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PART ONE - BASIC DATA

I. LAND MANAGEMENT UNIT NO. I

A. INTRODUCTION

The Land Management Survey field work on L.M.U. No. I was started April 1, 1937 and completed May 20, 1937. A brief review of the area was made August 1st to 7th, 1937.

The personnel of the party included:

Sec. of Agronomy, H. M. Ivory,
Agricultural Aide
Sec. of Biology, R. S. Neilson,
Agricultural Aide, Ass't. Chief of Party.

Sec. of Conservation Surveys, R. H. Kerr,
Jr. Soils Technologist
Sec. of Forestry, R. S. Richardson,
Jr. Forester
Sec. of Human Surveys, J. N. Hadley,
Ass't. Soil Conservationist
Sec. of Range Management, D. G. Anderson,
Jr. Range Examiner,
Chief of Party

B. GEOGRAPHICAL FEATURES

1. Description

a. Location

Land Management Unit No. I is located in the northwestern part of the Reservation and comprises the northwestern part of the Western Navajo Jurisdiction. The Unit lies in Coconino County, Arizona, roughly between 110°45' and 111°30' west longitude and 36°15' and 37°00' north latitude. Only about

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9,000 acres in the east portion of the Unit lie in Navajo County. Kaibito, Arizona, the Unit headquarters, is located approximately in the geographic center of the Unit. The area within the Unit lying south of the 36°45' parallel of latitude and east of the 111° 00' meridian of longitude was made Reservation by an Executive Order December 16, 1882. The area west of Kaibito and south of Navajo Canyon became part of the Reservation by an Executive Order May 17, 1884. The remainder of the Unit became Reservation January 8, 1900.

b. Area and Boundaries

The area of the Unit, compiled from Range Management Extensive Grazing Survey and including approved boundary changes, is 1,035,540 acres.

Boundaries of the Unit are as follows:

Beginning on the Colorado River at Lee's Ferry, the Unit is bounded on the west by Echo Cliffs to the Gap Trading Post; on the south by the north boundary of L.M.U. No. 3 along Crooked Ridge, Red Mesa, Little White Mesa, and Blue Canyon; on the east and north by the west boundaries of L.M.Units 4 and 2, along Black Mesa and White Mesa to Navajo Canyon, and on the north by the south rim of Navajo Canyon and the Colorado River.

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The boundaries of the Unit for the most part are along outstanding topographical features and are easily followed. Exceptions of this occur in two places, between Black Mesa and White Mesa. In these two places the most outstanding topographic features (lakes, springs, rocks, etc.) were used in connection with economic lines used by the Indians themselves.

Boundary Changes

Two boundary changes, both effective, were involved in this Unit. The first excluded the area west of Echo Cliffs and south of Crooked Ridge from the Unit. This area of 485,000 surface acres with 40,000 forage acres and a carrying capacity of 16,000 sheep units yearlong was added to L.M.U. No. 3. This change was proposed for reasons of usage, topography, and administration.

The second boundary change added to LM.U. No. I, 256,000 surface acres with 18,000 forage acres and a carrying capacity of 7,200 sheep units yearlong. This change comprised the area around Red Lake, Cow Springs and Black Mesa and was originally in L.M.U. No. 3. Reasons for making the change were primarily usage and ease of administration from Kaibito rather than Tuba City.

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c. Land Status

All the land lying within the Unit is tribal land with the exception of approximately 185 acres included in mining claims in Coppermine Area. These mining claims were excluded from Reservation land by Executive Order of May 17, 1884.

2. Physiography

a. Elevation, Topography, Drainage and Run-off

The following approximate elevations have been taken from the U.S.G.S. topographical maps edited in 1891 and 1892:

Average elevation -	6,000
Black Mesa - - -	7,000
White Mesa - - -	6,800
Preston Mesa - -	6,500
Coppermine - - -	5,800
Kaibito - - -	5,400
Lee's Ferry - -	3,142

The principal topographical features of the Unit are as follows: Echo Cliffs and Mormon Ridge in the west; Navajo Canyon and Glen Canyon of the Colorado River in the north; White Mesa and the head of Navajo Canyon in the east; Black Mesa, Blue Canyon and Wild Cat Peak in the south.

The topography is characterized by a broad, gently sloping, sandy plateau, broken by high mesas and deep canyons.

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Very little runoff can be expected on about five-eighths of the Unit, as the soil is light-textured and highly permeable. In this area gullies originate on the steep slopes of the mesa and fan as they reach the valleys. Estimates of annual runoff expectancy indicate that there is sufficient water for present flood irrigated farms that are found on the alluvial gully fans. These estimates, however, are misleading as the dry season of the year coincides with the growing season. Winter runoff will not be retained in the soil long enough to be of any great benefit for crop production.

About one-third of the Unit drains into the Colorado River through Navajo Canyon and Kaibito Canyon. These canyons vary from 400 feet to 1,000 feet in depth, with steep, rock sides, and no use can be made of the floodwaters for agricultural purposes. The central and eastern part of the Unit is drained by Blue Canyon and its tributaries. In this part of the Unit agronomic use can be made of floodwater. A relatively high runoff is found here as the drainages head on large areas of exposed rock and on the steep talus slopes.

The annual expectancy of runoff has been estimated at all important locations on the Unit.

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These figures are found in the discussion of the projects and in the following table.

Table I.* ANNUAL RUN-OFF EXPECTANCIES AT AGRICULTURAL AREAS

	WATER SUPPLY			FARM LAND		AMT. OF LAND AVAILABLE	
	Ann. Exp'cy A/Ft.	Max. Exp'cy Sec.Ft.	Max. Exp'cy A/Ft.	Present	Potential	Irri.	Fld. Irri.
Present Supply at Cow Spgs. Lake	100		400	20	40	60	
Additional by Diversion of 4.5 into Cow Spgs. Lake	250	2,500	600		100	100	
Complete Cow Spgs. Project	350		1,000	20	140	160	
Farm 1.Q94 Red Lake	400	3,000	700	120			120
Equalizing Reservoir Proposed above Cow Spgs. 4.0	600	1,500	400	30	120	150	
Wash 4.0 at EC.1 Quad. 94		300		75	10		

The entire area lies in the Colorado or Little Colorado River drainage and is a silt contributor to Meade Lake.

*Ann. - annual
Exp'cy - expectancy
A - acre
Max. - maximum
Sec. - second
Irri. - irrigated
Fld. - flood

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b. Geology

Practically all of this district is included in the Kaibito Plateau physiographic sub-province. The geologic formations include the Navajo sandstone, Carmel, Entrada and Morrison formations of the Jurassic Age, and the Dakota, Mancos and Mesa Verde formations of the Cretaceous Age. The dominant formation is the Navajo sandstone, which covers as much territory as all the other formations in the Unit.

1. Jurassic Formations

"The Navajo sandstone has its western margin in the Echo Cliffs monocline and the contact follows the cliffs as far north as it could be traced in this Unit. It extends northward from Tuba City to Navajo Canyon without interruption except where it is capped by the Carmel formation. The Navajo sandstone thickens rapidly to the north where it reaches a thickness of about 1,100 feet in Navajo Canyon. The Carmel formation comprises thin, dark red beds of sandstone and shale which caps many of the mesas in the northern part of the Unit. It is also exposed in the canyons near White Mesa and in the canyons to the north. It apparently dies out at a short distance

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south of White Mesa. The Entrado is a red to pink sandstone with conspicuous zones of of color. The Morrison formation in this unit is confined to White Mesa and a low rim along the outer margin of Black Mesa. The contact with the underlying Entrada formation is gradational and a sharp line cannot be seen between the two. The contact with the overlying Dakota is an erosional unconformative and easily distinguished.

2. Cretaceous Formations

"The Dakota in this district is confined to a narrow band along the foot of Black Mou tain and a cap about 30 feet thick on the top of White Mesa. It is composed of brown to buff sandstone with clay shale and a few thin coal seams near the base. The Mancos shale is a dark, bluish gray marine shale, which forms the long slopes at the foot of Black Mountain, and appears in Blue Canyon where it is dropped to the bottom of the canyon by the Blue Canyon monocline. It is dominantly shale, but has a few very thin platey sandstones. The Mesa Verde is confined to the rim of the top of Black Mountain. It is composed of buff or gray sandstones inter-bedded with clay shales. The Mesa Verde in some localities has been spread

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into three divisions, but no separation has been made in this Unit. The middle and lower members contain coal in most places, but none was found in this Unit.

3. Structure

"There are two main structural features that are important in this Unit: the Echo Cliffs monocline and the Blue Canyon monoclines. The Echo Cliffs monocline lies to the west of the Unit and extends from Moenave northward. The Blue Canyon monocline extends northward from Blue Canyon and appears near Red Lake and White Mesa. The entire Kaibito Plateau is traversed by numerous small faults, most of which have less than 25 feet throw. Only three of the main faults were mapped, but they play a very important part in the future development of water in the northern and western parts of the Unit."

The above information was obtained from "Geology of Unit One", by Mr. Tom Meeks, Junior Geologist.

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c. Erosion

Strong southwest winds, low annual rainfall, and light soils are responsible for the predominance of wind erosion on this Unit. Wind erosion is most severe over light-textured soils of the Kayenta and Todilto soils. Partially stabilized sand dunes ranging in depth from 36" to several feet are common west of Kaibito. Small, active sand dunes are sparsely distributed throughout the Unit, but are more frequent in the southern and southeastern portions. Extensive areas of barren sandstone dissected by deep canyons, are common to the northern portions of the Unit. A shallow, severely windblown, intermittent soil cover, spotted with accumulations of active dune sand, occupies the northwestern portion of the Unit. Sheet and gully erosion prevail on the steep slopes of Black Mountain and White Mesa. The extreme southeastern portion of Black Mountain, because of severe sheet erosion and steep slopes, consists of almost barren geologic material with intermittent, shallow soil cover.

d. Soils

Residual soils occupy the greater portion of the area and constitute the better classes of grazing land. The Floy, Todiltok Buell, and Kaibito Series are the most

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important of the residual series maps. Of the eight series of allucial soils maps, a portion of the Ives, Oraibi, Dennehotso and Concho Series are the only ones cultivated. Only seven-tenths of one per cent of the area is agricultural soils.

1. Range Soils

A large portion of Sub-Unit I is occupied by the Moenkopi sandy loam, a severely wind-blown soil, with a low waterholding capacity and a low forage value. The Floy sandy loam and the Floy loamy sand, occurring in the southern portions of Sub-Unit I and occupying nearly all of Sub-Unit II is highly permeable but has a relatively low waterholding capacity. Low annual precipitation and a high rate of evaporation are prime factors contributing to a low moisture content in these soils. The Floy sandy loam is a good range soil.

The severely wind-blown Kayenta loamy sand in Sub-Unit III readily absorbs all moisture that falls upon it, but its moisture-holding capacity is low.

The Buell loamy sand and sandy loam of Sub-Unit iV are of the better class of range soils. They have a high moisture penetration factor and moderate waterholding capacity.

Sub-Unit V contains a variety of soils. The Floy sandy loam on Black Mountain is a good range soil. The Bonito and Kayenta soils on the lower

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alluvial slopes of Black Mountain are of the better type of range soils. A large portion of Sub-Unit V is occupied by the Todilto loamy sand, a severely windblown soil with resultant low forage value.

The range soils of Unit I are typically loose, coarse-textured, highly permeable, and have a moderately high waterholding capacity. Their susceptibility to wind erosion, however, reduces their productive value. Insofar as low annual rainfall will permit, these soils will readily respond to a range management program. Recovery of a normal soil and vegetative cover will naturally be slow on the severely wind-modified areas.

2. Agricultural Soils

The Ives clay loam as mapped on this Unit has a friable surface over a medium-to-heavy-textured subsoil, except in the extremely heavy and compact subsoils. This type is well adapted to agriculture under approved irrigation practices. The water supply is the only limiting factor in the subjugation of this soil.

The Dinnehotso Series is one of the most important agricultural series in this Unit. It embraces a large portion of the present cultivated land. The surface soil ranges from friable to moderately compact. The subsoil is moderately compact and highly

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calcareous. Ordinarily this series has a low alkali content. Local areas are sometimes highly dispersed and have a high alkali content. These areas should be avoided. The series in general has a moderately high waterholding capacity. Where the subdrainage is adequate this soil is rated as Class B agricultural land. Areas of clay, of alkali concentrations, and of dispersed soil should be avoided in all subjugations.

The Tolani loamy sand is a recent over-wash soil. It is light in texture, has a friable and open surface and subsoil with a low alkali content. However, its light texture makes it susceptible to severe wind erosion, high penetration losses, both of which lower its agricultural value. It is rated as Class C agricultural land.

The Hunt Series commonly has a heavy, compact subsoil, fairly impervious to water. These factors result in poor sub-drainage and high alkali concentrations. However, some types, especially the Hunt sandy loam, have an open surface and subsoil with good waterholding capacity. Hunt sandy loam is rated as B agricultural soil.

The Concho Series is generally fine-textured and slowly permeable. A significant portion of this series is impregnated with alkali and characterized

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by "slick spots" and the presence of alkali-tolerant vegetation. Restricted areas, however, are more suitable to agricultural adaptation. These include Concho sandy loam and clay loam. Alkali concentrations and high clay content are limiting factors in this series. Because of impervious subsoils and high alkali-content Concho soils are usually classed as C or D agricultural land.

The Oraibi loamy sand is another recent overwash soil. It a friable, calcareous surface and a deep, variable-textured subsoil, low in organic matter. It absorbs water rapidly, but the coarse-textured subsoil makes it somewhat droughty. It is adapted to Navajo farming methods and occupies many of the small valleys. The loose, porous nature of this type makes it susceptible to wind and head erosion and thus reduces its agricultural rating to B or C.

3. Alkali

A limited portion of the Unit contains "alkali" or soluble salts in such concentration as to be injurious or prohibitive to plant growth. The fine-textured soil types of the Concho series, in the vicinity of Red Lake, are affected to some extent, by concentrations of alkali. These areas are recognized by "slick spots" and "piping holes", and by

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the presence of alkali-tolerant vegetation. No detailed investigation was made of this area so it is difficult to state how much alkali is present as tolerance of plants to alkali varies so much with conditions. Tolerance is influenced by such conditions as the nature of the salt present, soil type, moisture, etc. Alkali is not a problem when considering the Unit as a whole. The greater portion of the soils are permeable and well drained and distribution of salt through the soil profiles is such that there are no appreciable concentrations of alkali.

Normal precautions should be observed, however, in the selection of vegetative species for any proposed artificial revegetation of the above-mentioned area.

4. Value of Soils for Construction Purposes

The importance of information as to the stability of soils in earth-water retention or water-spreading structures should not be under-estimated. Specific mention of the value of soils for construction purposes may be found in the Branch of Conservation Surveys report.

Soils with medium to moderately light texture, such as sandy loam and clay loam, are very good for

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construction purposes. The loamy sands can be used only if proper precautions, such as lining and putting in cut-off walls, are taken. Soils of high clay content, high alkali concentration, and dispersed physical structure are unsuited for construction purposes and should be used only if extreme precautions are observed.

Detailed soil investigations should be made of proposed structure sites.

E. Climatology

Climatological records were not available for any part of the Unit. However, information was available from weather stations immediately outside the Unit. The stations located at Lee's Ferry, Tuba City, and Kayenta furnish information which can be used for judging the climate in the Unit. The records at Lee's Ferry and Tuba City will be more applicable to the Unit than those of Kayenta. The following tables show graphically, precipitation, temperature, growing season, wind movement and evaporation.

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AVERAGE ANNUAL PRECIPITATION

Location	Period of Records	J	F	M	A	M	J	J	A	S	O	N	D	Avg. ann'l Prec.	Avg. of growing Season	Date last killing frost	Date first killing frost
Kayenta	1915-1930	.63	.43	.64	.42	.36	.38	1.45	1.58	.75	.91	.64	.61	8.80	163	5/13	9/21
Tuba City	1898-1930	.55	.54	.54	.43	.53	.19	.34	.93	.84	.68	.78	.58	6.92	179	5/9	9/19
Lee's Ferry	1916-1930	.34	.60	.44	.59	.26	.16	.76	.96	.59	.64	.42	.44	6.20	229	4/18	10/18

TEMPERATURE RECORDS

Station	Record	Records	J	F	M	A	M	J	J	A	S	O	N	D	Year
Tuba City	Mean	1898-1930	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
"	Absolute Maximum	"	68	73	85	88	99	104	105	108	100	95	88	70	108
"	Absolute Minimum	"	-15	-3	12	14	22	34	40	44	28	18	8	-13	-15
Lee's Ferry	Mean	1931-1935													61.9
"	Absolute Maximum	"													114
"	Absolute Minimum	"													+5
Kayenta	Mean	1931-1935													53.4
"	Absolute Minimum	"													-15

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NN000850

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EVAPORATION IN INCHES
1921 to 1930

Station	J	F	M	A	M	J	J	A	S	O	N	D	Average Annual
Lees Ferry	2.076	3.088	5.773	7.967	11.594	12.773	13.359	11.083	8.917	6.112	2.945	1.928	87.615

WIND MOVEMENT IN MILES
1921 to 1930

Station	J	F	M	A	M	J	J	A	S	O	N	D	Average Annual
Lees Ferry	1,058	1,216	1,975	1,889	1,940	1,737	1,570	1,392	1,267	1,223	1,057	963	17,287

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NN000851

From a study of the preceding tables we find the following:

Average annual precipitation for the Unit ---------- 7"

Average annual precipitation on Black Mountain and White Mesa ---------- 8-1/2"

Average length of growing season ------ 160 to 80 days

The only records on evaporation come from Lee's Ferry where annual evaporation is approximately 80 inches. Prevailing winds are from the southwest.

