WORK REPORT

DETAILED CONSERVATION

SURVEY

****

LOKASAKOD IRRIGATION PROJECT

LAND MANAGEMENT UNIT 7

****

Lawrence A. Fronsugh
Junior Soil Surveyor

Howard F. Johnson
Assistant Soil Technologist

****

U. S. DEPARTMENT OF INTERIOR

C.I.C.O NAVAJO SERVICE

****

1941

APPROVED:

FIRMAN H. BROWN
Engineer in Charge
Irrigation Service
Navajo Service

F. W. 1452

ALL SERIES NAMES

are provisional

PENDING FINAL CORRELATION

by

THE INTERBUREAU CORRELATION COMMITTEE

F. W. 1453

TABLE OF CONTENTS

			Page
INTRODUCTION			1
CLIMATE			1
AGRICULTURAL HISTORY and PRACTICE			4
CONSERVATION SURVEY			4
IRRIGATION, DRAINAGE and ALKALI			7
Table	I.	Climatological Data from Weather Stations near Lokasakod	3
	II.	Acreage of Soil Types	8
	III.	Acreage of Land Use	9
	IV.	Analysis of Soil Samples	10
Figure	I.	Topography of Lower Part of Bidachochi Valley	2
	II.	Dinnchotso Clay Loam Profile	5
	III.	Tolani Clay Loam at Wash Bank near Tangent 2100 feet East of Base Line Station 120+00	5
	IV.	Looking up Gully toward the Headcut on Tangent 2100 feet off Base Line Station 120+00	6
Appendix	I.	Soil Series Descriptions	12
	II.	Description of Sample Profiles	20
	III.	Land Class Criteria	30
	IV.	Conservation Survey Legend	32
	V.	Township Plats	35

F. W. 1454

INTRODUCTION

The Lokasakod Irrigation Project is located approximately four miles south of Indian Wells Trading Post, Land Management Unit 7, Navajo County, Arizona.

The 1324 acres covered by the Conservation Survey included a considerable amount of Indian Allotment Land; to date the status has not been tied into the Conservation Survey Map with sufficient accuracy to plot. The survey covered parts of Sections 25, 26, 27, 34, 35 and 36 of Range 21 East, Township 23 North; and parts of Sections 1, 2, 3, 10 and 11 of Range 21 East, Township 22 North, Gila-Salt River Meridian. Appendix V shows the lands status section subdivisions and also indicates in general the survey area.

The survey was made by L.A. Bronaugh and H.F. Johnson the week of March 3 to 8, 1941.

The purpose of the survey was to gather and compile data necessary to evaluate the quality and quantity of land adapted to irrigation where the valley widens out below the Lokasakod Storage Reservoir and below a proposed diversion on the Bidachochi or Indian Wells Wash.

The area covered by the survey is a part of two smooth surfaced gently sloping alluvial valleys. Figure I shows the topography of the lower part of the area. Rough broken low hills generally bound the area on all sides except the east which follows the Bidachochi Wash.

Russian thistle (Salsola pestifer), other annuals and a scattered sacaton (Sporobolus spp.) are common on the recent alluvial fans. Blue gramma (Bouteloua gracilis) and galleta (Hilaria jamesii) occur on the older soils. Chamise (Atriplex canescens) is restricted to the low swales and water ways.

The elevation of the area is approximately 5,600 feet.

CLIMATE

No climatological data are available at the project. Records are available from Keams Canyon, Holbrook, Leupp, and Winslow. Table I is a summary of these data in tabular form. An estimate made for Lokasakod, based on these data, is also included.

F.W. 1455

CV-6417-201 NN001402

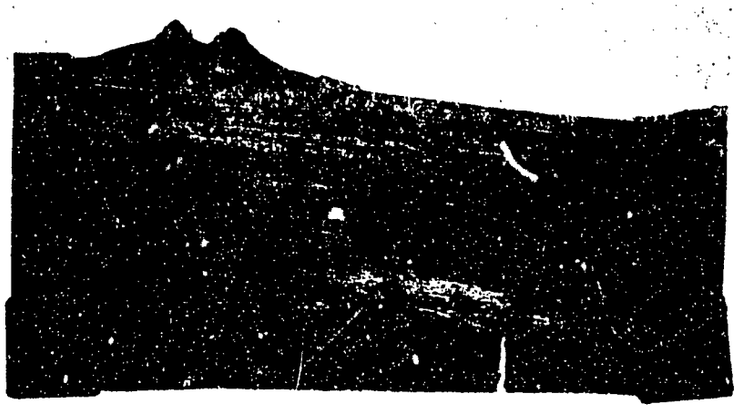

Figure I Topography of the lower part of Bidachochi Valley. Looking east from the low rim immediately west of Base line Station 80+00. The flag, x is on the Station.

F.W. 1456

CV-6417-201 NN001403

Table I. Climatological Data from Weather Stations near Lokasakod *

Station & Length of Record	Elevation (feet)	Length of Growing Season (Days)	Average Annual Temperature (F°)	Average Maximum Temperature (F°)	Average Minimum Temperature (F°)	Extreme Minimum Temperature (F°)
Jeddito	6,150					
Keams Canyon 16	6,600	133	50.0	65.3	34.8	-30
Holbrook 40	5,069	165	54.5	71.8	37.1	-21
Leupp 9	4,700	165	53.3	70.0	36.8	-12
Winslow 22	4,848	16[illegible]	55.0	71.4	37.9	-19
Lokasakod**	5,600	145				

Table I. (cont.)

Extreme Maximum Temperature (F°)	Average Annual Precipitation (in.)	Average Date Last Killing Frost in Spring	Average Date First Killing Frost in Fall	Latest Date of Killing Frost in Spring	Earliest Date of Killing Frost in Fall
104	12.43	May 19	Sept. 29	June 4	Sept. 13
106	9.25	May 4	Oct. 16	June 11	Sept. 22
105	7.07	May 6	Oct. 13	May 31	Sept. 10
107	8.[illegible]	May 6	Oct. 13	June 2	Sept. 27
	10.00	May 12	Oct. 4		

* U.S.D.A. Weather Bureau "Climatic Summary of the United States - Section 25 - Northern Arizona" Data from the establishment of station to 1930 inclusive.

