

NAVAJO SERVICE

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Land Management Unit #18

Agronomy Division

LOCATION:

Land Management Unit #18 lies in the southeast section of the Navajo Reservation. Its confines are approximately the 35°15' parallel on the south, the 36°15' parallel on the north, the 109°15' meridian on the west, and the 108°30' meridian on the east.

AREA:

The area of the Unit is 932,000 acres, including 11,300 acres of Indian Allotment in the Gallup Cut-out.

Proposed boundary changes would increase the area to 938,000 acres.

About .93% of the area is farmed at present and this can be increased to 1.24% by the subjugation of potential land.

POPULATION:

The population of the Unit is approximately 3,100, which makes 2.8 acres per capita being farmed at present within the Unit.

TOPOGRAPHY:

The topography varies from steep, mountainous country containing alluvial valleys to rolling terrain and tropical plateau.

Using Fort Defiance as a reference, the country lying to the north and east is steep, rough and broken, and cut-up by large gullies. To the north and the west is the north portion of Defiance plateau which breaks into Canyon de Chelly.

Red Lake Valley lies between the mountains and plateau. South and east the terrain is mountainous, steep and broken, merging down to low foothills and small valleys traversed by numerous gullies. West and south the terrain ranges from the Defiance plateau to rolling country. From Fort Defiance south to the Rio Puerco lies Black Creek Valley.

DRAINAGE:

Important drainages of the Unit are: Crystal Creek, Black Creek, Rio Puerco, Bonito Canyon, and White Water Creek.

WR 6137

Crystal Creek is tributary to the San Juan river drainage. The other drainages are tributary to the Little Colorado River.

None of the streams are perennial. They might be classed as nine-month perennial streams. During the period of summer rainfall all of the drainages carry large quantities of water and silt.

TEMPERATURE:

The range in temperature observed at three stations within the Unit is shown as follows:

<u>Station</u>	<u>Temperature Range</u>		
Fort Defiance	-24°	to	98°
Gamerco	-20°	to	98°
St. Michaels	-25°	to	106°

ELEVATION:

The elevation ranges from approximately 5,500 feet at Sanders, Arizona to 9,500 feet at Washington Pass, Lukachukai Mountains.

RAINFALL:

The rainfall as observed at three stations within the Unit is shown as follows:

<u>Station</u>	<u>Length of Record</u>	<u>Elevation</u>	<u>Maximum Annual</u>	<u>Minimum Annual</u>	<u>Average For Period</u>
Fort Defiance	22 yrs.	6,950'	22.44"	6.52"	12.88"
Gamerco	16 "	6,785'	17.74"	6.4 "	11.67"
St. Michaels	19 "	6,850'	20.86"	7.9 "	13.15"

GROWING SEASON:

The growing season as observed at three stations is shown as follows:

<u>Station</u>	<u>Growing Season</u>
Gamerco	125 to 135 days
St. Michaels	94 to 165 days
Fort Wingate	147 days

#### EROSION:

Gully erosion is the outstanding problem found within the Unit. Damage from wind erosion is very slight. The soil being farmed varies from a sand to heavy clay, but most of it is sandy loam to clay loam. Agricultural soil is abundant and the Unit as a whole is favorable for agriculture.

#### CULTURAL PRACTICES:

The farming practices in this Unit vary from primitive to modern. Plows are very common and widely used. Mowing machines and rakes are used in the harvesting of alfalfa and oats. The horse drawn blade is used for the cultivation and weeding of corn. The seed is usually sown by hand, using a stick or hoe in planting corn and beans. Hand broadcasting is used for the smaller seeds, such as oats, wheat and alfalfa. With the exception of alfalfa and oats the harvesting is done principally by hand. Corn is picked, husked, and dried before storing for winter use. Beans are gathered into piles, dried, and threshed by beating.

Underground pits are the common storage places used. A fire is built inside to dry them thoroughly before the products are stored. Where the pits are not used the crops are stored in stone or log buildings.

On most of the flood irrigated farms some effort is being made to divert the water from the smaller gullies and hold it on the land, but most of the structures are not as efficient as they might be.

#### METHOD OF LOCATION AND NUMBERING:

Each farm was located on quadrangle half tones, made from aerial mosaics and numbered, using the same numbers as those used on the agricultural survey, and water spreading survey during 1935. On large areas where more than one farm was included under one number the tracts were broken down, using the decimal system to number them. 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.

Present farm land is represented on the map by green color.

