

LAND MANAGEMENT SURVEY

L.M. UNIT I

SECTION OF AGRONOMY

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
REGION EIGHT
NAVAJO SERVICE
1937

121
WB

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NAVAJO SERVICE
AGRONOMY BRANCH REPORT

ON
LAND MANAGEMENT UNIT NO. 1.

Location and Boundaries.

Land Management Unit No. 1 is located in the northwestern portion of the Navajo Reservation. It lies in Coconino County, Arizona, roughly between $36^{\circ}15'$ and $36^{\circ}45'$ north latitude and $110^{\circ}45'$ and $111^{\circ}30'$ west longitude.

Boundaries of the unit are in general as follows: Beginning at Lees Ferry, Arizona thence south along the top of Echo Cliffs to Gap Trading Post, thence northeast along Crooked Ridge to the $111^{\circ}15'$ meridian, thence southeast to Red Mesa, thence east to E. C. W. windmill # 3, thence southeast to Little White Mesa, thence down Red Lake Valley to Blue Canyon, thence east and north along Blue Canyon to two and one-half miles east of $110^{\circ}45'$ $36^{\circ}15'$, thence northwest to the drainage divide on Black Mesa, thence north to the rim of Black Mesa at $110^{\circ}45'$; thence to Blue Lake, thence north to Badger Spring, thence west and north to White Mesa three miles north of the Window, thence north along the east rim of White Mesa to Square Butte (Standing Rock), thence north and west along the south rim of Navajo Canyon to the Colorado River, thence southwest along the river to the beginning point.

Area.

This boundary as outlined encloses an area of approximately 1,035,500 acres. Included in this are the following:

| | |
|-------------------------------|----------------|
| Inaccessible and barren ----- | 86,913 acres. |
| Waste ----- | 54,700 acres. |
| Mountainous ----- | 95,000 acres. |
| Area producing run-off ----- | 375,000 acres. |
| Farm land ----- | 803 acres. |

Topography:

This unit includes the Kaibeto plateau, the western end of Black Mesa and the lower end of Begashibito valley. The topography is characterized by a broad, gently sloping, sandy plateau broken by high mesas and deep canyons. The main topographical features are the Echo Cliffs and Mormon Ridges in the west; Navajo Canyon and Glen Canyon of the Colorado river in the north; White Mesa, the head of Navajo Canyon, and Kaibeto Canyon in the east; Black Mesa, Blue Canyon of the Moencopi Wash and Wildcat Peak in the south.

Soils.

The majority of the soils in this unit originate from sandstone, and are highly susceptible to wind erosion when the vegetative cover has been partially or wholly destroyed. A better developed soil less affected by wind, is derived from the Carmel sandstone. Soil developed from the Mancos shale or Black Mesa is heavier textured and more severely affected by water erosion than wind. The soils are derived from the grayish-white Navajo sandstone in the western half of the Unit; from the dark red Carmel formation in the north; from the red Entrada formation in the east; and from scattered areas of the brown to bluff Dakota sandstone and the dark bluish-gray Mancos shale in the south and south-east.

Residual soils occupy the greater portion of the area and constitute the better classes of grazing land. The Floy, Todilto, Euell and Kaibeto series are most important of the residual series mapped.

A very small portion of the Unit is occupied by alluvial soils. Of the eight series mapped, portions of the Ives, Oraibi, Demehotso, and Concho are the only ones cultivated.

Erosion.

Strong southwest winds, low rainfall and light textured soils are responsible for the predominance of wind erosion in this unit. Small active sand dunes are sparsely distributed throughout the unit but they are more frequent in the heavily overgrazed southern portion. Partially stabilized sand dunes, ranging in depth from thirty-six inches to several feet, are common west of Kaibeto.

Extensive areas of barren sandstone dissected by deep canyons are common in the north portion of the unit. A shallow, severely wind-blown intermittent soil cover with spotted accumulations of dune sand, occupies the northwestern portion of the unit.

Sheet and gully erosion prevail on the steep slopes of Black Mesa and White Mesa. The extreme southeastern portion of Black Mesa consists of almost barren geologic material with an intermittent shallow soil cover because of severe sheet erosion and steep slopes.

Elevation.

The following approximate elevations have been taken from the U. S. Geological Survey Topographical maps edited in 1891 and 1892:

| | |
|------------------------------------|-----------|
| Black Mesa ----- | 7,000 ft. |
| White Mesa ----- | 6,800 ft. |
| Preston Mesa ----- | 6,500 ft. |
| Echo Cliffs ----- | 6,500 ft. |
| Copper mine ----- | 5,800 ft. |
| Kaibeto ----- | 5,400 ft. |
| Red Lake (Tonalea) ----- | 5,400 ft. |
| Moencopi Wash ----- | 4,600 ft. |
| Lee's Ferry (Lowery's Lodge) ----- | 3,112 ft. |

Average elevation of the unit ---- 6,000 ft.

Climatological Data.

Climatological records are available from Lees Ferry, Tuba City and Kayenta. Due to the fact that none of these stations are located within the unit, the records of Lees Ferry and Tuba City will be more applicable than those of Kayenta.

Rainfall.

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AVERAGE ANNUAL PRECIPITATION (Inches.)

| Location of Station | Period of Record | AVERAGE ANNUAL PRECIPITATION (Inches.) | | | | | | | | | | | | Average Annual Precip. |
|---------------------|------------------|--|------|------|------|-----|------|------|------|-------|------|------|------|------------------------|
| | | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | |
| Kayenta | 1915-1930 | .63 | .43 | .64 | .42 | .36 | .38 | 1.45 | 1.52 | .75 | .91 | .64 | .61 | 8.80 |
| Tuba City | 1898-1930 | .55 | .54 | .54 | .43 | .53 | .19 | .34 | .93 | .84 | .68 | .78 | .53 | 6.92 |
| Lees Ferry | 1916-1930 | .34 | .60 | .44 | .59 | .26 | .16 | .76 | .96 | .59 | .64 | .42 | .44 | 6.20 |

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Temperature.

The following is the average temperature records from Tuba City, 1898 to 1930.

| Record | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Year |
|------------------|------|------|------|------|------|------|------|------|-------|------|------|------|------|
| Absolute Maximum | 68 | 73 | 85 | 88 | 99 | 104 | 105 | 108 | 100 | 95 | 88 | 70 | 100 |
| Absolute Minimum | -15 | -3 | 12 | 14 | 22 | 34 | 40 | 44 | 28 | 18 | 8 | -13 | -15 |
| Absolute Mean | 32.0 | 39.2 | 45.9 | 53.8 | 61.7 | 71.1 | 76.8 | 77.8 | 67.6 | 55.7 | 43.4 | 32.3 | 54.8 |

Evaporation.

EVAPORATION IN INCHES 1921-1930

| Station | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Average Annual. |
|------------|-------|-------|-------|-------|--------|--------|--------|--------|-------|-------|-------|-------|-----------------|
| Lees Ferry | 2.076 | 3.088 | 5.773 | 7.967 | 11.594 | 12.773 | 13.359 | 11.033 | 8.917 | 6.112 | 2.945 | 1.928 | 87.615 |

Growing Season.

| Location | Period of Record | Date of First Killing - Frost | Date of Last Killing-Frost | Average length of Growing Season. |
|------------|------------------|-------------------------------|----------------------------|-----------------------------------|
| Mayenta | 1915-1930 | September 21. | June 1. | 163 days. |
| Tuba City | 1898-1930 | September 19. | May 9. | 179 days. |
| Lees Ferry | 1916-1930 | October 18. | April 10. | 229 days. |

From the above data, the following can be applied to Unit 1.