4. Ecological Zonation

a. Vegetation

(1) Vegetative Zones

Species of vegetation in this area are typical of the Upper Sonoran Zone. A few species of vegetation typical of the Lower Sonoran Zone were found, but in such limited quantities that they are not important. The elevation and precipitation is not great enough for species typical of the Transition Zone.

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(2) Vegetative Species

Grasses

Blue grama	Bouteloua gracilis
Galleta grass	Hilaria jamesii
Spiny Muhley	Muhlenbergia pungens
Three-awn	Aristida spp.
Sand dropseed	Sporobolus cryptandrus
Indian rice	Oryzopsis spp.
Black grama	Bouteloua eriopoda
Saccaton	Sporobolus aeroides

Weeds

Russian thistle	Salsola pestifer
Indian wheat	Plantago spp.
Heath aster	Aster leuceline
Sunflower	Helianthus spp.
Lupine	Lupinus spp.

Shrubs

Black brush	Coleogyne ramosissima
Chamise	Atriplex canescens
Mormon tea	Ephedra spp.
Sand sage	Artemisia filifolia
Snakeweed	Gutierrezia spp.
Yellowbush	Chrysothamnus greenii

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Shrubs (continued)

Rabbit bush ---------- Chrysothamnus biglovii

Winter fat ---------- Eurotia lanata

Cliffrose ---------- Cowenia stansburiana

Trees

Pinon ---------- Pinus edulus

Juniper ---------- Juniperus monosperma

" utahensis

In listing the above species an attempt was made to rank the various species according to abundance and importance.

A table showing graphically the percentage and importance of the various vegetative types found in the area follows.

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(3) Vegetative Types

Table V

VEGETATIVE TYPES

Vegetative Type	Surface Acres	Percent of Area	Forage Acres	Carrying Capacity S. Mo.	Percent of Carrying Capacity
1 - Grassland	249,094	24.05%	38,713	185,822	45.26
4 - Sagebrush	37,789	3.65	3,982	19,114	4.65
5 - Browse	342,911	33.11	22,709	109,003	26.54
7 - Waste	54,700	5.28	0	-	-
8 - Barren	32,213	3.11	0	-	-
9 - Woodland	317,107	30.63	20,149	96,715	23.55
Cultivated*	1,726	.16	0	-	-
TOTAL	1,035.540	100.00%	85,553	410,654	100.00%

Woodland and browse each make up one-third of the area; grassland, one-fourth; waste and barren land, one-twelfth; and cultivated, less than one-eighth of one per cent. Carrying capacity figures show a different relationship. Although grassland comprises only one-fourth of the area,

*Note: The figure obtained here for cultivated area was based on compilation of range type maps and includes all land under fence adjacent to cultivated land. It also includes some area that was cultivated at the time the Extensive Grazing Survey was made of the area, but which is now abandoned land, but may be farmed in future years. The Section of Agronomy reports 803 acres actually cultivated on the area.

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it makes up 45 per cent, or nearly one-half of the carrying capacity. Browse and woodland each comprise about one-third of the area, but each makes up approximately one-fourth of the carrying capacity. This indicates a relatively low carrying capacity for woodland and browse types, and a relatively high average carrying capacity for grassland types. The entire area is in a low rainfall belt and a high carrying capacity range over the entire area could not be expected.

(4) Condition of Vegetation

For the most part, vegetation of the area has been over-used for so many years that a partial to severe depletion has resulted. Remaining palatable plants have lost a great deal of their vitality. Only a relatively small amount of volume growth is forthcoming. A large area north of the Coppermine is the exception. Here, the condition of vegetation is good with, in most cases, adequate cover.

b. Wildlife

Migratory waterfowls are found in this Unit only during the migration period. Only a small number of lakes and reserfoirs are suitable resting grounds for these individuals.

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NN000856

Mourning doves range over the entire Unit. They are quite abundant and are not regarded as game by the Indians. Antelope are found in the western portion of the Unit. This herd, which now numbers approximately 35 or 40 antelope, were practically extinct a few years ago, but through protection have come to increase in numbers. Several sight records were made during the field survey. The range is ideal for this species of game and can support several herds of this size. Mule-deer are not found in the area, probably due to lack of proper vegetation. Mountain sheep once ranged in the rough area along Echo Cliffs, Navajo Canyon, and the Colorado River. None have been reported in this area for some time. There are no fish on the area, and no suitable water for their habitat. Furbearers in the Unit include coyotes, bobcats, foxes, and badgers. Traders have reported purchasing 60 or 70 pelts of the various furbearers during the past season.

Bird life, in general, is not abundant. Any practice tending to increase the amount of natural vegetation, any increase in water supply, any increase in farming lands, in short, any conservation program will tend to improve the small bird habitat and will result in a larger bird population. Forty-seven species, and 797 individuals of birds were seen during the survey.

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Rodents in the area include prairie dogs, kangaroo rats, miscellaneous mice and ground squirrels. Prairie dogs are used as food in many cases. The remainder of the rodents are of little value.

5. Developmental Improvements

a. Population and Population Centers

1,167 Indians reside within L.M.U. No. I. 156 consumption groups were visited during the survey, with an average size of 7 persons per consumption group. Information as to individual sex, clans, age, etc. is available through Section of Human Surveys. Population centers in the Unit are of two natures: first, yearlong concentration at Kaibito and the area between Red Lake and Cow Springs; second, seasonal concentration of population around Antelope Reservoir and Kle Chee, dependent more or less upon water supply. A large number of people live in the area around the Coppermine and south toward the Gap, but are rather evenly scattered over the area and are not considered to be concentrated. Concentration of population around Red Lake, Cow Springs and Kaibito, is primarily because of farmland and available permanent water supplies.

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b. Accessibility

Roads and Trails

One main bladed road crosses the southern part of the area. This road is maintained yearlong. A bladed road from Red Lake through Kaibito to Inscription House, and roads from the Gap to Kaibito and the Coppermine comprise the principal roads of the area. Numerous wagon roads radiate from the principal roads making most of the area accessible to cars. Car travel in the area is difficult during dry season because of sand. Trails on White Mesa, Black Mountain and in Navajo Canyon make the entire area accessible to livestock.

Telephones

The Tuba City-Kayenta telephone line crosses the south-central part of the Unit. Branch lines extend from this line to Kaibito and Inscription House. Telephones are locates at Red Lake, Cow Springs, and Kaibito. For the present, telephone connections are adequate throughout the Unit.

Schools, Hospitals and Trading Posts

The only school facilities within the Unit are at Kaibito - the Kaibito Day School. Medical care for the Unit is carried out by the Field Staff of the Tuba City Indian Service Hospital.

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There are four trading posts located within the Unit: Red Lake, Kaibito, Coppermine and Cow Springs. Immediately outside the Unit, trading posts which affect the people are the Gap, Tuba City, Inscription House, Shonto, Cedar Ridge and Lowery's Lodge.

C. EFFECT OF ENVIRONMENT ON HUMAN ACTIVITIES

Because of the remote location of L.M.U. I, the Indians have had little contact with white men. Their herds of sheep have remained rather well isolated and as a consequence, several herds of the original Navajo type of sheep are to be found. In this connection, when selecting sheep for the breeding experiments at the Navajo Breeding Experiment Station located at Ft. Wingate, New Mexico, sheep from flocks grazed in this area and near Navajo Mountain were chosen as base stock because of the little influence of improved sires. A few of the more progressive Indians have realized the superiority of white men's livestock and have improved their herds accordingly. These individuals, however, are relatively few throughout the Unit.

Because of the lack of floodwater in a large part of the area, with the consequent hazard to crop production, little farming has been carried out. The inhabitants have had to be dependent on livestock production for a livelihood. There has been built up anumber oflarge herds of sheep and cattle. In

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this area, there are probably more large herds than in any other district on the Reservation. Wood, and wood products over a large portion of the area, are available and are widely used. Only in localized areas are forage plant species, such as chamise, sage brush and greasewood, which are used for fire wood. The area is relatively distant from improved roads and as a consequence, few automobiles and trucks are owned by the Indians.

Educational facilities have been rather mediocre for the area. Prior to the construction of the day schools the only educational facilities for the area were at Tuba City. Education has not progressed rapidly and white men's ways have not materially entered the Unit. Medical care for the Unit has been carried out by the Field Staff of the Tuba City hospital and it has been only in recent times, that the Indians have come to depend upon this agency for their medical care. Medicine men play an important part in their medical care. Trading posts are rather distant in this Unit and inhabitants do their trading at long intervals. This is especially noted when moving to winter range in the fall. Large amounts of supplies are purchased at this time. From the above facts, it will be noted that this Unit is not as progressive as other areas on the Reservation.

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NN000861

D. HUMAN ACTIVITY

1. Livestock Resources

a. Present Resources

At present, the principal values of the land are as range or watershed. Inasmuch as very little runoff can be expected from a large portion of the area because of the soil, range usage becomes the most important item for consideration. Of the 1,035,540 acres in this Unit, approximately one-eighth is waste or barren land. The remainder is used as range land, including the forest areas, which have a dual purpose.

(1) Carrying Capacity

From the Extensive Grazing Survey of this area in 1935, there are 85,553 forage acres with a carrying capacity of 34,221 sheep units yearlong, or 410,654 sheep months. The carrying capacity was computed using 2-1/2 forage acres requirement per sheep unit yearlong, except in the Buck Pasture where a forage acre requirement of 3 forage acre per sheep unit yearlong, was used.

(2) Seasonal Use and Class of Stock

The area is such that with the development of more water it can be used yearlong. The

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vegetation is such that either cattle or sheep is the predominant class of stock.

(3) Water Developments

Water developments in this Unit are the most important problem facing range management plans. During the survey 125 water supplies and developments were located, classified as follows:

20 - Permanent developed springs
9 - Permanent undeveloped springs
6 - Temporary undeveloped springs
6 - Temporary shallow wells
20 - Permanent shallow wells
3 - Permanent reservoirs
19 - Temporary reservoirs
32 - Reservoirs that are dry practically all the time and cannot be counted on to furnish any livestock water.
4 - Drilled wells
1 - Drilled well (water supply gone dry)
2 - Shallow wells with windmills
2 - Permanent or nearly permanent streams

125 - Total

Total permanent supplies - 61
Total temporary " - 31
Total undependable " - 33

On this classification there is some kind of water supply or development on an average of every 8,284 acres, a dependable supply, temporary or permanent on an average of every 11,256 acres, and a permanent supply on an average of every 16,976 acres.

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To apply an average figure for area in which water supplies are found in this Unit is very misleading. Whereas the developments as shown on the Vegetative Type map are rather uniformly scattered over the area, nearly all the permanent water is located in the central portion of the Unit (around Kaibito, Red Lake and Cow Springs). A very large area in the western portion of the Unit around the Coppermine and Kle Chee is practically without water of any kind. Antelope reservoir and a few temporary wells in sandstone pockets furnish all the water available. To look at the distribution of developments on a map is misleading, for it is in this area that so many charco type of reservoirs were constructed, nearly all of which have never caught water and which are located in sandy drainages where runoff is only slight in the heaviest of rainstorms. The area north of Kaibito around Tse Shizzie is similar in that water is only of a temporary nature and not adequate to care for the needs of the livestock. An area on Black Mesa is likewise characterized by inadequate water.

In order to correct the condition of water in this Unit, three drilled wells, ten reservoirs,

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and detailed geological surveys on the Tse Skizzie and Coppermine areas are proposed. Geological approval has been obtained on two drilled well locations and if water water is obtained on two drilled well locations, further detailed study might reveal other possible locations. If the wells prove to be dry, detailed study on rock slopes for the purpose of selecting masonry or cement dam sites will be necessary.

b. Utilization of Range Resources

(1) Present Stocking

Table VI. Grown Livestock Converted to Sheep Units from 1936 Dipping Records.

(Recompiled from Mr. C. Maddox' records according to boundary changes.)
Number of owners listed - 273 Number of bands dipped - 154

Class of Stock	No. of Head	No. of Units	Per cent of Units	Per cent of Units Per Class to Total Units Run
Ewes	26,223	26,223	54.85	
Wethers	3,973	3,973	8.31	
Bucks	416	416	.87	
Grown Sheep	30,612	30,612		Sheep - 64 %
Nannies	4,000	4,000	8.37	
Billies	142	142	.30	
Wethers	145	145	.30	
Grown Goats	4,287	4,287		Goats - 9 %
Cows	977	3,908	8.17	
Bulls	71	284	.59	
Steers	96	384	.81	
Grown Cattle	1,144	4,576		Cattle - 10 %
Mares	617	3,085	6.45	
Stallions	63	315	.66	
Geldings	723	3,615	7.56	
Mules and Burros	264	1,320	2.76	
Grown Horses	1,667	8,335		Horses - 17 %
Total	27,710	47,810	100 %	100 %

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b (1) continued

1936 Increase	No. of Head	Per cent Crop based on Grown Stock per Class
Lambs	13,024	43%
Kids	2,201	51%
Calves	468	41%
Colts	227	14%

Total grown sheep units run in 1936 ---- 47,810
Carrying Capacity ---------- 34,221
Number of sheep units overstocked ------ 13,589
Per cent overstocked ---------- 39.7 %
Base Preference number ---------- 125

The figures derived from the 1936 dipping records are not accurate. Because of the large boundaries which were made, the figures had to be recompiled from the original dipping vat records. Numerous original records did not show the actual range of the livestock. For this reason a large number of errors crept in. During the survey livestock numbers were checked. 1,140 horses and 1,960 cattle, beside 38,500 sheep were noted during the survey. This figure is low in horses and cattle. An estimate of 2,500 horses and 2,000 cattle is closer to the actual population. Because of the inaccuracy of both of these records the figures on livestock population will have to be corrected by the 1937 dipping count. In order to obtain accurate information for cattle and horse population, it will be necessary to conduct a roundup. Until more accurate information is obtained on livestock numbers, it will be difficult

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to formulate range management plans.

According to the 1936 dipping records, the area is 40% overstocked. Adjustment will be necessary in order to bring livestock numbers down to carrying capacity. The following table shows the distribution of livestock according to size of herds.

Table VII.

Size of Herd	Consumption Group No.	Consumption Group Per cent	Total Livestock Sheep Units	Total Livestock Per cent
0	7	5%	0	
1-50	17	12%	497	1%
51-100	17	12%	1,292	3%
101-150	25	17%	3,055	7%
151-200	13	9%	2,276	5%
201-250	8	5%	1,817	4%
251-300	8	5%	2,189	5%
301-350	9	6%	2,987	7%
351-400	6	4%	2,273	5%
401-500	11	8%	4,781	11%
501-600	2	1%	1,068	2%
601 & over	20	14%	22,793	51%
	143		45,028	

14% of the consumption groups own more than 50% of the livestock, and in the smaller bands, 17% of the people own

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only 1% of the livestock. 15% of the owners and 53% of the stock fall into herds larger than 500 head.

(2) Distribution and Livestock Movements

Distribution of livestock is of a seasonal nature in this area. In the central portion of this Unit where permanent water is available concentration of livestock exists during the summer months. This area has been overgrazed for so many years that serious depletion of range resources has resulted. In the western part of the area, water is available only during wet seasons and during snow storms. Livestock are rather evenly distributed over this area at that time. Water development as proposed during the survey will do much to correct the condition of concentration of livestock. Farming areas at Red Lake, Cow Springs, and Kaibito are another influencing factor in the concentration of livestock.

Livestock in this area exhibit extremely long seasonal shifts. The long shift between summer and winter range is made twice a year.

(3) Animal Husbandry Practices

(a) Selection

Selection in the breeding herds is not far advanced. A few of the larger owners have practiced selection in the breeding herds and consequently, have rather uniform individuals of good

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market type and quality. The selection in the smaller herds has been retrogressive. The keeping of scrub individuals in the breeding herd has built up a herd of culls. Traders, in some degree, are responsible for this practice because they will not buy smaller-sized lambs. At the same time, they do not offer a premium for larger lambs and individuals of good market type and quality. During a livestock adjustment program much could be done in culling out undesirable individuals.

(b) Bucks and Bulls

According to the 1936 dipping records, 416 bucks were listed in this Unit. This number is small for the number of ewes in the Unit. The larger owners have purchased bucks of good market type and quality, and in many cases, take special care of their herd. The smaller owners disregard special care for their bucks, and as a rule, have inferior individuals.

(c) Breeding and Lambing

Climatic conditions in the area are such that breeding season should come from November 20 to January 5. In doing this, lambing season will start April 20.

At present lambing season occurs the entire year even though aprons are used on the bucks. Many lambs

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are dropped during bad weather conditions. This not only stunts the growth of the lambs, but also results in high death loss of both lambs and mother ewes.

(d) Docking and Castrating

Lambs over the area are docked too long giving a shaggy appearance to the lamb at time of sale. Ram lambs are as a rule, let go to too old an age before castration.

(e) Shearing

Shearing occurs from a month to six weeks too early in this area. It is a common practice to pick sandy places in which to shear. The wool is buried in the damp sand in order to absorb as much moisture as possible. This is not only detrimental to the individual, but also to Navajo wool as a whole. Buyers of Navajo wool become aware of such practices and will not pay as much for the wool as they would if it were clean and unadulterated. Hand shearing is prevalent over the entire area. Fleeces are not sorted or tied. There is no incentive given by the traders for tied and sorted wool.

