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EXECUTIVE SUMMARY GEOTECHNICAL SITING INVESTIGATIONS FY 81.(U)

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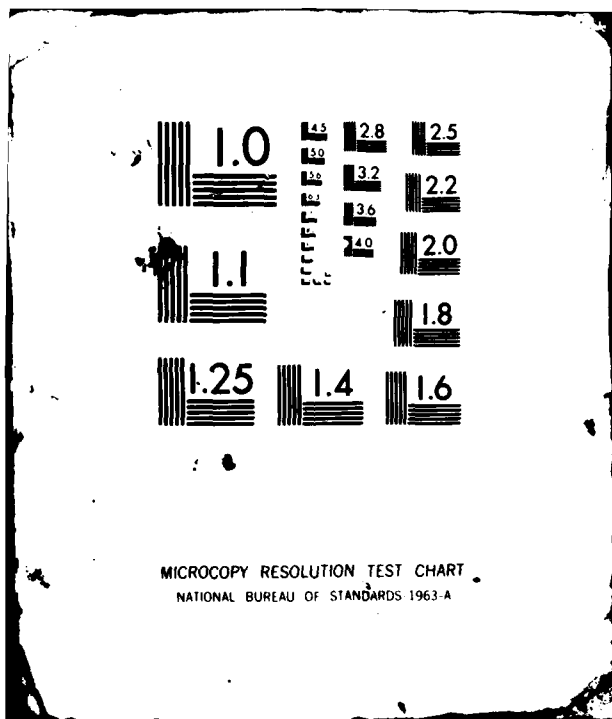
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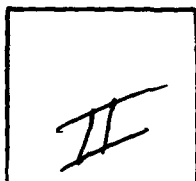




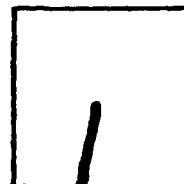
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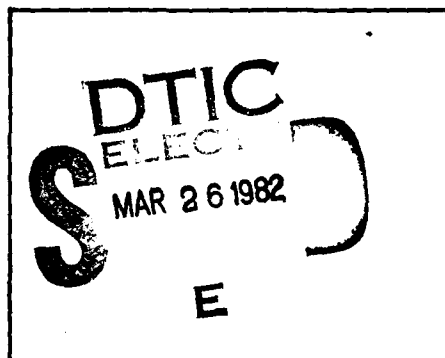
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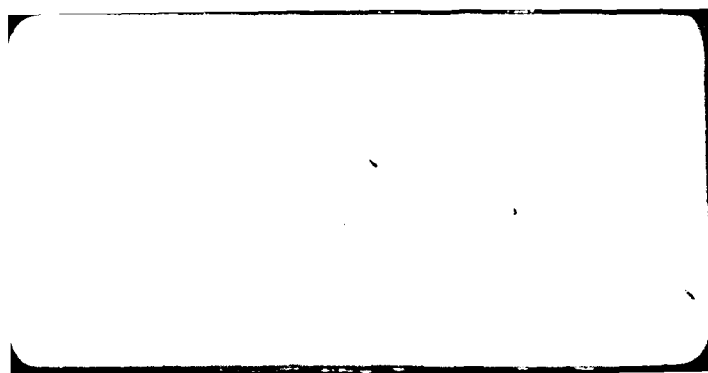
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**EXECUTIVE SUMMARY
GEOTECHNICAL SITING INVESTIGATIONS
FY 81**

Prepared for:

**U.S. Department of the Air Force
Ballistic Missile Office
Norton Air Force Base, California 92409**

Prepared by:

**Ertec Western, Inc.
3777 Long Beach Boulevard
Long Beach, California 90807**

30 November 1981

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Report is summary of geotechnical studies for the M-X project in Nevada and Utah which conducted by Ertec Western for the Air Force. The programs are divided into four major programs, such support programs, and three miscellaneous studies.		

FOREWORD

This report was prepared for the Department of the Air Force, Ballistic Missile Office (BMO), Norton Air Force Base, California, in compliance with Contract No. F04704-80-C-0006, CDRL Item 005A6. Summary discussions included in this report describe programs that were conducted in Fiscal Year 1981 (FY 81). Many of the FY 81 programs are continuations of studies begun in previous years. More details on these prior programs are included in reports listed in Appendix A and in three previous geotechnical summary reports:

- o Geotechnical Siting Status Report - 21 June 1978;
- o Executive Summary Report, Geotechnical Siting Investigations FY 79, FN-TR-30, dated 26 October 1979; and
- o Executive Summary Report, Geotechnical Siting Investigations, FY 80, FN-TR-42, dated 30 November 1980.

The major FY 81 programs, in terms of scope and effort, are Verification (Section 2.0), Water Resources (Section 3.0), Aggregate Resources (Section 4.0), and Siting Studies (Section 5.0). These programs are largely continuations of studies that were initiated in FY 79 and FY 80 to provide technical data to support MX siting decisions and to provide data needed by other MX associate contractors. Report Section 6.0 contains discussions of the other geotechnical studies performed in FY 81.

It should be noted that the geotechnical siting investigations were performed under the firm name of Fugro National, Inc. at its offices in Long Beach, California, in previous years. On 25 March 1981 the corporate name was changed to the Earth Technology Corporation (Ertec). Since that date, the geotechnical studies have been performed at the same Long Beach office under the name of Ertec Western, Inc. Environmental support has been provided by Ertec Northwest, Inc., Seattle, Washington, topographic mapping services have been provided by Ertec Airborne Systems, Inc., Cypress, California, and mineral resources surveys have been performed by Ertec Rocky Mountain Inc., Denver, Colorado.

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this report is to summarize the results of the geotechnical, siting, and environmental programs performed by Ertec, Inc. in FY 81 in support of the U.S. Air Force MX advanced ICBM program. Because the report is an overview, discussions are limited to presenting the scope, objectives, and summary findings of each program. The details of these studies are included in reports which were submitted during the year.

1.2 STUDIES PRIOR TO FY 81

The FY 81 Executive Summary has limited discussions about the studies performed in prior years even though many of the programs are continuations of programs started one or two years earlier. The FY 79 and FY 80 programs are summarized in Executive Summary Reports similar to this document (FN-TR-30 and FN-TR-42). The studies performed in FY 77 and FY 78 are summarized in a Geotechnical Siting Status Report which was submitted on 21 June 1978. The details of the geotechnical, environmental, and siting studies performed since 1974 are presented in separate reports, all of which are listed in chronological order in Appendix A. Including FY 81, the total number of reports submitted to the Air Force on the MX project over a period of nearly 6 1/2 years is 124, 107 of which are designated by a technical report number.

1.3 FY 81 PROGRAM

The schedules and milestone of the FY 81 programs are listed in Table 1-1. The multidisciplined programs can be divided into four major programs, seven support programs, and three miscellaneous studies. The major programs are:

- o Verification,
- o Water Resources,
- o Aggregate Resources, and
- o Siting

The support programs are:

- o Fault Studies,
- o Gravity Studies,
- o Environmental Field Surveys,
- o Mineral Resources,
- o Aerial Photos,
- o Topographic Mapping, and
- o OB Studies.

The miscellaneous studies include road design methodology, response to DEIS comments, and site selection for resistivity tests. The deliverables for these 14 programs included 44 reports, six different deliverables of maps and documents produced within the siting program including shelter layouts in 37 valleys and a land acquisition package and topographic maps for three OB sites and two valleys. Most of the programs were performed by the technical staff at Ertec Western, Long Beach, California; the staff included geologists, engineering geologist, geohydrologists, soils engineers, geophysicists, and geographers. The aerial photos and topographic mapping tasks were performed by Ertec Airborne Systems, Cypress, California. The environmental studies were conducted by environmental scientists at Ertec Northwest, Seattle, Washington, and the

REPORTS (A)

1. VERIFICATION STUDIES, DELAMAR VALLEY (FN-TR-27-DM-I & II)
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2. VERIFICATION STUDIES, PAHROC VALLEY (E-TR-27-PA-I & II) AND
MULESHOE VALLEY (E-TR-27-MS-I & II)
3. VERIFICATION STUDIES, LAKE VALLEY (E-TR-27-LV-I & II)
4. VERIFICATION STUDIES, CAVE VALLEY (E-TR-27-CV-I & II)
5. FAULT STUDIES REPORT (E-TR-64)
6. GRAVITY REPORT, BIG SMOKY VALLEY (FN-TR-33-SB)
7. GRAVITY REPORT, PINE VALLEY (E-TR-33-PI REV.)
GRAVITY REPORT, WAH WAH VALLEY (E-TR-33-WA)
8. GRAVITY REPORT, LAKE VALLEY (E-TR-33-LV)
GRAVITY REPORT, SPRING VALLEY (E-TR-33-SP)
9. GRAVITY REPORT, PAHROC VALLEY (E-TR-33-PA)
10. GRAVITY REPORT, DELAMAR VALLEY (E-TR-33-DM)
11. GRAVITY REPORT, RALSTON VALLEY (E-TR-33-RV)
12. GRAVITY REPORT, DUGWAY VALLEY (E-TR-33-DW REV.)
GRAVITY REPORT, SEVIER DESERT (E-TR-33-SD REV.)
13. GRAVITY REPORT, CAVE VALLEY (E-TR-33-CV)
GRAVITY REPORT, MULESHOE VALLEY (E-TR-33-MS)
14. INDUSTRY ACTIVITY INVENTORY, NEVADA-UTAH 2 SEPT 80
15. WATER RESOURCES PROGRAM, INTERIM REPORT 31 OCT 80 (FN-TR-40)
16. WATER RIGHTS INVENTORY, NEVADA-UTAH 19 DEC 80
17. WATER RESOURCES PROGRAM PROGRESS REPORT 13 FEB 81
18. WATER RESOURCES PROGRAM OPERATIONAL BASE STUDIES REPORT
VOLUME I - COYOTE SPRING OB, NEVADA (E-TR-51-I), 28 MAY 81
VOLUME II - MILFORD AND BERYL OB UTAH (E-TR-51-II), 28 MAY 81
19. PRELIMINARY WATER MANAGEMENT PLAN 14 VALLEYS 28 SEPT 81 (E-TR-53)
20. TECHNICAL SUMMARY REPORT (E-TR-52)
WATER RESOURCES MODELING, DRY LAKE (E-TR-58)
CARBONATE STUDY, COYOTE SPRING VALLEY (E-TR-57)
21. VSARS LAKE VALLEY (FN-TR-37I)
VSARS PINE AND WAH WAH VALLEYS (FN-TR-37g)
22. DARS DELAMAR VALLEY (E-TR-47-DM)
DARS DRY LAKE VALLEY (E-TR-47-DL)
23. DARS MULESHOE VALLEY (E-TR-47-MS)
DARS PAHROC VALLEY (E-TR-47-PA)
24. DARS PINE VALLEY (E-TR-PI)
DARS WAH WAH VALLEY (E-TR-47-WW)
25. VSARS GARDEN-COAL VALLEYS (E-TR-37O)
VSARS TULE VALLEY (E-TR-37N)
26. VSARS CAVE-STEPTOE VALLEYS (E-TR-37g)
27. REGIONAL LAYOUT-NEVADA/UTAH (1:500,000 MAP) 28 SEPT 1980
28. DTH PROPOSED ROUTING-FIRST 360 MILES (MAPS PRODUCED BY PARSONS)
29. PRELIMINARY BIOLOGICAL AND CULTURAL RESOURCES INVENTORY OF PROPOSED
OB SITES AT COYOTE SPRING, BERYL, AND MILFORD (FN-TR-48)
30. PRELIMINARY LAYOUTS FOR ALL 37 VALLEYS (1:82,500 MAPS) 15 MAY 1981
MX SYSTEM-NEVADA/UTAH (1:500,000 MAP) 15 MAY 1981
31. SHELTER LAYOUTS-IOC VALLEYS (1:8000 MAPS)
32. FIELD SURVEYS, IOC VALLEYS (E-TR-48-I, E-TR-48-II, E-TR-48-III)
33. LAND WITHDRAWAL PACKAGE
34. MX SYSTEM SITING SUMMARY REPORT (E-TR-58)
FIELD SURVEYS, DTH/OBTS (E-TR-58-I, II, III)
35. COYOTE SPRING OB SITE, (1:8000 TOPOGRAPHIC MAPS)
36. BERYL OB SITE (1:8000 TOPOGRAPHIC MAPS)
37. MILFORD OB SITE (1:8000 TOPOGRAPHIC MAPS)
38. HAMLIN VALLEY (1:8000 TOPOGRAPHIC MAPS)
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40. COYOTE SPRING OB REPORT (FN-TR-43)
41. MILFORD OB REPORT (FN-TR-44)
42. BERYL OB REPORT (FN-TR-45)
43. EASTERN COYOTE SPRING VALLEY
PHOTO GEOLOGIC INTERPRETATION (E-TR-PG-3)
44. MX MINERAL RESOURCES SURVEY (FN-TR-41)
45. MX MINERAL RESOURCES SURVEY, SEVEN ADDITIONAL VALLEYS (E-TR-50)
46. FY 80 EXECUTIVE SUMMARY (FN-TR-42)
47. FY 81 EXECUTIVE SUMMARY (E-TR-56)

GEOTECHNICAL PROGRAM

VERIFICATION

- FIELD STUDIES
- DATA AND LAB ANALYSES
- REPORTS

FAULT AND EARTHQUAKE STUDIES

- FIELD SURVEYS
- DATA EVALUATION
- REPORTS

GRAVITY.....

- REPORTS

WATER RESOURCES

FIELD STUDIES

- a. RECONNAISSANCE
- b. DRILLING AND TESTING
- I. VALLEY-FILL AQUIFER
- II. CARBONATE AQUIFER

DATA EVALUATION

- a. VALLEY
- b. CARBONATE
- c. OB
- d. WATER MANAGEMENT PLANNING

WATER APPROPRIATIONS

- a. SURVEYS
- b. HEARING PREPARATION

- REPORTS

AGGREGATE RESOURCES

- FIELD STUDIES
- DATA AND LAB ANALYSES
- REPORTS

SYSTEM SITINGS

- SHELTER LAYOUTS-1:82,500
- IOC SHELTER LAYOUTS-1:8000
- DTH/ASC FIELD RECONNAISSANCE
- DTH/ASC SITING STUDIES
- OBTS FIELD RECONNAISSANCE
- OBTS SITING STUDIES
- OB SITES ENVIRONMENTAL RESOURCE
- INVENTORIES-FIELD SURVEYS
- OB SITES ENVIRONMENTAL RESOURCE
- INVENTORIES-DATA EVALUATION
- IOC VALLEYS FIELD SURVEYS
- IOC VALLEYS DATA EVALUATION
- DTH/OBTS FIELD SURVEYS
- DTH/OBTS DATA EVALUATION
- REPORTS

TOPOGRAPHIC MAPPING

- FIELD WORK
- AERIAL PHOTOS
- MAPS

OPERATIONAL BASE STUDIES

- FIELD STUDIES
- DATA EVALUATION
- REPORTS

MINERAL RESOURCES

- MINERAL SURVEYS
- REPORTS

EXECUTIVE SUMMARY

- DATA EVALUATION
- REPORTS

Ertec
The Earth Reinforcing Corporation

**MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE
BMO/AFRC-MX**

FY81 GEOTECHNICAL INVESTIGATION

6 NOV 81

mineral resource surveys were carried out by mining geologists and economists at Ertec Rocky Mountain, Denver, Colorado.

Although each of the programs is discussed separately in this Executive Summary, a number of the programs were interrelated and required an integrated and coordinated effort of a number of tasks. For example, geotechnically suitable area boundaries determined from the Verification program were drawn on the 1:62,500 scale topographic maps which had been produced. These maps were then used in deployment area layout studies which also utilized data from the water resources studies and mineral resources surveys. The results of the layouts were used in determining the quantities of water needed for water appropriations. The layouts were then transferred to the 1:9600 scale topographic maps which were used for the environmental field surveys in the IOC valleys. Virtually all the major and support programs performed in FY 81 had similar multidiscipline involvement and application.

The status of the four major programs and two of the support programs at the end of FY 81 are summarized in Table 1-2. Several significant points are:

- o Verification field studies were completed for eight valleys in Utah, but reports were completed for only two valleys.
- o Verification field studies were completed for 27 valleys in Nevada, but reports were completed for only seven valleys.
- o Valley-fill drilling and testing to determine availability of water was completed in 18 valleys, and modeling was completed in six valleys. At the end of FY 81, modeling was in progress in 12 valleys.

VALLEY	SITING STUDIES		VERIFICATION STUDIES			AGGREGATE RESOURCES		
	26 SEPT 60 1:62500 MP8 LAYOUTS ①	15 MAY 61 1:62500 MP8 LAYOUTS ②	BASIC VERIF FIELD WORK	DATA GAP STUDIES	REPORT	VALLEY SPECIFIC AGGREGATE RESOURCES (VSARS) FIELD	VSAR REPORT	DETAILED AGGREGATE RESOURCES STUDY (DARS)
UTAH								
DUGWAY	5	5	C					
FISH SPRINGS FLAT	2	2	C					
PINE	5	5	C		C	C	C	C
SEVIER DESERT	4	2	C					
SEVIER LAKE ③	1	1						
SNAKE	16	19	C			C	C	
TULE	9	10	C			C	C	
WAH WAH	7	5	C		C	C	C	C
WHIRLWIND	11	12	C			C	C	
NEVADA								
ANTELOPE	7	4	C					
BIG SAND SPRINGS	3	3	C					
BIG SMOKY	13	10	C					
BUTTE	4	9	C					
CAVE	2	3	C	C	C	C	C	
COAL	6	6	C	C		C	C	
DELAMAR	4	3	C		C	C	C	C
DRY LAKE	10	10	C		C	C	C	C
GARDEN	6	6	C	C		C	C	
HAMLIN	8	10				C	C	
HOT CREEK	4	6	C					
JAKES	2	3	C					
KOBEH	6	5	C					
LAKE	6	7	C		C	C	C	
LITTLE SMOKY	3	4	C					
LONG	1	4	C					
MONITOR	3	6	C					
MULESHOE	2	3	C	C	C	C	C	C
NEWARK	1	5	C					
PAHROC	1	3	C		C	C	C	
PENOYER	4	5	C					
RAILROAD	19	13	C					
RALSTON	9	9	C		C ④			
REVEILLE	2	3	C					
SPRING	3	4	C					
STEPTOE ③		2	C			C	C	
STONE CABIN	7	8	C					
WHITE RIVER	8	12	C	C		C	C	

EXPLANATION

C WORK COMPLETED

I IN-PROCESS

P/C PARTIAL COMPLETION

1. NUMBER OF SITABLE CLUSTERS BASED ON 23 SHELTERS PER CLUSTER, 5200' SPACING, 2/3 HEX, LINEAR TRUNK CRN, PRIOR TO COMPLETION OF VERIFICATION STUDIES.
2. NUMBER OF SITABLE CLUSTERS BASED ON 23 SHELTERS PER CLUSTER, 5200' SPACING, 2/3 HEX, DIRECT CONNECT CRN, MAJORITY OF VERIFICATION STUDIES COMPLETED.
3. VALLEY NO LONGER CONSIDERED IN SITING STUDIES.
4. SOUTHERN HALF
5. SOUTHERN PORTION
6. WESTERN PORTION

AGGREGATE RESOURCES			WATER RESOURCES				TOPOGRAPHIC MAPS		GRAVITY REPORTS
VALLEY SPECIFIC AGGREGATE RESOURCES (VSARS) FIELD	VSAR REPORT	DETAILED AGGREGATE RESOURCES STUDY (DARS)	VALLEY FILL DRILLING/ TESTING	CARBONATE DRILLING TESTING	MODELING	WATER MANAGEMENT PLAN	1:9600 SCALE MAPS	1:62500 SCALE MAPS	
			C						C
					I				
C	C	C	C		C	C	C		C
									C
C	C				I			C	C
C	C		C						
C	C	C	C		C	C	C		C
C	C		C						C
			C						C
									C
C	C		C		I	C	C		C
C	C		C	C	I	C		C	C
C	C	C	C		C	C	C		C
C	C	C	C	C	C	C	C		C
C	C		C		I	C		C	C
C	C		C		I	C	C		C
			C						C
C	C				I	C	C		C
					I				
C	C	C	C		C	C	C		C
C	C				C	C	C		C
					I			C	
			C		I			C	
									C
			C						
			C		I	C			C
C	C			C					
C	C		C		I				C

WELTERS
TRUNK
STUDIES.
WELTERS
CONNECT
PLETED.
STUDIES.



MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE
BMO/APRCE-MX

STATUS OF MAJOR GEOTECHNICAL INVESTIGATIONS, DDA

8 NOV 81

TAB 1-2

12

- o Topographic maps at a scale of 1:9600 were completed for nine valleys and topographic maps at a scale of 1:62,500 were completed for four valleys and part of another valley.
- o Gravity reports were completed for 21 valleys.

Table 1-3 summarizes the studies that were performed at the OB site. As can be seen from examining the table, this one support task consisted of a number of subtasks involving a variety of disciplines from the four Ertec offices.

MOB/DAA SITES (1)	PRELIMINARY SITING STUDIES	PRELIMINARY GEOTECHNICAL STUDIES	VALLEY HILL DRILLING/TESTING
<u>NEVADA</u> • COYOTE SPRING	C	C	C
<u>UTAH</u> • BERYL	C	C	C
<u>UTAH</u> • MILFORD (North and South)	C	C	C
<u>NEW MEXICO</u> • CANNON AFB	-	-	-

OBTS/DTA SITES	OBTS/DTA SITING	GEOTECHNICAL RECONNAISSANCE	ENVIRONMENTAL SURVEYS
<u>NEVADA</u> • COYOTE SPRING MOB	C	C	C
<u>UTAH</u> • BERYL MOB	C	C	C (2)
<u>UTAH</u> • MILFORD (Central and South)	C	C	C
<u>NEW MEXICO</u> • CANNON MOB	C	C	-

C WORK COMPLETED
P/C PARTIALLY COMPLETED

NOTES:

1. MOB/DAA sites are those developed by the OB working group 20 AUG 80. More detailed siting studies since then have resulted in changes in the location of MOB/DAA sites. Portions of the new sites are not covered by the studies listed in the table.
2. Preferred site only.

WATER RESOURCES			TOPOGRAPHIC MAPPING	MINERAL SURVEY
VALLEY FILL DRILLING/TESTING	CARBONATE DRILLING/TESTING	MODELING	AT 1:5000 SCALE MAP	
C	C	P/C	C	C
C	C	P/C	C	C
C	C	P/C	C	C
-	-	-	-	-

ENVIRONMENTAL SURVEYS	TOPOGRAPHIC MAPPING	MINERAL SURVEY
C	-	-
C (2)	-	-
C	-	-
-	-	-

OS working
has since then
OS/DAA sites.
the studies listed



MX SITING INVESTIGATION
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STUDIES OF ENVIRONMENTAL AND
 SITING STUDIES FOR THE MOBILE
 AND THE AIR FORCE
 INVESTIGATION REPORT

12

2.0 VERIFICATION

2.1 VALLEY VERIFICATION PROGRAM

2.1.1 Background

Verification field studies in Nevada and Utah began in October 1978. Prior to this time, approximately 20,000 mi² (51,800 km²) of suitable area in Nevada and Utah had been identified during literature-based Screening studies. About 7700 mi² (19,900 km²) of this area were selected as the study area during FY 79. At that time, field studies were performed and reports prepared for portions of seven valleys. During FY 80, field Verification studies were performed in additional valleys so that by the end of FY 80, Verification field studies had been completed in 24 geographical valleys. During FY 81, field Verification studies were completed in 12 more valleys bringing the total to 36 geographical valleys (Figure 2-1).

Reports incorporating results from Verification studies and preceding Characterization studies in Dry Lake and Ralston valleys were published during FY 80. Verification reports for Delamar, Lake, Muleshoe, Pahroc, Pine, and Wah Wah valleys were published during FY 81. A report on Cave Valley was completed in the first month of FY 82. A revised map of suitable area based on the final Verification data is presented as Drawing 2-1.

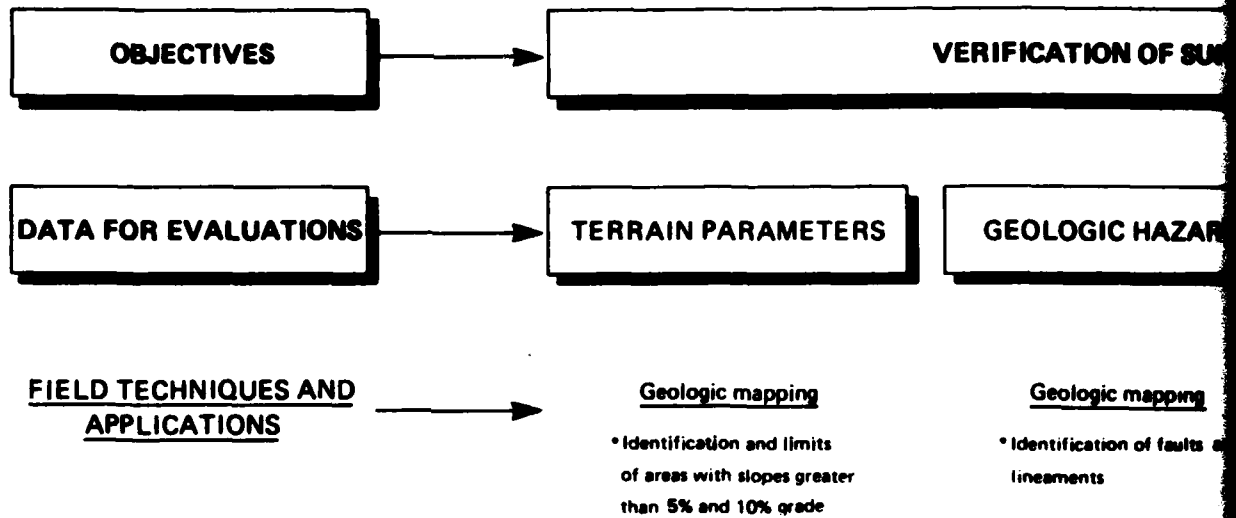
2.1.2 Objectives

The Verification studies in Nevada-Utah included the objectives that follow.

1. Verify and refine boundaries of suitable area;
2. Obtain geologic, geophysical, and engineering data for preliminary design studies;
3. Identify problem areas where additional field work will be necessary; and
4. Recommend additional sites for study in Nevada-Utah to ensure sufficient suitable area to deploy the MX system utilizing the multiple protective shelter mode.

Verification studies consisted of a combination of geologic, geophysical, and soils engineering investigative techniques designed to differentiate suitable and unsuitable areas and obtain basic information on soil and terrain characteristics. The geotechnical parameters evaluated and techniques used are shown schematically in Table 2-1. Table 2-2 lists the type and number of geotechnical activities performed to date in each valley.

Prior to starting the Verification field studies, a program plan was developed, logistics were planned, and photogeologic mapping initiated. Access was approved through state and district offices of the U.S. Bureau of Land Management (BLM) in Nevada and Utah via the Army Corps of Engineers (COE) in Sacramento, California. At BLM's request, all field activities were performed along existing roads or trails to minimize disturbance to the sites. Activity locations were changed in those few instances where a potential environmental or archaeological disturbance was identified.



UITABLE AREA FOR MX DEPLOYMENT

ARD

50'/150' DEPTH TO ROCK

50'/150' DEPTH TO GROUND WATER

EXTENT AND CHARACTERISTICS OF SOILS

GEO
PRO

Geologic mapping

- Surface limits of rock
- Depth to rock from topographic and geologic interpretation
- Geomorphic expression and erosion history

Seismic refraction surveys

- Subsurface projection of rock limits
- Delineation of high velocity layers from p-wave velocities (> 7000 fps)

Borings

- Occurrence of rock

Existing data

- Published literature

Geologic mapping

- Obtain water depths from wells in study area
- Monitoring wells
- Occurrence of ground water

Electrical resistivity/ seismic refraction surveys

- Provide supplemental data to support presence or absence of ground water

Existing data

- Published literature

Geologic mapping

- Extent of surficial soil units
- Surficial soil types

Borings

- Identification of subsurface soil types
- In situ soil density and consistency
- Samples for laboratory testing

Trenches and test pits

- Identification of surface and subsurface soil types
- Degree of induration and cementation of soils
- In situ moisture and density of soil
- Samples for laboratory testing

Cone penetrometer tests

- In situ soil strength

Laboratory tests

- Physical properties
- Engineering properties – shear strength, compressibility
- Chemical properties

Seismic re

- Compression
- Layering of

Electri

- Electrical e
- Layering of

CHARACTERISTICS OF BASIN FILL

EXTENT AND CHARACTERISTICS OF SOILS

Geologic mapping

- Extent of surficial soil units
- Surficial soil types

Borings

- Identification of subsurface soil types
- In situ soil density and consistency
- Samples for laboratory testing

Trenches and test pits

- Identification of surface and subsurface soil types
- Degree of induration and cementation of soils
- In situ moisture and density of soil
- Samples for laboratory testing

Cone penetrometer tests

- In situ soil strength

Laboratory tests

- Physical properties
- Engineering properties - shear strength, compressibility
- Chemical properties

GEOPHYSICAL PROPERTIES

Seismic refraction surveys

- Compressional wave velocities
- Layering of soil

Electrical resistivity surveys

- Electrical conductivity of soils
- Layering of soil

ROAD DESIGN DATA

Trenches and test pits

- Identification of soil types
- In situ soil density and moisture

Cone penetrometer tests

- In situ soil strength
- Thickness of low strength surficial soil

Laboratory tests

- Physical properties
- Compaction and CBR data
- Suitability of soils for use as road subgrade, subbase or base

Existing data

- Suitability of soils for use as road subgrade, subbase, or base
- Behavior of compacted soils

EXCAVATABILITY AND STABILITY

Borings

- Subsurface soil types
- Presence of cobbles and boulders
- In situ density of subsurface soils
- Stability of vertical walls

Trenches and test pits

- Subsurface soil types
- Subsurface soil density and cementation
- Stability of vertical walls
- Presence of cobbles and boulders

Laboratory tests

- Physical properties
- Engineering properties

Geologic mapping

- Distribution of geologic units

Seismic refraction surveys

- Excavatability

STATISTICS OF BASIN FILL

PRELIMINARY GEOTECHNICAL
CONSIDERATIONS AND
RECOMMENDATIONS

ROAD DESIGN DATA

EXCAVATABILITY
AND STABILITY

Trenches and test pits

- Identification of soil types
- In situ soil density and moisture

Cone penetrometer tests

- In situ soil strength
- Thickness of low strength surficial soil

Laboratory tests

- Physical properties
- Compaction and CBR data
- Suitability of soils for use as road subgrade, subbase or base

Existing data

- Suitability of soils for use as road subgrade, subbase, or base
- Behavior of compacted soils

Borings

- Subsurface soil types
- Presence of cobbles and boulders
- In situ density of subsurface soils
- Stability of vertical walls

Trenches and test pits

- Subsurface soil types
- Subsurface soil density and cementation
- Stability of vertical walls
- Presence of cobbles and boulders

Laboratory tests

- Physical properties
- Engineering properties

Geologic mapping

- Distribution of geologic units

Seismic refraction surveys

- Excavatability



MX SITING INVESTIGATION
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FIELD TECHNIQUES
VERIFICATION STUDIES

6 NOV 81

TABLE 2-1

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VALLEY	GEOLOGIC MAPPING STATIONS	SEISMIC REFRACTION MEASUREMENTS	ELECTRICAL RESISTIVITY SOUNDINGS	GRAVITY SURVEY	BORINGS	TRENCHES AND TEST PITS	CONE PENE- TROMETER TESTS (CPT)	FIELD CBR TESTS
ANTELOPE	64	14	12	YES	5	28	57	2
BIG SAND SPRINGS	77	16	14	YES	6	24	50	2
BIG SMOKY	203	28	28	YES	13	66	131	28
BUTTE	118	23	23	YES	6	35	71	2
CAVE	56	10	10	YES	4	16	20	0
COAL	83	15	15	YES	5	35	62	0
DELAMAR	79	13	12	YES	5	24	37	0
DRY LAKE	80	17	0	YES	18	47	84	0
DUGWAY	69	21	20	YES	5	27	48	0
FISH SPRINGS FLAT	59	17	17	YES	4	14	29	0
GARDEN	45	16	15	YES	6	34	43	0
HAMLIN	101	31	30	YES	9	54	91	0
HOT CREEK	61	12	9	YES	5	35	63	8
JAKES	49	17	16	YES	5	17	33	2
KOBEH	134	18	18	YES	4	28	51	4
LAKE	123	22	20	YES	7	54	102	2
LITTLE SMOKY	80	11	10	YES	4	22	39	2
LONG	85	18	17	YES	2	12	26	0
MONITOR	97	19	18	YES	4	27	48	2
MULESHOE	48	10	9	YES	3	17	24	0
NEWARK	123	26	26	YES	6	28	55	2
PAHROC	49	7	7	YES	3	18	28	0
PENOYER	90	18	15	YES	6	22	41	0
PINE	98	23	22	YES	10	44	86	15
RAILROAD	296	42	41	YES	14	88	171	19
RALSTON	112	30	13	YES	19	43	64	4
REVEILLE	43	12	12	YES	5	20	36	1
SEVIER DESERT	99	25	24	YES	10	60	101	0
SNAKE	255	58	56	YES	18	91	177	0
SPRING	134	29	27	YES	9	42	71	2
STEPTOE	45	12	11	YES	4	23	42	4
STONE CABIN	84	23	22	YES	8	39	73	7
TULE	221	49	46	YES	11	73	122	0
WAH WAH	73	21	21	YES	7	40	72	8
WHIRLWIND	180	37	36	YES	12	66	122	0
WHITE RIVER	141	44	43	YES	12	63	123	0
TOTALS	3722	804	735		274	1376	2493	116



MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE
BMO/AFRC-MX

VERIFICATION
FIELD ACTIVITIES TO DATE

6 NOV 81

TABLE 2-2

2.1.3 Scope

The FY 81 Verification program consisted of three major elements:

1. Reconnaissance level Verification studies;
2. Basic Verification studies; and
3. Data Gap studies.

2.1.3.1 Reconnaissance Level Verification Studies

Reconnaissance level Verification studies were performed during the first quarter of FY 81 in the six northern valleys; Butte, Jakes, Kobeh, Long, Monitor, and Newark. The studies were necessary to collect preliminary data on the rock-basin fill line and areas of shallow rock and shallow water to support preliminary layout studies. Basic Verification studies for the six northern valleys were then completed later in FY 81.

2.1.3.2 Basic Verification Studies

The basic Verification studies were performed in new valleys as well as in portions of the FY 80 Verification valleys in which field work had not previously been completed. By the end of FY 81, Verification field studies had been completed in the following valleys:

- | | | |
|-----------------|-----------------|----------------------|
| 1. Dugway | 13. Dry Lake | 25. Railroad |
| 2. Tule | 14. Delamar | 26. Sevier Desert |
| 3. Fish Springs | 15. Muleshoe | 27. Antelope |
| 4. Whirlwind | 16. Pahroc | 28. Little Smoky |
| 5. Snake | 17. Garden | 29. Big Sand Springs |
| 6. Hamlin | 18. Coal | 30. Ralston |
| 7. Pine | 19. Reveille | 31. Butte |
| 8. Wah Wah | 20. Big Smoky | 32. Jakes |
| 9. Spring | 21. Penoyer | 33. Kobeh |
| 10. Cave | 22. Steptoe | 34. Long |
| 11. Lake | 23. Hot Creek | 35. Monitor |
| 12. White River | 24. Stone Cabin | 36. Newark |

2.1.3.3 Data Gap Studies

Evaluation of the data collected in FY 80 and the first quarter of FY 81 resulted in identifying certain valleys in which additional field work was necessary to more accurately define the suitable area boundaries. These studies were termed "data gap studies" and consisted of drilling ground-water observation wells and performing seismic refraction surveys.

The data gap studies were performed in Cave, Muleshoe, Garden, Coal, and White River valleys.

2.1.4 Results

2.4.1.1 Suitable Area

As in FY 80, the Verification studies resulted in changes to the boundaries of the suitable area of many valleys. The presence of shallow rock, shallow ground water, and/or adverse terrain accounted for most of the changes (Table 2-3).

2.1.4.2 Basin-Fill Material Characteristics

A. Surficial Soils

Surface soils classified were predominantly coarse-grained (granular) consisting of sand and gravel. Fine-grained soils (silt and clay) exist over limited portions of most sites. The surficial soils were combined into three categories based on their physical and engineering properties:

1. Silty sand and clayey sand: Predominant surficial soil occurring primarily in alluvial fans which extend from the basin margins to the basin center or playa edge.
2. Gravel and gravelly sand: These are the second most predominant surficial soil type occurring primarily in alluvial

VALLEY	STATE	GEOTECHNICAL SUITABLE AREA (MI ²) - HORIZONTAL SHELTER		
		BEGINNING AREA ^a	RESULTING AREA ^b	AREA CHANGE
ANTELOPE	NEVADA	245	125	- 120
BIG SAND SPRINGS	NEVADA	235	210	- 25
BIG SMOKY	NEVADA	680	693	+ 13 ^d
BUTTE	NEVADA	182	295	+ 113
CAVE	NEVADA	135	115	- 20
COAL	NEVADA	275	240	- 35
DELAMAR	NEVADA	180	154	- 26
DRY LAKE	NEVADA	360	310	- 50
DUGWAY	UTAH	170	161	- 9
FISH SPRINGS FLAT	UTAH	155	135	- 20
GARDEN	NEVADA	230	200	- 30
HAMLIN	NEVADA-UTAH	425	335	- 90
HOT CREEK	NEVADA	185	252	+ 67 ^d
JAKES	NEVADA	180	157	- 23
KOBEH	NEVADA	365	211	- 154
LAKE	NEVADA	460	267	- 193
LITTLE SMOKY	NEVADA	340	254	- 86
LONG	NEVADA	114	230	+ 116
MONITOR	NEVADA	266	280	+ 14
MULESHOE	NEVADA	100	76	- 24
NEWARK	NEVADA	150	150	0 ^c
PAHROC	NEVADA	105	103	- 2
PENOYER	NEVADA	285	265	- 20
PINE	UTAH	165	278	+ 113 ^d
RAILROAD	NEVADA	790	748	- 42
RALSTON	NEVADA	420	375	- 45
REVEILLE	NEVADA	200	145	- 55
SEVIER DESERT	UTAH	225	477	+ 252 ^d
SNAKE	NEVADA-UTAH	625	656	+ 31 ^d
SPRING	NEVADA	210	250	+ 40 ^d
STEPTOE	NEVADA	105	90	- 15
STONE CABIN	NEVADA	390	397	+ 7
TULE	UTAH	540	391	- 149
WAH WAH	UTAH	50	234	+ 184 ^d
WHIRLWIND	UTAH	430	449	+ 19 ^d
WHITE RIVER	NEVADA	625	485	- 140
TOTALS		10, 597	10, 193	- 404

NOTES:

- a. FROM INTERMEDIATE SCREENING
- b. AT END OF FY 81
- c. BASED ON RECONNAISSANCE VERIFICATION MAPPING.
- d. VALLEY GEOGRAPHIC BOUNDARIES WERE EXPANDED



MX SITING INVESTIGATION
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CHANGES IN GEOTECHNICAL
SUITABLE AREA FOR HORIZONTAL
SHELTER BASING MODE

9 NOV 81

TABLE 2-3

fans near the valley margins. They consist of sandy, silty, and clayey gravel and sand with appreciable gravel content.

3. Silt and clay: These are the least extensive surficial soils occurring primarily in the lacustrine deposits in the center of the basin. These soils consist of sandy silt and clay and silty clay with appreciable amounts of fine sand.

B. Subsurface Soils

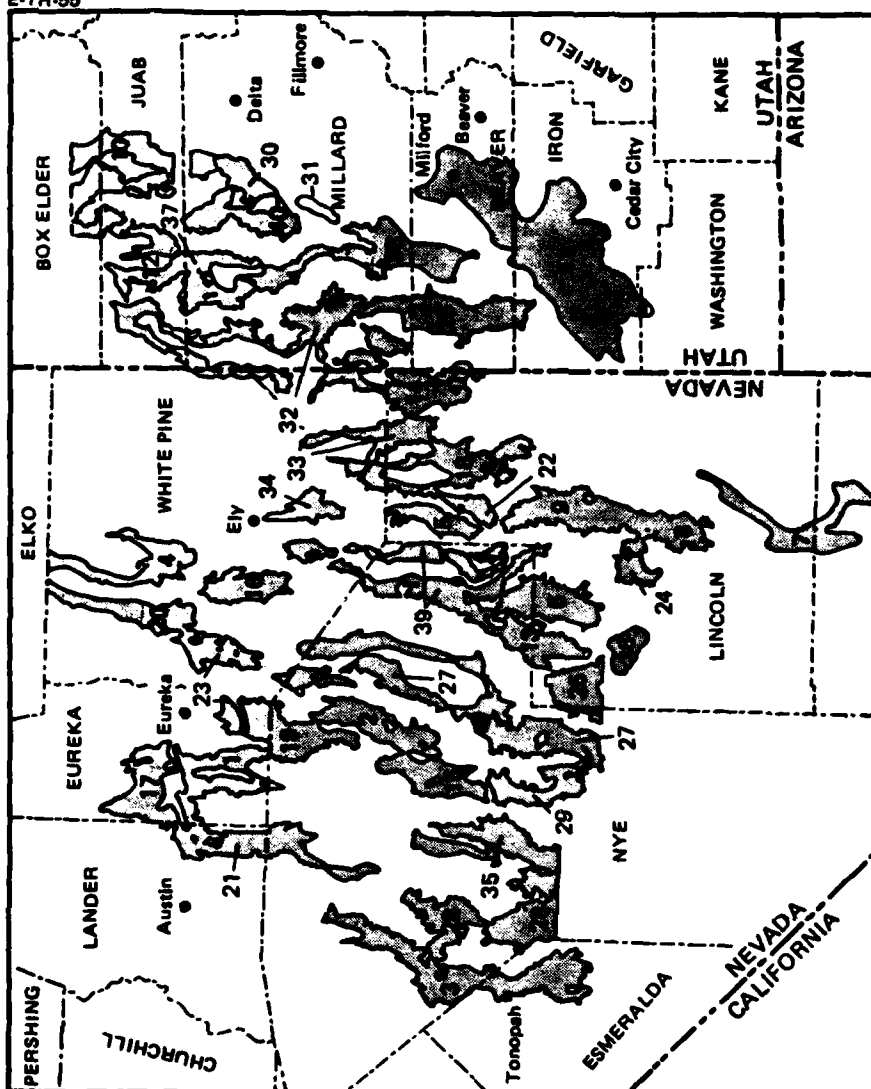
Subsurface soils obtained during the boring program (approximate depth of investigation of 160 feet [49 m]) were predominantly coarse-grained (gravel and sand). Fine-grained soils (silt and clay) are estimated to occur in about ten to 15 percent of the subsurface.

The coarse-grained soils are generally dense to very dense below depths of approximately 5 feet (15 m). They exhibit low compressibilities and possess moderate to high shear strengths. The fine-grained soils exhibit low to high plasticity and generally contain appreciable amounts of fine sand. Variable calcium carbonate cementation exists in the subsurface soils.

2.2 FAULT AND EARTHQUAKE HAZARDS PROGRAM

2.2.1 Background and Objectives

The Nevada-Utah siting region is located in the Great Basin physiographic province which is characterized by areas of high seismic flux, large earthquakes, and active faults. The most significant fault and earthquake hazards within the MX siting region are the potential of ground rupture immediately beneath facilities and the strong ground motion which may damage MX missile facilities and transportation and communications networks. The areas analyzed are depicted in Figure 2-2.



- | | | | |
|----------------------------|-------------------------|----------------------|------------------------|
| 1. ANTELOPE VALLEY | 11. ESCALANTE DESERT | 21. MONITOR VALLEY | 30. SEVIER DESERT |
| 2. BIG SAND SPRINGS VALLEY | 12. FISH SPRINGS FLAT | 22. MULESHOE VALLEY | 31. SEVIER LAKE |
| 3. BIG SMOKY VALLEY | 13. GARDEN VALLEY | 23. NEWARK VALLEY | 32. SNAKE VALLEY |
| 4. BUTTE VALLEY | 14. HAMLIN VALLEY | 24. PAHROC VALLEY | 33. SPRING VALLEY |
| 5. CAVE VALLEY | 15. HOT CREEK VALLEY | 25. PENOYER | 34. STEPTOE VALLEY |
| 6. COAL VALLEY | 16. JAKES VALLEY | (SAND SPRING VALLEY) | 35. STONE CABIN VALLEY |
| 7. COYOTE-KANE VALLEY | 17. KOBEH VALLEY | 26. PINE VALLEY | 36. TIKABOO VALLEY |
| 8. DELAMAR VALLEY | 18. LAKE VALLEY | 27. RAILROAD VALLEY | 37. TULE VALLEY |
| 9. DRY LAKE VALLEY | 19. LITTLE SMOKY VALLEY | 28. RALSTON VALLEY | 38. WAH WAH VALLEY |
| 10. DUGWAY VALLEY | 20. LONG VALLEY | 29. REVEILLE VALLEY | 39. WHITE RIVER VALLEY |
| | | | 40. WHIRLWIND VALLEY |



Ertec
The Earth Rectifying Corporation

**MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE
BMO/AFRC-MX**

AREAS STUDIED FOR YOUNG FAULTS WITHIN THE NEVADA-UTAH MX DEPLOYMENT REGION

6 NOV 81

FIGURE 2-2

The main objective of the FY 81 fault and earthquake hazards investigation was to determine the location of faults and lineaments to minimize earthquake-related hazards to engineered structures and facilities of the MX system. Other objectives of the study included estimation of maximum credible earthquakes, determination of age of last movement along individual faults, and assessment of earthquake recurrence intervals.

2.2.2 Scope

The scope of the FY 81 fault and earthquake hazards study included:

1. Analysis of color stereo aerial photographs for faults and lineaments,
2. Field verification of faults and lineaments,
3. Literature survey,
4. Magnetometer surveys across selected faults and lineaments,
5. Staking activities for FY 82 trench localities,
6. Map compilation, and
7. Report writing.

2.2.3 Results

Faults identified during FY 80 and FY 81 studies in the MX siting area have been compiled on a series of 1:62,500 maps utilized for siting studies. These faults, as well as those identified in the literature, have been depicted on a regional map of the MX deployment area in Utah and Nevada at a scale of 1:500,000 in Drawing 2-2.

Quaternary faults within the study area generally form linear trends subparallel to the regional northerly to northeasterly geologic structural fabric. In cross section, most valleys consist of asymmetric, tilted, fault blocks characterized by a relatively continuous, large displacement fault zone on one side of the valley and shorter, discontinuous faults widely scattered throughout the valley. Lengths of major fault zones are up to about 65 miles (105 km) and comprise single surface breaks and zones that are up to 5 miles (8 km) wide. Faults that have trends transverse to the regional structure are generally scarce but where they exist they generally strike northeasterly. All faults mapped have dip-slip separation representative of normal faulting.

In Nevada, late Pleistocene fault scarps are present in every valley studied and post Bonneville-Lahonton (less than 15,000 years) fault scarps are present in approximately one-third of the valleys.

In Utah, late Pleistocene fault scarps are not as common but post Bonneville-Lahonton fault scarps occur in about two-thirds of the valleys studied. The higher ratio of post Bonneville-Lahonton scarps to Pleistocene fault scarps in Utah may be attributed to removal of the older scarps by erosion associated with late Quaternary pluvial-lake fluctuations or to increased tectonic activity.

The ubiquity of fault scarps throughout the MX deployment area, their concordance with the regional trends, and the continuous

range of ages spanning the Quaternary Period indicate that the study area has been tectonically active throughout the Quaternary and presently has earthquake and fault-rupture hazards. The faults within the study area are similar in characteristics to faults in western and north-central Nevada where seismicity historically has been high. This suggests that comparable earthquake (7 to 7.75 magnitude) and fault-rupture hazards may be present in east-central Nevada and west-central Utah even though large magnitude earthquakes have not occurred there within historic time. Geomorphic characteristics of fault scarps suggest many major faults have remained dormant for many thousands of years before renewed rupturing with substantial surface displacements. This indicates that large earthquakes have recurrence intervals of several thousand years and perhaps much greater than 10,000 years.

2.3 GRAVITY PROGRAM

2.3.1 Background, Scope, and Objectives

Gravity surveys have been included in the MX siting investigations since 1977. The gravity data are obtained for the purpose of estimating the gross structure and shape of the basins and the thickness of the valley fill. These estimates are valuable in studying ground-water regimes and for modeling by the MX Survivability and Hardness community. Gravity surveys also have the potential of detecting areas of shallow rock that might exist between the widely spaced borings and seismic refraction lines.

Implementation of the gravity program is a joint effort between the Defense Mapping Agency (DMA) and Ertec. The Defense Mapping Agency, Hydrographic/Topographic Center (DMAHTC) performs the field work to obtain the gravity measurements, and the Defense Mapping Agency, Aerospace Center (DMAAC) calculates the outer zone terrain corrections for each gravity measurement station and provides existing data from its library. Ertec calculates inner zone terrain corrections, where needed, and performs geologic interpretations based on the gravity data.

2.3.2 Status of Field Surveys and Reports

During FY 81, the field data acquisition program was completed. Data have been acquired, or were available from the DMAAC library for 36 valleys in the Nevada-Utah siting area.

Prior to FY 80, data were obtained along widely spaced profiles in some of the valleys. During FY 80 and 81, data were obtained on an approximately evenly distributed grid within the valleys, including those that previously had only profiles.

The status of reports covering the gravity surveys is shown in Table 2-4.

2.3.3 Results of FY 81 Program

The gravity interpretations have demonstrated a wide diversity in the depths, shapes, and complexity of structure in the basins in Nevada and Utah. Relatively wide, shallow pediments are interpreted along the flanks of some valleys, whereas the bedrock in others appears to be at great depth very near the

REPORTS ISSUED**PRIOR TO 1981****NEVADA**

BIG SAND SPRINGS (LIBRARY*)
 COAL (PROFILES)
 DRY LAKE
 GARDEN (PROFILES)
 HAMLIN (PROFILES)
 HOT CREEK (LIBRARY*)
 WHITE RIVER (PROFILES)

UTAH

SNAKE SOUTH (PROFILES)
 WHIRLWIND (PROFILES)

DURING 1981**NEVADA**

DELAMAR
 LAKE
 MULESHOE
 PAHROC
 RALSTON
 SPRING
 BIG SMOKY
 (LIBRARY*)

UTAH

DUGWAY
 PINE
 SEVIER DESERT
 WAH WAH

* Report based on existing data in DMAAC Library rather than new field data.



