

*Item # LAND OPERATOR*  
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HISTORY OF RESERVATION.

The Navajo people became subject to the United States Government through the Treaty of Guadalupe Hidalgo. No reservation had been established for them but they occupied most of the area of the present reservation. After their return from Fort Sumner, they received under the Treaty of June 1, 1868, (15 Stat. 667) the area now known as the Treaty Area. This was a block of land covering 3,328,000 acres in the northeastern part of the present Navajo Reservation. This piece of land is almost bisected by the Arizona - New Mexico boundary. The returning Navajos did not all live on the Treaty Area, but returned to their former homes regardless of location.

See map showing boundaries of original reservation, additions and dates of establishment.

Due to controversy over land granted to the newly constructed Atlantic & Pacific Railroad along the southern boundary of the present reservation, the Navajos were given a strip of land west of the Treaty Area by Executive Order of October 29, 1878. By Executive Order of January 6, 1880 they received strips on the south and east of the Treaty Area. This increased the area of their reservation to 6,750,000 acres. In addition it was estimated they used 6,000,000 acres surrounding their reservation. Thus they occupied most of the present reservation.

By Executive Order December 16, 1882, a block of land covering 2,477,780 acres in the west central part of the present Navajo Reservation was set aside for the use of the Hopi Tribe and such other tribes as the Secretary saw fit to settle thereon. This land comprised what is now known as the Hopi Reservation. The Hopi Agency at Keams Canyon was established in 1899.

After many years of conflict, the Navajos were granted the Paiute strip in Utah and Arizona south of the San Juan River by Executive Order May 17, 1884. A small area south of the San Juan River in the vicinity of Fruitland originally included in Executive Order January 6, 1880 and excluded by Executive Order May 17, 1884, was recovered by Executive Order April 24, 1886.

The Allotment Act of Feb 8, 1887, (24 Stat. 388) was an attempt to encourage the Navajos to take up land on Public Domain adjacent to their reservation, but very little land was allotted until 1908. From 1908 to 1930 over 5,000 applications were filed for individual Indians. There are now approximately 4,700 patented allotments of 160 acres each.

An area of 1,750,000 acres on western Navajo, in the vicinity of Tuba City, was added to the Navajo Reservation by Executive Order January 8, 1900. The Tuba City townsite and adjacent land was bought from the Mormons in 1903. The Tuba Agency was started soon thereafter.

The Leupp area was acquired by Executive Order November 14, 1901. 600,000 acres of land were added to the Navajo Reservation through this action.

Largely through the effort of former Commissioner Leupp the Pueblo

Bonito Reservation on the present eastern Navajo was created by Executive Order Nov. 9, 1907 and Jan. 28, 1908. Subsequently this area was restored to public domain Dec. 30, 1908 and Jan. 6, 1911, but many Indians had received allotments under the Act of 1887. The first agency on the eastern Navajo Reservation was built at Chaco Canyon in 1909 and later moved to Crownpoint, New Mexico.

The Shiprock Agency was founded in 1904 under Superintendent Shelton. The total area of the Navajo Reservation in 1910 was 10,929,244 acres.

The area in Utah, north of the San Juan, was acquired by Executive Orders Mar. 10, and May 15, 1904 and Act of Mar. 1, 1923.

President Roosevelt issued Executive Orders Nov. 9, 1907 and Jan. 28, 1908 adding approximately one and a half million acres in the southern Navajo area. Exchanges were not completed until 1911 in this area. The Grey Mountain country west of Cameron, Arizona, south of the Little Colorado, was acquired for the Navajos by Executive Order Jan. 9, 1918, May 23, 1930 and Act of June 14, 1934. Act of May 23, 1930 also acquired the area north of the Little Colorado and east of the Colorado River. Some of the Navajo mountain country in the Paiute Strip which had been established by Executive Order in 1884 was restored to Public domain by Executive Order Nov. 19, 1892, 1908 and by Act of August 17, 1922, but re-acquired for the Navajos by Act of Mar. 1, 1933.

Additions also were made to the reservation north of Winslow and in the vicinity of Houck by Act of June 14, 1934.\* These and the above enumerated acquisitions and restorations brought the Navajo Reservation to its present status of about 15,000,000 acres with a population of 44,600.

#### IRRIGATION

##### HISTORY OF IRRIGATION.

The history of irrigation on this reservation dates from 1885 when some small ditches were constructed by the Indians. This was followed by investigations and surveys made by the Indian Service as early as 1904. Several small projects were constructed within a few years after this and the development has continued at an ever increasing rate since that time. The work was principally carried on through the office of the supervising engineer, located at Albuquerque, until the beginning of the Fiscal Year 1936, when the work was transferred to the reservation superintendent.

A brief detailed history will be found under each project in the following descriptions, which include the features of History of Irrigation, Water Supply and Project Works. The details of Project Works, also Works Needed to Complete, will be found in table No. 1. Estimated Cost to Complete and Economic Program for Completion will be found in tables 2 and 3 covering the entire list of projects in the three states.

The location of each project will be found on the attached key map and the symbols (6-D etc.,) shown under the project data in table attached.

\* For additional information as to recent purchases submitted by Supt. Fryer June 3, 1939, see page 35.

Attention is directed to the fact that records of stream flows on the Navajo Reservation are very meager. It should be understood that until a long record of stream flow is available it is necessary to evaluate the project water supplies by observations. Some of the projects known to have an assured water supply are indicated by "A" and others where there is doubt are indicated by "Q" in the accompanying table No. 1. The column headed "Annual Water Supply" shows not the amount of water which might be diverted or needed, but the estimated amount which passes the headgates.

ARIZONA.

Beautiful Valley - This is an Indian project located at the junction of Nazlini Creek and Beautiful Valley Wash. During the past year the Indians secured water from Nazlini Creek by the use of a temporary heading and about 2 miles of canal.

The heading has been totally destroyed and it is proposed to construct a permanent diversion, rebuild canals and necessary structures and subjugate the land.

Begashibito - This project, located just west of the Cow Springs Trading Post secures its water from the natural Begashibito Lake supplied by a wash of the same name in Klothla Valley. The project consists of a small dam for storage, pipe line, gate tower and main canal, and was completed in 1934.

It is proposed to subjugate the land and build adequate laterals and structures, also some flood protection work. A supplementary diversion from the west is feasible and will be undertaken when additional storage is required.

Chin Leo - The first surveys on this project were made in 1904, when a small reservoir was proposed. The two units of this project, known as Chin Leo and Frazer Heading, divert water from the Chin Leo Wash at the mouth of Canyon deChelley. The upper or Chin Leo Heading, serves the land below the Chin Leo Day School in the triangle between Chin Leo and Nazlini Wash. The lower, or Frazer Heading, serves the land in the Chin Leo Valley between Nazlini Wash and Frazer's Store through a siphon under the Wash. Concrete headings, 2 main canals and a siphon were constructed in 1935-36 under a W.P.A. program, supplementing previously constructed works which have been in use for many years.

It is proposed to construct a permanent weir, improve the 2 main canals, and subjugate the land. There is an ample water supply, but control is difficult on account of the continual movement of sand in this wash.

Denehotso - This project is on Laguna Creek and had been used by the Indians for 20 years prior to 1923 when the Government built a log crib diversion dam. This diversion dam was replaced by a concrete diversion in 1929-30, and a pipe flume was also constructed at the diversion on the south side. The main canal on the south side was recently completed while the main canal on the north side is yet to be rebuilt. Repairs to the dam and installation of sluice gates were carried out in 1933-35 under W.P.A. funds. The Soil Conservation Service built a new highline

canal on the south side in 1937-38, and also did some work on the north side of the canal.

It is proposed to construct a new main canal on the north side, provide adequate sluice facilities and subjugate the land.

Fort Defiance.-

Bonito Creek - Mr. Shoemaker, first Superintendent of Irrigation on the Navajo Reservation, supplementing his report of 1897, described the temporary loose rock and brush diversion and crude canal in use at that time. Both Agency and Indian lands were irrigated. He made some changes and repairs to the system. Surveys for reconstruction were made in 1903. A concrete diversion and headgate and 300 feet of new canal were constructed in 1922. Some subjugation work was done in 1937, mainly from CCC-ID funds. There is a concrete heading and outlet gate which diverts water from Bonito Creek on the north side and serves the irrigable land between Bonito Creek and Black Creek, immediately west of the Fort Defiance School.

Black Creek - This is a masonry diversion dam with outlet gate constructed in 1937-38 under the Irrigation-CCC-ID, cooperative, to serve land adjacent to Black Creek in the area north of the Good Shepherd Mission. About 1000 feet of main canal has been constructed. The 1939 program calls for installation of steel headgate and flumes to replace the wooden structures.

It is proposed to construct a new main canal on Bonito Creek, complete the main canal on Black Creek and subjugate the land.

Ganado - This project is located on the Pueblo Colorado drainage just east of the Ganado Community Center. A canal was constructed by J. L. Hubbell in 1903 to irrigate 160 acres. Under an agreement with Hubbell, approved by the Department May 31, 1913, he gave up his water rights and ditch in exchange for right in the proposed reservoir. Funds were appropriated by Congress for construction of the project, including a storage dam and 5-1/2 miles of ditch to cover 707 acres of land. The estimated cost was \$60,000 and construction work was begun in the spring of 1913. In 1923 extensive repairs were made to the headworks, following a severe flood. Again in 1931 the diversion was destroyed and the headworks were again rebuilt as they stand today. The project works consist of a masonry diversion, feeder canal, and an earth fill primary storage dam. About 9 miles north of the project there is another small masonry diversion from the headwater of Beautiful Valley drainage, with a short feeder canal to the Pueblo Colorado where the water is impounded by an earth fill secondary storage dam. The main canal from the Ganado primary storage follows the north side of the Pueblo Colorado Wash to a siphon just above the Ganado Mission, where the water is divided.

It is proposed to construct an additional diversion into the secondary storage.