- Average yearly precipitation ----- 7 inches.
- Average yearly precipitation (Black Mesa) ----- 8.5 inches.
- Average length of growing season ----- 170 days.
- Average period of growing season ----- April 25 to October 12.

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Drainage and Run-off.

Very little run-off can be expected from about one-half of the unit because the soil is light textured and highly permeable to water penetration. In this area, gullies originate on the steep slopes of mesa edges and fan as they reach the vallies. A few flood irrigated farms are found on these fans. Estimates of annual run-off expectancy may indicate that these farms receive sufficient water. Such estimates however are misleading because the dry season of the year coincides with the growing season.

About one-fourth of the unit drains into the Colorado river through Navajo Canyon. As this canyon varies from 200 to 1,000 feet deep with steep side slopes, no use can be made of the flood water for agricultural purposes. Kaibeto canyon which is a branch of Navajo canyon, is also useless for flood irrigation purposes.

The only part of the entire unit in which any use can be made of flood water, lies between White Mesa and Black Mesa. A rather high run-off is found here because the drainages head in areas of exposed sandstone and on steep slopes.

Roads.

As a general rule, the unit is well covered by roads accessible by automobile; some of the roads not traveled frequently are a little difficult to get over at certain times of the year when the sand is dry. Graded roads connect between Red Lake - Kaibeto - Shonta - Inscription House and Cow Springs. There is also an unmaintained road between Kaibeto-Gap and Cedar Ridge to Gap.

Rodents and Wild Life.

Prairie dogs are very numerous throughout the entire area in general. Mice and pocket gophers are present to some extent but the damage they cause is much less than that of the prairie dogs.

About the most important wildlife within the area is the antelope. It is estimated that a herd of about sixty head, range in this unit.

Vegetation.

Vegetation of this unit is very typical of the upper Sonoran zone. No lower Sonoran zone species were noted and the altitude is not high enough to produce ponderosa pine and other species typical of the transition zone.

Principal vegetation species occurring in the area are blue gramma, galleta, spiny muhley, three awn, oryzopsis, sand dropseed, chamiza, morman tea, sand sage, black brush, snakeweed, yellow brush, rabbit brush, russian thistle, Indian wheat, wild onions, and lupine.

Poisonous plant species occurring in the area are loco, lupine, larkspur, and some pingue.

The condition of the vegetation in the north and western part of the unit is very good except in localized areas, due to seasonal use and lack of water. Vegetation in the central, southern and eastern portion of the unit is in poor condition, lacking in vitality and growth, due to heavy over-grazing of the area. Forest areas are over mature and decadent with little to no reproduction.

Population and Economic Factors.

There are at present 1176 Navajos living within the unit which represent 157 consumption groups. These people gain their livelihood principally from livestock production but income is also derived from wage work. Agricultural products and hand made rugs and jewelry.

At the present time there are 0.68 acres per capita being farmed. This can be increased to 0.96 acres by the subjugation of proposed potential land.

Population concentrations are very few and small. The principal ones being located near Red Lake, Cow Springs, and Kaibeto.

Method of Locating and Numbering Farms:

Each farm was located on quadrangle half-tones, made from aerial mosaics and numbered, using the same numbers as those used on the agricultural and water spreading surveys during 1935, the number beginning with 1 on each quadrangle. Additional tracts of agricultural land not previously located were numbered, beginning with the number where the water spreading survey left off. A number was placed on each farm to correspond with the number on the map.

Agriculture Within Unit No. 1.

Generally speaking, this unit is not an agricultural unit, due primarily to the lack of sufficient water for farming purposes. The soil throughout the unit is favorable for crop production, except that it is very susceptible to wind erosion.

Most of the farming is located in gullies or on gully fans where it receives flood irrigation. There is only one irrigated tract within the unit consisting of approximately 20 acres. It is located about four miles southwest of Cow Springs.

There are four small agricultural concentrations found in this unit; (1) near Cow Springs, (2) at Red Lake, (3) about four miles south of Red Lake, and (4) in the vicinity of White Mesa.

During the surveys, one hundred and twelve tracts were located which comprise eight hundred and three acres of present farm land and three hundred twenty-five acres of potential farm land. Most of this is located within the above named concentrations but there are a few small scattered farms outside of these areas. All of the potential farms are located within these areas. There are about 0.68 acres per capita farmed at the present time. Potential land, as recommended in this survey, will increase this to 0.96 acres per capita.

Cultural Practices.

The farming methods of the people within this unit are mostly primitive with but very few modern improvements. Most of the Lavajos own hand plows and the horse-drawn blade which is used for weeding and cultivating, but other farm machinery is lacking. Corn, which is the principal crop grown, is planted and harvested by hand. Other crops are likewise produced principally by hand labor.

On the irrigated land, the border method is used for irrigation and each owner irrigates his field according to his turn. On the flood irrigated farms, the water usually is allowed to take its own course due primarily to the variations in the size of the flow of the gullies. Some of the owners are trying to check the small head erosions which endanger their farms, but when it becomes very serious, the field is abandoned. Practically no effort is made to check the serious wind erosion which affects all the farms within this unit.

Agricultural Land Classification.

The farming on this unit is divided into three types:
(1) Irrigated land which includes all farming done where permanent water is supplied for irrigation.

(2) Flood irrigated land; this includes all farming done where water is supplied to the farm from accumulated run-off from rains.

(3) Dry farming which includes all farming done where no additional water is supplied to the farm, other than the rainfall.

Each of these types of land are classified according to the legend of land classification which is attached to this report.

The principal type of land found within this unit is flood irrigated. This is because there is only one source of irrigation water which is supplying about twenty acres of land at the present time. The unit as a whole, is fairly sandy and as a result, there is very little run-off to supply the farms with flood water. Dry farming is not successful due to the low annual rainfall which is about seven inches.

Generally speaking, this unit is not adapted to agriculture except near Cow Springs where there is a supply of water for irrigation.

The following tables are compiled to show the acreage of each type of land and the acreage classified under each type.

ACREAGE OF EACH TYPE OF LAND

| Type of Land | Present Acreage | Potential Acreage |
|-----------------|-----------------|-------------------|
| Irrigated | 20 | 100 |
| Flood Irrigated | 725 | 225 |
| Dry Farming | 58 | 0 |
| TOTAL | 803 | 325 |

ACREAGE ACCORDING TO CLASS OF LAND

| Classification | Present Acreage | | | | Potential Acreage | | | |
|-----------------|-----------------|---------|---------|---------|-------------------|---------|---------|---------|
| | Class A | Class B | Class C | Class D | Class A | Class B | Class C | Class D |
| Irrigated | 20 | | | | 100 | | | |
| Flood Irrigated | 585 | 134 | 6 | | 200 | 25 | | |
| Dry Farming | 6 | 47 | 5 | | | | | |
| TOTAL | 611 | 181 | 11 | | 300 | 25 | | |

Agricultural Crops Produced.

Owing to the fact that this survey was conducted during the late winter and early spring months, it was impossible to determine exactly the crops grown during the previous season; but estimates were made as accurate as possible and the following acreages of the different crops obtained:

| Crop | Acres | Percent of Total |
|-------------------|-------|------------------|
| Corn | 564 | 70.23 % |
| Idle | 218 | 27.17 % |
| Squash and Melons | 19 | 2.36 % |
| Beans | 2 | .24 % |
| TOTAL | 803 | 100.00 % |

Yields.

