pipe siphon thirty-six inches in diameter and 1,700 feet long. A metal trashrack protects the intake to the siphon. The concrete outake of the siphon on the north bank of the Gila River is located in T4S, R10E, S15. It too is protected by a metal trashrack and just below it is a measuring gauge and Parshall flume. The high line canal travels in a westerly direction roughly parallel to the Gila River to the east edge of the reservation and then continues for about another 4 miles in a northwesterly direction. Water from the Blackwater Siphon enters the canal in T5S, R8E, S3. The canal ends in T4S, R7E, S23 at which point it wastes back into the river. The total length is about nineteen miles. The canal bottom width varies from along its course: at station 24+00 it is 4 feet, at station 782+00 it is 3 feet. Although the recorded design capacity is 80 c.f.s., the actual capacity is closer to 40 c.f.s. at the head of the canal. A dirt road exists along both canal banks.

The North Side Canal is not lined; it crosses through coarse textured soils resulting in seepage losses. At one point (around mile three) the Gila River has cut close to the canal which traverses a narrow bench on a hillside. The majority of structures on the North Side Canal consist of checks, turnouts, road culverts, and siphon drain crossings. In addition, there are a number of railroad crossings, wells, measuring devices, and drops along the length of the canal.

Lateral turnout structures tend to be simple single metal slide gates with handwheel lifts. Typical check structures are of concrete with a single slide gate operated by a handwheel lift. Although the concrete in many cases appears original due to the condition and formwork, the gates have probably been modified. A wood gate exists on a check structure near the head of the canal; according to the owner it is only about five years old. A little further down on the canal in T4S, R10E, S16, a typical check structure with a metal slide gate bears the manufacturers name of "Hinman Hydraulic Manufacturing Company, Denver" on the handwheel. Although there is no date, the gate structure appears fairly new. On the lower end of the North Side Canal, west of the Southern Pacific Railroad Crossing, there are fewer features along the canal. These include a few check typical check structures. A number of concrete abutments that are the remains of check structures were noted along the entire length of canal.

Dates of construction were noted on two railroad crossings. A concrete box culvert in T4S, R10E, S17 bears the date 1929. Where the railroad crosses over the canal in T5S, R8E, S3, the the intake of the concrete barrel crossing structure is inscribed with a date of 1925. The outtake structure on the west side of the crossing is new.

Typical road culverts and siphon drain crossings are simple concrete single barrel structures. Impressions of the formwork, consisting of horizontal boards, is visible in many instances. This was also noted on a concrete drop structure located in T4S, R10E, S19.

San Tan Flood-water Canal

The San Tan Flood-water Canal originates at the north end of Sacaton Dam. Water is delivered to the canal from the south side of the Gila River through the concrete conduit incorporated into the Sacaton Dam. The earth canal runs in a northwesterly direction for about sixteen miles, ending in T3S, R5E, S6 near the north boundary of the reservation. At its head the canal has a capacity of 80 cfs and a bottom width of about 15 feet. A dirt road exists along both canal banks.

Features along the canal include farm and lateral turnouts, checks, drops, and wells. The first 10 miles or so of canal built between 1909-1914 by the Reclamation Service, and the Indian Irrigation Service still incorporates a number of original concrete turnout and drop structures. The design of several turnouts is unique to this canal; the metal guides for the slide gates form a continuous arch above the gate. Although the gates themselves may have been replaced the metal gate housing and concrete appear original. Embedded in the concrete are benchmarks of either the United States Reclamation Service or the United States Indian Irrigation Service. At least one turnout (Station 572 in T3S, R5E, S14) both benchmarks appear on the same turnout. Three such turnouts were noted.

Also noteworthy are a series of original concrete drop structures located on the canal between Stations 387 (T3S, R6E, S29) and 572 (T3S, R5E, S24). Four (possibly five) such structures feature curved concrete downstream transition walls in which the impressions left by the

horizontal boards used for formwork are visible. Again, benchmarks of the United States Reclamation Service and/or United States Indian Irrigation Service were found embedded in the concrete. One other early drop structure located along the same length of canal is of a different design. The concrete downstream transition walls are more angled and the drop contains a slide gate operated by a cable hoist with a handwheel lift. The benchmark is of the United States Indian Irrigation Service. A short distance to the west of the turnout to the San Tan Indian Canal is another early drop structure that is now deteriorating. Rebar is exposed in the concrete and stone riprap is visible on the upstream side.