MX SITING INVESTIGATION
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STATUS OF GRAVITY REPORTS

6 NOV 81

TABLE 2-4

rock outcrop lines. Some valleys are symmetrical in cross section, appearing to be true grabens; others are asymmetrical as though formed by tilted blocks. Many faults are interpreted to be trending across the dominant north-south orientation of the Basin and Range structures.

3.0 WATER RESOURCES PROGRAM

3.1 BACKGROUND AND OBJECTIVES

The MX Water Resources Program was initiated in June 1979 for the purpose of evaluating the availability of water for both the construction and operational phases of the MX project in Nevada and Utah and to assess the effects of these withdrawals on the local water users, the environment, and the aquifers. Six valleys in the siting area were studied during FY 79.

The Water Resources Program was expanded in FY 80 to include field investigations and evaluation of the hydrogeologic conditions in all valleys within the siting area to better quantify the potential effects of MX ground-water withdrawals on the local water users and the environment, to suggest the optimum water-supply system for the project, and to provide information in support of water-appropriation applications. It included field investigations of the hydrogeologic conditions in 23 deployment valleys and one potential OB site valley (Steptoe).

The FY 81 Water Resources Program continued the general approach of updating and expanding the existing data base in the Nevada-Utah siting area in order to identify and quantify aquifer characteristics, ground-water and surface-water regimes, water quality, and water use and appropriations in the region.

3.2 SCOPE

The FY 81 Water Resources Program included the following activities:

- o Field investigations in Coyote Spring Valley and Escalante Desert and six northern Nevada valleys that were added to the deployment area during the summer of 1980. The six valleys are Kobeh, Butte, Jakes, Monitor, Newark, and Long.
- o Completion of valley-fill drilling and testing in four valleys that were in progress at the end of FY 80, plus, drilling and testing in the Milford, Beryl, and Coyote Spring OB areas and Reveille, Big Sand Springs, Muleshoe, and Coal valleys.
- o Completion of carbonate aquifer drilling and testing in two valleys that were in progress at the end of FY 80 plus drilling and testing of two carbonate wells and drilling of one carbonate aquifer monitoring well in Coyote Spring Valley.
- o Development of computer numerical models of the ground-water system in nine valleys and the White River regional ground-water flow system and the refinement and update of six models developed in FY 80.
- o Application for the appropriation of ground water in the six northern Nevada valleys, and in the Coyote Spring, Ely, and Delta OB sites (Section 3.4).
- o Preparation for hearings by the state engineers on the Air Force water-appropriation applications.
- o Development of preliminary water management plans for 12 deployment area and two OB valleys in which MX construction was scheduled to begin in 1982 or 1983 based on the 17 March 1981 COE water-use schedules.

A summary of all Water Resources Program field activities to date is shown in Table 3-1. The location of major Water Resources Program field activities is shown in Figure 3-1.

3.3 RESULTS AND CONCLUSIONS

3.3.1 Valley-Fill Aquifer Studies

The following summarizes the results and conclusions of the valley reconnaissance and drilling and testing program.

VALLEY	DRILLED WELLS(1)	AQUIFER PUMP TESTS(2)	WATER QUALITY ANALYSES	WATER LEVEL MEASURE- MENTS (4)	DISCHARGE MEASURE- MENTS	WATER TABLE MONITORING WELL (5)
NEVADA						
ANTELOPE	0	0	4	38	6	6
BIG SAND SPRINGS	2	1	4	7	4	1
BIG SMOKY	0	2	5	23	2	0
BUTTE	0	0	5	21	6	5
CAVE	2	1	9	14	3	2
COAL	3	1	7	20	1	5
COYOTE SPRING (MOB)	5	3	7	6	9	0
DELAMA R	2	1	4	3	4	0
DRY LAKE	3	1	8	3	5	0
GARDEN	2	1	11	66	8	7
HOT CREEK	4	2	28	36	14	6
JAKES	0	0	3	2	8	0
KOBEH	0	0	8	49	13	5
LAKE	0	0	0	67	0	15
LITTLE SMOKY	0	0	4	20	3	3
LONG	0	0	6	23	3	6
MONITOR	0	0	17	12	22	0
MULESHOE	2	1	5	3	8	0
NEWARK	0	1	15	49	11	5
PAHROC	0	0	0	5	1	0
PENoyer	0	0	6	39	9	6
RAILROAD	4	2	12	64	15	19
RALSTON	0	0	2	24	6	3
REVEILLE	2	1	6	9	6	1
SPRING	2	2	15	88	10	13
STEPTOE	1	1	23	39	16	9
STONE CABIN	0	0	7	25	8	5
WHITE RIVER	1	4	22	112	3	11
UTAH						
DUGWAY	2	0	1	37	1	3
FISH SPRINGS FLAT	0	0	2	85	1	9
ESCALANTE DESERT (AOB)	4	2	32	86	4	0
PINE	2	1	6	3	2	0
SEVIER DESERT	0	1	7	79	0	14
SNAKE(3)	0	5	26	349	7	40
HAMLIN(3)	2	5	23	138	15	16
TULE	4	3	14	190	5	16
WAH WAH	3	1	5	3	0	0
WHIRLWIND	2	1	3	94	2	15
TOTAL	54	44	362	1931	241	246

NOTE:

1. Includes test and observation wells.
2. Includes both drilling and reconnaissance program
3. Straddles Nevada - Utah border
4. Includes multiple measurements at monitoring sites through March 1981
5. Total does not include 7 wells outside water resources study area boundaries

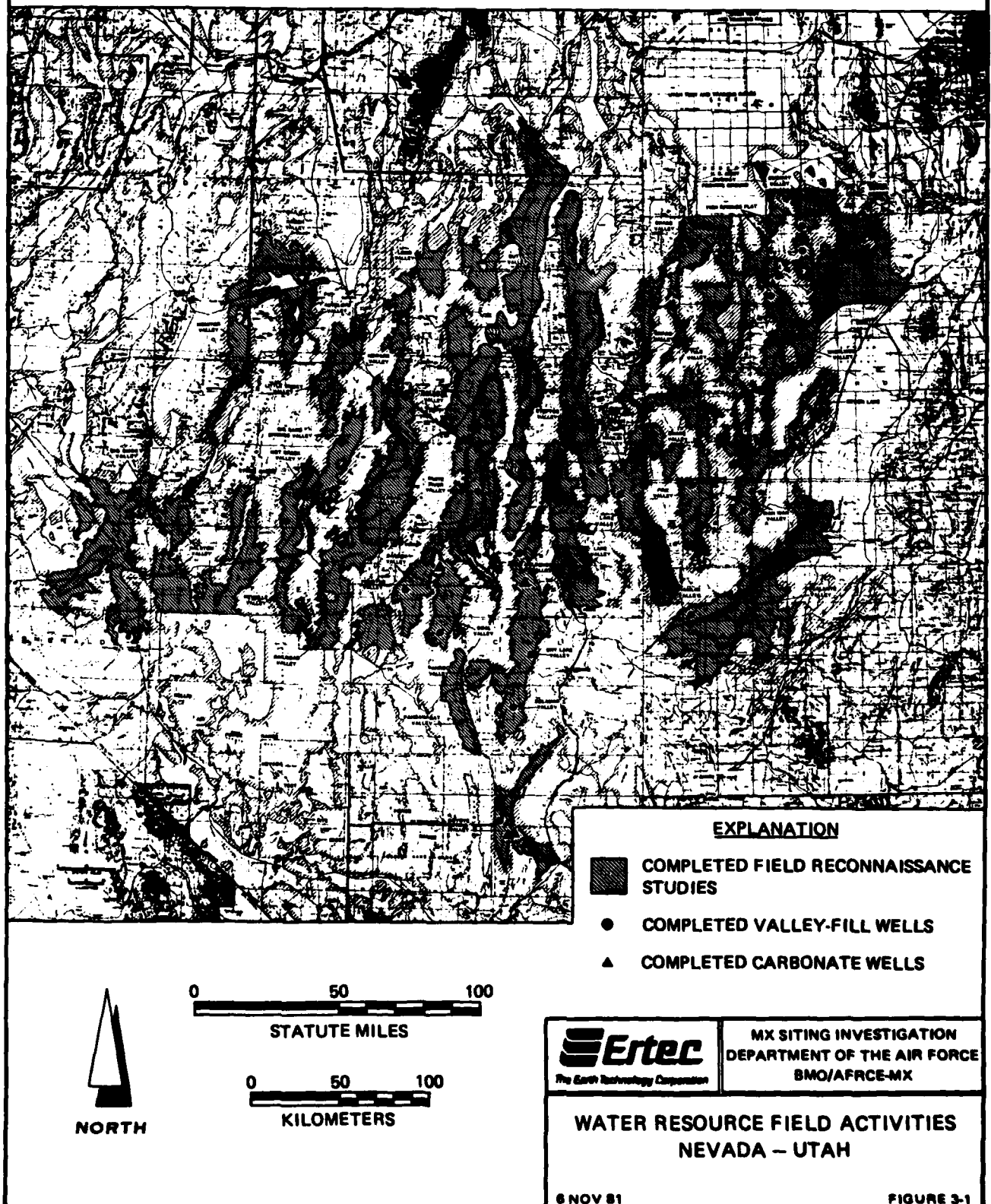


MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE
BMO/AFRC-MX

**SUMMARY OF MX WATER RESOURCES
PROGRAM FIELD ACTIVITIES**

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TABLE 3-1



- o Most of the valleys in the deployment area have sufficient ground-water available in valley-fill aquifers to supply MX construction needs based on state perennial yield estimates, ground-water in storage, and present ground-water rights.
- o Approved ground-water rights presently exceed the state estimated perennial yield in Big Smoky, Penoyer, Lake, and Stone Cabin valleys. Alternate sources of water supply for MX would be required in these valleys depending on the State Engineer's ruling on the Air Force applications for ground-water appropriations.
- o Ground water of suitable quality for drinking and construction is believed to be present in nearly all of the valleys based on field investigations and available data. Ground water is of generally poorer quality in Dugway, Whirlwind, and Fish Springs Flat valleys, Utah, and would require some treatment for MX domestic purposes.
- o Well yields obtained during valley-fill aquifer testing (reconnaissance and drilling programs) ranged from 7 gallons per minute (gpm) (0.44 l/s) to 2200 gpm (139 l/s). Well yields averaged 341 gpm (21.6 l/s) for the test wells drilled by Ertec.
- o The transmissivities calculated from valley-fill aquifer tests performed by Ertec on privately owned wells and wells drilled as part of the Water Resources Program ranged from 4 to 19,000 ft²/day (0.37 to 1766 m²/day). Storativity ranged from 0.001 to 0.14.
- o Based on lithologic logs, unconfined valley-fill aquifer conditions were indicated in all wells drilled and tested by Ertec except in Cave and Tule valleys. Cave and Tule valleys wells showed semiconfined to confined aquifer conditions.
- o Drawdown of water levels in existing wells or alteration of spring discharge has not been detected during aquifer testing by Ertec.
- o Valley-fill aquifer testing of an Air Force test well in Muleshoe Valley yielded 50 gpm (3 l/s) with 302 feet (92 m) of drawdown. Additional aquifer testing in the valley would be required to verify whether wells tapping the valley-fill aquifer would be capable of supplying the rates of withdrawal required for MX construction.
- o Computer simulations of the valley-fill aquifer's response to projected MX pumping have been completed for Delamar, Dry Lake, Muleshoe, Pine, and Wah Wah valleys. Maximum simulated drawdowns at a distance of 1 mile (1.6 km) from MX production wells ranged from 0.8 feet (0.2 m) to 6 feet (2 m).

- o The magnitude of these projected drawdowns is low and significant impacts to existing water users and the environment could be avoided or minimized through appropriate setback of Air Force wells from existing wells and environmentally sensitive areas, and through a comprehensive hydrologic monitoring program.

Table 3-2 provides a summary of valley-fill aquifer drilling and testing information.

3.3.2 Carbonate Aquifer Studies

Exploratory drilling and testing have been conducted in Steptoe, Coyote Spring, Dry Lake, and Coal valleys. The carbonate aquifer drilling and testing information is summarized in Table 3-3.

The preliminary results and conclusions of the studies are listed below:

- o Potential well yields ranged from 3400 gpm (215 l/s) in Coyote Spring Valley to 95 gpm (6 l/s) in Coal Valley.
- o Estimated transmissivities for the carbonate aquifer tests ranged from in excess of 40,000 ft²/day (3717 m²/day) in Coyote Spring Valley to a low of 200 ft²/day (19 m²/day) in Steptoe Valley.
- o Specific capacities for the carbonate aquifer tests ranged from 283 gpm per foot (59 l/s per m) of drawdown in Coyote Spring Valley to 0.8 gpm per foot (0.2 l/s per m) of drawdown in Steptoe Valley.
- o Carbonate aquifer drilling and testing results, evaluation of flow system behavior, and detailed analysis of structural features suggest that permeability development associated with faulting is a major factor controlling ground-water movement and, consequently, well development potential. The variation in well yields from the drilling and testing program is due to the different hydrostratigraphic sequences and the varying structural conditions encountered at each site.

VALLEY LEGAL DESCRIPTION	DRILLING RESULTS									
	DEPTH (FEET)		TEST WELL			OBSERVATION WELL				
			CASING DIAMETER (INCHES)	DRILLING DATES		DRILLED DEPTH (FEET)	PIEZOMETERS			STA
	DRILLED	CASED		START	END		NO.	(INCHES)	DEPTH (FEET)	
Beryl O.B. (C-33-17)21dd	353	353	10	12/05/80	12/07/80	504	2	2	236& 332	12/0
Big Sand Springs 8N/53E-29da	620	573	10	03/23/81	04/07/81	649	2	2	493& 650	03/0
Cave 7N/63E-14ab	463	435	10	09/11/80	09/25/80	460	2	2	273& 422	08/2
Coal 1S/59E-34cb	1340	0-1123 1111- 1315	10 6	12/13/80	02/19/81	1452	1	2	1452	12/1
Coyote Spring O.B. 12S/63E-29db	1221	860	10	12/15/80	01/28/81	714	2	2	560& 714	11/1
Delamar 6S/63E-12ad	1215	1195	10	02/29/80	03/12/80	1015	2	2	640& 981	02/1
Dry Lake 3S/64E-12ac	1010	990	10	01/26/80	02/12/80	1305	2	2	795& 1300	01/0
Dugway #1 (C-12-10)31cc	402	400	10	07/28/80	08/01/80	-----NO OBSERVATION WELL				
Dugway #2 (C-11-10)19bb	-----NO TEST WELL DRILLED-----					178	1	2.5	174	07/
Garden 2N/57E-22ba	1065	1010	10	09/11/80	10/24/80	1099	2	2	315& 1032	08/
Hamlin 8N/69E-35dc	480	475	10	08/18/80	08/21/80	522	1	2	435	08/

Legend for abbreviations: DNA-Does not apply
 O.P.-Observation well-pumping
 NC-Not conclusive
 O.R.-Observation well-recovery
 NA-Not applicable

T.R.-Test well-recovery
 o-Static water levels after
 Δ-Monitoring conducted 16
 *-Preliminary Data

OBSERVATION WELL				AQUIFER TEST RESULTS*						
EZOMETERS		DRILLING DATES		DEPTH TO WATER (FEET) ^o		DIS-CHARGE (GPM)	TRANS-MISSIVITY (sq ft/day)	STORATIVITY		TESTING
(INCHES)	DEPTH (FEET)	START	END	TEST	OBSERVATION			INITIAL	DELAYED	START
2	236& 332	12/03/80	12/04/80	185	176& 193	600	13000 (T.R.)	DNA	DNA	01/08/81
2	493& 650	03/04/81	03/09/81	467	472& 469	435	7800 (T.R.)	DNA	DNA	05/12/81
2	273& 422	08/23/80	09/10/80	229	231& 231	223	2400 (O.P.)	9.2x10 ⁻⁵	1.3x10 ⁻²	10/13/80
2	1452	12/15/80	12/19/80	845	862	450	3700 (O.P.)	4.0x10 ⁻⁴	6.3x10 ⁻³	05/29/81
2	560& 714	11/13/80	11/22/80	N/A	547& 549	NO AQUIFER TEST				
2	640& 981	02/15/80	02/23/80	871	Dry& 867	85	1100 (O.P.)	NC	NC	05/03/80
2	795& 1300	01/03/80	01/24/80	395	383& 383	500	3400 (O.P.)	5.3x10 ⁻⁴	1.3x10 ⁻²	04/03/80
NO OBSERVATION WELL DRILLED-----				Dry	NA	NO AQUIFER TEST				
2.5	174	07/28/80	07/29/80	NA	Dry	NO AQUIFER TEST				
2	315& 1032	08/07/80	08/16/80	422	Dry& 431	517	12000 (O.P.)	6.4x10 ⁻⁴	2.5x10 ⁻³	11/05/80
2	435	08/06/80	08/07/80	158	176	110	2500 (O.P.)	1.9x10 ⁻⁴	1.0x10 ⁻²	09/09/80

Test well-recovery
 Static water levels after well development
 Monitoring conducted 16-19 February 1981
 Preliminary Data

Up

1 2

WATER TEST RESULTS*				MONITORING ^Δ			COMMENTS
STORATIVITY		TESTING DATES		DEPTH TO WATER			
INITIAL	DELAYED	START	END	TEST WELL	DEEP PIEZOMETER	SHALLOW PIEZOMETER	
DNA	DNA	01/08/81	01/22/81	185	193	176	Water level taken on 8 January 1981
DNA	DNA	05/12/81	05/22/81	467	471	472	Water levels taken on 7 April 1981
9.2x10 ⁻⁵	1.3x10 ⁻²	10/13/80	10/25/80	228	230	229	
4.0x10 ⁻⁴	6.3x10 ⁻³	05/29/81	06/08/81	NOT MONITORED			
NO AQUIFER TEST				627	550	549	No aquifer test, test well dry upon completion in alluvium
NC	NC	05/03/80	05/13/80	NA	867	Dry@590	Test well not accessible for sounding
5.3x10 ⁻⁴	1.3x10 ⁻²	04/03/80	04/27/80	395	383	383	Transmissivity and storativity values averaged from values obtained for both shallow and deep piezometers
NO AQUIFER TEST				Dry@ 327 ft	NA	NA	No observation well drilled
NO AQUIFER TEST				NA	Dry@174	NA	No test well drilled
6.4x10 ⁻⁴	2.5x10 ⁻³	11/05/80	12/12/80	421	430	Dry	
1.9x10 ⁻⁴	1.0x10 ⁻²	09/09/80	09/14/80	156	174	NA	

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VALLEY-FILL AQUIFER
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TABLE 3-6

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VALLEY LEGAL DESCRIPTION	DRILLING RESULTS								
	DEPTH (FEET)		TEST WELL			OBSERVATION			
			CASING DIAMETER (INCHES)	DRILLING DATES		DRILLED DEPTH (FEET)	PIEZOMETERS		
	DRILLED	CASED		START	END		NO.	(INCHES)	DEPTH (FEET)
Hot Creek #1 7N/51E-10ad	540	480	10-0' to 340 8-340 to 480	08/26/80	08/29/80	500	1	2.5	480
Hot Creek #2 6N/50E-27ac	505	505	10	08/27/80	08/28/80	455	1	2.5	455
Milford O.B. (C-31-13)5bb	600	374	10	11/14/80	11/17/80	342	2	2.5	138& 342
Muleshoe 4N/64E-7dc	1215	1170	10	07/27/81	07/29/81	1253	2	2	672& 1134
Pine (C-26-17)10aa	951	870	10	06/25/80	07/12/80	1157	1	2	882
Railroad #1 3N/52E-2da	484	461	10	08/01/80	08/03/80	495	1	2.5	495
Railroad #2 10N/58E-17bd	610	580	10	09/18/80	09/21/80	604	2	2.5	220& 600
Reveille 3N/50E-13ca	681	680	10	02/10/81	02/13/81	710	2	2	405& 703
Spring 9N/68E-30ab	700	699	10	08/03/80	08/07/80	700	2	2	247& 700
Tule #1 (C-20-14)6dd	624	620	10	07/08/80	07/10/80	620	1	2.5	620
Tule #2 (C-17-15)17ca	430	400	10	07/09/80	07/16/80	310	1	2.5	296
Wah Wah (C-26-14)25ab	-----NO TEST WELL DRILLED-----					1250	1	2	1114

Legend for abbreviations: DNA-Does not apply
 O.P.-Observation well-pumping
 NC-Not conclusive
 O.R.-Observation well-recovery
 NA-Not applicable

T.R.-Test well-recovery
 o-Static water level
 Δ-Monitoring conductance
 *-Preliminary Data

OBSERVATION WELL			AQUIFER TEST RESULTS*							
WELL ID	DRILLING DATES		DEPTH TO WATER (FEET) °		DIS- CHARGE (GPM)	TRANS- MISSIVITY (sq ft/day)	STORATIVITY		TESTING DATES	
	START	END	TEST	OBSERVATION			INITIAL	DELAYED	START	END
480	09/02/80	09/03/80	237	256	235	19000 (O.P.)	1.3×10^{-3}	2.0×10^{-2}	09/26/80	10/09/80
455	09/06/80	09/07/80	292	304	375	1600 (O.P.)	1.4×10^{-4}	4.1×10^{-3}	09/24/80	10/03/80
138& 342	11/22/80	11/22/80	31	31& Dry	350	3400 (O.P.)	4.5×10^{-4}	8.0×10^{-2}	12/08/80	12/17/80
672& 1134	06/27/81	07/02/81	268	270& 264	50	30 (O.P.)	1.0×10^{-4}	6.2×10^{-4}	08/24/81	09/05/81
882	06/08/80	06/16/80	443	434	75	330 (O.P.)	2.2×10^{-4}	1.6×10^{-3}	07/20/80	08/10/80
495	08/14/80	08/15/80	233	235	735	11000 (O.P.)	1.5×10^{-4}	6.0×10^{-2}	08/12/80	09/29/80
220& 600	09/20/80	09/21/80	281	Dry& 280	705	7900 (O.P.)	3.3×10^{-4}	1.1×10^{-3}	10/19/80	11/30/80
405& 703	02/04/81	02/06/81	316	321& 321	550	5000 (O.P.)	1.2×10^{-4}	1.2×10^{-2}	04/01/81	04/11/81
247& 700	08/09/80	08/11/80	230	Dry& 219	600	NC	NC	NC	09/09/80	09/22/80
620	07/21/80	07/21/80	84	89	50	NC	DNA	DNA	07/28/80	08/15/80
296	07/21/80	07/22/80	47	53	255	NC	DNA	DNA	08/01/80	08/15/80
1114	07/07/80	07/30/80	NA	Dry	NO AQUIFER TEST					

Well-recovery
water levels after well development
conducted 16-19 February 1981
by Data

Updated

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TEST RESULTS*				MONITORING ^Δ			COMMENTS
STORATIVITY		TESTING DATES		DEPTH TO WATER			
INITIAL	DELAYED	START	END	TEST WELL	DEEP PIEZOMETER	SHALLOW PIEZOMETER	
1.3x10 ⁻³	2.0x10 ⁻²	09/26/80	10/09/80	238	255	NA	Water levels monitored on 1 April 1981
1.4x10 ⁻⁴	4.1x10 ⁻³	09/24/80	10/03/80	291	301	NA	
4.5x10 ⁻⁴	8.0x10 ⁻²	12/08/80	12/17/80	28	Dry	28	
1.0x10 ⁻⁴	6.2x10 ⁻⁴	08/24/81	09/05/81	-----NOT MONITORED-----			
2.2x10 ⁻⁴	1.6x10 ⁻³	07/20/80	08/10/80	437	434	NA	
1.5x10 ⁻⁴	6.0x10 ⁻²	08/12/80	09/29/80	230	233	NA	
3.3x10 ⁻⁴	1.1x10 ⁻³	10/19/80	11/30/80	279	278	NA	
1.2x10 ⁻⁴	1.2x10 ⁻²	04/01/81	04/11/81	316	321	321	
NC	NC	09/09/80	09/22/80	229	219	Dry@165	
DNA	DNA	07/28/80	08/15/80	86	89	NA	
DNA	DNA	08/01/80	08/15/80	47	53	NA	Following drilling the well was dry
NO AQUIFER TEST -----				NA	236	NA	

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 VALLEY-FILL AQUIFER
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TABLE 3-3

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E-TR-55

VALLEY LEGAL DESCRIPTION	DRILLING RESULTS								
	DEPTH (FEET)		TEST WELL			OBSERVATION WELL			
	DRILLED	CASED	CASING DIAMETER (INCHES)	DRILLING DATES		DRILLED DEPTH (FEET)	PIEZOMETERS		
				START	END		NO.	(INCHES)	DEPTH (FEET)
Wah Wah (C-27-14) 28dd	1399	1350	10	10/23/80	12/10/80	1399	1	2	987
Whirlwind (C-15-12) 19ad	1033	1025	10	10/20/80	11/10/80	1220	1	2	1191
White River 8N/61E-27dc	-----NO TEST WELL DRILLED-----					1300	2	2	200± 400

Legend for abbreviations: DNA-Does not apply
 O.P.-Observation well-pumping
 NC-Not conclusive
 O.R.-Observation well-recovery
 NA-Not applicable

T.R.-Test well-recovery
 o-Static water levels
 Δ-Monitoring conducted
 *-Preliminary Data

WATER TEST RESULTS*

MONITORING^Δ

STORATIVITY

TESTING DATES

DEPTH TO WATER

COMMENTS

INITIAL

DELAYED

START

END

**TEST
WELL**

**DEEP
PIEZOMETER**

**SHALLOW
PIEZOMETER**

1.8x10⁻³

1.4x10⁻¹

04/14/81

04/24/81

570

564

NA

DNA

DNA

12/08/80

12/18/80

795

797

NA

NO AQUIFER TEST

NA

40

40

No test well drilled

Updated - 28 September 1981



**MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE
BMO/AFRC-MX**

**VALLEY-FILL AQUIFER
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TABLE 2-2

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VALLEY LEGAL DESCRIPTION	DRILLING RESULTS								
	DEPTH (FEET)		TEST WELL			OBSERVATION			
			CASING DIAMETER (INCHES)	DRILLING DATES		DRILLED DEPTH (FEET)	PIEZOMETERS		
	DRILLED	CASED		START	END		NO.	(INCHES)	DEPTH (FEET)
Coal/Garden 3N/59E-10bd	1837	0-118	10	08/17/80	12/08/80	-----	NO	OBSERVATION	WEL
Coyote Spring O.B. 13S/63E-23ddd	669	0-50.5	10	11/20/80	12/10/80	-----	NO	OBSERVATION	WEL
Coyote Spring O.B. 13S/63E-23dd	628	0-126	20	04/14/81	05/05/81	-----	NO	OBSERVATION	WEL
Coyote Spring O.B. 13S/64E-35dd	937	0-87 0-325	12 3/4 8 5/8	05/21/81	06/03/81	-----	NO	OBSERVATION	WEL
Dry Lake 3N/63E-27ca	2395	0-347 0-775	10 8	10/23/80	11/21/80	-----	NO	OBSERVATION	WEL
Steptoe 12N/63E-12ba	2447	0-50 0-958	8 6	08/28/80	10/13/80	-----	NO	OBSERVATION	WEL

Legend for abbreviations: DNA-Does not apply
 NA-Not applicable
 o-Static water levels after well development
 Δ-Monitoring conducted 16-19 February 1981
 *-Preliminary Data

			AQUIFER TEST RESULTS*							
OBSERVATION WELL			DEPTH TO WATER (FEET) °		DIS-CHARGE (GPM)	TRANS-MISSIVITY (sq ft/day)	STORATIVITY		TESTING DATES	
WELLS	DRILLING DATES						INITIAL	DELAYED	START	END
DEPTH (FEET)	START	END	TEST	OBSERVATION						
TEST WELL DRILLED-----			803	NA	95	400	DNA	DNA	01/13/81	01/16/81
TEST WELL DRILLED-----			353	NA	540	40,000	DNA	DNA	12/18/80	12/23/80
TEST WELL DRILLED-----			350	NA	3400	T value pending final analysis	DNA	DNA	07/10/81	09/28/81
TEST WELL DRILLED-----			458	NA	-----AQUIFER TESTING PENDING-----					
TEST WELL DRILLED-----			853	NA	106	13,400	DNA	DNA	12/07/80	12/12/80
TEST WELL DRILLED-----			427	NA	100	200	DNA	DNA	01/18/81	01/21/81

Updated -

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1

WATER TEST RESULTS*
MONITORING Δ
STORATIVITY
TESTING DATES
DEPTH TO WATER
COMMENTS
INITIAL
DELAYED
START
END
**TEST
WELL**
**DEEP
PIEZOMETER**
**SHALLOW
PIEZOMETER**

DNA

DNA

01/13/81

01/16/81

804

NA

NA

(CV-DT-1)

DNA

DNA

12/18/80

12/23/80

354

NA

NA

(CE-DT-4)

DNA

DNA

07/10/81

09/28/81

Not
Moni-
tored

NA

NA

(CE-DT-5)

---AQUIFER TESTING PENDING---

Not
Moni-
tored

NA

NA

(CE-DT-6) Used as
observation well for
CE-DT-5 testing.

DNA

DNA

12/07/80

12/12/80

851

NA

NA

(DL-DT-3)

DNA

DNA

01/18/81

01/21/81

424

NA

NA

Well cased to 958 feet
below land surface.
Aquifer test performed
through perforated
casing (SV-DT-2).

Updated - 28 September 1981


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DEPARTMENT OF THE AIR FORCE
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**CARBONATE AQUIFER
DRILLING AND TESTING INFORMATION
WATER RESOURCES PROGRAM**

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TABLE 3-3

13

- o The carbonate aquifer units with the greatest potential for supplying water for MX needs are 1) the Pole Canyon Limestone of Cambrian age, 2) undifferentiated limestones and dolomites of Cambrian to Ordovician age, and 3) the Ely Springs, Laketown, Sevy and Simonson dolomites, and the Guilmette Formation of Ordovician to Devonian age.
- o A major aquitard controlling regional ground-water movement is the Chainman Shale and Scotty Wash Quartzite of Mississippian age.
- o Deep-seated basin and range faults, which displace carbonate rocks, serve to establish ground-water conduits which are capable of transmitting a large amount of recharge water to the various carbonate aquifers and also provide avenues for upward and lateral transport of deeply circulated ground water.
- o The siting area valleys that have an estimated high potential for carbonate aquifer development are Butte, Cave, Coal, Coyote Spring (OB), Dry Lake, Garden, Hamlin, Kobeh, Muleshoe, Pahroc, Railroad, Spring, and White River.
- o Existing quality data from regional springs and analyses of spring and well samples collected indicate that water within the carbonate aquifers generally meet standards for construction and domestic water use. All water is basically of the calcium-magnesium-bicarbonate type. Significant amounts of sulfate and chloride are present near the terminus of some flow systems where mixing with noncarbonate water may be occurring. The averages for total dissolved solids in individual valleys ranged from 300 to 650 mg/l.

3.3.3 Operational Base Studies

Operational base studies were conducted for the potential OB sites in Coyote Spring Valley, Nevada, and Escalante Desert, Utah.

The results and conclusions of the OB studies are summarized below:

- o Due to the inadequate supply of surface water available in Coyote Spring Valley, any surface water for the OB would have to be leased or purchased and piped from the Muddy River Springs area, southwest of the valley, or from the Overton Arm of Lake Mead (Colorado River).

- o The valley-fill deposits in Coyote Spring Valley will provide only limited development of ground water. The valley-fill aquifer is not considered to be an adequate source of water for OB construction and operation. Tests conducted by Ertec in the central part of the valley indicate low hydraulic conductivity and, consequently, low anticipated well yields for these deposits.
- o A test well in southern Coyote Spring Valley that penetrated fractured carbonate rock was pumped by Ertec for 30 days at a rate of 3400 gpm (215 l/s) with approximately 12 feet (4 m) of drawdown. These results suggest a potential yield of water from the carbonate system more than adequate to meet current OB water-supply requirements for construction and operational use.
- o Significant short-term impacts to downflow surface and ground-water users in the Muddy River Springs area due to MX ground-water withdrawals from the carbonate aquifer in Coyote Spring Valley are not expected based on the results of carbonate aquifer tests.
- o All but four of the sites with available water chemistry analyses in Coyote Spring Valley and the adjacent Muddy River Springs area meet federal and state drinking water standards. Three water samples that did not meet standards are from wells located in an area of high domestic and agricultural use in the Moapa area. Water from the carbonate test wells in Coyote Spring Valley does not meet federal or state drinking water standards for fluoride. All water samples analyzed meet the criteria established by the Portland Cement Association for the mixing of cement.
- o Existing use of ground water in Escalante Desert, Utah, (Milford and Beryl OB sites) exceeds the estimated annual rate of replenishment, and the Utah State Engineer has closed the basin to additional ground-water appropriations.
- o Lease or purchase of existing surface or ground-water rights will be necessary to supply water for OB construction and operation in Escalante Desert.
- o The valley-fill aquifer at both of the proposed OB locations in the Milford and Beryl districts is capable of delivering water in sufficient quantities and of acceptable quality to meet MX Operational Base requirements. Existing ground-water rights could be leased or purchased, the points of diversion transferred to a location at or near the OB, and a new well or wells drilled for MX water supply.
- o Well yield during valley-fill aquifer testing at the Milford OB site was 350 gpm (22 l/s). A transmissivity of 3400 ft²/day (316 m²/day) and a storativity of 0.08 were calculated from test results.

- o Well yield during valley-fill aquifer testing at the Beryl OB site was 600 gpm (38 l/s). A transmissivity of 13,000 ft²/day (1208 m²/day) was calculated from test results. No storativity has been determined.
- o Preliminary numerical analysis of a well field at each candidate OB site in the valley was performed using a computer simulation of six wells withdrawing ground-water at a total rate of 2900 acre-ft/yr (3.6 hm³/yr) for 30 years. For a secondary OB site in Beryl, a water-level drawdown of 9 feet (3 m) at 1 mile (1.6 km) and 2 feet (0.6 m) at 6 miles (10 km) from the well field was obtained after 30 years. In Milford, a drawdown of 11 feet (3 m) at 1 mile (1.6 km) and 4 feet (1 m) at 6 miles (10 km) from the well field was obtained after 30 years.

3.3.4 Water Management Planning

Preliminary water management plans were developed for the following valleys:

Cave	Escalante Desert (OB)	Pahroc
Coal	Garden	Pine
Coyote Spring (OB)	Hamlin	Spring
Delamar	Lake	Wah Wah
Dry Lake	Muleshoe	

The four basic water-supply sources considered are 1) the appropriation of ground water and the construction of wells in the valley-fill aquifer, 2) the appropriation of ground water and the construction of wells in the regional carbonate aquifer, 3) the lease or purchase of existing surface- or ground-water rights, and 4) the importation of water from "water rich" valleys or sources, such as Railroad, Spring, and Snake valleys and the Colorado River. These water-supply sources were evaluated for each of the 14 study valleys based on legal and physical water availability, potential impacts of withdrawal, cost, timeliness to develop, and water quality. The results of this evaluation along with the results of the water-supply

system evaluation and recommended additional investigations are summarized in Table 3-4.

Primary and secondary suitable areas, and excluded areas for MX valley-fill aquifer water-supply well development, have been identified for each of the 14 study valleys based on cultural, hydrogeologic, environmental, and legal considerations. All of the 14 study valleys have suitable drilling areas for valley-fill aquifer water-supply wells with the exception of Coyote Spring Valley. The results of Ertec testing of a test well indicate that the valley-fill aquifer is not a viable water-supply source for OB construction and operation in that valley.

The principal elements of a hydrologic monitoring program, which is an important factor in water management, include monitoring of ground-water levels, spring discharges, and surface- and ground-water chemistry. Streamflow should also be monitored in certain areas. Where possible, monitoring sites or stations should be located to detect hydrologic changes prior to impact at existing wells or springs.

If significant or unacceptable impacts of existing water sources (wells, springs, or streams) are projected or develop there are several mitigation options available:

- o Reduction of the rate of water withdrawal at the Air Force point of diversion causing impact;
- o Cessation of water withdrawal at the Air Force point of diversion causing impact;
- o Delivery of water to the impacted point of diversion to compensate for temporarily reduced production capacity or water quality.

VALLEY	PREFERRED WATER-SUPPLY SYSTEM AND SOURCE OF MX WATER							NUMBER OF RECOMMENDED ADDITIONAL DRILLING/ TESTING SITES PRIOR TO WATER-SUPPLY SYSTEM DEVELOPMENT
	EXISTING AF WELL	VALLEY-FILL DEVELOPMENT	CARBONATE DEVELOPMENT	LEASE-PURCHASE	IMPORTATION	EARLY STORAGE	AF POD *	AMMEND AF POD *
CAVE								1
COAL								2
COYOTE SPRING								1
DELAMAR								2
DRY LAKE								2
ESCALANTE								0
GARDEN								1
HAMLIN								2
LAKE								1
MULESHOE								1
PAHROC								1
PINE								1
SPRING								1
WAH WAH								2

* POD - PENDING AIR FORCE GROUND-WATER
APPROPRIATION APPLICATION POINT
OF DIVERSION



MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE
BMO/AFRC-MX

SUMMARY OF WATER MANAGEMENT PLANNING RESULTS

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TABLE 3-4

3.4 WATER APPROPRIATIONS

Ertec filed applications for appropriation of ground water in 29 deployment valleys within the Nevada-Utah siting area in FY 80, and in six deployment valleys and three potential OB sites in FY 81. Table 3-5 lists the valleys for which water appropriation applications have been filed, the quantity of ground water requested, and other details of the filing.

The total quantity of ground water by valley, listed in Table 3-5, is based on the number of MX clusters sited in a valley as determined from Ertec MX shelter layouts and on COE construction water-use estimates (17 March 1981) for the Main and Alternative OB site valleys. The table also lists the number of points of diversion for each valley. The total annual quantity of ground water requested in Snake Valley is higher than other deployment valleys due to Nevada and Utah limitations on the transfer of water rights from one state to the other even though it is within the same hydrologic basin.

The total quantity of ground water requested annually for construction in each deployment valley includes water for a construction plant and camp in each valley except Delamar Valley.

Applications for appropriation of ground water at the potential OB sites in Coyote Spring Valley, Steptoe Valley (Ely), and Sevier Desert (Delta) were filed in early and mid FY 81. No applications were filed for the Milford and Beryl OB sites because the Utah State Engineer will not allow additional

<u>VALLEY</u>	<u>TOTAL QUANTITY OF GROUND WATER REQUESTED (ACRE - FT/YR)</u>	<u>NUMBER OF POINTS OF DIVERSION</u>	<u>DATE OF FILING</u>
DRY LAKE	3810	1	1-30-80
DELAMAR	1585	1	1-30-80
WHITE RIVER	3810	1	1-30-80
SNAKE	5687	5	10-25-79 & 7-15-80
REVEILLE	2770	5	7-11-80
HOT CREEK	3115	5	7-11-80
LITTLE SMOKY	2076	3	7-11-80
ANTELOPE	3805	5	7-11-80
RAILROAD	4148	4	7-11-80
GARDEN	3456	8	7-11-80
COAL	3456	9	7-11-80
PAHROC	1388	4	7-11-80
MULESHOE	1731	3	7-11-80
CAVE	2076	6	7-11-80
SPRING	2425	5	7-11-80
HAMLIN	3464	5	7-11-80
PINE	2421	5	7-11-80
TULE	4146	8	7-11-80
FISH SPRINGS FLAT	2537	8	7-11-80
WAH WAH	3801	7	7-11-80
WHIRLWIND	3685	8	7-11-80
DUGWAY	3111	5	7-11-80
SEVIER	2076	3	7-11-80
STONE CABIN	4152	8	7-15-80
RALSTON	4152	8	7-15-80
BIG SAND SPRINGS	2076	4	7-15-80
PENOYER	2422	2	7-15-80
LAKE	3805	5	7-15-80
BIG SMOKY	4146	3	7-15-80
BUTTE	2464	4	11-18-80 & 6-8-81
JAKES	1758	3	11-18-80
KOBEH	3530	5	11-18-80
NEWARK	1404	2	11-18-80
MONITOR	2112	3	11-18-80
LONG	1404	2	5-25-81
<u>OB SITES</u>			
COYOTE SPRING	19370 *	2	5-25-81 & 7-24-81
STEPTOE**	9685	1	11-18-80
ESCALANTE DESERT***	-	-	-

- * Two applications presently on file for 9685 acre-ft./yr. each. Only one will be acted upon.
- ** The quantity requested for this valley was based on the assumption that it was a potential OB site. At this time Steptoe Valley is being considered for missile deployment only.
- *** No applications filed.



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GROUND-WATER APPROPRIATION APPLICATIONS

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TABLE 2-5

appropriation of ground water in the Milford and Beryl portions of the Escalante Desert.

In Coyote Spring Valley, there are two points of diversion for which 9685 acre-ft/yr (22.1 hm³/yr) of ground water have been requested, one valley-fill aquifer site and one carbonate aquifer site. Testing by Ertec at the valley-fill aquifer site, subsequent to the filing (November 1980) of the application to appropriate ground water, indicated that the valley-fill aquifer would be incapable of supplying the quantity of water required during peak year MX use. Another application for 9685 acre-ft/yr (22.1 hm³/yr) was filed (July 1981) for the productive carbonate aquifer site which had been drilled at a later date (April 1981) and proven capable of supplying most of the estimated peak year construction water requirement of 9685 acre-ft/yr (22.1 hm³/yr).

Preparation for MX water appropriation application hearings, which were expected to begin by the end of 1981, focused on the 12 deployment and two OB site valleys in which construction was scheduled in 1982 and 1983 according to the COE. These valleys are listed in Section 3.3.4, Water Management Planning. A detailed example of the intended hearing presentation in support of the Air Force applications for ground water in Dry Lake Valley was developed by Ertec. This was intended to serve as a model for presentations on other MX valleys. A copy of the presentation was submitted to Air Force for review at the end of FY 81.

4.0 AGGREGATE RESOURCES PROGRAM

4.1 BACKGROUND

The MX aggregate program began in 1977 with the investigation of Department of Defense (DoD) and BLM lands in California, Nevada, Arizona, New Mexico, and Texas. Refinement of the potential MX siting area in FY 79 added portions of Utah and Nevada that were not studied in the initial Aggregate Resource Evaluation Investigation (AREI) for portions of Nevada and California. This additional area, defined as the Utah Aggregate Resources Study Area (UARSA) was evaluated in a second general aggregate resources investigation that was submitted on 3 March 1980.

Valley-specific Aggregate Resources Studies (VSARS), initiated in FY 79, were more detailed and utilize to a greater extent the geologic and engineering data obtained from Verification studies. The Detailed Aggregate Resource Studies (DARS), begun in FY 81, more closely examine and refine potential basin-fill and crushed rock aggregate sources identified during previous studies.

4.2 OBJECTIVES AND SCOPE

4.2.1 Valley-Specific Aggregate Resources Study

The main objectives of the valley-specific studies were to determine the suitability of basin-fill deposits and ledge rock in concrete mixes and road construction.

The scope of work for a valley was as follows:

- o Identify and sample potential aggregate sources in the valley and adjacent mountains;
- o Perform laboratory tests including gradation, L.A. abrasion, $MgSO_4$ and $NaSO_4$ soundness, alkali reactivity, and specific gravity and absorption;
- o Compile and evaluate test data; and
- o Prepare valley reports with the results of the study and conclusions.

4.2.2 Detailed Aggregate Resources Study

Detailed Aggregate Resources Studies (DARS), initiated in 1980, further defined potential crushed rock and coarse and fine basin-fill aggregate sources identified during previous aggregate studies. The objectives of the two evaluations comprising the DARS were as follows:

Road-Base Aggregates Evaluation

- o Refine the location of potential basin-fill and rock sources (initially identified in VSARS) for road-base aggregates; and
- o Provide additional laboratory test data on the general quality of basin-fill aggregates for use as road-base material.

Concrete Aggregates Evaluation

- o Refine the areal extent of the most acceptable VSARS basin-fill and rock concrete aggregate sources; and
- o Provide additional laboratory testing information on the quality and concrete-making properties of potential coarse and fine basin-fill and crushed-rock aggregates.

The scope of this evaluation included the following:

- a. Compilation and analysis of appropriate existing data on the quality and quantity of potential road-base and concrete aggregates.

- b. Selection and backhoe excavation of staked and permitted basin-fill locations; sampling when gravel percentage exceeded 30 percent, or when suitable fine aggregates for concrete mixes were present. Selection and sampling of acceptable crushed-rock sources of coarse aggregates for concrete mixes.
- c. Laboratory tests to supplement available existing data for the determination of the suitability of specific basin-fill and rock units as sources of road-base or concrete aggregates.

Road-Base Aggregate Tests

- o Gradation Analysis
- o L.A. Abrasion
- o 5-Cycle $MgSO_4$ Soundness

Concrete Aggregate Tests

- o Gradation Analysis
- o L.A. Abrasion
- o 5-Cycle $MgSO_4$ Soundness
- o 5-Cycle $NaSO_4$ Soundness
- o Alkali Reactivity
 - Petrographics
 - Mortar-bar Method
 - Carbonate Rock Test
- o Trial Concrete Mixes
 - Concrete Mix Design
 - Trial Batches
 - Cylinder Breaks

- d. Development and application of road-base and concrete materials classification systems that textually and graphically depict the locations of the most suitable aggregate sources in the study area.

4.3 STATUS OF PROGRAMS

The progress of the Valley-Specific Aggregate Resources Study is summarized in Table 4-1 and Figure 4-1. Reports for six valleys field investigated in FY 80 were finalized and submitted in FY 81. Cave and Steptoe valleys were evaluated in FY 81.

Detailed aggregate studies field work was completed for Dry Lake, Delamar, Pahroc, Muleshoe, Pine, and Wah Wah valleys in

VALLEY	FIELD WORK COMPLETED	REPORT DATE
WHIRLWIND	SEPTEMBER 1979	JUNE 1980
HAMLIN	SEPTEMBER 1979	JUNE 1980
SNAKE	SEPTEMBER 1979	JUNE 1980
WHITE RIVER	OCTOBER 1979	JUNE 1980
DRY LAKE	NOVEMBER 1979	JUNE 1980
MULESHOE	NOVEMBER 1979	JUNE 1980
DELAMAR	NOVEMBER 1979	JUNE 1980
PAHROC	NOVEMBER 1979	JUNE 1980
PINE	AUGUST 1980	FEBRUARY 1981
WAH WAH	AUGUST 1980	FEBRUARY 1981
TULE	AUGUST 1980	JULY 1981
LAKE	SEPTEMBER 1980	FEBRUARY 1981
GARDEN	SEPTEMBER 1980	JULY 1981
COAL	SEPTEMBER 1980	JULY 1981
CAVE	OCTOBER 1980	SEPTEMBER 1981
STEPTOE	OCTOBER 1980	SEPTEMBER 1981

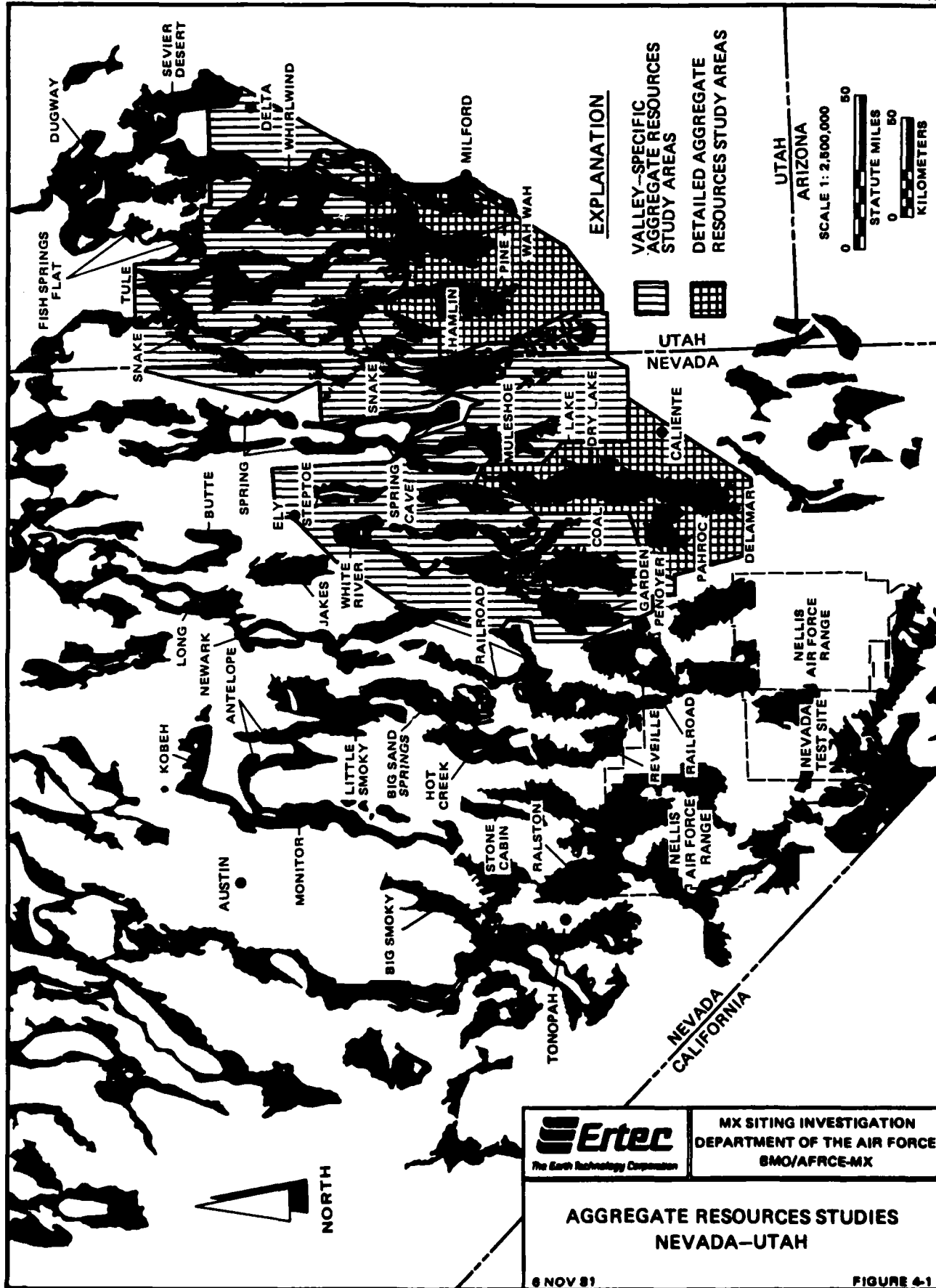


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SUMMARY OF AGGREGATE
RESOURCES STUDIES

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TABLE 4-1



October and November 1980 (Figure 4-1). Final reports were submitted in May and June 1981.