Much slipping of the wool, which is thought to be shedding, is caused merely by lambing in bad weather.

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(f) Herding

Herding methods over the area are, as a whole, poor. Close herding and corralling in the same pens over extended periods of time has resulted in severe range depletion. Trailing to and from water and herding from the rear instead of the front of the herd are a very prevalent practice. Even though some of the larger owners practice good actual herding each day, they hold a herd on a given area over too long a period of time and range depletion results.

(g) Salting

Salting, for the most part, in the smaller herds is done on salt bush. The larger owners purchase some salt. The requirements of the area would be approximately from 75 to 100 tons of salt per year. The traders report selling approximately 10 tons of salt per year. Only a few salt troughs were seen on the area. Depletion of the scanty amount of salt bush species has resulted from the practice of not furnishing salt.

(h) Supplemental Feeding

Because of the limited agricultural land on the area, nearly all supplemental feed that is now consumed is imported. Several owners feed hay and grain to their horses. There is only a limited amount of potential

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agricultural land. Because of the above facts, supplemental feed will never be of extreme importance in this area.

(4) Livestock Pests and Diseases

Livestock pests and diseases in this Unit offer only a minor problem. Scabies and lice are effectively controlled by dipping. Scabies have not been reported in this area for three years. Re-infection of the herd with lice by using old bedding grounds and bedding in the same corral for long periods of time can be corrected by proper herding methods.

Grub-in-the-head is present, but not in large quantities and causes only slight damage.

Screw-worms are not reported.

(5) Range Rodents

Rodents over the entire area are quite abundant and in large areas are causing enough damage to warrant control methods. The areas have been delimited and a series of projects recommended for rodent control bearing in mind concentration, value of range lands affected and damage done by rodents.

Kangaroo rats are the most widespread and perhaps the most abundant rodent throughout the area and are found in practically faunal type in the area. In only two areas is the kangaroo rat population large enough to warrant control.

Prairie dogs are very abundant in the following locations: the Gap of Coppermine roads, the Gap of Keibito road,

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the plateau east and north of Kaibito, a small area south of White Mesa near Kaibito Wash, the narrow valley along the Kaibito Red Lake road, a small area northwest of White Mesa and a small area south of Antelope Reservoir. Concentrations of prairie dogs in these areas vary from 30 to 40 dens per acre. Total number of dens of the area are estimated at 608,000. In these excessively concentrated areas projects have been recommended for rodent control.

Ground squirrels are rather widely distributed throughout the Unit. However, their concentration is limited to two faunal types: one along Kaibito Wash and another along Black Canyon. Their concentration is not intensive enough to warrant rodent control.

Miscellaneous Mice.

Various species of mice occur in every faunal type of the Unit. They are nowhere abundant and on range ground they are probably unimportant. However, they may be come a very important factor in reproduction on woodland areas.

Other rodents in the Unit include rock squirrels, Abert squirrels, chipmunks, woodrats, pocket-gophers, and rabbits. The distribution of these rodents is rather spotted throughout the area and damage is so slight that rodent control is unwarranted.

(6) Predators

Predators of the area include coyotes, bob-cats, Navajo dogs, an occasional mountain lion, and skunks. Coyotes are

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by far the most numerous predators in the area. Several sight records were made during the field survey. Traders report buying several pelts during the last year, and frequent losses of sheep are reported by the Indians, particularly during lambing season. Control of coyotes is not recommended at present; however, it may become necessary to control these animals in order to encourage loose herding of sheep. Bob-cats are numerous along rocky outcrops and in deep canyons. They are not reported as taking many sheep. Predatory-inclined Navajo dogs are responsible for some livestock losses. Actual facts in this regard are very difficult to obtain. No recent records have indicated the presence of mountain lions. However, an occasional individual strays into this Unit from the north. Foxes are very scarce, but their presence is indicated by an occasional pelt's being brought in. Predatory losses from this animal have not been reported. Skunks are present but are very rare throughout the Unit.

(7) Poisonous Plants

As has been indicated before in this report, poisonous plant losses are small. Proper herding methods and proper handling of stock will prevent any losses from most of the poisonous species. Greasewood Flats should be grazed only after the animals have received water. Proper utilization of the range will hold losses from loco, the Rayles goldenrod, larkspur, and lupine to a minimum.

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b. Income from Livestock

Income from livestock may be divided into commercial and non-commercial income. The former includes sale of livestock, wool and mohair, pelts and meat to the traders; and the latter includes all livestock or livestock products which are consumed at homr. Wool used in blanket weaving is not included within this classification. Home consumption of livestock is relatively large over this area. The following break-down has been given for non-commercial livestock income. All but 15 consumption groups reporting showed a consumption of 5,796 sheep and goats, and based on this average per consumption group, the remaining 15 groups would consume 513 head, making a total of 6,309 sheep and goats consumed. All but 8 consumption groups reported a consumption of 102 head of cattle. The remaining 8 groups, on this average, would consume 8 head, making a total of 110 cattle consumed. Computing the value of sheep consumed at $3.00 per head and cattle at $20 per head, the total non-commercial income from livestock was $21,127.

Livestock sales within the Unit were made primarily to traders and included all forms of livestock and livestock products. Sales may be classified as follows:

Sheep, Goats, and Lambs	$4,314.73
Cattle	4,394.72
Wool and Mohair	21,885.42
Pelts	1,081.53
Meats	1,005.34
Total Commercial Income from Livestock	$32,681.74

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2. Farming

(a) Present Farm Land

Land Management Unit No. 1 is not an agricultural unit. Less than one-eighth of one per cent of the area is cultivated or potential agricultural land. The soil throughout the Unit is favorable for agriculture except in restricted areas where it is susceptible to wind erosion. Available water for crop production is the limiting factor.

(1) Acreage and Classification

The largest acreage of cultivated land is flood irrigated and located on gully fans. Only 20 acres of irrigated land is found within the Unit. The following table graphically represents the acreage of land according to the class lying within the Unit.

TABLE VIII.

Classification	PRESENT			POTENTIAL	
	Class A	Class B	Class C	Class A	Class B
Irrigated	20			100	
Flood Irrigated	585	134	6	200	25
Dry Farming	6	47	5		
	611	181	11	300	25

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(2) Location and Distribution

Practically all of the cultivated land within the Unit lies in Sub-Unit 5. There are four small agricultural concentrations within the 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. One hundred and twelve tracts of land were located on the survey, and comprise 803 acres of cultivated land. Most of this lies within the above-named concentration.

(3) Yields

No actual measurements of crop yield were made. The yields to be listed are estimates compared with the yields of other units studied together with information from people within the area. These figures are only approximate.

TABLE IX.

Agricultural Yields

Crop	Present Ave. Production	Expected Ave. Production
Corn	15 bu. per acre	20 bu. per acre
Squash and Melons	3,000 lbs. per a.	4,000 lbs. per acre
Beans	250 lbs. per a.	325 lbs. per acre

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(b) Potential Farmland

During the survey 325 acres of potential farmland were located, falling in the following classes:

Class A - Irrigated - 100 acres

Class A - Flood Irrigated - 200 acres

Class B - Flood Irrigated - 25 acres

The entire amount of potential agricultural land lies within the agricultural concentrations previously discussed.

Expected yields on potential land are as follows:

Corn --------- - 20 bu. per acre

Squash and Melons --------- 4,000 lbs. per acre

Beans --------- 325 lbs. per acre

c. Wildlife on Agricultural Lands

(1) Rodents

Rodents are very numerous throughout the area in general and in many cases are concentrated around agricultural lands. Kangaroo rats are heavily concentrated around the farming area at Red Lake. Mice and pocket-gophers are present to some extent, but the damage they cause is much less than that caused by the two preceding rodents. Projects for the control of rodents have been recommended where damage and concentration are important enough to warrant control. It is difficult to estimate the actual damage done by rodents. In many cases crops were planted as often as three and four times before enough plants survived rodent infestation and reached a

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stage where rodent damage was reduced to a point that the plants could live. In many cases the planting was done one day and by the following morning, rodents, especially kangaroo rats and mice, had eaten all the seed that had been placed in the ground. Crops in many parts of the Unit have been reported as a total loss because of rodent damage.

(2) Crop Pests

Grasshoppers constitute the most important agricultural pest in the Unit. They are reported as doing considerable damage in all agricultural areas within the Unit. Fall plowing with a lister plow will do much to control this insect and at the same time, keep wind erosion at a minimum. Cutworms are present in all farming areas. They are second in importance only to grasshoppers and are difficult to control artificially. The most effective control measure is fall plowing and cleaning the field after harvesting. Corn ear-worm is present in all fields and is causing moderate damage. Army-worms, though present on range land, were not found on agricultural areas. Smut and fungus are present but are doing no serious damage.

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d. Present Utilization of Farm Resources

(1) Present Crops

Because of the inadequate supply of water it is necessary that proper crops and proper methods of farming be made effective in order that the maximum production can be obtained from this resource. At present, by allowing fields to remain fallow by improper cultural methods, and other practices, effective use of water is not being made. Valuable topsoil is fast being removed from a number of fields through faulty farming methods. There are three principal crops grown in the Unit, namely, corn, melons and squash, and beans. Acreage of each of these crops are:

Corn -------564 acres, or 70 per cent

Melons
and Squash - 19 acres, or 2 per cent

Beans ------ 2 acres, or 1/4 of 1 per cent

Idle land comprises 218 acres, or 27 per cent.

(2) Cultural Practices

(a) Type of Farming

The farming methods of the people within this Unit are very primitive with few modern improvements. Most of the Navajo's own walking plows and a horse-drawn blade which is used for weeding and cultivating, but other farming

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machinery is lacking. Corn, the principal crop of the Unit, is harvested by hand.

(b) Location of Farms

The farms located at Red Lake and Cow Springs have a more stable water supply and are located in valley floors. The remainder of the farms are for the most part located in washes or in gully fans on the lighter-textured soils. In the dry years crop failure or partial crop failure is prevalent among farms of this type because of a deficient water supply.

(c) Use of Water

On irrigated land the fields are irrigated by the border method. It was noted in some cases that some owners were attempting to check head erosion in cultivated areas, but wind erosion had become so advanced that the fields were abandoned. Frequently no attempt was being made to check wind erosion, which is the most serious factor affecting farm land in the Unit.

The use of water within this area is not conducive to large crop yields. In many cases this is no particular fault of the Indian. Leveling and bordering of the land has not been practiced. The water

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reaching the field is not retained nor is it spread evenly over the field. In many cases the location of the farm is such that the water is not flowing slowly enough to penetrate the soil and numerous cases were seen where only the lower portion of the farm was receiving enough water. It was evident from observations made in the field that this condition could be corrected by the use of brush and wire in the upper portion of the field, thereby slowing the stream flow and allowing for water penetration. In cases where water conservation methods can be used it may be expected that yields on flood-irrigated land will be increased from 25 per cent to 50 per cent of the present yields. In many cases this type of program might mean the difference between a good crop produced and crop failure.

(d) Harvesting and Storing

Harvesting of crops is carried on by hand. No rat-proof storages were noted during the survey. The principal method of storing is to construct an underground pit in which the corn is placed. Melons are stored within the hogan or pit.

Type of farming as a whole is not intensive, but at Low Springs and Red Lake there is greater tendency toward intensive farming methods than in the remainder of the Unit.

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(e) Income from Agriculture

Agricultural income over this Unit is primarily non-commercial, only a small portion of the produce being sold to traders. There was a wide discrepancy between the yields reported by the Section of Human Surveys and those reported by the Section of Agronomy. However, these differences have been taken into consideration and a figure derived which is representative for the Unit. For a further description of the non-commercial agricultural income refer to "Income of the Unit." Total non-commercial agricultural income of the Unit amounted to $10,633.10. Commercial agricultural income for the area was primarily from corn, only two dollars and thirty-two cents' worth of squash and peaches being sold to traders. Total commercial income amounted to $444.08. Commercial and non-commercial income amounted to $11,077.18 for the entire area.

Agricultural products used in trade and barter have been included in the above figures. An accurate estimate of agricultural products used in this manner could not be obtained although there is a prevalent practice among the Indians of trading and bartering agricultural products.

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3. Woodland

Within the woodland stands of this Unit some of the largest pinon and juniper trees of the Reservation are to be found. Woodlands are above the average in quality although the tree population produces only a thin crown cover.

(a) Present Resources

(1) Acreage and Location

On the Unit there are 322,335 acres of woodland scattered rather uniformly over the area with the exception of the northern part where woodland stands are lacking. The most important tree appearing within the Unit is the juniper. Approximately 92,000 acres of woodland are 100 per cent juniper; 150,000 acres of woodland are comprised of 90 per cent, or more, of juniper; 200,000 acres are comprised of 75 per cent, or more, juniper, and approximately 290,000 acres, or about 9/10 of the woodland stands, are comprised of 50 per cent, or more, of juniper. Only 36,000 acres, or approximately 10 per cent of the woodland are predominantly pinon.

The relatively thin crown cover in woodland stands can be shown best in the following figures: 96,000 acres show less than 5 per cent crown cover; 204,000 acres show less than 10 per cent crown cover; 304,000, or nearly 90 per cent of the area show 25

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per cent crown cover; in the area there are only 24,000 acres which are more than 25 per cent crown cover.

(2) Class, Site, and Condition

The entire woodland stands within the Unit fall in Site III Classification. Only a few acres of woodland on Black Mesa have more than 30 per cent crown cover, but because of inaccessibility they have become Site III. The remaining acreage does not exhibit more than 30 per cent crown cover and therefore, falls in the same class. The following acreages show the classification of woodland stands according to condition and usage:

a	Good	Full Use	9,955 acres
b	Fair	Restricted Use	100,900 acres
c	Poor	Non-Use	211,500 acres

The above figures show a predominance of fair or poor woodland stands within the Unit with only a very limited acreage falling into a full-use classification.

From the classification of woodland 31.1 per cent of the total area of the Unit are strictly woodland types. These include all areas which were classified in the Extensive Grazing Survey as 9, or

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woodland. In addition to this area, there is a large acreage of other types which have a scattering of trees on them. Included in these 1(9), 4(9), 5D(9) and 7Ia(9) types, are 74,750 acres, or approximately 7 per cent of the area of the Unit. The total area within the Unit being strictly woodland or with scattered trees is 397,090 acres, or 38.3 per cent of the area.

(3) Available Products

The survey of the Unit showed that there are more than 73,370 posts available for cutting at the present time. There are more posts actually available than this number indicates; however, because of recommended cutting practices, site class and condition of stands, the above figure represents only the posts that should be cut at the present time. In future years on a sustained yield basis more posts will be available. There are more than 33,700 cords of wood. This includes only dead material. Only a few poles on Black Mesa and White Mesa were located during the survey and they were not in large enough quantities to be of economic importance or to enable an estimate of the actual numbers to be made. Woodland and wood products over the area are adequate to serve the needs of the people within the Unit and at the

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same time furnish wood and wood products to units immediately joining the area which are lacking in this regard.

(4) Grazing Value

The grazing value of the woodland stands within the Unit is relatively low as compared to the grazing value of other range vegetative types. However, the stands serve a dual usage and furnish not only wood and wood products, but also grazing land. The woodland stands comprise two-fifths of the area and furnish approximately one-fourth of the carrying capacity of the Unit.

(5) Watershed and Wildlife Value

Watershed values of woodland are relatively low for this Unit. This is due primarily to two reasons: first, the sandy soil produces only a minor run-off and secondly, the stands of woodland, as has been pointed out before, are thin, being able to retain only a slight amount of water on the watershed. One exception to the foregoing statement occurs on Black Mesa. In this area steep slopes, a more dense woodland standand a clay soil are combined to give the woodland stand a relatively high watershed value. Wildlife value of woodland stands within the area is a negligible factor.

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b. Utilization of Wood Resources

(1) Cutting Practices

Cutting practices over the Unit are not conducive to proper forest management. Whereas utilization has been light over the entire area, a very heavy utilization in localized areas has caused a good deal of damage. The clear cutting of woodland stands immediately adjacent to corrals and hogans has done much to deplete forest resources and caused much damage. Very inefficient use of forest resources is shown throughout the area. The cutting of whole trees and the leaving of tall stumps are evidences of this.

(2) Pests and Diseases

Woodland pests and diseases are causing severe damage in localized areas. The leaf-scale is, perhaps, the most important pest and is found entirely in pinon stands. A rather large area north of White Mesa was the most severely infested stand on the Unit. Locally, this pest kills a large number of trees, but in general, is not severe over the entire Unit. Mistletoe is scattered through the Unit, but is not abundant and only light infestation was seen. It is the only pest which affects the juniper tree, the most important forest tree on the Unit.

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(3) Fire and Wind Damage

Recent fire damage is very light, due primarily to the fact that woodland stands have so thin a crown cover. There were noticed, however, large areas with a large number of dead trees. These were, probably, due to old fires which occurred many years ago. Fire hazard in the area is at a minimum because of the scattered character of the woodland stands. Wind damage is doing a good deal of hram over the entire area, primarily through soil losses. The light-textured soil is blown from around the roots of the trees, leaving them bare and without adequate protection from wind abrasion and a loss of water-holding capacity to the soil. These factors are important in the destruction of woodland stands.

(4) Grazing Damage

Grazing damage over the entire Unit is slight, but in localized areas extreme over-use by livestock has caused much damage to reproduction can be attributed to improper season of use or to of use or to over-grazing. Principal areas showing bad effects of over-grazing of woodland stands include areas immediately adjacent to hogans and corrals, reservoirs, and around population centers.