Between Station 572 (T3S, R5E, S24) and 874 (T3S, R5E, S3), the San Tan Flood-water Canal crosses an expansive floodway and there are no features along this stretch of canal. Along the lower end of the canal to the west of Station 874, there are a number of newer turnouts with single vertical metal slide gates and handwheel lifts.

San Tan Indian Canal

The San Tan Indian Canal, later renamed Lateral 9-6, has its heading at what is known as the Captain Wheel Turnout on the San Tan Flood-water Canal. The original combined turnout and check structure, built after the heading of the San Tan Indian Canal was moved from the river to the San Tan Flood-water Canal, still exists although it is no longer in use. The original turnout consists of two metal slide gates operated by a cable type hoist. The hoist sits on a concrete platform bearing a United States Reclamation Service benchmark. Adjacent to the hoist platform is a small concrete structure that originally contained gate operating equipment. The structure is now empty and at the southeast corner is a large hole caused by dynamite used in an attempt to demolish the building. Pieces of round twisted rebar are exposed in the concrete. The new turnout is a short distance to the east of the old one and consists of two adjacent metal vertical slide gates. Just below the turnout is the replacement check structure on the San Tan Flood-water Canal. It contains 4 bays, the 2 inside ones containing vertical slide gates with handwheel lifts, the 2 outer ones containing grooves for stop logs.

The bottom width of the canal at its heading is about 5 feet. After travelling southwest a short distance, the earth canal heads in a general northwest direction to its terminus just north of the Gila River in T3S, R5E, S21. From there, a wasteway delivers water back to the river. The total length of the canal is about eleven and a half miles. Dirt roads exist along both banks of the earth canal. Features along the canal consist of numerous checks and turnouts. All appear to be replacements. Typically these concrete structures contain a single metal vertical slide gate. Road crossings consist of simple single barrel concrete culverts.

Casa Blanca Canal

The Casa Blanca Canal originates at the Pima Lateral a little over a mile south of Sacaton Dam in T4S, R6E, S24. A concrete turnout structure previously described under the Pima Lateral forms the head of the canal. The first 6 miles of the canal, which has a bottom width of 18 feet

at its head, were originally part of the Little Gila Canal and are sometimes still referred to that way. The official head of the Casa Blanca Canal is located at the end of the Little Gila Canal 6 miles to the west in T4S, R5E, S12. The original structure, constructed in 1927-28, is still in place although it is no longer functional. The heading consists of a 4 bay concrete flume with a slide gate at the entrance to each bay. One of the bays has been filled in with silt and all 4 gates and hoist mechanisms are missing. Incorporated into the structure is a lateral turnout with a single metal slide gate. At this point, the bottom width of the canal is 15 feet. The entire Little Gila-Casa Blanca Canal is unlined. A roadway exists on both canal banks. The Casa Blanca Canal ends in T4S, R4E, S22. Excess water either enters an on-farm ditch or an off-reservation drain.

Features along the Casa Blanca Canal include a number of checks and drops, wells, and lateral turnouts. Primary laterals are Numbers 18-10 and 18-21 and 18-32 and 5-C. It appears that many of the structures along the Casa Blanca Canal are replacements or reconstructions, especially towards the lower end. Evidence of earlier structures that had been removed was visible. At one check/drop structure located in T4S, R6E, S23, the old metal gate structure was found in an embankment next to the canal. The existing 2-bay check/drop is of old concrete with a replacement single metal slide gate in one bay. The second bay contains grooves for the placement of stop logs. Towards the end of the Casa Blanca Canal a newer looking check\drop was noted for its lifting device. Rather than a handwheel, the single slide gate is operated by a jack-type lift. Also noted were a number of concrete measuring structures that appear to be a form of Cipolletti weirs.

Also recorded on the Casa Blanca Canal is an old abandoned pump structure located in T4S, R5E, border of Sections 9 and 10. The Peerless pump was driven by a Fairbanks Morse motor. The name John Bean Company was also identified on the structure. Although the data plate contains serial numbers, no date was found.