4.4 CONCLUSIONS

From the valley studies, it is concluded that all investigated areas appear to have adequate gravel, sand, and crushed-rock sources, although quality and quantity are variable. Valleys influenced by Pleistocene Lake Bonneville (Whirlwind, Wah Wah, Snake, and Tule) have abundant, well-defined, high quality gravel reserves deposited in lacustrine shoreline features. Valleys where alluvial processes are dominant possess somewhat lower quality and less distinct gravel reserves deposited in alluvial fans.

High quality sources of sand are of limited distribution. The only major sources of suitable high quality sand are located in lacustrine or alluvial deposits derived directly from granitic rock sources (e.g., Deep Creek Range bordering Snake Valley).

Sources of high quality crushed rock are available for all valleys. Paleozoic and Precambrian carbonate and quartzitic rock units are extensive and widely distributed in numerous Utah and Nevada formations. In addition, individual units within widespread undifferentiated Tertiary volcanics will also supply acceptable crushed-rock sources.

Although most rock will supply acceptable coarse aggregates, limited sources are delineated in this study. Sufficient quantities of basin-fill aggregates within the valley will probably make processing of crushed-rock aggregates unnecessary.

Results of the Detailed Aggregate Resources Study indicate that there are sufficient quantities of acceptable coarse and fine, road-base and concrete aggregates available for the construction of the MX missile system in the study areas. Because of less stringent physical and chemical requirements, road-base aggregate sources are larger and more widespread than concrete aggregate sources.

Concrete made from aggregates excavated from sources within the valley areas generally met or exceeded the design requirement of 28-day compressive strengths of 6500 psi. Mixes containing only basin-fill gravel and sand aggregates ranged in compressive strength from 4505 to 8160 psi. Mixes which contained crushed rock and local sand aggregates generally had higher 28-day compressive strengths, ranging from 3830 to 8790 psi.

5.0 SITING STUDIES

5.1 BACKGROUND

Ertec has performed siting studies for deployment of the MX missile in the Nevada-Utah siting area for a period of three years and has carried out limited studies in New Mexico in FY 81. In FY 79 and FY 80, the siting program was limited to methodology studies and experimentation with various basing modes. These studies continued as a minor program at the start of FY 81, and it was not until the second half of FY 81 that the siting program was expanded into a major program to meet the requirements of the tiering process and the schedules of the initial Land Acquisition Package.

The siting programs in FY 79 and FY 80 are discussed in previous executive summary reports and are summarized as follows:

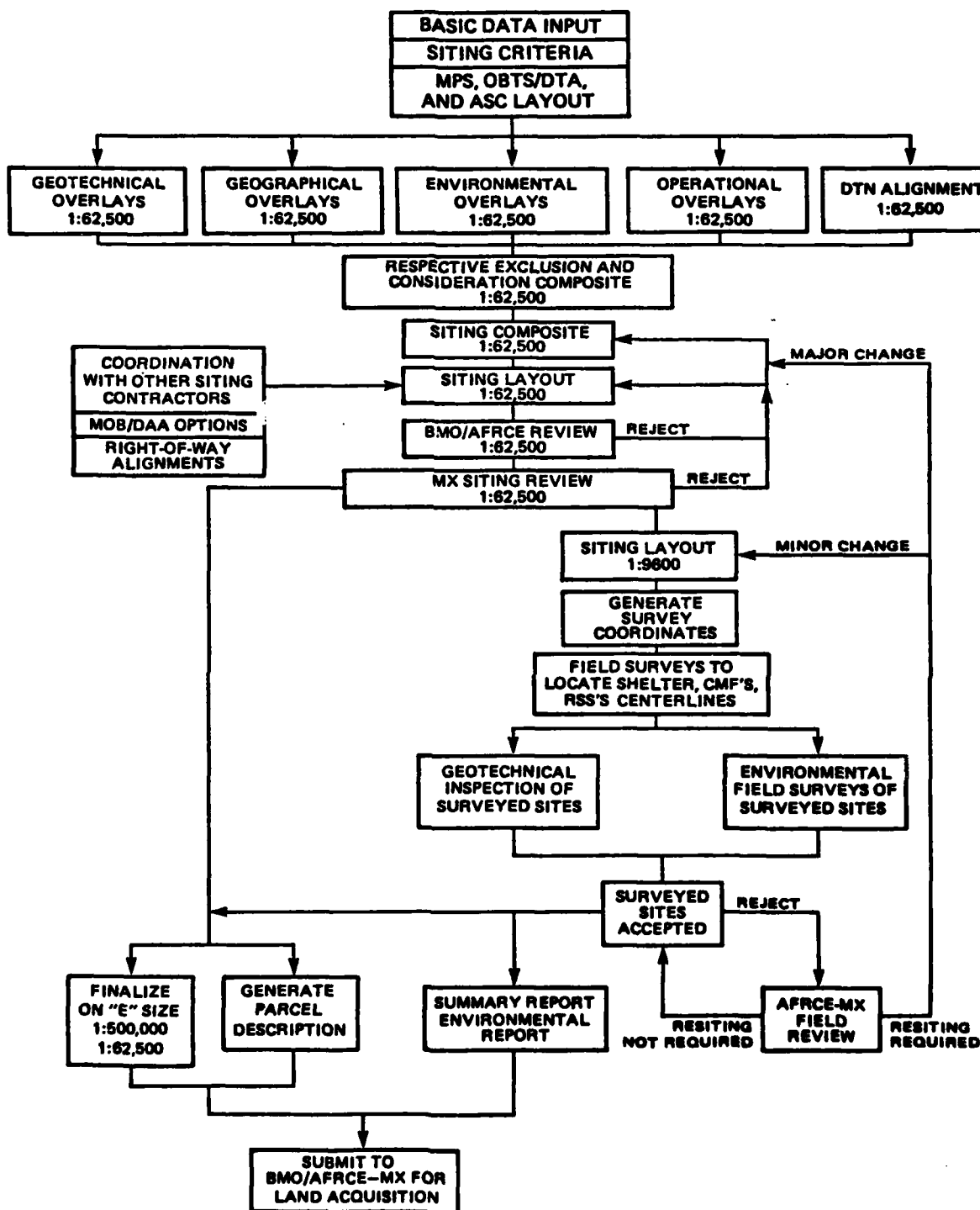
- o In FY 79, the following activities took place:
 - Initial shelter siting in Dry Lake Valley, Nevada; and
 - Initial routing studies for the DTN.
- o In FY 80, the siting studies consisted of:
 - Conceptual cluster layouts of all valleys in the Nevada/Utah Deployment Area at a scale of 1:62,500;
 - Conceptual Designated Transportation Network (DTN) routes from the various Main Operating Base (MOB) sites in Nevada and Utah;
 - Initial siting studies for the four Area Support Centers (ASCs);
 - Completion of shelter layouts at a scale of 1:9600 for Dry Lake Valley and the starting of similar layouts for Pine and Wah Wah Valley; and
 - Initial siting studies for the Operational Base (OB) and Operational Base Test Site (OBTS).

5.2 OBJECTIVES AND METHODOLOGY

The primary objective of the siting program in FY 81 has been to complete conceptual layouts for shelters, conceptual routing for the DTN, and determine possible locations for the OBTS and ASCs. The results of these studies were depicted on topographic base maps at a scale of 1:62,500 as the first step in the planning and design process. When completed, these conceptual layouts could be used for follow-on environmental assessments, field surveys, as portions of bid documents for final layout studies and design, and for incorporation in a Land Acquisition Package.

To complete the objectives required a rather complex siting process which is depicted in the flow charts in Figures 5-1 and 5-2. The starting point for the process was suitable area boundaries as determined from the Verification program. A series of overlays were prepared to identify geotechnical, geographical, and environmental factors which needed to be considered. After completion of the layouts, they were reviewed by BMO/AFRCE. Following this review, the layouts were sent to MX state coordination offices for review by various state agencies. Based on their comments, the layouts were modified and final drawings were prepared for the Land Acquisition Package.

The right portion of both flow charts shows the process that was used in those valleys identified as possible Initial Operational Capability (IOC) valleys. In these valleys, shelter sites were located and field surveys were carried out.



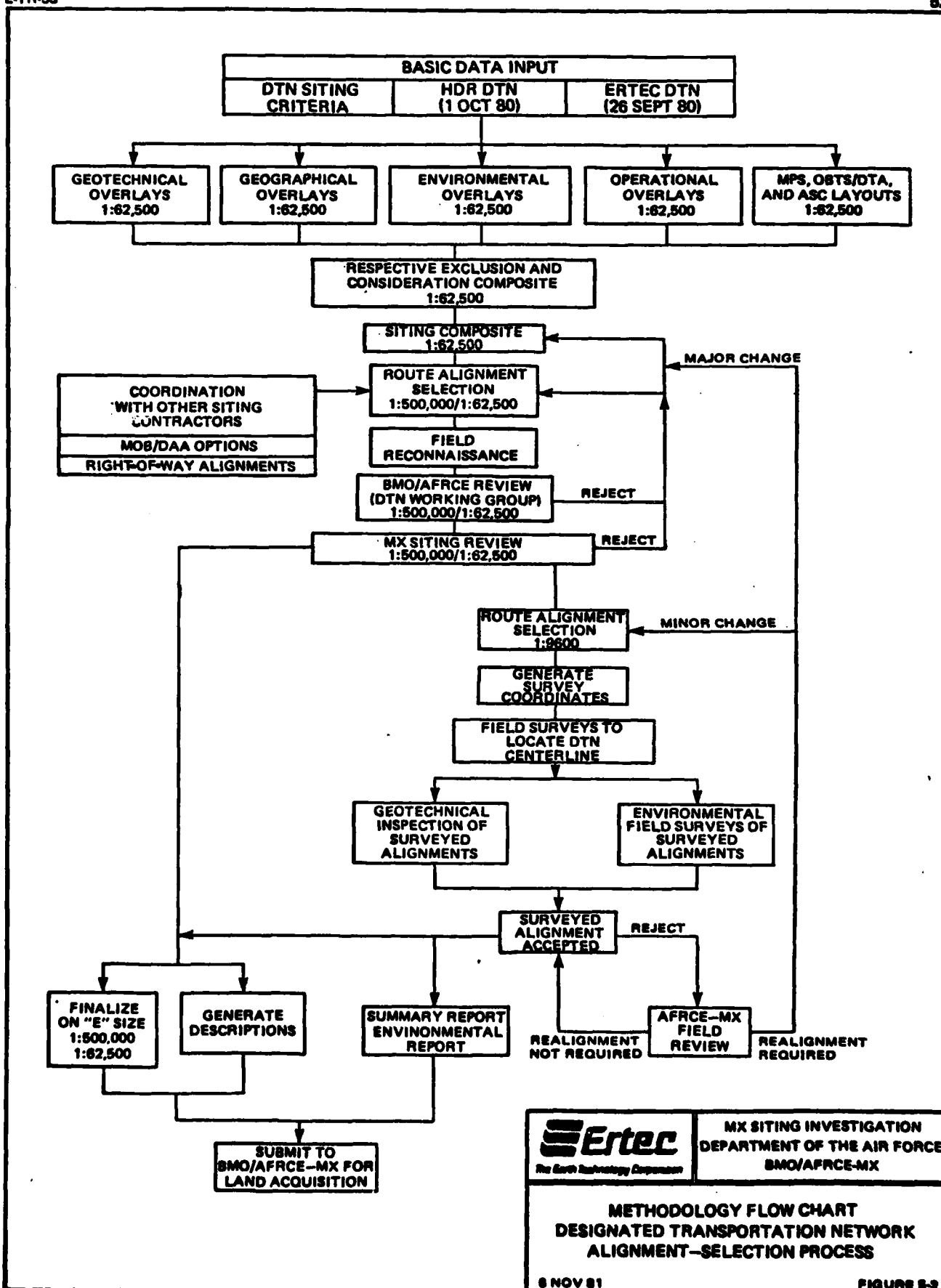
Ertec
The Earth Technology Corporation

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**METHODOLOGY FLOW CHART
FACILITY LAYOUT
SITE-SELECTION PROCESS**

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FIGURE S-1



5.3 SITING CRITERIA AND REQUIREMENTS

The general geometric and spatial shelter layout requirements for the Multiple Protective Structure (MPS) system are as follows:

- o 5200-foot (1586-m) spacing $\pm$ 200 feet (61 m);
- o 2/3-filled hexagonal pattern;
- o Relative angle formed by the longitudinal centerline of neighboring shelters: nominal 60°, minimum 55°;
- o Twenty-three shelters with 11 or 12 backfills per cluster; and
- o Maximum of three near neighbors per shelter.

For ASCs the general siting requirements are:

- o Each ASC is to provide security coverage for a circular area with a radius of 65 statute miles;
- o Locate ASCs along the DTN to efficiently provide overnight stopover accommodations for the Special Transportation Vehicle (STV);
- o Locate ASCs in "suitable" terrain but without loss of shelter sites;
- o Arrange ASCs so that the combined service areas cover all shelter locations; and
- o Consider proximity to major highways and local communities as being desirable.

In addition to these basic criteria, there were a number of other siting requirements in the form of exclusions and considerations. Operational requirements are listed in Table 5-1, Table 5-2 lists geotechnical and environmental requirements, and Table 5-3 covers the geographical requirements. In all three tables, exclusions mean that the area is not suitable for siting and considerations mean that the area is not preferred for siting but may be used if necessary.

SHELTERS AND AREA SUPPORT CENTERS (ASCs)

I. EXCLUSIONS:

- Quantity Distance (QD) Stand Off:
 - Existing road with an average daily traffic (ADT) greater than 50 vehicles per day: 2965' from centerline of road to HSS and CMF
 - Inhabited buildings: 2956' from CMF and HSS
 - Pipelines: 300'
 - Above ground Petroleum Oils, Lubricants (POL): 1800'
 - Radio, microwave facilities: 2965' from CMF and HSS
 - Power generating facilities: 5 statute miles
- Cluster roads cannot coexist with or cross federal, state, and county roads with an ADT of 250 vehicles per day

II. CONSIDERATIONS:

- Powerline; QD to all MX facilities:
 - Less than 50 kV : 750'
 - 50 kV to 250 kV: 1250'
 - More than 520 kV: 2500'
- Powerlines; QD to manned MX facilities with radio communications facilities:
 - Less than 45 kV: 100'
 - 45 kV and greater: 5000'
- Cluster Siting:
 - Clusters to be located so as to minimize the number of inhabited buildings within the QD zones
 - Clusters should be reasonably close to other clusters in the DDA
 - Locate clusters in areas with a minimum of medium to tall vegetation
- Cluster Roads:
 - Site MPSs to permit the CRN to be oriented North to South to the greatest extent possible
 - The CRN may coexist with or cross roads with an ADT less than 250 vehicles per day
 - Minimize environmental impact by coexisting with unpaved county roads of all other factors are equal
 - The CRN may cross from one siting area to another through unsuitable area as long as slope requirements and environmental exclusions are not violated
 - Slope requirements:
 - Nominal trunk and spur grades: maximum three percent
 - MPS access ramp grade: maximum five percent
 - Occasional grades of five percent may exist for a maximum of 500' sections
 - The CRN for a cluster will be separate from any other cluster
- Operational Support Roads (OSRs):
 - May connect CRNs, but shall preclude STV or TEL entrance or exit
 - Slope requirement: maximum 10 percent grade



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SYSTEM SITE – SELECTION
OPERATIONAL REQUIREMENTS
PAGE 1 OF 2

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TABLE 5-1

DESIGNATED TRANSPORTATION NETWORK (DTN)

I. EXCLUSIONS:

- Road grade greater than seven percent

II. CONSIDERATIONS:

- Should not cross railroad
- Cost effectiveness (construction cost vs. operating cost)
- Minimum grade
- Shortest road length
- Minimum elevation

OPERATIONAL BASE TEST SITE/DESIGNATED TRAINING AREA (OBTS/DTA)

I. EXCLUSIONS:

- Four - mile separation (from shelter centerline to)
 - OB/DAA
 - Airfields
 - Railroads
 - Major highways or major service road
 - DTN
 - Powerlines greater than 250 kV
 - Mining or processing plants
- One - mile separation from pipelines
- Approximately 3000' of the cluster road network with average of three percent grade with a maximum of five percent grade for not more than 5000'
- One shelter to face magnetic west
- The DTA shall be sited adjacent to the OBTS but outside the "No public use" area
- Locate within OB siting bubble and/or EIS boundary
- The "No public use" area is the zone 1 mile from the centerline of each OBTS shelter, the CMF, and the cluster road

II. CONSIDERATIONS:

- An additional area 0.9 to 1.5 miles outside the "No public use" area would allow all public use on a noninterference basis
- Minimize driving distance from OB/DAA



MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE
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SYSTEM SITE-SELECTION
OPERATIONAL REQUIREMENTS
PAGE 2 OF 2

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TABLE S-1

GEOTECHNICAL

I. EXCLUSIONS:

- Outcropping or shallow rock
- Surface slope greater than 10 percent
- Adverse terrain (two or more drainages 10' deep within 1000').
- Standing water, swamps, or perennial streams
- Depth to rock less than 50' (i.e. material with a seismic velocity of 7,000 fps)
- Depth to water less than 50' (i.e. first encountered water)
- Active playas

II. CONSIDERATIONS:

- Fault rupture hazard
- Potential sheet wash
- Surface slope greater than five percent
- Dunes
- Dessication cracks
- Tufa
- Boulder fields

ENVIRONMENTAL

I. EXCLUSIONS:

- Designated Wilderness Areas
- Wilderness Study Areas
- Existing/Proposed Federal and State
 - Wildlife refuges, archaeological areas
- Existing/Proposed National
 - Wildlife refuges, preserves, registered archaeological properties
- Federal Threatened and Endangered Species
- Non-attainment Air Quality Areas

II. CONSIDERATIONS:

- Federal and state proposed Threatened and Endangered Species
- Locally identified "sensitive" areas
 - Environmentally
 - Socio-Economically
- Visual Resources



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SYSTEM SITE-SELECTION
GEOTECHNICAL/ENVIRONMENTAL
REQUIREMENTS

6 NOV 81

TABLE 5-2

GEOGRAPHICAL

I EXCLUSIONS:

- Existing/proposed federal and state:
 - Parks, landmarks, refuges, monuments, forests, recreational areas
- Existing/proposed national:
 - Grasslands, Indian reservations, ranges, military ranges (training areas, proving grounds, test site), registered historic properties
- Radii from population centers:
 - 20 statute miles from cities of 25,000 or more
 - 3.5 statute miles from cities of 5,000 to 25,000
 - 1 statute mile from cities of less than 5,000
- Inhabited buildings
- Industrial complexes:
 - Active mining areas, tank farms, pipeline complexes
- "High" potential mineral areas: *
 - Oil and gas fields, active and potentially mining areas, strippable coal, oil shale, uranium deposits, known geothermal resource areas
- COE recommended exclusions

II CONSIDERATIONS:

- Private property
- State property
- "Good" potential mineral areas: *
 - Oil and gas, active and potentially active mining areas, strippable coal, oil shale, uranium deposits, known geothermal resource areas
- Irrigated farmland
- Prime agricultural land
- Moapa Indian Expansion Area
- Duckwater Indian Expansion Area
- Ranch and grazing allotments
- Existing access roads
- Proposed utility corridors

* Mineral potential to be determined by a study as required by FLPMA

NOTE:

1. EXCEPT DTN



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SYSTEM SITE-SELECTION GEOGRAPHICAL REQUIREMENTS

6 NOV 81

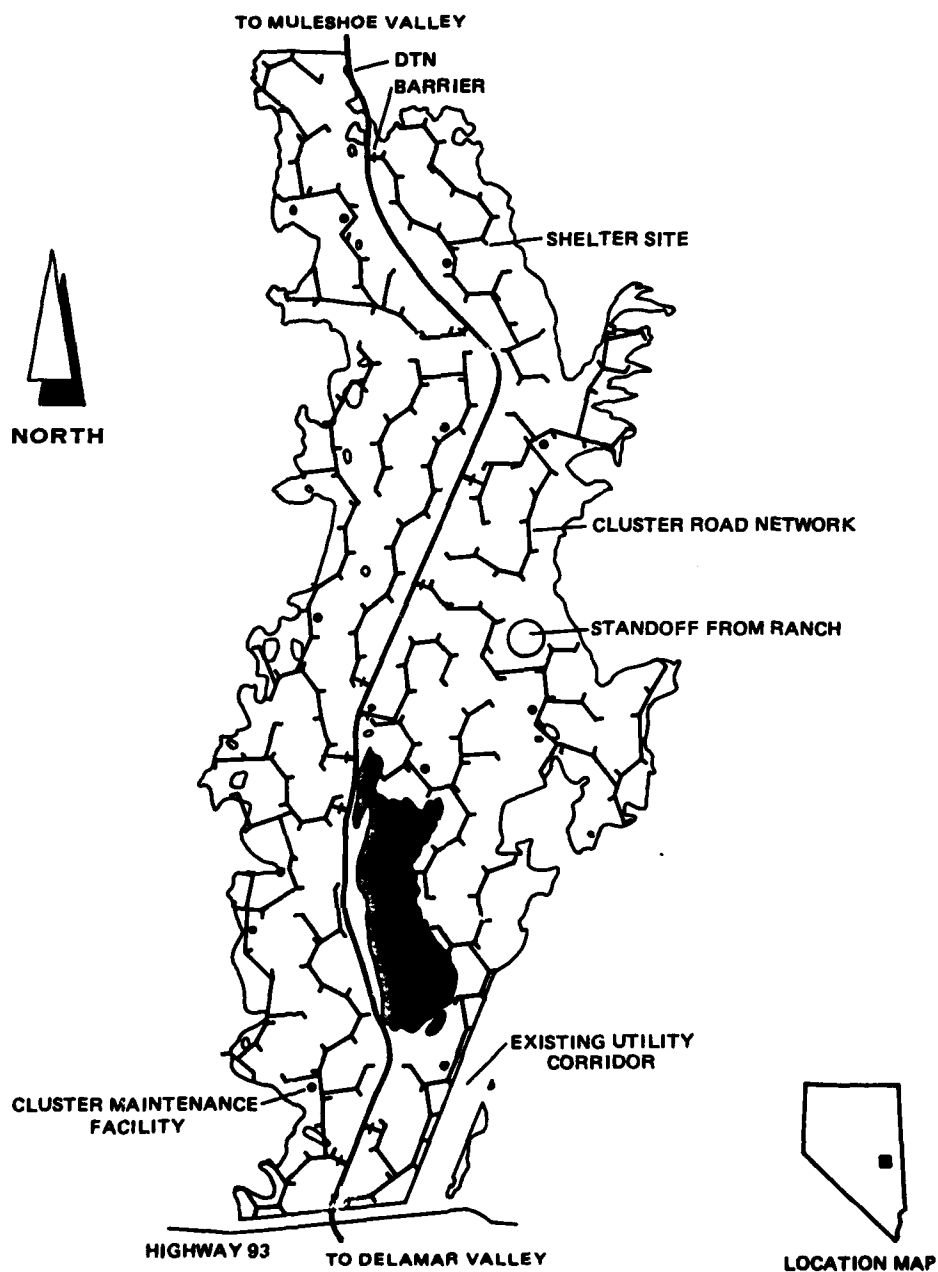
TABLE 9-3

5.4 FY 81 SITING ACTIVITIES

The FY 81 siting activities consisted of a continuation of those programs which were started in FY 80. Shelter layouts and DTN routing, which were once again the major activities, continued during the entire year. OBTS siting became an important program in the last quarter of the year. The one new activity, which was added to the FY 81 program, was a series of field programs. These included preliminary environmental resources inventories at three candidate OB sites, field surveys in the IOC valleys, and field surveys for some OBTS sites and segments of the DTN. The details of all these activities are described briefly in the following sections.

5.4.1 Shelter Siting Studies

Shelter Layouts was the major siting program in FY 81. Layouts were completed for nine valleys in Utah and 28 valleys in Nevada, and their locations are shown as the shaded areas in Drawing 5-1. Shelter sites are not shown on the map but the cluster roads are shown. The number of clusters (i.e., 23 shelters per cluster) per valley is listed in Drawing 5-1. Initial layouts were completed and submitted to BMO/AFRCE on 15 May 1981. At that time, 227 clusters were identified in the 37 valleys. The reduction to 200 clusters was to take place during the review process and as a result of more detailed studies in FY 82. A typical example of a valley layout is shown in Figure 5-3. The layout is for Dry Lake Valley, Nevada, where it was possible to site 10 clusters, (i.e., 230 shelters).



NOTE: 1. ASSUMES COYOTE SPRING MOB

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23/1 CLUSTER, 5200' SPACING
2/3 HEXAGONAL PATTERN
DIRECT CONNECT CLUSTER ROAD NETWORK
DRY LAKE VALLEY, NEVADA
SCHEMATIC MPS LAYOUT 9/17/81

6 NOV 81

FIGURE 5-3

Following the submittal of the layouts, a number of activities continued. The Ertec Western layout team continued to update overlays, improve base maps, and perform quality assurance checks of the layouts. At the same time, AFRCE, BMO, and TRW personnel were reviewing the layouts and plans were being formulated for a state review process. Initial meetings with the states regarding the review process were held on 21 and 22 May and continued on a monthly basis through August. As a result of the state comments, layouts were revised and the process was expected to continue into FY 82. Table 5-4 depicts those valleys for which siting review comments had been received and also shows what other layout activities had been completed.

Other shelter siting studies which took place in FY 81 included:

- o Valley clustering at 5200-foot spacing for five valleys in Nevada and two valleys in Utah;
- o A variety of valley clustering scenarios to support 4600, 2300, and 1500 shelters for horizontal and vertical basing modes in Nevada and Utah; and
- o Completion of layouts of Pine and Wah Wah valleys at a scale of 1:9600 to support the field surveys (Section 5.4.6).

The details of shelter siting studies are discussed in Part I of the MX System Siting Summary Report (E-TR-58-I).

5.4.2 DTN/ASC Siting Studies

DTN/ASC siting studies began early in FY 81 and continued during the remainder of the year. The purpose of these studies was to determine the best routing for the DTN and the most suitable locations for the ASCs in the Nevada/Utah deployment

		1:62,500 LAYOUTS					1:9000 LAYOUTS
		15 MAY '81	BMO/AFRCE-MX	LAND PARCEL	VALLEY		8 MAY '81
		BMO/AFRCE-MX SITING REVIEW (SUBMITTED)	SITING REVIEW (COMMENTS RECEIVED)		CLUSTERING		FIELD SURVEY
UTAH					5200'	1.73 mi	
1. DUGWAY	DW	●					
2. FISH SPRINGS FLAT	FS	●					
3. PINE	PI	●	●	●	●		●
4. SEVIER DESERT	SD	●					
5. SEVIER LAKE	SL	●					
6. SNAKE	SV	●					
7. TULE	TL	●	●				
8. WAH WAH	WA	●	●	●	●		●
9. WHIRLWIND	WW	●					

NEVADA							
1. ANTELOPE	AN	●					
2. BIG SAND SPRINGS	BG	●					
3. BIG SMOKY	BS	●					
4. BUTTE	BV	●					
5. CAVE	CV	●	●				
6. COAL	CL	●					
7. DELAMAR	DM	●	●				
8. DRY LAKE	DL	●	●	●	●	●	●
9. GARDEN	GN	●					
10. HAMLIN	HV	●	●				
11. HOT CREEK	HC	●			●		
12. JAKES	JV	●					
13. KOBEH	KB	●					
14. LAKE	LV	●	●		●		
15. LITTLE SMOKY	LS	●					
16. LONG	LG	●					
17. MONITOR	MV	●					
18. MULESHOE	MS	●	●		●		
19. NEWARK	NK	●					
20. PAHROC	PA	●	●				
21. PENOYER	PN	●					
22. RAILROAD	RR	●					
23. RALSTON	RV	●					
24. REVEILLE	RE	●					
25. SPRING	SP	●	●		●		
*26. STEPTOE	SO	●					
27. STONE CABIN	ST	●					
28. WHITE RIVER	WR	●					

* STEPTOE VALLEY DELETED FROM FURTHER SITING STUDIES
AS OF SEPTEMBER 1981



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SUMMARY OF MULTIPLE PROTECTIVE SHELTER LAYOUTS

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TABLE 9-4

area. Limited DTN studies were performed in New Mexico to support the siting of the OBTS/DTA options. The details of the DTN/ASC siting studies are discussed in Part II of the MX System Siting Summary Report (E-TR-58-II) and are summarized in the following paragraphs.

The DTN studies consisted of field reconnaissance and office studies to determine the optimum routes. Close coordination with the shelter layout program was necessary to integrate these two activities into a compatible system which met all the operational requirements, satisfied all the exclusion requirements, and considered all of the geotechnical, environmental, and geographical factors. Initial studies concentrated on the first 360 miles (576 km) of the DTN. When this phase of the study was completed, the routing was depicted on 1:62,500 base maps which had been developed by the Ralph M. Parsons Company.

These maps were submitted to the AFRCE and copies were given U.S. Army Corps of Engineers so they could prepare bid documents for final routing and design study contracts.

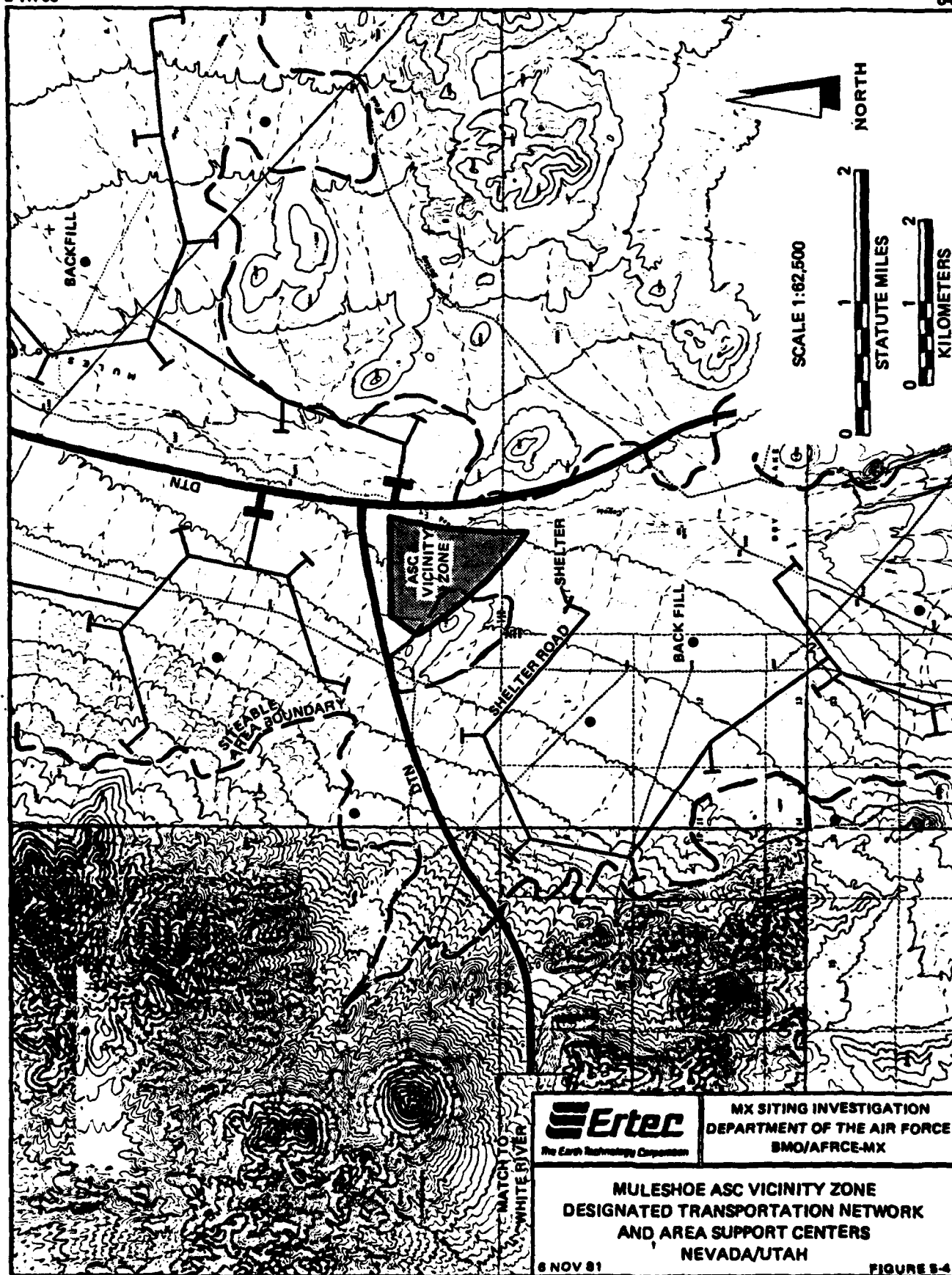
As the DTN studies were completed, the selected routes were added to the valley shelter layout maps at the 1:62,500 scale. The routing was also shown on a regional map at a scale of 1:500,000 and updated periodically as the work progressed. The final routing is shown in Drawing 5-1. For a MOB at Coyote Spring, Nevada, the total length of the DTN is 1426 miles (2282 km).

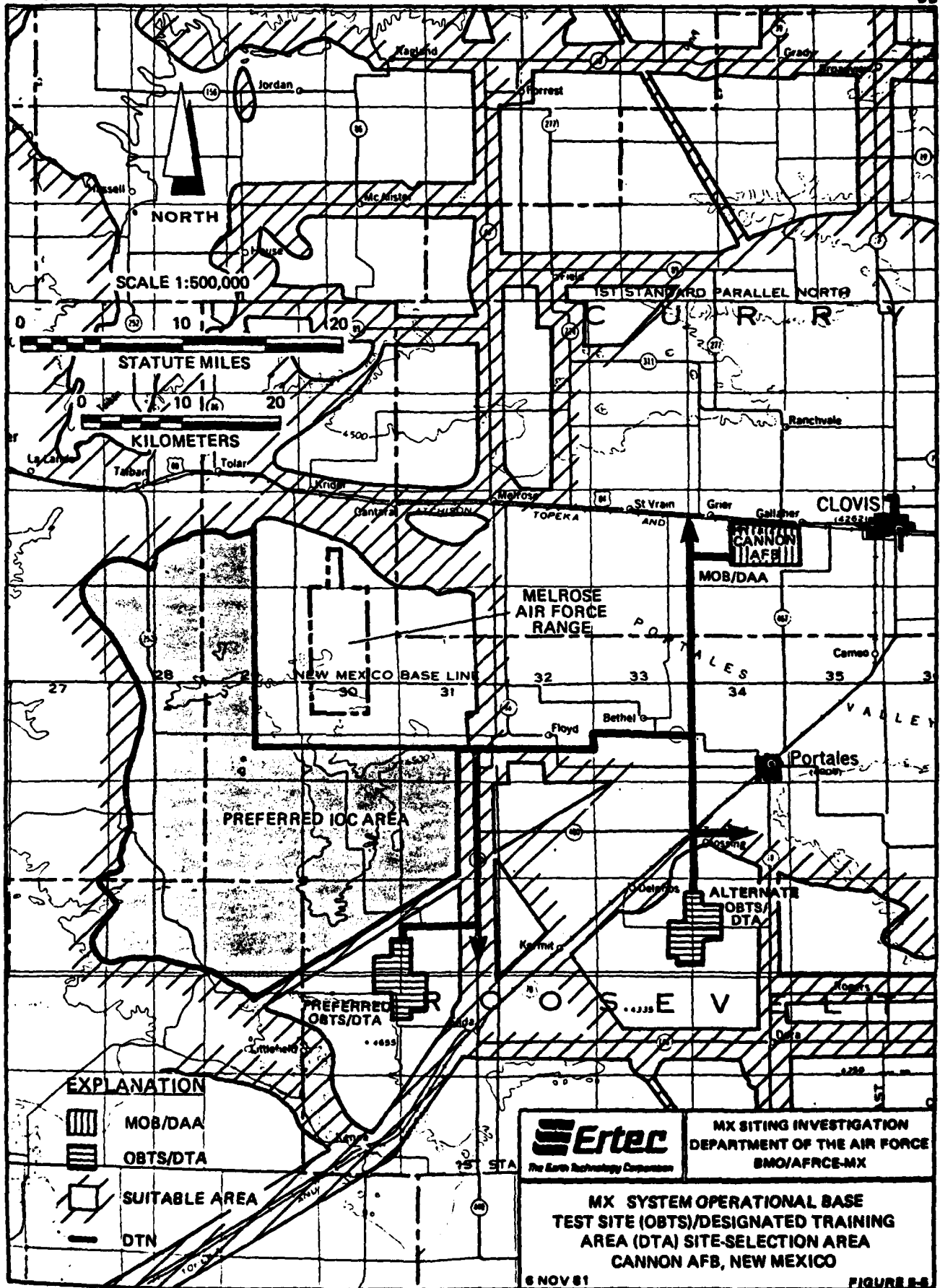
The ASC siting studies were coordinated with the DTN studies since the ASCs were to be located adjacent to the DTN. Based on the primary criterion that ASCs be located within 65 miles (105 km) of shelter sites, it was determined that four ASCs would be needed to cover the 37 valleys in the Nevada/Utah deployment area. One mi² (2.6 km²) vicinity zones were evaluated and final sites were selected which met all the criteria and, at the same time, did not infringe on shelter sites. The selected sites are shown in Drawing 5-1. The site in Muleshoe Valley is shown in Figure 5-4 to show the relationship between the DTN, shelter sites, and the ASC.

5.4.3 OBTS/DTA Siting Studies

OBTS/DTA siting studies were performed in Nevada, Utah, and New Mexico in the last quarter of FY 81. These studies were coordinated with the in-house shelter and DTN studies and with OB studies being performed by the base comprehensive planner (EDAW). The details of these studies are discussed in Part III of the MX System Siting Summary Report (E-TR-58-III) and are briefly summarized in the following paragraphs.

Preferred and alternative OBTS/DTA sites were selected for each of the MOB/DAA sites at Coyote Spring, Nevada, Beryl and Milford, Utah, and near Cannon Air Force Base (AFB), New Mexico. For the study in New Mexico, the initial step was to select a preferred IOC area (Figure 5-5). At each site, preferred and alternative layouts conforming to BMO criteria and requirements were produced at a scale of 1:62,500. Figure 5-6 presents an example of a layout in Coyote Spring Valley, Nevada.





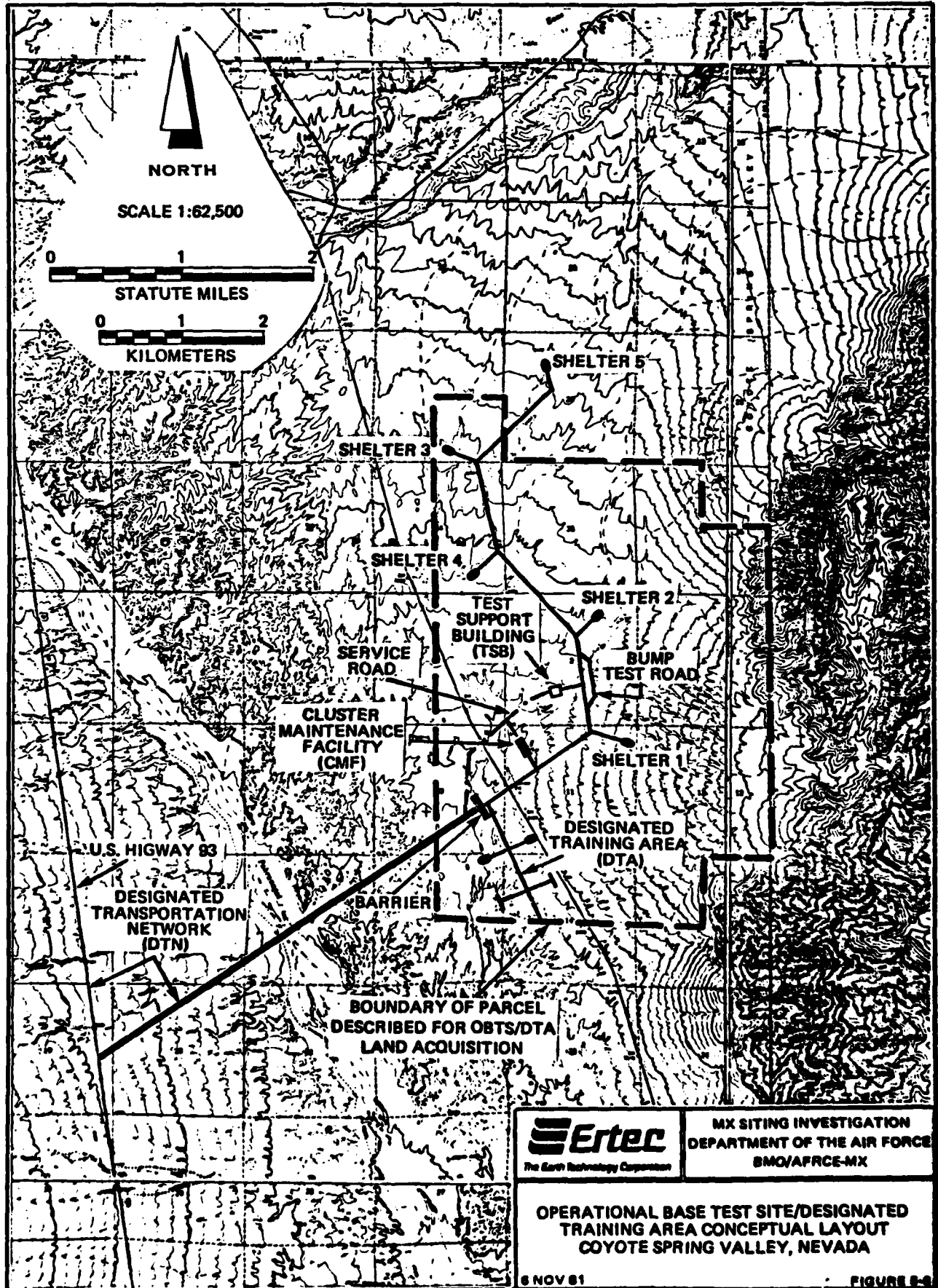
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MX SYSTEM OPERATIONAL BASE
TEST SITE (OBTS)/DESIGNATED TRAINING
AREA (DTA) SITE-SELECTION AREA
CANNON AFB, NEW MEXICO

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FIGURE 2-5



The final OBTS/DTA layouts were 1) given to the environmental assessment contractor in support of the tiered decision-making process, 2) used for the OBTS/DTN field surveys, 3) depicted on the regional map (Drawing 5-1), and 4) incorporated in the Land Acquisition Package.

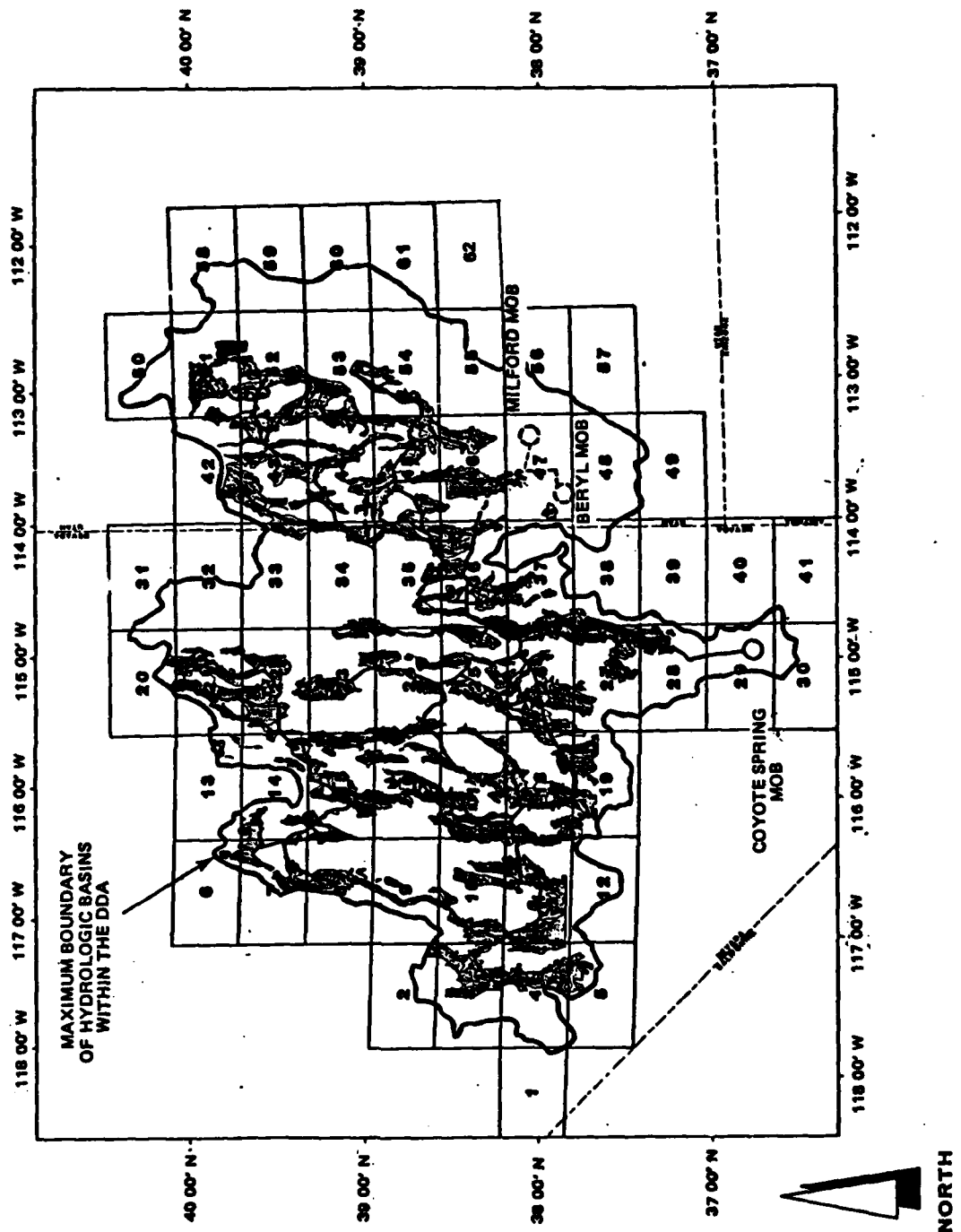
5.4.4 Land Acquisition Package

A primary purpose of the FY 81 siting studies was to prepare maps depicting MX facilities for incorporation in the Land Acquisition Package. If the MPS-MX system had continued, this package would have been submitted to BLM for their review and then forwarded to Congress as part of the process of withdrawing BLM lands for use by the Department of Defense.

The Land Acquisition Package consisted of the following elements:

- o A regional map at a scale of 1:500,000 showing the system layout (similar to Drawing 5-1);
- o Base maps at a scale of 1:62,500 depicting shelter sites, cluster roads, DTN routes, ASC sites, MOB and OBTS/DTA site options, borrow areas, utility corridor, access roads, etc.; and
- o Land parcel descriptions of all facilities (legal descriptions).

The base maps consisted of a series of standard "E" size maps which covered the entire Nevada/Utah deployment area. A grid was developed as shown in Figure 5-7; it consisted of 62 map sheets. Eighteen of these were used in the initial Land Acquisition Package, and the remaining map sheets were in various stages of development at the end of FY 81.



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'E' SIZED (1:62,500) BASE MAP INDEX
DESIGNATED DEPLOYMENT AREA (DDA)
NEVADA/UTAH

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FIGURE 5-7

The initial Land Acquisition Package had just been completed and reviewed by AFRCE-MX when President Reagan made the decision to terminate the MPS-MX system.

5.4.5 Preliminary OB Site Environmental Resource Inventories

Preliminary OB environmental resource inventories were performed for the proposed OB sites at Coyote Spring, Nevada, and Milford and Beryl, Utah. The purpose of these studies was to determine if there were any environmental "show-stoppers" which might preclude the use of these sites. The office and field studies included preliminary data on wildlife species and habitats, plant species, a literature review of the abiotic and biotic environments, vegetative associations, a literature review of cultural resources, consultations with agencies and academic personnel, and field visits of potential cultural resource sites. The results of these studies are presented in a report identified as FN-TR-46.

5.4.6 Field Surveys in IOC Valleys

In the first half of FY 81, field surveys were conducted in three valleys which had been selected because of their potential of becoming the valleys for initial construction to meet the IOC schedule of having 10 clusters operational by mid-1986. For discussion purposes, these valleys are referred to as the IOC valleys. The purposes of the surveys were to test cluster layout procedures and evaluate potential field problems at specific shelter sites. Dry Lake Valley, Nevada, was selected as an IOC valley because it was large enough to support 10

clusters and was relatively close to the proposed Main Operational Base (MOB) site in Coyote Spring Valley. Pine and Wah Wah valleys, Utah, were selected because they were the closest valleys to proposed MOB sites near the towns of Beryl and Milford and, together, could support 10 clusters. The results of these surveys are presented in three volumes of report number E-TR-48. Table 5-5 summarizes the results of the surveys in terms of the number of sites which were relocated for archaeological, biological, geotechnical, or cultural reasons. Because some sites were relocated, other sites also had to be moved to meet siting criteria; these relocations are also listed at the bottom of the table. For all three IOC valleys, a total of 71 sites were relocated but only 10 of these sites were resited for archaeological, biological, or cultural reasons.

The field surveys did verify that the general siting process methodology was acceptable regarding the application of siting requirements, suitable area boundaries, and the use of 1:9600 base maps. The one weakness was in the fact that the siting review process had not been finalized at the time the field surveys were initiated, and some later changes in layouts were being considered as a result of input from the states.

5.4.7 DTN/OBTS Field Surveys

The field surveys were performed at four OBTS sites; one at the Coyote Spring MOB, Nevada, one at the Beryl MOB, Utah, and two at the Milford MOB, Utah. An alternate OBTS at the Beryl MOB

	NEVADA	UTAH	
	Dry Lake Valley	Pine Valley	Wah Wah Valley
Number of Clusters	10	5	5
Number of Shelters	230	115	115
Number of CMFs	10	5	5
Number of RSSs	5	4	4
DTN	39 miles (62 km)	0	0
Cluster 2 Roads	30 miles (48 km)	0	0

	NEVADA		UTAH					
	Dry Lake Valley		Pine Valley		Wah Wah Valley		Total IOC Valleys	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Archaeological	3	13	1	4.5	2	8	6	8
Biological	0	0	1	4.5	0	0	1	1
Geotechnical:								
Fault	2	9	1	4.5	0	0	3	4
Bedrock	1	4	0	0	1	4	2	3
Earth cracks	2	9	0	0	0	0	2	3
Wash in front of shelter	3	13	4	18	4	15	11	15
Wash affecting shelter	6	26	4	18	7	27	17	24
Wash at rear of shelter	1	4	6	27	2	8	9	13
Playa	0	0	1	4.5	0	0	1	1
Cultural	0	0	3	14	0	0	3	4
Criteria	5	22	1	4.5	10	38	16	23
Totals	23		22		28		71	



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**SUMMARY OF SURVEYED
AND RELOCATED SITES**

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TABLE 5-5

and two OBTSs near Cannon AFB, New Mexico, MOB were not surveyed because permission to enter onto private land at these sites had not been obtained at the time of the field surveys.