Potential land	Yellow
Water spreading areas	Cross hatch XXII
Meadow land	Orange
Planting possibilities	Blue

Potential land adjacent to present farms is not always located accurately on the map. It is colored principally to indicate potential land near the present farm.

#### AGRICULTURAL LAND CLASSIFICATIONS:

On this survey 814 farms were located, which represent a total of 8,668 acres.

This is divided into three types:

- (1) Irrigated land  
This includes all farming where permanent water is supplied for irrigation of the crops.
- (2) Flood irrigated land  
This includes all farming where water is supplied by accumulated runoff from rains.
- (3) Dry farm land  
This includes all farming down where no extra water is supplied besides the rainfall.

Besides the present agricultural land, 8,570 acres of potential land was located. This is usually located adjacent to present farms or at other suitable locations.

According to the legend of land classification attached to this report, each type of land was classified and the totals are listed as follows:

Classification	Present Land				Potential Land			
	Class A	Class B	Class C	Class G	Class A	Class B	Class C	Class G
	Irrigated	520	236	0	90	91	98	0
Flood Irrigated	2480	1027	0	1039	1575	412	0	4772
Dry Farm	2266	868	9	133	733	107	0	572
TOTALS	5266	2131	9	1262	2399	617	0	5554

Type of Land	Present Land	Potential Land
Totals		
Irrigated	846	399
Flood Irrigated	4546	6759
Dry Farm	3276	1412
TOTAL	8668	8570

It is noted that the acreage of potential land might be increased considerable if the need arises for more agricultural land. This expansion can be accomplished by increasing the water storage for irrigated lands, locating additional flood water sites and subjugating more dry farm land at the higher elevations where the rainfall is sufficient for this type of farming.

AGRICULTURAL CONCENTRATION:

The agricultural concentrations within this Unit are divided into eight groups:

1. Crystal Area
2. Sawmill Area
3. Red Lake Area
4. Black Creek Valley
5. Oak Springs Area
6. Pine Springs Area
7. Puerco Valley
8. Danoffville

Crystal Area:

The principal farming in this area is supplied with irrigation water. Two diversion dams have been built, the lower dam being privately owned by Chee Dodge. No storage is possible under the present system and the farmers depend upon the flow of Crystal Creek to produce their crops.

Most of the owners in this area are very progressive and are doing a better type of farming than the average found within the Unit.

The principal work needed on the land in this area is to lay out a system of irrigation ditches so that water will not be lost in the long winding ditches as they are now. Head erosion needs control and contour farming needs to be encouraged.

Sawmill Area:

The farming in this area is practically all flood irrigation. The farms are located along the drainages south of the Sawmill and in Blue Canyon. Work is needed on many of these farms to stop the head cutting and spread the water more uniformly over the land. Corn and oats are the two principal crops grown in this region.

Red Lake Area:

Most of the farms in this area are supplied with irrigation water which is the only thing that makes farming possible in this area due to the heavy soil.

Water is supplied from the large storage of Red Lake. The soil is the principal draw back in this area, most of it being a heavy clay to clay loam. Water is sufficient for approximately 700 acres of expansion, if suitable land is located.

The principal work needed on the farms in this area is to protect them from excessive flood water and check the head erosion. Furrow irrigation and fall plowing should be encouraged.

#### Black Creek Valley:

In this area all three types of farming are found, but flood irrigation is the principal type. Farms are found all along the valley in the drainages, usually where a gully fans. The principal work needed is to spread the water more uniformly to prevent the gully fans from cutting through, and to check the head erosion. The main recommendation on the dry farms on this area is to contour list.

Approximately 60 acres of irrigated land is found near Fort Defiance but no work is suggested here because the major part of the area is owned by the Indian Agency and Good Shepherd Mission.

#### Oak Springs:

This is a comparatively small area. Most of the farms are flood irrigated. A diversion dam and storage reservoir has been built to supply irrigation water but it has not been used. A few ditches are necessary to put this system into operation. A very large portion of the land in this vicinity was idle this year and there is plenty of land to use the available water.

#### Pine Springs:

This area is rather small due to the Unit boundary running through Pine Springs. The farming in this area is mostly flood irrigated and the same work is needed as that listed for the other flood irrigated areas.

#### Puerco Valley:

Flood irrigation is the principal type of farming found in this area. The farms are usually selected on gully fans or where a shallow gully overtops. The principal work needed is to spread the water more evenly and to check the small gullies which are forming. It would be possible to subjugate additional land near many of the farms in this area.