No actual measurements of crop yields were made on this unit; therefore the yields to be listed are estimates compared with the yields of other units studied and information from people within the unit. For this reason, these figures should by no means be taken as definite.

| Crop. | Present Average Production. | Expected average Production. |
|-----------------|-----------------------------|------------------------------|
| Corn | 15 bu. per acre | 20 bu. per acre. |
| Squash & Melons | 3,000 # per acre | 4,000 # per acre. |
| Beans | 250 # per acre | 325 # per acre. |

It is expected that increased yields can be accomplished by the following:

1. More efficient use of the available water.
2. Crop rotation and soil fertility practices.
3. Contour listing where the water is scarce to reduce the run-off.
4. The introduction and use of ordinary farm machinery.
5. Fall plowing to reduce cutworm damage.
6. Proper seed selection.
7. Proper seed bed preparation.
8. Planting at the proper time.
9. Proper cultivation practices.
10. Wind-break plantings to reduce wind erosion damage.

Suggested Crops.

Suggested crops for this unit will vary somewhat with the conditions under which they are produced. On the dry farms, such crops as corn, beans and rye are recommended.

On the flood irrigated farms where the water is a little doubtful such crops as corn, beans, melons, squash, wheat and oats are recommended.

On the irrigated farms and flood irrigated farms with sufficient irrigation such crops as garden vegetables, fruit trees, various grains and grasses, alfalfa and clover are recommended.

(For suggested crops on each farm, see the Agronomy Survey notes attached to this report.)

Farming as found Within Each Sub-Unit of Unit No. 1.

Unit No. 1 was divided into five sub-units by the study group for the purpose of discussing the problems within smaller areas and to give special attention to locations where work is needed. The sub-units are shown on the map and numbered. The following is a general Agronomy inventory of the Unit compiled by sub-units:

Sub-Unit # 1.

This sub-unit consists mostly of low rolling hills with grass as the principal vegetation. The area as a whole is fairly sandy and there is practically no run-off to supply water for flood irrigated farms. The rainfall is not sufficient for dry farming and there are no supplies of water for irrigation.

This sub-unit is best adapted to livestock production, but most of the range is under utilized at the present time, due to the lack of sufficient stock water.

There was no farming found at the present time in this sub-unit nor none recommended, due to the lack of water.

Sub-Unit # 2.

This sub-unit consists of rolling sandy hills and plateau. It is probably grazed a little heavier and the sand dunes are more active than on sub-unit # 1. It contains a few flood irrigated farms and a few class "D" dry farms but as a whole, this is not an agricultural section. Again, because of insufficient water. Three of the flood irrigated farms, as listed below, need improvement if they are to continue in cultivation.

There is a total of 85 acres farmed at the present time in this sub-unit. No potential farm land is recommended.

70 acres are flood irrigated.

15 acres are dry farmed.

Farms # 3, 6, and 7 in Quad. # 79, consisting of 17 acres could be improved by the construction of wire spreaders at \$10.00 per acre. They receive flood irrigation. The soil averages sand to sandy loam. The slope is 1 to 2%. If this land is not needed, the work on these farms would be very questionable, due to the fact that the water supply is questionable and in favorable years, crops can be produced to some extent.

The balance of the farm land needs no subjugation work, but many of the farms could be improved by contour listing and planting.

There are five acres of Class "C" flood irrigated land and three acres of Class "C" dry farming that are not recommended for cultivation due to the lack of sufficient water.

Sub-Unit # 3.

This sub-unit presents some more favorable conditions for farming than the above sub-units. The area as a whole, is fairly sandy and consists of rolling hills, mesas and plateau. Dry farming is not successful due to the low rainfall but several farms located in gullies or on gully fans are farmed successfully. There is no supply of water for irrigating farm land. There are 59 acres farmed at the present time and no potential land was located in this sub-unit.

15 acres are flood irrigated.

15 acres are dry farmed.

Farms which need subjugation work are listed as follows:

Quad No. 75, Farms Nos. 2, 14 and 17.

These farms comprise about 9 acres of flood irrigated land. The soil averages a sandy loam and the slope ranges from 1 to 3%. It will be possible to improve these farms by bordering at an average cost of \$17.25 per acre.

There are two acres of Class "C" dry farming which are not recommended for farming due to the lack of water and severe wind erosion.

The balance of the farm lands needs no subjugation work, but can be improved by proper cultural practices such as contour plowing and contour listing and planting.

Sub-Unit # 4.

This sub-unit consists mostly of rough, broken, stoney land with plateau in the southern part. Several large gullies drain this area; Navajo Canyon, a deep, rough, rocky drainage forms the boundary on the north and east sides. In general this sub-unit is not adapted to Agriculture except in the southern portion where several farms are located.

There are 76 acres of present flood irrigated farms and 20 acres of potential land in this sub-unit. Farms which need subjugation work are listed as follows:

Quad. 93, Farms Nos. 27, 28 and 29.

These farms comprise about 22 acres of present flood irrigated land and 20 acres of potential land; the soil is sandy clay loam, and the slope ranges from 1 to 3%. They can be improved by bordering at an average cost of \$17.25 per acre. The potential land requires the same treatment as the present. The balance of the farm land can be improved by proper cultural practices.

Sub-Unit # 5.

This sub-unit varies from mountainous country to plateau, the latter being predominant. It is much better supplied with water than any of the other sub-units which naturally makes farming more favorable.

The majority of the land is flood irrigated but there is one irrigation project located at Cow Springs. The farm land in this sub-unit is worthy of special consideration because it represents the biggest and the primary agricultural asset of the whole unit.

There are approximately 503 acres farmed at the present time and 305 acres of potential farm land.

20 acres of the present land are irrigated.

553 acres of the present land are flood irrigated.

50 acres of the present land are dry farmed.

100 acres of the potential land are irrigated.

205 acres of the potential land are flood irrigated.

The farming is concentrated into five principal areas:

(1) Cow Springs, (2) Above Cow Springs Lake, (3) Red Lake, (4) South of Red Lake, and (5) White Mesa. The following is the observations wide within each of these areas:

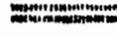
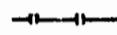
(1) Cow Springs.