** Estimated

F. W. 1457

CV-6417-201

NN001404

AGRICULTURAL HISTORY and PRACTICES

Flood water farming has been practiced on the fan of the Lokaskod Wash and also on the fans of some of the minor side drainages for a considerable time. Uncertain water supply has made the growing of crops hazardous; good yields of corn, melons and squash have been obtained under favorable seasons.

A tabulation of the planimeter data show 135 acres have been farmed by flood irrigation in the recent past. However, very little produce has been obtained for several years because of the dry seasons.

CONSERVATION SURVEY

The Detailed Conservation Survey includes an area of the Lokaskod Valley from its confluence with the Bidochochi Wash for about one mile upstream and the Bidochochi Valley, west of the wash for approximately 2 miles down stream. This includes all the flood water farms on the fan of the Lokaskod Wash.

Traverse boards were used for mapping with controls measured by stadia. The control points are located on the ground by iron pipes driven flush with the ground surface. The scale is 1 inch equals 660 feet or 3 inches equals 1 mile.

Five factors were mapped and indicated in the composite symbol; namely, soil type, slope group, erosion, land use and land class. The land class grouping is shown by cross hatching on the accompanying map; the other factors are shown in the symbol only.

Four soil series and eleven soil types exclusive of river wash, rough broken and rough igneous land were mapped. In general soils of the Tolani and Dinnehotso series are suited to irrigation and those of the Hunt and Todilto series are not. Appendix I gives a description of the series mapped. Appendix II is a skeleton description of each sample collected. As indicated by the analysis of soil samples, see Table IV, the textures within the delinations vary somewhat; that is small areas of sand and sandy loam may occur within the loamy sand soil type, etc.

The soils are brown or reddish brown in color, low in organic matter content, and rich in lime, gypsum and various calcium, magnesium and sodium salts Phosphate, while probably present in comparatively large quantities, occurs as an insoluble compound with calcium and is largely unavailable to plants. See Table IV.

Medium to light textures are predominate in the area. This facilitates all cultural practices. Some difficulty may be experienced with

F. W. 1458

CV-6417-201 NN001405

Figure II - Dennehotso clay loam profile. Taken at the pit at Sample location S-4 300 feet south of Base line Station 90+00. Note the fairly well defined surface soil, subsoil, and sandy substratum. This is a highly productive soil.

Figure III - Tolani clay loam at Wash bank near tangent 2100 feet east of Base line Station 120+00. This soil has been built up recently by the Wash before the gully started cutting. It is also very productive.

F. W. 1459

CV-6417-201 NN001406

Figure IV Looking up the gully toward the headcut on tangent 2100 feet off Base line Station 120+00. This loose friable soil headcuts very rapidly where water is wasted.

F. W. 1460

CV-6417-201

NN001407

Figure IV Looking up the gully toward the headcut on [illegible] feet off Base line Station 120-[illegible]. This loose friable soil headcuts very rapidly where water is wasted.

F. W. 1461

wind erosion on the lighter textured soils because of their loose structure. The subsoils and substrata are generally sandy which should permit adequate subdrainage; the areas of Hunt sandy loam and clay loam were classed as "C" land because of their tight heavy subsoil. Figure II is a profile of Dinnebotso clay loam showing the sandy substratum. Figure III shows the open profile of the less developed Tolani clay loam.

Wind erosion is active on the Lokasakod Wash fan. Accumulation has been rather rapid from material deposited by the wash. The sandy substrata permits rapid head cutting by under cutting where water from side drainage spills into Bidachochi Wash. Figure IV is looking upstream into a headcut.

One thousand thirteen acres or 77.7 percent of the 1324 acres surveyed are considered irrigatable. Of this 644 acres are "A" land, 321 "B" land and 45[illegible] "D-" land. Table II shows the acreage in each land class by soil type.

Appendix III defines each land class. A slightly higher dispersion ratio then is ordinarily permitted in class A and B land is thought not to be particularily serious because of the universally open soil and the high content of lime, calcium carbonate, present.

Almost all the soil mapped is well adapted to either irrigation farming or range water spreading where topography permits.

IRRIGATION, DRAINAGE and ALKALI

Irrigation is necessary for the production of crops in the area. The source of water is the Lokasakod Wash, the water to be stored in Lokasakod Reservoir and used as needed. No information is available as to the quality of this water. The land has been classified on the assumption that the water is satisfactory. Analysis should be made of this as soon as available in representative quantity.

Drainage should never become a problem unless water is grossly over used.

The alkali content of the soil is low. The moderately high dispersion ratio is probably caused by the relatively high ratio of sodium to calcium plus magnesium. If the water is good this should not be serious with so high a content of lime present. The pH is within the satisfactory range.

Howard F. Johnson

Howard F. Johnson
Assistant Soil Technologist

F. W. 1462

Table II. Acreage of Soil Types in Agricultural Soil Groups

Soil Type	Land Classes (Acres)					Total	
Number	A	B	B-	C	D	Acreage	%
19B					148	148	8.6
19I					6	6	.3
21.4					18	18	.9
21.7					110	110	6.0
35					54	54	2.4
57.7	101	51				152	8.3
57.13	133					133	10.0
57.16		16				16	.8
60.7		12		29		41	2.0
60.13				35		35	1.9
68.4			452			452	25.7
68.7	186	111				297	16.2
68.13	174				7	181	9.9
68.16		121				121	7.0
Total Acreage	644	321	452	64	343	1824	
Percent	35.2	17.7	24.7	3.5	18.8		100.0

F. W. 1463

CV-6417-201 NN001410

Table III. Present Acreage of Land Use within Area

Land Use	Land Class					Total	
	A	B	B-	C	D	Acreage	Percent
Waste Land					68	68	3.7
Pasture Land	615	317	350	64	275	1621	88.8
Cultivated	29	4	102			135	7.5
Total Acreage	644	321	452	64	343	1824	
Percent	35.3	17.7	24.7	3.5	18.8		100.0