Biological resources surveys and geotechnical inspections were also made along the DTN route from each MOB toward the IOC valleys, along one road corridor from the Coyote Spring MOB to the OBTS, and along one OBTS road from the Beryl MOB. The other OBTS road connections could not be surveyed because authorization to enter private land was not granted at the time of the field surveys. The areas surveyed in Nevada and Utah are shown in Figures 5-8 and 5-9, respectively. Figure 5-8 shows the 72-mile (116-km) segment of the DTN in Nevada along which biological surveys and geotechnical inspections were made. Figure 5-9 shows a 64-mile (103-km) segment of the DTN in Utah where similar surveys and inspections were made.

Preliminary results of the studies indicated that the OBTS sites in Nevada and Utah and the DTN segments which were studied were environmentally and geotechnically acceptable. Unfortunately, it was not possible to complete the field surveys because of a stop work order issued on 14 October 1981. The directions were to compile data reflecting the status of the program as of 2 October 1981. These data were compiled in an unfinished report designated as E-TR-59.

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EXECUTIVE SUMMARY GEOTECHNICAL SITING INVESTIGATIONS FY 81.(U)

NOV 81

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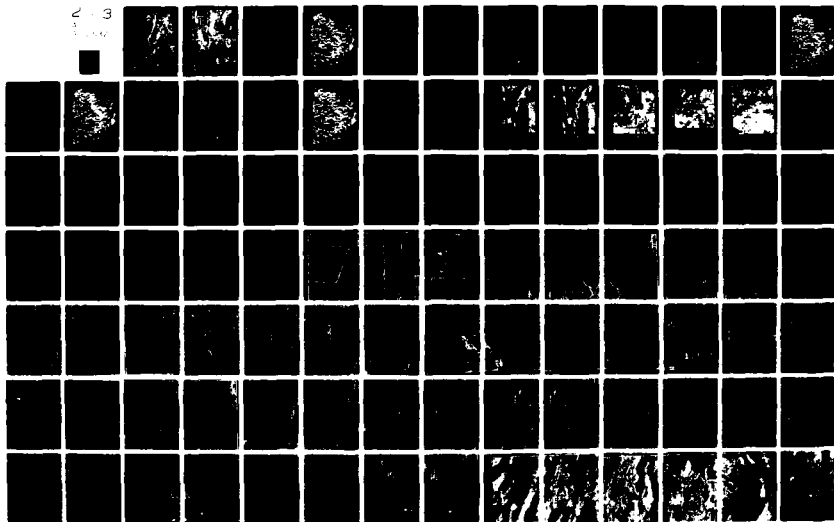
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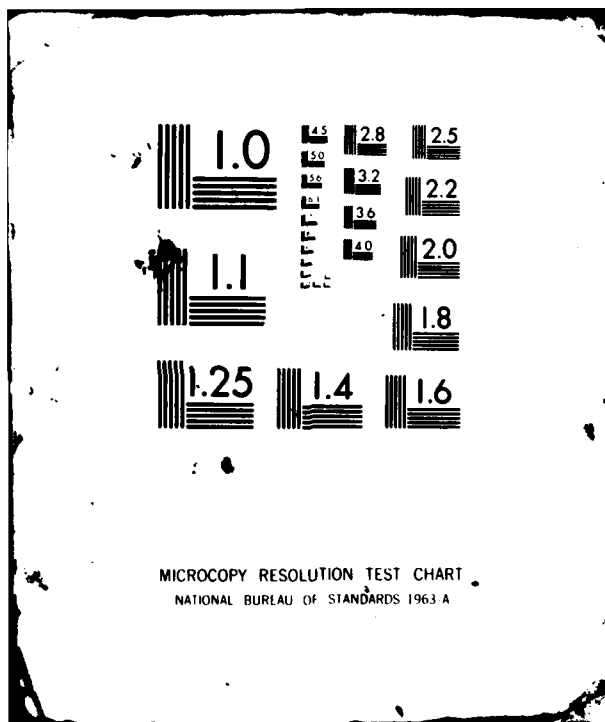
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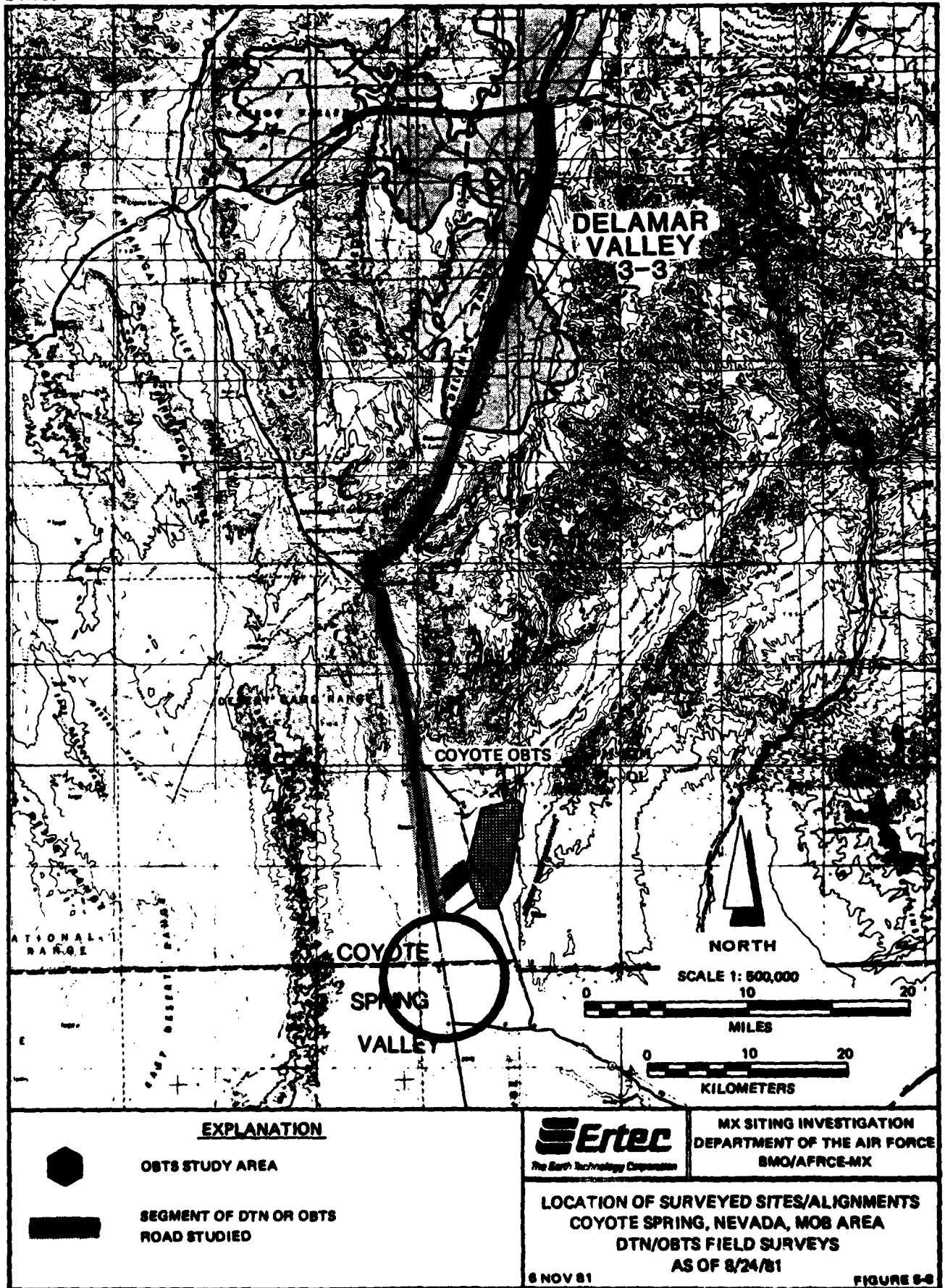
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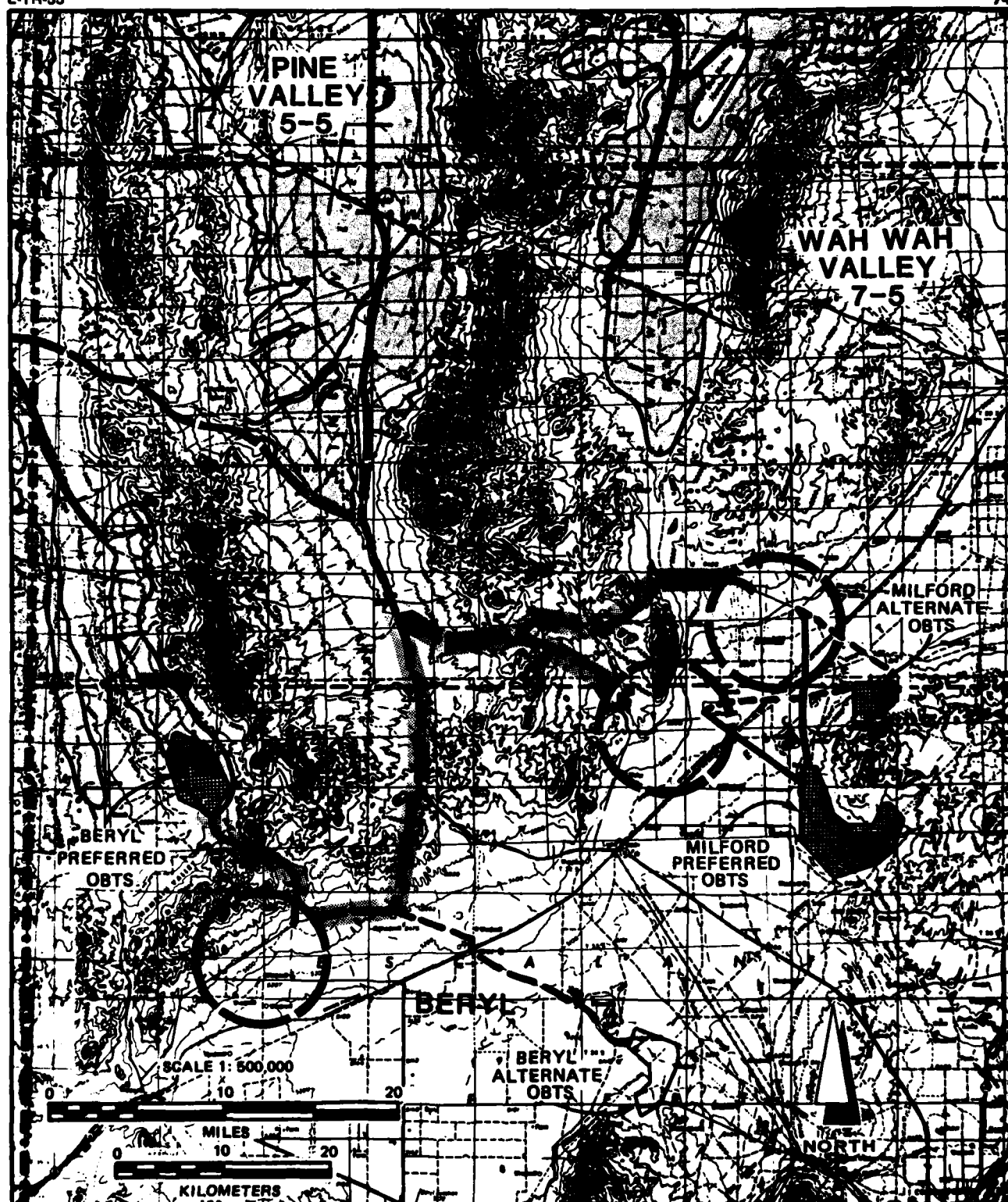
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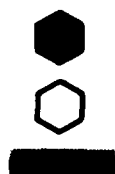








EXPLANATION



OBTS STUDY AREA

PROPOSED OBTS
(NO FIELD SURVEYS PERFORMED)

SEGMENT OF DTN OR OBTS
ROAD STUDIED

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LOCATION OF SURVEYED SITES/ALIGNMENTS
BERYL/MILFORD, UTAH, MOB AREA
DTN/OBTS FIELD SURVEYS
AS OF 8/24/81

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FIGURE 8-2

6.0 SUPPORT PROGRAMS

6.1 MINERAL RESOURCES SURVEYS

6.1.1 Background, Objectives, and Approach

In June 1980, Ertec was tasked to carry out a mineral resources survey of the MX siting area in Nevada and Utah (Figure 6-1). The survey was done to develop the necessary information on mineral and energy resource potential to accompany the MX application for land withdrawal. The scope of the survey was guided by the regulations for land withdrawal contained in the Federal Land Policy and Management Act of 1976.

The objective of the Mineral Resources Survey was to inventory and evaluate past and present mineral and energy resource activities in the MX siting area. This was to be done in sufficient detail so that potential future mineral exploitation in the MX deployment areas and the impacts of the MX system on future mineral activity could be assessed.

The survey drew heavily on existing published and unpublished data such as geologic and structural data; mine and mining district reports; aeromagnetic, seismic, and gravimetric data; and an inventory of all claims and leases. The data were supplemented by an update of the claim and lease inventory, a review of existing high altitude aerial photography and remote sensing data, contact with mining companies and individuals with interests in the siting area, field examination of significant mineral occurrences and major active mining operations, and consultation with experts knowledgeable of present and

future resource potential in the area. Evaluation of the mineral resources of the entire MX siting area provided a framework within which the resource potential in the MX deployment areas could be assessed. In addition, the potential market demands of the mineral commodities in the siting area were considered.

6.1.2 Mineral and Energy Resources Setting

The Basin and Range geologic province, which includes the MX siting area, is one of the most highly mineralized areas in the United States. Sedimentary and igneous rocks, as well as the overall tectonic framework of the Basin and Range province, have both contributed to the formation and localization of economic deposits of metals, nonmetallic minerals, and oil and gas. This localization has generally occurred along major metallogenic provinces or "mineral belts" in Nevada and Utah.

The mountain-valley physiography which typifies the Great Basin area of the Basin and Range province has largely limited historical mineral exploitation to the exposed mountain areas, while the alluvium-filled valleys have been little explored. More recent exploration has drifted toward the valley areas where favorable geologic conditions exist beneath the valley-fill materials.

The principal metals produced in the siting area are silver, gold, lead, zinc, copper, tungsten, molybdenum, uranium, and beryllium. The principal nonmetallic minerals are alunite, barite, and fluorspar.

Exploration for oil and gas in the Great Basin is still in its infancy. Structural complexity of the region deferred discovery and production until 1954 in Railroad Valley. Recent discoveries of major oil and gas fields within the overthrust belt of Utah and Wyoming have renewed exploration interests in its southern extension along the southeastern portion of the siting area. The current high level of exploration may lead to additional discoveries in the Great Basin.

6.1.3 FY 80 Mineral Resources Survey

A mineral resources survey covering 29 designated deployment valleys was completed and a report issued as a draft in January 1981. The Mineral Resources Survey considered four classifications of mineral potential; high, good, speculative, and low. Based on known mineral occurrences (including oil and gas) and favorable geologic environments within the siting area, evaluations of mineral potential for new economic discoveries to the year 2000 and beyond were made.

There are areas in the DDA that possess high or good potential for economical mineral deposits. The geologic ingredients necessary for the formation and storage of oil and gas are present in the siting area and areas of favorability have been identified. A summary of mineral and energy resource potential areas is presented in Table 6-1. Siting of the MX system could cause some hindrance of the mining and petroleum industries, mainly in the form of curtailment in size and scope of exploration, restriction in size of future mining operations, and

POTENTIAL	AREA (PERCENT MX DEPLOYMENT AREA) ¹		
	MINERAL	ENERGY	
		OIL AND GAS	GEO THERMAL
HIGH	2	9	
GOOD	12	38	
SPECULATIVE	50	34	
LOW	36	19	19*
TOTAL	100	100	

*PERCENT FAVORABLE FOR LOW
TO INTERMEDIATE TEMPERATURE
GEO THERMAL RESOURCES.

(1) FOR THIS STUDY MX DEPLOYMENT
AREA EQUIVALENT TO
GEOTECHNICALLY SUITABLE
VALLEY AREA



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SUMMARY OF MINERAL AND ENERGY
RESOURCE POTENTIAL AREAS - FY80
MINERAL RESOURCE SURVEY

8 NOV 81

TABLE 9-1

competition in the market-place for labor and materials. Construction of the system will, of necessity, spur the development and mining of aggregate and stone materials.

6.1.4 Seven Additional Valley Mineral Resources Survey

A supplemental mineral resources survey covering seven additional deployment valleys was completed and a report issued as a draft in June 1981. The seven valleys covered in this supplemental survey were added to the MX DDA adjoining the western and northwestern boundaries. This survey followed the same work scope as the FY 80 mineral resources survey. The same four classifications of mineral potential was used; high, good, speculative, and low.

The additional valley survey area includes the Montezuma Valley (part of southern Big Smoky Valley), Big Smoky, Monitor, Kobeh, and Jakes valleys and parts of Newark, Long, and Butte valleys. All of the western portion of the survey area falls within the highly mineralized Antler Orogenic Belt which itself is crossed by several regional lineaments and the very productive Manhattan Mineral Belt. Approximately half of the northern portion of the study area lies within the Eureka Mineral Belt which includes all of the major production centers in the northern portion of the study area except the Cherry Creek Mining district.

Both the western and northern portion of the study area are the sites of current mining operations and intense exploration. Oil and gas exploration is continuing in White Pine County in

the northeast portion of the study area, and some oil shale potential may exist in Eureka County in the extreme northwestern portion. Future development of new gold, molybdenum, tungsten, silver, lead, zinc, turquoise, barite, and possible copper and other industrial mineral resources in the study area is a certainty. The degree to which these resources are developed will depend on the availability of land, human resources, water resources, and ancillary resources necessary for mineral development. A summary of mineral and energy resource potential areas in the seven additional valleys is presented in Table 6-2.

6.1.5 Resources Land Status Survey of Deployment Areas

In December 1980, the BLM in Nevada/Utah requested the Resources Land Status Survey be updated from the FY 80 Mineral Resources Survey to include all claims and leases on file as of January 1981. This work was directed to provide a common level of inventory between the states.

Lists and descriptions of claims and leases were developed from county, state, and federal records. The survey included all mining claims (patented and unpatented), federal and state leases (oil and gas, geothermal, potassium, sodium, etc.) and state mineral leases within the MX deployment areas. This Resources Land Status Survey was completed in May 1981 and integrated into the Draft Mineral Resources Survey Report.

POTENTIAL	AREA (PERCENT MX DEPLOYMENT AREA) ¹		
	MINERAL	ENERGY	
		OIL AND GAS	GEOTHERMAL
HIGH	3	19	
GOOD	8	14	
SPECULATIVE	60	25	
LOW	29	42	
TOTAL	<u>100</u>	<u>100</u>	2*

- PERCENT FAVORABLE FOR LOW TO INTERMEDIATE TEMPERATURE GEOTHERMAL RESOURCES.

(1) FOR THIS STUDY MX DEPLOYMENT AREA EQUIVALENT TO GEOTECHNICALLY SUITABLE VALLEY AREA



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SUMMARY OF MINERAL AND ENERGY
RESOURCE POTENTIAL AREAS -
SEVEN ADDITIONAL VALLEY MINERAL
RESOURCES SURVEY

6 NOV 81

TABLE 9-2

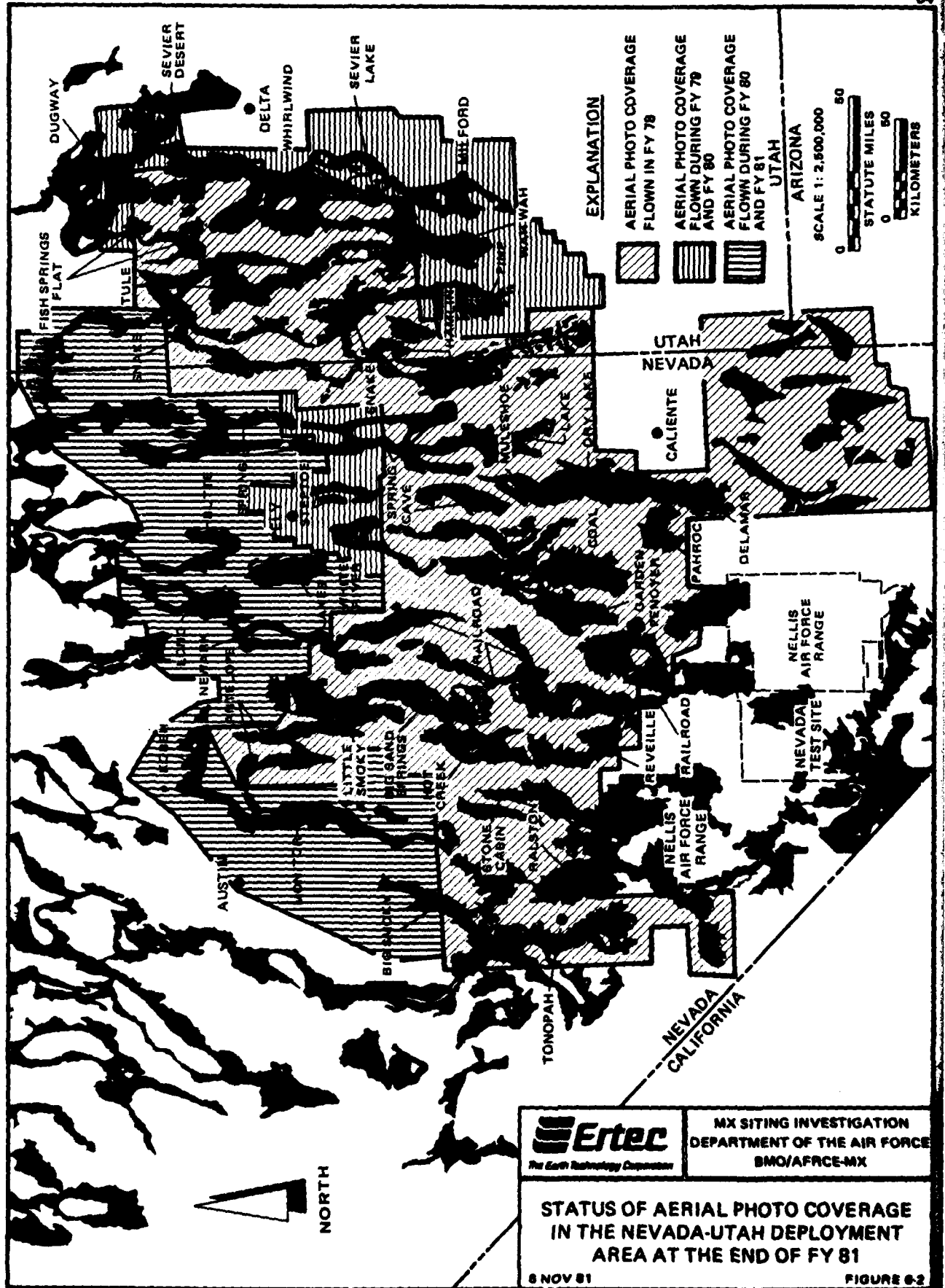
6.2 AERIAL PHOTOGRAPHY AND TOPOGRAPHIC MAPPING

6.2.1 Aerial Photography

In the latter part of FY 78, the Air Force authorized obtaining new 1:25,000 color photos for the deployment area in Nevada and Utah. A total of 8119 photographs were flown, covering an area of about 28,000 mi² (72,600 km²) (Figure 6-2). These photos were used for the aerial photo interpretation task of the Verification program and other geotechnical, environmental, and siting tasks in subsequent years. These same photos were also used for producing topographic maps as discussed later in this section.

In the third quarter of FY 79, the Air Force authorized obtaining additional aerial photos. The area of coverage was extended to the east in Utah and to the south to cover the Union Pacific railroad and potential Operational Base sites. In eastern Nevada, the area of coverage was extended north around Ely to obtain photos for railroad access and basing studies. These two new areas of coverage are shown in Figure 6-2 and represent 2116 photos covering a total area of about 7400 mi² (18,900 km²). At the same time, oblique aerial photos were taken of many of the valleys.

As siting studies continued in FY 80, it appeared that the area that had been identified for deployment of the MX-Multiple Protective Structure (MPS) system (31 valleys) was not large enough. It was recommended that the deployment area be extended to include six northern valleys in Nevada; Antelope, Butte, Kobeh, Long, Monitor, and Newark.



Flying for aerial photographs of these valleys began (Figure 6-2) in August 1980 and was completed in October. The area of coverage is nearly 11,000 mi² (28,500 km²) and consists of 3085 exposures.

Combining the three different series of aerial photos, the total area of aerial photo coverage is 46,400 mi² and consists of 13,320 exposures.

6.2.2 Topographic Mapping

6.2.2.1 Background

Layout methodology studies for the MX-MPS basing mode were initiated in FY 79. Dry Lake Valley, Nevada, was selected as the valley for these studies and the program included the production of topographic map sheets of the valley at a scale of 1:4800. The contour interval was 5 feet (1.5 m) for the southern half and 10 feet (3 m) for the northern half. The map sheets were photographically reduced to a scale of 1:9600 and layouts were prepared at both scales. It was concluded from the results of the study that a map scale of 1:9600 was the most suitable for preliminary siting studies.

In FY 80, 1:9600 maps were produced for four valleys near Dry Lake Valley, Nevada; Delamar, Pahroc, Cave, and Muleshoe and two valleys in Utah; Pine and Wah Wah (Figure 6-3). Pine and Wah Wah valleys were potential IOC valleys, as was Dry Lake Valley, and the 1:9600 maps were used for the field surveys as

discussed in Section 5.3 The number of map sheets and the dates the maps were completed are summarized in Table 6-3.

Layout studies in the DDA in Nevada and Utah were initiated in FY 80 as a follow on to FY 79 methodology studies. It was decided to prepare conceptual layouts at a scale of 1:62,500 (1 inch = 1 mile). A review of existing USGS topographic maps determined that most of the DDA was covered by either 7.5 minute (1:24,000 scale) or 15 minute (1:62,500 scale) USGS topographic maps, but that there were a few areas where the most detailed maps available were 2° sheets (1:250,000 scale). It was concluded that maps at this scale were not of sufficient detail to produce conceptual layout drawings. The decision was made to produce new topographic maps at a scale of 1:62,500 with 10-foot (3-m) contour intervals for those deployment valleys where the most detailed maps available were the 2° sheets. This program was carried out in FY 80 and included producing maps for Penoyer, Tikaboo, Coal, Garden, Railroad, and the western part of the Snake valleys; all of these valleys are in Nevada (Figure 6-3). The dates these maps were completed are listed in Table 6-3.

6.2.2.2 FY 81 Program

No 1:62,500 scale topographic maps were produced in FY 81, however, the 1:9600 mapping did continue for two valleys in Nevada, one OB site in Nevada, and two OB sites in Utah. The two valleys were Hamlin and Lake and the OB sites were Coyote (Coyote Spring Valley, Nevada), Beryl, and Milford (Figure 6-3). The latter two OB sites are located in the Escalante

1: 62,500 SCALE TOPOGRAPHIC MAPS		
VALLEY	NUMBER OF MAP SHEETS	DATE MAP COMPLETED
PENOYER, NEV.	1	JULY 1980
TIKABOO, NEV.	1	JULY 1980
COAL, NEV.	1	OCTOBER 1980
GARDEN, NEV.	1	OCTOBER 1980
RAILROAD, NEV.	1	OCTOBER 1980
SNAKE (WESTERN), NEV.	1	DECEMBER 1980

1: 9600 SCALE TOPOGRAPHIC MAPS		
VALLEY/OB SITE	NUMBER OF MAP SHEETS	DATE MAPS COMPLETED
DRY LAKE, NEV.	37	SEPTEMBER 1979
DELAMAR & PAHROC	49	DECEMBER 1979
CAVE & MULESHOE	46	APRIL 1980
PINE, UTAH	55	AUGUST 1980
WAH WAH, UTAH	30	SEPTEMBER 1980
HAMLIN, NEV.	45	MAY 1981
LAKE, NEV.	72	AUGUST 1981
COYOTE OB, NEV.	5	JANUARY 1981
BERYL OB, UTAH	6	MARCH 1981
MILFORD OB, UTAH	18	MARCH 1981



MX SITING INVESTIGATION
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SUMMARY OF TOPOGRAPHIC MAPPING

6 NOV 81

TABLE 9-2

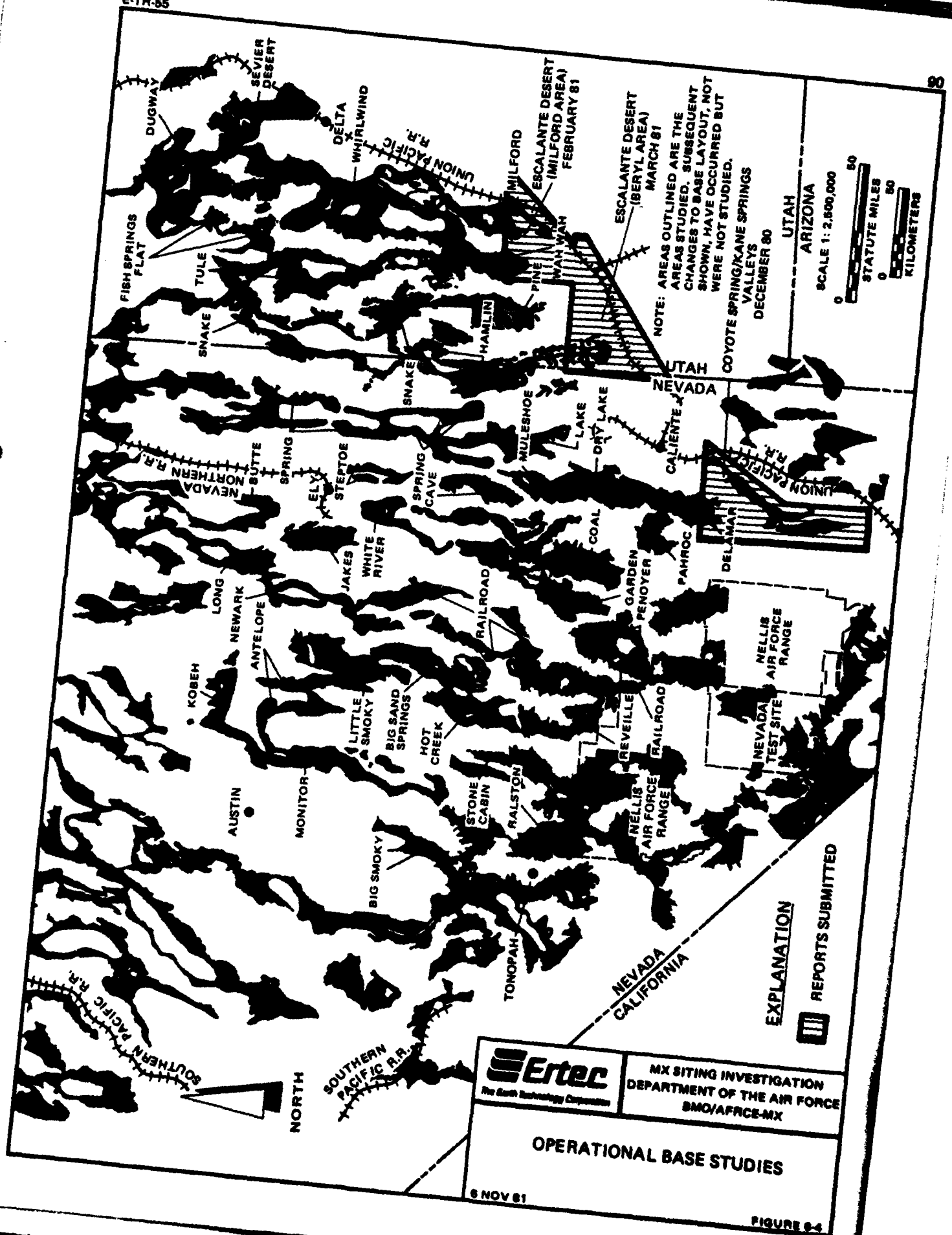
Desert, Utah. The number of map sheets and the dates the maps were completed are summarized in Table 6-3.

Topographic map coverage for the OB sites was based on preliminary OB siting studies performed by Ertec, the Air Force, and other associate contractors. Field control was extended beyond the initial OB siting areas in order to extend the topographic mapping quickly without having to perform additional field work. At the same time the mapping of the OB sites was in progress, the base comprehensive planner (EDAW) began studies to determine final OB site locations. These studies resulted in some changes in the boundaries of the original OB sites as depicted in the initial Land Acquisition Package which was submitted to the Air Force on 2 October 1981. As a result of the changes, the topographic maps that were originally produced for the three OB sites do not cover all portions of the final OB site layouts.

6.3 OPERATIONAL BASE STUDIES

6.3.1 Scope and Objectives

The candidate Operational Base sites at Milford, Coyote Spring, and Beryl (Figure 6-4) were evaluated to determine their geographic, cultural, geotechnical, and geohydrologic characteristics. Geographic and cultural data were compiled from BLM master title plats and available topographic maps. The geotechnical and geohydrological conditions were evaluated by detailed field mapping, subsurface exploration, interpretation of aerial photographs, and a review of existing literature.



In general, the studies were limited to evaluating the relative suitability of the areas as potential OB sites using subjective geotechnical criteria. Proposed options for Operational Base layouts were based on best estimates of the actual conditions on-site.

6.3.2 Siting Studies

At the outset of the siting studies, it was recognized that field investigation would be required before a final site could be selected. During the months of October and November 1980, preliminary geotechnical field studies were performed. The Operational Base field studies consisted of a combination of geologic, geophysical, geohydrological, and soils engineering investigative techniques designed to differentiate suitable and unsuitable areas and obtain basic information on soil and terrain characteristics. In addition, the field studies delineated areas subject to hazards such as flooding, faulting, subsidence, and rock fall. Following completion of the field studies, the data were compiled and three final reports (one for each proposed Operational Base) were submitted to the BMO/APRCE between 23 December 1980 and 27 March 1981.

6.3.2.1 Layout Options

During Ertec's study of the Operational Base, activity centers within the base included 1) the Main Operating Base, 2) a Designated Assembly Area, 3) an operational base test and training site, 4) the support community (military), and 5) a marshalling yard. Each of the centers has a specified size

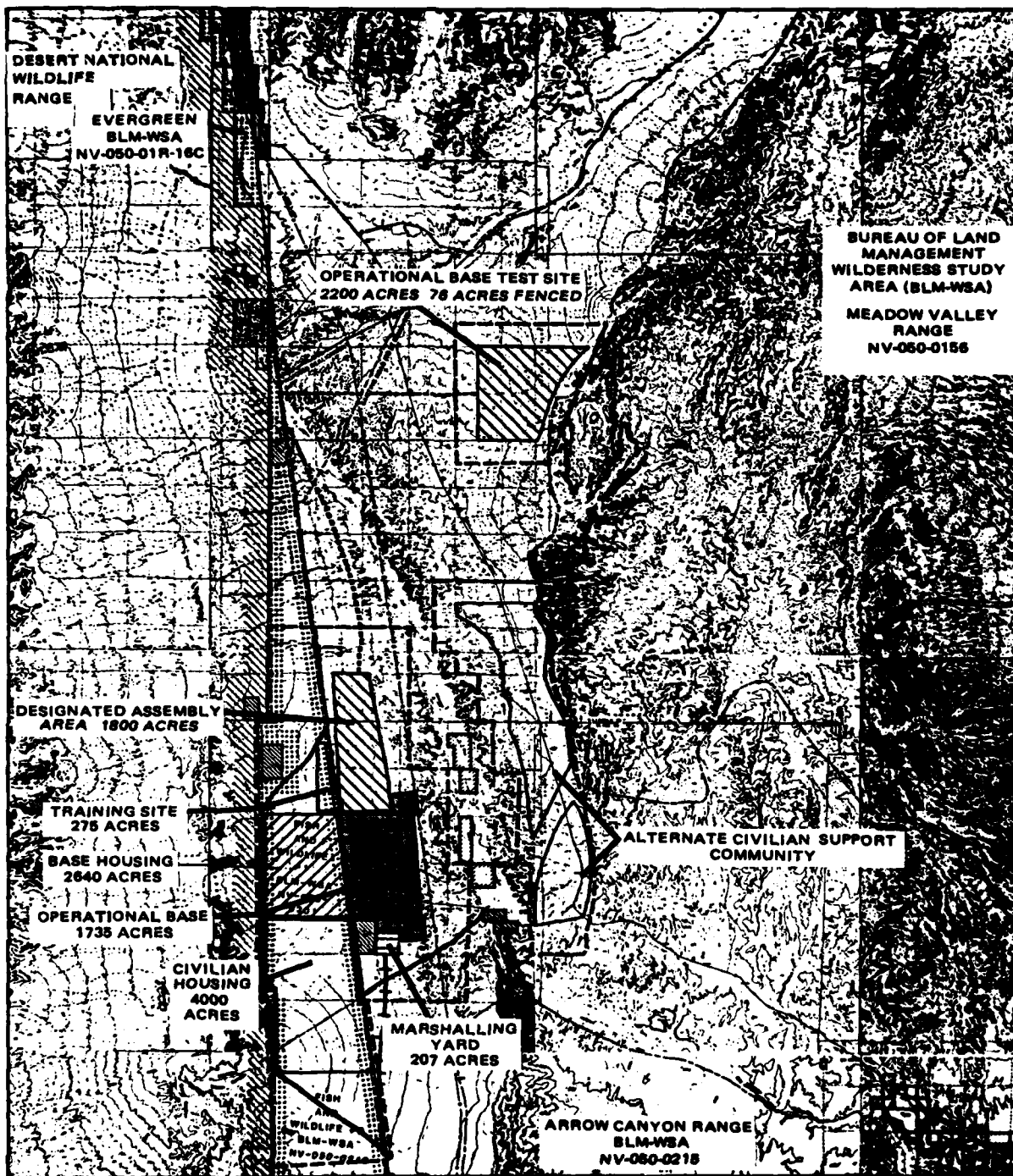
and, in some cases, a specified distance from other centers or structures.

Layout options for the three sites are shown in Figures 6-5 through 6-9. These layouts are responsive to the required area and separation distance specifications. The layouts represent an attempt to optimize the base siting to the geotechnical and cultural conditions in the siting areas. These studies were followed by more detailed studies by the base comprehensive planner (EDAW). From their studies, final sites were selected for the MOB, DAA, and support community. Ertec was tasked to carry out similar studies for the OBTSs after some revisions of the siting criteria. For these studies, geotechnical conditions were interpreted from aerial photographs; field verification studies were not performed.

6.4 OTHER STUDIES

6.4.1 Draft Environmental Impact Statement Responses

In May 1981, Ertec Western was authorized by AFRCE to participate in the response to public comments received on the Draft Environmental Impact Statement (DEIS) on deployment area selection and land withdrawal/acquisition for the MX system. The purpose of preparing these responses was to aid in updating the DEIS so that a Final Environmental Impact Statement (FEIS) could be prepared. Comments were received from Henningson, Durham and Richardson (HDR) through the Public Comment Management Information System (PCMIS). Final responses were composed for single and aggregated comments in the areas of geology, mining, and minerals.



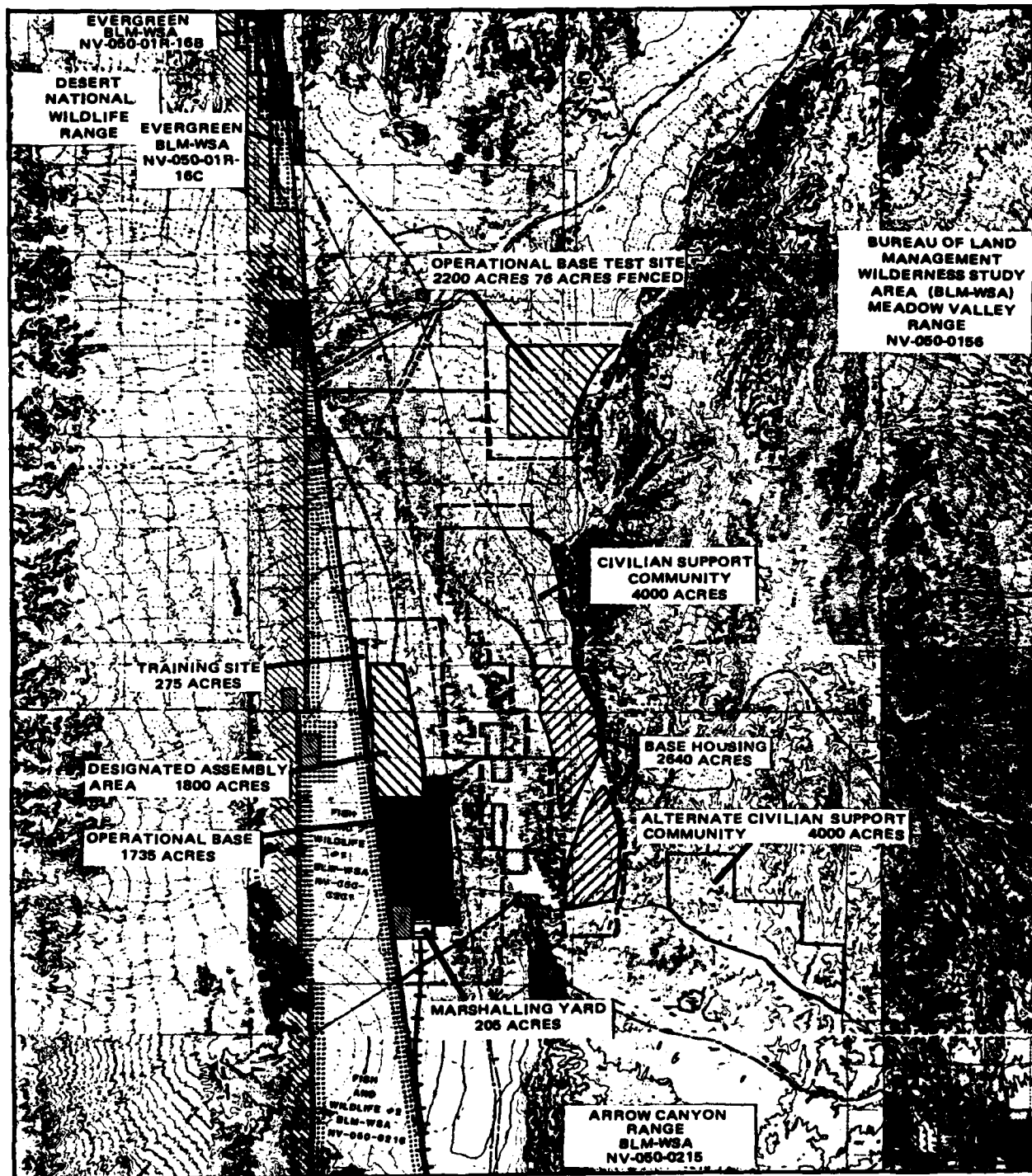
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OPERATIONAL BASE LAYOUT
OPTION 1
COYOTE SPRING/KANE SPRINGS,
NEVADA

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FIGURE 2-5



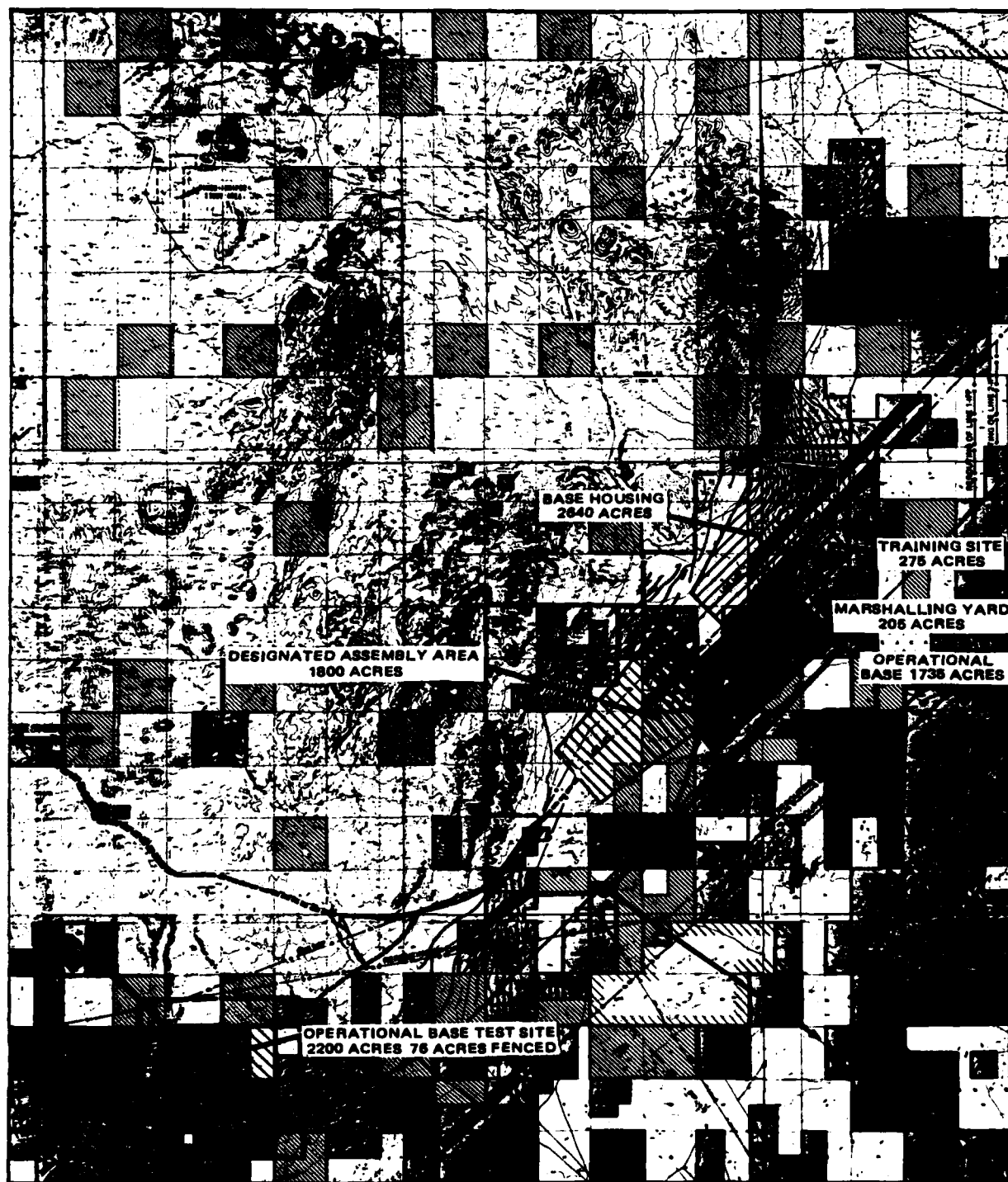
Ertec
The Earth Technology Corporation

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE
BMO/AFRC-MX

OPERATIONAL BASE LAYOUT
OPTION 2
COYOTE SPRING/KANE SPRINGS,
NEVADA

6 NOV 81

FIGURE 6-6



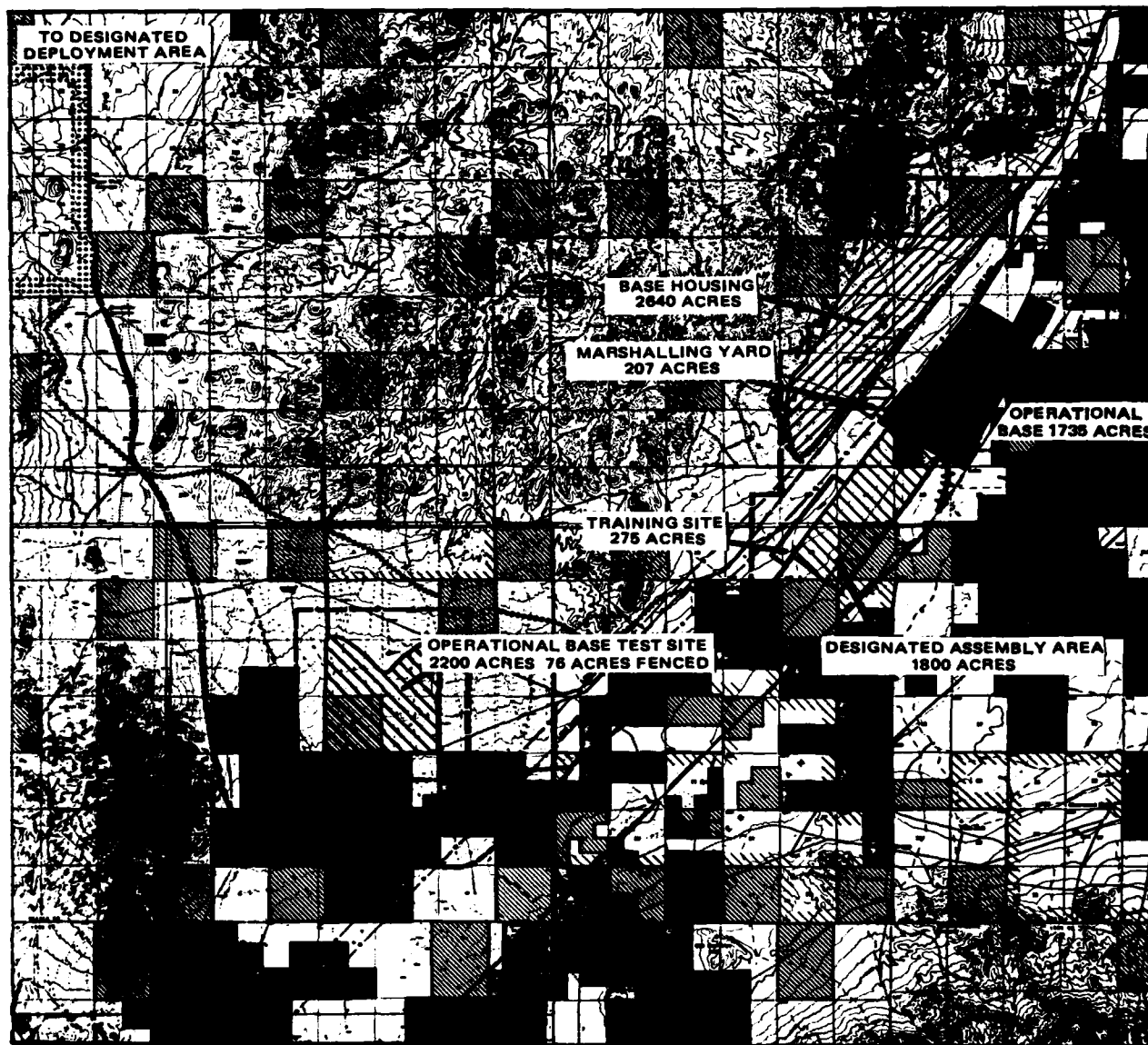
Ertec
The Earth Technology Corporation

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE
BMO/AFRC-MX

OPERATIONAL BASE LAYOUT
OPTION 1
ESCALANTE DESERT, MILFORD AREA,
UTAH

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FIGURE 6-7



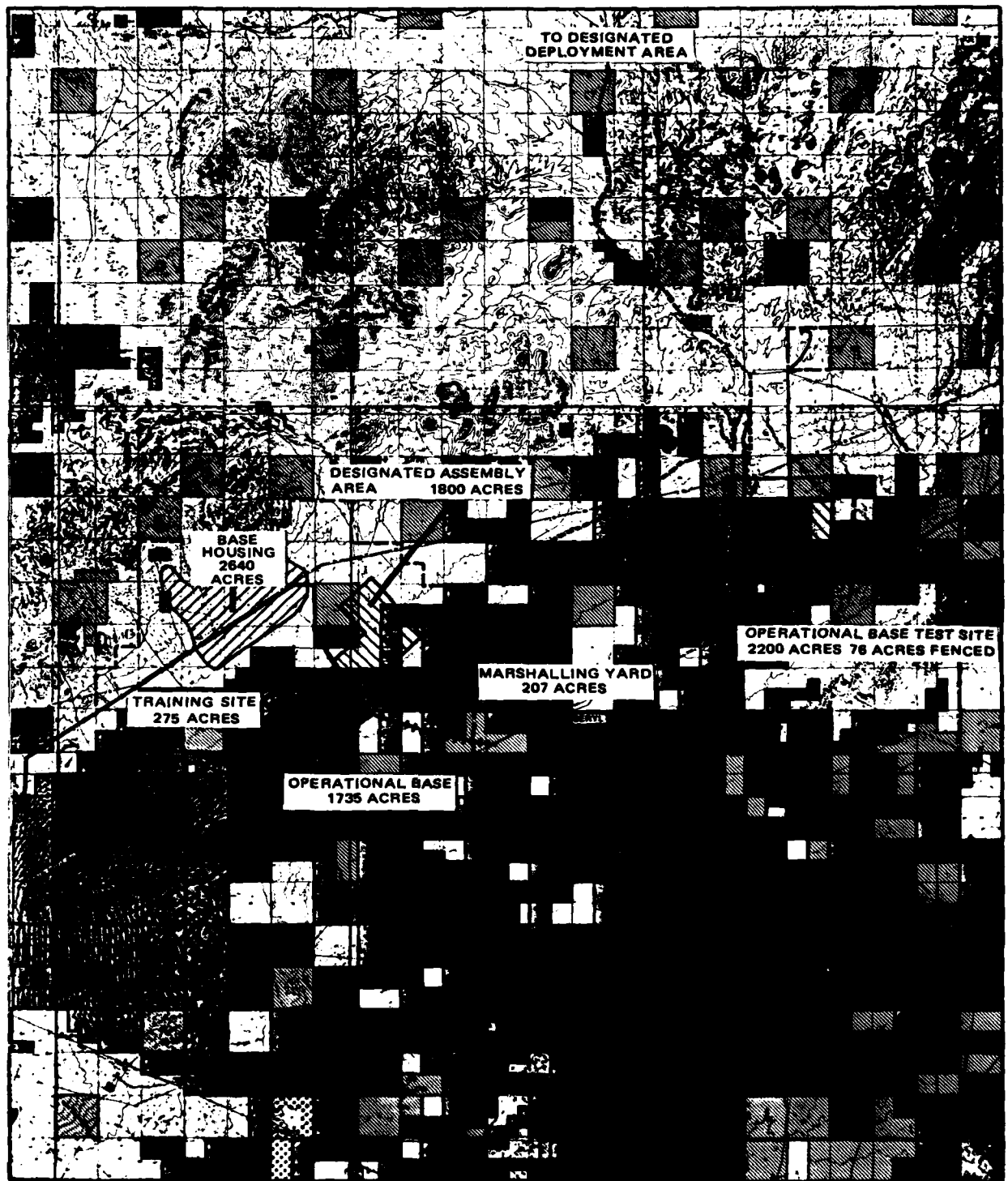
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DEPARTMENT OF THE AIR FORCE
BMO/AFRC-MX

OPERATIONAL BASE LAYOUT
OPTION 2
ESCALANTE DESERT, MILFORD AREA,
UTAH

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FIGURE 6-8



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OPERATIONAL BASE LAYOUT
ESCALANTE DESERT,
BERYL AREA, UTAH

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FIGURE 6-9

6.4.2 Road Design Methodology Studies

The road design methodology studies which began in FY 80 continued in FY 81. These studies consisted of:

1. Follow-on mobility tests;
2. CBR versus CPT correlation studies; and
3. Mechanistic approach to road design.

Brief summaries of work performed by Ertec pertaining to these studies are presented in the following paragraphs.