Operation and maintenance of the present project, and of several closely related projects, as later defined, is carried on with pitifully inadequate funds. Needs for 1940 and succeeding years are \$3,500, increasing to \$5,000 in 1941, \$10,000 in 1942, \$15,000 in 1943 and thereafter.

See note of Proj. 241912  
(37 Stat. 5-222)

Annual assessments at the rate of \$3.00 per acre are made in accordance with order of the Washington Office.

The Ganado Water User's Association is composed of all Indian farmers on the project. There is no organization among the few white users.

Collections in past years have been made at stipulated rates from white users and at the rate of about \$1.00 per acre from Indian users. The collections from Indian users have been in the form of endorsed checks issued in payment for labor in connection with spring ditch cleaning.

Present plans call for consolidation <sup>was made</sup> of several closely related developments under the one title of Ganado Project. These include Cornfields, Coldfields, Klagech and the present Ganado Project. Under such a consolidation, one foreman can be responsible for all operation and maintenance activities, justification for more adequate funds can be based on a larger and more effective Indian Water User's Organization. A more comprehensive program of education in land usage instituted.

Cornfields - The Cornfield unit is also on the Pueblo Colorado, about 6 miles below Ganado. Proposals for development were recommended between the years 1900-20. Government assistance was given the Indians in construction of a diversion and main canal during 1921-23. The Soil Conservation Service did a small amount in 1936. The project works consist of a loose rock diversion and main canal with 5 masonry turnouts. The 1939 program includes construction of a wood pile throat and silt trap and realignment of the Indian ditch.

It is proposed to extend the system and subjugate additional land as the Indians request it.

Houck - This is an Indian built system which has been used for many years and is located near lower Black Creek just above the junction of the Rio Puerco. The Soil Conservation Service gave some assistance in the form of bank protection in 1935. A permanent diversion and headgates are included in the 1939 program.

Future works will include reconstruction of the main canal with structures, construction of a lateral system and subjugation of the land.

Jeddito - This is a new project on the lower Jeddito Wash. Construction of a diversion, headworks and main canal is included in the 1939 program.

Future works will ultimately consist of a two-way diversion or a siphon in order that land on both sides of the wash may be served, also construction of a lateral system and subjugation of the land.

Kinlichee - This project was begun in 1925, prior to which the Indians were using crude and temporary methods. It is located on the Pueblo

Colorado upstream from Ganado. It is designed to irrigate land on the north side of the wash near the Kinlichee Day School. During 1925-26, a diversion, main canal and several flumes were constructed. A new masonry version was constructed in 1933 from W.P.A. funds. The projects include a masonry diversion weir, concrete headworks, main canal and 2 siphons.

Future plans call for construction of a lateral system and subjugation of the land.

Klagetoh - This project is located on a tributary to Wide Ruins Wash near the Klagetoh Day School. It includes the Demonstration Area fenced by the Soil Conservation Service. A storage dam and distribution system was built under W.P.A. funds in 1933-36. A small amount of maintenance work was done in 1937 by the Soil Conservation Service.

Future works will include some reconstruction of the main canal and laterals, subjugation and maintenance.

Lower Dinebito - This project is located on the Dinebito Wash northeast of Hotevilla. It is a new project recently completed. The project works consist of a concrete diversion and main canal, begun in 1936 and completed in 1937. Laterals, subjugation of the land and fencing of 230 acres were completed in 1938.

No future work is planned at this time, but should include extension of the irrigable area if needed, planting of windbreaks and maintenance.

Lower Moencopi - This is a new project located on Moencopi Wash about 9 miles below Tuba City. The project works consist of a concrete diversion and headworks and a main canal built under P.W.A. in 1933-35. Project works consist of a masonry arch dam with concrete apron and stilling pool, concrete headworks, main canal with masonry drops constructed under P.W.A. in 1933-35. The Soil Conservation Service did some maintenance work in 1936 in cooperation with the Irrigation Service and placed a reinforced concrete blanket on the spillway and provided tailwater outlets on the irrigable area.

Future work will consist of construction of a lateral system, fencing, windbreak planting, erosion protection and subjugation of about 400 acres. Improvement of the headworks and dam must be prosecuted immediately to save the structures.

Lower Rock Point - This is one of the larger new land projects. It is located on Chin Lee Wash, just below its junction with Lukachukai Wash. The project works consist of a large earth diversion dam with a solid rock spillway, concrete headworks and main canal. Work was begun under P.W.A. in 1933. Construction of a lateral system, subjugation, fencing and windbreak planting has been partly constructed on about 800 acres. Additional subjugation and investigation of ground water supply by well drilling were included in the current program.

Future work will consist of completing the lateral system, better sluicing facilities on the main canal and subjugation. This is one

of the large potential land areas on the reservation near an assured water source and the future is expected to develop a need for more extensive construction in this area. A large storage dam on Lukachukai Creek has been considered. A permanent weir may become necessary.

Operation and maintenance appropriations of \$3,500 in 1940, \$5,000 in 1941, \$5,000 in 1942, \$8,000 in 1943, \$10,000 in 1944 and \$12,000 in 1945 should be made specifically for this project.

Lukachukai - Tohtso - This is located on Tohtso Creek, a large tributary of the Lukachukai. Project works include a concrete diversion weir with a main canal to supply land on the north side of Tohtso Creek. 80 acres under the Tahtso Canal have been subjugated. 16

Future work includes the extension of the Tohtso Canal or construction of a new canal from the Lukachukai diversion on the south side to serve additional land between the two washes. The latter would require either a flume or siphon across Tohtso Creek. Construction of a storage reservoir on the headwaters of Lukachukai may be found desirable in the future.

Many Farms - This is a large new land project begun in 1933 by the CCC-ID. It is located on the Chin Lee Wash, just below the Frazer Store. The project works consist of a loose rock diversion, concrete headworks, main canal and laterals. Subjugation and fencing of 500 acres was also completed in 1937-38. 17

Future plans include extension of the main canal to serve the old Indian project of Many Farms, about 3 miles north of the present project, where the Indians for many years have been irrigating from the temporary heading, and it is planned to provide water from the main canal now being completed.

Marsh Pass - This is located on Laguna Creek near the Government School at Kayenta. After completion of the school in 1914, Engineer Baker made the first investigations. Work was started in 1916 and the project formally accepted by the Agency in 1919. Floods caused much damage and necessitated considerable maintenance work in the following year. The present works consist of a masonry dam, feeder canal, earth storage dam and main canal to the farm lands. Considerable work was done on the project under P.W.A. funds in 1933-35. 18

Future work will include construction of a lateral system, reconstruction of a portion of the feeder canal, excavation and protection of a portion of the main canal now endangered by blow sand, repairs to the dam, construction of a lateral system, fencing, windbreak planting and subjugation.

Moenava - The five small units at Moenava are located in small valleys below the high escarpment west of Tuba City. They were old Mormon projects acquired by the Indians in 1900, where there are many natural springs. The work consists mainly of collecting the water from these springs into small storage reservoirs. Some work was done under P.W.A. in 1932-35. Extensive development took place in 1935-36 under the Soil 19

Conservation Service. The five units, namely, Old Moenave, Upper and Lower Vanzee Ranch and Upper and Lower Littlefields, are within the Soil Conservation Service Moenave Demonstration Area. A complete system of laterals and feeders was built and the land subjugated.

Future work will include construction of a small storage dam if found feasible by investigations now being made.

Moencopi Wash - This project is located on Moencopi Wash near Tuba City on land formerly owned by the Mormons. The land was acquired in 1903 by purchase. A dam originally built by the Mormons washed out in 1909 and was repaired that year. It again washed out in 1910, and was later destroyed by floods. A concrete diversion was provided in 1915 and work on the canal, sluice gate and wasteway was done in 1921-24. The present works consist of a concrete diversion, main canal and lateral system. The irrigated areas have been fairly well subjugated.

Future work should include the construction of a more efficient lateral system, bank protection on Moencopi Wash and additional subjugation.

Natural Bridge - This was originally an Indian project designed to divert water from Black Creek through a concrete heading into an earth storage on the west side of the wash, which was constructed, together with a distributary system, under P.W.A. in 1933-35. Since then Black Creek has changed its course so as to leave the intake.

To make the diversion system operative it will be necessary to construct a diversion crest across Black Creek, build a new main canal and structures, raise the present storage capacity to 5500 acre feet and subjugate the land.

Nazlini - This project is located on Nazlini Creek near the Nazlini Store. Project works consist of a concrete heading and main canal. Natural rock in the stream bed is used as the diversion crest. The main canal was built primarily for land west of the Nazlini Creek, however, construction of a small canal and wooden flumes provided water for small farms adjacent to the stream. A diversion and canal was constructed under P.W.A. in 1933-35. Flumes carrying water to the old Indian lands in the canyons were repaired in 1936. They are again in need of some work.

Investigations have shown that the soil in this area is of poor quality and the possible silting of the proposed reservoir would render it useless in a short time. Due to these factors the project is likely to be condemned and no more developments made.

Oak Springs - This is an old Indian project consisting of a masonry storage dam impounding water from springs and small perennial streams serving a small area through the main canal. Work was done on this project by E.C.W. and the Soil Conservation Service in 1935-38.

Completion of the project will require work on the main canal which will be done chiefly by the Indians with some assistance by the Government in supervision and furnishing of materials, also subjugation of the irrigable area.

Oraibi Wash, -Lower - This project is located on Oraibi Wash, north-east of the Oraibi Village. The project works consist of a masonry diversion dam and headworks, silt trap, main canal with flume, rough leveling and fencing of about 70 acres. It was built under P.W.A. in 1933-35. CCC-ID fenced and rough leveled the land in 1936, also some maintenance work was done on the main canal. Upper Oraibi, or Hardrock, is a potential project on which no work has been done.