F. W. 1464

CV-6417-201 NN001411

Table IV. Analysis of Soil Samples Collected

Analysis by SCS Soils Laboratory, Albuquerque, New Mexico

Lab. No.	Field No.	Location	(1) Depth	Sand	Silt	Clay	(2) Disp.	T.S.(3) Grav.	T.S.S.(4) Bridge	(5) pH
1191	7-1 A	1400' E. of Sta.	0-6	75.7	15.7	8.6	35.3	<0.5	0.02	8.20
1192	B	0/00	6-18	82.7	12.2	5.1	36.1	<0.5	0.02	8.40
1193	C		18-36	57.4	32.3	10.3	22.9	<0.5	0.10	8.35
1194	D		36-54	44.3	45.1	10.6	19.2	<0.5	0.14	
1195	E		54-72	55.5	34.6	9.9	21.4	<0.5	0.12	
1196	7-2 A	1650' NE of Sta.	0-6	81.0	5.4	6.6	30.9	<0.5	0.03	8.40
1197	B	40/00	6-13	82.4	10.7	6.9	35.9	<0.5	0.02	8.20
1198	C		13-36	69.6	16.0	14.4	24.4	<0.5	0.07	8.35
1199	D		36-54	81.1	11.5	7.4	22.7	<0.5	0.03	
1200	E		54-72	69.0	16.9	14.1	13.2	<0.5	0.03	
1201	7-3 A	1320' N. of Sta. 27/00	0-6	33.4	47.4	19.2	27.1	<0.5	0.10	8.30
1202	B		6-13	47.2	42.5	10.3	23.0	<0.5	0.07	8.20
1203	C		13-36	33.3	37.4	23.3	13.0	<0.5	0.14	8.25
1204	D		36-54	27.4	42.2	30.4	12.3	<0.5	0.14	
1205	E		54-72	20.3	46.4	33.3	16.9	<0.5	0.17	
1206	7-4 A	300' S. of Base	0-3	39.8	38.1	22.1	33.8	<0.5	0.10	8.40
1207	B	line Sta. 90/00	8-17	28.3	47.1	24.6	40.4	<0.5	0.11	8.45
1208	C		17-40	29.3	39.3	31.4	16.6	<0.5	0.11	8.50
1209	D		40-60	61.0	34.5	4.5	32.9	<0.5	0.13	
1210	7-5 A	Tangent 1220' E.	0-12	53.0	35.5	11.5	28.8	<0.5	0.07	8.50
1211	B	of Base line Sta.	12-30	23.8	34.9	41.3	21.0	<0.5	0.13	8.45
1212		50/00	30-60	49.4	38.4	12.2	14.4	<0.5	0.11	

F.W. 1465

CV-6417-201

NN001412

Table IV. (cont.)

Lab. No.	Field No.	Location	(1) Depth	Sand	Silt	Clay	(2) Disp.	T.S. Grav.(3)	T.S.S. Bridge(4)	(5) pH
1213	7-6 A	Approx. 3000' on	0-6	29.0	22.7	43.3	17.1	<0.5	0.10	1.25
1214	B	tangent at Sta.	6-13	15.5	32.7	51.3	[illegible]	<0.5	[illegible]	1.50
1215	C	50+00	13-36	24.2	52.3	[illegible]	40.7	<0.5	0.1[illegible]	1.60
1216	D		36-54	54.9	31.3	13.3	[illegible]	<[illegible]	[illegible]	
1217	E		54-72	64.3	30.1	5.1	[illegible]	<[illegible]	0.15	
1218	7-7 A	Base Line Station	0-6	61.3	29.7	[illegible]	[illegible]	<[illegible]	0.11	1.50
1219	B	40+00	6-13	60.6	29.5	[illegible]	[illegible]	<0.5	[illegible]	[illegible]
1220	C		13-36	29.3	[illegible]	[illegible]	[illegible]	<[illegible]	0.1[illegible]	[illegible]
1221	D		36-54	32.3	[illegible]	[illegible]	[illegible]	<[illegible]	0.17	
1222	7-8 A	W. Tangent 34+75	0-6	57.1	[illegible]	[illegible]	[illegible]	<[illegible]	[illegible]	1.40
1223	B	from Base Line Sta.	6-13	[illegible]	[illegible]	[illegible]	57.5	<0.[illegible]	[illegible]	[illegible]
1224	C	40+00	13-36	[illegible]	[illegible]	[illegible]	[illegible]	<0.5	0.14	1.60
1225	D		36-54	[illegible]	46.1	15.7	[illegible]	<0.5	0.14	
1226	E		54-72	53.0	36.4	10.6	20.7	<0.5	0.17	

(1) Depth in inches.
(2) Dispersion. Percent of the clay fraction that is dispersed.
(3) Percent total salts. Gravimetric method.
(4) Percent total salts. Analytical Bridge.
(5) pH Expresion of weak acidity or alkalinity 7.0 is neutral, below 7.0 is acid and above is alkaline.

Table IV. (cont.) Chemical Analysis of Selected above Samples

Lab. No.	Percent O.M.(7)	Percent "P"(8)	Percent $CaCO_3$	Parts per Million Ca	Mg	Na	Cl	SO_4	CO_3	HCO_3	Total
1191				35	Tr	70	10	20	0	245	390
1206	0.71	1.40	11.4	35	Tr	190	10	55	0	525	815
1210				35	Tr	130	10	55	0	500	730
1207	0.61	0.63	14.5								
1203	0.4[illegible]	0.34	14.5								

(7) Organic Matter.
(8) Carbon Dioxide Soluble Phosphorous.