Southside Canal

The Southside Canal takes off of the Pima Lateral about 3 miles west of Coolidge just to the south of Highway 87. At the head of the canal is a concrete turnout structure previously described under the Pima Lateral. The canal has a bottom width of 32 feet at its head and a capacity of 225 cfs. At Station 11+00, just below its heading, the canal enters a 5,600-foot long 84-inch diameter concrete box siphon that crosses under McClellan Wash. The concrete intake structure to the siphon is original and displays an Indian Irrigation Service benchmark. A slide gate with a handwheel lift bearing the name "Snow Irrigation Supply, LA" is located at the siphon entrance. A trash rack protects the gate structure. Also included at the siphon entrance is a lateral turnout consisting of a pair of circular metal slide gates, and a gauging station.
A second, shorter 84-inch diameter concrete siphon carries the canal under the Santa Cruz Wash at Station 210+00. Up to the Santa Cruz siphon, the Southside Canal is unlined; thereafter it is concrete lined for the entire length. A dirt road exists along both banks of the canal for its

entirety.

There are very few features on the Southside Canal compared to the other SCIP canals. In addition to a number of wells, there are several bridges that are similar to each other and appear to be original. Bridges are typically a simple single span with concrete abutments, wood stringers and decking formed by 2-inch by 6-inch planks laid vertically next to each other.

Agency Canal (Renamed Progressive Ditch)
The Agency Canal is a lateral which takes off of the Little Gila Canal (Casa Blanca Canal) in T4S, R6E, S23. The lateral roughly parallels the Little Gila Canal for about four miles to its end point in T4S, R6E, S7. The Agency Canal is unlined and a segment just north of Sacaton is buried 18 inch diameter pipeline. Features along the canal include a number of turnouts. The canal has a bottom width of 5 feet at the beginning and a capacity of 20 c.f.s.

Sacaton Flats Lateral (Renamed Lateral 7-72, North Ditch)
Sacaton Flats Lateral, renamed Lateral 7-72 at its takeout from Pima Lateral, begins in T4S, R7E, on the border between Sections 27 and 28. The unlined lateral heads straight north for less than a mile and then takes off to the west as the North Ditch and then after a little more than a mile continues west as the Middle Ditch. The lateral ends at Pima Lateral in T4S, R7E, S19. Features of the lateral include a number of turnouts which appear to be fairly recent. The North Ditch has a bottom width of 3 feet and a capacity of 15 c.f.s. The Middle Ditch has a bottom width of 4 feet and a capacity of 15 c.f.s..

Blackwater Lateral (Lateral 8)
Blackwater Lateral takes out of Pima Lateral on the west boundary of Casa Grande Ruins National Monument in T5S, R8E, on the border between Sections 16 and 17. The inflow capacity of the canal is 15 cfs. The first half mile of the lateral travels straight north to Highway 87 in buried pipeline. After crossing under the road, the lateral continues north in an open earth ditch with a bottom width of about four feet for a little over a mile. The lateral then heads in a northwesterly direction inside the reservation to its terminus in T4S, R7E, S26. Along the Blackwater Lateral are numerous features including turnouts and checks. A road exists along both banks.