Paiute Canyon - This project is located in Paiute Canyon which is a tributary to the San Juan River. The first work was done in 1921 when five flumes were installed in the canal. The present works include a masonry diversion dam and main canal with a number of flumes and drops constructed under P.W.A. in 1933-34. The Soil Conservation Service put in additional flumes and worked on the canal in 1936.

Future works for this project will include subjugation of the irrigable area and construction of laterals and structures and flood protection.

Red Lake - This project is located on Black Creek north of Fort Defiance. This was one of the earliest projects built for the Navajos. A crib diversion dam, feeder canal and storage dam were constructed in 1885. A distribution system to cover 700 acres was provided soon after. The diversion dam washed out in 1906 and was repaired. The system was again damaged in 1916 and again repaired, at which time the land had not been put to use. The present masonry diversion dam and concrete headgates were built in 1936. Feeder canal was also rebuilt in that year. The project works consist of a diversion dam, feeder canal with two sluice ways, earth storage dam, main canal with wooden structures and flume across the flood channel.

It has long been the plan to raise the dike on the storage dam in order to increase the capacity of the lake to care for additional land on Black Creek below the present project. Considerable work on the present main canal and construction of a canal for the new lands will be necessary. Subjugation of all land brought under the project is badly needed.

Red Rock -

Cove - The project works on this unit consist of a concrete diversion, 2 masonry diversions on the main drainage, heading in the Cove Demonstration Area, and main canals to the irrigable lands. The upper diversion and canal was built under P.W.A. in 1933 and the Soil Conservation Service Demonstration Area was opened in 1934 when new diversions and canals and the wasteway on the original diversion were constructed.

To complete this project metal headgates should be installed on the diversion dam, concrete sluice ways provided on the main canal and the land should be fully subjugated.

Unit - This was originally an Indian project. The project works consist of a concrete diversion with headworks and main canal constructed by the Government in 1927.

Sluice way structure and subjugation of the land are needed to complete the project.

Valley - The project works include a masonry arch storage dam on a<sup>49</sup> tributary to Red Rock Wash, constructed in 1937. A small concrete diversion from the channel below the storage dam was completed in the same year.

A metal flume and subjugation of the irrigable area is needed to complete the project.

Zilbetod - This is located on the tributary to Red Rock Wash, north of Red Rock. The project works consist of a concrete diversion with headworks and a main canal built in 1932. These have been partially destroyed and are to be reconditioned in 1939.

In addition to reconditioning the existing work the land should be subjugated.

Reservoir Canyon - This project is located on a short tributary to Moencopi Wash near Tuba City. Due to the extensive amount of ground water in this area, Reservoir Canyon flows a dependable stream the year around. This was first utilized by Mormon settlers who are said to have been implicated in the Mountain Meadow Massacre. The Mormons had constructed three reservoirs in the canyon and after the lands were purchased in 1903 the Indians began farming them. In 1908 two of the dams were rebuilt and raised and headgates installed. Drifting sand threatened to fill the canal and a stone culvert was built. In later years this was extended by use of corrugated pipe. A new feeder canal was constructed in 1937 by CCC-ID. This project has long been used by the Hopi Indians of the Moencopi Village and the lands are fairly well subjugated.

Improvement of the reservoir and subjugation of the land would complete this project.

Rock Point - This project is located on Lukachukai Creek just above the large lower Rock Point project. This is an old diversion used by the Indians and improved from time to time by the Government. The concrete diversion, with earth dike and a main canal were constructed in 1932-33. The earth dike on the east end of the concrete weir was subsequently washed out and the Indians have farmed for sometime by making temporary repairs.

It is proposed to construct a permanent diversion weir and improve the main canal by providing sluice structures and subjugate the land.

Round Rock - This project is located on the south side of Lukachukai Creek under an earth storage reservoir supplied by 4 miles of feeder canal diverting water from Lukachukai Creek by means of a concrete diversion dam with radial sluice gate. Two main canals serve the land below the reservoir. Two tracts, totaling 120 acres, have been completely subjugated. The first surveys were made in 1925. The concrete diversion dam was completed in 1934, main feeder canal and part of the distribution system in 1936, while the storage reservoir and the remainder of the distribution system and part of the subjugation of the land were completed in 1937. Additional subjugation will be done in 1939.

Future work will include construction of additional main canals and subjugation of land as selected. 34

Segihotsoci - This is one of the few projects available to the Indians in the northern part of the reservation. It was considered for development from 1900-28, but due to extreme distances and unimproved highways the plans were never carried out until 1928, when the Indian system was improved by construction of a headgate and flumes. A concrete diversion was constructed in 1933-34, and maintenance on the distributary system was done in 1937, by both the Irrigation Service and CCC-ID. Some improvement to the distribution system is being made from 1939 funds.

To make this project efficient it will be necessary to construct a sluice gate, improve and extend the main canal, provide structures and subjugate the land.

Sehili - About 1885-86 a ditch approximately three miles long covering some 505 acres, was built by the Government. In 1904 the Indians were using about 1 mile of ditch and irrigating about 100 acres. In 1933-35 a loose rock diversion with concrete headworks and a main canal were constructed. Some maintenance work was done on the diversion by CCC-ID in 1937. 31

To complete this project a sluice way should be constructed, the main canal improved, irrigable area subjugated and erosion control is needed.

Tenospos - This project, commonly known as Carrizo Creek in the early days, was an Indian project when Shoemaker reported on it in 1897. Aside from occasional maintenance to the old Indian system no work was done by the Government until the P.W.A. program of 1933-35. Project works include three concrete diversions with headworks and two main canals with structures, including drops, turnouts and one flume. Part of the irrigable area has been fairly well subjugated. 36

Biclabito - This project consists of a masonry diversion, feeder canal, earth storage dam and main canal. 60 acres have been subjugated. The storage dam, originally an ECW stock tank built in 1934, was raised, the diversion dam and feeder canal constructed and the land subjugated and fenced in 1937 cooperatively by Irrigation and CCC-ID. 35

Additional work, other than maintenance, will be required only in case additional land is brought under the system, which would require an extension of the main canal and additional subjugation.

Todenstani - The project works on Upper Todenstani include 2 concrete diversions, feeder canal and main canal constructed under P.W.A. funds during 1933-35. 37

Future work should include extension of the main canal with structures to take in part of the land in the lower end of the project in place of some of the steeper land in the upper area which is affected by erosion.

The future plan will have to include erosion control and flood protection. The main canal, being very steep, will need additional drops and paved sections. Structures and subjugation are also needed.

Todenstani, Lower - This project lies at the foot of the Carrizo Mountains and is subject to terrific floods. The project was constructed at the time Upper Todenstani was constructed, just west of Tesnospos. The project works consist of a masonry diversion, sluice gate, headgate and main canal. No land was brought under this system and it has been found that this project is not practicable due to inferior quality of the land. 39

Tolthlakan -

Tochenlini - This project is located on both sides of Walker Creek near the Sweetwater Trading Post. It consists of a concrete diversion with two headworks and two main canals constructed in 1927. Additional work is included in the 1939 program. 40

Future plans include construction of another outlet and sluice gate for the lands on the north side of the wash, structures on the main canal on the south side, new main canal with structures on the north side with silt traps on each canal and subjugation of the lands, also fencing.

Tolani Lakes - The Indians had long taken advantage of the natural flooding of Oraibi Wash over numerous lakes northeast of Leupp. They planted on the silt fans and let natural flooding do the rest. In 1934 the Soil Conservation Service began an extensive program designed to control this flooding and provide an irrigation system. A large earth dike has been constructed to divert water from the fan of the Oraibi Wash into Corn Wash in the Denobito drainage. A concrete and masonry weir with outlet and sluice gates has been provided and a canal with 5 masonry checks and turnout constructed to irrigate a small area. 41

To make the system workable it will be necessary to install a larger outlet gate and a large radial sluice gate and to reline and regrade the main canal. The area selected for irrigation will also require subjugation and enlargement provided further evaluation of the project indicates that it is feasible. It is understood that some \$12,000 would be required for reconstruction and \$3,500 for subjugation.

Wheat Fields - In 1885-86 the Indian Service built a small ditch and crib diversion from Wheat Field Creek. In 1897 the original works were repaired and two miles of new canal built by Mr. Shoemaker. The Indians were actually farming the land at that time. This was known as the upper unit. 42

A report was made in October 1904 regarding the possibility of diverting water from the creek for storage in a reservoir. A diversion dam and supply ditch were built in 1905-06. Work was started on the storage dam in 1907 and finished early in 1910, to a capacity of 1300 acre feet. A main canal from the reservoir carried water to the irrigable area, about a mile from the dam. This is known as the lower unit. The diversion has been washed out for sometime, but water is still diverted to the lake by temporary methods.

Proposed work includes the improvement of the main canal with adequate structures, a permanent diversion dam and headworks on the upper unit, also a concrete or masonry diversion to the feeder canal and reconstruction of the main canal of the lower unit. Subjugation of the land in both units would complete the project.

NEW MEXICO.

Captain Tom -

Captain Tom and Captain Tom Lower - The first work on this project was the construction of a diversion dam and canal near Nava in 1915. Two concrete diversions were constructed in 1924. Repairs made to the headgates on the Nava diversion and a new canal dug in 1928. The Captain Tom storage dam was built under P.W.A. funds in 1933-36 to a capacity of 1020 acre feet. Sheep Dip storage dam was also built at the same time, having a capacity of 710 acre feet. There are two main feeder canals. A small diversion and feeder canal from Sheep Dip storage were built in 1937.

Future work on Captain Tom and Captain Tom Lower include reconditioning four of the five diversions, construction of a new diversion, installation of permanent canal structures, raising the Sheep Dip storage dam 20 feet to give a total capacity of 4500 acre feet and subjugation of the land.

Specific appropriations should be made for operation and maintenance of this project as follows: \$2,500 in 1940, \$3,500 in 1941, \$5,000 in 1942, \$8,000 in 1943, \$10,000 in 1944 and \$12,000 in 1945.