F.W. 1466

CV-6417-201

NN001413

Azonal Alluvial-Subgroup A

Color -reddish brown
Origin -Jurassic sandstone
Development-none
Reaction -calcareous

Tolani Series, No. 68

The soils of the Tolani Series consist of very recent alluvial material exhibiting no apparent profile development. They occupy alluvial fans and low valley floors that are or recently have been subject to reoccuring floods. The soil materials are dominantly sandy in texture and reddish brown to brown in color. This soil represents the recently deposited and undeveloped member of its soil family. The surface soil is generally subject to wind erosion. Gully headcutting also proceeds very rapidly. Both white and black alkali salts may be present in local areas.

I. Profile

The soil consists of reddish brown and brown sandy loam and interspersed thin layers of silt and clay. It is calcareous and friable, and has a low organic matter content. There is no indication of translocation of lime or clay. The structure is large block or laminated typical in recently deposited sandy soil material.

II. Variations

Variations are a common characteristic of this soil. The color varies from brown through shades of red to lavender. The materials in the profile vary considerably but are generally open in the subsoil. Gravel fragments may be present either on the surface or buried as thin lenses in the profile.

III. Topography

Typical gentle sloping flood plains, often more or less hummocky, subject to wind erosion and excessive flooding.

F.W. 1467

CV-6417-201 NN001414

Tolani Series, No. 68 (cont.)

IV. Drainage

Good to excessive.

V. Native Vegetation

Russian thistle and other annuals are most common on these soils. Chamise, big rabbit brush and giant sacaton are the most common perennials.

VI. Utilization

These soils are well adapted to either flood or permanent water irrigation providing the alkali content is low. They often require protection against wind erosion.

VII. Distribution

General on fans and flood planes in the valley of the central and western portion of the Reservation.

F. W. 1468

CV-6417-201 NN001415

Azonal Alluvial - Sub group A

Color - reddish brown
Origin - red sandstone
Development - Slight
Reaction - calcareous

Dinnehotso Series, No. 57

This series is derived from recent alluvial deposits which have been subject to slight profile development. The soil occupies gently sloping to level valley floors, and is subject to occasional flooding. The soil materials are mixtures derived from sandstone and shale, and are predominantly reddish brown in color and light in texture. They develop alkali "slick spots" in local areas. Wind erosion is especially severe on this series in northern part of the Reservation.

I. Profile

a. Topsoil, 0 to 12", the surface soil is a light brown calcareous, massive, friable material, having a low organic matter content.

b. Subsoil, 12 to 24". The subsoil is reddish brown, more calcareous, massive to weakly prismatic structure, and friable. Lime accumulation appears as minute spicules, or as coating in root cavities.

c. Substratum, 24" plus. The substrata is light brown, calcareous, stratified sandy loam, friable and permeable.

II. Variation

The colors vary considerably, but are predominantly reddish-brown. Red and purple are observed in many profiles. Rock fragments sometimes found in the substratum.

III. Topography

Gently sloping to level valley floor.

F. W. 1469

CV-6417-201 NN001416

Appendix I. (cont.)

Dinnehotso Series, No. 57 (Con't)

IV. Drainage

Internal drainage is normally good unless affected by a high water table or erratic impervious layers causing perched water table.

V. Native Vegetation

Galleta, blue grama, and sacaton are the common grasses adapted to this soil. Chamise, Yellow brush, Rabbit brush, and Ephedra, are common browse species.

VI. Utilization

This soil is well adapted to, and extensively used for, irrigation. Alkali areas should be avoided.

VII. Geographic Distribution

Quite widely west of the Lukachukai Mountains.

Remarks:

The Tolani Series No. 68, Moenave No. 61, and Kempe No. 67 Series may be correlated with the Dinnehotso Series, because of similarity of profile.

Type Locality:

The Dinnehotso Irrigation Project, Type No. 12.

F.W. 1470

CV-6417-201 NN001417

Azonal Alluvial - Sub group B

Color	- reddish brown
Origin	- red shale
Development	- slight
Reaction	- calcareous

Hunt Series, #60

The Hunt soils are derived from alluvial materials from reddish brown shales. The profile shows a slight degree of weathering. The subsoil is heavy textured. High alkali content characteristic. The soils of this series occupy valley floors and are subject to periodic overflow. Sheet erosion is usually active because of normal sparse vegetation.

I. Profile

a. Topsoil, 0 to 12". The surface is reddish-brown with a purple cast, calcareous. Platey structure but friable, with a crust mulch surface. The organic matter content is low.

b. Subsoil, 12" to 40". The subsoil is reddish-brown, calcareous, prismatic structure with some vertical fracture lines, compact consistency.

c. Substratum, 40" plus. The substratum is stratified, moderate to heavy textured alluvium.

II. Variations

Colors vary but are dominantly reddish. Structure varies from platey to prismatic. Substratum sometimes lighter in texture.

III. Topography

Gently sloping to level valley floors, surface often cut by gullies.

F.W. 1471

CV-6417-201 NN001418

Appendix I. (cont.)

Hunt Series, #60, (Con't)

IV. Drainage

Surface, often restricted; internal, slow.

V. Vegetation

Drought and alkali resistant, shadscale, gallota, saaaton.

VI. Utilization

Not generally adapted to cultivation because of alkali content and restricted subdrainage. Has produced satisfactorily under optimum conditions.

VII. Distribution

General where Chin Lee formation occurs.

Note:

May correlate with "Navajo Series" as mapped on the "Winslow Soil Survey". Alkali often present in toxic quantities.

F. W. 1472

CV-6417-201 NN001419

Light Brown Desert - Residual

Color - reddi brown
Origin - sandstone
Development - strong
Reaction - calcareous

Todilto Series, No. 21

The Todilto soils are developed under arid or semi-arid conditions with rainfall ranging from 6 to 11 inches on Navajo, Wingate, Morrison and other sandstones. These soils are universally sandy and usually occupy a gently rolling or undulating topography. Exceptions to the sandy nature are found in depressions where the texture is often clay loam or heavier. Thin stony profiles are in evidence on wind eroded sections, little evidence of development can be found on some of these areas, but as a whole the Todilto profiles show moderate development.