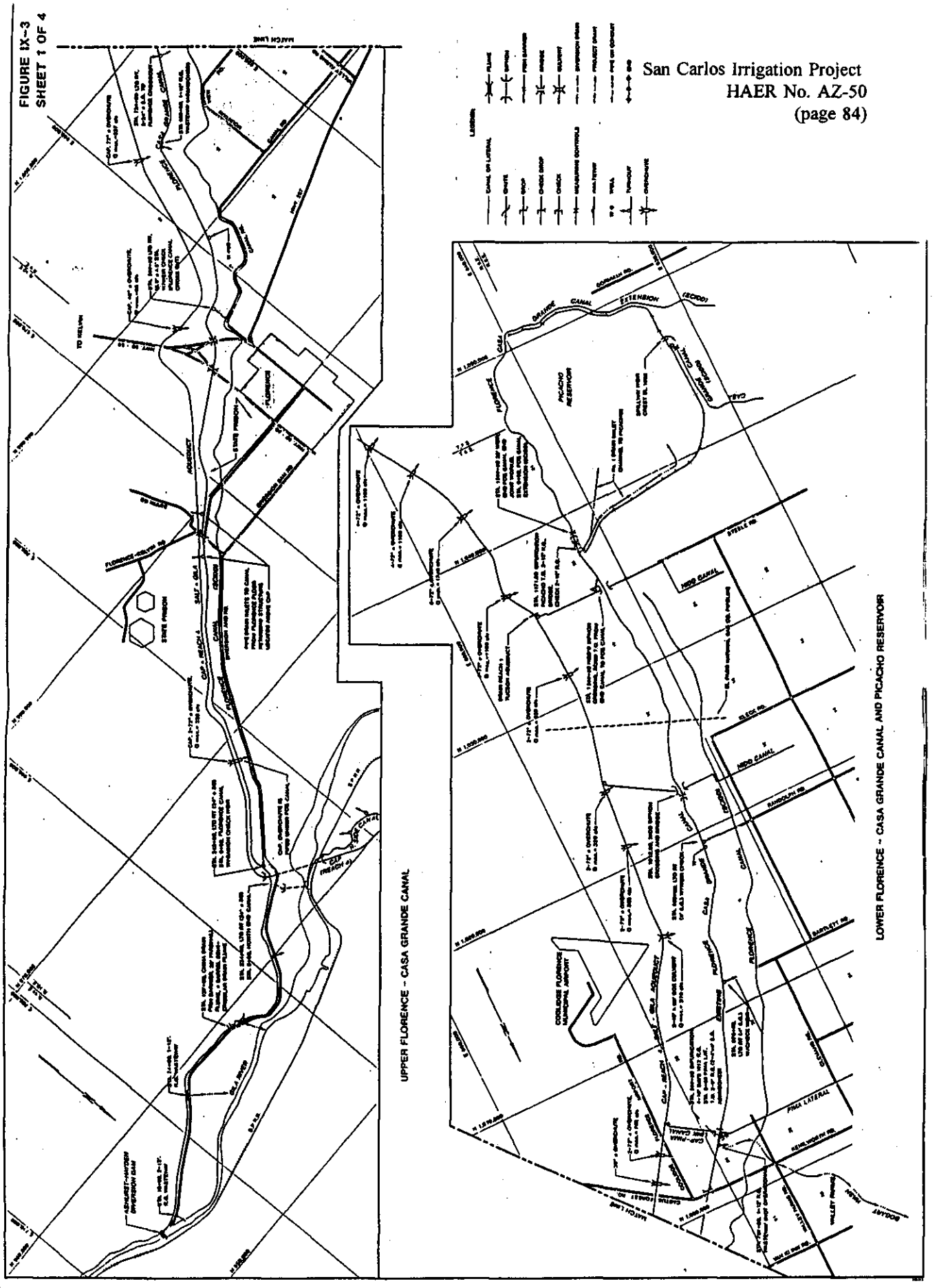
FIGURE IX-3
SHEET 1 OF 4
UPPER FLORENCE - CASA GRANDE CANAL
LOWER FLORENCE - CASA GRANDE CANAL AND PICACHO RESERVOIR
PICACHO RESERVOIR
HEID CANAL
FINA LATERAL

Figure 11

XI. PROJECT SIGNIFICANCE

The SCIP is significant in that it produced an integrated irrigation system that serves both Indian and non-Indian lands. Prior to SCIP, irrigation canals had been constructed independently on and off the Gila River reservation and had resulted in severe water shortages for the Indians due to increased upstream diversions. Implementation of SCIP was intended to alleviate that situation. It took many studies and extensive lobbying by one of Arizona's best known politicians, Carl Hayden, to secure federal funding for the project. The entire project is also closely linked with Charles R. Olberg, the BIA engineer who supervised design and construction, and whose work on SCIP culminated in the invention of a unique multiple dome design for Coolidge Dam.

As finally developed, SCIP included the construction of a major storage dam on the Gila River as well as two diversion dams. Previously constructed canals on both Indian and non-Indian lands were upgraded and extended in combination with entirely new canals to create a comprehensive distribution system. In an effort to modernize Indian agricultural practices, "lands were leveled, cleared, surveyed, titled, adjusted for gradient, and provided with ditches and headgates."[129] The development of SCIP also resulted in the creation of the Town of Coolidge which was founded in 1926 and became the location for project headquarters.

Just as SCIP has local significance as a unified irrigation system encompassing a range of storage, diversion, and distribution features, it is also notable for some of its shortcomings. The project provides interesting insights and a representative case study of the operations of the BIA (specifically, the branch then known as the Indian Irrigation Service) in the early twentieth century. At the time of its construction in the 1920's, SCIP was one of about 150 irrigation projects on the various Indian reservations of the west. The projects ranged in size from tracts of a few acres to large scale irrigable areas of well over 100,000 acres. SCIP falls between the two extremes.