6.4.2.1 Follow-on Mobility Tests

In FY 81, four test beds were built at the Nevada Test Site for the follow-on mobility tests. These test beds consisted of a compacted subgrade with overlays of varying thicknesses of gravel, soil-asphalt, and soil-cement. The test beds were traversed by a Terex vehicle equipped with two different types of tires and wheel loads ranging from 60 kips to 115 kips. Ertec was involved in performing cone penetrometer tests in the test bed areas before compaction, before traffic (after compaction), and after traffic. The results were presented in a report in May 1981. Ertec was also involved in planning the test program, analyzing the test results, and recommending tire type, tire pressure, and wheel load for the prototype MX missile transporter.

6.4.2.2 CBR Versus CPT Correlation Studies

Field and laboratory studies were performed to develop correlation between California Bearing Ratio (CBR) and Cone

Penetrometer Test (CPT) resistance of the surficial soils from Nevada-Utah deployment area.

The field studies consisted of performing both CBR and CPTs at several locations in nine valleys in the deployment area. The laboratory studies were performed on four selected surficial soil samples from three valleys in the deployment area. These samples were compacted to four different densities in standard CBR molds for CBR tests and large molds (11.5 inches diameter and 14.5 inches high) for cone penetrometer tests. The studies resulted in developing preliminary relationships between CBR and CPT resistance. The results of these correlation studies were presented in a report in August 1981.

6.4.2.3 Mechanistic Approach to Road Design

The current state-of-art design methodology does not extend to roads subjected to very high wheel loads. Therefore, a mechanistic approach to the design of the operational roads was developed. In the mechanistic approach the stress-strain and failure properties of pavement and in-situ surficial soils were characterized by laboratory and field tests. The performance of selected pavement sections under different wheel loads was evaluated using numerical analyses. In order to perform the numerical analyses, DIRT II finite element program was used. This program was revised and modified to suit the characteristics of the surficial soils and boundary conditions of the wheel loading configuration. The results of Ertec's studies were presented in two briefings to the Roads Working Group in

March and May 1981. In addition, the mechanistic approach was used to predict the behavior of the test roads, under traffic, of the Follow-on Mobility Tests conducted at Nevada Test site. The predictions were in good agreement with the field results. The mechanistic design approach was also used to estimate the behavior of the operational roads in Nevada-Utah under the wheel loads of the MX missile transporter.

6.4.3 Site Selection Study for Multifrequency Resistivity Tests

A study was made of existing gravity, seismic refraction, and electrical resistivity data in the proposed MX siting region to select test sites for multi-frequency (to 100 kHz) resistivity studies to be conducted by Mission Research Co. and the U.S. Geological Survey. The purpose of their studies was to evaluate the levels of currents which would be induced from the electromagnetic pulse that accompanies an atmospheric nuclear explosion. In order to evaluate the geological influence on the multifrequency measurements, a program of conventional deep electrical soundings by Ertec was planned, and Letter of Authorization requests for land access have been submitted to the Corps of Engineers.

APPENDIX A
TECHNICAL REPORT LIST

TR REPORTS WITH NUMBER DESIGNATIONS

<u>Report Number</u>	<u>Description</u>	<u>Date of Report</u>
FN-TR-1	Fugro National, Inc., 1975a, Siting evaluation report: Cons. report for SAMSO, v. I, 55 p., appendices.	30 June 1975
FN-TR-2	_____, 1975b, Geotechnical report, White Sands Missile Range/Fort Bliss Military Reservation: Cons. report for SAMSO, v. IIA, 113 p., data summary sheets, appendices and graphics volume.	30 June 1975
FN-TR-3	_____, 1975c, Geotechnical report, Yuma Proving Grounds/Luke-Williams Bombing and Gunnery Range: Cons. report for SAMSO, v. IIB, 122p., data summary sheets, appendices and graphics volume.	30 June 1975
FN-TR-4	_____, 1975d, Geotechnical report, Nellis Bombing and Gunnery Range: Cons. report for SAMSO, v. IIC, 125 p., data summary sheets, appendices and graphics volume.	30 June 1975
FN-TR-5	_____, 1975e, Recommended geotechnical field investigation: Cons. report for SAMSO, v. III, 45 p.	30 June 1975
FN-TR-6	_____, 1975f, Environmental assessment report: Geotechnical field investigation: Cons. report for SAMSO, v. IV, 165 p., appendices.	30 June 1975
FN-TR-7	_____, 1975g, Water rights and resources: Cons. report for SAMSO, 104 p., appendices.	30 November 1975
FN-TR-8	_____, 1975, Comparative environmental assessment of the three MX land mobile missile system concepts: Cons. report for SAMSO, 179 p., appendices.	30 November 1975
FN-TR-9	_____, 1976a, Siting evaluation report: Cons. report for SAMSO, v. I, 63 p., appendices.	31 May 1976

TR REPORTS WITH NUMBER DESIGNATIONS (cont.)

<u>Report Number</u>	<u>Description</u>	<u>Date of Report</u>
FN-TR-10	<u> </u> , 1976b, Geotechnical report, White Sands Missile Range Extension: Cons. report for SAMSO, v. IIA, 88p., data summary sheets, appendices and graphics volumes.	31 May 1976
FN-TR-11	<u> </u> , 1976c, Geotechnical report, Gila Bend Group: Cons. report for SAMSO, v. IIB, 120 p., data summary sheets, appendices and graphics volume.	31 May 1976
FN-TR-12	<u> </u> , 1976d, Geotechnical report, Nellis Group: Cons. report for SAMSO, v. IIC, 142 p., data summary sheets, appendices and graphics volume.	31 May 1976
FN-TR-13	<u> </u> , Inc., 1976e, Recommended geotechnical field investigations: Cons. report for SAMSO, v. III, 79 p., appendix.	31 May 1976
FN-TR-14	<u> </u> , 1976f, Multiple aim-point validation (MAV) program, Luke Bombing and Gunnery Range, Arizona. Part 1 - Site selection and surficial geology, Part 2 - Soils engineering and seismic refraction: Cons. report for SAMSO, 63 p.	30 September 1976
FN-TR-15	<u> </u> , 1976g, MX siting regions evaluations: Delineation and analysis of suitable Department of Defense and Bureau of Land Management lands: Cons. report for SAMSO, 51 p., appendices.	30 September 1976
FN-TR-16	<u> </u> , 1977a, MX siting investigation continuous United States, volume I coarse screening: Cons. report for SAMSO, v. I, 30 p., app.	1 June 1977
FN-TR-17	<u> </u> , 1977b, MX siting investigation geotechnical evaluation continuous United States, volume II intermediate screening: Cons. report for SAMSO, v. II, 175 p., appendices.	30 September 1977

TR REPORTS WITH NUMBER DESIGNATIONS (cont.)

<u>Report Number</u>	<u>Description</u>	<u>Date of Report</u>
FN-TR-18	Fugro National, 1977d, Geotechnical report Mohawk - Tule Valley, Arizona: cons. report for SAMSO, v. I and II, 141 p., appendices.	Vol. I - 27 January 1978 Vol. II - 17 September 1977
FN-TR-19	_____, 1978a, Geotechnical report Lechuguilla Desert Arizona; cons. report for SAMSO, v. I and II, 147 p., appendices.	20 January 1978
FN-TR-20	_____, 1978c, Aggregate Resources Report Department of Defense and Bureau of Land Management lands, southwestern United States: Cons. report for SAMSO, 74 p., appendices. (draft).	10 February 1978
FN-TR-21	_____, 1978d, Geotechnical Investigation Misers Bluff Test Program Planet Ranch Test Valley, Arizona: Cons. report for SAMSO, 52 p., appendices. (draft).	23 September 1977
FN-TR-21A	_____, 1978, Crosshole velocity survey, Misers Bluff ground zero-2 (GZ-2) Planet Ranch Test Valley, Arizona.	20 March 1978
FN-TR-22	_____, 1978e, MX siting investigation, geotechnical evalu- ation, Trench Layout Report: Cons. report for SAMSO, 39 p., appendices. (draft).	31 March 1978
FN-TR-23	_____, 1978f, Geotechnical investigation, Methodology Report, MX siting investigation, western conterminous United States: Cons. report for SAMSO, 67 p., appendices (draft).	30 March 1978
FN-TR-24	_____, 1978g, MX siting investigation, conterminous United States, V. III Fine Screening: Cons. Report for SAMSO. (in progress).	14 July 1978 revised - 11 September 1978
FN-TR-25	_____, 1978h, MX siting investigation, geotechnical evalu- ation, Geotechnical Ranking of Seven Candidate Siting Regions Report.	30 May 1979

TR REPORTS WITH NUMBER DESIGNATIONS (cont.)

<u>Report Number</u>	<u>Description</u>	<u>Date of Report</u>
FN-TR-26a	Fugro National, 1978i, MX siting investigation, geotechnical summary, prime characterization sites, Central High Plains Candidate Siting Province Report.	16 June 1978
FN-TR-26b	_____, 1978j, MX siting investigation, geotechnical summary, prime characterization sites, Southern High Plains Candidate Siting Province Report.	29 September 1978 revised - 2 February 1979
FN-TR-26c	_____, 1978k, MX siting investigation, geotechnical summary, prime characterization sites, Rio Grande/Highlands Candidate Siting Province Report.	16 June 1978
FN-TR-26d	_____, 1978l, MX siting investigation, geotechnical summary, prime characterization sites, Sonoran Candidate Siting Province Report.	16 June 1978
FN-TR-26e	_____, 1978m, MX siting investigation, geotechnical summary, prime characterization sites, Great Basin Candidate Siting Province Report.	16 June 1978
FN-TR-27	Verification Reports (see Sheet A)	
FN-TR-28	Fugro National, 1979b, Arizona Verification Studies, FY 79: Cons. report for SAMSO; v. I, _____ pages and one data volume with 13 tables, 17 figures, 13 drawings, 95 p., and appendices; v. II, data volume similar to v. I.	5 November 1979
FN-TR-29	_____, 1979c, Thermal Properties of Soils, 137 pages, 59 figures, 9 tables, and 13 plates.	23 November 1979
FN-TR-30	_____, 1979d, Executive Summary Report, Geotechnical siting investigation FY 79, 74 p., 20 figures, 6 tables, 5 photographs.	26 October 1979
FN-TR-31	_____, 1979f, Alternative Energy Sources for the MX System, Nevada-Utah (Draft); 520 p.; 24 figures.	draft - 25 February 1980 30 April 1980

TR REPORTS WITH NUMBER DESIGNATIONS (cont.)

<u>Report Number</u>	<u>Description</u>	<u>Date of Report</u>
FN-TR-32	Fugro National, 1980d, MX Siting Investigation, Shelter Layout Study; 30 p.; 1 figure; 8 tables; 7 drawings.	27 February 1980
FN-TR-33	Gravity Survey Reports (see Sheet B)	
FN-TR-34	Fugro National, Inc., 1980f, Aggregate Resources Report, Utah-Nevada Study Area, 99 p., 3 figures; 35 tables; 6 photos; 2 drawings.	3 March 1980
FN-TR-35	<u>Coyote Spring and Kane Springs Valleys, Nevada; 41 p.; 7 figures; 2 tables; 3 drawings.</u> (2) Proposed Operational Base Site, Escalante Desert, Milford Area, Utah; 39 p.; 7 figures; 3 tables; 3 drawings. (3) Proposed Operational Base Site, Steptoe Valley, Ely Area, Nevada; 38 p.; 5 figures; 3 tables; 3 drawings.	15 May 1980
FN-TR-36	<u>Earthquake Hazards in the FY 79 Verification Sites - Nevada-Utah Siting Region; 72 p.; 2 figures; 5 drawings.</u>	26 March 1980
FN-TR-37	Aggregate Resources Reports - Valley Specific (see Sheet C)	
FN-TR-38	Fugro National, 1980l, EIS Water Resources Program Summary for Draft Environmental Impact Statement, Vol. I, 151 p., 4 figures, 6 tables; Water Resources Program Summary for Draft Environmental Impact Statement, Vol. II, 8 tables.	15 May 1980 revised - 1 August 1980
FN-TR-39	<u>verification studies, FY 79 and FY 80, v. I; 12 p., 4 tables, 13 drawings; Summary of suitable area Nevada-Utah, verification studies, FY 79 and FY 80, v. II; 7 drawings.</u>	2 July 1980
FN-TR-40	<u>program interim report; 94 p., 3 figs., 5 tables, 9 app.</u>	31 October 1980

TR REPORTS WITH NUMBER DESIGNATIONS (cont.)

<u>Report Number</u>	<u>Description</u>	<u>Date of Report</u>
FN-TR-41	Fugro National, 1980u, MX Mineral resources survey, Nevada/Utah siting area (draft), v. I-XI, 311 p., 3 app.	30 October 1980 revised - 15 January 1981
FN-TR-42	Study, 1980, 103 pp., 1 app., 33 figs., 12 tables, 7 drawings.	30 November 1980
FN-TR-43	Proposed Operational Base Site, Coyote Spring Valley, Nevada, v. I and II.	23 December 1980
FN-TR-44	Proposed OB site, Milford Utah, 77 pp. vol. I Synthesis, 12 figs., 7 tables, 6 drawings.	20 February 1981
FN-TR-45	203 pp., vol. II, Geotechnical data, 131 figs., 6 tables, 1 drawing.	27 March 1981
FN-TR-46	Proposed OB Site, Beryl, Utah, vol. I Synthesis, 66 pp., 4 app., 7 figs., 6 tables, 6 drawings.	20 March 1981
E-TR-47	sources Inventory and Environmental Evaluation of the Proposed Operational Base Sites in Coyote Spring Valley and Milford-Beryl area, 1981h, 168 pp., 4 app., 25 figs., 17 tables, 4 Eq.	
E-TR-48-I	Ertec Western, Aggregate Resources Reports - Valley Detailed (see Sheet D)	
E-TR-48-II-I	Surveys, IOC Valleys, 94 pp., 3app., 19 figs., 1 drawing.	8 July 1981 revised - August 1981
	Resources Survey, Dry Lake Valley, Nevada, vol. II, part I 251 pp., 9 app., 50 figs., 48 tables.	August 1981

TR REPORTS WITH NUMBER DESIGNATIONS (cont.)

<u>Report Number</u>	<u>Description</u>	<u>Date of Report</u>
E-TR-48-II-II	_____, 1981t, Field Surveys, IOC Valleys, Biological Resources Survey, Pine and Wah Wah valleys, Utah, vol. II, part II, 288 pp., 10 app., 66 figs., 5 tables.	August 1981
E-TR-48-III-I	_____, 1981t, Field Surveys, IOC Valleys, Cultural Resources Survey, Dry Lake Valley, Nevada, vol. III, part I, 169 pp., 9 app., 17 figs., 19 tables.	August 1981
E-TR-48-III-II	_____, 1981t, Field Surveys, IOC Valleys, Cultural Resources Survey, Pine and Wah Wah valleys, Utah, vol. III, part II, 133 pp., 5 app., 18 figs., 22 tables.	August 1981
E-TR-49-II	Ertec Western, 1981u, Mineral Resources Survey, Operational Base Sites, Nevada/Utah Siting Area, vol. I, vol. II, and vol. III, 30 April 1981, 75 pp., 2 figs., 8 photos, 5 app., 12 drawings.	Not submitted (1)
E-TR-50	_____, 1981v, Mineral Resources Survey, Seven Additional Valleys, Nevada/Utah Siting Area, 23 June 1981, vol. I, II, III, IV, maps and appendices.	22 June 1981
E-TR-51	_____, 1981w, Water Resources Operational Base Studies Report. Vol. I, Coyote Spring Operational Base, Nevada, 57 pp., 6 app., 12 figs., 13 tables. Vol. II, Milford and Beryl Operational Bases, Escalante Valley, Utah, 82 pp., 7 app., 19 figs., 16 tables, 2 drawings.	28 May 1981

(1) The report was not submitted because there were some changes in the locations of the operational base sites. The report was to be submitted after the surveys were extended to the new locations.

TR REPORTS WITH NUMBER DESIGNATIONS (cont.)

<u>Report Number</u>	<u>Description</u>	<u>Date of Report</u>
E-TR-52	<u>Report, 1981s.</u> Vol. I, 97 pp., 5 figs., 2 app., 2 drawings, 55 tables. Vol. II, 286 pp., 4 tables. Vol. IIA, 41 pp., 38 figs. Vol. IIB, 146 pp., 111 tables.	In Progress
E-TR-53	<u>Water Management Report vol. I</u> , 250 pp., 1 app., 5 figs., 57 drawings. Vol. II, 13 drawings.	28 September 1981
E-TR-54	<u>Region, Nevada and Utah.</u> Vol. I, 77 pp., 11 figs., 3 tables. Vol. II, 3 tables, 1 fig., 11 plates.	6 November 1981
E-TR-56	<u>Groundwater Withdrawals, Dry Lake Valley, Nevada</u> , 36 pp., 4 figs., 6 tables.	30 November 1981
E-TR-58	<u>Shelter Siting Summary</u> , 17 pp., 18 drawings. Part II, 282 pp., 57 tables, 23 figs. Part III, 344 pp., 25 tables, 15 figs.	In Progress
E-TR-59 (1)	<u>DTN/OBTS Field Surveys.</u>	In Progress
E-TR-60	<u>Methodology.</u> 1981, Mechanistic Approach to MX Road Design	In Progress

(1) As directed by a Stop Work Order, this report was not completed.

VERIFICATION REPORTS

<u>Report Number</u>	<u>Description</u>	<u>Date of Report</u>
FN-TR-27	Fugro National, 1979a, Nevada-Utah Verification Studies, FY 79: Cons. report for SAMSO; v. IA 221 pages, v. I (B 122 pages appendix; v. 2 through 8, data volumes with about 15 tables, 75 figures, and 4 drawings in each volume.	Vol. I & II 17 - July 1979 Vol. III - VIII and 1A & 1B - 24 August 1979
FN-TR-27-DL	_____, 1980g, Verification Study, Dry Lake Valley, Nevada; v. I - Synthesis, 90 .; 11 figures; 11 tables; 7 drawings; v. II - Geotechnical Data; 28 p.; 86 figures; 21 tables; 6 drawings.	14 March 1980
E-TR-27-RV (1)	_____, 1980, Verification Study, Ralston Valley, Nevada, 1981k, Vol. I, Synthesis, 48 pp., 5 app., 12 figs., 11 tables, 7 drawings.	15 June 1980
FN-TR-27-DM	Vol. II Geotechnical Data, 23 pp., 16 figs., 62 tables, 1 drawings. _____, 1981i, Verification Study, Delamar Valley, Nevada, 1981k, Vol. I, Synthesis, 48 pp., 5 app., 12 figs., 11 tables, 7 drawings.	24 March 1981
FN-TR-27-WA	Vol. II Geotechnical data, 97 pp., 53 figs., 10 tables, 2 drawings. _____, 1981k, Verification Study, Wah Wah Valley, 1981m, Vol. I Synthesis, 46 pp., 9 figs., 8 tables, 7 drawings. Vol. II Geotechnical data, 149 pp., 83 figs., 15 tables, 2 drawings.	24 March 1981

(1) The Verification studies in Ralston Valley did not include cone penetrometer tests, test pits, surficial samples, or resistivity surveys.

GRAVITY SURVEY REPORTS

<u>Report Number</u>	<u>Description</u>	<u>Date of Report</u>
FN-TR-33-WW	Fugro National, 1980a, Gravity Survey - Whirlwind Valley, Utah, 19 p., 2 app., 8 figs.	30 January 1980
FN-TR-33-HV	_____, 1980b, Gravity Survey - Hamlin Valley, Nevada; 16 p., 2 app., 13 figs.	27 February 1980
FN-TR-33-DL	_____, 1980h, Gravity Survey - Dry Lake Valley, Nevada; 18 p., 2 app., 7 figs.	27 March 1980
FN-TR-33-SV	_____, 1980j, Gravity Survey - Southern Snake Valley (Ferguson Desert), Utah; 13 p., 2 app., 11 figs.	28 March 1980
FN-TR-33-WR	_____, 1980m, Gravity Survey - Southern White River Valley, Nevada; 23 p., 2 app., 8 figs., 1 table, 1 drawing.	22 May 1980
FN-TR-33-GN	_____, 1980n, Gravity Survey - Garden Valley, Nevada, 14 p., 2 app., 6 figs., 1 drawing.	30 May 1980
FN-TR-33-CL	_____, 1980o, Gravity Survey - Coal Valley, Nevada, 13 p., 2 app., 5 figs., 1 drawings.	30 May 1980
FN-TR-33-BG	_____, 1980p, Gravity Survey - Big Sand Springs Valley, Nevada, 17 p., 1 app., 5 figs.	09 July 1980
FN-TR-33-HC	_____, 1980q, Gravity Survey - Hot Creek Valley, Nevada, 18 p., 1 app., 5 figs.	09 July 1980
FN-TR-33-BS	_____, 1980r, Gravity Survey - Big Smoky Valley, Nevada, 15 p., 1 app., 2 figs., 1 table, 2 drawings.	28 November 1980
E-TR-33-WA	Ertec Western, Gravity Survey, Wah Wah Valley, Utah, 17 p., 2 app., 3 figs., 2 tables, 2 drawings.	2 March 1981

GRAVITY SURVEY REPORTS

<u>Report Number</u>	<u>Description</u>	<u>Date of Report</u>
E-TR-33-PI	<u>1981p, 19 p., 2 app., 5 figs., 2 tables, 2 drawings.</u> Inc., 1981h, Gravity Survey, Pine Valley, Utah,	2 March 1981 revised - 15 May 1981
E-TR-33-LV	<u>17 p., 2 app., 2 figs., 2 drawings.</u> Inc., 1981, Gravity Survey, Lake Valley, Nevada,	20 May 1981
E-TR-33-SP	<u>13 p., 2 app., 1 fig., 2 drawings.</u> Inc., 1981, Gravity Survey, Spring Valley, Nevada,	20 May 1981
E-TR-33-DM	<u>16 p., 1 app., 2 figs., 2 drawings.</u> Inc., 1981, Gravity Survey, Delamar Valley, Nevada,	20 July 1981
E-TR-33-PA	<u>19 p., 2 app., 3 figs., 2 tables, 2 drawings.</u> Inc., 1981, Gravity Survey, Pahroc Valley, Nevada,	20 July 1981
E-TR-33-RV	<u>19 p., 2 app., 4 figs., 2 drawings.</u> Inc., 1981, Gravity Survey, Ralston Valley, Nevada,	20 August 1981
E-TR-33-DW	<u>1981, 21 p., 2 app., 5 figs., 1 table, 2 drawings.</u> Inc., 1981, Gravity Survey, Dugway Valley, Utah,	19 December 1981 revised - 28 August 1981
E-TR-33-SD	<u>Utah, 1981, 16 p., 2 app., 2 figs., 2 drawings.</u> Inc., 1981, Gravity Survey, Sevier Desert Valley,	24 January 1981 revised - 28 August 1981
E-TR-33-MS	<u>Nevada, 20 p., 2 app., 6 figs., 2 drawings.</u> Inc., 1981, Gravity Survey, Muleshoe Valley,	14 September 1981
E-TR-33-CV	<u>20 p., 3 app., 4 figs., 2 drawings.</u> Inc., 1981, Gravity Survey, Cave Valley, Nevada,	14 September 1981

AGGREGATE RESOURCES REPORT - VALLEY SPECIFIC

<u>Report Number</u>	<u>Description</u>	<u>Date of Report</u>
FN-TR-37	Fugro National, 1980k, Valley-Specific Aggregate Study.	6 June 1980
a to e	a. Dry Lake, Muleshoe, Delamar, Pahroc Valleys; 45 p.; 6 figures; 3 tables; 2 drawings. b. Snake Valley, 47 p.; 9 figures, 3 tables; 2 drawings. c. White River Valley; 44 p.; 7 figures; 3 tables 2 drawings. d. Whirlwind Valley, 43 p.; 5 figures; 3 tables; 2 drawings. e. Hamlin Valley; 44 p.; 6 figures; 3 tables; 2 drawings.	
FN-TR-37-g	<u>Wah Wah, Utah</u> 42 pp., 1 app., 2 tables, 2 figs., 2 drawings.	27 February 1981
FN-TR-37-f	<u>1981d</u> 40 pp., 1 app., 2 tables, 2 figs., 2 drawings.	27 February 1981
E-TR-37-i	<u>Coal valleys, Nevada</u> , 1981, Aggregate Resources Study, Garden and 43 pp., 5 app., 2 figs., 2 tables, 2 drawings.	2 July 1981
E-TR-37-h	<u>Nevada, 41 pp.</u> , 1981, Aggregate Resources Study, Tule Valley, 5 app., 2 figs., 2 tables, 2 drawings.	3 July 1981
E-TR-37-j	<u>Steptoe valleys, Nevada</u> , 1981, Aggregate Resources Study, Cave and 41 pp., 5 apps., 2 figs., 2 tables, 2 drawings.	25 September 1981

AGGREGATE RESOURCES REPORT - VALLEY DETAILED

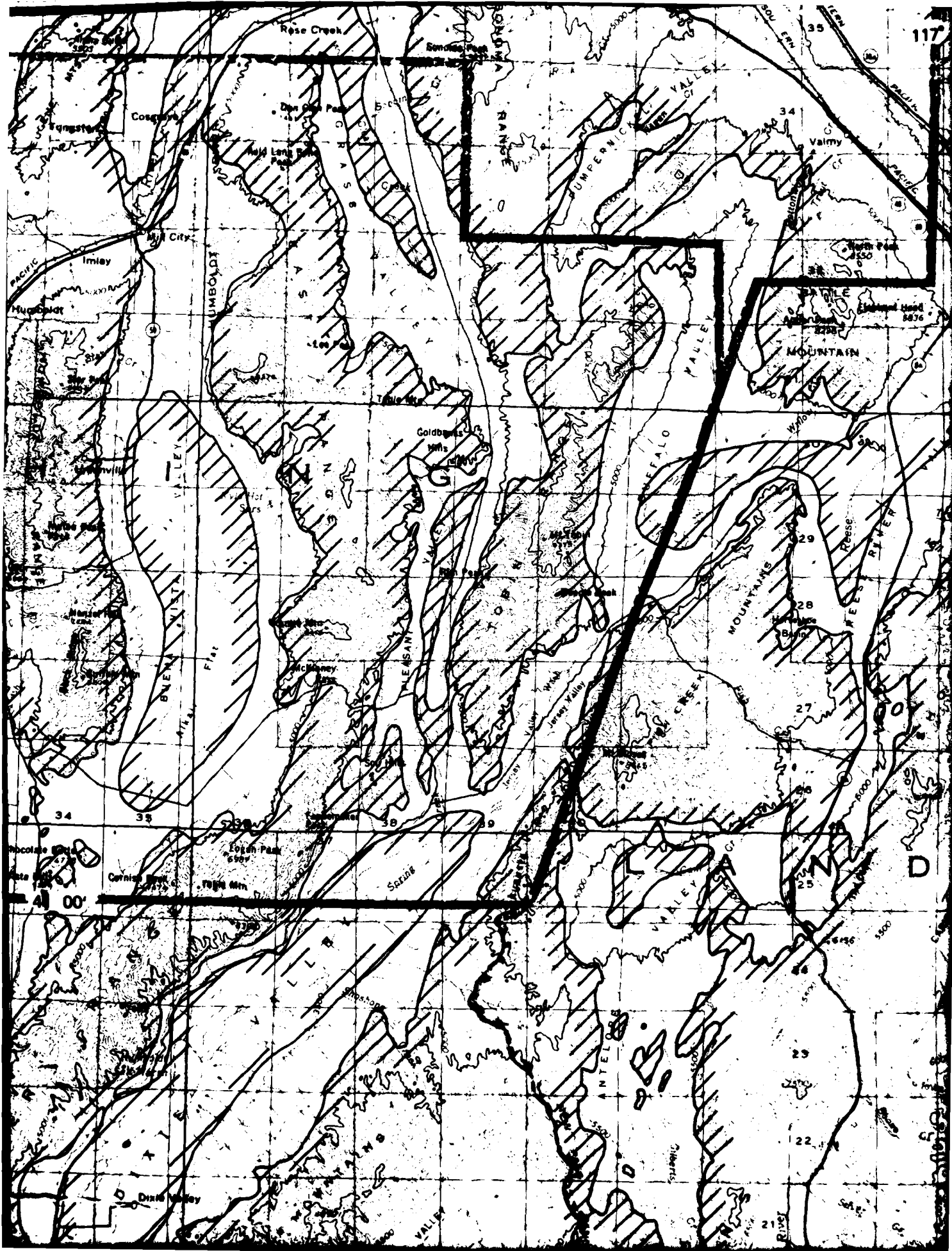
<u>Report Number</u>	<u>Description</u>	<u>Date of Report</u>
E-TR-47-PI	Ertec Western, 1981o, Detailed Aggregate Resources Study, Pine Valley, Nevada, 12 June, 1981, 75 pp. 7 appendixes, 7 figs., 6 tables, 3 drawings.	21 June 1981
E-TR-47-WW	<u>Wah Wah Valley</u> , 1981p, Detailed Aggregate Resources Study, Wah Wah Valley, Utah, 12 June 1981, 86 pp. 7 app., 9 figs., 7 tables, 3 drawings.	21 June 1981
E-TR-47-DM	<u>Delamar Valley</u> , 1981q, Detailed Aggregate Resource Study, Delamar Valley, Nevada, 29 May 1981, 58 pp., 7 app., 3 tables, 6 figs., 3 drawings.	29 May 1981
E-TR-47-DL	<u>Lake Study Area</u> , 1981, Detailed Aggregate Resource Study, Dry Lake Study Area, Nevada, 29 May 1981, 80 pp., 7 apps., 9 figs., 7 tables, 3 drawings.	29 May 1981
E-TR-47-MS	<u>Muleshoe Valley</u> , 1981r, Detailed Aggregate Resource Study, Muleshoe Valley, Nevada, 5 June, 1981, 54 pp., 7 app., 5 figs., 5 tables, 3 drawings.	5 June 1981
E-TR-47-PA	<u>Study Area</u> , 1981s, Detailed Aggregate Resource Study Pahroc Study Area, Nevada, 5 June 1981, 59 pp., 7 app., 6 figs., 3 tables, 3 drawings.	5 June 1981

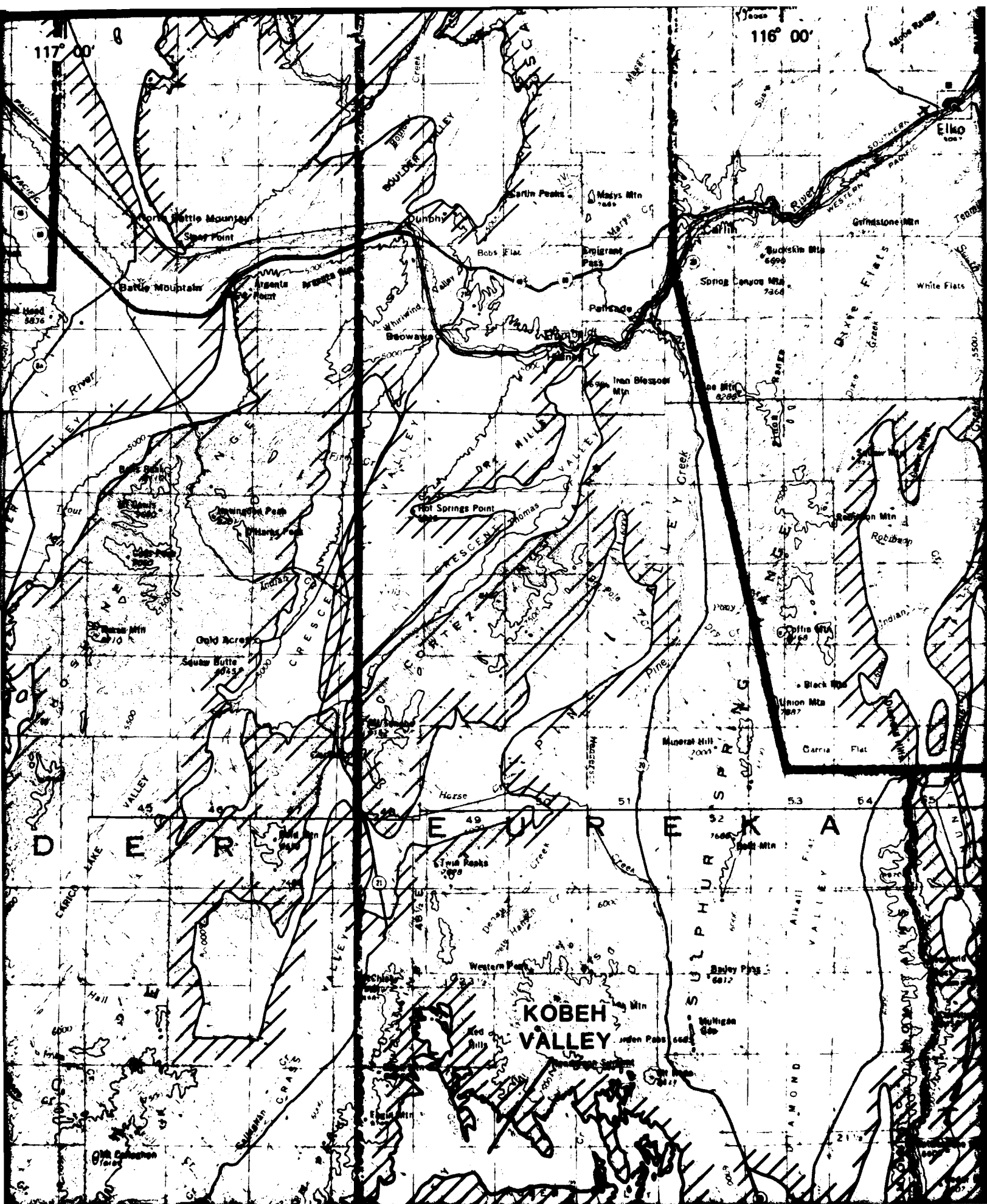
TR REPORTS WITH LETTER DESIGNATIONS

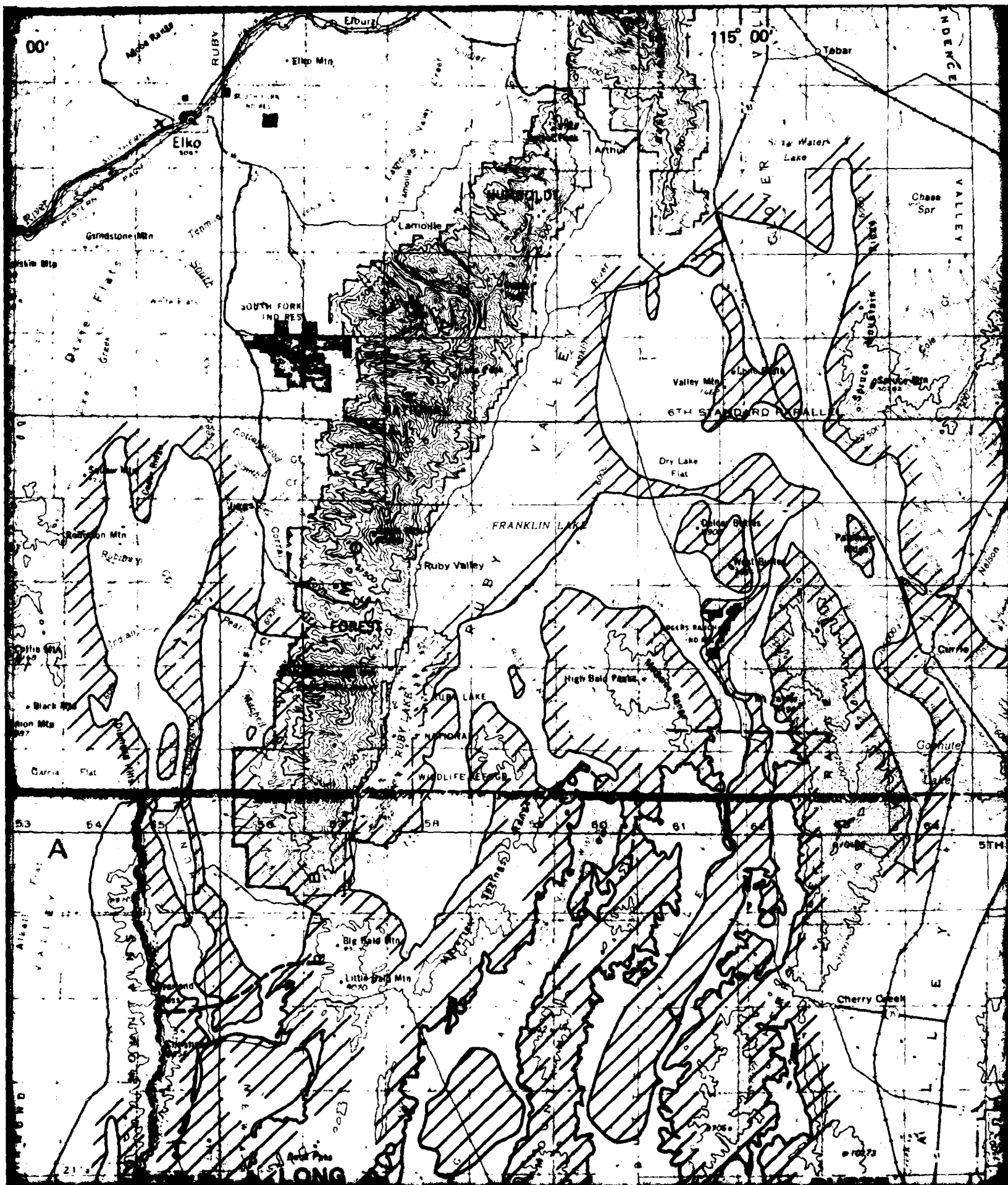
<u>Report Number</u>	<u>Description</u>	<u>Date of Report</u>
FN-TR-ST	Fugro National, 1977c, MX siting program soil temperature determination, Luke Bombing and Gunnery Range, Arizona: Cons. report for SAMSO, in progress, 32 p., appendices.	31 May 1977
FN-TR-WR	<u>1977e</u> , Evaluation of water resources in vicinity of Stoval Field, San Cristobal Valley, Yuma county, Arizona: cons. report for SAMSO, 42 p., appendices.	October 1977
FN-TR-GE	<u>1978b</u> , General geotechnical site feasibility analysis for the environmental assessment of an MX test facility, Vandenberg Air Force Base, California: Cons. Report for SAMSO, 29 p., appendices.	1 January 1978
FN-TR-BT	<u>1978N</u> , Geotechnical report, shear strength of compacted backfill, break-out and erection tests, MAV test site, San Cristobal Valley, Arizona, 51 p.	23 October 1978
FN-TR-RP	<u>1979e</u> , Railroad Pass Evaluation, Nevada-Utah Siting Area, 21 p., 2 figures, 1 table, 3 photos, 2 drawings.	16 November 1979
FN-TR-WS	<u>1980e</u> , Evaluation of Screening Results and Geotechnical Conditions, State of Wyoming; 26 p.; 6 figures; 1 table.	28 February 1980
FN-TR-DTN	<u>1980p</u> , Preliminary evaluation of designated transportation network; 22 p., 3 figs., 6 tables, 9 drawings.	6 June 1980
FN-TR-MFR	<u>1981j</u> , Geotechnical Evaluation, Multi-Frequency Resistivity Studies, 1981l, 7 pp., 2 figs., 5 drawings.	15 April 1981
FN-TR-ETB-1	<u>1980s</u> , Progress report, geotechnical study for mobility test tracks, ETB mobility study, Nevada Test Site, Nevada; 35 p., 7 tables, 3 app., 13 figs.	29 August 1981

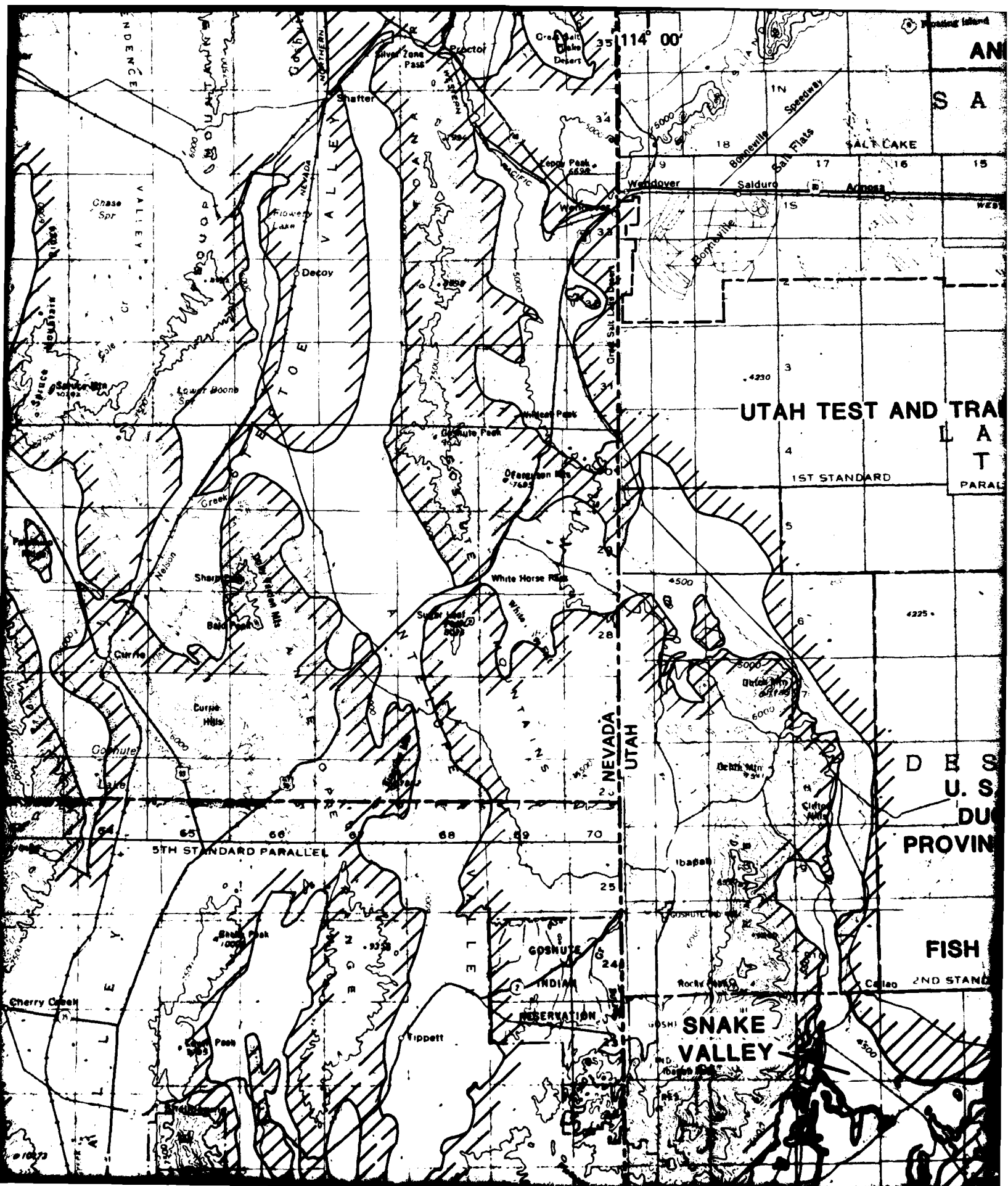
REPORTS WITHOUT TR DESIGNATIONS

<u>Description</u>	<u>Date of Report</u>
1. Fugro National, Inc., 1978o, Geotechnical siting status report: Cons. report for SAMSO; v. I, 242 pages, v. II, maps, app.	21 June 1978
2. _____, 1980a, MX siting investigation, Nevada and Utah water law and procedures for rights acquisition, water resources program FY 80; 5 p., 2 tables, 1 app.	12 February 1979 revised - 2 June 1980
3. _____, 1979, MX siting investigation geotechnical summary water resources program, FY 79; 54 p., 2 figs., 3 tables, 12 drawings, 3 app.	21 December 1979
4. _____, 1980b, Municipal water-supply and wastewater treatment facilities in selected Nevada and Utah communities; 2 p., 4 tables, 2 app.	20 June 1980
5. _____, 1981b, MX siting investigation, Water Resources Program, Progress Report, 1981c, 34 pp., 6 tables, 2 figs., 8 drawings, 2 app.	September 1980
6. _____, 1981a, Cone Penetrometer Test Results, Engineering Test Beds Follow-on Mobility Test, 4 app.	19 December 1980
7. Ertec Western, Inc., Regional Studies for Valley Clustering, 246 pp., 2 app., 1 fig., 4 tables.	21 August 1981
8. _____, Photo-geologic Interpretation of Geotechnical Conditions and Hazards in Proposed Siting Area of Eastern Coyote Spring Valley, 44 pp., 3 drawings.	28 September 1981
9. _____, 1981, Aquifer Testing, Dry Lake Valley, Nevada, 32 pp., 11 figs., 1 table.	30 November 1981