Grey Mesa - A masonry diversion and two main canals are the principal features constructed on this project under P.W.A. in 1933-36.

Future work includes installation of metal gates in the diversion dam, improvement of the two main canals and subjugation of the land.

Toadlena - This unit includes the Hudson Lake reservoir, date of construction unknown. The dam washed out in 1936 and was repaired under the 1938 program. There was also a small storage dam at the school, date of construction also unknown. The diversion dam and main canal were built under P.W.A. in 1933-35. Some Government assistance was given the Indians in constructing a log crib diversion, which has been partially destroyed.

Future works on the unit include the replacement of the log crib diversion with a permanent concrete structure, stabilization of the main canal and subjugation of the land.

Casamera Lake - This project consists of a diversion, storage and distribution system built under P.W.A. in 1933-35. It is not considered feasible at the present time.

Chas. H. Burke School - This project was a three acre garden used by the school in 1928. Extension of the project to its present works and size was made in 1930. The storage reservoirs were revamped by the Soil Conservation Service in 1937. The project consists of two earth storage dams impounding water from a large spring south of the school, which is conducted to the reservoir in a lined canal. There is an extensive spring runoff from the small mountain watershed to the south. Water is taken from the reservoir through one main canal and used on the school land.

Completion of this project will require enlargement of the present canal, installation of structures and subjugation of the land.

Choiska - This project is located below the Tohatchi School. The area <sup>40</sup> was farmed for 75 years by Indian methods prior to construction of a permanent diversion and canal in 1929. The dam was damaged by floods in 1932 and reconstructed that same year. A new sluice gate was installed in the diversion from P.W.A. funds in 1933-35. A new sluice way and drop were built in the canal in 1937. A masonry diversion and canal are now being constructed to divert water from the Tohatchi drainage into Red Willow drainage which is the source of supply for the project. This will increase the available irrigation water.

Future plans for the project include the construction of a storage reservoir at Whiskey Lake, which lies in the head waters of the Tohatchi drainage. Also construction of another storage reservoir on Red Willow drainage, reconstruction of a main canal and subjugation of the irrigable area. <sup>49</sup>

Crystal - This project is in two units. Upper and lower. Upper Crystal project was started by the Indians in 1890. A log crib diversion dam was built by the Government in 1895. This project was known as Cottonwood Crook and was described by Mr. Shoemaker in a report in 1897. Some repairs were made to the system in 1909. The structures were badly damaged during the flood of 1929 and the project, as it now stands, was reconstructed during 1928-29. The project includes a main canal, partially concrete lined, with four flumes. Work on the Lower Crystal Project was done under P.W.A. funds in 1933-37. This project includes a concrete diversion dam and headworks on rock diverting to the north side, part of the water being carried to the south side through a pipe across the diversion crest into the main canal. A main canal has also been provided for the north side.

To complete the Upper Crystal project so that it can be operated, extensive subjugation will be necessary as the land is good but excessively steep. More turnouts and checks are needed on the main canal. On Lower Crystal, sluice gates and turnouts should be provided. An excellent storage site could be developed immediately below Lower Crystal to provide supplemental storage for Red Lake as well as for land immediately below the site. Subjugation of the land is also necessary.

Cudai - This project is almost completely Indian constructed. Early reports <sup>50</sup> indicate that this land was being farmed as early as 1900. The project consists of a brush and rock weir, main canal and lateral system to some exceedingly fine land. No major structures have been built. The Government has assisted in some maintenance on the heading and canal.

This project should be completely revamped and subjugated.

Fruitland - The Fruitland Project is located on the south side of the San Juan River, near Farmington, New Mexico. This project has been partly constructed with funds allotted under the P.W.A. program beginning in 1933 and will be completed with funds allotted under regular appropriations. The irrigable area of the project is 3,675 acres which is to be divided into small tracts for such Indians living in the vicinity who will make beneficial use of the land. This project, when completed, will sustain approximately four hundred Indian families and will greatly relieve the overcrowded condition of the range in this section. There are at present approximately five hundred acres under cultivation on the old part of this project, which includes 2 units of good land along the river served by old <sup>51</sup>

Indian ditches.

Project works consist of a loose rock diversion dam in the San Juan River, reinforced concrete sluice ways and headworks, main canal 23 miles long with 26 structures, 60 miles of laterals with 900 structures, 1 automatic waste gate, 6 sand traps, 2 metal flumes, 1 thirty-six inch steel siphon 9280 feet long, concrete lined tunnel 3800 feet long, concrete flumes, siphons, drops and smaller canal structures. Subjugation of some 600 acres has been completed. The area under constructed works is 1150 acres and the ultimate irrigable area of the project is 3675 acres.

Completion of the project will require mechanizing the headgate control, improvement of the distribution system and subjugation of the land, including windbreak planting and fencing to be prosecuted during the next 5 years.

Estimate of cost to complete and economic program of completion will be found in tables attached.

Operation and maintenance of the project is being carried on under present appropriations of \$14,000 annually which will be sufficient through the fiscal year 1944, but should be increased to \$15,000 in 1945 and should be made specifically for this project.

No water users organization exists at the present time on this project.<sup>52</sup> It is anticipated that one will be formed during the current fiscal year.

Hogback - This project is one of the oldest, largest and most successful on the reservation. In 1903 or 1904 a small ditch was built to take water from the San Juan River about 9 miles above the Shiprock Agency. The heading was in solid rock and consisted of about 75 feet of tunnel with a timber headgate built by the Indian Service and about 4 miles of ditch built by the Indians at their own expense. The cost to the Government was \$350. Project surveys were begun in 1937 under Superintendent of Irrigation Harper. Superintendent Shelton and Assistant Engineer Ritter reported 767 acres being irrigated in 1908. In the fall of 1908 and spring of 1909 Consulting Engineer J. H. Quinton reported favorably upon the proposed project. The canal was to be 12-1/2 miles long to cover 3900 acres of land. Actual work was commenced in May 1909 and continued during 1910-11, when a new concrete heading and a new main canal were started. In July 1911 there occurred the heaviest flood known from the time of earliest settlement, doing considerable damage to the canal. Another flood in September further damaged the canal and in the first week of October general rains caused a larger flood than in July, the water reaching a point about 5 feet higher. Water went over the entire headgate, destroyed about 600 feet of canal, making it necessary to change the entire plan of headworks. The total expenditures on this project in 1909 to 1913 fiscal years amounted to \$180,980.44.

In 1933-36 the diversion was strengthened and the main canal extended, 1100 feet of canal lined, 500 acres subjugated and bank protection works improved.

The water supply is obtained by direct diversion from the San Juan River. A filing on 110 sec. ft. of water was made with the State Engineer Mar. 13, 1913, approved Aug. 11, 1913.

The project works consist of a loose rock weir built in 1932-33 under P.W.A., reinforced concrete headgates, 18 miles of main canal with 45 structures, 42 miles of laterals with 500 structures, concrete automatic wasteway, 3 sand sluices, 6 metal flumes and 2 metal inverted siphons. Also 2 miles of drainage canals and 2 miles of dikes. Some rough leveling has been done on the lower part of the project. There are 5425 acres of irrigable land under the project and 3064 acres are under constructed works.

A power plant was constructed near the Sub-agency in 1936 to supply power for five pumping plants proposed to pump water from the canal and the river at various points in the vicinity of Shiprock. This is a gas-electric plant with two units, using propane gas from the Rattlesnake Field about 7 miles southwest of Shiprock. Power and gas are being used at the Sub-agency, but the pumping plants have not been installed. An 8 mile transmission line to the Hogback heading was also installed in 1936. The gas engines are type LOC, 4 cyclo, Superior, 6 cylinder, 300 HP, 360 RPM.

Generators are Electric Machinery Mfg. Co., 2400 volts, 60 cycles, 440 KVA, 352 KW, Superior with Flyball Governors.

The transformers are 3 in number, step up, total capacity 225 KVA, 2300 volts primary, 6900 volts secondary.

The transmission line is 8 miles in length, 6900 volts, 60 cycles, 3 phase with 4 stranded bare copper for 6 miles and No. 6 solid bare copper for 2 miles on 30 foot cedar poles spaced 175 feet.

The 5 pumps which have been purchased but not installed are 6" to 12", Byron Jackson, horizontal, centrifugal and vertical turbine, speed 1160 to 1750 RPM with total capacity of 11,000 GPM against a static head of 85 feet with 6" to 12" discharge pipe.

The motors, 6 in number, are General Electric, induction type, 220-440 volts, total 310 HP.

Future work required on this project will consist of drainage on some 700 acres, 2 sluice ways on the upper end of the canal, extension of the main canal, complete subjugation of some 600 acres, river protection on the upper half of the project and installation of 5 pumping plants for irrigation of additional land when necessary. The pumping units have been purchased.

The estimated cost to complete is shown on table No. 2, showing distribution by features.

The economic program is shown on table No. 3.

The Indians living on this project are wholly dependent upon their ability to produce profitable crops. In this section of the reservation the Indians are turning to agricultural pursuits for a livelihood with surprising rapidity. It is expected that all available land will be in use in the near future. In order to successfully maintain and operate the system, which is at present serving more than 3000 acres of the available irrigable lands, it is necessary to keep a small crew at work the entire year.

Present specific appropriations of \$15,000 annually are believed adequate for the operation and maintenance needs of this project.

Assessments at the rate of \$3.00 per acre are made in accordance with an annually renewed order from the Washington Office.

The Indian water users are organized under the Hogback Water User's Association formed in 1927 when 1836 acres were reported under irrigation. No organization for the few white users exists. There is no repayment contra

In the past few years collections have been made from all white users, including Government institutions, at the stipulated rate. Collections from Indian users, made through the Hogback Water User's Association, have amounted to approximately \$1.00 per acre. These collections have been accomplished by means of endorsed checks issued to the Indians in payment for spring ditch cleaning labor. An effort is being made through the Extension Division to educate those Navajo farmers, both individually and as an organization, to the necessity for making full payments and as to the advantages to be derived in more adequate operation facilities and maintenance work when full payments are made.