#### Danoffville:

The farming in this section is composed of both flood irrigation and dry farming. On the flood irrigated farms gully control and a more uniform distribution of water are the principal things needed.

Some of the dry farms in this section, having been broken out by white farmers using large equipment, are larger than the usual Navajo farm and present a different problem. Fields of 50 to 200 acres are very common. Negotiations have been under way for the purchase of this land by the resettlement administration and as a result many farms have been left idle. This has increased the erosion on the slopes and work is needed to check this damage. Contour terracing and contour listing are the principal control measures recommended.

AGRICULTURAL PLANTS USED:

The crops grown this year within this Unit are shown in the following table:

Crop	Acres	Percentage
Corn	2696	31.11 %
Idle Land	2617	30.19 %
Meadow Grass	1240	14.30 %
Beans	875	10.10 %
Oats	766	8.85 %
Alfalfa	276	3.18 %
Squash	65	.75 %
Clover	47	.54 %
Wheat	47	.54 %
Potatoes	16	.18 %
Cane	10	.11 %
Vegetables	10	.11 %
Melons	3	.04 %
TOTAL	8668	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 districts studied and the figures should by no means be taken as definite.

Crop	Present Average Production	Expected Average Production
Corn	18 bu. per acre	22 bu. per acre
Wheat	15 " " "	20 " " "
Cane	20 " " "	25 " " "
Beans	250 lbs. " "	400 lbs. " "
Potatoes	4000 " " "	7000 " " "
Squash and Melons	4000 " " "	5000 " " "
Oats	1 ton " " (cut for hay)	2 tons " "
Meadow Grass	1 " " "	2 " " "
Alfalfa	2 " " "	3 $\frac{1}{2}$ " " "
Clover	1 $\frac{1}{2}$ " " "	2 $\frac{1}{2}$ " " "

The increased production can be accomplished by the following:

1. Proper seed selection.
2. Proper seed bed preparation and cultivation practices.
3. The introduction and use of ordinary farm machinery.
4. Crop rotation and strip cropping where wind erosion is serious.
5. Fall plowing to reduce the damage being done by cutworms.
6. More efficient use of the available water.

#### SUGGESTED CROPS:

Crops which could be produced within this Unit are corn, alfalfa, wheat, oats, barley, clover, meadow grass, melons, squash, beans, potatoes, peaches, and vegetables.

All of these crops are not suitable for the whole Unit due to the higher elevation in some places and soil conditions in other places.

Suggested crops for each farm can be found in the Agronomy Survey notes.

#### COST OF DEVELOPMENT:

The total cost of agricultural development, involving leveling, furrowing, bordering, terracing, or uniformly spreading water as the case may be on the present farm land is approximately \$68736.00. The cost on the potential land is approximately \$44,785.00. These costs do not include diversions or ditches.

This is further broken down as follows:

Type of Land	Acres of Present Land to be Treated	Acres of Potential Land to be treated	Average Cost	Cost on Present land	Cost on Potential Land	Total Cos of Presen and Poten tial Land
Irrigated	266	69	\$30.46	\$ 8,625.00	\$ 1,580.00	\$ 10,205.00
Flood Irrigated	2610	2834	16.67	51,655.00	39,109.00	90,764.00
Dry Farm	310	222	23.59	8,456.00	4,096.00	12,552.00
<b>TOTALS</b>	<b>3186</b>	<b>3125</b>	<b>\$17.98</b>	<b>\$68,736.00</b>	<b>\$44,785.00</b>	<b>\$113,521.00</b>

Estimated costs on each tract can be obtained from the Agronomy Survey notes.

The following table was used as a guide in making the above cost estimate:

TABLE FOR CALCULATING COST OF SUBJUGATION

Slope	Leveling Only	Leveling and Bordering	
		Flood	Irrigated
Less than 1 %	\$ 0 to 6	\$ 8 to 12	\$ 8 to 10
1 %	6 to 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

TABLE SHOWING THE POPULATION, ACRES (PRESENT AND POTENTIAL), AND PERCENTAGES OF THE DIFFERENT CROPS GROWN IN THE EIGHT DIVISIONS OF THE UNIT AS DIVIDED BY THE SOCIAL ECONOMIC DIVISION.