**UTAH TEST
AND TRAINING RANGE**

S A L T

BASE LINE

UTAH TEST AND TRAINING RANGE

L A K E

**T
PARALLEL SOUTH**

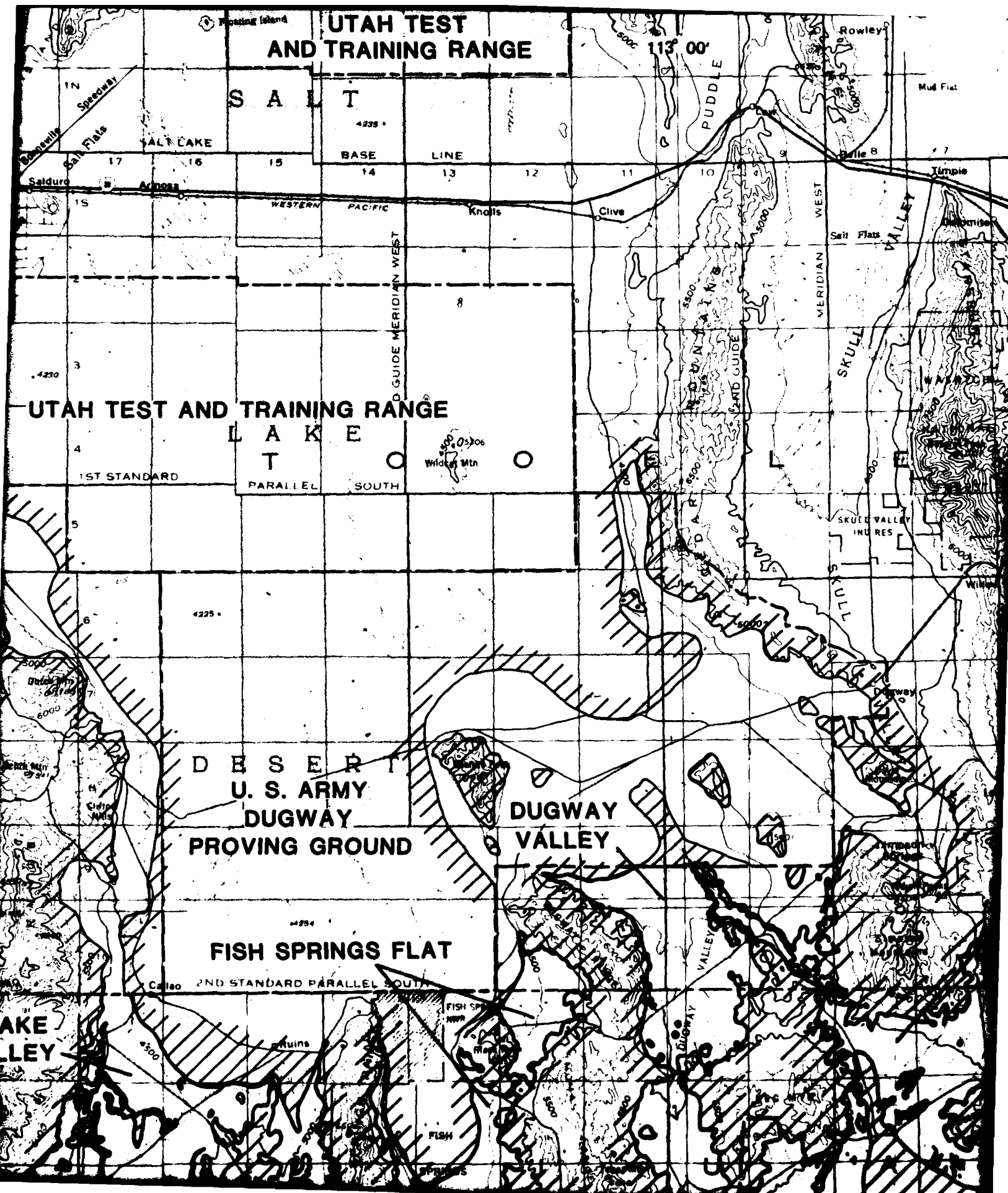
**D E S E R T
U. S. ARMY
DUGWAY
PROVING GROUND**