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Juans Lake - The Indians were using some of this land at the time Supt. Robinson made a report in 1921. No major work was done until 1933, at which time a diversion dam, storage and distribution system was built under P.W.A. funds. The project works include an earth impounding dike and a storage dike on the natural basin known as Juan's Lake. Water is diverted from the Kimenola Wash. It is stored and conveyed to agricultural land below the lake by means of an outlet tower and main canal.

To complete the project fully it will be necessary to rework the main canal, provide turnouts and checks and to subjugate the irrigable area. An evaluation of this project will probably indicate its impermanency.

Mariano Lake - This project was originally an Indian built stock reservoir. Under the P.W.A. program of 1933-35 a larger storage dam and distribution system were built. The project works consist of an earth impounding dike and outlet tower, also a diversion dike.

To complete this project it will be necessary to construct a main canal with suitable structures and to subjugate the land. The dry cycle of the past few years has made this project of questionable merit.

Mulholland Well - This well was drilled originally as an oil prospect about 20 years ago through private enterprise. It developed into a good water well and the owners constructed a small storage reservoir and subjugated about 10 acres of land. The project was purchased for the Navajos soon thereafter. In 1935 E.C.W. built a large storage reservoir and did some maintenance work in 1937. This is an artesian well with a flow of 110 gal. per min. Two earth storage dams conserve the water for irrigation.

To complete the project it will be necessary to construct a main canal with structures and subjugate about 100 acres of land. A new well should also be provided to serve the larger area.

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Naschiti - There are 2 units, North and South. The old Indian system near Drole's Store, on the north unit, was revamped by the Soil Conservation Service in 1936, when 2 diversions and 2 main canals were constructed at this site. Under the current year's program 3 diversions, 1 storage dam and a distribution system are being built.

The Lower, or Southern, unit includes a storage and distribution system built under P.W.A. in 1933-35.

Additional main canals and subjugation of the irrigable area will be needed to complete the project.

Sanostee - There are 5 small units in this group. The Indians had been irrigating by means of a temporary diversion in the Sanostee unit for many years. By 1930 they had constructed 3 miles of canal on the north side of the wash. The Government built a concrete diversion and a new canal in 1931. The works now consist of a double wing concrete diversion with sluice and outlet gates and 2 main canals with 3 flumes on one of the canals.

To complete this unit repairs should be made to existing structures, additional structures provided and the land subjugated.

Beautiful Mountain - This is an Indian unit which has received no assistance from the Government under than small amounts of maintenance. No major structures have been built. The Indians used their own main canal with a temporary heading. Plans for a permanent diversion were at one time approved, but a movement was started to remove the farmers to Sanostee and the money was transferred to that unit.

If and when this unit is constructed it will be necessary to provide a diversion, main canal with structures and subjugate the land. This will probably be desired as soon as the adjoining Sanostee unit is completed.

Stinking Water - This small unit has been operated for 30 years by the Indian farmers with a temporary heading and they have constructed 2 miles of canal. An earth storage dam on the upper Tociito drainage was completed in the fall of 1938. The Indian Service is constructing a masonry diversion with stool outlet gates.

Additional work needed to complete this unit is the installation of metal outlet and sluice gates at the diversion dam, reconstruction of the main canal with structures including sluice way and subjugation of the irrigable area.

Tocito - This is an old Indian unit on which the farmers used a temporary diversion and 1 canal. The 1939 program includes construction of a masonry diversion.

Completion of this unit will require construction of the main canal with structures, including sluice way, and subjugation of the land.

Tohalsissy - The concrete diversion and main canals were built in 1925. The headworks were almost immediately washed out. The dam was repaired under P.W.A. in 1933. It is of concrete and diverts water to both north

And south side of the Sanostee Wash. Outlets and sluice gates are being provided on each end of the dam, main canals have been constructed to the farming area on both sides of the wash.

Completion of this unit will require installation of radial gates in place of the shear gates in the diversion structure and the installation of turnouts and checks on the main canals, also subjugation of the land.

Todilto Park - This was originally a small Indian project located on the upper headwaters of Black Creek. In 1935 E.C.W. built a rock sausage type diversion with timber headgate and the following year the Soil Conservation Service built a main canal and a number of masonry structures.

Plans for the future include installation of additional structures on the existing canals and subjugation of the land.

There is another site upstream from the present diversion which may be used. This will entail construction of a diversion and main canal and the land should be subjugated.

#### UTAH.

Aneth - In 1905 James M. Holley, trader at Aneth, with the help of the Indians constructed the first heading and ditch about six miles above Aneth. The Government made surveys for improving the project in 1911, but no work was done until 1926, at which time considerable maintenance and new construction were carried out. A contract between Mr. Tanner, owner of the private land under the project, and the Government was drawn in 1926. This Agreement provided regulations on the basis of area owned and for the work required of Indians and private owners at such time as maintenance and new construction became necessary. Water for the project is taken from McElmo Creek by means of a throat type intake.

To complete the existing project it will be necessary to reconstruct the present intake or construct a diversion weir. Additional drops and turnouts and side drainage protection are needed for the main canal. The land should be subjugated.

There is a large potential project in the vicinity of Aneth which should be included in the long time plan of irrigation development. This project lies on a bench just east and south of the Aneth Day School. One plan is to take water from the San Juan River by means of a large pumping plant to pump water from the San Juan River to the bench and the other is to take water from the San Juan River by means of a gravity diversion many miles up stream.

Montezuma Creek - This was originally an Indian project. In 1936 the Irrigation Service constructed a concrete intake and a concrete heading with rail, wire and loose rock diversion and a concrete sluice structure on the canal, and regraded a portion of the main canal.

More adequate diversion facilities, additional structures on the main canal and subjugation of the land are needed to complete this project.

Monument Valley - This is a small project on the headwater of the Gypsum Creek where an arch masonry storage dam with outlet tower and short main canal were constructed in 1937.

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There is a possibility of developing additional storage on some on the small slick-rock dam sites. The farm land generally lies in the coves and canyons below the dam sites, and Indians on the small tracts can develop their own distribution system.

This ends the history and descriptive matter.

PROJECT WORKS.

Detailed descriptions of existing project works are included in the foregoing project histories and on Tabulations attached.

WORKS NEEDED TO COMPLETE.

Works needed to complete have been described in the foregoing project histories and are listed by features on Tabulation attached.

ESTIMATED COST TO COMPLETE.

This is given in Tabulation attached, showing distribution by project and features.

ECONOMIC PROGRAM FOR COMPLETION.

This is shown by project on Tabulation attached based upon a six year program. See also Summary Table.

PUBLIC NOTICES.

None.

CV-6417-201

NAVAJO RESERVATION - ARIZONA - NEW MEXICO & UTAH - IRRIGATION PROJECT DATA

Table with columns: STATE & Project, Location - Key Map, Water Supply Source, Annual Ac. Ft., Elev. Irrig. Area, Kind, Hsight Feet, Storage Dam Vol. Cu. Yd., Date Complt., Diversion No. and Description, No. Miles, No. Canals, Cost to 6/30/38, 1939 Funds, Amount Req'd., Total Cost, Ult. Irrig. Area, Cost per Acre, Area Const., No. Farms, Crop Data 1938, Remarks. Includes sub-sections for ARIZONA, NEW MEXICO, and UTAH.

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NN003129



ESTIMATED COST TO COMPLETE, Irrigation Construction.

ARIZONA	Head Works	Distrib. System	Subju-gation	Miscel-laneous	Total
Beautiful Valley	\$ 5,500	\$ 5,000	\$21,000		\$ 34,500
Begashibito	8,000	3,500	10,000		21,500
Chinlee	) 8,000	7,000	27,000		42,000
Frazer Heading	)				
Denehotso		15,000	40,000		55,000
Ft. Defiance (Bonito Ck.)	)	6,000	24,000		30,000
Black Creek	)				
Ganado	10,400	1,000	78,000		89,400
Cornfields		5,500	9,000		14,500
Houck	9,000	10,000	36,000		55,000
Jeddito			30,000		30,000
Kinlichee		2,000	20,000		22,000
Klagetoh		2,000	32,000	F 2,700	36,700
Lower Dinebito					
" Moencopi	3,000	2,200	18,000		23,200
" Rock Point		6,000	60,000	S 8,000	74,000
Luka-chukai	) 7,000	25,000	50,000	S 15,000	97,000
Tohtso	)				
Many Farms		6,500	30,000		36,500
Marsh Pass (Kayenta)	800	3,800	16,250		20,850
Moenava				S 7,000	7,000
Moencopi Wash	2,600	6,000	4,000	F 7,000	19,600
Natural Bridge	12,000	15,000	120,000	* 48,000	195,000
Nazlini		500			500
Oak Springs		500	2,500		3,000
Oraibi Wash (Lower)		2,200	9,250		11,450
Paiute Canyon	900	1,900	10,000		12,800
Red Lake	1,500	48,000	150,000	S 25,000	224,500
Red Rock, Cove	600	2,400	10,000		13,000
" " Unit		1,800	9,000		10,800
" " Valley		3,600	20,000		23,600
" " Zilbetod	3,500	2,800	12,000		18,300
Reservoir Canyon		3,000		S 15,000	18,000
Rock Point	10,000	11,500	9,000		30,500
Round Rock				37,700	37,700
Segihotsoci			6,000		6,000
Shili	4,000	6,000	25,000		35,000
Tesnospos (Carrizo Ck.)	3,000	6,000	15,000	F 4,000	28,000
Biclabito (N. Mex.)	800				800
Todenstani		2,600	12,000		14,600
Tolthlakan	1,000	10,000	20,000	Fen. 700	31,700
Tochenlini	6,000	3,000	17,500		26,500
Tolani Lakes					
Wheatfields, Upper	) 17,000	8,000	30,000		55,000
" Lower	)				
TOTAL	\$114,600	\$235,300	\$985,500	\$170,100	\$1,505,500

F Flood Protection; S Storage; \*\$40,000 S, \$8,000 Feeder Canal;  
 / \$17,000 Cooperative.