(5) Fire Protection

There is no present system of fire protection and because of the thin stands, fire protection is not needed within the Unit. There appears to be no area which will necessitate afforestation or re-forestation.

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c. Income From Woodland Resources

There were reported sales of wood (including posts) to the extent of $524.32 in the Unit during the calendar year 1936. More products are available for sale, but the demand is low and increased income is not to be expected.

4. Mineral Resources

Copper is the only mineral resource of the district. White Mesa copper district was prospected in 1882 and many claims located. No development work has been done in recent years; however, at the present time, plans are being put into effect to re-open operations at the Coppermine. Only a small amount of ore has been removed. The most abundant ore mineral is chrysocolla, but small amounts of malacite and azurite occur. The copper occurs in Navajo sandstone disseminted between the quartz grains along the joints and bedding planes. In some places the malacite is associated with hematite. The average ore runs from 5 per cent to 8 per cent with some as high as 14 per cent.

The only coal-bearing formations in the Unit are confined to Black Mesa. A few thin beds of coal appear at various points on Black Mountain, but are too thin to be of economic importance. Mineral resources of the area are in such quantities that they are of little commercial value.

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5. Economic Status of the People

Figures regarding income of Land Management Unit No. 1 were obtained through various sources, namely, traders' schedules, schedules from individual indians and Section of Agronomy estimates. Table X shows graphically the total income for the Unit.

TABLE X.

INCOME OF LAND MANAGEMENT UNIT NO. I.

	Total Commercial Income	Total Non-Commercial Income	Gross Income	Per cent of Income
Wages	11,484.68		11,484.68	12
Livestock	32,681.74	21,127.00	53,808.74	58
Agriculture	444.08	10,633.10	11,077.18	12
Rugs	13,213.78		13,213.78	14
Miscellaneous	3,227.19		3,227.19	4
TOTALS	61,051.47	31,760.10	92,811.57	100

The above table shows $92,811.57 gross income including commercial and non-commercial forms of income. This makes a per capita income of $79.00, a figure which is lower than that of other units studied on the Reservation. Total consumption in the area amounted to $109,609.77. This shows practically 18 per cent more consumption than income during the past year. There are certain conditions which arise which make these figures more less an estimate. Under "Wages" the figure is perhaps quite low because all Indian Service

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wages of a temporary nature in the Western Navajo Jurisdiction have been charged to Land Management Unit No. 3. Only wages of a permanent nature in the Indian Service have been charged to Unit No. 1 through the Day School at Kaibito. The Roads Division, although doing some work in this Unit, has not distributed its cost to this area. Another factor which might influence the present condition and make an unfavorable balance appear in regard to income and consumption is the fact that perhaps a large number of livestock were held over and not sold. This appears to be the case because sales from livestock and meats amounted to approximately $10,000.00. Sales from wool and mohair amounted to approximately $22,000.00. Under similar conditions elsewhere on the Reservation these two sources of income have been about equal and it would indicate that a large number of livestock have been held over. Credit business with traders may account for a further discrepancy between income and consumption.

Table XL graphically represents the gross commercial income for the Unit. Livestock comprises nearly 50 per cent of the total, wages include approximately 15 per cent, rugs approximately 20 per cent, with agricultural products and miscellaneous, such as pinons, jewelry, baskets, and wood making up only a minor portion of the income.

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TABLE XI.

GROSS COMMERCIAL INCOME

WAGES		$11,484.68
S.C.S.	$ 660.10	
E.C.W.	8,626.68	
U.S.I.S.	1,320.00	
Traders	877.90	
LIVESTOCK AND LIVESTOCK PRODUCTS		$32,681.74
Sheep, Goats, and Lambs	$ 4,314.73	
Cattle	4,394.72	
Wool and Mohair	21,885.42	
Pelts	1,081.53	
Meat	1,005.34	
AGRICULTURAL PRODUCTS		$ 444.08
Corn	441.78	
Melons and Squash	1.30	
Peaches	1.00	
RUGS		$13,213.78
MISCELLANEOUS		3,227.19
Pinons	$2,349.11	
Jewelry and Baskets	353.76	
Wood (including posts)	524.32	
TOTAL		$61.051.47

Total consumption in the Unit may be classified as follows:

Commercial ------ $77,849.67 or 71 per cent
Non-commercial -- $31,760.10 or 29 per cent
TOTAL --$ 109,609.77

Food consumption amounted to $83,554.66. Of this amount, 33 per cent or $31,760.10 was home-produced and consumed. 67 per cent was purchased from the trader; of this, 1 per cent, or $598.70 was produced within the district, sold to the trader and re-purchased

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by the Indians. The remainider, $51,195.86, was imported into the district. Of this food which was imported into the district, $38,122.08 may be classified as non-producible within the district. However, if a large enough acreage of potential agricultural land could be developed for this purpose, $13,073.86 of food might be classes as producible.

Approximately 500 acres of land would be required to produce the producible products that are imported to the district at the present time. Table XII shows graphically the crops which are imported, the yields to be expected based on an average of 8 units already studied on the Reservation and the acreage that would be required to produce the amount which is now imported.

TABLE XII

ACREAGE REQUIRED TO PRODUCE PRODUCIBLE IMPORTED PRODUCTS

Crop	Imported	Value	Yield per Acre	Acreage Required
Corn	7,506	$ 268.81	800	9
Oats	38,763	1,451.58	720	55
Hay	95,028	1,943.84	3,000	32
Beans	283	24.49	200	1
Potatoes	25,438	950.62	3,500	7
Melons	9,652	323.70	1,500	6
Onions	4,008	210.86	4,000	1
Peaches	171	16.30	6,000)	1
Apples	5,075	374.43	6,000)	
Total Raw Agri.		5,564.63		112
Flour		7,509,15	700	372
TOTALS		$13,073.78		484

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There was a wide variation between the figures obtained by the Section of Human Surveys and the Section of Agronomy in regard to agricultural income. Agronomic figures were based on yields to be expected from the land and did not take into account production losses from flood, drouth, pests and rodents. It was felt from reviewing the data obtained that hields had been placed too high for this area, especially in regard to corn. The annual rainfall is approximately 7 inches and although farms are located on gully fans on very suitable locations, they are dependent upon local showers for water supply. Figures reported to the Branch of Human Surveys were considered to be low, especially in regard to corn. The figures reported included only yields at harvest time and did not include corn which was used between the green corn stage and harvest time, nor did they account for losses due to livestock getting into the cornfields. Adjustment between the two sources of figures was necessary in order to arrive at a figure that was representative for the Unit. Bearing in mind that the agronomic yields were, perhaps, too high for this low rainfall belt and that the sociological figures were low because of various factors influencing their estimate, both figures were combined to give the agricultural income. The following four tables graphically represent the factors involved and the figures derived from the survey which, in the final result, give the agricultural income for the area.

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TABLE XIII

AGRONOMIC ESTIMATES OF AGRICULTURAL PRODUCTS THAT WOULD BE PRODUCED WITHOUT UNUSUAL CROP FAILURES

Crop	Acreage	Production in Lbs.	@ C.W.T.	Value
Corn	564	315,840	$3.58	$11,309.07
Squash and Melons	19	57,000	3.35	1,090.50
Beans	2	500	8.65	43.25
TOTAL				$13,261.82

TABLE XIV

NON-COMMERCIAL AGRICULTURAL INCOME (1936)

(Based on Agronomic estimates (subtracting acreages that were reported, crop losses from flood, drouth, pests, and rodents.)

Crop	Acreage	Production in Lbs.	Less Amt. Sold to Trader	@ C.W.T.	Value
Corn	414	231,840	214,765	$3.58	$7,688.59
Squash & Melons	19	57,000	56,994	3.35	1,909.30
Beans	2	500	500	8.65	43.25
TOTAL					$9,641.14

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TABLE XV.

NON-COMMERCIAL INCOME BASED ON HUMAN DEPENDENCY SURVEY SCHEDULES
(assuming one-half of the corn was consumed between "green-corn" stage and harvest time or lost from damage from livestock.)

Crop	Reported	Ave.Per Cons.Group	(in lbs.) Est.Total Quantity	Total less Sold to Trader	C.W.T.	Value
Corn	137,468	1,800	1,896.96	172,621	$3.58	$6,179.83
Squash	48,600	1,700	89,400	89,394	3.35	2,793.70
Beans	910	65	1,755	1,775	8.65	151.81
			TOTAL ----------			$9,125.34

TABLE XVI

NON-COMMERCIAL AGRICULTURAL INCOME, 1936, USING AGRONOMIC ESTIMATES ON CORN AND HUMAN DEPENDENCY SCHEDULE RESULTS ON THE OTHER AGRICULTURAL PRODUCTS.

Crop	Production in Lbs.	Amt.Sold to Trader	Total Consumed	@ C.W.T.	Value
Corn	231,840	17,075	214,765	$3.58	$7,688.59
Squash	89,400	6	89,394	3.34	2,793.70
Beans	1,775	0	1,775	8.65	151.80
			TOTAL ----------		$10,633.10

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Table XIII is based on agricultural yields estimated by the agronomist for the entire area and does not take into account severe crop losses due to flood, drought, rodent damage or insects. It is the agricultural income that can be expected under normal conditions in the area.

In Table XV the figures derived by the Section of Human Surveys have been combined to compute the agricultural income. It is assumed that one-half of the corn was consumed between "green-corn" stage and harvest time and was not reported on Human Dependency Survey Schedules. Figures in this table concerning squash and beans are perhaps more correct than agronomic estimates because at the time of survey in the farm area, no crops were planted and acreages of squash and melons could not be accurately ascertained. Another factor influencing these figures is the practice of planting squash between the rows of corn. When the two sources of data concerning agricultural income are combined using the figures that appear to be more nearly accurate for the area, we arrive at Table XVI.

Yields on conr were taken from agronomic estimates and yields reported to the Section of Human Surveys were taken on other agricultural products. This gives a total agricultural income of $10,623.10, a figure that is probably more representative of the area than estimates reported by either section.

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II. SUB-UNITS

Land Management I has been divided into five sub-units for the purpose of more clearly defining conditions, ease of administration and collection and interpretation of data. The special division was made through a combined viewpoint of the various branches represented during the survey. Sub-division lines follow natural topographical boundaries wherever possible, economic lines, and lines delimiting certain general divisions.

A. Sub-Unit No. 1

Sub-Unit No. 1 is located in the northwest part of the Unit and is bounded on the north by Navajo Canyon, on the west by Echo Cliffs, on the south by Kla Kai sa ahni, and on the east by the rim west of Bert Tso's windmill. The area in the Sub-Unit is 200,510 surface acres.

Soils in the northern portion of the sub-unit are very shallow and fall into D and E classes of range soils. Large areas of sandstone with only spotted soil accumulations occur. Soils in the southern portion of the sub-unit are of a better grade and fall into A, B, and C classes of range soils. On a whole, the area is sandy with high water penetration and relatively low water-holding capacity. Run-off can be expected for the most part only in the northern portion along sandstone slopes and is not available for agricultural development.

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Range in the northern portion of the sub-unit is relatively low in carrying capacity and is characterized primarily by black-brush types. Range in the southern portion of the area is of a much better quality and has a relatively high carrying capacity and is characterized by grassland types with high forage acre factors. The carrying capacity of the sub-unit is 5,370 sheep units yearlong and is at present used as winter range because of a lack of permanent water. Rodent damage in the area is slight.

There is at present no farmland found within the unit and no potential farmland is available. The principal reason for this is the lack of run-off on suitable farmland. Where run-off does occur the soil is such that it cannot be farmed.

Woodland resources throughout the sub-unit are more than adequate to care for the needs of the people. In the northern portion of the sub-unit there is a lack of woodland stands, most of the woodland appearing in very scattered form. In the southern portion of the sub-unit there are adequate woodland stands of good quality but with a rather sparse crown cover. Many large trees are to be found. There is adequate post and duel wood supply for the area.

Wildlife habitat throughout the area is suitable at present for only furbearers, such as coyotes, badgers, bob-cats and skunks and game animals such as antelope and mourning doves.

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Mourning doves and antelope are the only game species to be found within the area and the area is sparsely settled with them. There are two reservoirs which provide suitable resting ground for migratory waterfowl.

B. Sub-Unit II

SubUnit II, or the Coppermine Sub-Unit, is located immediately south of the Sub-Unit I and comprises the area lying within Land Management Unit No. I west of Mormon Ridges. The area of the sub-unit is 17,965 surface acres.

Soils of the sub-unit are, as a whole, very sandy with a high water penetration value and relatively low water-holding capacity. There are few rock slopes which furnish enough area for run-off and in no place is there enough rock drainage to allow water to flow out of the sub-unit. Erosion over the area is characterized by active wind erosion. Numerous sand dunes, either active or partially stabilized, are to be found within the area.

This sub-unit offers one of the largest range resources within the Unit. The area as a whole is relatively high in carrying capacity and is characterized by very palatable species. Carrying capacity for the sub-unit is 9,755 sheep units year-long. Because of the lack of permanent water, it has been used only as winter range and depletion of the range resources has remained at a minimum, except in the southern portion where there has been more water available. Rodent damage is severe only in the southern portion of the sub-unit.

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At present there are 85 acres of farmland, 70 acres of which are flood-irrigated and 15 acres are dry farm. Because of the low rainfall and uncertain water supply for flood-irrigated farms, and the predominance of wind erosion, this sub-unit is not to be classified as an agricultural area. Active wind erosion is occurring on all present land which is farmed.

Woodland resources in this area are more than adequate to meet the needs of the inhabitants and there are large areas of woodland stands. There is an abundance of posts and fuel wood. within the area but as a whole, they are very scattered throughout.

The only game species found in this area are antelope and mourning dove. The larger portion of the herd of antelope grazing within the Land Management Unit No. I is to be found within this sub-unit.

The bird habitat is not conducive to a large bird population and there are no suitable resting places for m gratory waterfowl.

The principal mineral resources of Land Management Unit No. I are located in this area and include the Coppermine claims.

C. Sub-Unit No. III

Sub-Unit No. III is located in the central portion of the Unit and includes the area around Kaibito, bounded on the

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NN000902

west by Sub-Unit No's. I and II, on the north by Kaibito Canyon, on the east by White Mesa and on the south by Sub-Unit V, and comprises 111,344 surface acres.

Soils of this sub-unit fall into the better class of range soils, are rather deep throughout with high water penetration value and high water-holding capacity. Erosion over the area is predominantly wind erosion. Active or partially stabilized sand dunes varying from a few inches to several feet deep are to be found throughout the area. Sheet and gully erosion are important only along the steeper slopes of rocky outcrops along White Mesa.

The area in the western portion of the sub-unit is of relatively high carrying capacity and falls into medium or good range land. Usage on this part of the sub-unit has been primarily as winter range. The area near Kaibito Canyon and Kaibito has been used as yearlong range because of the presence of adequate permanent water and is in a state of bad depletion. Many indicators of over-grazing, such as snakeweed, yellow-brush, annual weeds and grasses, etc. are to be found in this part of the sub-unit. Active wind erosion is more severe in these over-utilized areas.

At present there are 76 acres of farmland within the sub-unit and they fall into the flood irrigated class. There is no potential farmland, due primarily to a lack of water for agricultural purposes where there is agricultural soil.

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Wildlife appearing within the sub-unit is only species typical of the remainder of the area. Bird habitat is not particularly good and there are no suitable resting places for migratory waterfowl. Black Mesa furnishes the only suitable habitat for deer and big game.

D. Sub-Unit IV

Sub-Unit IV, or Ste Skizzie, is located in the northern portion of the Unit, is bounded on the north and east by Navajo Canyon, on the south and west by Kaibito Canyon, and on the north by SubUnit No. III. It includes 141,341 surface acres. Soils over the central and southern portion of the sub-unit are rather good range soils. In the northern and western portions of the area many rocky out-crops and shallow soil deposits are to be noted. Run-off is to be expected only in the rocky outcrops and in the canyons. Soil for the most part has a high water-holding capacity and a high absorptive value. Erosion is predominantly wind erosion, some areas exhibiting gully erosion, especially in alluvial valley fills.

With the exception of the northern and western portions of the sub-unit the range soils are of the better class and range is of high forage acre factor throughout most of the sub-unit. Carrying capacity is 4,227 sheep units yearlong. Usage in the area has been yearlong with certain areas in the

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northern and western portion being used only as winter range. Permanent livestock water is lacking within this sub-unit. Rodent damage is very severe in the southern and eastern portion of the area.

Farming resources constitute 59 acres of present farmland and an additional 20 acres of potential farmland, all falling into either flood-irrigated or dry farm. Erosion is moderately severe on farmland. Further development, with the exception of 20 acres, cannot be expected because of the lack of run-off.

Woodland resources are only moderate in this sub-unit. Extensive areas of scattered woodland are to be found with adequate available woodland products for the population. Utilization has not been severe. Insect damage is probably more severe in woodland stands within this sub-unit than in any other place in Land Management Unit No. I. Leaf-scale is the most important woodland pest and is found in a large are north of White Mesa.

E. Sub-Unit No. V.

Sub-Unit No. V comprises the southeast portion of Land Management Unit No. I and is the largest of the sub-units, including the Buck Pasture. The area has been further divided by the Section of Range Manag ment for purposes of livestock distribution. However, the data given here is for the entire sub-unit.