Division	Pop- ulation	Con- sump- tion Groups	Acreage and % of Total		% Corn	% Oats	% Idle	% Alfalfa	% Meadow Grass	% Beans	% Squash	% Melons	% Clover	% Vege- tables	% Cane	% Wheat	% Pota- toes
			Present	Potential													
Crystal			1370	3720	128	245	59	98	784	4	12	0	1	3	0	31	5
			15.84	43.41	9.34	17.88	4.3	7.15	15.23	.3	.9	0	.07	.2	0	2.3	.4
Sawmill			782	647	253	189	127	10	168	3	10	0	8	1	0	6	7
			9.02	7.55	32.35	24.17	16.24	1.28	21.48	.38	1.28	0	1.02	.13	0	.78	.89
Red Lake			279	78	50	68	37	81	4	0	1	0	36	0	0	0	2
			3.21	.91	17.92	24.38	13.26	29.03	1.43	0	.36	0	12.90	0	0	0	.72
Black Creek Valley			1602	1405	752	22	599	34	156	21	9	0	2	6	0	0	2
			18.48	16.39	46.93	1.37	37.38	2.12	9.73	1.30	.56	0	.12	.37	0	0	.12
Oak Springs			376	303	55	13	286	6	15	0	1	0	0	0	0	0	0
			4.33	3.54	14.82	3.45	76.06	1.60	4.00	0	.27	0	0	0	0	0	0
Pine Springs			428	82	150	125	116	4	28	3	2	0	0	0	0	0	0
			4.93	.96	35.05	29.21	27.10	.93	6.54	.70	.47	0	0	0	0	0	0
Puerco Valley			1975	2043	996	44	736	43	86	45	24	1	0	0	0	0	0
			22.78	23.84	50.43	2.33	37.27	2.18	4.35	2.28	1.21	.05					
Danoff-ville			1856	292	312	60	657	0	0	799	6	2	0	0	10	10	0
			21.48	3.41	16.81	3.23	35.40	0	0	43.05	.32	.11	0	0	.54	.54	0
TOTALS			8668	8570	2696	766	2617	276	1240	875	65	3	47	10	10	47	16
			100.00	100.00	31.11	8.85	30.19	3.18	14.30	10.10	.75	.04	.54	.11	.11	.54	.18

WR 6146

SUMMARY:

1. Unit #18 is located in the southeastern part of the Navajo Reservation.
2. The topography varies from plateau to rough broken hills.
3. The rainfall averages 13.5 inches.
4. The average growing season is 114 days.
5. The soil on the farm land varies from a fine sand to heavy clay.
6. .93 % of the Unit acreage is being farmed. This can be increased to about 1.84 %.
7. There are 2.8 acres per capita now being farmed.
8. The principal agricultural concentrations are found at Crystal, Sawmill, Red Lake, Black Creek Valley, along the railroad and along the Zuni Road.
9. Corn is the principal crop grown, representing approximately 31 % of the cultivated land.
10. The acreage of the present agricultural land is 8,668 acres.
11. The acreage of potential land located is 8,570 acres.
12. The total cost of subjugation is \$113,521.00, divided as follows:  
    \$68,736.00 on present land.  
    44,785.00 on potential land.
13. A larger variety of crops should be grown.
14. Crop yields can be increased by:
  - (1) more efficient utilization of water
  - (2) proper seed selection
  - (3) proper tillage practices
15. Erosion control is needed on most of the flood irrigated farms.

Attached is a legend of land classification and definition of terms used in the Agronomy Survey sheets.

Approved:

Submitted:

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J. O. Woods  
Chief Agronomist

*H. M. Ivory*  
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Agricultural Aide

WR 6147

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 loam over light clay.  
li-c

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.

WR 6148

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 within Unit.

Treatment

Recommended soil and water conservation practices, such as borders, dikes, terraces, and furrows. (Details of recommended treatment will be found in the Engineers notes on each farm.)

Cost per Acre

Estimated cost per acre for doing recommended work for each tract. (Estimated by Engineer and Agronomist)

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.

WR 6149

LEGEND USED IN LAND CLASSIFICATION

FLOOD IRRIGATION

Grade of Agricultural Land

- 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. (Note all areas where watershed area is large in proportion to cultivated area, for engineering survey.)
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.

WR 6150

IRRIGATED LAND

Existing Projects

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.

WR 6151

DRY FARMING

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.

WH 6152

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

Proposed 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 levelling 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 levelling is permissible.

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.

WR 6153

POTENTIAL LAND

Grades A and B

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

Grade C

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 exceed 2%.

WR 6154