In spite of the intentions of the BIA to remedy the plight of the Pima Indians, the agency's efforts fell short of its expectations. This appears to be symptomatic of other BIA projects of the period as described by Preston and Engle in their 1930 Survey of Conditions of the Indians in the United States. They concluded that "The most serious error of the Indian irrigation service is in continuing to make extensions to projects where there is a question as to the adequacy of the water supply." Among their specific recommendations for SCIP, the authors suggested that "The project limits be set at not to exceed 80,000 acres and in so doing the Indians' rights to water for the entire irrigable acreage should be fully protected." This advice was not followed and over time, the problems anticipated by Preston and Engle proved to be the case for SCIP.

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[129] Hackenberg, Robert. "Pima and Papago Ecological Adaptations". Handbook of North American Indians, Southwest, Volume 10. Edited by Alfonso Ortiz. Washington, DC: Smithsonian Institution, Washington, DC. p. 174.

The total amount irrigated has never exceeded much above 80,000 acres of which a maximum of 33,000 acres were Indian lands. In many years, the amount of Indian lands irrigated has been less than that estimated for the years prior to non-Indian settlement.

Another failing of SCIP that was described by Preston and Engle as typical of BIA projects was the lack of initial data gathering to determine feasibility. Information that should have been obtained as part of early planning included comprehensive soil surveys, determination of productive acreage, and the necessity for drainage. The lack of complete data during the initial construction phase of SCIP necessitated revamping of parts of the system as described earlier in this document. There was also no provision at the outset to educate the Indians on improved irrigation techniques which interfered with their success. All of these factors combined with a now outdated and inefficient delivery system have contributed to hamper the agricultural success of SCIP.

As stated above, the shortcomings of SCIP were not an isolated example. In fact, a study of another BIA project in Arizona revealed its own inadequacies. The Ak Chin Project on the Ak Chin Maricopa Indian Reservation was initiated in 1912 and this small irrigation system utilizing groundwater was built to serve about 160 acres. In an article entitled "Illusions of Choice in the Indian Irrigation Service: The Ak Chin Project and an Epilogue", Thomas McGuire concluded that "there was virtually no discussion of the appropriateness of the Ak Chin Project in meeting the goals, needs and desires of the newly formed reservation. It is in this sense that the irrigation system on Section 32 was a failure. But it was a failure not simply because the locus of decision making was entirely in the hands of the Indian Service. Rather, it was poorly conceived and poorly located because the decision makers gave unwarranted credence to the paper allotments, and imputed unsubstantiated motives to the recipients of these ephemeral land titles."[130]

From an engineering standpoint, although SCIP created an integrated system, as a whole it is not distinctive for any engineering or technological innovations. It was developed piecemeal, incorporating existing features with new ones. When completed, the system never operated as intended due to water shortages compounded by silting, and in some cases, design deficiencies. For most of the original features, it appears that standard BIA designs were employed. There were a few exceptions, however, and these were noted in the literature for their "experimental" nature. Although the results were costly and not always successful, the features themselves are noteworthy for their unique design. The open conduit in Sacaton Dam did not function from the start and was replaced early on with a closed conduit. The non-standard BIA design for the Sacaton Bridge proved very expensive as did the China Wash flume. Yet both the Sacaton Dam and Bridge, and China Wash Flume are distinctive and impressive structures.

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[130] McGuire, Thomas R. "Illusions of Choice in the Indian Irrigation Service: The Ak Chin Project and an Epilogue". Journal of the Southwest. 30(2). 1988. p. 200-221.

Other features found on SCIP are significant for demonstrating the evolution of the irrigation project as a dynamic system. The remaining early, if not original, turnouts, drops, and checks, bear the benchmarks of the United States Indian Irrigation Service and United States Reclamation Service. These features provide documentation of the types of regulating structures employed by those agencies and the methods of construction of the period. A few surviving early bridges also represent types of construction no longer used. Later features, some altogether new, others reconstructions of earlier ones, show the change in design and construction of irrigation structures. The canals themselves, although perhaps not of engineering significance, have altered the landscape and helped define agricultural and settlement patterns of the area.

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