I. Profile

a. Topsoil, 0 to 9". Reddish-brown, sandy loam, low in organic matter content, loose, m e, faint to mildly calcareous, ging 9" deep. This is underlain by:

b. Subsoil, 9 to 50". Reddish-brown, sandy clay loam, friable, breaking up into a cloddy or nut-like structure, calcareous, with small nodules appearing at depth of 20 inches plus. At 20 inches, or thereabout, the color becomes brown, texture definitely heavier (clay loam) with nut structure that is firm to pressure. Lime appears in nodules and along lines of fracture, and some colloidal stains to a depth of 50". Abruptly underlying the zone of maximum accumulation is:

c. Substratum, 50" plus. A zone of transition of loose, partially decomposed sandstone to a depth of about 12" where consolidated sandstone is encountered.

F. W. 1473

CV-6417-201 NN001420

II. Variations

May include profiles of color, texture, and depth variations. Areas of high wind activity may be non-calcareous on the surface, and a number of profiles lack the transition zone between the lower B and the present material, and in shallow phases the type development may be feeble.

III. Topography

Rolling, undulating, low hilly or mesa top topography.

IV. Drainage

Fair to good.

V. Native Vegetation

Ephedra, grama, galleta, snake wood (an overgrazed condition), mainly grassland.

VI. Utilization

This is a semiarid grassland that will not stand too severe over grazing without active wind erosion. Used primarily for grazing.

VII. Geographic Location

Scattered over all north central Arizona uplands.

Type Locality: Sandy loam, 7 miles west x 4 miles south.
Quad. 110° 15' x 35° 45'

Loamy Sand, 5 miles west x 2 miles south.
Quad. 110° 30' x 35° 45'

Remarks: The following series may correlate because of similarity in profile characteristics: White Mesa, No. 31; Salina, No. 36; and Round Rock, No. 41.

F. W. 1474

CV-6417-201 NN001421

Appendix II.

FORM FOR PROFILE DESCRIPTION AND RELATED INFORMATION

Soil Type [illegible].4 Observer Bronaugh No. _____ Date [illegible]

Location Lokasakod 140' E. of Sta. 0+00

HORIZON (Letter or No.)					
DEPTH	0-6	6-13	13-36	36-54	54-72
COLOR (Dry or moist)	brownish red	brownish red	brownish red	brownish red	brownish red
TEXTURE	Sandy loam	Loamy sand	Sandy loam	Loam	[illegible]
STRUCTURE (Character and size of aggregates)					
ORGANIC MATTER (Relative quantity and state of decomposition)	Low	Low	Low	Low	Low
CONSISTENCY (Dry or moist)					
PERMEABILITY					
EFFERVESCENCE with HCL	Strong	Strong	Strong	Strong	Strong
LIME (Distribution, physical condition)					
COLLOIDAL STAIN (Color, distribution)					
MINERALS					
CONCRETIONS					
SALTS %	0.02	0.02	0.10	0.14	0.1[illegible]
GRAVEL, STONES and BOULDERS					
WORM AND ROOT CASES (Size, frequency)					
ROOTS (Character, relative abundance					
Dispersion %	35.3	36.1	22.9	19.2	[illegible].4
pH	3.20	3.40	3.35		
SAMPLE NO. 7-1	A	B	C	D	E

F. W. 1475

Appendix II. (cont.)

FORM FOR PROFILE DESCRIPTION AND RELATED INFORMATION

Soil Type 63.4 Observer Bronaugh No. _____ Date 3-5-41

Location Lokosakod 1650' NE of Sta. 40+00

HORIZON (Letter or No.)					
DEPTH	0-6	6-18	18-36	36-54	54-72
COLOR (Dry or moist)	Light brown	Light brown	Light brown	Light brown	Light brown
TEXTURE	Sand	Loamy sand	Sandy loam	Loamy sand	Sandy loam
STRUCTURE (Character and size of aggregates)					
ORGANIC MATTER (Relative quantity and state of decomposition)	Low	Low	Low	Low	Low
CONSISTENCY (Dry or moist)					
PERMEABILITY					
EFFERVESCENCE with HCL	Strong	Strong	Strong	Strong	Strong
LIME (Distribution, physical condition)					
COLLOIDAL STAIN (Color, distribution)					
MINERALS					
CONCRETIONS					
SALTS %	0.03	0.02	0.07	0.03	0.03
GRAVEL, STONES and BOULDERS					
WORM AND ROOT CASES (Size, frequency)					
ROOTS (Character, relative abundance					
Dispersion %	30.9	35.9	24.4	22.7	19.2
pH	8.40	8.20	8.35		
SAMPLE NO. 7-2	A	B	C	D	E

F. W. 1476

Appendix II. (cont.)

FORM FOR PROFILE DESCRIPTION AND RELATED INFORMATION

Soil Type 63.7 Observer Bronaugh No. _____ Date 2-6-41

Location Lokasakoo 1320' N. of Sta. 27+00

HORIZON (Letter or No.)					
DEPTH	0-6	6-13	13-36	36-54	54-72
COLOR (Dry or moist)	Reddish brown	Reddish brown	Reddish brown	Light brown	Light brown
TEXTURE	Loam	Loam	Clay loam	Clay	Clay
STRUCTURE (Character and size of aggregates)	Laminated	Laminated			
ORGANIC MATTER (Relative quantity and state of decomposition)	Medium	Low	Low	Low	Low
CONSISTENCY (Dry or moist)	Mellow	Mellow	Mellow	Mellow	Mellow
PERMEABILITY	Medium				
EFFERVESCENCE with HCL	Medium	Medium	Medium	Medium	Medium
LIME (Distribution, physical condition)					
COLLOIDAL STAIN (Color, distribution)					
MINERALS					
CONCRETIONS					
SALTS %	0.10	0.07	0.14	0.14	0.17
GRAVEL, STONES and BOULDERS					
WORM AND ROOT CASES (Size, frequency)					
ROOTS (Character, relative abundance					
Dispersion %	27.1	33.0	13.0	12.3	16.9
pH	8.30	8.20	8.25		
SAMPLE NO. 7-3	A	B	C	D	F

F. W. 1477

Appendix II. (cont.)