ESTIMATED COST TO COMPLETE (contd.)

	Head Works	Distrib. System	Subju- gation	Miscel- laneous	Total
<b>NEW MEXICO</b>					
Capt. Tom	20,000	5,000	135,000	20,000	180,000
Capt. Tom, Lower					
Grey Mesa	600	10,000	48,000		58,600
Toadlena	2,500	3,000	12,000		17,500
Casamera Lake					
Chas. H. Burke Sch.		1,500	5,250		6,750
Choiska		8,000	48,000 S	40,000	96,000
Crystal	5,000	15,000	94,500	25,000	139,500
Cudai	30,000	22,000		56,000	108,000
Fruitland	7,000	15,000	136,000		158,000
Hogback		8,000	9,800 PP	25,000	42,800
Juans Lake					
Mariano Lake					
Mulholland Well		1,800	6,000	W 10,000	17,800
Naschiti, North )	10,000	3,500	55,000		68,500
" South )					
Sanostee		5,000	50,000		55,000
Beautiful Mountain	9,000	5,000	24,000		38,000
Stinking Water		3,000	7,500		10,500
Tocito	1,000	4,000	7,000		12,000
Tohalsissy	1,200	2,700	10,000		13,900
Todilto Park	5,500	4,500	30,000		40,000
TOTAL	\$91,800	\$117,000	\$678,050	\$176,000	\$1,062,850
<b>UTAH</b>					
Aneth	1,000			F 1,500	2,500
Montezuma Creek	3,000	7,000	30,000		40,000
Monument Valley				S 24,000	24,000
TOTAL	\$4,000	\$7,000	\$30,000	\$25,500	\$66,500
( Arizona	\$114,600	\$235,300	\$985,500	\$170,100	\$1,505,500
Total ( New Mexico	91,800	117,000	678,050	176,000	1,062,850
( Utah	4,000	7,000	30,000	25,500	66,500
	\$210,400	\$359,300	\$1,693,550	\$371,600	\$2,634,850

PP Pumping Plants; T Surveys, \$10,000, W Well.

ECONOMIC PROGRAM FOR COMPLETION		IRRIGATION CONSTRUCTION					
	1940	1941	1942	1943	1944	1945	Total
<b>ARIZONA</b>							
Beautiful Valley		\$ 10,500	\$ 24,000				\$ 34,500
Begashibito			11,500	10,000			21,500
Chinlee	4,000	4,000		7,000	27,000		42,000
Fraser Heading							
Denohotwo	7,500	27,500	20,000				55,000
Ft. Defiance, Bonito Ck.	2,000		2,000	2,000	12,000	12,000	30,000
Black Creek							
Ganado	3,000	1,000		50,400	35,000		89,400
Cornfields	3,000	2,500	9,000				14,500
Houck		12,000	19,000	24,000			55,000
Jeddito	30,000						30,000
Kinlichee					2,000	20,000	22,000
Klagetoh		2,700	2,000			32,000	36,700
Lower Dinebito							
Lower Moencopi	3,	2,200		18,000			23,200
Lower Rock Point			14,000	20,000	20,000	20,000	74,000
Lukaihukai	3,500	3,500	7,500	27,500	28,000	27,000	97,000
Tohtso							
Many Farms	4,000	2,500			15,000	15,000	36,500
Marsh Pass (Kayenta)		4,600	16,250				20,850
Moenvave				7,000			7,000
Moencopi Wash			19,600				19,600
Natural Bridge		20,000	55,000	40,000	40,000	40,000	195,000
Nazlini	500						500
Oak Springs		500	2,500				3,000
Oraloi Wash, Lower					11,450		11,450
Paiute Canyon	900	1,900				10,000	12,800
Red Lake		1,500		25,000	123,000	75,000	224,500
Red Rock, Cove			3,000			10,000	13,000
Red Rock, Unit			1,800	9,000			10,800
Red Rock, Valley			13,600	10,000			23,600
Red Rock, Zilbetod			12,000				12,000
Reservoir Canyon		2,800	18,000				20,800
Rock Point	13,500	17,000					30,500
Round Rock		20,000	17,700				37,700
Segihotsoci		6,000					6,000
Shilli			35,000				35,000
Tenospos	4,000			24,000			28,000
Biclabito (N.M.)	800						800
Todenstani					14,600		14,600
Telthlakan	1,700	10,000	20,000				31,700
Tochenlini					26,500		26,500
Tolani Lakes							
Wheatfields, Upper		55,000					55,000
Wheatfields, Lower							
<b>Total</b>	<b>81,400</b>	<b>225,700</b>	<b>305,450</b>	<b>273,900</b>	<b>354,550</b>	<b>281,000</b>	<b>1,502,000</b>
<b>NEW MEXICO</b>							
Captain Tom		72,000	27,000	27,000	27,000	27,000	180,000
Capt. Tom, Lower							
Grey Mesa	58,600						58,600
Toadlena		17,500					17,500
Casamera Lake							
Chas. H. Burke Sch.				6,750			6,750
Choiska	20,000	20,000	8,000	24,000	24,000		96,000
Crystal					92,250	47,250	139,500
Cudai				52,000		56,000	108,000
Fruitland	43,000	40,000	25,000	25,000	25,000		158,000
Hogback		12,500	26,300	4,000			42,800
Juans Lake							
Mariano Lake							
Mulhollan Well		10,000	7,800				17,800
Naschiti, North	43,500	25,000					68,500
Naschiti, South							
Sanostee		55,000					55,000
Beautiful Mountain		38,000					38,000
Stinking Water			10,500				10,500
Tocito	12,000						12,000
Tohalsissy				13,900			13,900
Todilto Park		40,000					40,000
<b>Total</b>	<b>177,100</b>	<b>330,000</b>	<b>104,600</b>	<b>152,650</b>	<b>168,250</b>	<b>130,250</b>	<b>1,062,850</b>
<b>UTAH</b>							
Anoth	2,500						2,500
Montezuma Creek	40,000						40,000
Monument Valley	4,000	3,000	6,000	6,000	6,000		24,000
<b>Total</b>	<b>45,500</b>	<b>3,000</b>	<b>6,000</b>	<b>6,000</b>	<b>6,000</b>	<b>-</b>	<b>66,500</b>
<b>Grand Total</b>	<b>304,000</b>	<b>558,700</b>	<b>416,050</b>	<b>432,550</b>	<b>528,800</b>	<b>391,250</b>	<b>2,651,350</b>

OPERATION AND MAINTENANCE.

In addition to the five larger projects with 16,925 irrigable acres on which operation and maintenance is discussed under their respective headings, there are sixty-five small irrigation projects and units on the Navajo and Hopi Reservations embodying 31,694 irrigable acres for the operation and maintenance of which a blanket appropriation of \$6,500 has been made for the past several years. This amount was increased to \$8,500 for the fiscal year 1939. The Captain Tom Wash and Lower Rock Point Projects are now financed from this appropriation.

Small groups of Indians are endeavoring to cultivate, develop and maintain these projects with the assistance of the Irrigation Division of the Navajo Service.

The amount appropriated in the past has been insufficient to render adequate assistance to the Indians in operating and maintaining those projects which has caused them to become discouraged.

As most of these Indians are dependent on the returns from crops raised on these projects for sustenance for themselves and their families, it is requested that funds in the amount of \$25,000 be appropriated to assist the Indians in successfully operating and maintaining miscellaneous projects. This amount is estimated to meet the need in the fiscal year 1940 and should be increased at the rate of \$5,000 per year until a maximum of \$50,000 has been obtained.

Each of the five larger projects should be furnished with specific appropriations as indicated on the following tabulation, which also includes the sixty-five miscellaneous projects.

ESTIMATE OF COST AND ECONOMIC PROGRAM FOR OPERATION AND MAINTENANCE.

ARIZONA	1940	1941	1942	1943	1944	1945	Total
Ganado	3,500	5,000	10,000	15,000	15,000	15,000	63,500
L. Rock Pt.	3,500	5,000	5,000	8,000	10,000	12,000	43,500
*Misc. Proj.	14,000	17,000	20,000	22,000	25,000	28,000	126,000
Total	21,000	27,000	35,000	45,000	50,000	55,000	233,000
NEW MEXICO							
Capt. Tom	2,500	3,500	5,000	8,000	10,000	12,000	41,000
Fruitland	14,000	14,000	14,000	14,000	14,000	15,000	85,000
Hogback	15,000	15,000	15,000	15,000	15,000	15,000	90,000
*Misc. Proj.	10,500	12,500	15,000	17,000	18,500	21,000	94,500
Total	42,000	45,000	49,000	54,000	57,500	63,000	310,500
UTAH							
Misc. Proj.	500	600	700	800	900	1,000	4,500
GRAND TOTAL	63,500	72,500	84,000	100,000	109,000	119,000	548,000
* Approximate division based upon Arizona 56%, New Mexico 42%, Utah 2%.							
Misc. Projects total	25,000	30,000	35,000	40,000	45,000	50,000	225,000

OTHER INFORMATION.

Potential Projects.- In addition to the projects which have been described in detail on the preceding pages, and in the tabulations, there are a number of area which are recognized as potential sites for suitable irrigation projects. No work has been done on these other than general investigations and since there are no surveys, estimates or plans, they are not included in the tabulations. The following list shows the principal projects with the approximate irrigable area, water supply being taken into consideration.