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Soils of the sub-unit are variable. In the north and western portion of the sub-unit soils are medium heavy, and are sandy loam or clay loam with some areas exhibiting only soil material. Erosion over the area is likewise varied. The western portion which is characterized by light-textured soil is very susceptible to wind erosion and many active or partially stabilized sand dunes are present. Gully and sheet erosion become the important factor in the central and southern portions of the sub-unit. Geological erosion is found on the steeper slopes of Black Mesa where only geological material and soil material are to be found. A large percentage of the agricultural soils in Land Management Unit No. I are to be found within this sub-unit. Range soils for the most part are of the better class.

The carrying capacity of the area is relatively low, due primarily to a depletion of palatable range species within the area. Continued use of the range because of adequate permanent water supplies and concentration of population around farming areas and trading posts has resulted in increased wind erosion and depletion of vegetative cover. The area has been used as year-long range with a concentration during the summer months. Utilization has been very severe over many years. Rodent damage to the range has been very severe but during 1934 rodent control work was carried out in a large portion of the area and only light infestations occur at the present time. However, at the

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present time, rodents are on the increase and recommendations for caring for this situation have been considered.

Farming resources in the area comprise 573 acres of present farmland, which includes 20 acres of irrigated land. There are present 305 acres of potential agricultural land, 100 of these being potential irrigated land. The better grade of agricultural soils are to be found in this sub-unit and with the development of the Cow Springs Project, agricultural resources can be developed. Rodent damage to agriculture is especially important around Red Lake and Cow Springs.

Woodland resources in the area are limited to the western and southeastern portion of the sub-unit. A large area in the central portion of the sub-unit has no trees at all. Woodland products are adequate for the sub-unit but because of severe over-use, especially from outside individuals coming from other units for their posts and fuel wood, the woodland stands are in a poor condition. Extreme over-use along the slopes of Black Mesa and in the vicinity of Wild Cat Peak was noted.

Bird and game habitat are not suitable over the area, as a whole. Cow Springs Lake and Red Lake with a few minor temporary reservoirs furnish the only suitable migratory waterfowl resting places.

The following table graphically represents the resources ~~and conditions~~ to be found within the various sub-units. ~~Under~~

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Type of Farm	Class of Land	Soil	Slope %	Recommendation	Potential Acres	Acres to be Subjugated	Cost per Acre	Total Cost
Flood irrigated	A	S	1	Contour list	0	0		
" "	A	S	1	Contour list	0	0		
Dry farm	C	S	1-2	None	0	0		
Flood irrigated	B	SL	1	Contour list	0	0		
" "	A	SL	1	" "	0	0		
" "	A	S	1-2	Wire spreaders	0	9	$15	$ 135.00
" "	A	S	1	Contour list	0	0	0	0.00
" "	A	S	1-3	Wire spreaders	0	3	$18	54.00
" "	5A,4B	S	1-5	" "	0	5	18	90.00
" "	C	SL	1-2	None	0	0	0	0
" "	B	S	1-3	None	0	0	0	0
" "	A	S	1	None	0	0		
" "	A	S	1-1.5	Contour list	0	0		
Dry farm	B	S-SL	1	" "	0	0		
Flood irrigated	A	S	1	" "	0	0		
" "	B	S	2	" "	0	0		
Dry farm	A	SL-CL	1-10	None	0	0		
Flood irrigated	B	S	1-2	Contour list	0	0		
Flood irrigated	A	S	1	Contour list	0	0		
" "	A	SL	2	Border	10	20	$20	$ 400.00
" "	A	SCL	2	Border	8	18	15	270.00
" "	A	SL	2	"	0	4	20	80.00
" "	A	S-SL	1.5	Contour list	0	0		
" "	A	SL	1	" "	0	0		
" "	A	S	2	" "	0	0		

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TABLE XVII.

Quad. No.	Farm No.	Acreage	Present Crops	Suggested Crops	Present Yield	Type of Farm
78	4	1	Corn	Corn, squash, melons	Ave.	Flood irrigated
111°15' 36°45'	5	2	Corn	Corn, squash	Ave.	" "
	6	3	Idle	" "	-	Dry farm
	2	4	2 Corn, 2 Beans	Corn, beans, squash	Ave.	Flood irrigated
	3	5	Corn	" " "	-	" "
79	3	9	5 Corn, 4 idle	Corn, squash	Ave.	" "
111°15' 36°30'	5	4	Corn	" "	Ave.	" "
	6	3	2 Corn, 1 idle	Corn, squash, melons	Ave.	" "
	7	9	5 Corn, 4 idle	" " "	Ave.	" "
	11	3	Idle	Corn	-	" "
	12	2	Idle	Corn	-	" "
	13	3	Corn	Corn, squash	-	" "
86	1	18	Corn	Corn, beans, squash	Ave.	" "
111°[illegible] 36°45'	1.1	12	Corn	Corn	Ave.	Dry farm
	3	2	Corn	Corn, squash	Ave.	Flood irrigated
	5	5	Idle	Corn, beans	-	" "
111°00' 36°45' 73	8	2	Idle	Corn	0	Dry farm
111°15' 36°45' 78	1	3	Idle	Corn, beans	-	Flood irrigated
93						
110°45' 36°45'	26	1	Idle	Corn, squash	-	Flood irrigated
	27	10	Corn	Corn, squash, melons	Ave.	" "
	28	8	Corn	Corn, squash	Ave.	" "
	29	4	2 Corn, 2 idle	" " "	Ave.	" "
	30	2	Idle	Corn	-	" "
	31	2	Corn	Corn, beans, squash	Ave.	" "
	32	2	Idle	Corn, beans	-	" "

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s- t ld	Type of Farm	Class of Land	Soil	Slope %	Recommendation	Potential Acres	Acres to be Subjugated	Cost per Acre	Total Co
9.	Flood irrigated	A	S	2	Contour list	0	0		
9.	" "	A	S	2	" "	0	0		
9.	" "	B	S	1	" "	0	0		
	" "	B	S	1	" "	0	0		
9.	" "	A	S	1-2	" "	0	0		
9.	Flood irrigated	A	S	1-2	Border and level	5	11	$18	$ 198.0
9.	" "	6A,6B	S-SL	-	Contour list	0	0	0	
9.	" "	A	S-SL	1-2	Border	0	10	25	250.0
9.	" "		S-SL	1	Level and border	0	18	20	360.0
	" "	A	S-SCL	1	Border	15	15	18	270.0
		A	S-SL	1	Contour list	0	0	0	
9.	" "	A	S-SL	1-2	Wire spreaders	10	20	15	300.0
9.	" "	B	S-SL	1	" "		5	15	75.0
	" "	B	S-SL	1	None	0	0	0	
9.	" "	B	S-SL	1	Deep listing	0	0	0	
9.	" "	B	S	1-2	Contour list	0	0	0	
9.	" "	A	S-SL	1.5	Contour list & border	0	3	20	60.0
	" "	B	S-SL	1-3	Contour list	0	0	0	
9.	" "	A	SL	1	" "	0	0	0	
9.	" "	B	S	1	" "	0	0	0	
9.	" "	A	S	1-3	None				
9.	" "	5A,2B	S	1	Deep contour list	0	0	0	
	" "	C	S	1-2	Contour list	0	0	0	
	Dry farm	B	S	1	" "	0	0	0	
	Flood irrigated	B	S	1	" "	0	0	0	
	Dry farm	B	S-SL	1	" "	0	0	0	
	" "	B	S	1	" "	0	0	0	
	Flood irrigated	A	S	1	Border	0	4	$10	$ 40.00
	Dry farm	B	S	1	Contour list	0	0	0	
	Flood irrigated	B	S	1	" "	0	0	0	
	" "	B	S	1-2	Border	0	2	$15	$ 30.00
	" "	B	S-SL	1-5	None	0	0	0	
	" "	B	S-SL	1-2	Contour list	0	0	0	
	" "	B	S-SL	1-4	" "	0	0	0	
	" "	B	SC	1	" "	0	0	0	
	" "	B	SI-SCL	1	" "	0	0	0	

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TABLE XVII. (continued)

Quad. No.	Farm No.	Acre age	Present Crops	Suggested Crops	Present Yield	Type of Farm
93 110°45' 36°45'	33	6	2 Corn, 4 Idle	Corn, beans, squash	Ave.	Flood irrigated
	34	4	Corn	" " "	Ave.	" "
	35	3	Corn	" " "	Ave.	" "
	36	2	Idle	" " "	-	" "
	52	15	Corn	Corn, squash, melons	Ave.	" "
72 111°00' 36°30'	1	6	4 Corn, 2 Squash	Corn, squash	Ave.	Flood irrigated
	3	12	Corn	Corn, beans, squash	Ave.	" "
	4	10	Corn	" " "	Ave.	" "
	5	18	Corn	" " "	Ave.	" "
	6		Native	Corn	0	" "
	7	3	Idle	Corn	0	
	8	10	Corn	Corn, squash	Ave.	" "
	9	5	Corn	Corn, beans, squash	Ave.	" "
	10	4	Idle	Corn, beans	0	" "
	16	18	Corn	Corn, rye, wheat	Ave.	" "
73 111°00' 36°45'	1	1	Corn	Corn, squash, beans	Ave.	" "
	2	3	Corn	" " "	Ave.	" "
	3	3	Idle	Corn, beans, squash	0	" "
	4	10	Corn	Corn, beans	Ave.	" "
	5	1	Corn	Corn beans	Ave.	" "
	6	6	Corn	Corn, beans, melons	Ave.	" "
	7	7	4 Corn, 3 Idle	" " squash	Ave.	" "
	9	3	Idle	Corn	0	" "
	10	4	Idle	Corn	0	Dry farm
	11	4	Idle	Corn	0	Flood irrigated
	12	2	Idle	Corn	0	Dry farm
	13	4	Corn	Corn, squash	Ave.	" "
	14	4	Idle	" "	0	Flood irrigated
	15	1	Corn	Corn, squash, beans	-	Dry farm
	16	1	Corn	Corn, beans, squash	-	Flood irrigated
	17	2	1 Corn, 1 Squash	Corn, melons, squash	-	" "
	18	5	Corn	Corn	Ave.	" "
	19	1	Corn	Corn, melons, squash	Ave.	" "
	20	1	Corn	Corn, melons, peaches	Ave.	" "
	21	4	Idle	Corn	-	" "
	22	2	Idle	Corn	-	" "

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es-nt eld	Type Farm	Class of Land	Soil	Slope %	Recommendation	Potential Acres	Acres to be Subjugated	Cost per Acre	Total Cost
re.	Flood gated	A	S	1	Wire spreaders	0	5	$10	$ 50.00
re.	"	A	S	1	" "	0	15	10	150.00
re.	"	A	S	1-2	Contour list	0	0	0	0
	"	A	S	1-3	Border and level	0	3	15	45.00
re.	Dry F	B	S	1	Contour list	0	0	0	0
	"	B	S	1-3	" "	0	0	0	
	Flood gated	B	S	1-2	" "	0	0	0	0
	"	A	S	2	Wire spreader	4	5	12	60.00
re.	"	A	S	1.5	Contour list	0	0	0	0
	"	A	S	1-2	Wire spreaders	0	4	15	60.00
	"	A	S-SL	1-2	Level and spreaders	5	5	20	100.00
re.	"	80A-40B	S-SL	0	None	0	0	$ 0	0
re.	"	B	CL-C	0	None	0	0	0	0
	"	C	C	0	None	0	0	0	0
or	Dry F	B	SCL	1	Contour list	0	0	0	0
re.	"	B	S	1	" "	0	0	0	0
re.	Flood gated	A	S	1	Level and border	0	1	15	15.00
	Dry F	B	SL	1	List	0	0	0	0
re.	Flood gated	A	SCL	1	Wire spreaders	0	35	10	350.00
	" "	A	S-SCL	1	" "	10	35	10	350.00
re.	" "	A	S-SL	1-2	" "	0	15	10	150.00
re.	Dry F	B	S	1	Contour list	0	0	0	0
re.	"	A	S-SL	1	" "	4	0	0	0
re.	Flood gated	A	S	1-2	Border	0	7	20	140.00
re.	" "	A	S	1	Border	0	4	15	60.00
re.	" "	A	SL	1	None	0	0	0	0
re.	" "	A	SL	1-3	Border	0	2	12	24.00
re.	" "	A	S-SL	1-2	Border	0	40	$ 15	600.00
re.	Irrig	A	S-SL	1	Border	100	100	$ 15	$1,500.00
re.	Flood gated	A	SL	1-2	Eng. Proj. #45	20	0	0	0
	"	B	S	1.5	None	0	0	0	0
re.	" "	B	S-SL	1-2	Border	10	20	$ 18	$ 36.00
or	Dry F	B	S-SL	1-3	Contour list	0	0	0	
or	Flood gated	B	S-SL	1-2	Wire spreaders	0	4	15	$ 60.00
re.	"	B	S-SL	1-2	" "	0	30	15	$ 450.00
or	"	B	S-SL	1-2	Contour list	10	0	0	0

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TABLE XVII. (continued)

Quad. No.	Farm No.	Acreage	Present Crops	Suggested Crops	Present Yield	Type of Farm
93 110°45' 36°45'	1	5	Corn	Corn, Squash, Beans	Ave.	Flood Irrigated
	2	15	10 Corn, 5 Idle	Corn, Oats, Beans	Ave.	" "
	3	2	1 Corn, 1 Squash	Corn, Squash, Beans	Ave.	" "
	4	3	Idle	Corn, Beans	-	" "
	5	3	Corn	Corn, Squash, Beans	Ave.	Dry Farm
	6	5	Idle	" " "	-	" "
	7	1	Idle	Corn, Squash	-	Flood irrigated
	8	1	Idle	" "	-	" "
	9	9	5 Corn, 4 Idle	Corn, squash, Beans	Ave.	" "
	10	4	Idle	Corn, Squash	-	" "
	50	5	Native	Corn, Oats, Squash	-	" "
94 110°45' 36°30'	1	120	100 Corn, 20 Idle	" , Squash, Melons	Ave.	" "
	2	2	1 Squash, 1 Melons	" , Beans, Melons	Ave.	" "
	3	1	Idle	" , Beans,	-	" "
	4	2	1 Corn, 1 Idle	Beans, Corn	Poor	Dry Farm
	5	1	Corn	Corn, Squash, Beans	Ave.	" "
	6	1	Corn	Corn, Peaches	Ave.	Flood Irrigated
	7	2	Idle	Corn	-	Dry Farm
	8	25	15 Idle, 10 Corn	Corn, Squash	Ave.	Flood Irrigated
	9	35	30 Corn, 5 Idle	Corn	Ave.	" "
	10	15	10 Corn, 5 Idle	Corn, Beans	Ave.	" "
	11	5	3 Corn, 2 Idle	Corn, Beans	Ave.	Dry Farm
	12	6	4 Corn, 2 Idle	Corn, Beans	Ave.	" "
	13	7	Corn	" , Melons	Ave.	Flood Irrigated
	14	4	Corn	" " , Beans	Ave.	" "
	15	1	Corn	" " "	Ave.	" "
	16	2	Corn	" " "	Ave.	" "
	17	40	20 Corn, 20 Idle	Corn, Oats	Ave.	" "
	18	20	Corn	Corn, Oats, Alfalfa	Ave.	Irrigated
	21	30	20 Corn, 10 Squash	Corn, Squash	Ave.	Flood Irrigated
	22	2	Idle	" "	-	" "
	25	10	8 Corn, 2 Idle	" " , Beans	Ave.	" "
	26	3	Corn	" , Beans	Poor	Dry Farm
	27	4	2 Corn, 2 Idle	" , Squash	Poor	Flood Irrigated
	30	30	20 Corn, 10 Idle	" , Beans, Squash	Ave.	" "
	31	7	2 Corn, 5 Idle	" " "	Poor	" "

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s-t ld	Type of Farm	Class of Land	Soil	Slope %	Recommendation	Potential Acres	Acres to be Subjugated	Cost per Acre	Total Co
e.	Flood irrigated	B	S	1-2	Wire spreaders	0	6	$20	$ 120
e.	" "	B	S	1-2	" "	5	9	20	180
e.	" "	A	S	1-3	" "	0	3	20	6
e.	" "	A	S	1-2	" "	0	18	20	360
e.	" "	A	S	2	" "	0	2	10	20
e.	" "	B	S	1	None	0	0	0	
e.	" "	A	SL	1.5	None	0	0	0	
	" "	A	SL	1	None	0	0	0	
e.	" "	A	SL	1	None	20	0	0	
e.	" "	A	SL	1	None	10	0	0	
	" "	A	SL	1	None	20	0	0	
	" "	A	SL-CL	1	None	50	0	0	
e.	" "	A	S	1	Wire spreaders	0	3	5	$ 1
	" "	B	S-SL	1.5	Contour list	0			
						316	518	(Ave.) $14.60	$ 7,56

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TABLE XVII. (concluded)

Quad. No.	Farm No.	Acreage	Present Crops	Suggested Crops	Present Yield	Type of I
24 110°45' 36°30'	32	6	Corn	Corn, beans, squash	Ave.	Flood irri
	33	4	Corn, squash	Same as now	Ave.	"
	34	3	Corn, 6 idle	Corn, squash	Ave.	"
	35	18	10 corn, 2 squash	" " , oats	Ave.	"
	40	2	Corn	Corn, squash	Ave.	"
	41	1	Corn	" " , melons	Ave.	"
	42	1	Corn	" " "	Ave.	"
	43	4	Idle	Corn, peaches, grapes	-	"
	44	5	Corn	" " "	Ave.	"
	45	3	Corn	" " "	Ave.	"
	46	20	Idle	" " "	-	"
	47	0	Idle	" " "	-	"
95 110°45' 36°15'	1	3	Corn	Corn, squash, beans	Ave.	"
	2	2	Idle	" "	-	"
Grand Totals		805				

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certain items a break-down to sub-units could not be made and only the total figure for the Unit is given. In any case, the figure for the entire Unit is, perhaps, more accurate than the figures for the various sub-units and in any case where a comparison is to be made with other units, total figures should be used. A break-down of figures of the the various sub-units is helpful only to a limited extent.