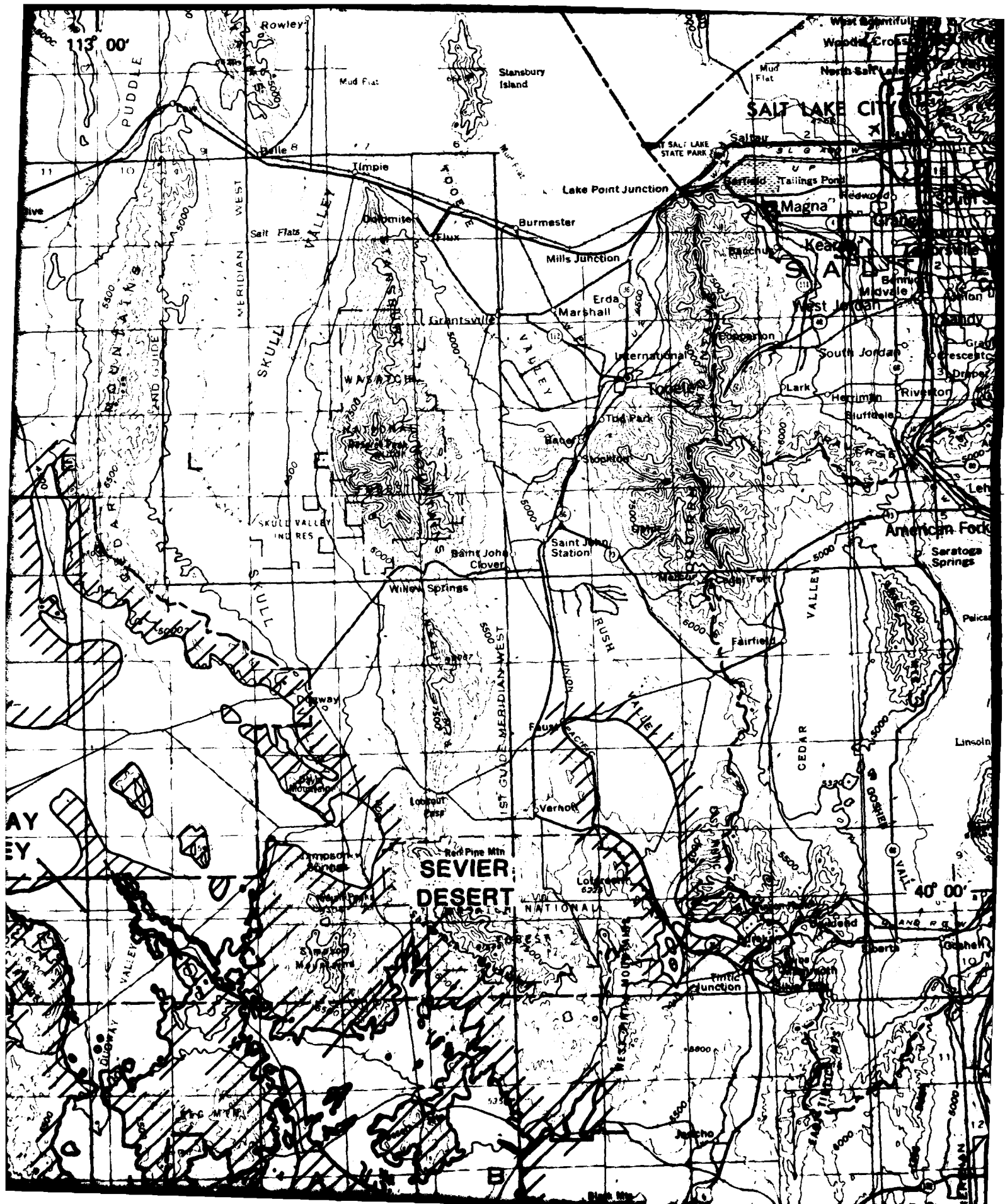
**DUGWAY
VALLEY**

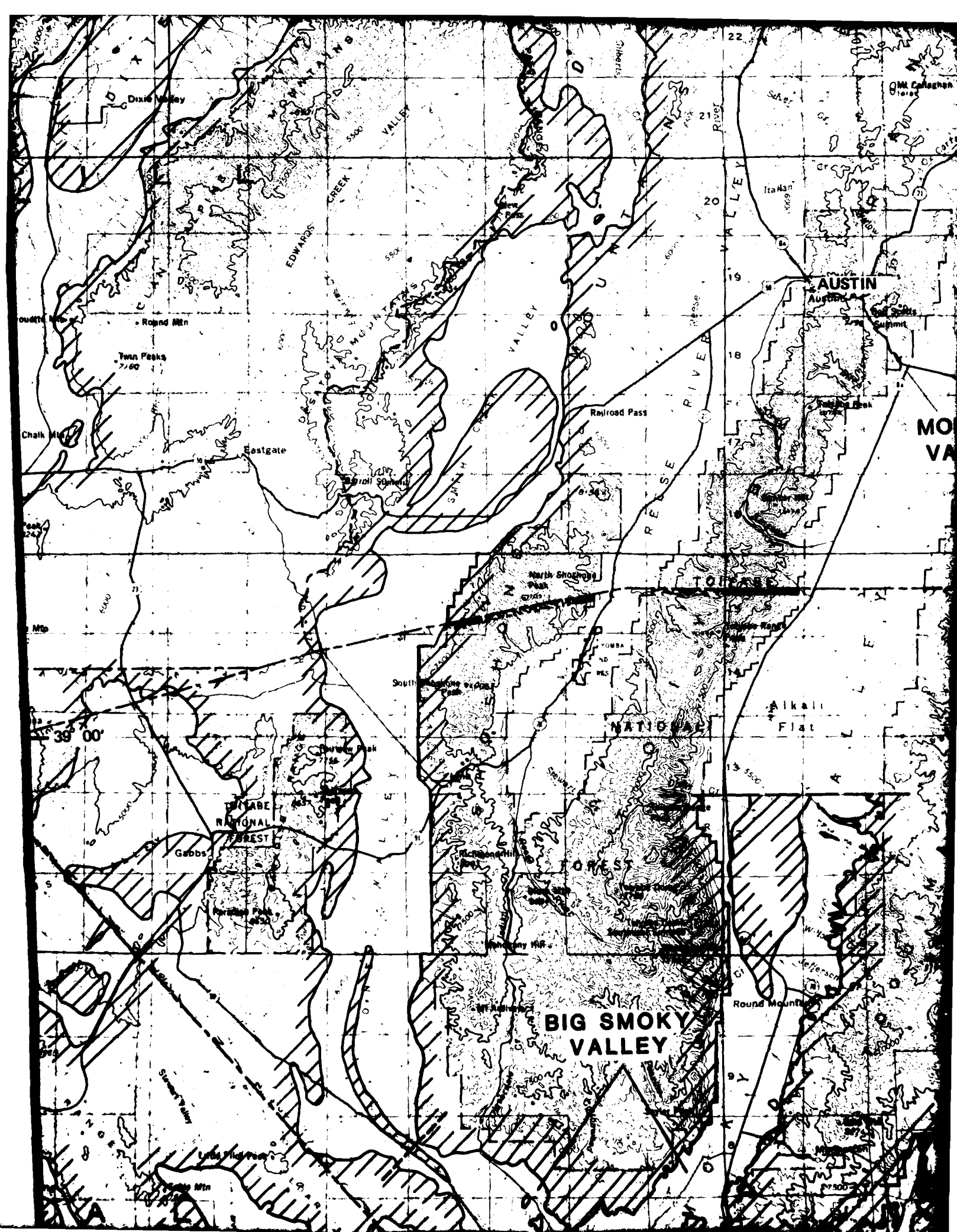
FISH SPRINGS FLAT

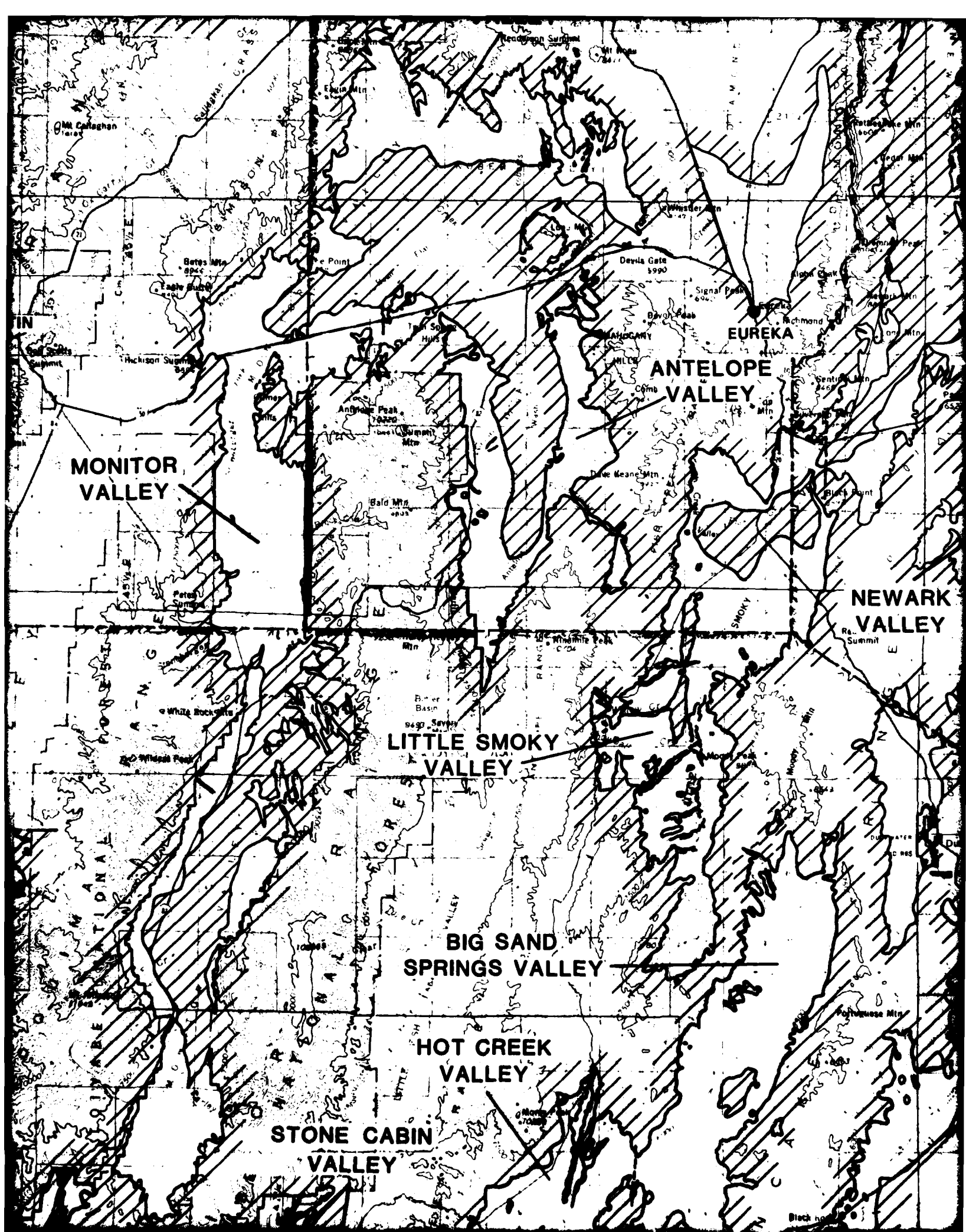
2ND STANDARD PARALLEL SOUTH

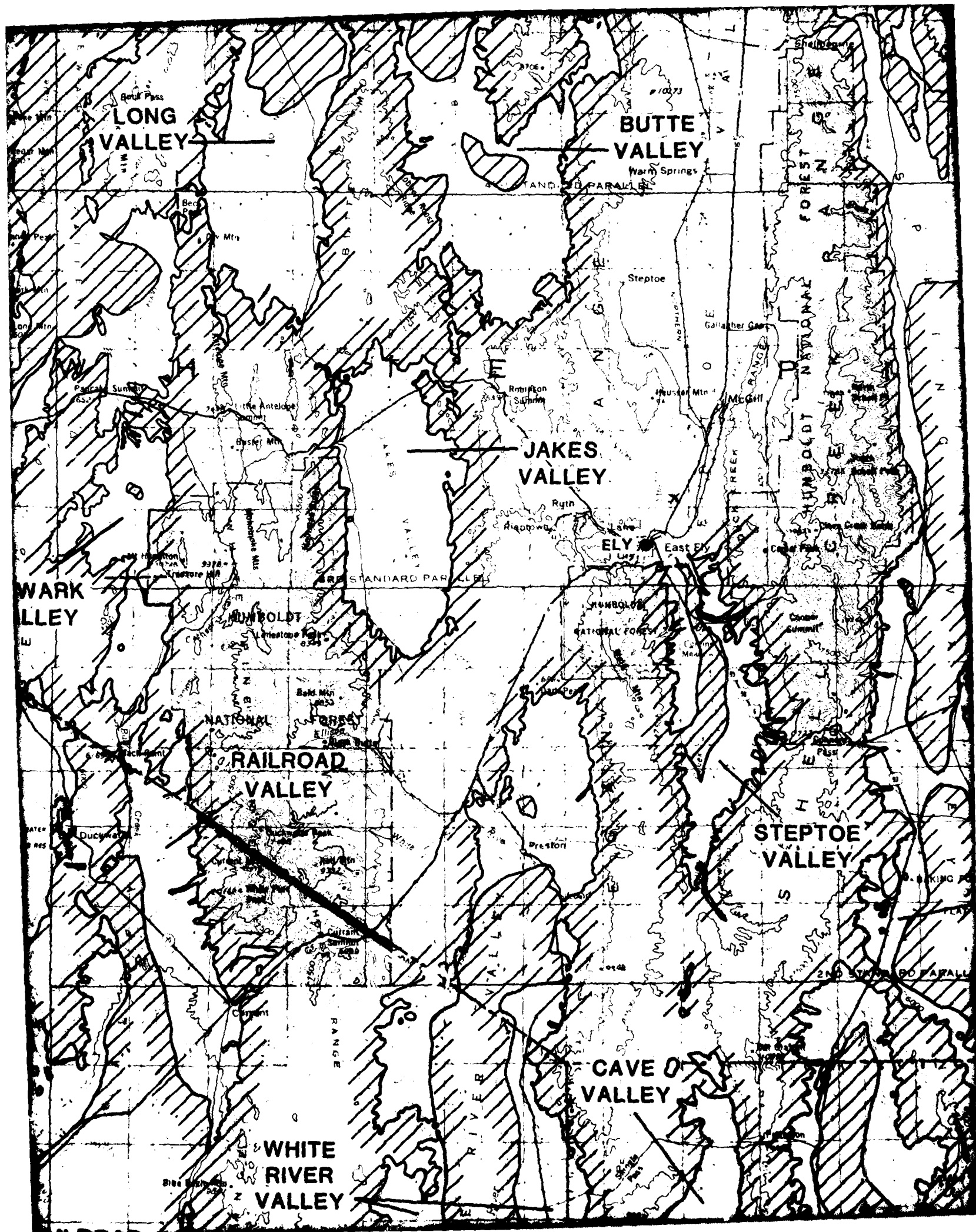
**L A K E
V A L L E Y**

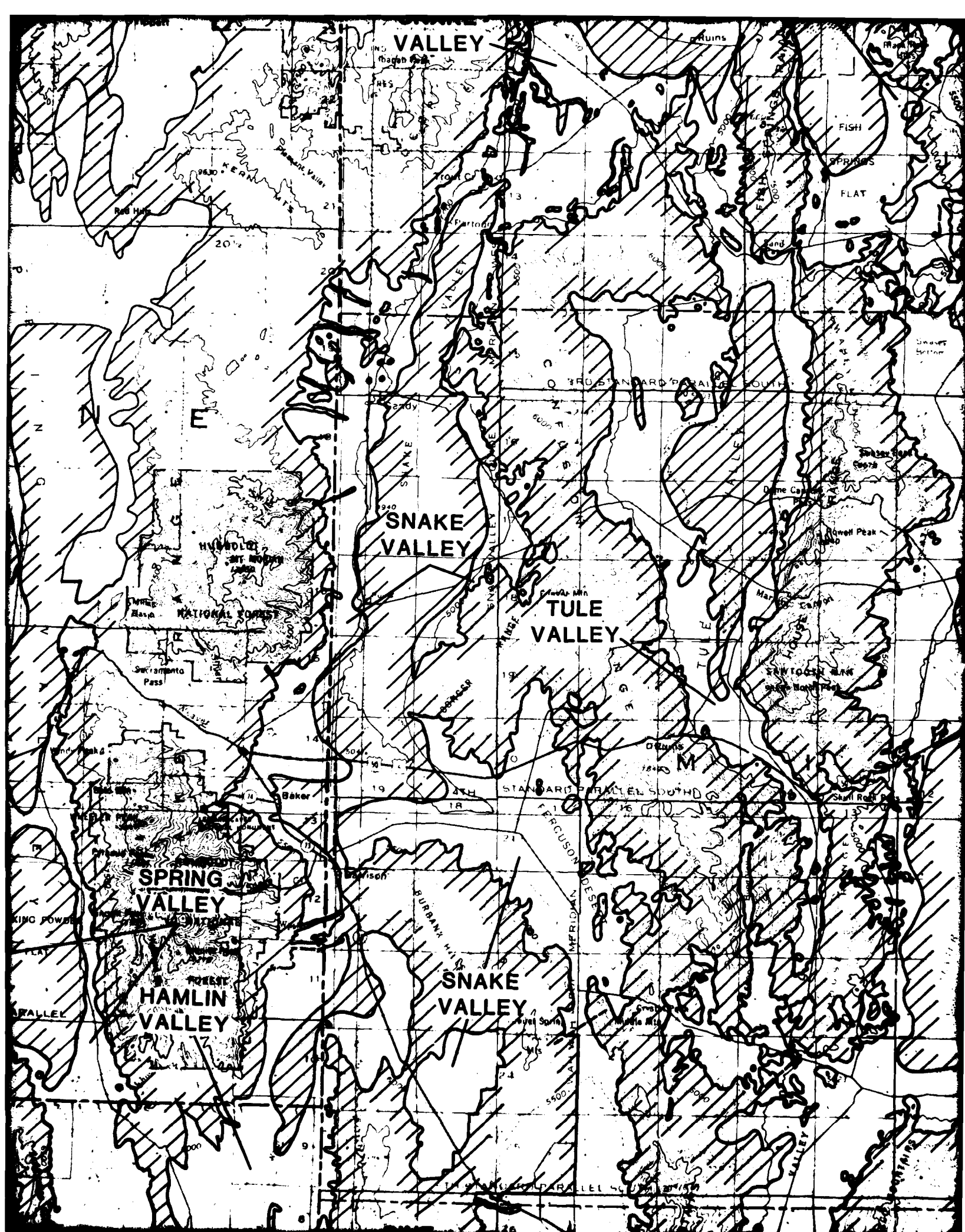


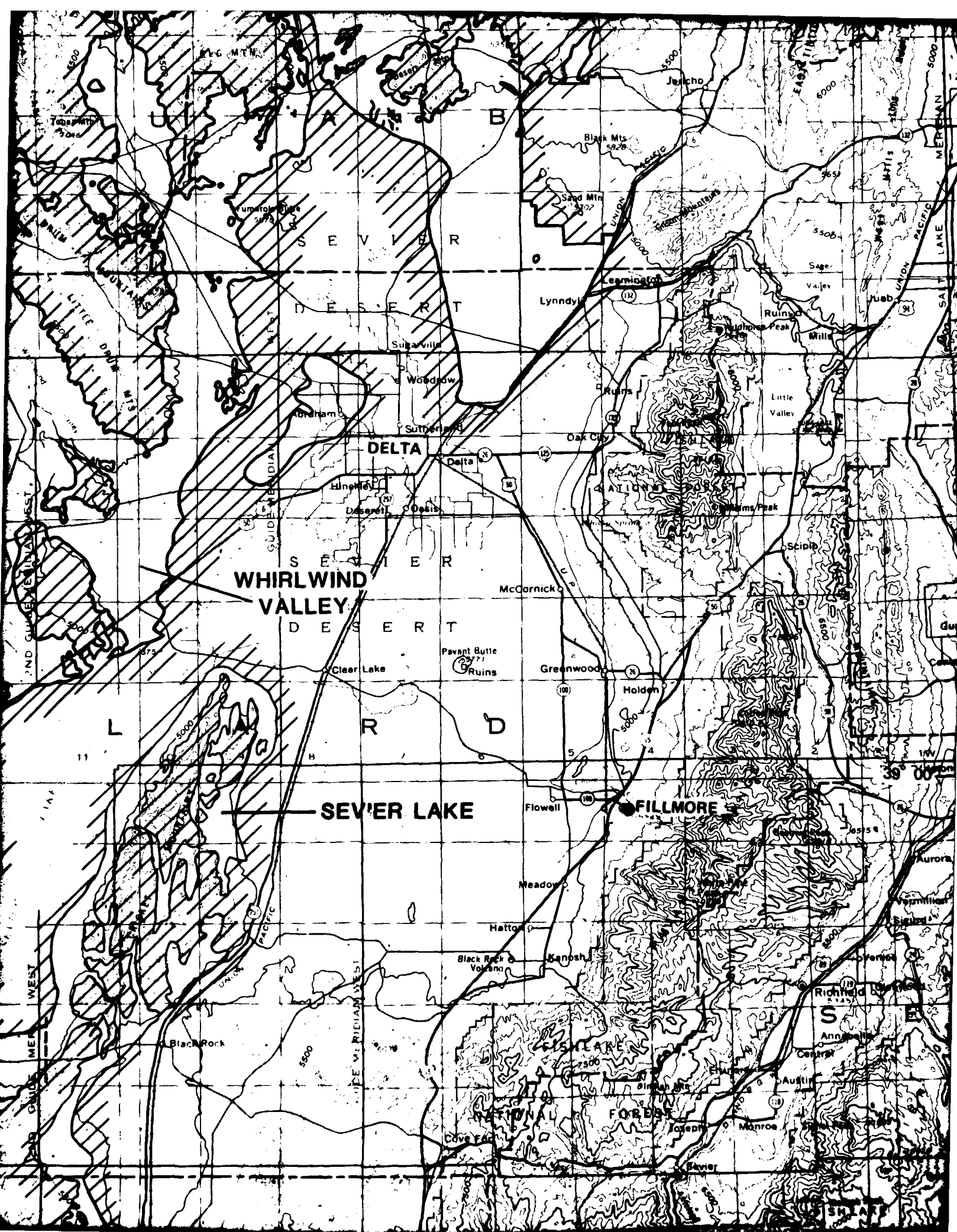


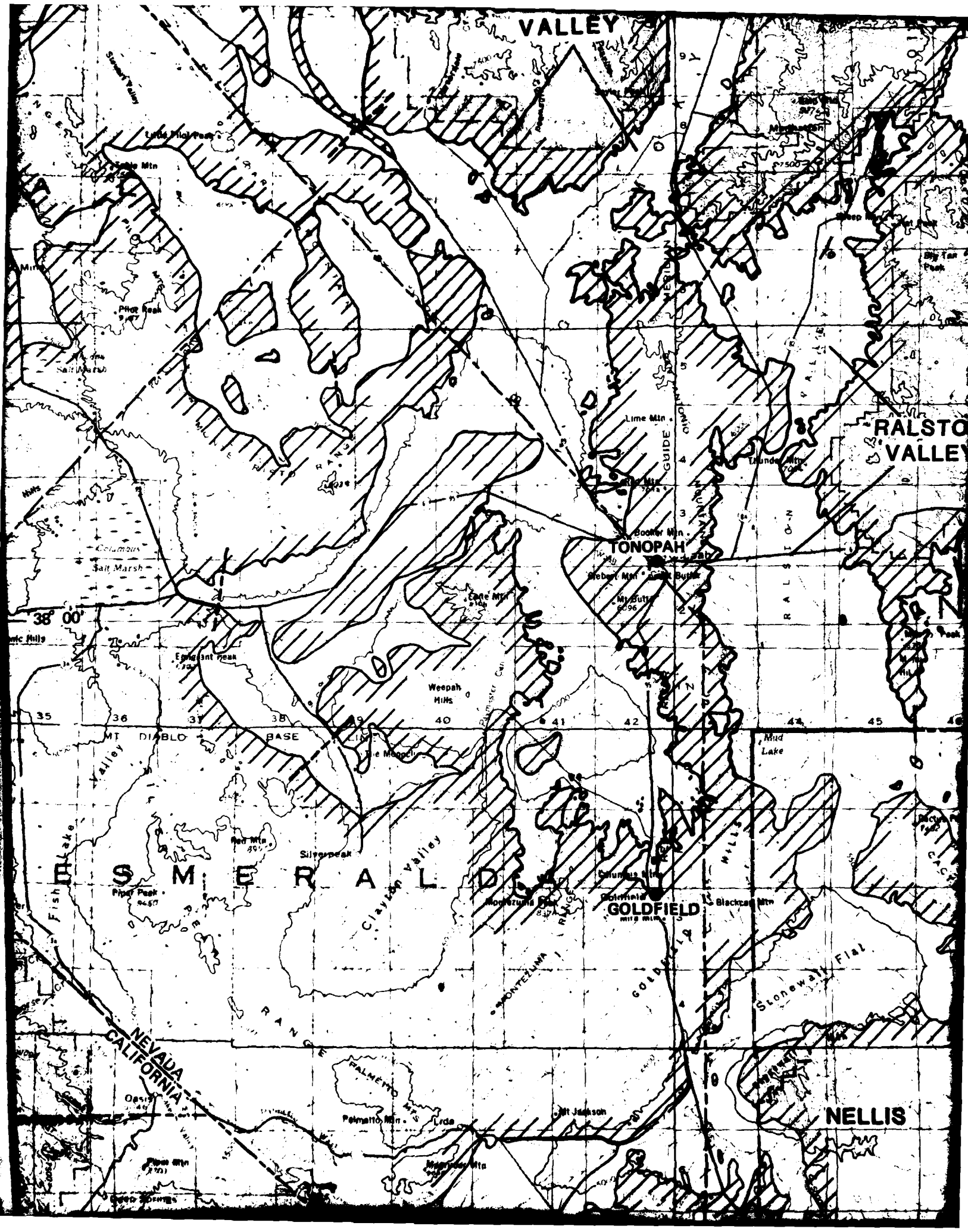


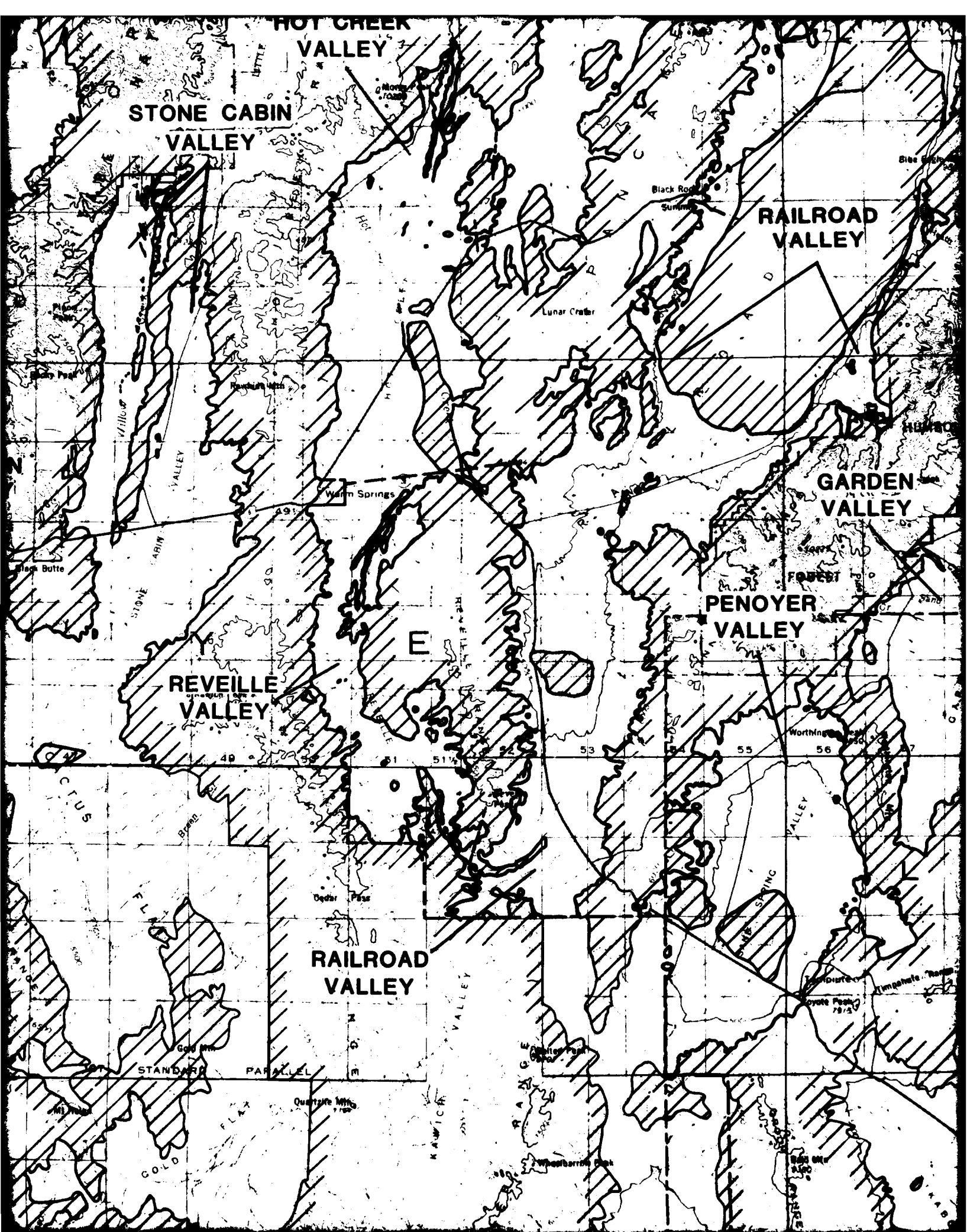


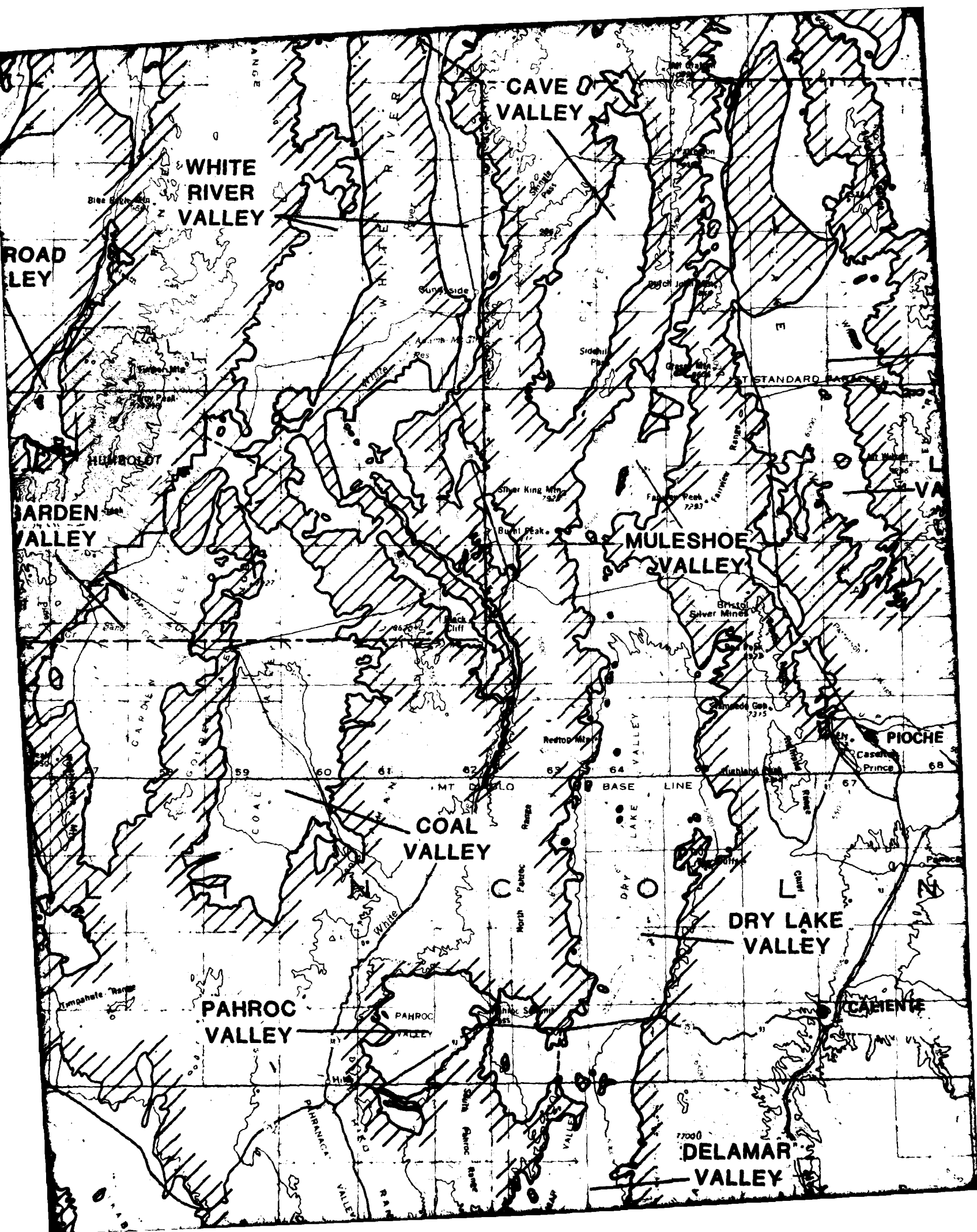


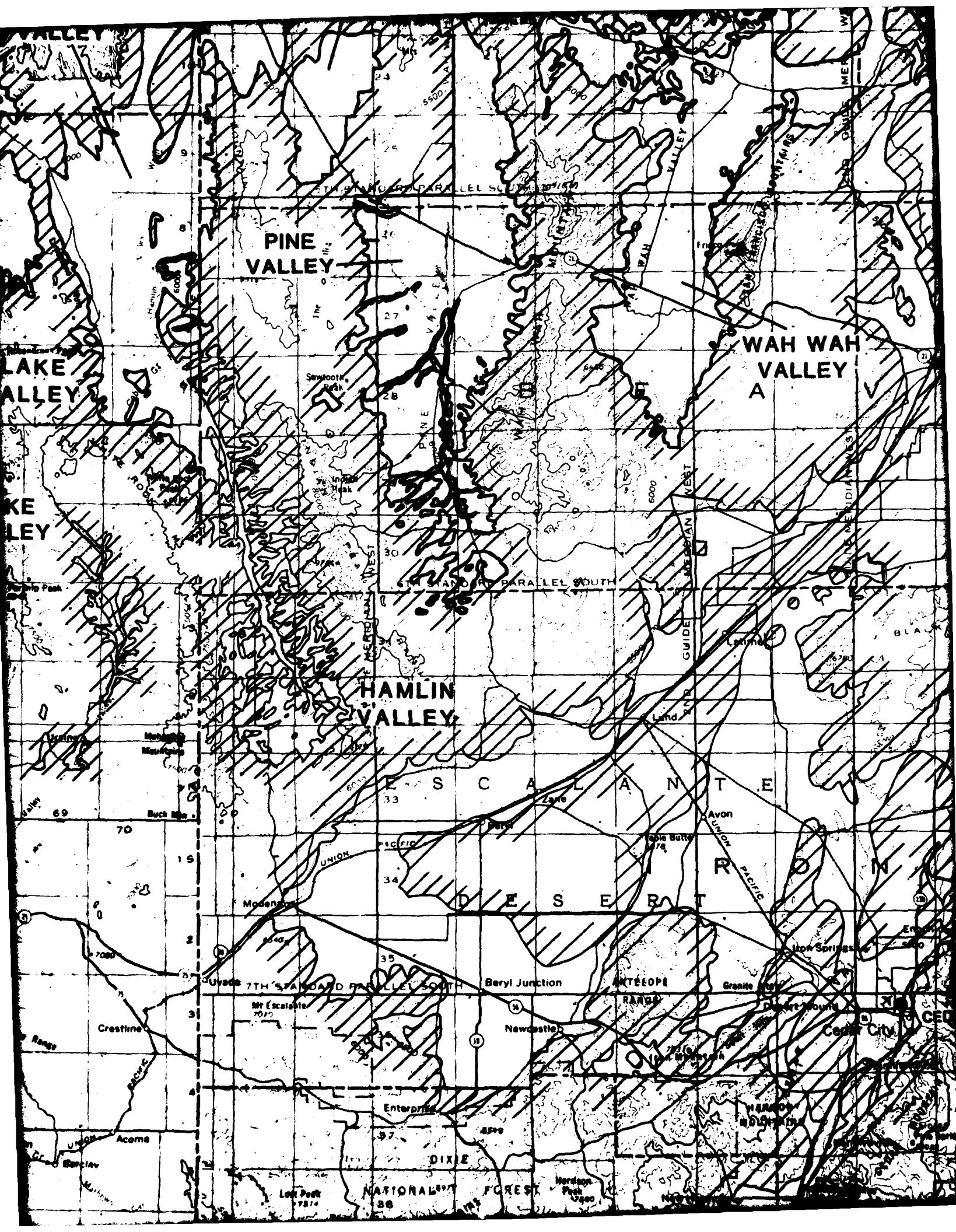




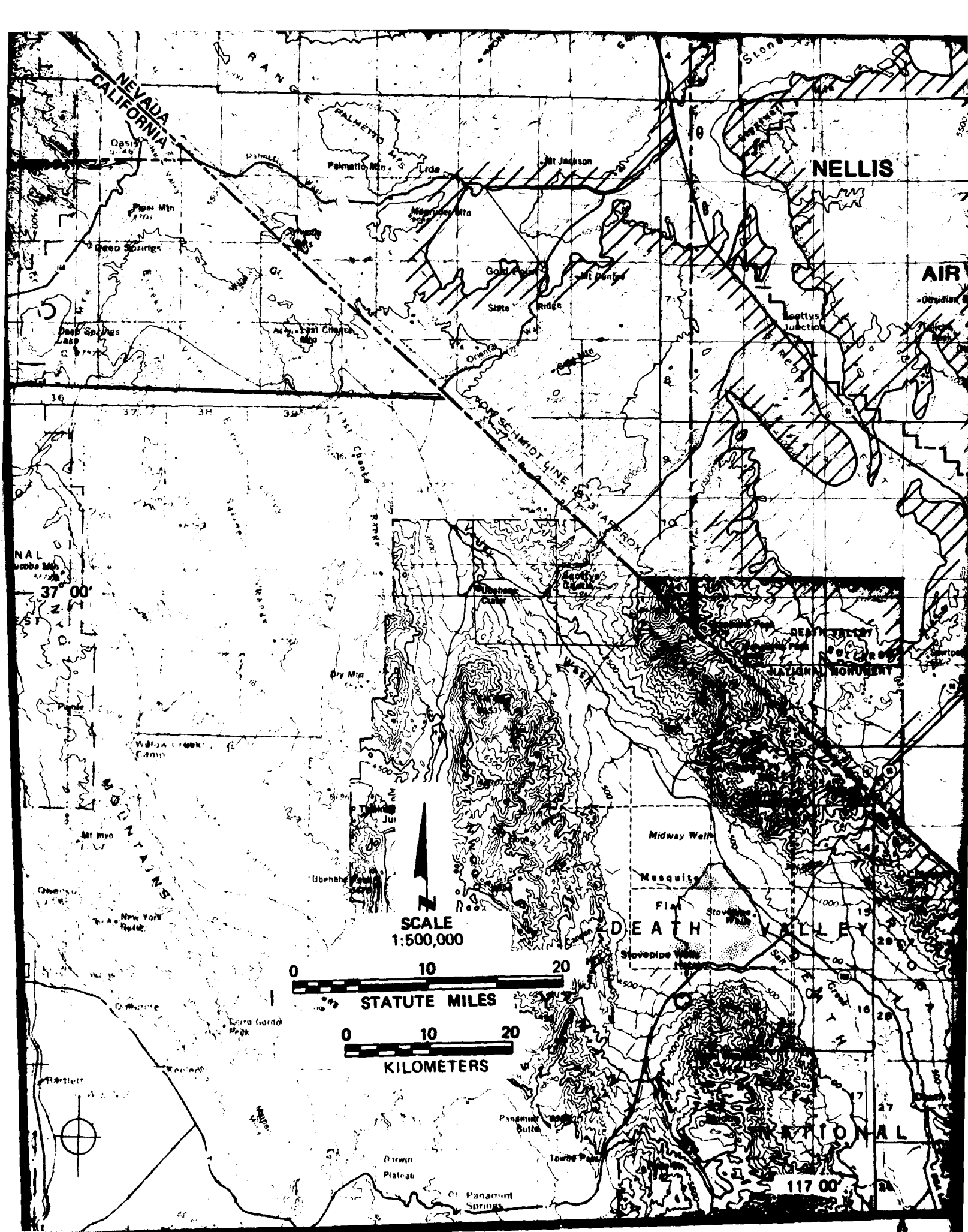


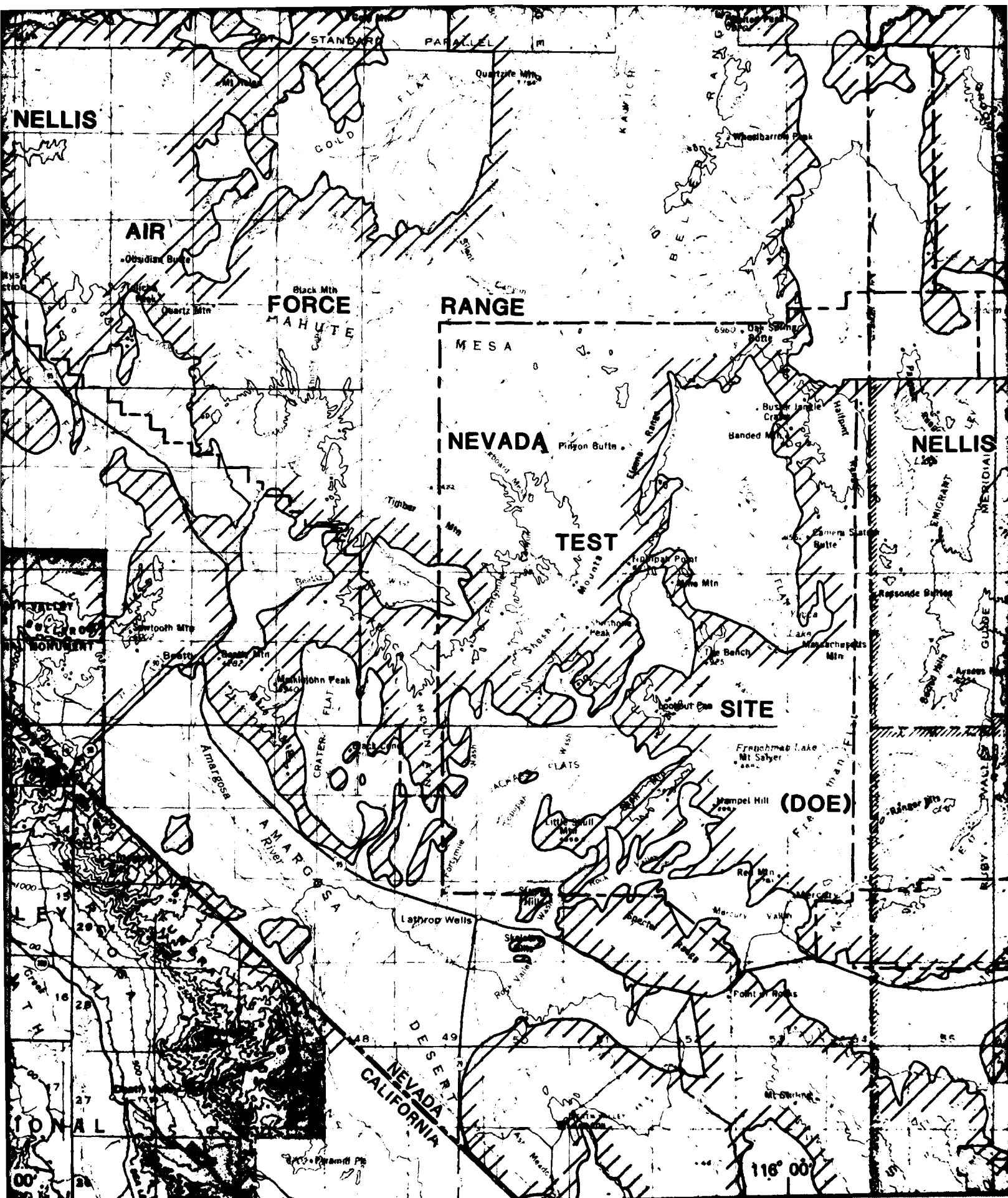


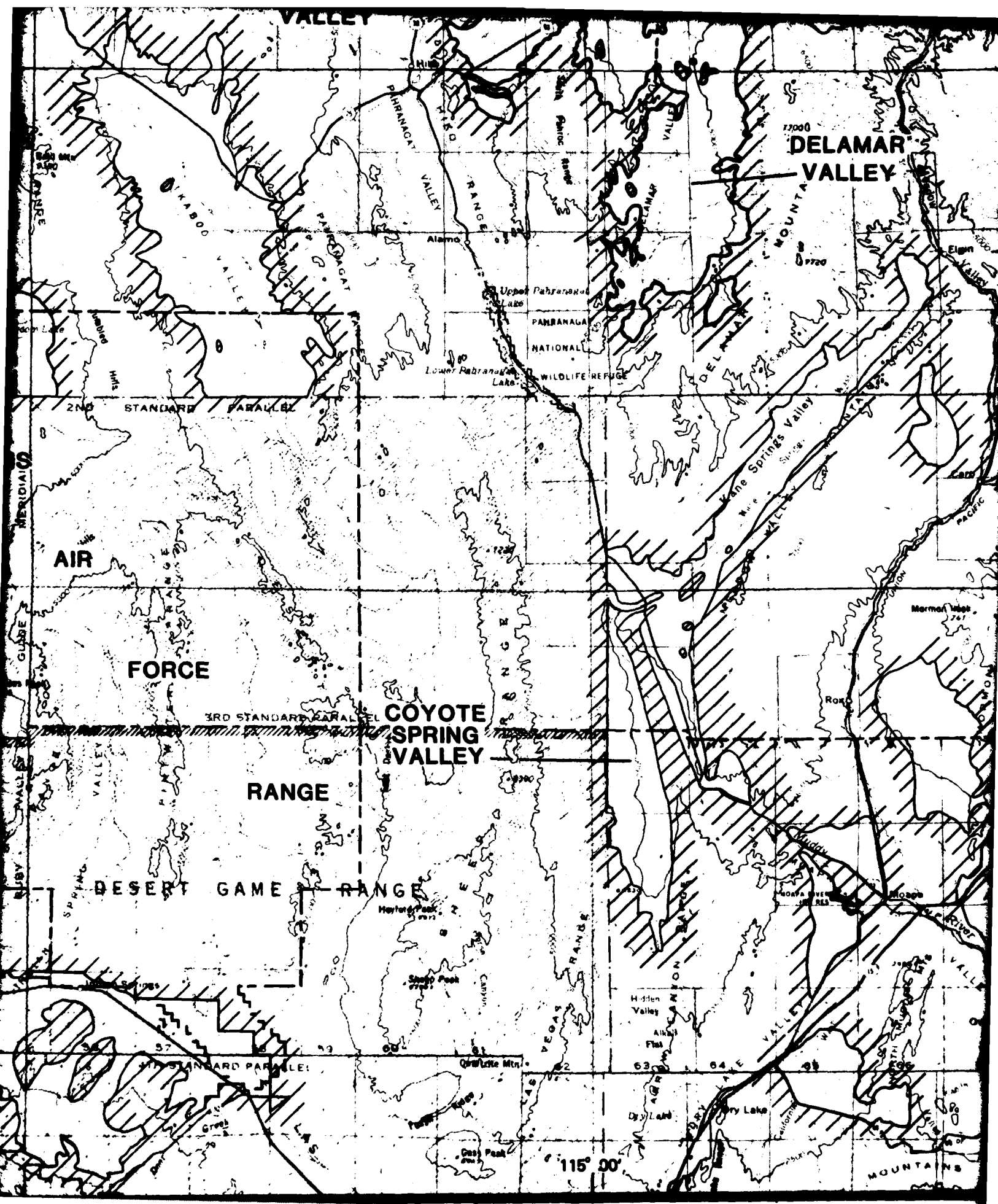


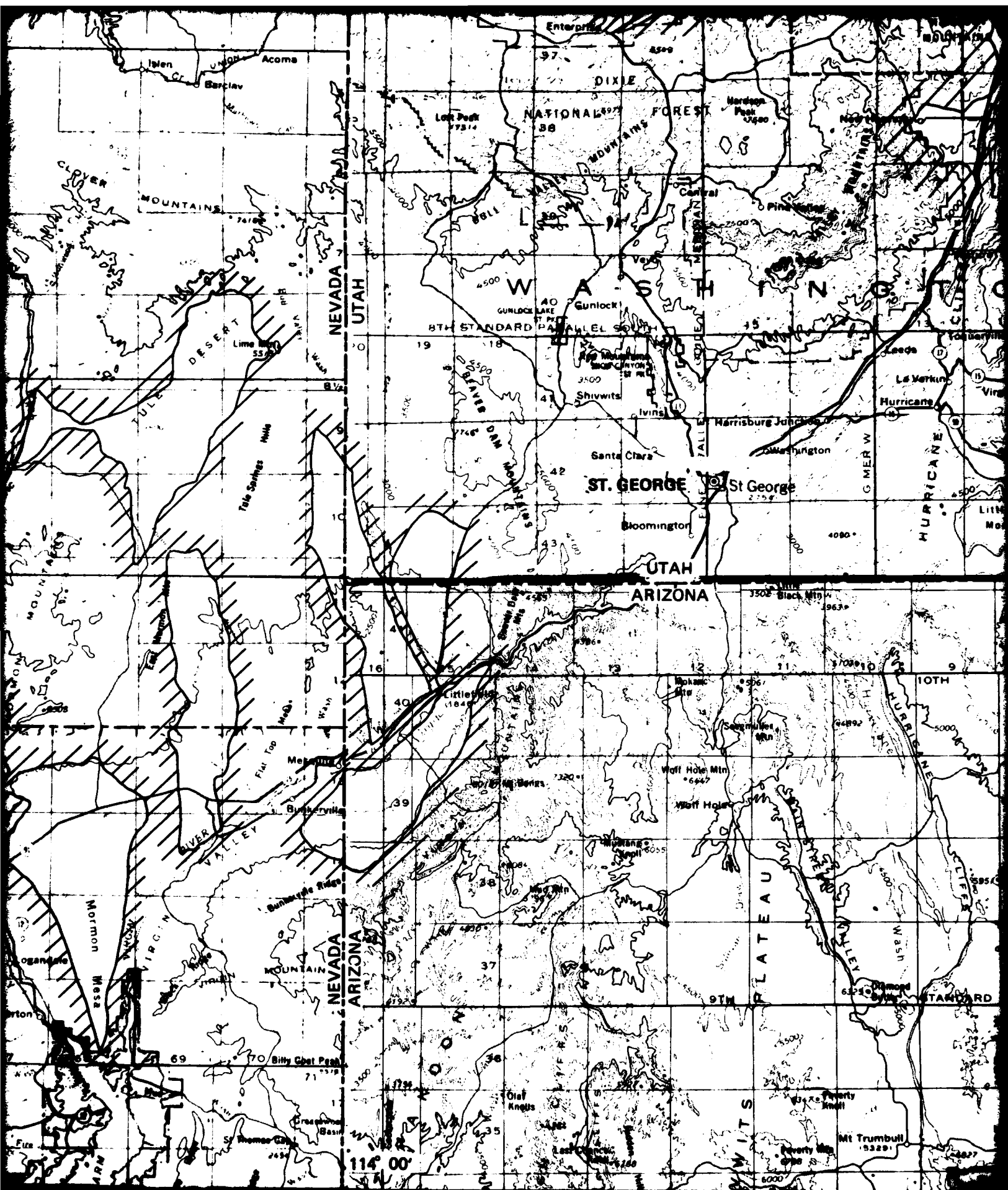


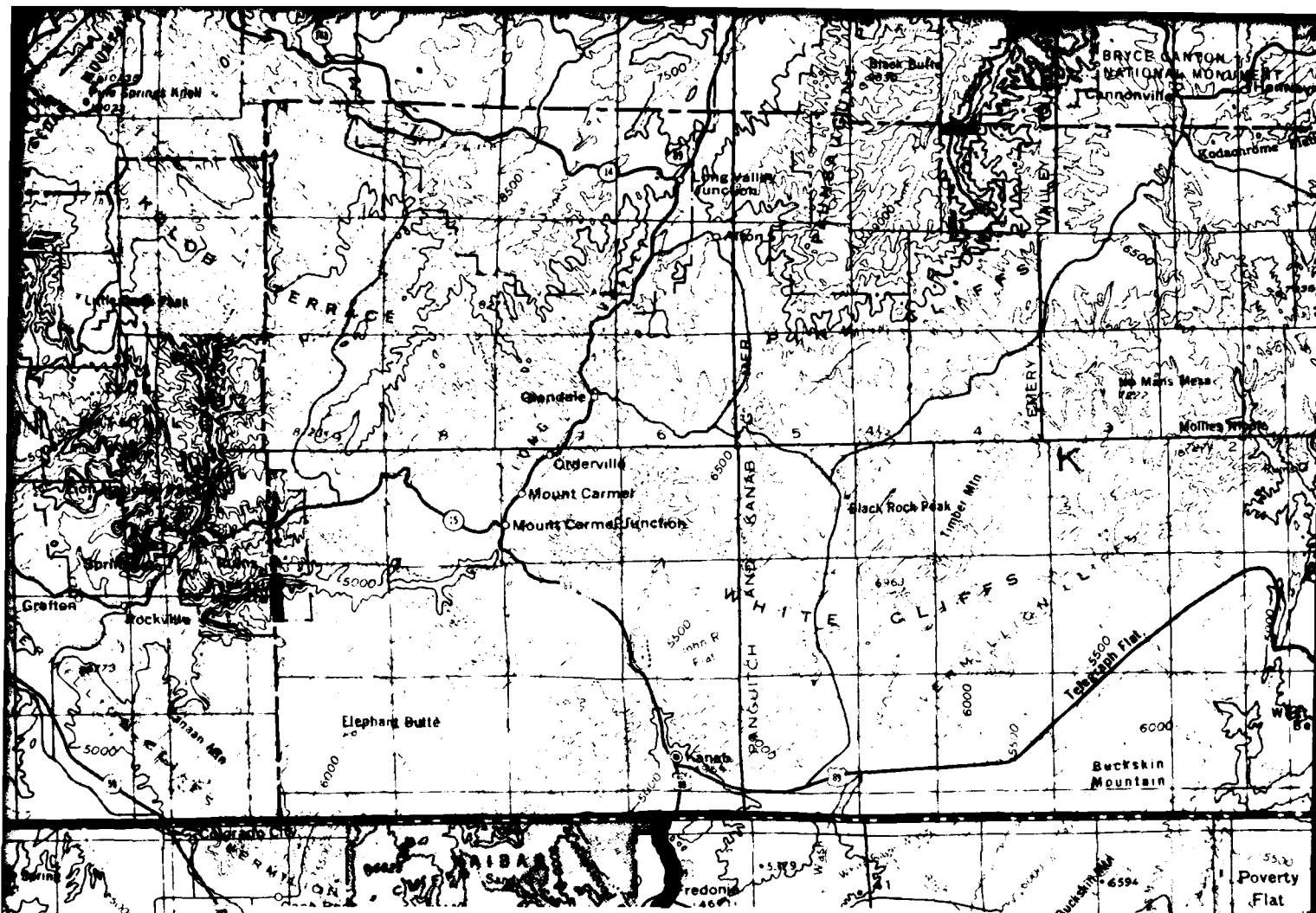












EXPLANATION



SUITABLE AREA FOR HORIZONTAL SHELTER BASED ON VERIFICATION STUDIES
FY 79, FY 78, FY 80, AND FY 81

Yellow
Me



SUITABLE AREA FOR HORIZONTAL SHELTER BASED ON SCREENING STUDIES.
LOCALLY MODIFIED BY RECONNAISSANCE STUDIES

- 1 25 OCT 1979
- 2 27 FEB 1980
- 3 20 JUN 1980
- 4 26 NOV 1980
- 5 6 APR 1981
- 6 27 AUG 1981
- 7 14 OCT 1981
- 8

Ertec

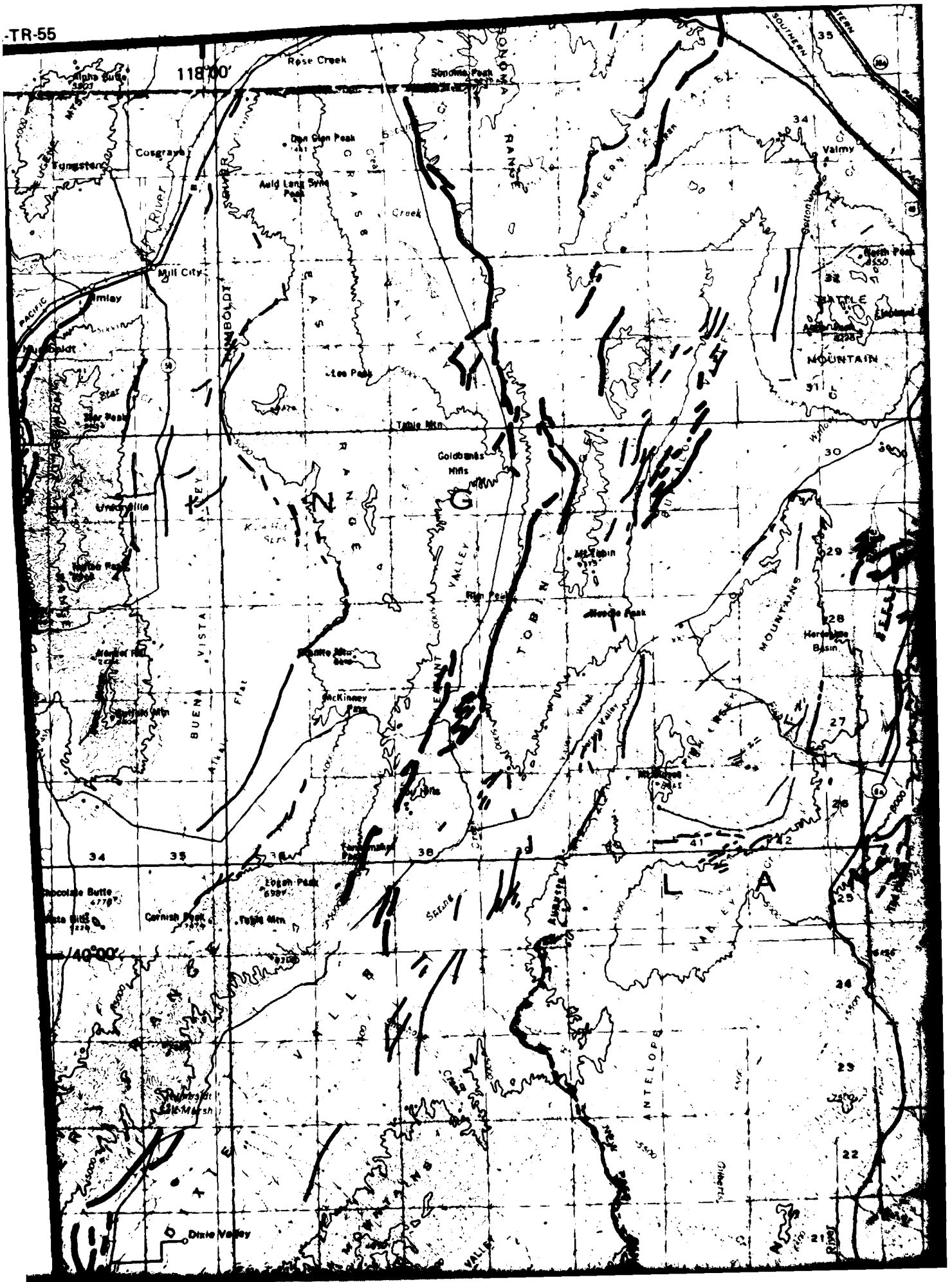
The Earth Technology Corporation

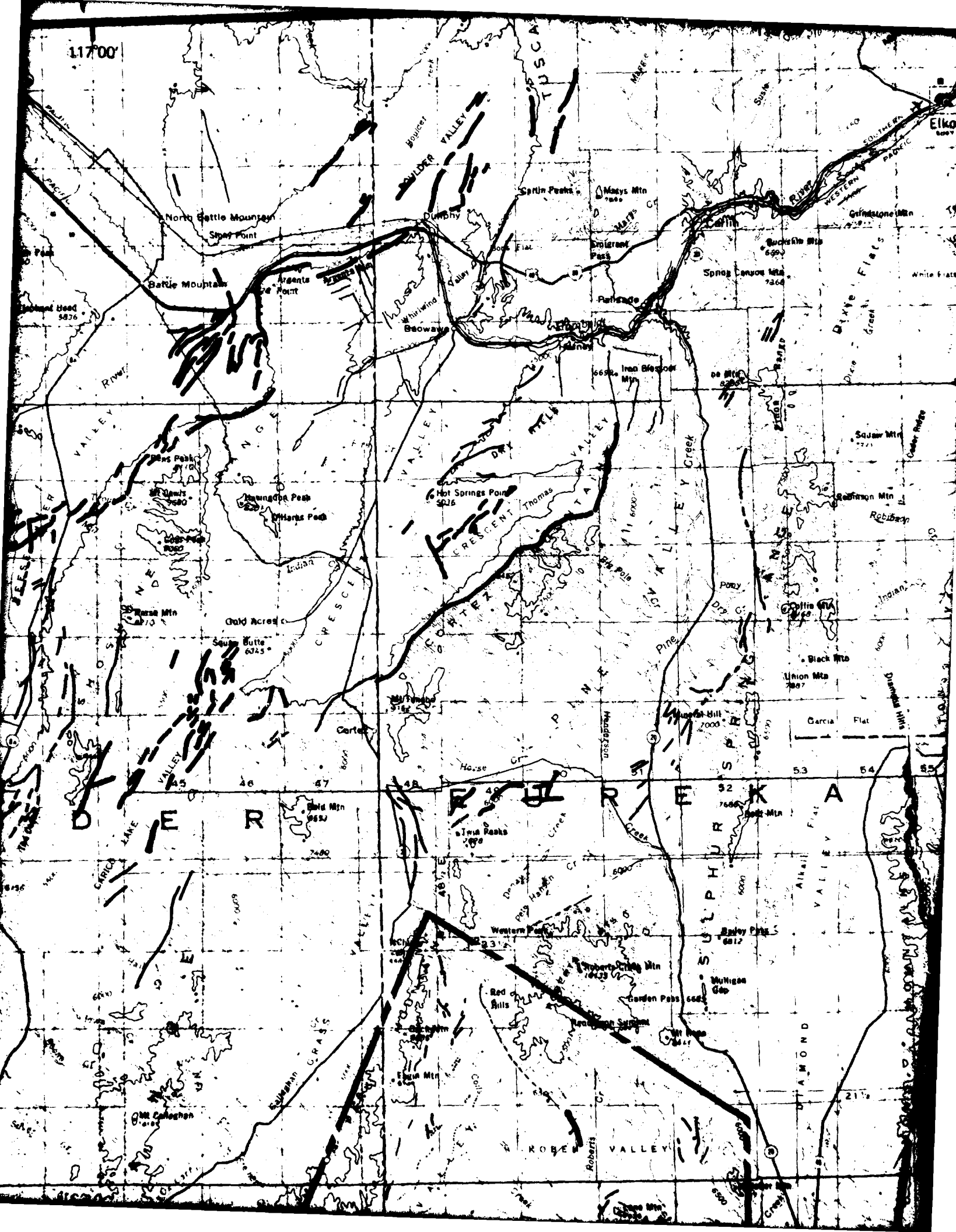
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE
BMO/AFRC-MX

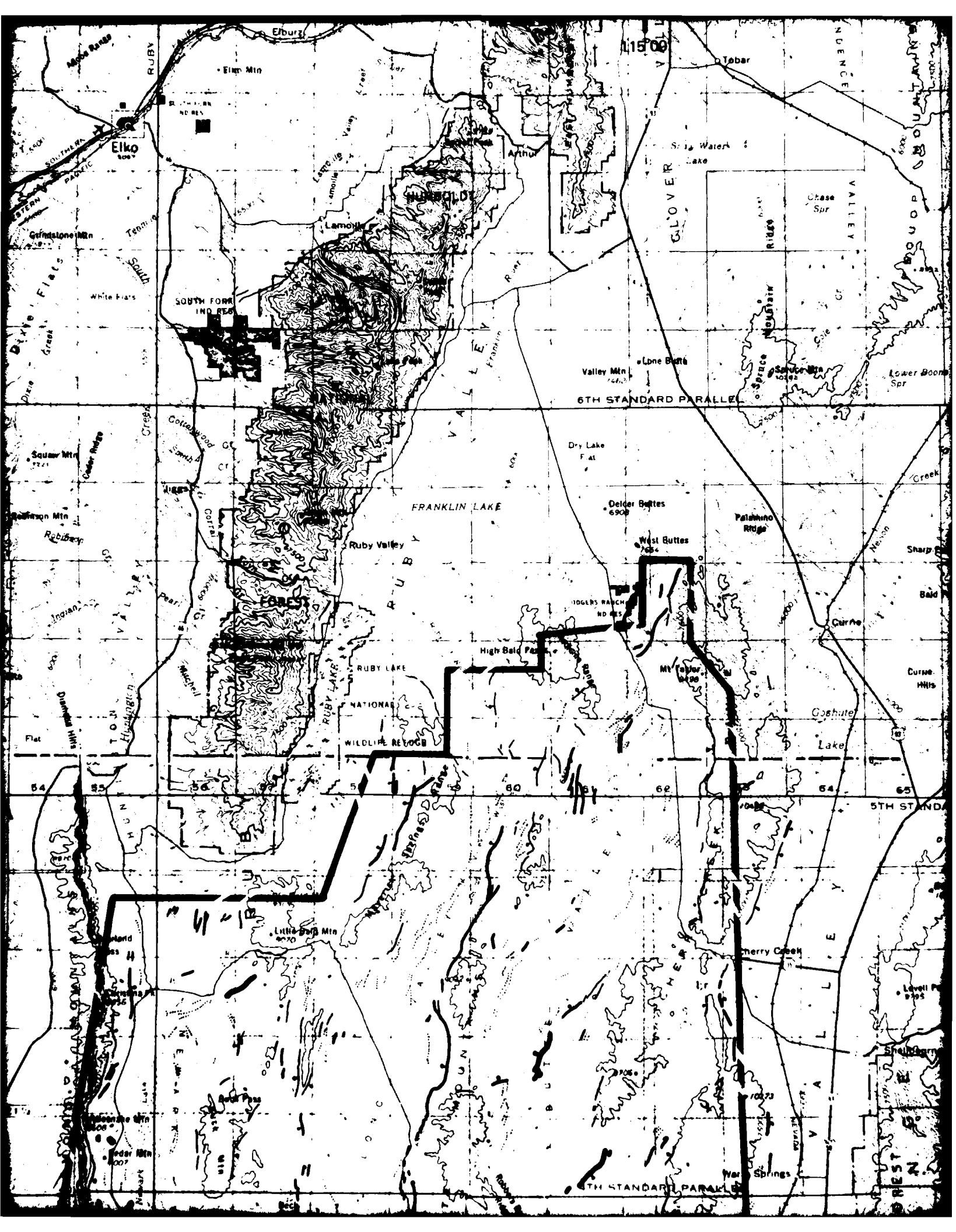
**GEOTECHNICALLY
SUITABLE AREAS
NEVADA-UTAH**