Project	Available Irrigable Area
Big Sage Mesa (Tolthlakan Area)	600
Upper Dinebito	500
Jeddito	500
Oljeto	200
Oraibi Wash (Upper)	400
Polacca	500
San Juan River (Cudai to Four Corners)	7000
San Juan River (Below Four Corners)	5100
Standing Rock	150
Torreon	200
Wepo Wash	400
Wide Ruins	500
Total	<u>16050</u>

Population vs Resources.- Reference is made to the report of Jan. 1939, by Dr. John H. Provinse and Dr. Solon Kimball of the Soil Conservation Service, covering a study of the relationship between population and resources, projected 50 years into the future, on a 10 year interval basis. The tabulation accompanying the report follows:

Agriculture

Year	(1)				(2)				
	Popu- lation	% In- crease	Acre- age	% In- crease	Per Capita	Per acre Income	Total Income	Per Capita	Per Capita Increase
1937	32,038		32,200		1.	\$31.80	\$1,023,970	\$31.96	\$
1947	36,842	15.	40,200	25	1.1	33.39	1,342,278	36.43	4.47
1957	42,379	32.3	50,200	56	1.2	34.98	1,755,996	41.44	9.48
1967	48,746	52.2	62,200	93	1.	36.57	2,274,654	46.66	14.70

(1) An increase of 8,000, 10,000 and 12,000 acres for each successive ten year interval making a total of 30,000 additional acres in the next 30 years of a potential 57,000 acres available. Figured on the basis that the present facilities permit a maximum of 1,200 acres subjugated and that during the past five years approximately 700 acres of new land have been made available for cultivation each year.

(2) Figured on a five percent, ten percent and fifteen percent increase for each successive ten year interval in total value of crops due to improved farming methods, the introduction of crops requiring intensive

cultivation, and giving a higher per acre yield, and the improvements of farm land and water supply facilities insuring a more certain return.

Livestock

<u>Year</u>	<u>Population</u>	<u>Total Income</u>	<u>% Increase</u>	<u>Per Capita</u>	<u>% Increase</u>
1937	32,038	\$1,439,590 (1)		\$44.93	
1947	36,842	1,792,530 (2)	24	48.65	3.72
1957	42,379	2,016,456 (3)	40	47.58	2.65
1967	48,746	2,240,382 (4)	56	45.96	1.03

(1) Actual income from economic survey including value of wool used in rugs.

(2) Maximum income using a S. U. income of \$4.70 per productive animal as determined by the results of three years on the Ganado Demonstration Area and assuming that proper stocking and management practices have been achieved. The carrying capacity is now figured at 536,549 S.U. Under resolutions passed by the Tribal Council 9,627 excess horses will be removed, leaving 31,032 permitted horses using 155,160 sheep units of range. 381,389 sheep units will remain for grazing by productive animals.

(3) An estimated 12-1/2% (47,644 S.U. to Prod. stock) increase in carrying capacity due to good management, feeding, etc. This has been divided proportionally between horses and productive stock.

(4) Another 12-1/2% increase (over the original figure) which probably represents the maximum increase in range carrying capacity which may be expected.

MISCELLANEOUS SURVEYS

There is an increasing dearth of feasible irrigation projects on the reservation and there are constant calls for determining whether Indians' request for various structures and canals are feasible. Also there is an increasing amount of records of existing projects to be made and kept up to date. To carry forward our program and keep abreast of an over increasing demand for more land, we must have competent and permanent survey crews. The tabulated estimate of future expenditures found below is one we feel is necessary to carry on this important work.

	1940	1941	1942	1943	1944	1945	Total
Arizona	12,000	15,000	12,000	10,000	8,000	6,000	63,000
New Mex.	10,000	12,000	10,000	8,000	6,000	4,000	50,000
Utah	1,600	1,000	800	800	800	600	5,600
<b>TOTAL</b>	<b>23,600</b>	<b>28,000</b>	<b>22,800</b>	<b>18,800</b>	<b>14,800</b>	<b>10,600</b>	<b>118,600</b>

S.C.S. and CCC-ID COOPERATIVE WORK

These divisions have initiated many projects of an irrigation nature of such as will directly benefit existing irrigation projects. It will be necessary at times to supply technical assistance, skilled personnel, material and supplies, or common labor where the specific regulations governing the expenditure of their funds do not permit the continuation of the work to a point where it will become a completed or integral part of an irrigation project. To supply this want we have tried to anticipate future expenditures in the tabulated list below.

	1940	1941	1942	1943	1944	1945	Total
Arizona	3,000	6,000	6,000	6,000	5,000	5,000	31,000
New Mex.	2,000	5,000	5,000	5,000	4,000	3,000	24,000
Utah	1,000	2,000	2,000	2,000	1,000	1,000	9,000
<b>TOTAL</b>	<b>6,000</b>	<b>13,000</b>	<b>13,000</b>	<b>13,000</b>	<b>10,000</b>	<b>9,000</b>	<b>64,000</b>

SUBSISTENCE TRACTS

There are a multitude of unnamed tracts on the Reservation which the Indians, by themselves or sometimes with a small amount of assistance from the Government, have developed. There are constant calls on larger projects for additions in subsistence tracts where the water, land and industry of the Indians warrant further work. To cover this vital and unpredictable need, we present the tabulated estimate of future expenditures:

	1940	1941	1942	1943	1944	1945	Total
Arizona	12,000	15,000	15,000	15,000	12,000	12,000	81,000
New Mex.	10,000	12,000	12,000	12,000	10,000	10,000	66,000
Utah	1,000	2,000	2,000	1,000	1,000	1,000	8,000
<b>TOTAL</b>	<b>23,000</b>	<b>29,000</b>	<b>29,000</b>	<b>28,000</b>	<b>23,000</b>	<b>23,000</b>	<b>155,000</b>

QUARTERS

As the projects on the reservation are developing in quantity as well as size, both irrigation and stock water operation and maintenance become of greater importance. The day of small crews operating at-large, and covering only a few developments, is past. To administer the increasing irrigation projects and to maintain the additional water developments, it becomes necessary for us to district the reservation and place therein competent and permanent employees.

For the last few years many members of our permanent force have been living in tents, temporary and makeshift shacks, in fact anywhere they could find space for a cot and a stove. In other instances they have been given fair quarters temporarily vacated by the members of some other division such as Education, I.E.C.W., etc., only to be required to move on at a moment's notice when that division again required the quarters. In many instances this entailed an unsatisfactory property accounting, and considerable confusion during the transfer.

At one of our major projects, the Hogback, the original operators house is a series of temporary additions, made throughout the years, and has now reached such a state of decrepitude that it will of necessity be abandoned within the next two years. At another of the projects (Fruitland) the ditchrider and his family are living in a tent, framed from form lumber salvaged during the construction of the project.

The Water Maintenance Foreman for District 12, and his family, are occupying CCC-ID quarters. They have now been asked to vacate in order to provide quarters for a member of that organization. The foreman in District 15 has recently vacated CCC-ID quarters for Education quarters, which, on brief notice, he might be required to vacate - for what? The Water Service Foreman at Chinlec has occupied an unsatisfactory three-roomed adobe and rock cottage for twenty years, and, without question, this will be beyond repair within the next two years.

The Water Maintenance Supervisor and his family are now quartered in a very satisfactory house at Polacca, Arizona, one hundred miles from Window Rock. The need for his presence at Window Rock is felt every day, and, in the interests of economy and efficiency, he should be so moved.

Two of the three members of our clerical force living at Fort Defiance and commuting daily to Window Rock, are living in makeshift quarters on the site of the proposed central heating plant. This plant will be constructed during the fall of this year, and the only satisfactory solution is to build the required quarters at Window Rock where they are now employed

To save loss by theft, misplacement, and deterioration by weather, adequate storage and warehousing facilities should be supplied at various stations on the reservation.

To present these vital needs we are incorporating herewith as a part of our justification a 6-year program of construction as presented to the Washington Office in April of this year. We earnestly request that we be permitted to proceed with the item "F.Y. 1940" program, as outlined therein, with funds available. Funds in the amount of \$35,000 are available for immediate construction from P.W.A.

PROJECT BUILDINGS, (Existing)

Unit	Residences	Offices	Warehouses	Plant Bldgs.	Other	Total
Polacca	3	1	1	1		6
Chin Loo	2		1			3
Rock Point						0
Many Farms	2					2
Hogback	2	1	3	1		7
Fruitland	1	1	1	1	1	5
<b>TOTAL</b>	<b>10</b>	<b>3</b>	<b>6</b>	<b>3</b>	<b>1</b>	<b>23</b>

ESTIMATED COST TO COMPLETE. Quarters.

ARIZONA.				
Chin Lee	4-room frame cottage	Water Service	4,000	
" "	5- " " "	Irrigation	4,700	
" "	4- " " "	"	4,000	
" "	Warehouse, yard, equipt. storage	"	4,000	
Cornfields	4-room frame cottage	"	4,200	
Fort Defiance	Type "A" rock house	"	7,125	
" "	Warehouse, yard, equipt. storage	"	4,000	
Ganado	4-room frame cottage	"	3,800	
" "	Warehouse, yard, equipt. storage	"	4,000	
Houck	4-room frame cottage	"	4,200	
Kayenta	4- " " "	"	4,500	
" "	Warehouse, yard, equipt. storage	"	4,000	
Leupp	5-room frame cottage	Water service	4,500	
Lukaichukai	4- " " "	Irrigation	5,000	
Many Farms	4- " " "	"	4,000	
Oraibi	Type "A" rock house	"	7,125	
" "	Warehouse, yard, equipt. storage	"	4,000	
Red Lake	4-room frame cottage	"	4,200	
Rock Point	5- " " "	"	5,000	
" "	Warehouse, yard, equipt. storage	"	4,000	
Round Rock	4-room frame cottage	"	4,000	
Tosnospos	4- " " "	"	4,000	
" "	Warehouse, yard, equipt. storage	"	3,000	
Tuba City	Type "A" rock cottage	Water Service	7,125	
Window Rock	Apartments of the "4-H" type, (3 units)	Administration	12,750	
" "	Type "C" rock cottage	"	8,500	
TOTAL - 18 single houses, 1-3 unit apartment, 7 warehouses - -				\$129,725

NEW MEXICO				
Crownpoint	4-room stucco cottage	Water Service	4,200	
Fruitland	4- " frame " (2 units)	Irrigation	7,000	
" "	Warehouse, yard, equipt. storage	"	3,500	
Nava	4-room frame cottage	"	3,500	
Shiprock	4- " " "	Water Service	3,500	
" "	5- " " "	Irrigation	4,500	
" "	4- " " "	"	3,500	
Toadelona	5- " " "	"	4,500	
TOTAL - 5 single houses, 1-2 unit houses, 1 warehouse - - - -				\$34,200

Total Arizona and New Mexico, 27 units and 8 warehouses.