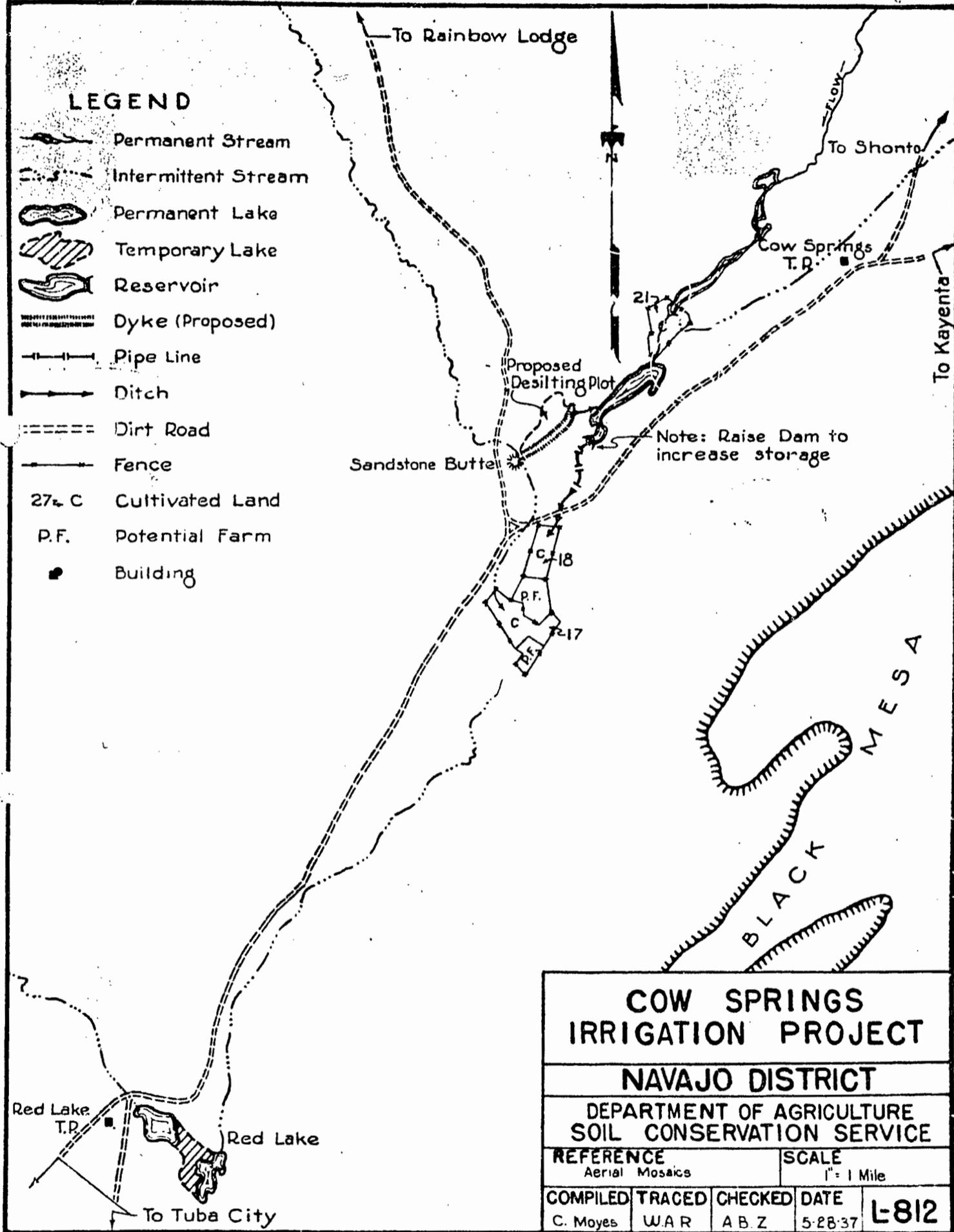
About four miles southwest of Cow Springs, there are 20 acres of present irrigated land. Water is supplied from Cow Springs Lake. A small dam which was built by the Irrigation Service in 1935 made it possible to store approximately 400 acre feet of water. The annual expectancy is about 100 acre feet. Therefore no spillway was provided at the dam. Should the lake become too full and over flow the water overflowing, the dam would destroy the outlet system of the lake and flood over the farm land. The Engineering branch is proposing to divert some additional water into the lake from a side drainage which is endangering the irrigated farm land at the present time. This will make the annual expectancy of the lake about 400 acre feet. They also propose to raise the dam about 10 feet as a safety factor to protect the farm land and irrigation system.

The additional water will make it possible to irrigate an additional 140 acres. 100 acres of this will be new land to be brought under cultivation and the other 40 acres will be the irrigation of the farm which is now flood irrigated by the water to be diverted into the lake. The map shows this project in detail.

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LEGEND

-  Permanent Stream
-  Intermittent Stream
-  Permanent Lake
-  Temporary Lake
-  Reservoir
-  Dyke (Proposed)
-  Pipe Line
-  Ditch
-  Dirt Road
-  Fence
- 27 1/2 C Cultivated Land
- P.F. Potential Farm
-  Building



| | | | | |
|--|---------------|-------------------|----------------------|-------|
| COW SPRINGS IRRIGATION PROJECT | | | | |
| NAVAJO DISTRICT | | | | |
| DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE | | | | |
| REFERENCE Aerial Mosaics | | | SCALE 1" = 1 Mile | |
| COMPILED C. Moyes | TRACED WAR | CHECKED A.B.Z. | DATE 5-28-37 | L-812 |

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(2) Above Cow Springs Lake

About three miles up Cow Springs Wash from the lake, there is a location where it will be possible to put in an equalizing dam to control the flow of the wash. This would make it possible to farm the canyon from the equalizing dam to the lake. It is very likely that there would be enough sub-irrigation to produce farm crops without any additional irrigation. The land is all very level and no additional subjugation would be required. It is estimated that there is over 100 acres of potential land below this dam besides the 30 acres which are being farmed immediately above the lake at the present time. The permanent flow of the wash is used to irrigate a small portion of this land but it is not sufficient to irrigate the entire area; therefore it was classed as flood irrigated.

(3) Red Lake.

At the Red Lake farming area, there are two possible ways of handling the flood water and a preliminary engineering survey will be necessary before a final decision is made. One method is to put in some rock and wire jetties to spread the water over a larger part of the area than at present. The other method is to construct a dyke with weeps along the east side and take the excess water into the lake without damage to the farm land.

The trader at Red Lake, Mr. O'Farrel and several of the Indians who farm in there, say there is sufficient sub-irrigation to produce their crops and that the flood water often destroys their crops. There is about 120 acres farmed in this area.

(4) Below Red Lake.

About $4\frac{1}{2}$ miles south of Red Lake, there are approximately 75 acres of farm land located on a fully fan. An equalizing dam in the wash above the farms is what is needed, but no suitable place was located; however the land can be improved by putting in some water spreaders to get a more uniform distribution of the flood water.

(5) White Mesa.

In the vicinity of White Mesa, there are a group of farms located in washes or on gully fans. Most of these farms can be improved by putting in some spreaders to help hold the small amount of available water on the land and at the same time, give it a more uniform distribution.

The following table shows the expected run-off for the principal drainages affecting farms in this area:

| Location | Annual expectancy Acre Ft. | Maximum ex- pectancy Acre Ft. |
|---|-------------------------------|-------------------------------------|
| Supply at Cow Springs Lake | 100 | 400 |
| Additional water supplied by diversion of Wash # 4.5 into the lake. | 250 | 600 |
| Water supplied to farm # 1, Quad. 94 (at Red Lake) | 400 | 700 |
| Equalizing reservoir in Cow Springs Wash (Drainage # 4) above the lake. | 600 | 400 |

The table on the following page shows each of the farms in this sub-unit with the recommended subjugation work, cost etc.

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| Quad No. | Farm No. | Present Acre-age | Pot. Acre-age | Type of Land | Recommended Work and cost per Acre. | Total Cost | Soil Type* | Slope |
|----------|-------------|------------------|---------------|-----------------|-------------------------------------|------------|------------|--------|
| 72 | 1 | 6 | 5 | Flood Irrigated | Border @ \$18.00 | \$198.00 | S | 1 - 2% |
| 72 | 4 | 10 | 0 | " | " @ 25.00 | 250.00 | SL | 1 - 2% |
| 72 | 5 | 18 | 0 | " | " @ 20.00 | 360.00 | SL | 1 - 2% |
| 72 | 6 | 0 | 15 | " | " @ 18.00 | 270.00 | SCL | 1 - 2% |
| 72 | 8 | 10 | 10 | " | " @ 15.00 | 300.00 | SL | 1 - 2% |
| 93 | 9 | 5 | 0 | " | " @ 10.00 | 75.00 | SL | 1 - 2% |
| 93 | 1 & 2 | 20 | 0 | " | Wire spreaders @ 15.00 | 200.00 | S | 1 - 2% |
| 93 | 4 | 3 | 0 | " | " @ 15.00 | 45.00 | S | 1 - 3% |
| 93 | 8 | 1 | 4 | " | " @ 12.00 | 60.00 | S | 2 - 2% |
| 93 | 10 | 4 | 0 | " | " @ 15.00 | 60.00 | S | 1 - 2% |
| 93 | WS.50 | 0 | 5 | " | " @ 12.00 | 60.00 | S | 1 - 2% |
| 94 | 6 | 1 | 0 | " | " @ 15.00 | 15.00 | S | 1 - 2% |
| 94 | 8,9, & 10 | 75 | 10 | " | " @ 20.00 | 1500.00 | SL | 1 - 2% |
| 94 | 13 | 7 | 0 | " | Border @ 15.00 | 100.00 | SL | 1 - 2% |
| 94 | 14 | 4 | 0 | " | Wire spreaders @ 10.00 | 40.00 | S | 1 - 2% |
| 94 | 16 | 2 | 0 | " | Border @ 20.00 | 40.00 | SL-SCL | 1 - 2% |
| 94 | 17** | 40 | 0 | " | " @ 15.00 | 600.00 | S | 1 - 2% |
| 94 | 18 | 0 | 100 | Irrigated | " @ 12.00 | 1200.00 | S | 1 - 2% |
| 94 | 19 | 3 | 2 | " | " @ 15.00 | 45.00 | SL | 1 - 3% |
| 94 | 25 | 10 | 10 | Flood Irrigated | " @ 15.00 | 150.00 | SL | 1 - 2% |
| 94 | 27 | 4 | 0 | " | " @ 18.00 | 72.00 | SL | 1 - 2% |
| 94 | 30 | 30 | 0 | " | " @ 18.00 | 540.00 | S | 1 - 2% |
| 94 | 32,33,34,35 | 31 | 5 | " | Wire spreaders @ 15.00 | 465.00 | SL | 1 - 2% |
| 94 | 40 | 2 | 0 | " | " @ 15.00 | 30.00 | SL | 1 - 2% |
| 95 | 1 | 3 | 0 | " | " @ 20.00 | 60.00 | SL | 1 - 2% |
| Total | 289 | 166 | | | Av. cost per acre @ 15.00 | \$6,822.00 | S | 1 - 2% |