III. THE EFFECT OF HUMAN ACTIVITY ON THE NATURAL RESOURCES

A. DESTRUCTION OF VEGETATION WITH SOIL AND WATER LOSS

Destruction of vegetation adjacent to farming areas, permanent water supplies, and trading posts is very prevalent throughout this Unit. Vegetation in the northern and western portion of this Unit has received less use and is, consequently, in a poor state of condition. Constant mis-use of the range area, especially around Red Lake, Kaibito and Cow Springs, has resulted in a very sparse vegetation, the reduction of plant vitality, and an increase in erosion potential. The light-textured soils which characterize the area are very susceptible to wind erosion upon the depletion of vegetation. Areas which are mis-used and on which the vegetation has been killed out soon become active sand dunes very difficult to stabilize. Depletion has reached the extent around Cow Springs

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that all perennial species have been killed out leaving only annual weeds and grasses in their place. Large barren areas near Cow Springs and Red Lake are testimony of this mis-use. With such vegetative depletion, there comes an increased erosion hazard and an increased loss of moisture.

Woodland management has not exhibited extreme over-use except in localized areas. The use for the most part has been slight. Clear cutting of trees and leaving high stumps has shown inefficient use of woodland. This is especially true on the slopes of Black Mesa and in the areas around population centers. With the destruction of trees, comes consequent increase in erosion hazard with added moisture losses. Woodland stands in the western portions of the area have been used only lightly. Combined with this factor, is a light-textured soil which produces little runoff. Consequently, woodland stands have little watershed value. The areas which have the more important watershed value in maintaining water on the ground exhibit more extreme mis-use with a depletion of forest resources.

B. CHANGE OF VEGETATION

Indicators of over-grazing are to be found throughout the entire area. Snakewood, yellowbrush, three-awn grass, and other species, either unpalatable or of low palatability, are

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predominant over large areas, especially around population centers, farming areas, and permanent water supplies. The more nutritious and palatable species have been killed out, but mis-use of the land in more favorable conditions of competition have resulted in a greater amount of the less palatable species.

Even though vegetative density has not been greatly reduced in some areas, available forage for livestock has been greatly reduced because of the influx of unpalatable species and the reduced volume growth. Continued over-grazing has reduced the vitality of palatable species and when moisture and soil conditions are such that plants could produce forage, their vitality is so low that a slow recovery is noted. Proper range management with its component factors, such as proper stocking, proper distribution of stock, and proper seasonal use will do much to correct this condition.

C. DESTRUCTION OF FARMLAND

The light-textured soils typical of this Unit are very susceptible to wind erosion and very little has been done by the Indians to prevent such soil and moisture losses from occurring. Only in a few instances are provisions made for the spreading of water on farmland. Gully heads are allowed to remain unchecked and it is a common practice to allow fields to remain fallow. Harvesting is done in such a way

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that all stover is removed, allowing the soil to be free for active wind erosion. Lister plowing is not practiced and leveling and bordering of fields was not noted except in irrigated areas. The above factors produce a condition where extreme soil and moisture losses occur. Plans for correcting such conditions are to be included in the recommendations for farmland.

Cultural practices within the Unit are not conducive to soil and moisture conservation. Fall listing of the fields is not practiced. Fall and winter crops were not noted. With the farmland left idle or unprotected from wind, valuable top-soil losses are heavy.

D. DESTRUCTION OF WILDLIFE AND WILDLIFE HABITAT

Competition with increased livestock numbers, depletion of vegetation and soil and moisture losses have resulted in a poorer wildlife habitat than once characterized this area. Large herds of antelope once ranged in the area. They became practically extinct, but because of protection, have increased to a number of from 35 to 50 head. Mountain sheep once ranged in the area, but because of extensive killing, are not to be found in the area at present. Rabbits and other small game are held to a minimum because of hunting. Resting places for migratory waterfowl are, on the whole, very scattered and very poor throughout the area.

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PART TWO

ESTABLISHMENT OF PROPER LAND USE

I. NECESSARY ADJUSTMENTS

A. PROPER RANGE CONTROL

1. Grazing Dates

Unit No. 1 is recommended for yearlong grazing provided that permanent water is developed in sub-units 2 and 4. If it is impossible to obtain water in these areas, further study will be necessary to formulate a plan of seasonal use that will result in proper use of range resources in the area. Disregarding water, the area is yearlong range and in the future, if a system of seasonal use is adopted, any portion of the Unit may be used at any season of the of the year.

2. Proper Class of Stock

The area should be stocked with either sheep or cattle and should include productive stock of as high quality as the range will permit for economic production. Enough horses to fulfill the needs of the people should remain, but none in excess. The recommended requirement in this regard is six horses per family and eight to ten horses per consumption group where the group is large.

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3. Proper Numbers of Livestock

The numbers of livestock in Unit No. 1 is not to exceed the maximum carrying capacity of 34,186 sheep units yearlong, distributed as follows:

Sub-Unit	1	Kle Chee	5,370	sheep	units	yearlong
" "	2	Coppermine	9,755	"	"	"
" "	3	Kaibito	2,780	"	"	"
" "	4	Tse Skizzie	4,727	"	"	"
" "	5	Red Mesa	3,589	"	"	"
" "		Cow Springs	4,751	"	"	"
" "		Black Mesa	2,483	"	"	"
" "	6	Buck Pasture	700	Rams	1/6 to 11/20	

Methods of maintaining accurate livestock statistics in regard to livestock population of the area should be provided. It is recommended that using the 1937 dipping records for sheep and goats and the 1937 round-up tally for cattle and horses as a basis, these figures be kept up to date and corrected from time to time by dipping vat records and future round-ups.

4. Sires and their Care

Three bucks per 100 ewes is recommended, or a requirement of approximately 700 bucks is required. A pasture located about 12 miles southwest of Kaibito has already

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been constructed to care for these animals. Improvement of the market type and quality of bucks in this area should continue. The program was started by the Government purchase of rams this past summer. Culling of all old, unsound, or off-type rams in the area should become a vital part of the program. The sale or disposal of unsound, light-fleeced, or off-type rams would rid the range of unprofitable livestock.

A requirement of five bulls per 100 cows is recommended for the area. These herd sires should be of good type and quality. All scrub, old, or unsound bulls should be removed from the range; to allow them to stay is to make for uneconomic livestock production.

5. Breeding and Lambing

Breeding season is recommended from November 20 to January 5, at which time the bucks should be released from the pasture. This will make lambing season begin April 20.

6. Shearing

Shearing should begin June 1. Shearing plants of the machine type should be installed at Antelope Reservoir, the Coppermine, Kaibito, Red Lake, and Cow Springs. There should be education as to proper shearing, tying and sorting fleeces, and proper handling of the wool. This practice in time will increase the market value of the product.

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7. Salting

In order to stop the depletion of the range resources in the saltbush areas, it will be necessary for the Indians to purchase more salt for their sheep. This practice of depending on saltbush as a source of salt for livestock should be stopped, for not only does the range suffer abuse in areas where salt species occur, but this inefficient source of salt is not adequate to meet the needs of livestock and severe economic losses are incurred in this manner.

8. Herding

Herding practices over the entire area need to be modified to meet the demands of proper land use regarding range resources. To reduce the effect of close herding or depletion of range resources through excessive use and trampling, a system of loose herding, (herding from the front of the herd instead of the rear) and bedding out should be established. If this is impossible because of such small units of production, 50 to 150 sheep per flock, a multiple corral system of herding is recommended whereby herds are bedded in one corral for a short period of time and then moved to another. Rotation bedding grounds in this manner will reduce the effect of continued use of the same bed-ground over extended periods of time.

9. Range Water Developments

Present water development for the Unit includes recommendations on 20 new developments and 15 maintenance projects that are fully described in Construction Program Section of this report. Water

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development is of vital importance in regulating range usage and deserves serious consideration in Land Management Plans for the area.

10. Livestock Movements and Distribution

The distribution of livestock over the entire Unit as uniformly as possible, as forage and water resources permit, is essential to proper use of range resources of the area. Further water development and use of temporary water when it is available will aid materially in proper use of range resources and obtain a more even distribution of livestock throughout the area. All concentration of livestock around cultivated areas and around permanent water should be avoided as much as possible for in most instances, these areas are already in a severely depleted condition, in many cases only annual or unpalatable species are present. Long shifts of livestock should be eliminated as nearly as possible. With usage of the range on the yearlong basis, this should eliminate the necessity of long seasonal shifts. For example: it should eliminate Crooked Finger's movement from Antelope Reservoir to Badger Spring. Either one location or the other should be selected as his range and his livestock allowed to remain there yearlong. A movement of stock twice a year, approximately 50 miles, will thus be eliminated. Stock movements from this Unit to surrounding units should be eliminated. Owners that, at present, go from one unit to another should select one or the other unit as their range and stay within whichever they choose.

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11. Protection from Poisonous Plants

Careful herding methods should effectively control livestock losses from poisonous plants especially in regard to greasewood. Proper handling of livestock, and not over-grazing these areas, should reduce livestock losses to a minimum. Eradication of poisonous plants does not seem feasible in view of the present small death loss in the area.

12. Reduction of Injurious Rodents

Prairie dogs are by far the most injurious range rodent in this area and definite control is needed over large areas. Rodent control on range land should follow the priority as listed on 300,000 acres of range land.

(1)	Treatment of Type N-1 (See map.) 304 acres	$ 45.00
(2)	Treatment of Type N-6 6,904 acres	$ 830.00
(3)	Treatment of Type N-2 4,606 acres	$ 690.00
(4)	Treatment of Type N-8 71,660 acres	$10,750.00
(5)	Treatment of Type N-4 4,563 acres	$ 685.00
(6)	Treatment of Type N-7 76,154 acres	$11,425.00
(7)	Retreatment of Red Lake-Cow Springs Area 88,000 acres	$7,000.00
(8)	Treatment of Type N-3 775 acres	$ 115.00

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(9) Treatment of Type G-1	20,448 acres	$ 1,065.00
(10) Treatment of Type G-30	9,056 acres	$ 1,350.00
(11) Treatment of Type N-5	17,699 acres	$ 1,650.00
TOTAL RANGE RODENT CONTROL RECOMMENDED	300,169 acres	$37,605.00

13. Control of Predatory Animals

There is, at present, no recommended control of predatory animals in this Unit. In future years it may become desirable and necessary to control coyotes in order to encourage open herding of sheep. If these animals become numerous enough to warrant control, such control is recommended.

14. Range Waterspreading and Erosion Control

Waterspreading and erosion control projects on range land are relatively small jobs and because of their remote location on the Reservation, unit costs on the projects will be relatively high. Location of the following projects will be found on Map No. ___.

Erosion Control Project #1 Quad 110°45' 36°30'

This project lies 6 miles south of Tonalea. Numerous small gullies at the head of two larger gully heads are causing severe soil losses in the valley. It is recommended that dikes to concentrate the water, and drop structures be constructed and that erosion control on the small gullies be established.

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1,000 acres of range land and 85 acres of flood-irrigated farmland is affected. The cost is $1,500. Planting is also proposed for this area. (See Range Planting Possibilities.)

Erosion Control Project #2 Quad. 111°00' 36°45'

This project lies south of Kaibito about 9 miles, and consists of controlling a gully 10' deep which is actively headcutting back into valuable range land. Construction of a dike around the gully head and another to keep the water out of the gully, is recommended. 2,500 acres of range land and 20 acres of farmland are affected. Cost is estimated at $1,900.00

Waterspreading Area #50 Quad. 110°45' 36°45'

South of White Mesa. This location for this project is located about 1/2 mile above the site located during the water-spreading survey in 1935. Diverting the water from this wash will benefit 5 acres of farmland and 200 acres of range land. Estimated cost, $250.00, including subjugation of agricultural land.

Erosion Control Project #1 Quad. 111°00' 36°30'

Eight miles south of Kaibito. This gully is endangering 25 acres of farmland, 2,000 acres of range land, and a stock-water reservoir. It is planned to raise the dam on the reservoir to make an equalizing structure and ditch the water to the farmland. This will prevent further headcutting into range land and will provide a more stable water supply for the farmland. Estimated cost, $1,170.00

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Erosion Control Project #1 Quad. 110°45' 36°45'

About 10 miles northeast of Kaibito. Numerous small gullies are actively cutting in a long, fairly level valley. It is recommended that diversion and spreader structures be constructed to spread the water and control erosion. 900 acres of range land and 38 acres of farmland are affected. Cost is estimated at $1,200.00.

Erosion Control Project #1 Quad. 111°00' 36°45'

Along Kaibito-Gap road. The road has been re-located several times and numerous gullies have formed along the remaining ruts. It is recommended to put in drain and thank-you-m'ams along 1-1/2 miles road. Acreage affected, 1,000 acres of range land. Estimated cost is $300.00

Erosion Control Project #2 Quad. 110°45' 36°30'

Just north of Cow Springs Trading Post. Several small gully heads are actively cutting in a rather broad, level valley. Wire spreaders and rock sausages are recommended. Five acres of irrigated farmland and 1,000 acres of range land are affected. Estimated cost, $600.00.

Erosion Control Project #1 Quad. 110°45' 36°15'

At this location a gully head 3' deep and 12' wide is cutting back into a relatively flat valley. Proposed treatment consists of a wire and rock sausage with an earth dike at each end to divert the water to the drop. 300 acres of range land is affected. Estimated cost, $95.00.

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15. Range Planting Possibilities

Planting possibilities on range land have been limited to small areas in Cow Springs and Red Lake Washes, more on an experimental basis than for extensive work. South of Tonalea, at two locations along the main drainage, it is recommended that areas of approximately 100 acres each be planted with sacaton and chamise among the greasewood that is already present. This is primarily for erosion control to prevent further gullying.

South of Cow Springs Trading Post, along the main drainages, severe depletion of range forage species has resulted and it is recommended that an area of 100 acres be planted with galleta, sacaton and chamise. At present, only Russian thistle is present. Any area planted should be fenced to protect it from livestock for a period of three years, and it would aid materially if such planting be placed so as to furnish a source of seed for the area lying below on the same drainages.

B. PROPER FARM MANAGEMENT

1. Present Farmland

a. Subjugation and Flood Irrigation

Table No. XVII on page 74 of this report shows the present and potential farmland to be found in L.M.U. No. I, showing location, acreage, present crops,

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suggested crops, type of farm, soil, slope, recommendations, and cost of subjugation per acre and per farm. 518 acres of present and potential farmland has been recommended for subjugation at an average cost of $14.60 per acre. This consists primarily of spreading water to receive more efficient use of water resources or leveling and bordering of the land. Erosion control on farmland is also handled to a large degree by the proper handling of water. Projects for land subjugation and erosion control on agricultural land with justification are included in the construction program for this Unit.

b. Cultural Practices

A change of cultural practices, especially to contour or deep listing of the land, is recommended on 269 acres of present agricultural land. General recommendations in regard to cultural practices for all agricultural land include fall plowing to reduce insect population and damage, cultivation to control weeds and conserve moisture, and strip-cropping to reduce wind erosion.

c. Erosion Control

(1) Planting

Windbreak planting is to be encouraged throughout the entire Unit, but because of low rainfall and in most cases, a relatively uncertain water supply, actual planting recommendations have been limited

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to three locations where water supply is adequate and a need for windbreaks is important. Windbreak planting at Red Lake, Cow Springs and 7 miles southeast of Red Lake have been recommended and are included in Table _____ under the Construction Program.

(2) Engineering Structures

Engineering structures to prevent or control erosion on agricultural land consist primarily of spreaders on the farmland. Additional engineering structures to control erosion on agricultural land include an equalizing reservoir in Cow Springs Wash 2 miles above Cow Springs Lake to prevent flooding of present farmland and allow for development of an additional 120 acres of farmland. An estimate has been made of the cost of this project, but it is merely indicative. Detailed surveys are needed by Engineering, Soils, and Agronomy to determine the actual cost and feasibility of the project. From observations conducted during the present survey the project is easily justified, but more information is necessary before final plans are drawn up on the project. It is proposed to construct a dam with a core wall and outlet pipe. The farmland below must be drained before crops can be raised.

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Another erosion control and flood control project is located at Red Lake. Each year the agricultural land of approximately 120 acres is flooded, causing severe damage to the crops. Two plans have been submitted. Plan A is more desirable, but is difficult to justify on increased return on agricultural land. Plan B is suggested, provided that Plan A is unfeasible from an economic standpoint as determined by detailed surveys. Plan A consists of constructing a dike to divert the water away from the south end of the farms, leaving an opening to furnish enough water for flood irrigation purposes.

Plan B is to spread the water evenly over Farm #1. This would materially reduce flood damage during minor floods but would have little effect on maximum floods. More detailed surveys in the area are needed to determine the feasibility of this erosion and flood control work.

d. Protection from Pests

(1) Cultural Practices

Fall plowing is recommended throughout the area to reduce insect hazard, especially grasshoppers, cutworms, and army worms. If fields are plowed in furrows at right angles to the prevailing wind, wind

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erosion will be less than if the fields are left bare of crops and smooth. More moisture will be absorbed from this method than from not plowing.