FORM FOR PROFILE DESCRIPTION AND RELATED INFORMATION

Soil Type 57.13 Observer H.F. Johnson No. _____ Date 3-[illegible]-41

Location Lokyaskod 200' South of Base line Sta. 90+00

HORIZON (Letter or No.)	A_1	A_2	B	C	
DEPTH	0-[illegible]	[illegible]-17	17-40	40-60	
COLOR (Dry or moist)	Med. reddish brown	Med. reddish brown	Med. reddish brown	Light reddish brown	
TEXTURE	Clay loam	Clay loam	Light clay	fine sandy loam	
STRUCTURE (Character and size of aggregates)	Single grain to fragmentary	Weakly Prismatic	Weakly Prismatic	Massive Stratified	
ORGANIC MATTER (Relative quantity and state of decomposition)	0.17 %	0.61 %	0.4[illegible]%	Low	
CONSISTENCY (Dry or moist)	Soft	Soft	Mellow	Soft	
PERMEABILITY	Med. High	Med. High	Medium	High	
EFFERVESCENCE with HCL	Medium	Medium	Medium	Weak	
LIME (Distribution, physical condition)	11.4 Disseminated	14.5	14.5 Occasional	Disseminated	
COLLOIDAL STAIN (Color, distribution)			Spickules Faint		
MINERALS					
CONCRETIONS					
SALTS %	0.10	0.11	0.11	0.13	
GRAVEL, STONES and BOULDERS					
WORM AND ROOT CASES (Size, frequency)			Scattered	Scattered	
ROOTS (Character, relative abundance	Many small	Many small	Many small	Scattered	
Dispersion %	38.3	40.4	1[illegible].6	22.9	
pH	8.40	8.45	8.50		
SAMPLE NO. 7-4	A	B	C	D	

F. W. 1478

Appendix II. (cont.)

FORM FOR PROFILE DESCRIPTION AND RELATED INFORMATION

Note: To be used as directed by proper technical supervisor.

SOIL TYPE Pinnehotso Clay loam (57.13) OBSERVER H.F. Johnson DATE 3-6-41

NAME AND NO. OF SURVEY Lokasakod STATE Arizona COUNTY [illegible]

SAMPLE NO. AND LOCATION 7-4 300' South [illegible] Base line Station 90+00

ORIGIN AND PARENT MATERIAL Alluvial from Morrison formation (?)

STAGE OF DEVELOPMENT Slight

DISTRIBUTION (Relative to Natural Features and Extent) Through valley except on fans of main [illegible].

COMMON VARIATIONS IN TYPE AS DESCRIBED

Site Conditions and Interpretation of the Soil in Relation to its Site

Erosion Class IPPI Erodibility Heavy if water concentrates (Sheet) (Gully) (Wind)

Factors Inducing Erosion

Land Use or Dominant Native Vegetation Range - galleta [illegible] of chaparral some sacaton in local areas

Topography 1 (% Slope) 4 (Slope Group) [illegible] (Exposure)

Relative Moisture Holding Capacity Medium (A Horizon) High (B) Medium to low (C)

Relative Rate of Run-off Low (High, Low, Medium) Internal Drainage good

Factors Contributing to Run-off

Position and Influence of Water Table None

Crop or Range Adaptation

Recommended Cultural Practices

Special Notes

F. W. 1479

Appendix II. (cont.)

FORM FOR PROFILE DESCRIPTION AND RELATED INFORMATION

Soil Type 63.7 Observer H.F. Johnson No. Date 3-[illegible]-41

Location Lokasakod Tangent 120[illegible]' E. of Sta. 50+00

HORIZON (Letter or No.)					
DEPTH	0-12	12-30	30-60		
COLOR (Dry or moist)	Brown, Med. Lt. Reddish brown	Brown, Med. Lt. Reddish brown	Light reddish brown		
TEXTURE	Sandy loam	Light clay	Loam		
STRUCTURE (Character and size of aggregates)	Stratified or laminated	Stratified or laminated	Stratified or laminated		
ORGANIC MATTER (Relative quantity and state of decomposition)	Medium	Medium	Low		
CONSISTENCY (Dry or moist)	Soft	Soft	Dry Mellow		
PERMEABILITY	High	Medium	High		
EFFERVESCENCE with HCL	Medium	Medium	Medium		
LIME (Distribution, physical condition)	Disseminated	Disseminated	Disseminated		
COLLOIDAL STAIN (Color, distribution)	None				
MINERALS					
CONCRETIONS					
SALTS %	0.07	0.1[illegible]	0.11		
GRAVEL, STONES and BOULDERS					
WORM AND ROOT CASES (Size, frequency)					
ROOTS (Character, relative abundance	Many small	Many small	Many small		
Dispersion %	[illegible]	21.0	14.4		
pH	8.50	8.45			
SAMPLE NO. 7-5	A	B	C		

F.W. 1480

Appendix II. (cont.)

FORM FOR PROFILE DESCRIPTION AND RELATED INFORMATION

Note: To be used as directed by proper technical supervisor.

SOIL TYPE 63.7 OBSERVER H.F. Johnson DATE 3-6-41

NAME AND NO. OF SURVEY Lokaseakod STATE Arizona COUNTY Navajo

SAMPLE NO. AND LOCATION 7-5 Tangent 1200' E. of Base line Sta. 50+00

ORIGIN AND PARENT MATERIAL Alluvial from Morrison (?)

STAGE OF DEVELOPMENT Recent

DISTRIBUTION (Relative to Natural Features and Extent) On fan and in valley of Lokaseakod Wash

COMMON VARIATIONS IN TYPE AS DESCRIBED Variable as all recent deposits

Site Conditions and Interpretation of the Soil in Relation to its Site

Erosion Class 4 Erodibility (Sheet) Very (Gully) Moderate (Wind)

Factors Inducing Erosion Loose sandy profile

Land Use or Dominant Native Vegetation Cultivated Annuals and scattered Shrubs

Topography 1 (% Slope) A (Slope Group) E & SE (Exposure)

Relative Moisture Holding Capacity N.A. (A Horizon) (B) (C)

Relative Rate of Run-off Low (High, Low, Medium) Internal Drainage good

Factors Contributing to Run-off

Position and Influence of Water Table

Crop or Range Adaptation

Recommended Cultural Practices

Special Notes

F.W. 1481

CV-6417-201 NN001428

Appendix II. (cont.)