* S = sandy
 SL = sandy loam
 SCL = sandy clay loam
 CL = clay loam

** This tract is flood irrigated at present, but it is proposed to divert the flood water into Cow Springs Lake and irrigate this farm.

The balance of the farm land which is about 294 acres and 139 acres of potential land, needs no treatment other than proper land use and cultural practices.

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NN002506

The following table shows the farm numbers within each sub-unit.

| Sub-Unit | Farm Numbers | Quad. Nos. | Location |
|----------|--|------------|----------------|
| I. | 0 | --- | ----- |
| II. | 2, 3, 4, 5, 6, | 78 | 111°15' 36°15' |
| | 3, 5, 6, 7, 11, 12, 13. | 79 | 111°15' 36°30' |
| III. | 1, 1.1, 3, 5, | 86 | 111°30' 36°15' |
| | 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13. | 75 | 111°00' 35°15' |
| | 14, 15, 16, 17, 18, 19, 20, 21, 22, | 76 | 111°15' 36°45' |
| | 1 | | |
| IV. | 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 31, 32. | 93 | 110°45' 36°15' |
| V. | 1, 3, 4, 5, 6, 7, 8, 9, 10, 16 | 72 | 111° 36°30' |
| | 7 | 73 | 111° 36°45' |
| | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 50 | 95 | 110°45' 36°45' |
| | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 25, 26, 27, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47. | 94 | 110°45' 36°30' |
| | 1, 2, 17, 18 | 95 | 110°45' 36°15' |

The following table is compiled to show the population, consumption groups, acreage, of present and potential land, and the percentage of the different crops grown in the five sub-units of the unit.

| Sub-Unit | Pop-ulations | Consump-tion Groups | : Acreage and percent of total. | | | | | |
|----------|--------------|---------------------|---------------------------------|---------------|---------------|-------------------|------------|---------------|
| | | | : Pres-ent | Poten-tial | Corn | Melons and Squash | Beans | Idle |
| I. | | | 0 | 0 | 0 | 0 | 0 | 0 |
| II. | | | 85 10.59% | 0 | 61 7.60% | 0 | 2 0.25% | 22 2.71% |
| III. | | | 76 9.46% | 0 | 36 4.48% | 0 | 0 | 40 4.98% |
| IV. | | | 59 7.35% | 20 6.15% | 45 5.60% | 1 .12% | 0 | 15 1.62% |
| V. | | | 583 72.60% | 305 93.85% | 422 52.55% | 18 2.21% | 0 | 143 17.81% |
| TOTAL | 1176 | 157 | 803 100% | 325 100% | 564 70.23% | 19 2.36% | 2 0.25% | 218 27.15% |

Farm pests, Weeds, Rodents, and Insects.

1. Weeds.

No serious weeds were located or reported from any of the farms of this unit. It is therefore believed that proper cultivation practices will control the weeds on the farm land.

2. Rodents.

Prairie dogs, pocket gophers and kangaroo mice are present on most of the farms within the unit. The prairie dog infestations were more noticeable on the northern part of the unit. Control measures for these rodents are needed on the farms, especially for the prairie dogs.

3. Insects.

Cutworm damage was reported from practically all the farms of this unit. Grasshopper damage was reported from a few farms but not to a serious extent.

Fall plowing should be practiced to check the cutworm damage and unless serious grasshopper outbreaks are reported, no control measures are needed.

Other insects, such as the army worm and corn bore, are probably present on the farms but no serious damage was reported.

The following table is compiled to show the
farm ownership on Unit #1

| Quad. No. | Farm No. | Acres | Owner's Census Number | Owner's Name | Acreage Owned |
|--------------|-------------|-----------------|-----------------------------|---|-----------------------|
| 72 | 1 | 6 | | Zon-nez-Tso | 6 |
| 72 | 3 | 12 | | Bi-dog ni tsa Bidonie Dan Chae | 6 6 |
| 72 | 4 | 10 | | Amos Singer | 10 |
| 72 | 5 | 18 | | Ha Talley Ha Talley Begay Bert Warren Charley White Amos Begay (fenced but not farmed) | 6 6 3 3 4 |
| 72 | 6 | 15 of Pot. | | Claimed by Bert Warren | 15 |
| 72 | 7 | 3 | | John Guy Hat | |
| 72 | 8 | 10 & 10 Pot. | | Bi dog ni tsa Bidonie Clarence Chee | 4 6 |
| 72 | 9 | 5 | | Thomas Naz | 5 |
| 72 | 10 | 4 | | Bi-dog ni tsa Bidonie | 4 |
| 72 | 16 | 18 | | Bi dog ni tsa Bidonie Dan Chae Nockie Dena | 6 6 6 |
| 73 | 1 | 1 | | Rube Watson | 1 |
| 73 | 2 | 3 | | Everet Mann | 3 |
| 73 | 3 | 3 | | Teddie Naz | 3 |
| 73 | 4 | 20 | | Antokie Eddie Jones Zann Nazzie | 7 7 6 |
| 73 | 5 | 1 | | | |
| 73 | 6 | 6 | | Gish She Bitah | |

| Quad. No. | Farm No. | Acres | Owner's Census Number | Owner's Name | Acreage Owned |
|--------------|-------------|-------|-----------------------------|--|------------------|
| 73 | 7 | 7 | | Dena Ahshiddie Chee Clemen Henery Teddie Naz | 2 3 2 |
| 73 | 8 | 2 | | Lillian Franklin | 2 |
| 73 | 9 | 3 | | Abandoned (no owner) | |
| 73 | 10 | 4 | | Ne Ha talley Begay | 4 |
| 73 | 11 | 2 | | Dog Aut-Cley (not using) | 2 |
| 73 | 12 | 2 | | Bi Ahde Cli he | 2 |
| 73 | 13 | 4 | | Bert Warren (has abandoned) | 4 |
| 73 | 14 | 4 | | Aut Saddle Chee | |
| 73 | 15 | 1 | | Mattie Jones (Eddie Long) | 1 |
| 73 | 16 | 1 | | Gisheen Begay | 1 |
| 73 | 17 | 2 | | Hosteen Soney Begay | 2 |
| 73 | 18 | 5 | | Fred Gishe | 5 |
| 73 | 19 | 1 | | Dog Autcley | 1 |
| 73 | 20 | 1 | | Dog Autcley | 1 |
| 73 | 21 | 4 | | Tall Nookie | 4 |
| 73 | 22 | 2 | | Tsidna Gimrie | 2 |
| 78 | 1 | 3 | | Zon-Nez le shinney | 3 |
| 78 | 2 | 4 | | | |
| 78 | 3 | 5 | | | |
| 78 | 4 | 1 | | | |