(2) Rodent control is recommended around infested agricultural areas. These areas should extend for a radius of about 1/2 a mile to a mile around the cultivated area.

Rodent control recommendations around cultivated areas in this Unit are as follows:

	Estimated Cost:
Treatment of Cow Springs Farms 1,200 acres	$180.00
Treatment of Red Lake Farms 900 acres	135.00
Treatment of White Mesa Farms 1,100 acres	165.00
Treatment of farms south of Red Lake 1,300 acres	195.00

Beside the above recommended rodent control work, insect infestation should be combated by poisoning. This is especially recommended for grasshopper infestation.

e. Harvesting and Storing

Under present conditions of cultivation, hand methods are ample means of caring for harvests. However, with improved cultivation methods, increased yields and the

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development of additional agricultural land, improved machinery will have to be employed in order successfully and economically to harvest crops. This is especially true if the irrigated land at Cow Springs Lake is developed. Hay rakes, mowers, balers, etc. will be needed for economic handling of crops.

Store houses should be made rodent-proof and rodent control around storehouses will be necessary from time to time.

f. General Recommendations

General recommendations for improved farm management cover seed selection, variety of crops grown, and type of farming. Seed selection should be expleained to the Indians and they should be encouraged to practice selection in an attempt to increase the quality and quantity of yields. A larger variety of crops could and should be grown in this area. Peaches, alfalfa, vegetables, sudan grass, and clover should be grown more extensively than they are at present. No dry farming should be practiced in the area with the exception of Black Mesa as the rainfall is so low as to make crop failure very prevalent. Farm crops should be planted on an average from April 25 to May 1, and not later than May 10th. Feeding of agricultural products,

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such as corn stover, to livestock should be encouraged.

2. Potential Farmland

By diversion and economical use of floodwater, 325 acres of potential agricultural land can be subjugated. The location and description of this land will be found in Table XVII, page 74, of this report. All subjugation costs have been included in the figures of present and potential farmland in a previous paragraph. This figure does not include the construction of the diversion into Cow Springs Lake. The land irrigated from Cow Springs Lake is being flooded from floodwaters of drainage 4.5 (see map). It is recommended to divert the water from this drainage into Cow Springs Lake, raise the dam to increase storage capacity, and develop an additional 140 acres of land below the lake. Approximately 15 acres of land will be flooded by an increase in the reservoir capacity. A diversion dike of approximately 10,000 yds. of dirt provided with a 200' spillway (for large floods) and two 18" culverts will be needed to divert the water from the drainage to the lake. Approximate cost of the project is $3,100.00, using heavy equipment and $6,300.00, using teams. U.S.I.I.S. has already spent $9,000.00 on the project, which would make the expenditure on land developed, including subjugation cost of $15 per acre, $95.00 per acre if heavy equipment is used, and $115.00 per acre if teams are used. Further detailed surveys are needed on this project before final decision is reached.

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No land should be broken from native cover in this Unit for agricultural development unless adequate water is available for flood irrigation.

C. PROPER WOODLAND MANAGEMENT

1. Improvement of Woodland Stands

Any practice for proper land use in forested areas will invariably lead to improved conditions. Recommendations for specific stand improvement practices follow:

a. Cutting and Marking

Cutting practice in the Unit should conform to regulations as set forth by the Division of Woodland Management. Cutting of green material, especially posts and brush, should be made under the direct or indirect supervision of this Division. No green material should be cut without being marked. Such areas as afford available products are delineated as full-use or restricted-use areas (see map). A permit is required for cutting of green material, such permit to be obtained from the District Supervisor. It will be the responsibility of the Division of Woodland Management to mark trees to be cut, or to train markers for that purpose.

Clear cutting of any stand or portion thereof is not to be permitted unless it is decided that such area

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could better be used for other than the production of forest products. Posts may be cut on restricted or full-use areas when trees have been marked and a permit has been issued;in any case, porper slash disposal will be necessary to reduce fire hazard and potential insect and pathological invasion. At the present time there are more than 73,300 posts available for use in the 9,955 acres full-use area, and the 100,920 acres restricted-use area. The fuel resources of the Unit amount to more than 33,700 cords of dead material.

In this Unit ample woodland area provides more than enough woodland products for the needs of the population. However, Unit No. 3 is not so fortunate and large amounts of woodland products are exported to that Unit. An area on Black Mesa lying south of a line due east of Red Lake as far as the Unit boundary, has been designated as a use area for the Hopi Indians at Tuba City. The remainder of the area may be used as a supply for woodland products for other Indians from Unit No. 3, provided they acquire permits to cut green material. Dead and down firewood may be obtained without permits. No change in the policy of allowing these Indians to come to Unit No. 1 for woodland products is recommended.

b. Grazing in Woodland Stands

Present practices regarding use of woodland for grazing is resulting in severe damage in certain areas.

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Close herding, bedding down at the same corrals over extended periods of time, and over-utilization of range resources are to be corrected. Bedding out or multiple corral systems will be necessary to relieve the present conditions. Close herding and concentration of livestock in woodland stands should be eliminated as completely and rapidly as possible. Woodland stands in this area may be classified and used as yearlong range.

c. Police Power

In order to enforce the recommendations and plans in regard to stand improvement, the persons who direct the plans must have police power with severe enough penalties that regulations may be enforced effectively.

2. Fire Protection

At the present time, because of a large percentage of the stands in the area exhibiting a relatively thin crown cover and a sparse undergrowth, the fire hazard is low. No system of fire protection is proposed at present. In future years, if the fire hazard increases, a system of fire protection will be needed. Provisions can be made at such times as a system is deemed advisable.

3. Reforestation and Afforestation

There are no recommended sites in the Unit for reforestation. At Cow Springs Lake, if the proposed diversion with

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desilting plot is constructed, an area is proposed for afforestation. Principal tree species to be planted is cottonwood.

D. WILDLIFE DEVELOPMENT

1. Improvement of Habitat

Any program that increases vegetative cover, conserves moisture, or prevents erosion will improve the native wildlife habitat. Planting of Cow Springs Lake according to Diagram L-350 is recommended to improve this lake as a resting place for migratory waterfowl. The desilting plot at Antelope Reservoir and any reservoir desilting plots fenced in the future according to Diagram L-468 is recommended. At all planting sites, if the improvement of wildlife habitat is borne in mind when selecting species, wildlife conditions will be improved.

2. Protection

Continual protection of all game is recommended. Complete legal protection of the herd of antelope is highly desirable until such time that the herd is large enough to be utilized on a sustained yield basis.

E. GENERAL RECOMMENDATIONS

1. Education and Demonstration

Education and demonstration as to the proper practices

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governing land use in general should be an important part of the program. It is understood that education of the inhabitants of the area is a long-time program in itself. However, if the program is not started, its duration will be longer. It is true that the problems of education are difficult. It will be no easy task to change the ideas of present practices to those of proper land use, but if land management is to be successful, education together with enforcement of rules and regulations will be necessary.

The buck pasture will serve as a possible demonstration area for proper herding methods. The area is not fortunate in having no demonstration area within its boundaries. Farms which are selected for subjugation work might serve as demonstration of farming practices.

An education program should embrace the following:

a. Proper range management and animal husbandry practices including: proper herding methods, proper selection and livestock improvement, proper shearing, breeding, and lambing, proper salting and livestock distribution.

b. Proper farm management practices including proper tillage, erosion control, economic use of water, dates of planting, proper harvesting and storing of produce, seed selection and crops.

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c. Proper woodland management including proper use of grazing resources in woodland stands, proper cutting practices, proper slash disposal benefits derived from use on a sustained yield basis.

d. General principles and practices regarding proper land use.

2. Social Adjustments

Figures in regard to wage work are low for this Unit because of the relative lack of developments, only one day school, and no demonstration area. Wage work om construction, roads, etc. was small and a large amount of irregular wages were charged to L.M.U. No. 3. There is at present no recommendation regarding distirbution of wage work other than the general recommendation that persons employed should, insofar as possible, come from consumption groups which have, at present, a low annual income.

In considering the development of agricultural land, it will be advisable to investigate thoroughly the needs of the people and to distribute newly developed land to families which have small herds and/or low annual income. The development of agricultural land under conditions where engineering costs seem excessive, may be justified from human dependency needs. Careful study in this regard is needed before projects are rejected on a strictly engineering or agronomic basis.

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II. THE CONSTRUCTION PROGRAM

A. GENERAL STATEMENT

In the formation of a construction program each phase of land management must be borne in mind in its proper relation to each other. A construction program consists not only of a list of projects worthy of consideration in priority, but each must be weighed in view of the picture of land use as a whole. It becomes difficult for personnel of only a few years' experience to properly evaluate the various projects in view of benefits to be derived from the land. Whereas a person in a single branch may be able to accurately weigh the merits of the various projects concerned by his own branch work and plan a fairly accurate priority for those projects, when those are weighed in relation to the projects as a whole, lack of experience as a land manager handicaps him. Furthermore, policy and other factors such as funds available, departments involved in construction, etc. are not clearly understood by the personnel of the study group. It is felt that if the study group furnishes a list of the projects in priority for the various branches with a list of the more desirable projects in view of the entire group, the formation of the actual construction program should become the duty of the Planning Board, a group more thoroughly trained and experienced in Land Planning.

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The projects which follow are recommended by the group and are listed in priority for the various branches.

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R.M. Justification @ 2.50 per A.Y.L.	Estimated Cost	Recommendations
$ 1,135	Unknown	Check well to see if it has sanded. May need deepening.
$ 1,250.00	"	" " " " " " " " " " "
$ 900.00	$ 900	Deepen well 100 ft.
$ 1,100.00	$ 815	Widen spillway. Repair desilting plot fence.
$ 1,000.00	$ 1,000	Raise dam. Enlarge spillway.
$ 650.00	$ 450	Repair spillway.
$ 960.00	$ 1,275.	Repair washed-out dam. Fence desilting plot.
$ 400.00	$ 25	Repair desilting plot fence.
$ 130.00	$ 65	Repair pipeline.
$ 775.00	$ 200	Develop spring.
$ 240.00	Unknown	Repair leak in reservoir.
$ 615.00	$ 625	Construct storage and repair troughs.
$ [illegible].00	$ 195	Install hand pump. Divert water away from well.
$ 720.00	$ 190	Develop well.
$ 420.00	$ 35	Repair desilting plot fence.
$ 320.00	$ 35	Install hand pump.
$ 9,885.00	$ 5,810	

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WATER DEVELOPMENTS AND MAINTENANCE
AT EXISTING SUPPLIES
(Listed in Priority)

Location (Quadrangle)	"S	"W	Project Number	Purpose	Area Serviced	Forage Acres	R.M. Justification @ 2.5 per S.U.Y.L.
111°00' 36°45'	16-3/4	13	1A-23	Stock Distribution	16,000	1,735	$ 1,735
111°15' 36°30'	3-3/4	3-3/4	1A-25	" "	16,000	1,250	$ 1,250.00
111°15' 36°45'	9-1/4	10-1/4	1A-28	" "	12,000	900	$ 900.00
111°15' 37°00'	16	4	1A-92	" "	10,000	1,100	$ 1,100.00
111°00' 36°30'	4-3/4	1/2	1A-47	" "	8,000	400	$ 1,000.00
111°00' 36°45'	15-1/2	3-1/4	1A-34	" "	6,500	610	$ 650.00
110°45' 36°45'	2	12	1A-14	" "	8,000	960	$ 960.00
111°00' 36°45'	1-1/4	1-1/4	1A- 6	" "	5,000	400	$ 400.00
111°15' 36°30'	8-3/4	13	1A-116	" "	6,500	130	$ 130.00
111°15' 36°45'	13-1/4	10	1A-107	" "	5,000	775	$ 775.00
111°30' 37°00'	13-3/4	4-1/4	1A-120	" "	7,000	240	$ 240.00
111°15' 37°00'	10	4	1A-91	" "	9,000	615	$ 615.00
110°45' 36°15'	3/4	9	1A-76	" "	3,000	210	$ 210.00
111°00' 36°45'	15-3/4	8-1/4	1A-21	" "	6,000	720	$ 720.00
111°15' 37°00'	13-1/2	9-1/2	1A-94	" "	7,000	420	$ 420.00
111°00' 36°30'			1A-84	" "	8,000	320	$ 320.00
TOTAL MAINTENANCE AND DEVELOPMENT					133,000	9,885	$ 9,885.00

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R.M. Justification per A.Y.L.	Estimated Cost	Recommendations
$1,920.00	$ 5,500	Drill well, install 50,000 gal. storage tank, troughs and windmill.
1,950.00	$ 5,500	" " " " " " " " " "
$ 800.00	$ 800	Construct reservoir.
$ 490.00	$ 2,000	" "
$ 670.00	$ 2,000	" "
$ 850.00	$ 1,500	" "
$1,050.00	$ 1,500	" "
$ 560.00	$ 2,000	" "
$2,140.00	$ 5,000	Drill well, install 50,000 gal. storage tank, troughs and windmill.
$ 835.00	$ 2,500	Construct reservoir and 80 to 160 acre desilting plot.
$1,280.00	$ 4,500	Drill well, install 50,000 gal. storage tank, troughs, and windmill.
$ [illegible]00.00	$ 1,500	Construct reservoir.
$1,110.00	$ 2,000	Construct reservoir and 80 to 160 acre desilting plot.
$ 640.00	$ 2,000	" " " " " " " " "
$ 820.00	$ 1,500	Construct reservoir
$13507.00	$ 40,500	

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WATER DEVELOPMENT (New Projects)
(Listed in Priority)

Location (Quadrangle)	"S	"W	Project Number	Purpose	Area Serviced	Forage Acres	R.M. Justification @ 2.50 per S.V.Y.L.
111°30' 36°45'	7-3/4	1-3/8	1A-151	Stock Distribution	14,000	1,962	$1,962.00
111°15' 36°45'	1	13	1A-150	" "	15,000	1,950	1,950.00
111°15' 36°45'	17	5-1/2	1A-154	" "	8,000	800	$ 800.00
111°15' 36°45'	10-1/2	3-3/4	1A-155	" "	7,000	490	$ 490.00
111°15' 36°45'	9-1/2	5-1/2	1A-156	" "	8,000	670	$ 670.00
111°00' 36°45'	2	10-1/2	1A-157	" "	7,500	850	$ 850.00
111°00' 36°45'	5	10-1/2	1A-158	" "	7,500	1,050	$1,050.00
111°00' 36°45'	11	13	1A-159	" "	7,000	560	$ 560.00
111°00' 37°00'	15-1/4	2	1A-161	" "	15,000	2,140	$2,140.00
110°45' 36°30'	16-1/2	5-1/4	1A-162	" "	4,500	835	$ 835.00
111°00' 36°30'	1	7	1A-160	" "	1,280	1,280	$1,280.00
111°158 36°30'	1-3/4	8-1/2	1A-153	" "	6,000	300	$ 300.00
110°45' 36°30'	15	2-1/2	1A-163	" "	5,000	1,110	$1,110.00
110°45' 36°15'	1-1/2	2-1/4	1A-164	" "	4,000	640	$ 640.00
111°30' 36°30'	1-1/4	1-1/4	1A-152	" "	8,000	820	$ 820.00
TOTAL NEW PROJECTS					131,500	13,507	$13507.00

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OTHER RANGE DEVELOPMENTS

Location (Quadrangle)	"S	"W	Project Number	Purpose	Area Serviced	Estimated Cost	Recommendations
111°30' 36°45'	7-3/4	1-3/8	Dipping vat	Stock Distribution	250,000	$2,000.00	Construct dipping vat if well proves satisfactory. Primary consideration.
111°00' 37°00'	15-1/4	2	" "	" "	250,000	$2,000.00	Same as above. Also primary consideration.
Red Lake			Shearing plant		120,000	$ 550.00	Construct power shearing plants. Secondary consideration.
Cow Springs			" "		70,000	$ 550.00	Same as above. Secondary, also.
Kaibito			" "		120,000	$ 550.00	Same as above. Secondary, also.
1A-151			" "		200,000	$ 550.00	Same as above. Secondary, also.
1A-161			" "		80,000	$ 550.00	Same as above. Secondary, also.