FORM FOR PROFILE DESCRIPTION AND RELATED INFORMATION

Soil Type 68.16 Observer H. F. Johnson No. Date 3-6-41

Location Lokasakod - Approximately 3000' W. on tangent at 50+00

HORIZON (Letter or No.)					
DEPTH	0-6	6-18	18-36	36-54	54-72
COLOR (Dry or moist)	Med. reddish brown	Med. reddish brown	Light reddish brown	Light reddish brown	Light reddish brown
TEXTURE	Light clay	Heavy clay	Silty clay loam	Sandy loam	Sandy loam
STRUCTURE (Character and size of aggregates)					
ORGANIC MATTER (Relative quantity and state of decomposition)	Low	Low	Low	Low	Low
CONSISTENCY (Dry or moist)	Friable	Friable	Friable	Mellow	
PERMEABILITY	Med. Low	Med. Low	Medium	High	High
EFFERVESCENCE with HCL	Med.	Med.	Med.	Med.	Med.
LIME (Distribution, physical condition)	Dissem.	Dissem.	Dissem.	Dissem.	Dissem.
COLLOIDAL STAIN (Color, distribution)	None				
MINERALS					
CONCRETIONS					
SALTS %	0.10	0.13	0.13	0.18	0.15
GRAVEL, STONES and BOULDERS					
WORM AND ROOT CASES (Size, frequency)					
ROOTS (Character, relative abundance					
Dispersion %	17.1	23.2	40.7	18.8	31.4
pH	8.25	8.50	8.60		
SAMPLE NO. 7-6	A	B	C	D	E

F. W. 1482

Appendix II. (cont.)

FORM FOR PROFILE DESCRIPTION AND RELATED INFORMATION

Soil Type 60.7 Observer H.F. Johnson No. _____ Date 3-5-41

Location Lokasakod Base line Sta. 40+00

HORIZON (Letter or No.)					
DEPTH	0-6	6-18	18-36	36-54	
COLOR (Dry or moist)	Reddish brown	Darker Reddish brown	Darker Reddish brown	Darker Reddish brown	
TEXTURE	Sandy loam	Sandy loam	Light clay	Light clay	
STRUCTURE (Character and size of aggregates)	Single grain	Stratified	Stratified	Stratified	
ORGANIC MATTER (Relative quantity and state of decomposition)	Low	Low	Low	Low	
CONSISTENCY (Dry or moist)	Soft	Mellow	Friable	Very Hard	
PERMEABILITY	High	Medium			
EFFERVESCENCE with HCL	Med.	Med.	Strong	Strong	
LIME (Distribution, physical condition)	Disseminated	Disseminated	Disseminated	Disseminated	
COLLOIDAL STAIN (Color, distribution)	None				
MINERALS					
CONCRETIONS					
SALTS %	0.11	0.07	0.16	0.17	
GRAVEL, STONES and BOULDERS					
WORM AND ROOT CASES (Size, frequency)					
ROOTS (Character, relative abundance					
Dispersion %	35.5	41.6	13.0	8.3	
pH	3.50	3.65	3.30		
Clay too tough to obtain bottom sample					
SAMPLE NO. 7-7	A	B	C	D	

F.W. 1483

Appendix II. (cont.)

FORM FOR PROFILE DESCRIPTION AND RELATED INFORMATION

Soil Type 68.7 Observer H.J. Johnson No. _____ Date 3-6-41

Location Lokasakod N. Tangent 24+75 from Base Line 40+00

HORIZON (Letter or No.)					
DEPTH	0-6	6-18	18-36	36-54	54-72
COLOR (Dry or moist)	Brown	Brown	Brown	Reddish brown	brown
TEXTURE	Sandy loam	Sandy loam	Light clay	Loam	Sandy loam
STRUCTURE (Character and size of aggregates)					
ORGANIC MATTER (Relative quantity and state of decomposition)					
CONSISTENCY (Dry or moist)	Soft	Soft	Mellow	Mellow	Soft
PERMEABILITY	High				
EFFERVESCENCE with HCL	Medium	Medium	Medium	Medium	Medium
LIME (Distribution, physical condition)	Disseminated	Disseminated	Disseminated	Disseminated	Disseminated
COLLOIDAL STAIN (Color, distribution)	None				
MINERALS					
CONCRETIONS					
SALTS %	0.07	0.08	0.14	0.14	0.17
GRAVEL, STONES and BOULDERS					
WORM AND ROOT CASES (Size, frequency)					
ROOTS (Character, relative abundance					
Dispersion	12.1	57.5	22.7	24.9	22.7
pH	8.42	8.65	8.60		
SAMPLE NO. 7-3	A	B	C	D	E

F. W. 1484

CRITERIA FOR GROUPING SOILS FOR IRRIGATION

Class A Land - Recommended Excellent

Class A soils consist of the highest type of arable lands. They are easy to cultivate, are not susceptible to excessive erosion and retain and supply enough moisture and contain sufficient plant nutrients for the maintenance of those physical, chemical and biological conditions in the soil that favor continued production of moderate to high yields of all farm crops adapted to the locality, provided sound farm management is practiced. They exhibit at least 12 inches of tillable surface.

Class B Land - Recommended Good

Lands in this class are also recommended for irrigation. However, they are not as desirable nor of such high general value as Class A lands inasmuch as they may be more difficult to till and may not have as wide a range of crop adaptation. From the standpoint of inherent soil characteristics and environmental features, the soils may require one or more easily applied, simple practices, such as strip farming or heavy manuring, to insure safe and permanent cultivation. They should have at least 12 inches of tillable topsoil.