| Quad. No. | Farm No. | Acres | Owner's Census Number | Owner's Name | Acreage Owned |
|-----------|----------|-------|-----------------------|-------------------------------|---------------|
| 78 | 5 | 2 | | | |
| 78 | 6 | 3 | | | |
| 79 | 3 | 9 | | | |
| 79 | 5 | 4 | | Black Horse | 4 |
| 79 | 6 | 3 | | Elvin Tsidna Ginnie | 3 |
| 79 | 7 | 9 | | Black Horse | 9 |
| 79 | 11 | 3 | | Claw Begay | 3 |
| 79 | 12 | 2 | | Claw Begay | 2 |
| 79 | 13 | 3 | | | |
| 86 | 1 | 18 | | Clizzie Ah Millie Begis | 3 |
| | | | | John Spencer | 10 |
| | | | | Nockie Kihashazzie | 5 |
| 86 | 11 | 12 | | Nockie Kihashazzie | 4 |
| | | | | Ahstzan Tsinnie | 8 |
| 86 | 3 | 2 | | John Bone | 2 |
| 86 | 5 | 5 | | Clizzie Al nilly Begis | 5 |
| 93 | 1 | 5 | | See Collier Denet Sosi | |
| 93 | 2 | 15 | | Estity Begay | 7 |
| | | | | Hah talley-ba Ason | 8 |
| 93 | 3 | 2 | | Ahcitty Bothma | 2 |
| 93 | 4 | 3 | | Ah-citty | 3 |
| 93 | 5 | 3 | | Hosteen Tsa-Clachse- haree | 3 |
| 93 | 6 | 5 | | Tapahonso | 5 |

| Quad. No. | Farm No. | Acres | Owner's Census Number | Owner's Name | Acreage Owned |
|-----------|----------|-------|-----------------------|--|---------------|
| 93 | 7 | 1 | | Tapahonso | 1 |
| 93 | 8 | 1 | | | |
| | | 4 | Poten. | Day ne ni ned | 1 |
| 93 | 9 | 9 | | Chon nah tillie Begay | 9 |
| 93 | 10 | 4 | | Hosteen Doe Clizzie | 4 |
| 93 | 26 | 1 | | Hosteen etna | 1 |
| 93 | 27 | 10 | | Tex Jackson | 10 |
| | | 10 | Poten. | | |
| 93 | 28 | 8 | | Lester Dodsol | 8 |
| 93 | 29 | 4 | | Tah Cheeney Sosi | 4 |
| 93 | 30 | 2 | | Tity Johnson | 2 |
| 93 | 31 | 2 | | Henry Bigman | 2 |
| 93 | 32 | | | Joe Sly | 2 |
| 93 | 33 | 6 | | | |
| 93 | 34 | 4 | | Clah-l Tsoie | 4 |
| 93 | 35 | 3 | | | |
| 93 | 36 | 2 | | | |
| 93 | WS.50 | 5 | Poten. | Hosteen Doe Clizzie (has abandoned) | 5 |
| 93 | 51 | 1 | | | |
| 93 | 52 | 15 | | Sid-na-jinnie Begay | 15 |
| 94 | 1 | 120 | | John Daw Clevan Daw Guy Daw Kee Daw Tsie Bah Daw | |

| Quad. No. | Farm No. | Acres | Owner's Census Number | Owner's Name | Acreage Owned |
|-------------|----------|-------|-----------------------|---|---------------|
| 94 (Cont'd) | | | | Grey Hat Edith Willard Holmes Joseph Talles Paul Numkena Sam Numkena | |
| 94 | 2 | 2 | | John Daw | 2 |
| 94 | 3 | 1 | | Ben Daw | 1 |
| 94 | 4 | 2 | | Dagi Chez | 2 |
| 94 | 5 | 1 | | Frank Whitehair | 1 |
| 94 | 6 | 1 | | Nockie Denea | 1 |
| 94 | 7 | 2 | | Robert White Rock | 2 |
| 94 | 8 | 25 | | Grey Hat Claw Bidonie | |
| 94 | 9 | 35 | 71251 | George Black hat Toha-honney Nez Noto-in-Clezie | |
| 94 | 10 | 15 | | Bilinish Clezzie Ashie | |
| 94 | 11 | 5 | | Many Goats | 5 |
| 94 | 12 | 6 | | Jim Many Goats | 6 |
| 94 | 13 | 7 | | Many Mules Begay | 7 |
| 94 | 14 | 4 | | Nockie Shinney & son-in-law | 4 |
| 94 | 15 | 1 | | Nockie Shinnie & son-in-law | 1 |
| 94 | 16 | 2 | | Nockie Shinnie & son-in-law | 2 |

| Quad. No. | Farm No. | Acres | Owner's Census Number | Owner's Name | Acreage Owned |
|-----------|----------|-------|-----------------------|---|---------------|
| 94 | 17 | 40 | | Joddie Yazzie Kedinee Begay Billie Clarence Clarence John Billie Billie Mann West Billies Mother | |
| 94 | 18 | 20 | 71283 | Billie Mann Deschinnie Begay Frank White hair Eli Shorty John Billie Charley Kee Soney-or-So West Billie Daniel Yoel Dugie-del-hilly Ed Yazzie Ed Yazzie Bidonie Jim Salt Bis-si yan Begay Dan Little man Big Goat ? Sam Joe ? | |
| 94 | 19 | 3 | | Clarence | 3 |
| 94 | 20 | 10 | | Big Goat | 10 |
| 94 | 21 | 30 | 79771 | Boyd Nez Hosteenigay Astzon adtlhdonie (Tessie Green) James Watson Lee Brown Navajo Jim's wife Ed Yazzie Hosteen Tsa Yah Tohee John Billie Mann Joe Williams ? | |
| 94 | 22 | 2 | | Hah Talley Guy | 2 |
| 94 | 25 | 10 | | Archie | 10 |

| Quad. No. | Farm No. | Acres | Owner's Census Number | Owner's Name | Acreage Owned |
|-----------|----------|--------|-----------------------|---|---------------|
| 94 | 26 | 3 | | Hosteen Sosi Bidah | 3 |
| 94 | 27 | 4 | | Hosteen Sosi | 4 |
| 94 | 30 | 30 | | Tsid na Jinnie Yazzie Tсах hah gawney | |
| 94 | 31 | 7 | | Clah Bidriga-Clachee | 7 |
| 94 | 32 | 6 | | Clah Begay Tachinney ne Clah Tse Ah goodie Soney | |
| 94 | 33 | 4 | | Slaw ne Taggie | 4 |
| 94 | 34 | 3 | | Gishie Bidonie (Charley Yarn) | 3 |
| 94 | 35 | 18 | | Dave Kerley (Chis Chilley) Tachinnie Doe Autin Edward Lamey Chon Tilley Begay | |
| 94 | 40 | 2 | | Clemen | 2 |
| 94 | 41 | 1 | | | |
| 94 | 42 | 1 | | Jodie Yazzie | 1 |
| 94 | 43 | 4 | | | |
| 94 | 44 | | | (Abandoned) | |
| 94 | 45 | 3 | | | |
| 94 | 46 | 2 | | | |
| 94 | 47 | Poten. | | | |
| 95 | 1 | | | Tsee Yee Hintnieso | 1 |
| 95 | 2 | | | Auteiddie Begay | 2 |

Recommendations.