ECONOMIC PROGRAM FOR COMPLETION. Quarters.

	1940	1941	1942	1943	1944	1945	Total
Arizona	24,750	37,625	15,325	15,125	16,700	20,200	129,725
New Mex.	11,500	4,200	11,500	7,000	- -	- -	34,200
Utah	- -	- -	- -	- -	- -	- -	- -
<b>TOTAL</b>	<b>36,250</b>	<b>41,825</b>	<b>26,825</b>	<b>22,125</b>	<b>16,700</b>	<b>20,200</b>	<b>163,925</b>

## STOCK AND DOMESTIC WATER DEVELOPMENT

### HISTORY OF WATER DEVELOPMENT.

It was realized early that underground water development was necessary for improvement of conditions on both the Navajo and Hopi Reservations. As a preliminary step, Prof. H. E. Gregory was asked to make a geological examination with a view to development of a water supply. His report on the Navajo Country, published in Water Supply Paper No. 380 in 1916, was the basis for inaugurating an extensive program.

Some of the earliest work was done at the Hopi Villages and in the vicinity of Keams Canyon and in Chinlee Valley, where a large number of wells and springs had been completed by 1914.

In 1909 a well-drilling outfit was purchased. Four wells were drilled for irrigation of the school and agency garden at Leupp. A domestic well was also drilled.

The well rig used at Leupp was moved to Keams Canyon, drilling to a depth of 1,308 feet, but was unsuccessful. Three other rigs were also put to work in the fiscal year 1912 and continued through fiscal years 1913 and 1914, by which time 46 good wells had been drilled and 44 others were either dry or produced bad water. At the same time spring development was undertaken.

\$10,000 was allotted in 1914 for 3 wells to be drilled by contract at Leupp. The first was put down in Section 10, Township 17 north, Range 13 west, in which water was struck at 800 feet. The flow amounted to 5,400 gallons per hour.

When drilling for oil on some of the lands in the vicinity of Pueblo Benito School 2 artesian wells were developed, one in Section 12, Township 18 north, Range 12 west, 1,034 feet deep, where flowing water was struck at 730 feet, amounting to 8,520 gallons per hour. The other in Township 19 north, Range 13 west, was 1,420 feet deep and flowed 12,000 gallons per hour.

The early work was carried out under the Irrigation Division principally by \_\_\_\_\_ under the supervision of Mr. Alex H. Womack who, until his retirement in 1936, was actively engaged in extending the underground water development over the entire Navajo country.

### WATER SUPPLY.

Deep drilled wells, shallow dug wells, springs and charcos.

PROJECT WORKS, WORKS NEEDED TO COMPLETE AND ESTIMATED COST TO COMPLETE.

(Construction)

	No. Const. by Irrig. Division	No. Needed to Complete	Est. Cost to Complete
<b>ARIZONA</b>			
Deep wells, artesian	21	4	\$ 36,000
Deep wells, pumped	112	55	214,300
Shallow wells	152		
Springs	215	117	84,200
Earth reservoirs	70	145	72,500
Concrete tanks	45	55	55,000
Metal tanks	45		
Troughs	342	344	48,160
Wind pumps, no auxiliary	109	155	8,250
Power pumps only	6	3	3,000
Actual Separate water supply units	570	321	521,450
<b>NEW MEXICO</b>			
Deep wells, artesian	19	39	359,580
Deep wells, pumped	22	20	68,400
Shallow wells	84		
Springs	83	78	56,160
Earth reservoirs	28	85	42,500
Concrete tanks	4	20	20,000
Metal tanks	4		
Troughs	140	274	38,360
Wind pumps, no auxiliary	21	20	3,000
Power pumps only		3	3,000
Actual separate water supply units	236	222	591,000
<b>UTAH</b>			
Deep wells, pumped		4	8,780
Springs		2	1,440
Earth reservoirs		3	1,500
Concrete tanks		4	4,000
Troughs		12	1,680
Wind pumps, no auxiliary		4	600
Actual separate water supply units		9	18,000
<b>ARIZONA, NEW MEXICO AND UTAH</b>	<b>806</b>	<b>552</b>	<b>1,130,450</b>

SUMMARY (Including E.C.W., CCC-ID and S.C.S.)

ARIZONA, NEW MEXICO & UTAH	No. Const.		Total Com- pleted	No. Need- ed to Complete	Grand Total	Est. Cost to Complete
	6-30-39 Irrig. Div.	ECW & CCC-ID SCS				
Deep wells, artesian	40	10	50	43	93	395,580
Deep wells, pumped	134	97	131	79	210	291,480
Shallow wells	236	326	562		562	
Springs	298	447	745	197	942	141,800
Earth reservoirs	98	999	8 1105	233	1338	130,160
Concrete tanks	49	10	59	79	138	79,000
Metal tanks	49	137	186		186	
Troughs	482	10	4 496	630	1126	88,200
Wind pumps	130	57	187	179	366	11,850
Power pumps	6	7	13	6	19	6,000
Actual separate water supply units	806*	1878	12° 2696	552	3248	1,130,450

\*Cost to 6-30-38 \$808,097 / \$490,120 O & M. °Cost \$10,258.

Throughout the past 27 years there have been drilled a great many wells which have proven satisfactory and which are in production today on the Navajo and Hopi Reservations. It has been the history of these developments that the average production period before rehabilitation becomes necessary is fifteen years. This fifteen year cycle, therefore, necessitates quite an extensive annual rehabilitation program.

Not only within the well itself is rehabilitation necessary but the storage, control and distributary system need replacing, enlarging and reconditioning. In addition to this rehabilitation work, the land management program now being prosecuted on the Navajo Reservation requires the drilling of a considerable number of new wells to facilitate the execution of the range management program. These wells also require storage and distributary systems. To this end we have worked out a yearly estimate which we believe will be adequate for the requirements.

ECONOMIC PROGRAM FOR COMPLETION. (Construction)

Feature	1940	1941	1942	1943	1944	1945	Total
Arizona	206,950*	100,000	100,000	50,000	50,000	14,500	521,450
New Mex.	171,000*	100,000	108,000	100,000	82,500	29,500	591,000
Utah	10,000	4,500	1,000	1,000	1,000	500	18,000
<b>TOTAL</b>	<b>387,950</b>	<b>204,500</b>	<b>209,000</b>	<b>151,000</b>	<b>133,500</b>	<b>44,500</b>	<b>1,130,450</b>

\*Includes \$166,950 and \$131,000, respectively in 1939 fund available for 1940.

OPERATION AND MAINTENANCE.

Since 1927 the water developments of the Irrigation Division in Arizona, New Mexico and Utah have more than twice doubled in number. It is therefore obvious that in addition to reconstruction of a number of these developments and provisions for new water, there is each year a tremendous amount of ordinary operation and maintenance to be done. Most of these developments are very necessary for proper use of the range resources of the Navajo Reservation, and it is therefore desirable to keep them in good operating condition. A lack of needful operation and maintenance on these developments has been severely felt at times. Aside from providing as much good water for the Navajo and Hopi Indians as possible, both for their benefit and the benefit of their livestock, operation and maintenance is a matter of protecting our original capital invested. In other words, an expensive well development producing little or no water because of lack of personnel and money to make some minor repair is detrimental to both the range management program, the Irrigation Division program, and the welfare of the Navajo and Hopi people. The tabulation below is our estimate of what will be needed to carry on this work for the next six years.

ESTIMATE OF COST AND ECONOMIC PROGRAM.

	(Operation and Maintenance)						Total
	1940	1941	1942	1943	1944	1945	
Arizona *	41,400	43,700	46,000	48,300	50,600	52,900	282,900
New Mex.*	46,800	49,400	52,000	54,600	57,200	59,800	319,800
Utah *	1,800	1,900	2,000	2,100	2,200	2,300	12,300
<b>TOTAL</b>	<b>90,000</b>	<b>95,000</b>	<b>100,000</b>	<b>105,000</b>	<b>110,000</b>	<b>115,000</b>	<b>615,000</b>

\*Approximate division based upon Ariz. 46%, New Mex. 52% and Utah 2%.

With reference to the History of Reservation, Superintendent Fryer, on June 3, submitted a schedule of all lands that have been purchased by the Government for the Navajo Indians in Arizona, New Mexico and Utah, to December 31, 1938. He states that all purchases from 1928 to date are reimbursable from Navajo tribal funds and purchases prior to 1928 apparently were from gratuity appropriations.

Mr. Fryer further states that according to the records there are now 3,732 patented Indian allotments on the public domain in the State of New Mexico, all in trust status and containing approximately 160 acres each, and that there are approximately 75 Indian homestead entries of 640 acres each on the public domain, of which the greater number are subject to cancelation by the G.L.O. for non-compliance with homestead laws. The Navajos have obtained fee patents by citizen homestead entries and small holding claims for approximately 980 acres.

Summary of Schedule of Lands Purchased to 12-31-38.

	<u>Acres Purchased</u>	<u>Price Paid</u>	<u>Ave. per Ac.</u>
Arizona	476,240.21	\$756,499.58	\$1,588
New Mexico	187,382.16	378,029.84	2,017
Utah	1,920.11	5,212.00	2,714
TOTAL	<u>665,542.48</u>	<u>1,139,741.42</u>	<u>1,712</u>