Class B Minus (-) Land - Good, Except Droughty and Susceptible to Wind Erosion

Soils in this class closely resemble those in Class B, except that the surface is either loamy sand or sand, and the subsoil and substratum are also usually very light in texture. As a consequence, they are highly susceptible to wind erosion and quite often droughty.

These soils, where they have excessive sub-drainage, are sometimes the only class suited to irrigation if the water available is of very poor quality, because extremely sandy surfaces will tolerate a higher sodium to calcium plus magnesium ratio before "freezing up".

F. W. 1485

CV-6417-201 NN001432

Class C Land - Marginal or Doubtful

Soils placed in this class are considered marginal or of doubtful quality for irrigation. They generally have one or more characteristics, such as slope, erosion, depth of soil matle, extremes in surface textures, depth of water table, stoniness, and/or salt content which interfere with their use under irrigation. Soils in this class are often not sufficiently affected that their ability to produce is greatly lowered. An example of this condition is noted where black alkali "slick spots" occur intermittently in an area of what otherwise would be good land; for all purposes these spots are sterile and may either remain as they now are, grow larger, or gradually become productive, depending upon a great number of factors. Another quite common example of land in this class are the moderately heavy clays, rather poor in physical condition. These are very difficult to manage and require a great deal more effort to produce a crop; they are not adapted to as wide a range of crops and seldom produce as high yields as do Class A and B land.

In general, Class C soils do not produce satisfactory yields and cannot be depended upon to continue production without extensive, expensive treatment.

Class D Land - Not Recommended

Lands in Class D are not recommended for irrigation.

F. W. 1486

CV-6417-201 NN001433

Appendix IV.

CONSERVATION SURVEY LEGEND*

COMPOSITE SYMBOL - - - - Soil Type / Slope--Erosion (Sheet, Gully, Wind) / Land Class

Soil Series and Type.

Types and symbols are shown on map and described in the report.

Slope.

- A 0-2%
- B 2-5%
- C 5-10%
- D 10% and over

Erosion.

Normal Geologic Erosion.

- O. No apparent erosion.
- W. Normal erosion (active).
  - Ws. Normal sheet erosion.
  - Wg. Normal sheet and gully erosion.
  - Ww. Normal wind erosion.

Accelerated Erosion.

Water Erosion.

Sheet Erosion.

1. Less than 25 percent of the topsoil removed.
2. 25 to 75 percent of the topsoil removed.
3. 75 percent or more of the topsoil removed, or all the topsoil and less than 25 percent of the subsoil removed.
4. All the topsoil and 25 to 75 percent of the subsoil removed.
5. All the topsoil and 75 percent or more of the subsoil removed; parent material may be eroded.
6. The symbol 6 is reserved for conditions of local significance, such as slips or catsteps.

Gully Erosion.

7. Occasional gullies: More than 100 feet apart.
8. Frequent gullies: Occurring less than 100 feet apart but including less than 75 percent of the delineated area.
9. Very frequent or large gullies. This symbol is used to designate an intricate network [illegible] to be outlined, or any appreciable area of which more than 75 percent is gullied.

* Reference - "Soil Conservation Handbook", E. A. Norton, USDA Misc. Pub. No. 352, 1939.

F. W. 1487

CV-6417-201 NN001434

Gully Erosion (continued)

Note: 7, 8, or 9. Shallow gullies: Can be crossed with tillage implements but would be obliterated by normal tillage.

7, 8, or 9. Deep gullies that have penetrated into compact subsoil or through it into compact parent material.

7V, 8V, or 9V. Deep gullies that have penetrated into friable parent material.

Accumulations.

+ Recent accumulations.

15+ Denotes the depth of accumulation in inches (not often used).

⚠ Detrimental deposits indicated by the symbol within a triangle.

Wind Erosion.

Removals.

F. Less than 25 percent of the topsoil removed.
R. 25 to 75 percent of the topsoil removed.
S. 75 percent or more of the topsoil removed, or all of the topsoil and less than 25 percent of the subsoil removed.
T. All the topsoil and 25 to 75 percent of the subsoil removed.
U. All the topsoil and 75 percent or more of the subsoil removed; parent material may be eroded.

Accumulations.

F. Shallow accumulations, less than 6 inches, either level or in hummocks.
H. Moderate accumulations, level, 6 to 12 inches.
K. Moderate accumulations, hummocky, 6 to 12 inches.
L. Severe accumulation, 12 to 36 inches.
M. Small dunes, 36 to 72 inches high.
N. Large dunes, 72 inches, or more, high.

Note: The proportion of the area covered is indicated by following the class letter with the numeral 2 to indicate one- to two-thirds of the area affected, or 3 to indicate more than two-thirds of the area affected. No numeral following indicates less than one-third of the area affected.

F.W. 1488

Undifferentiated Erosion.

Q. This symbol indicates erosion undifferentiated as to character or degree, such as may occur on farm yards and similar areas.

Stabilized Erosion.

Stabilized erosion is indicated by overscoring the appropriate symbol, as $\overline{7}$ or $\overline{R}$, if it is evident that plant cover has recently reestablished normal erosion.

Land Classification (Irrigation only).

A. Excellent.
B. Good.
B-. Good, but highly susceptible to wind erosion.
C. Marginal.
D. Not recommended.

Note: Further discussion of land classes included in the report.

Land Use.

L. Cultivated land.
Ll. Orchard.
X. Idle land.
Xl. Waste land.
P. Pasture or range.
F. Woodland or timber.
$\overline{F}$. Grazed woodland.
H. Urban areas, farmstead, roads, etc.

Note: The land use symbol does not occur in the composite symbol, but as a separate symbol alone.

Miscellaneous Symbols.

(S.3) Soil sample number and location.

br Survey type boundary

----- Land use boundary (if different than the soil boundary)

Cobble stones on surface.

Rock outcrops.

Individual shallow gully.

Individual deep gully.

Individual deep, rapidly eating gully.

AAA Alkali area.

F. W. 1489