1. No dry farming should be practiced in this unit unless it is on Black Mesa.
2. Seed selection should be explained to the Navajos and they should be encouraged to practice it.
3. The use of simple farm machinery should be encouraged.
4. Proper cultivation practices should be practiced to control weeds and conserve moisture.
5. Fall plowing should be practiced to reduce cut-worm damage.
6. Contour listing and strip cropping should be encouraged to reduce wind erosion damage.
7. Windbreak plantings should be encouraged on all the farms wherever possible.
8. A larger variety of crops to include such plants as peaches, alfalfa, vegetables, sudan grass and clover, should be produced.
9. No new land should be broken for cultivation unless a sufficient supply of moisture is assured.
10. Grasshopper outbreaks should be guarded against and checked as soon as discovered.
11. General rodent control should be carried out around the infested fields.
12. Farm crops should be planted about April 25th to May 1st., and not later than May 10th.
- *13. The irrigation project at Cow Springs lake should be handled under direct government supervision, both as to handling of water and producing crops.
14. The available additional water storage should be developed at Cow Springs Lake and additional farm land subjugated to the extent of the water supply.
15. The proposed equalizing reservoir in Cow Springs Wash should be constructed to insure protection for farm land above the lake.
16. The farm at Red Lake should be protected against flood water in the most feasible manner.
17. The farms on both the north and south side of White Mesa should get a more uniform distribution of flood water and also conserve as much water as possible. Brush and wire spreaders are recommended to fulfill these needs.

Total Subjugation Costs.

The total cost of the agricultural development within this unit involving leveling, furrowing, bordering, or uniformly spreading water, as the case may be on the present farm land, is approximately \$5094.00. The estimated cost on the potential land is approximately \$2924.00. These costs do not include diversions or ditches.

This total cost is further broken down as follows:

| Type of Land. | Acreage of present land to be treated. | Cost on present land. | Acreage of potential land to be treated. | Cost on potential land. | Average cost per acre on pres. & potential land. | Total cost on pres. & potential land. |
|-----------------|--|-----------------------|--|-------------------------|--|---------------------------------------|
| Irrigated | * 40 | \$ 600.00 | 100 | \$1500.00 | \$ 15.00 | \$2100.00 |
| Flood irrigated | 297 | 4494.00 | 86 | 1224.00 | 15.12 | 5708.00 |
| Dry Farming | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 337 | \$5094.00 | 186 | \$2924.00 | \$ 15.21 | \$8008.00 |

* This 40 acre tract is flood irrigated at present but proposed work will divert the flood water and irrigate this tract.

The estimated cost on each farm can be obtained from the Agronomy survey notes attached to this report.

The following table was used as a guide in making the cost estimates for each farm.

| Slope | Leveling Only | Leveling and bordering. | |
|--------------|---------------|-------------------------|---------------|
| | | Flood irrigated. | Irrigated. |
| Less than 1% | \$ 0 - 6 | \$ 8 to \$12 | \$ 8 to \$10 |
| 1% | \$ 6 -10 | \$ 14 to \$20 | \$ 14 to \$18 |
| 2% | | \$ 20 to \$30 | \$ 18 to \$25 |
| 3% | | \$ 30 to \$45 | \$ 25 to \$40 |
| 4% | | \$ 40 to \$60 | \$ 35 to \$50 |
| 5% | | \$ 50 to \$75 | \$ 40 to \$70 |

The following is a list of projects listed according to priority which are recommended for immediate work.

1. Irrigated Farms Below Cow Springs.

Farms No. 17 and No. 18, Quad 94, (110°45' 36°30')
It is proposed to raise the dam at Cow Springs Lake and divert drainage # 4.5 into the lake. This gully at the present time floods over Farm No. 17 and often destroys crops. By diverting it into the lake, the water can be controlled and used for irrigation.

At the present time only 20 acres are irrigated from this lake but it is estimated that the water will be sufficient for about 160 acres. Therefore Farm No. 17, consisting of about 40 acres can be irrigated and 100 acres of potential land. It will be necessary to level and border this land. Estimated cost is \$15.00 per acre. The soil is sandy loam, slope about 1%.

There is an additional 450 acres of suitable land for farming in this locality if water could be supplied for it.

2. Potential Farms in Cow Springs Wash.

Farms Nos. 45, 46 and 47, Quad. 94 (110°45' 36°30'
Just above Farm No. 45, there is a suitable location for an equalizing dam for the flow of the wash. By the construction of this dam, the entire area down to the lake could be farmed. No additional subjugation would be necessary because the land is level and crops could very likely be produced from the sub-irrigation they would receive. It is estimated that there are at least 100 acres of potential land which could be farmed in this area. A few farms have been in here previously but have apparently been abandoned due to the excess water flooding over them. The total cost for the construction of the project, as estimated by Mr. Moyes, is \$13,000.00. (For details, see Engineering Report.) No subjugation is necessary. The soil is sandy clay loam and the slope about 1%.

3. Farm at Red Lake.

Farm No. 1, Quad. 24 (110°45' 36°30')

This farm located at Red Lake receives flood irrigation. The large flows of the drainage southeast of the lake often floods out and destroys crops produced on this farm. A more detailed engineering survey is needed to determine the best method of handling this water. Two methods are suggested:

(1) The one is to construct rock and wire jetties on the one side of the area where the water has a tendency to concentrate at the present time. This would tend to spread the water more uniformly over the entire area.

(2) The other method is to construct a dike with weeps along the south and east side of the farm land and carry the excess water into the lake bed.

(A rough estimate of this work can be obtained from Mr. Moyes' Engineering Report.)

The Indians in this vicinity and Mr. O'Farrel, the Indian trader claim that there is enough sub-irrigation for the production of crops in this area without additional flood irrigation. The farm land is very level and the soil averages a sandy loam to sandy clay loam. No subjugation work is needed if the flood water is controlled.

4. Farms South of Red Lake.

Farms Nos. 8, 9 and 10, Quad. 24 (110°45' 36°30')

Farms Nos. 8, 9 and 10 are located on a large gully fan of drainage No. 4.2. The engineers' estimated annual expectancy of this gully is 225 acre feet. At the present time, crops are sometimes flooded out due to the water concentrating. It would be very desirable to construct an equalizing reservoir above the farm land to control the flood water, but no suitable location was made for such a dam. Therefore, it is proposed to construct brush and wire spreaders on the farm land to spread the water more uniformly over the entire area. There are approximately 75 acres farmed at the present time and 10 acres of potential land. The estimated cost of the wire spreaders is \$10.00 per acre. The soil is a sandy loam to sandy clay loam, and the slope ranges from 1% to 2%.

5. Farms In Vicinity of White Mesa.

Farms Nos. 1,2,4,8,10, and W.S., Quad 93
(110°45' 36°45')

Farms Nos. 32,33,34,35 and 40, Quad. 94
(110°45' 36°30')

There are approximately 61 acres of present farm land and 24 acres of potential land in scattered tracts in the vicinity of White Mesa. These farms are located in gullies and on small gully fans. All of the drainages are relatively short and therefore a very little work is needed to handle the water. Spreader fences are proposed on these farms to give the water a more uniform distribution and to help reduce the wind erosion. The estimated cost is about \$18.00 per acre. The soil averages a sand to sandy loam, and the slope is about 1% to 2%.