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PROJECTS ON FARMLAND

Farm Number	Location	% Slope	Soil*	Present Crop	ACREAGE Present	ACREAGE Potential	Treatment Recommended	Justifiable Expenditure	Cost per acre	Cost	Justification
							Sub-Unit No. 5				
33, 34, 35	110°45' 36°30' 1/4"S x 12"W										
WS #50	110°45' 36°45' 15-1/4"S x 10-3/4"W	1-2	S	Corn	25	10	Wire and brush spreaders	$1,400	$20	$ 700	Erosion control, water conservation increased acreage.
No. 8	110°45' 36°45' 15-3/4"S x11-1/2"W	2	S	Corn	1	4	" " " "	200	$12	$ 60	Erosion control, increased acreage of farmland.
" 10	110°45' 36°30' 15"Sx10-1/2"W	1-2	S	Corn	1		" " " "	$ 160	$15	$ 60	Erosion control, increased crop production.
" 32	110°45' 36°30' 3/4"S x 11"W	1-2	S	Corn	6		1,200 ft. wire & brush spreaders	$ 240	$20	$ 120	Erosion control, increased crop production.
No. 4	110°45' 36°45'	1-3	S	Corn	3		Border	$ 120	$15	$ 45	Erosion control, water conservation, increased crop production.
8 and 9	111°00' 36°30 3"S x 4-1/2"W	1-2	S-SL	Corn	15	10	Wire and brush spreaders	$1,000	$15	$ 375	Erosion control, water conservation, increased acreage and crop yield.
6 and 14	110°45' 36°30' 14"S x 7"W	1	S	Corn	5		Level and border	$ 200	$15	$ 75	Erosion control, water conservation, increased yields.
No. 13	110°45' 36°30' 15-1/2"Sx9-3/4"W	1-2%	S	Corn	7		Border	$ 280	$20	$ 140	" " " " " "
" 16	110°45' 36°30' 14"S x 6-1/4"W	1-3%	SL	Corn	2		Border	$ 80	$12	$ 24	" " " " " " " "
" 1	110°45' 36°15' 3/4"S x 13"W	1%	S	Corn	3		150' wire spreaders	$ 140	$ 5.00	$ 15	" " " " " " " "

*S = Sandy SL = Sandy loam SCL = Sandy clay loam

FW 226

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NN00094

PROJECTS ON FARMLAND

Farm Number	Location	% Slope	Soil*	Present Crop	ACREAGE Present	ACREAGE Potential	Treatment Recommended	Justifiable Expenditure	Cost per acre	Cost	Justification
							Sub-Unit No. 5				
No's. 17 and 18	110°45' 36°30' 8"S x 7-1/4"W	1-2	S to SL	Corn, 40 Idle, 20	Irr.,20 Fld.irr.40	100	Border (Add stoi[illegible])	$16,000	$15	$2,100	Erosion control, conservation of wate[illegible] increased acreage and production of farmland.
21, 44, 45, 46, 47	110°45' 36°30' 5"S x 5"W	1	SCL	Corn Idle	40	100	See Eng. Report	9,600			
8, 9, 10	110°45' 36°30' 16-3/4"S x 11-1/2"W	1-2	S	Corn, 55 a Idle 20	75	10	8,500 ft. brush and wire spreaders	3,400	$10	$ 850	Erosion control, water conservation, increased acreage.
No. 4	111°00' 36°30' 1/2"S x 4-1/2"W	1-2	S-SL	Corn	10		Border	400	$25	$ 250	Erosion control, water conservation, increased crop production.
5	111°00' 36°30' 1/4"S x 4-3/4"W	1	S-SL	Corn	18		Level and border	$ 720	$20	$ 360	Erosion control, water conservation, increased crop production.
1 and 6	111°00' 36°30' 5-1/2S x 1-1/2"W 1/4"S x 5-1/2"W	1-2	S-SL	Corn, 4 Squash, 2	6	20	Border	$ 1,040	$18	$ 468	Erosion control, water conservation, increased crop acreage.
No. 25	110°45' 36°30' 5"S x 1-1/2"W	1-2	S-SL	Corn, 8	10	10	Border	$ 800	$18	$ 360	Erosion control, water conservation, increased crop acreage.
27 and 30	110°45' 36°30' 4"S x 2"W	1-2	S-SL	Corn, 22 Idle, 12	34		5,100 ft. wire & brush spreaders	$ 1,360	$15	$ 510	Erosion control, water conservation increased crop production.
No. 19	110 45' 36 30' 7-3/4"S x 6-1/4"W	1-2	S	Corn	3	2	Border	$ 200	$18	$ 90	Erosion control, water conservation increased crop acreage.
No's. 1 & 2	110°45' 36°30 17"S x 12-1/2"W	1	S	Corn	22		2,200 lin. ft. wire & brush spreaders	$ 880	$10	$ 22	Erosion control, water conservation Increase of production.
No 40	110°45' 36°30' 0"S x 13"W										

*S = Sandy SL = Sandy loam SCL = Sandy clay loam

(continued)

F.W. 227

CV-6417-201

NN00095O

PROJECTS ON FARMLAND

Farm Number	Location	% Slope	Soil*	Present Crop	ACREAGE Present	ACREAGE Potential	Treatment Recommended	Justifiable Expenditure	Cost per acre	Total Cost	Justification
											Note: No present or potential farmland in Sub-Unit No. 1.
							Sub-Unit No. 2				
No's. 6 and 7	111°15' 36°30 0"S x 9"W	1-3	S	Corn	8		Wire spreaders	$ 320	$18	$144	Erosion control and increased crop production.
No. 3	111°15' 36°30' 5-1/2"Sx1-1/2"W	1-2	S	Corn, 5a	9		Wire and brush spreaders	$ 360	$18	$162	Erosion control and increased crop production.
							Sub-Unit No. 3				
No. 2	111°00' 36°45' 9-1/4"Sx4-3/4"W	1.5	S-Sl	Corn	3		Border	$ 120	$20	$ 60	Head erosion control, water conservation, increased crop production.
" 14	111°00' 36°45' 12"S x 1-1/4"W	1-2	S	Idle	4		Border	$ 160	$10	$ 40	Head erosion control, water conservation, increased crop production.
" 17	111°00' 36°45' 6-3/4"x2-3/4"W	1-2	S	Corn, 1 a. Squash, 1 a.	2		Border	$ 80	$15	$ 30	Water conservation, increased crop production.
							Sub-Unit No. 4				
No. 27	110°45' 36°45' 4-1/2"Sx10-1/4"W	2	S	Corn	10	10	Border	$ 800	$20	$ 40	Water conservation, erosion control, increased crop production.
" 28	110°45' 36°45' 4-1/2"Sx10-3/4"W	1	SCL	Corn	8	10	Border	$ 720	$15	$270	Water conservation, erosion control, increased crop production.
" 29	110°45' 36°45' 4-1/2"S x 9-1/4"W	2	SL	Corn, 2 a. Idle, 2 a.	4		Border	$ 160	$20	$ 80	Water conservation, erosion control, increased crop production.

* S = Sandy SL = Sandy loam SCL = Sandy clay loam

(continued)

F. W. 228

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NN000951

F.W. 229

EROSION CONTROL AND WATER SPREADING PROJECTS
(other than those already listed)
(see farm projects, listed in priority)

Location (Quadrangle)	Classification	Recommendation	Estimated Cost	Justification
110°45' 36°30'	EC #1	Drop structure and dike	$1100	Erosion control on 1000 acres range land & 85 acres farmland.
111°00' 36°45'	EC #2	Diversion dike & spreaders	$1900	" " " 2500 " " " & 20 " "
111°00' 36°30'	EC #1	Equalizing reservoir	$1170	" " " 250 " " " & 25 " "
110°45' 36°45'	EC #1	Spreader fences	$1200	" " " 900 " " " & 38 " "
111°00' 36°30'	EC #2	Eros. Contr. along road	$ 450	" " " 1000 " " "
111°00' 36°45'	EC #1	" " " "	$ 300	" " " 1000
110°45' 36°30'	EC #2	Wire spreaders-sausages	$ 600	" " " 1000 " " " & 4 " "
110°45' 36°15'	EC 1	Rock wire sausages & dike	$ 95	" " " 300 " " "

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NN00096

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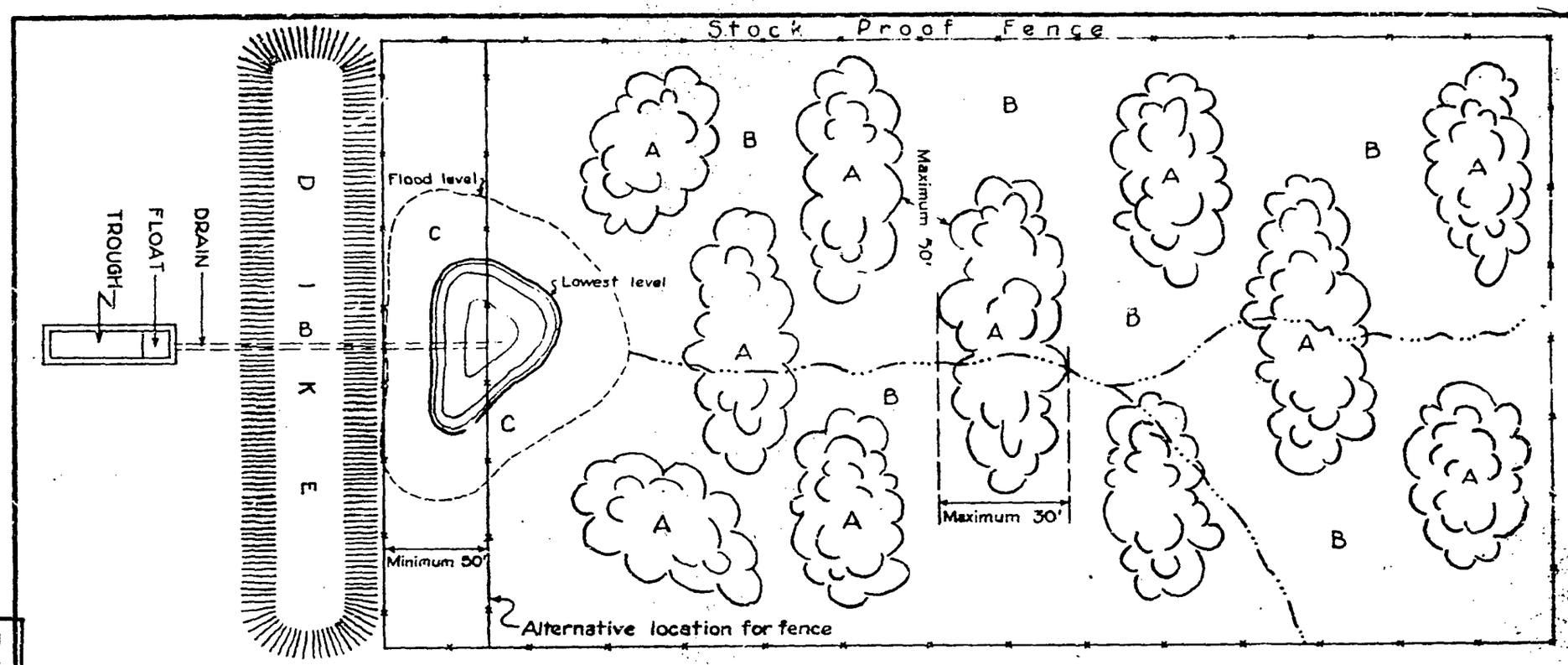
RODENT CONTROL PROJECTS FOR IMMEDIATE CONSIDERATION

Type Number	Location	Acreage	Land Use of Area	Type of Rodent Control	Cost per acre	Total Cost	
Cow Springs Farms		1,200	Farm	Rats, mice, prairie dogs	$ 0.15	$ 180.00	200 acres farmland
Red Lake		900	Farm	" " " "	0.15	135.00	240 acres farmland
White Mesa 110 45' 36 45'		1,100	Farm	" " " "	0.15	165.00	150
South Red Lake		1,300	Farm	" " " "	0.15	195.00	150
N-1	Sub-Unit III	304	Range	Prairie dog	0.15	45.00	Protection for range land. F.A.F. 12. Annual value of land, $36.00
N-6	" " V	6,904	Range	" "	0.15	830.00	Annual value of forage on range land, $975.00
N-2	" " V	4,606	Range	" "	0.15	690.00	" " " " " " ", $550.00
N-8	" " V	71,660	Range	" "	0.15	$10,750.00	" " " " " " ", $10,000.00
N-4	" " I	4,563	Range	" "	0.15	685.90	" " " " " " ", $650.00
N-7	" " III	76,154	Range	" "	0.15	$11,425.00	" " " " " " ", $8,360.00
				PROJECTS OF SECONDARY PRIORITY			
N-3	" " II	775	Range	" "	0.15	115.00	Range forage annual value, $55.00
G-1	" " IV	20,448	Range	" "	0.15	3,065.00	Range forage value per annum, $2,050.00
G-30	" " IV	9,056	Range	" "	0.15	1,350.00	" " " " " , $900.00
N-5	" " II	17,699	Range	" "	0.15	1,650.00	" " " " " , $1,750.00

F. W. 230

NN000953



PLANTS SUGGESTED FOR PROPAGATION

A - Suitable shrubs such as Chamisa, Greasewood, Hackberry, Willow, Tamarisk, etc.

B - Planted or natural grasses.

C - Wild Millet or Chufa in intermittent water.

GENERAL NOTES

Arrangement of plants is intended merely to illustrate the importance of thicket edge and is not to be followed exactly.

Opening of drain to be elevated at least 2/3 of depth of water at average level. For detail of drain, see diagram L-469.

Fence preferably should not enclose dike. If no float and trough are installed, a minimum of 50' of charco (measured perpendicular to fence) should be outside of fence, and if size allows, fence should extend across deepest part of charco.

F.W. 231

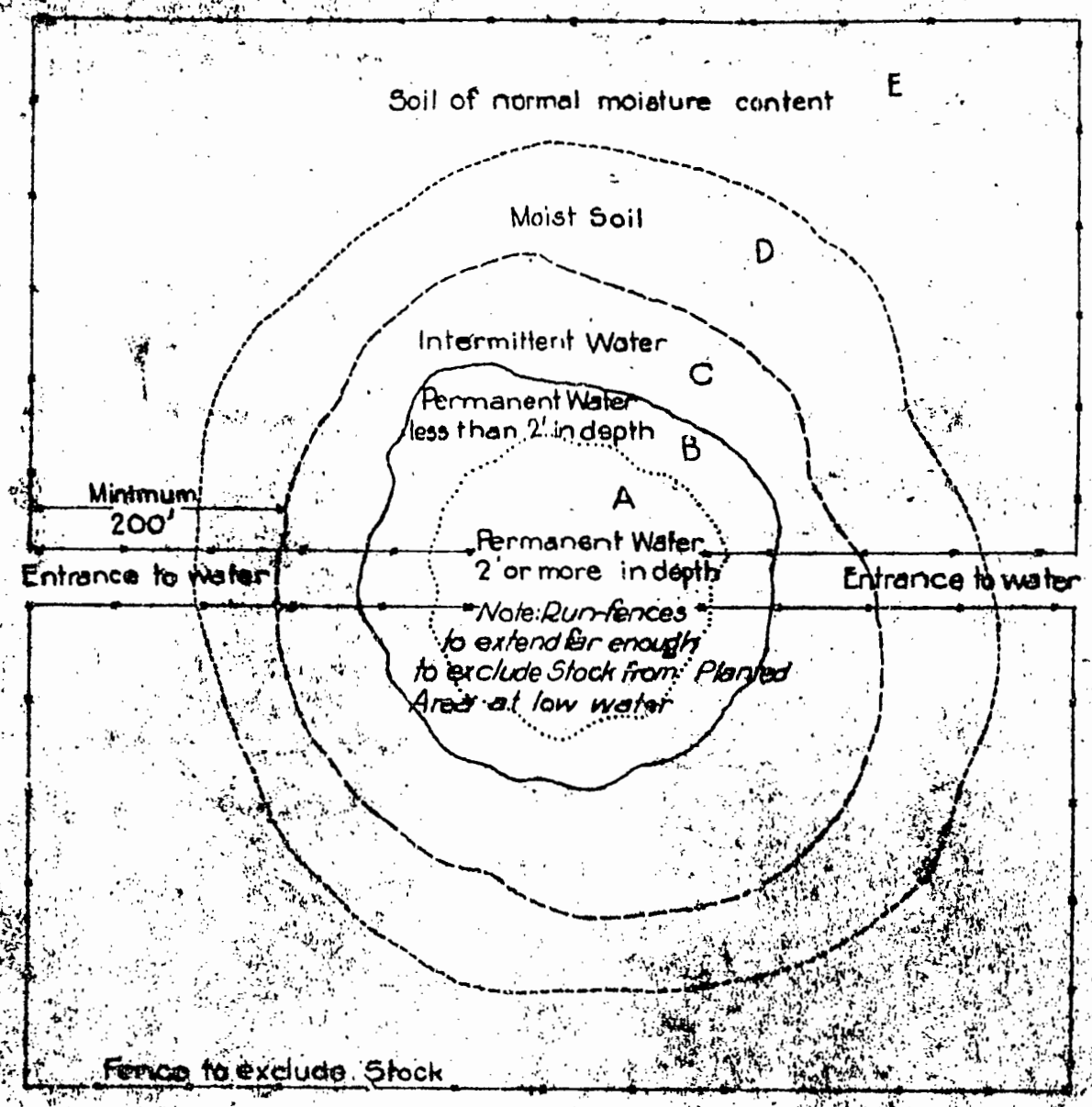
L-468

DIAGRAM SHOWING USE OF SHRUB CLUMPS AS BAFFLES TO IMPEDE THE FLOW OF WATER INTO RESERVOIRS, AND ALSO TO FURNISH COVER, FOOD & MAXIMUM TENSION ZONE FOR WILDLIFE - SHOWS ALSO A SUGGESTED PLAN FOR INCREASING THE VALUE OF STOCK WATERING RESERVOIRS TO WATERFOWL.

Compiled - Paul Phillips Approved _____ Retraced - 2-17-37. W.R.

CV-6417-201

NN000954



Plants Suitable for Propogation

A Sago Pondweed. (Potamogeton pectinatus)
B Wapato (Sagittaria latifolia), Bulrush (Scirpus americanus)
C Wild Millet (Echinochloa crus-galli), Cheat (Bromus secalinus)
D Wild Millet (Echinochloa crus-galli), Nettle, Sedges (Carex sp)
E Native shrubs & high grasses

IDEAL PLAN OF REFUGE FOR MIGRATORY WATERFOWL
Compiled by Paul Phillips
April 16, 1938
References: W. L. McAtee, U.S.D.A. Bulletin 1335

F. W. 232

Hilo P. Benton — Approved — L-356