SUMMARY

1. Land Management Unit No. 1 is located in the northwestern portion of the Navajo Reservation.
2. The area of this unit, under its present boundary, is 1,035,540 acres.
3. The majority of the soils of this unit are fairly sandy.
4. Wind erosion is active over practically the entire unit.
5. The average elevation of the unit is 6,000 feet.
6. The average annual precipitation is 7 inches.
7. The average growing season extends from April 25th to October 12th.
8. This unit produces a relatively small amount of run-off due to the large amount of sandy soil.
9. Prairie dogs are numerous throughout the entire unit.
10. Grasses are the predominating type of vegetation.
11. The population of the unit is 1,176 people or 157 consumption groups.
12. There is 0.63 acres per capita farmed at the present time. This can be increased to 0.96 acres by the subjugation of potential land.
13. Population concentrations are few and small in this unit.
14. Farming practices are mostly primitive with a few modern improvements.

SUMMARY (Contd.)

15. The acreage of agricultural land in this unit is shown as follows:

| <u>Type</u> | <u>Present</u> | <u>Potential</u> |
|-----------------|----------------|------------------|
| Irrigated | 20 | 100 |
| Flood irrigated | 725 | 225 |
| Dry Farm | 58 | 0 |
| Total | 803 | 325 |

16. Crops produced are shown as follows:

| | |
|-------------------------|-----|
| Corn ----- | 70% |
| Squash and Melons ----- | 2% |
| Idle ----- | 28% |

17. No serious weeds were observed in this unit.

18. Cutworm damage was reported from all parts of the unit.

19. Subjugation costs are shown as follows:

| | |
|--------------------------------------|------------------|
| Average cost per acre ----- | \$ 15.21 |
| Total cost on present land ----- | \$5034.00 |
| Total cost on potential land ----- | \$2924.00 |
| Total for present and potential land | <u>\$8000.00</u> |

Approved:

John O. Woods
Chief Agronomist

Submitted:

Howard M. Ivory

Howard M. Ivory
Agricultural Aide

Attached is definitions of terms used in the Agronomy Survey Sheets, a legend of land classification, and the Agronomy write-up sheets for each farm.

DEFINITIONS OF TERMS USED IN
AGRONOMY SURVEY BLANKS

Tract No.

Each tract or farm is numbered beginning with one on each quadrangle. The number in the notes corresponds to a number on the map and a number placed on each tract. The study will use these numbers as permanent in references to location of a farm under consideration.

Acres

Number of acres of tract as estimated by the Agronomist on the survey.

Topography

The surface conditions of the tract. Expressed in the following terms: slope, rough, even, irregular, hummocky, rolling.

Soil

Soil texture defined as:

C = Clay, S = sand, L = loam, li = light, F = fine.
The use of the symbols thus: FSL indicates a fine sandy
li-c

loam over light clay.

Erosion

The extent of erosion: Gully or sheet, caused by wind or water.

Classification: Slight, moderate, severe.

Water

Water available for crop production. Classification: Doubtful, sufficient, excess.

Expansion

The possibilities of expanding the present farmed land to take in additional adjacent land. Listed as the acreage of potential land.

Present Crop

The crop or crops grown on the tract and acreage of each, if more than one.

Suggested Crop

Crops which the Agronomist suggests growing on the tract.

Yield

Estimate of yield for crops grown on tract as compared to other yields.

Treatment

Recommended soil and water conservation practices, such as borders, dikes, terraces and furrows. (Does not include ditches or diversions. For these details, see Engineer's report.)

Cost Per Acre.

Estimated cost per acre for doing recommended work for each tract.

Class

The class of land as defined by the legend of land classification.

Remarks.

Includes type of land; irrigated, flood irrigated, or dry farming, and any features noticeable to Agronomist. Where more space is needed, remarks are continued on the back of survey sheets.

LEGEND USED IN LAND CLASSIFICATION

FLOOD IRRIGATION - PRESENT LAND

Grade of Agricultural Land

A - B - C and Grass land as classified by Agronomist on Agricultural Land Survey.

A - Grade

1. Will be confined to the following soil textures; Fine sand, very fine sand, fine sandy loam and loam.
2. Will not contain more than .2% alkali.
3. Water must be available for satisfactory growing of tilled crops.
4. Must not have over 3 percent slope for above-mentioned soil textures.

B - Grade

1. Will be confined to soil textures included in Grade A. Land plus silt loam and clay loam textures.
2. Will not contain more than .4% alkali.
3. Adequate water available under normal conditions.
4. Slope not over 5 percent.

C - Grade

Not recommended for Agricultural purposes.

1. Slope too steep or irregular considering type of soil and alkali condition.
2. Presence of over .6% alkali.
3. Excessive erosion conditions.
4. Lack of available water.
5. Deficient drainage.

IRRIGATED LAND ---PRESENT

A - Grade.

1. Will be confined to the following soil textures: Fine sand, very fine sand, fine sandy loam, and loam.
2. Must have adequate water supply for growing any crop.

B - Grade

1. Will be confined to soils with silt loam and clay loam textures, in addition to soil textures included in Grade A land.
2. Must have adequate water for production of two cuttings of alfalfa.

C - Grade

Not recommended for agricultural purposes.

1. Slope too steep or irregular.
2. Presence of over .4% alkali.
3. Excessive erosion.
4. Lack of available water.
5. Deficient drainage.

Note: The amount of white alkali will not exceed .4% of any irrigable land. Over .05% black alkali automatically excludes any land from project. Coarse sand, stony land, and shallow soil will be considered as non-irrigable land.

DRY FARMING -- PRESENT AND POTENTIAL

A - Grade

1. Will be confined to soils with fine sand, very fine sand, and fine sandy loam textures, when the slope does not exceed 5% and up to soils with loam and silt loam textures, when the slope does not exceed 2%.
2. Adequate seasonal rainfall for the growth of beans and corn.

B - Grade

1. Will include any dry farms which are not classed as A Grade, and which would not be recommended to take out of cultivation because of excessive erosion.

C - Grade

Not recommended for Agricultural purposes.

1. Slope too steep or irregular.
2. Excessive erosion.
3. Lack of available water.
4. Deficient drainage.

POTENTIAL LAND -- FLOOD IRRIGATED.

Grades A and B.

Specifications for Grades A and B under this heading are the same as for present flood irrigated land.

C - Grade

1. Will include only soils with loam, silt, loam, and clay loam textures.
2. Area must be large enough to use probable water supply or such as to economically justify control of excess water.
3. Slope must not exceed 3% and preferably not 2%.

IRRIGATED LAND (Available water supply continuous or nearly so.)

Potential Areas (Under consideration at present.)

A - Grade.

1. Will be confined to soils with fine sand, very fine sand, fine sandy loam, and loam textures when slope does not exceed 5%, and up to soils with silt loam and clay loam textures when slope is not more than 3%.
2. Must have adequate water supply.
3. Must be easily put under ditch.
4. No leveling allowed for this class.

B - Grade

1. Will be confined to silt loam and clay loam soils.
2. An uncertain water supply would justify placing soils of fine sand, very fine sand, fine sandy loam and loam textures in this grade.
3. A slight amount of leveling is permissible.

IRRIGATED LAND (Available water supply continuous or nearly so.)

Potential Areas (Under consideration at present.)

A - Grade.

1. Will be confined to soils with fine sand, very fine sand, fine sandy loam, and loam textures when slope does not exceed 5%, and up to soils with silt loam and clay loam textures when slope is not more than 5%.
2. Must have adequate water supply.
3. Must be easily put under ditch.
4. No leveling allowed for this class.

B - Grade

1. Will be confined to silt loam and clay loam soils.
2. An uncertain water supply would justify placing soils of fine sand, very fine sand, fine sandy loam and loam textures in this grade.
3. A slight amount of leveling is permissible.