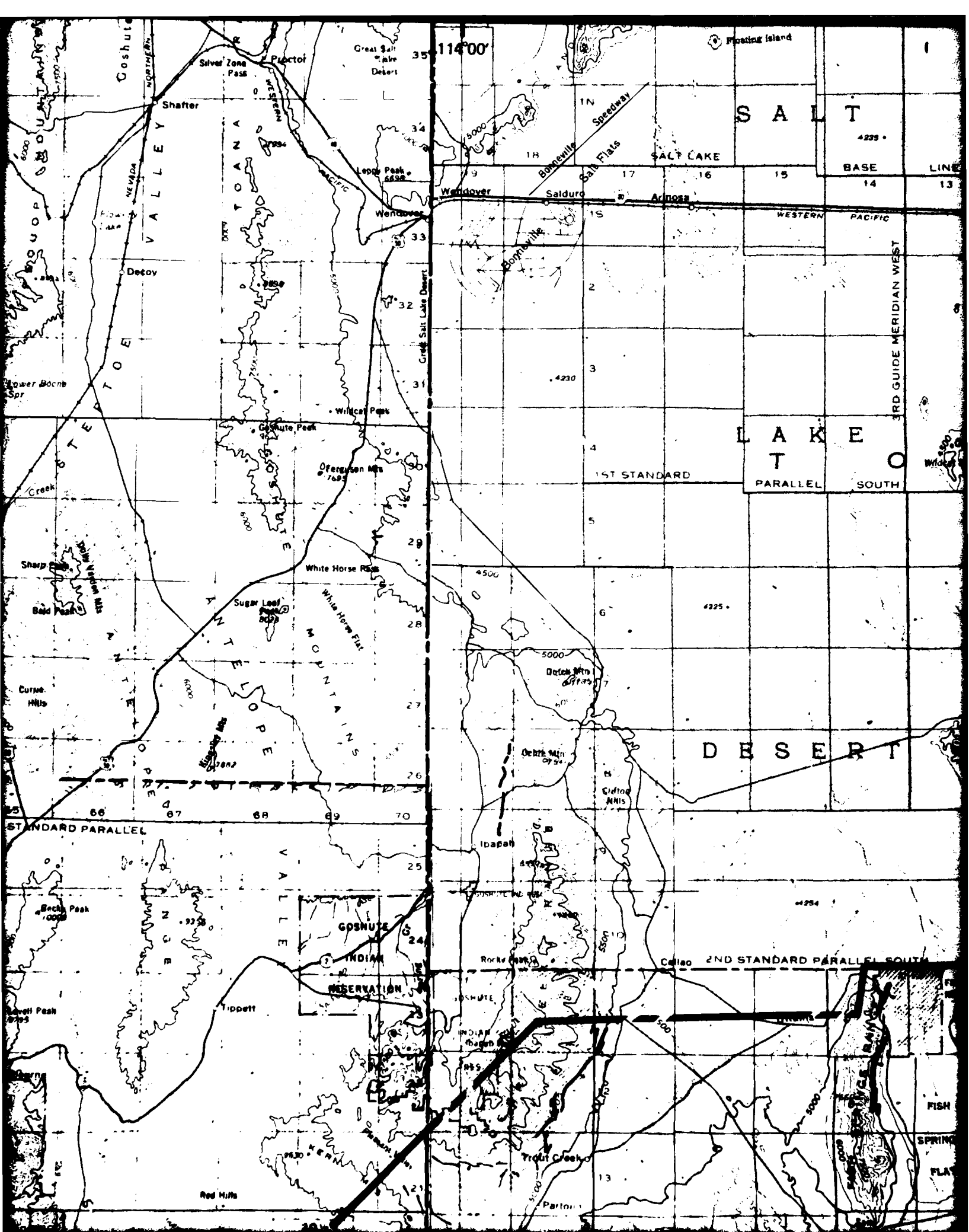
6 NOV 81

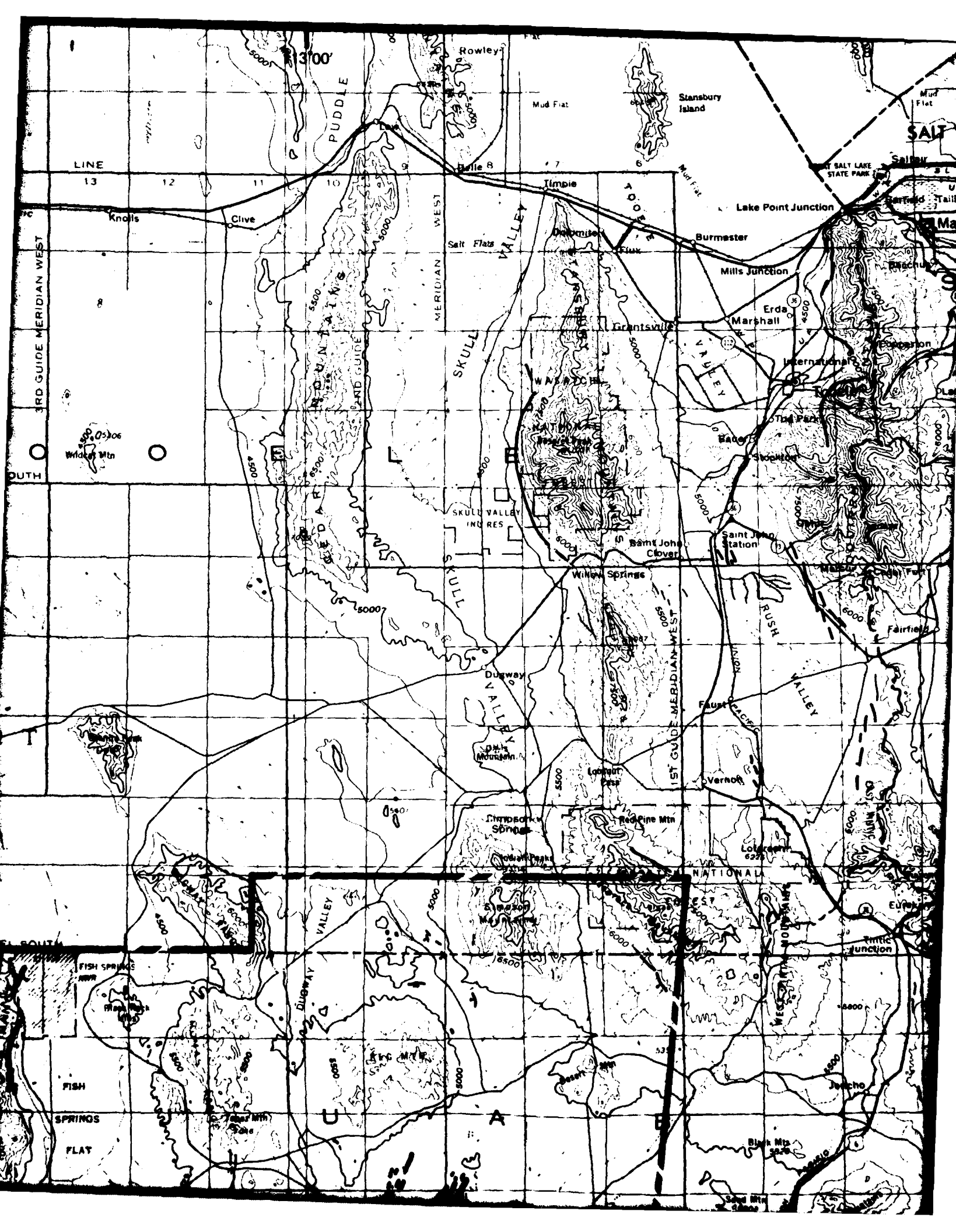
DRAWING 2-1

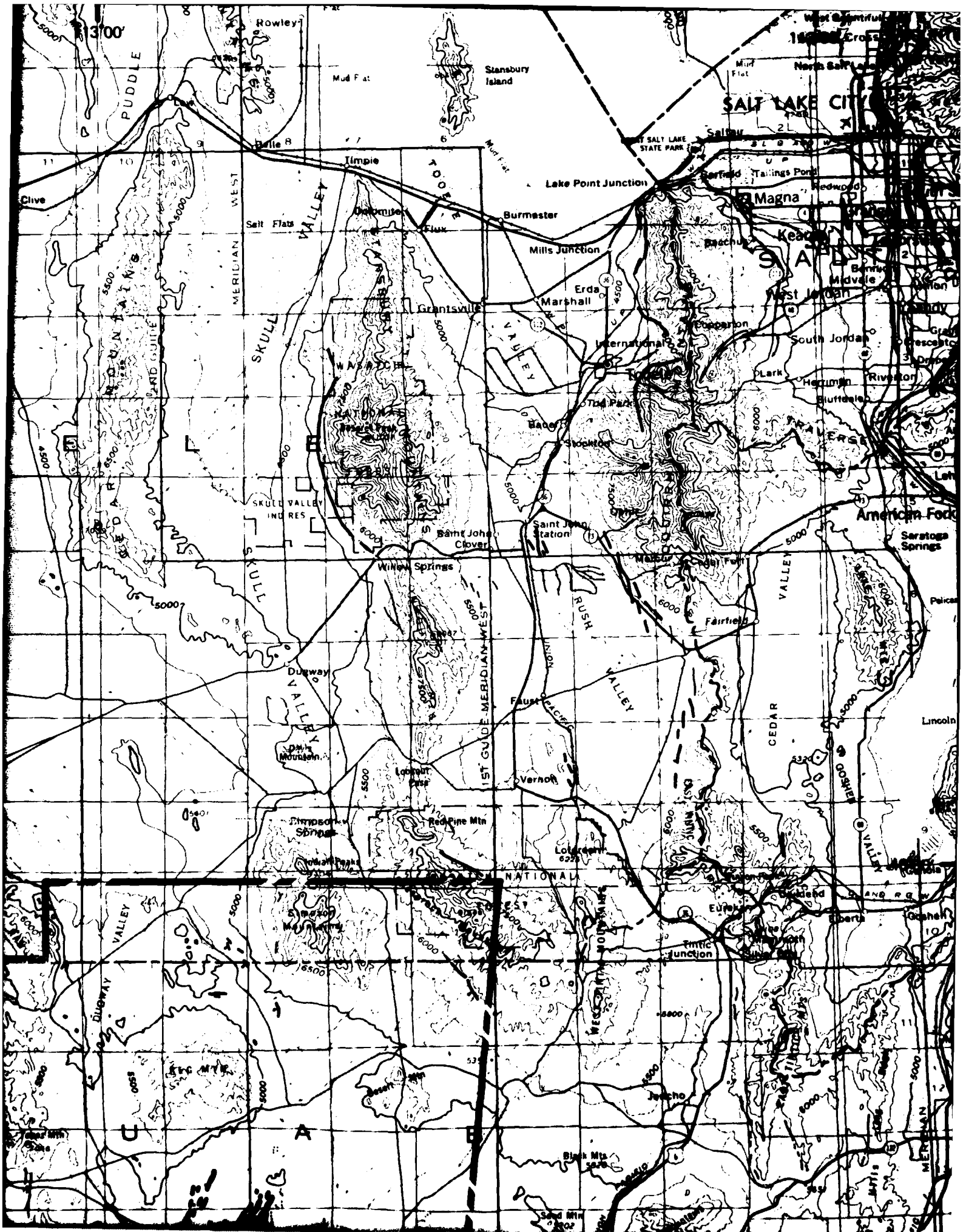


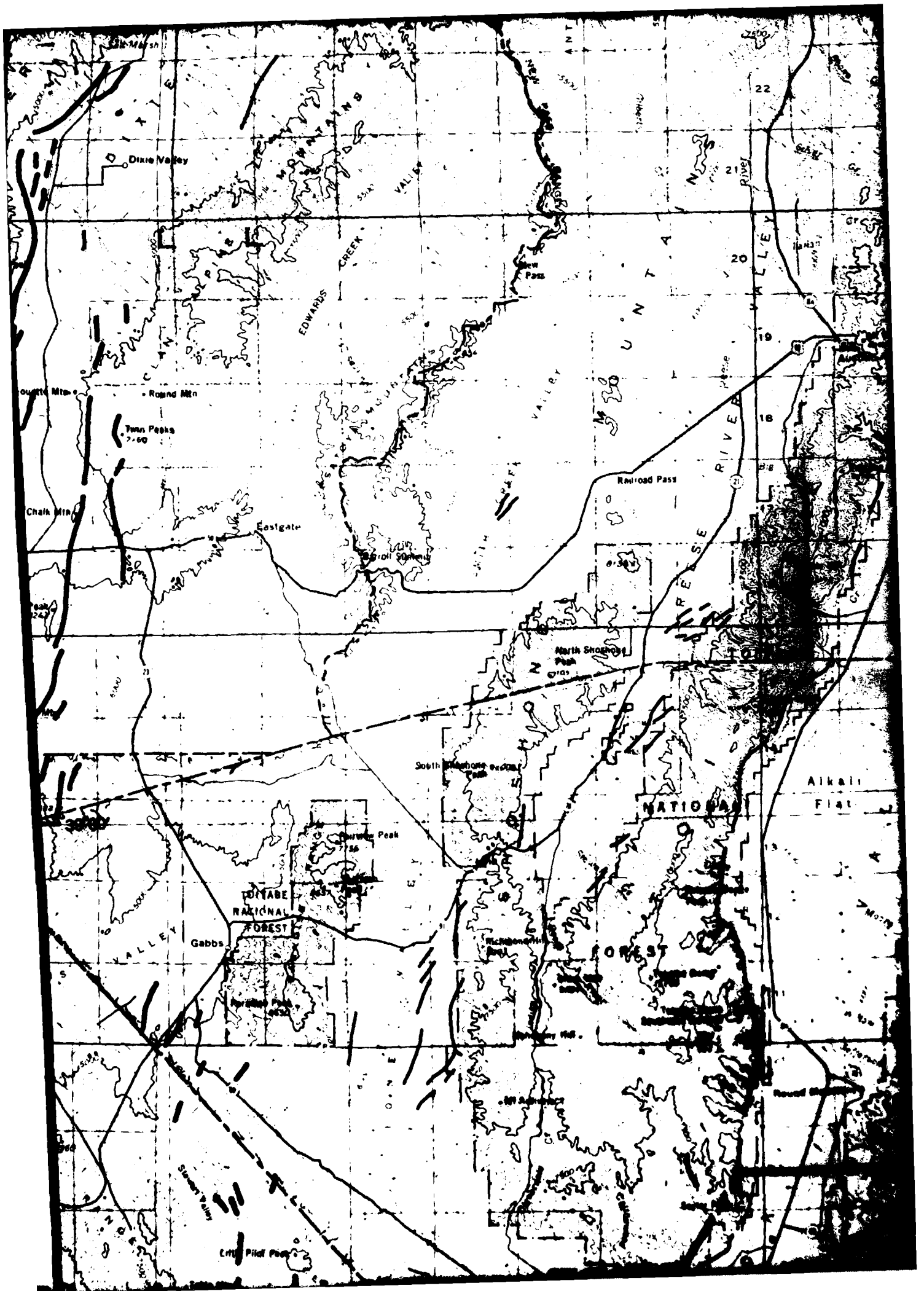


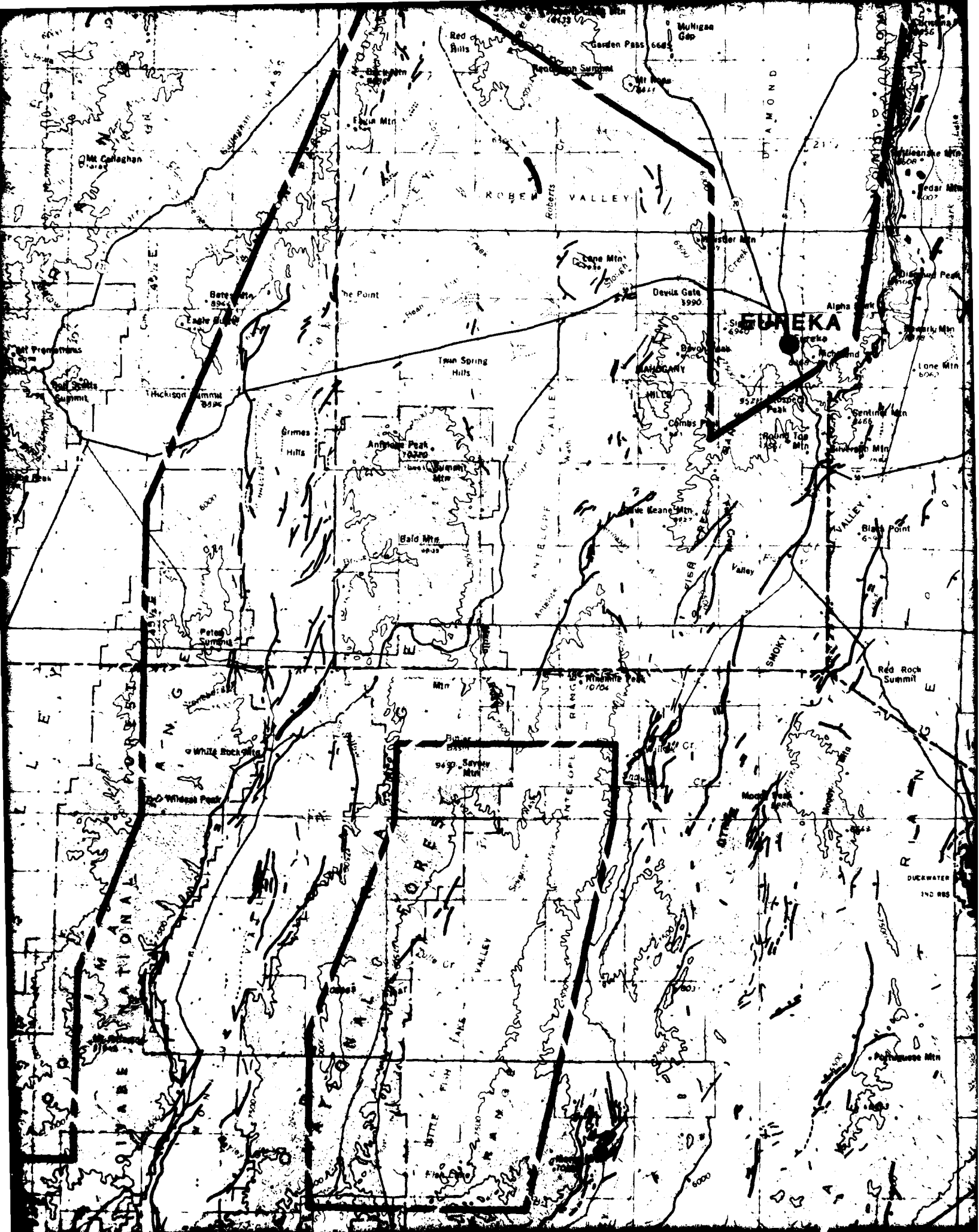


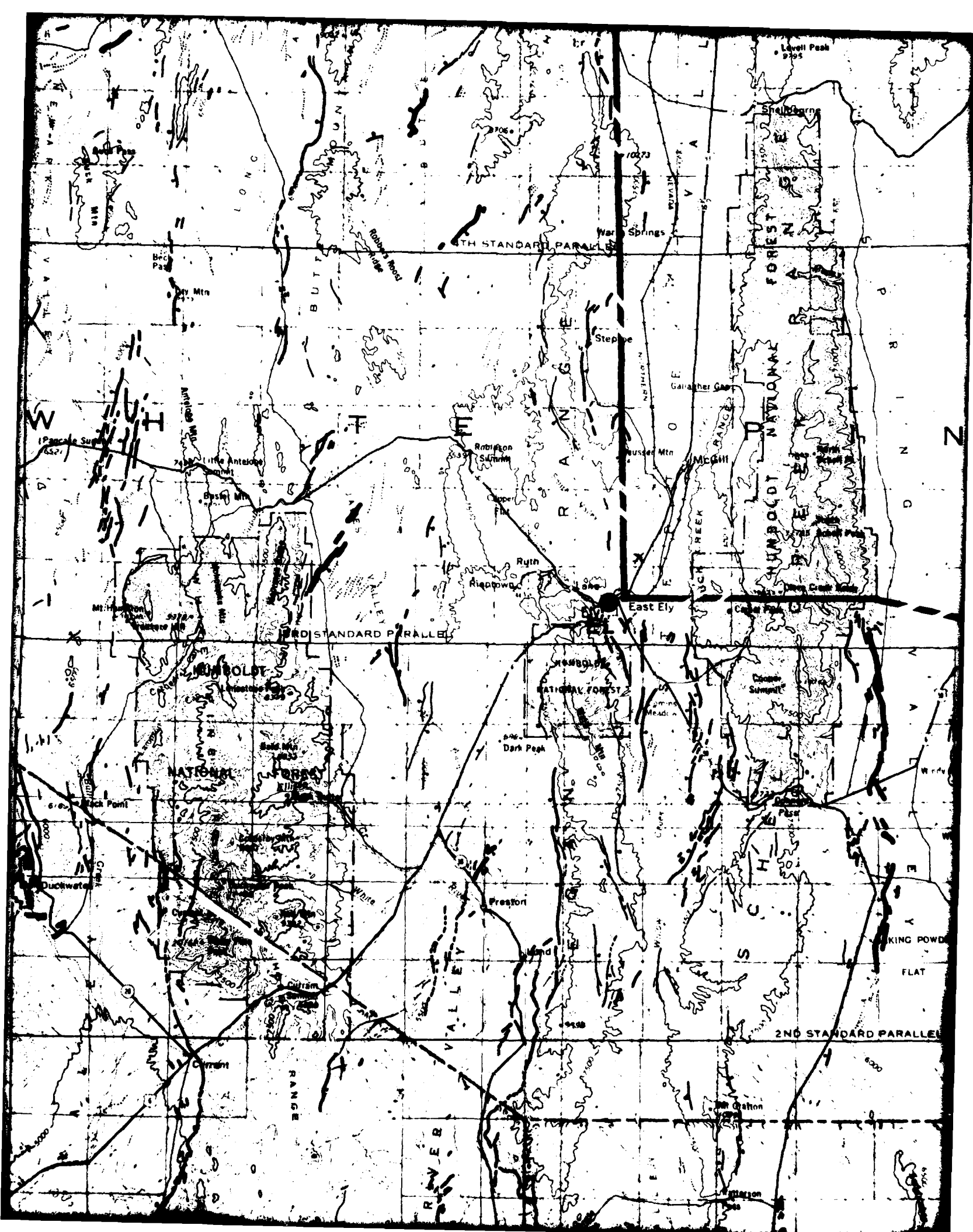


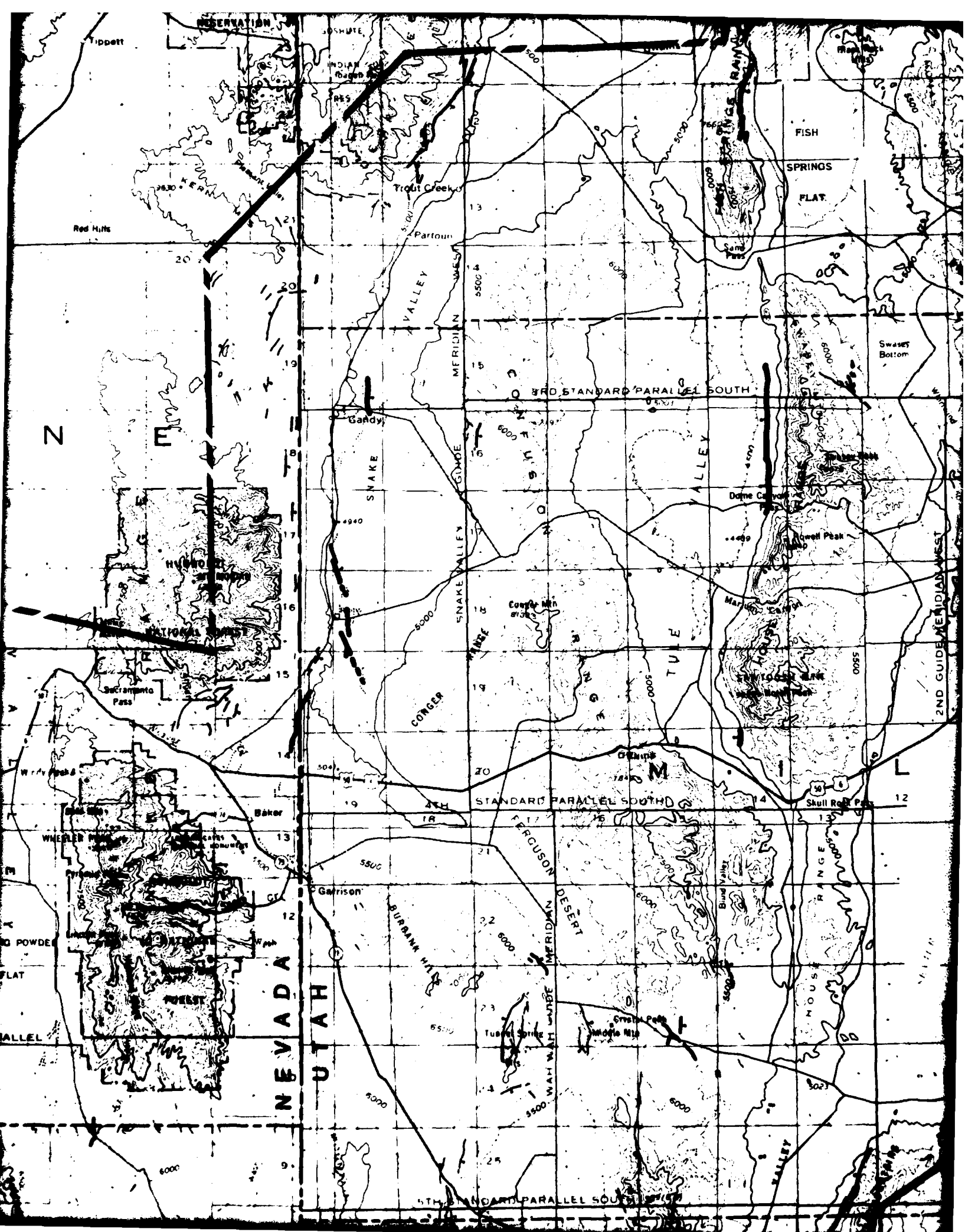


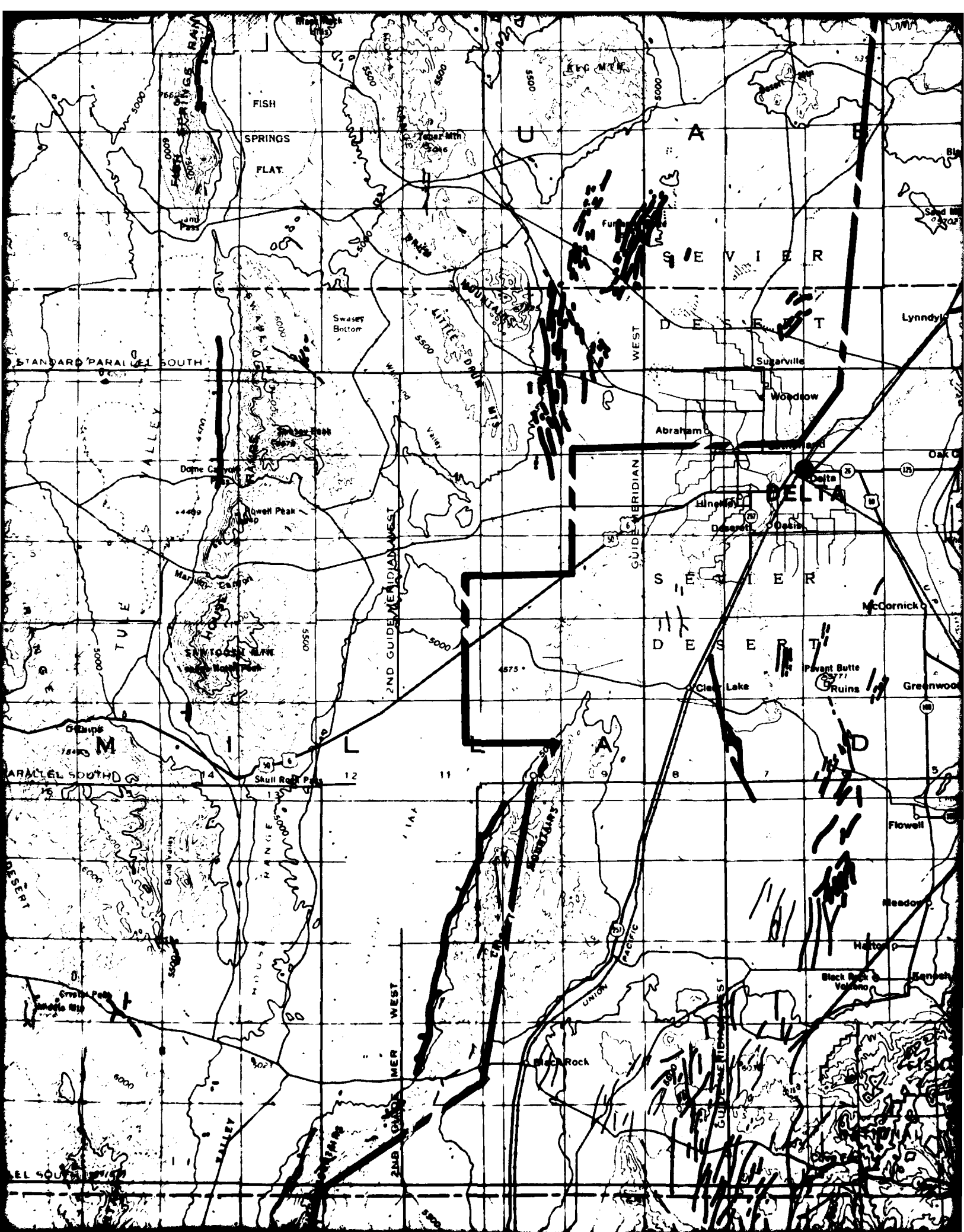


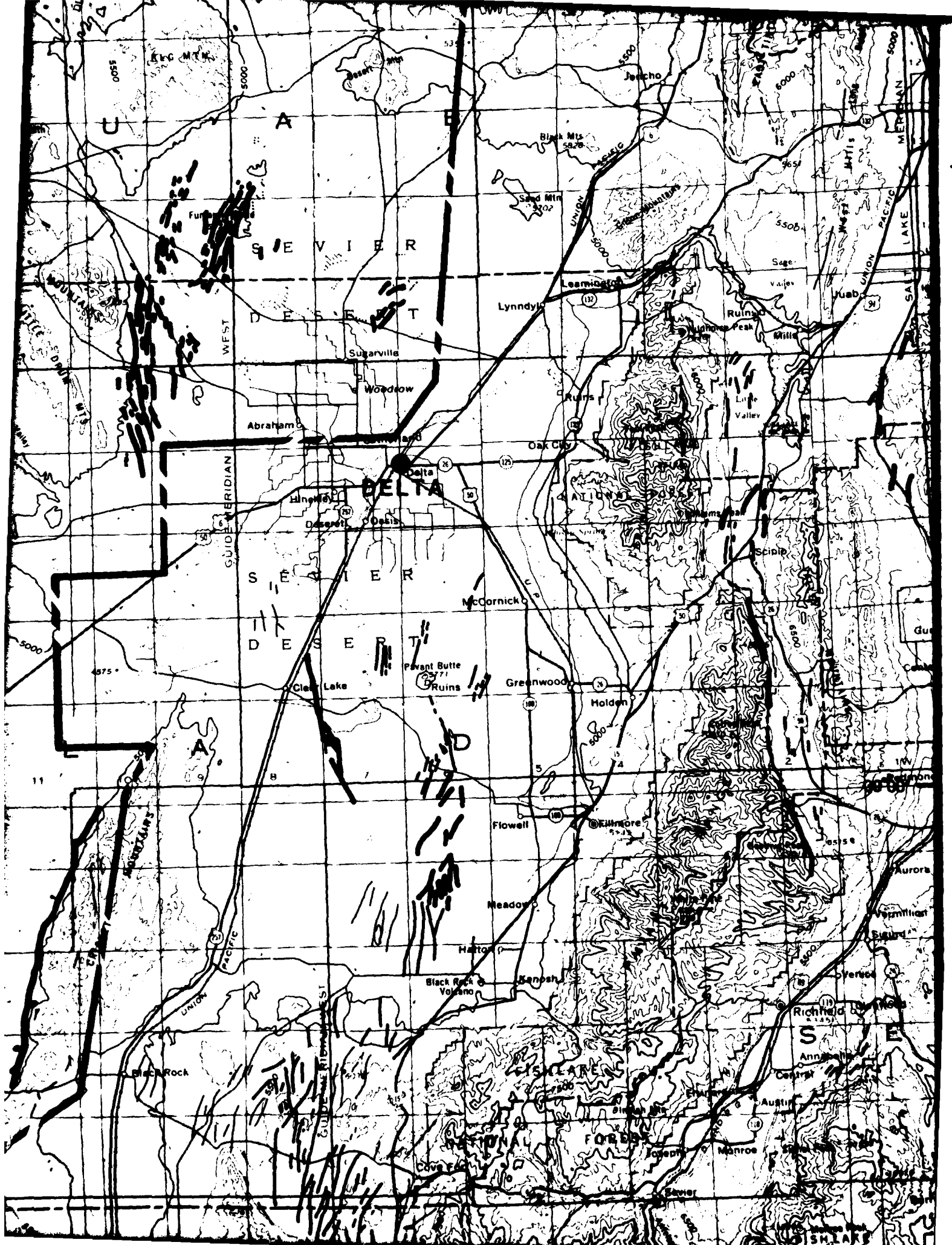


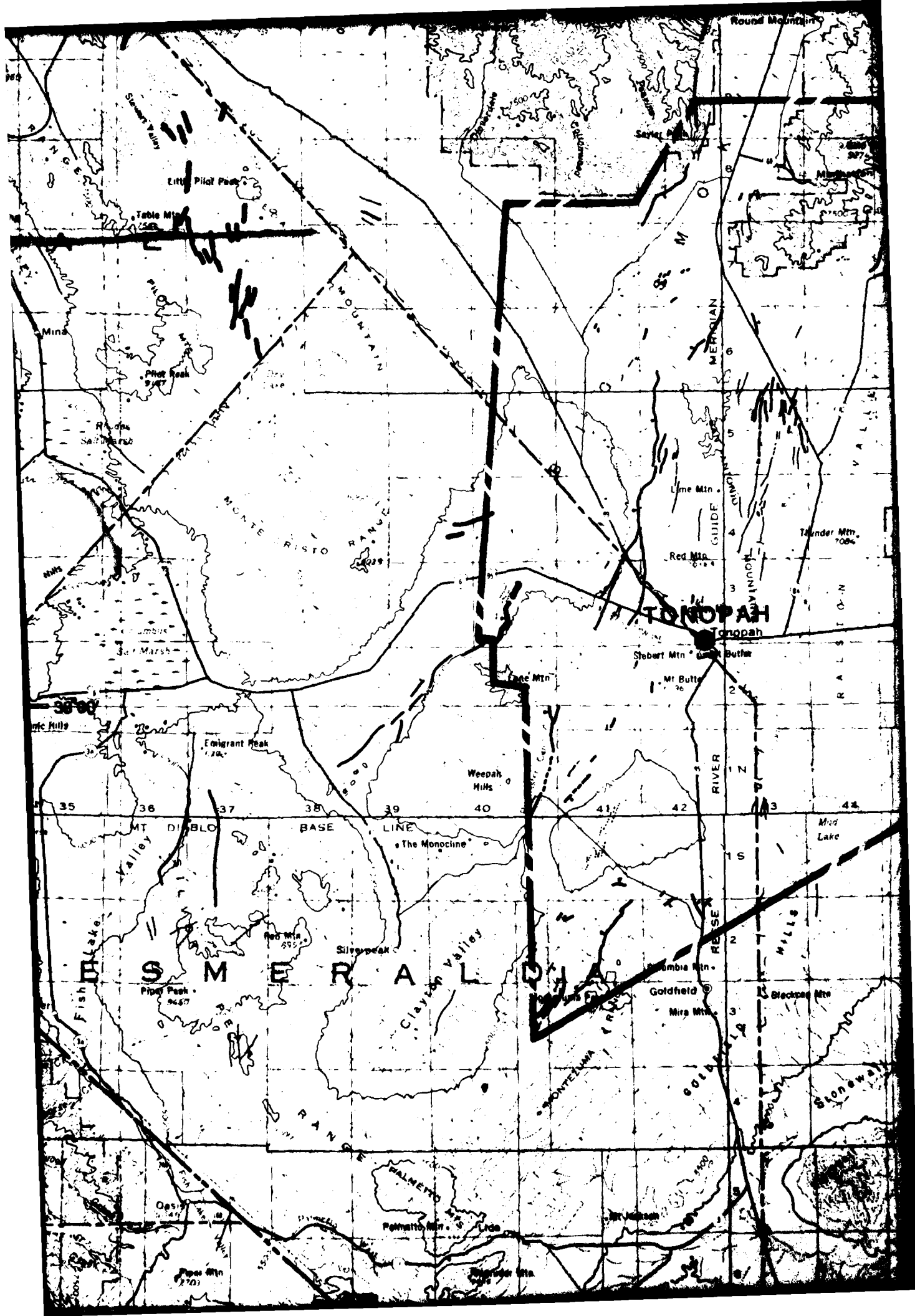


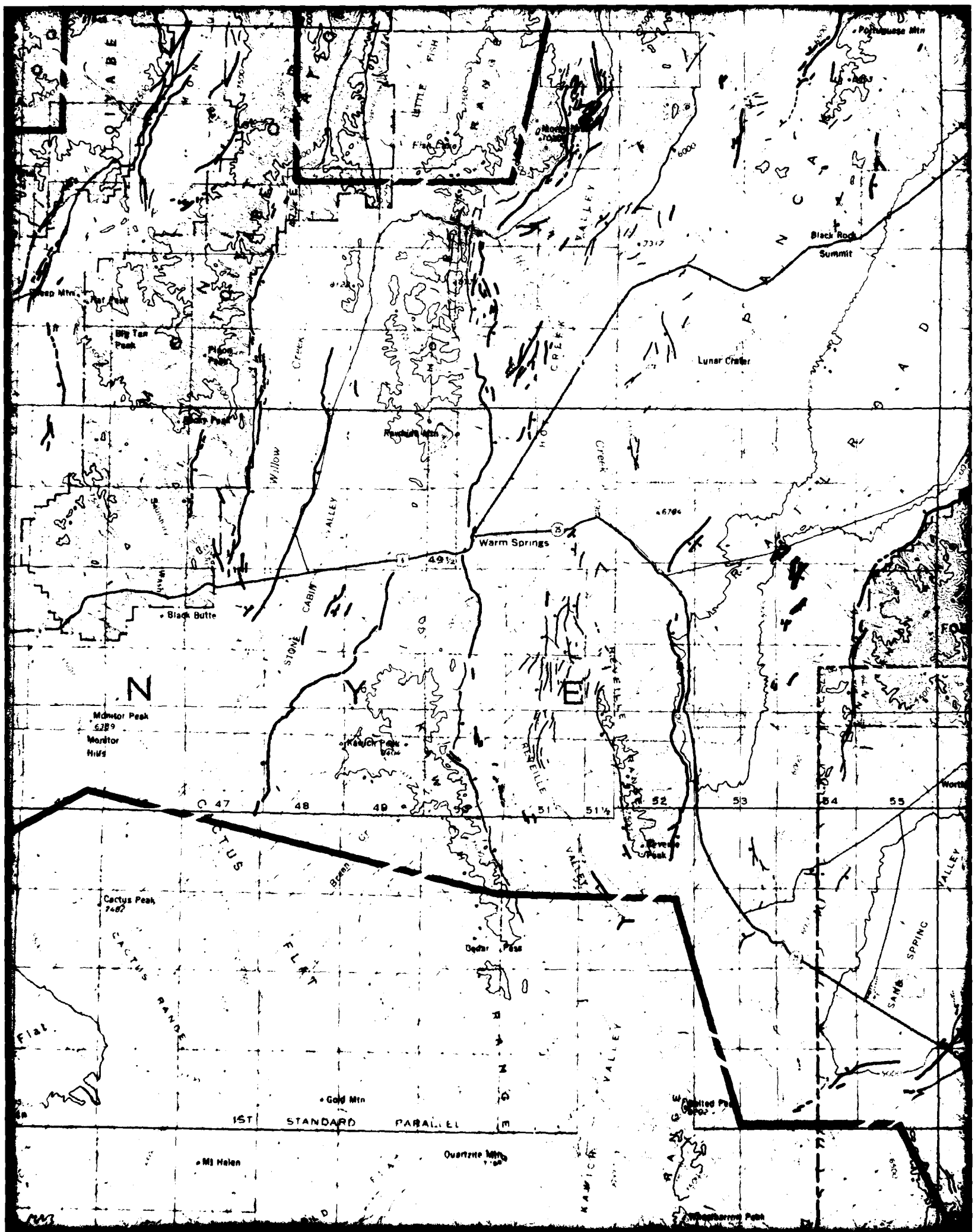


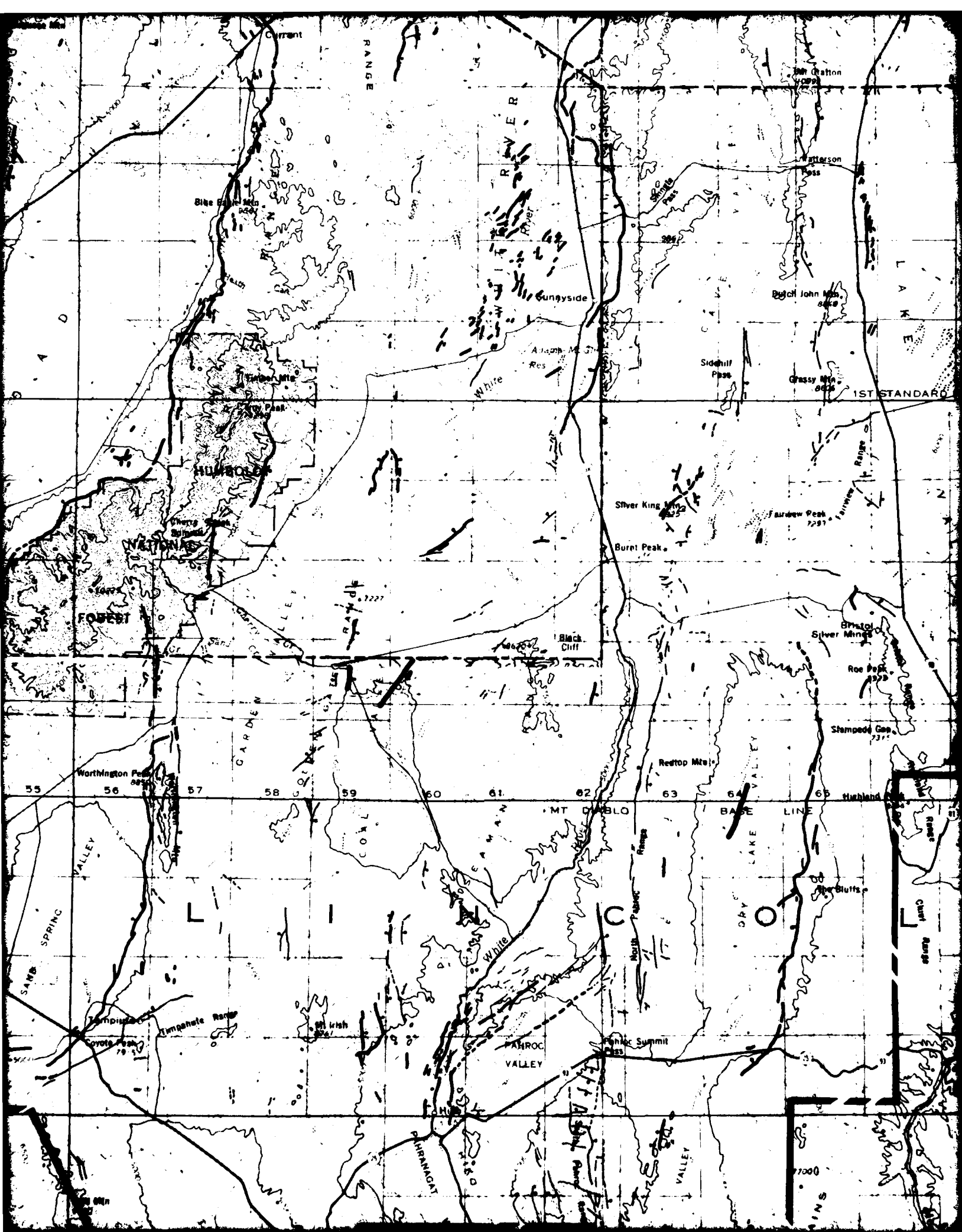


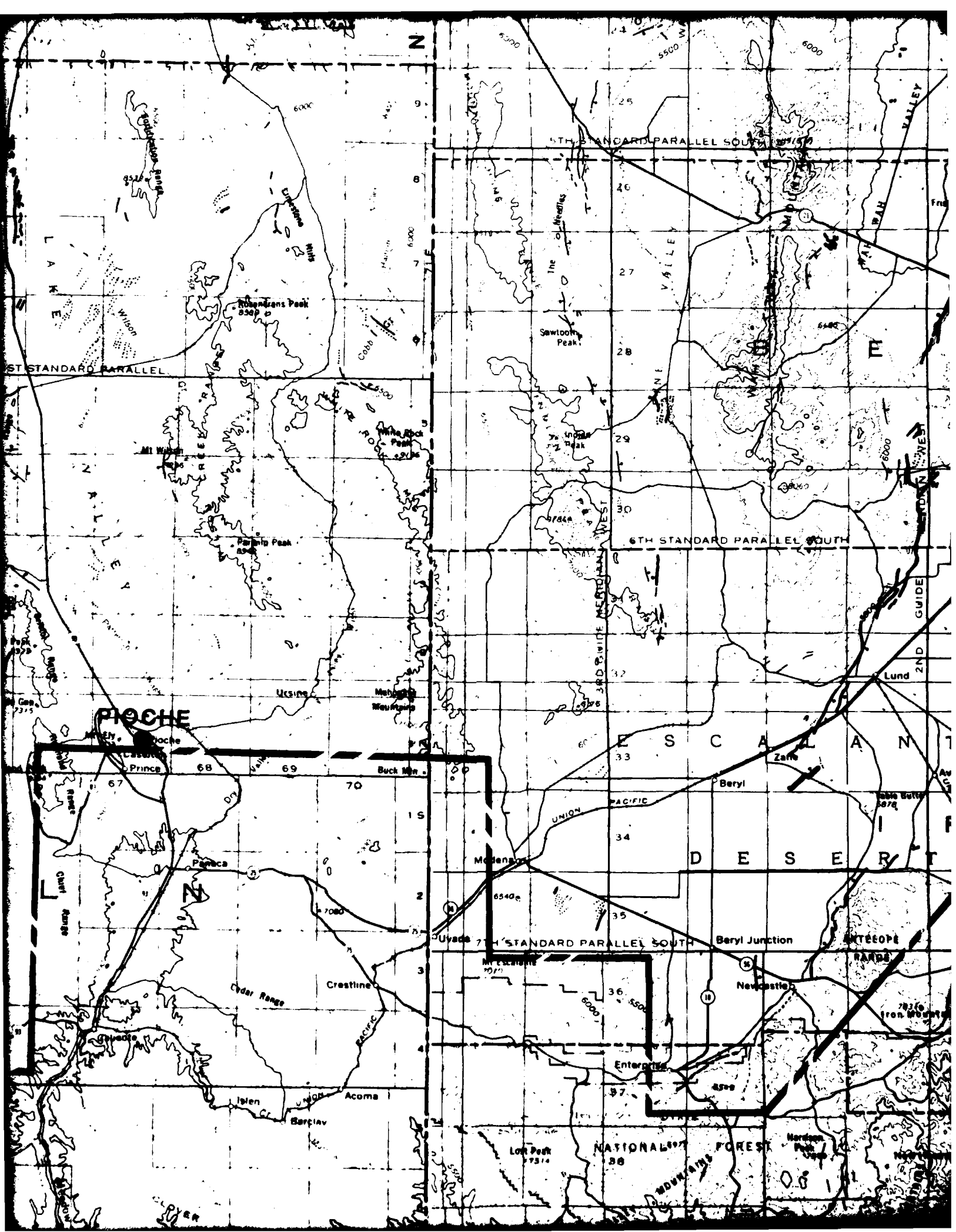


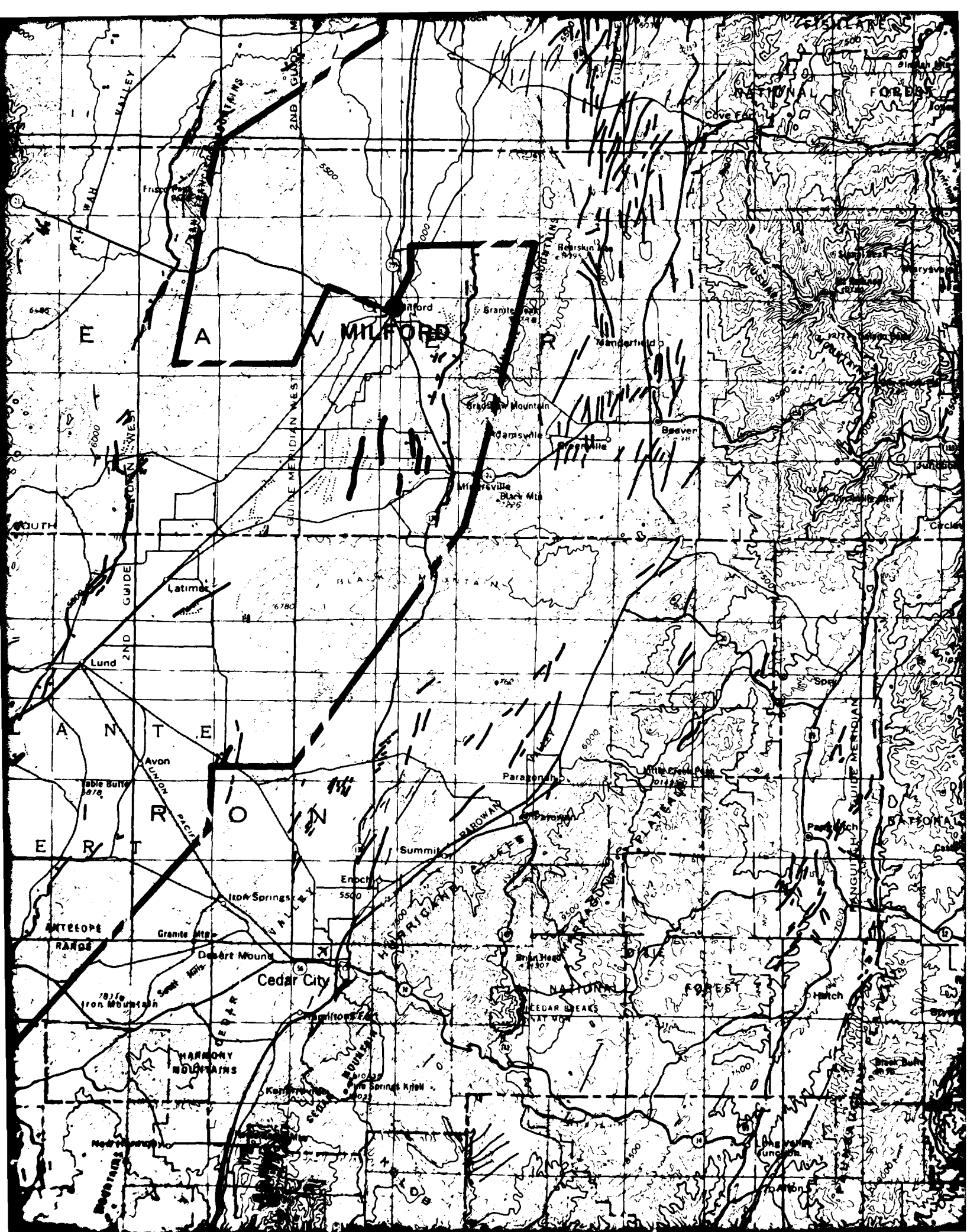




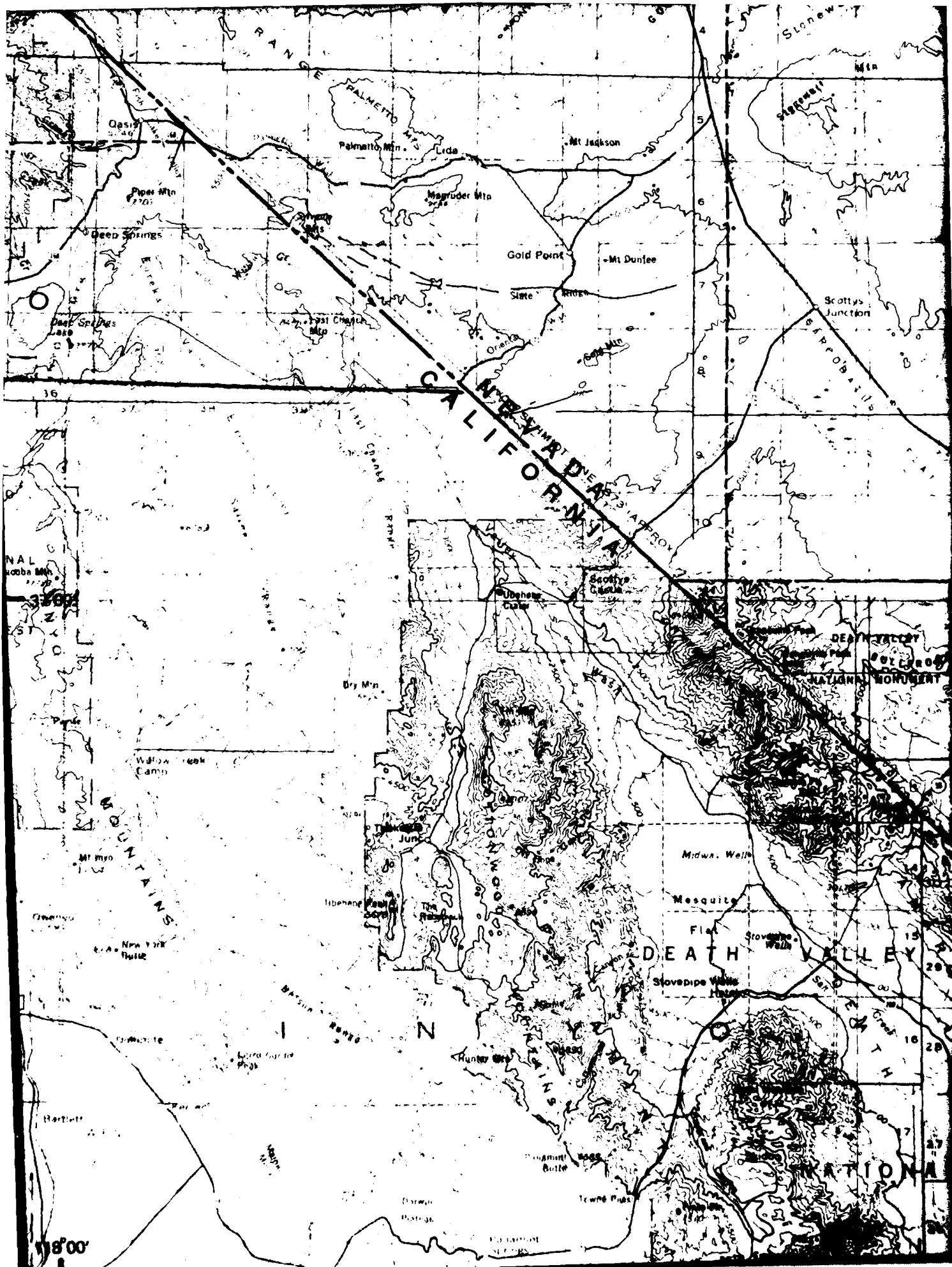


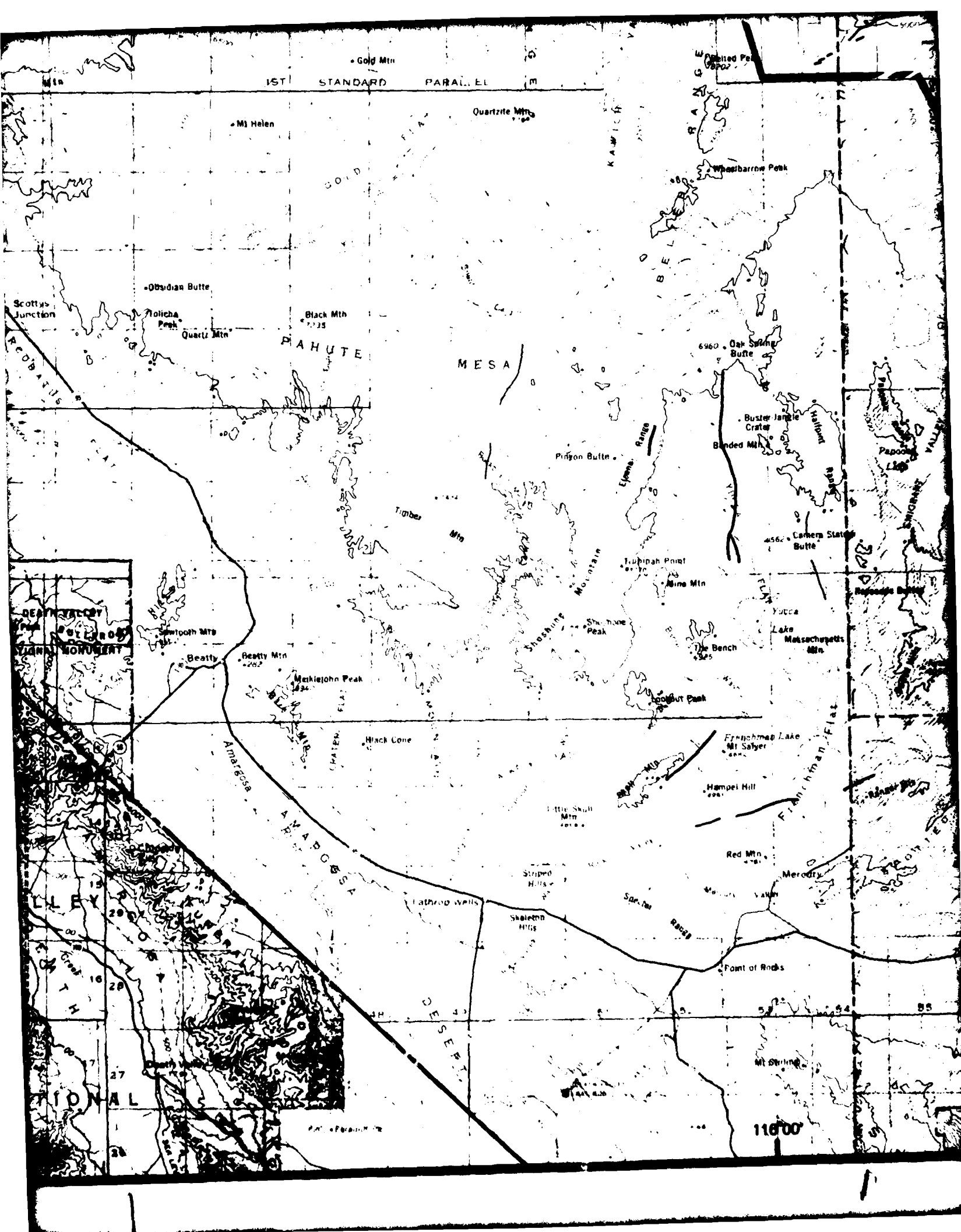


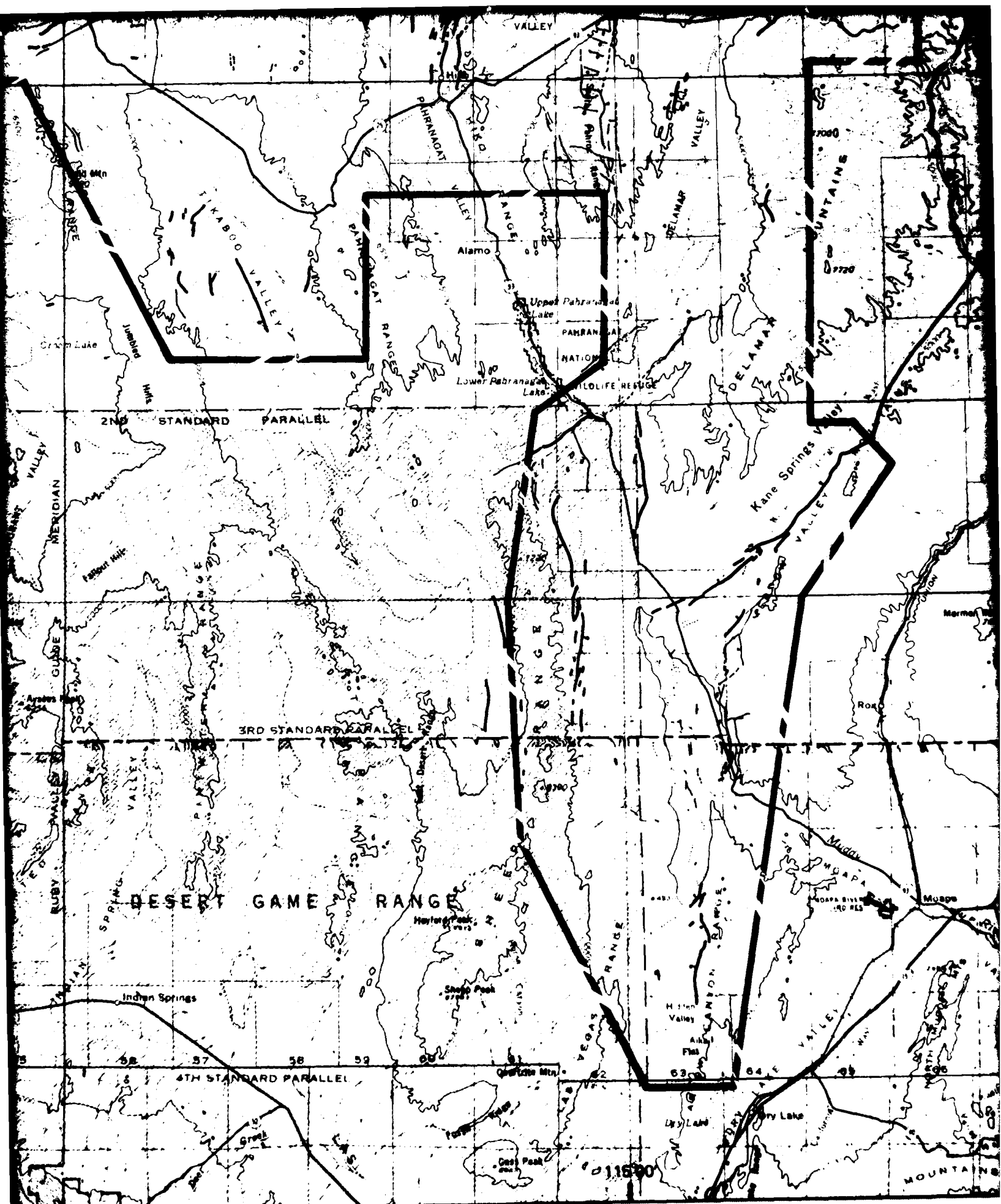


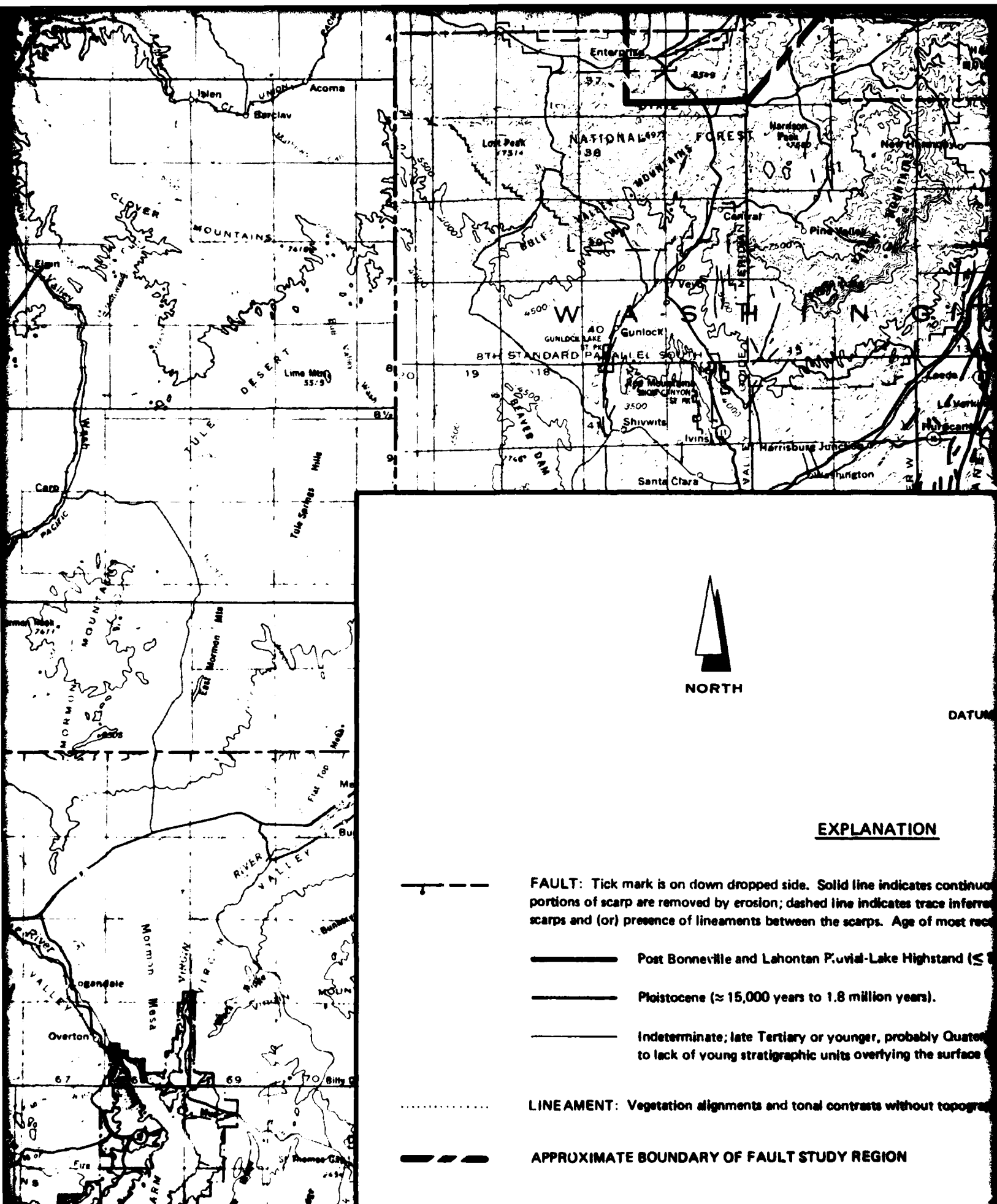


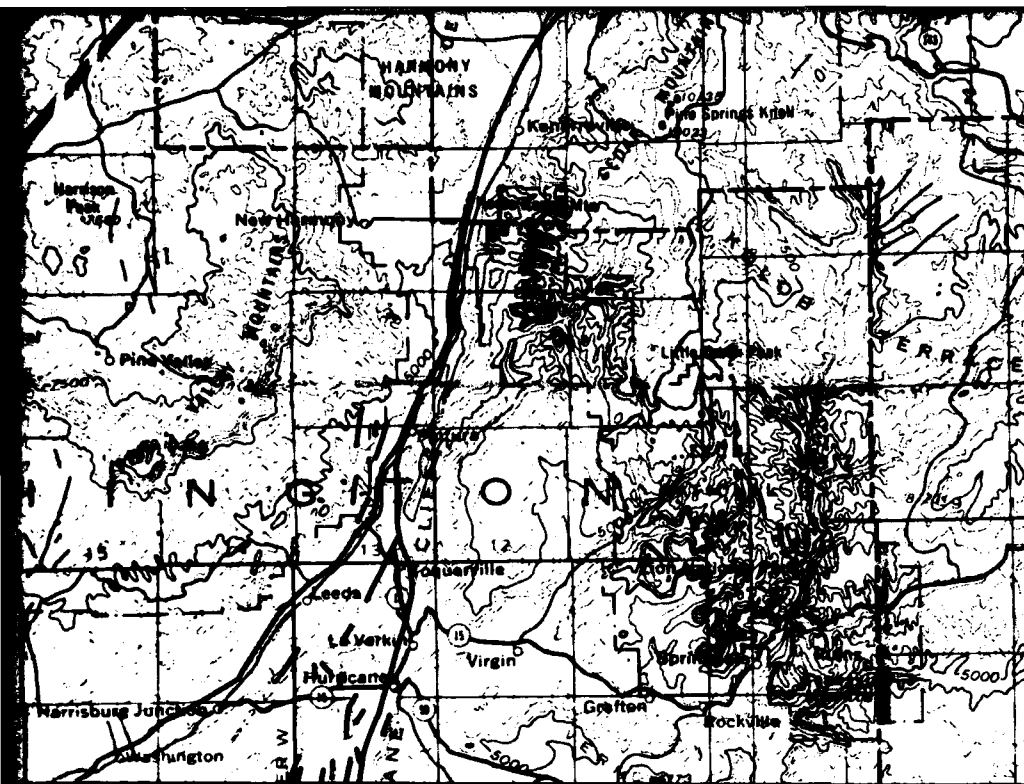




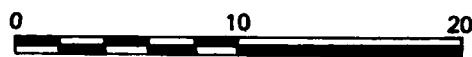








SCALE 1:500,000



1 INCH EQUALS APPROXIMATELY 8 MILES



DATUM IS MEAN SEA LEVEL CONTOUR INTERVAL 500 FEET

EXPLANATION

pped side. Solid line indicates continuous fault scarp except for narrow drainage crossings where small
sion; dashed line indicates trace inferred between more widely spaced scarps based on alignment of
ts between the scarps. Age of most recent movement denoted by line width.

and Lahontan Pluvial-Lake Highstand ($\leq 15,000$ years).

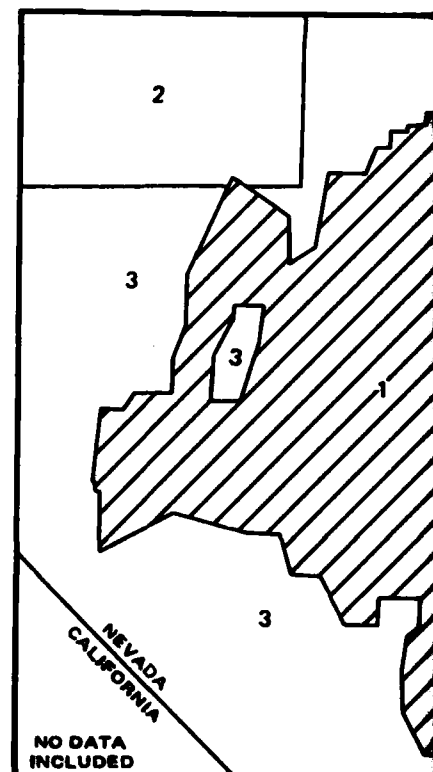
000 years to 1.8 million years).

ter Tertiary or younger, probably Quaternary. Scarps are prominent but age cannot be determined due
atigraphic units overlying the surface trace of faults.

as and tonal contrasts without topographic relief; believed to be faults or fault-related cracks.

FAULT STUDY REGION

LOCATION DIAGRAM



NO DATA
INCLUDED

REFERENCE

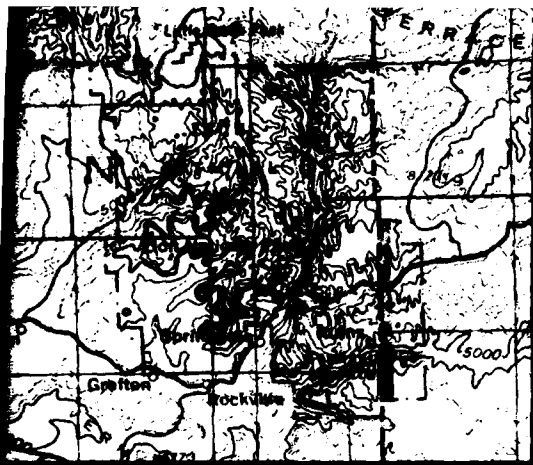
- (1) AREA COVERED IN THIS REPORT.
- (2) WALLACE, R.E., 1979, MAP OF YOUNG EARTHQUAKES IN NORTHERN-CENTRAL UTAH, U.S. GEOLOGICAL SURVEY OPEN FILE REPORT 79-1554, MAP.
- (3) STEWART, J.H., AND CARLSON, J.E., 1979, GEOLOGICAL SURVEY MAP, SCALE 1:500,000.
- (4) ANDERSON, L.W., AND MILLER, D.A., 1979, MAP OF UTAH: FUGRO INC., AND UTAH GEOLOGICAL SURVEY, SCALE 1:500,000.

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MX
DEPA

MAP OF YOUNG FAULTS
IN THE MX DEPT
EAST-CENTRAL
AND WEST-CENTRAL

6 NOV 81



SCALE 1:500,000

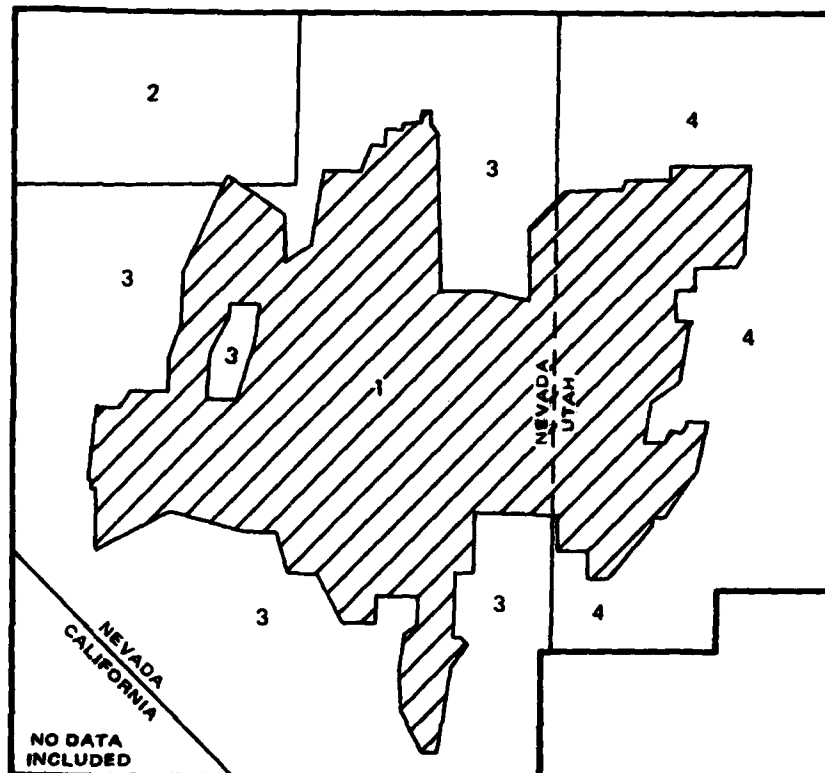
10 20

1 INCH EQUALS APPROXIMATELY 8 MILES

0 10 20

1 INCH EQUALS APPROXIMATELY 8 MILES
IN SEA LEVEL CONTOUR INTERVAL 500 FEET

LOCATION DIAGRAM OF DATA SOURCES



REFERENCES

- (1) AREA COVERED IN THIS REPORT.
- (2) WALLACE, R.E., 1979, MAP OF YOUNG FAULT SCARPS RELATED TO EARTHQUAKES IN NORTHERN-CENTRAL NEVADA: U.S. GEOLOGICAL SURVEY OPEN FILE REPORT 79-1554, MAP SCALE 1: 125,000.
- (3) STEWART, J.H., AND CARLSON, J.E., 1978, GEOLOGIC MAP OF NEVADA: U.S. GEOLOGICAL SURVEY MAP, SCALE 1: 500,000.
- (4) ANDERSON, L.W., AND MILLER, D.G., 1979, QUATERNARY FAULT MAP OF UTAH: FUGRO INC., AND UTAH GEOLOGICAL AND MINERALOGICAL SURVEY, SCALE 1: 500,000.

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**MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE
BMO/AFRC-MX**

**MAP OF YOUNG FAULTS AND LINEAMENTS
IN THE MX DEPLOYMENT AREA,
EAST-CENTRAL NEVADA
AND WEST-CENTRAL UTAH**

6 NOV 81

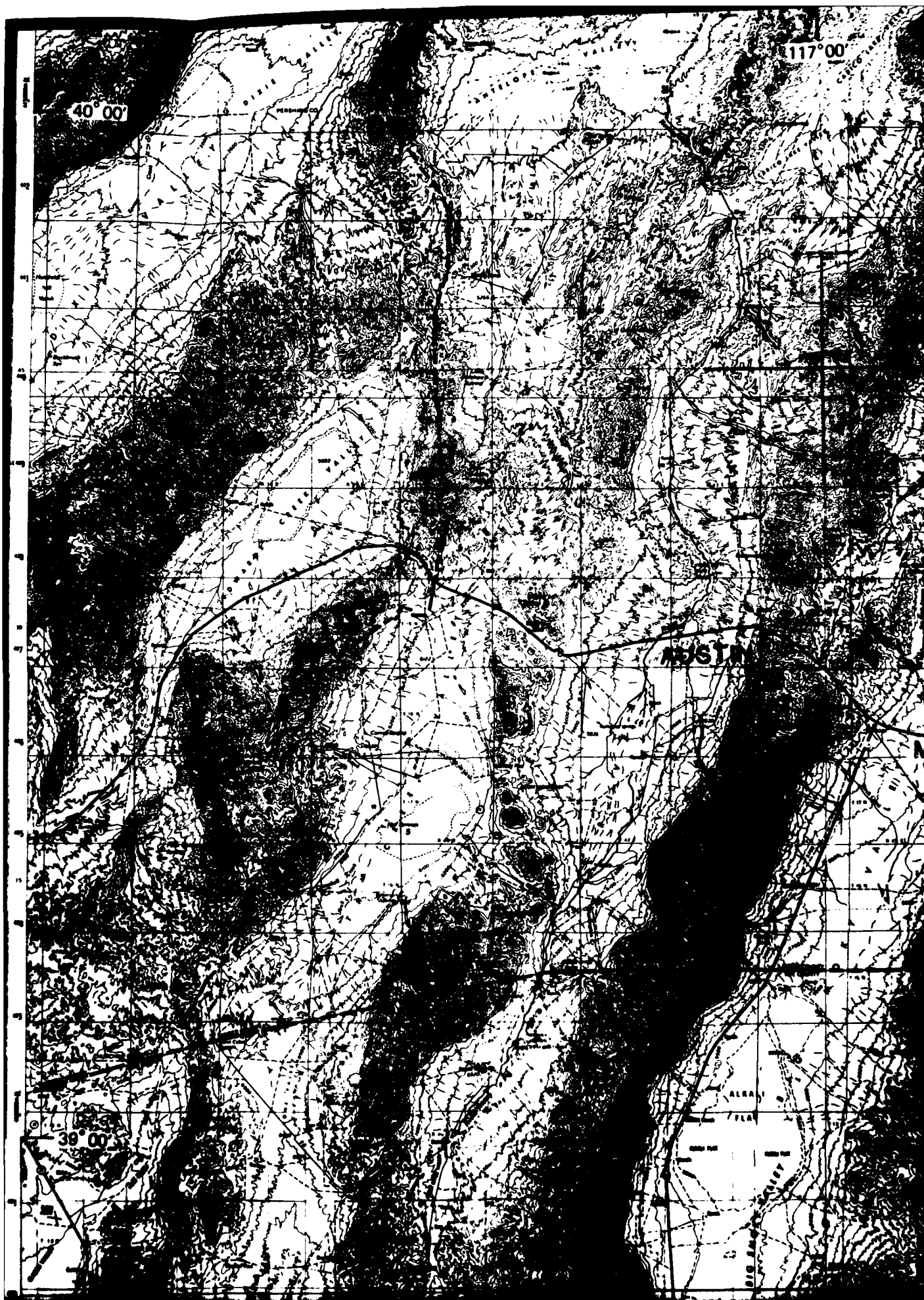
DRAWING 2-5

scarp except for narrow drainage crossings where small
can more widely spaced scarps based on alignment of
ement denoted by line width.

(years).

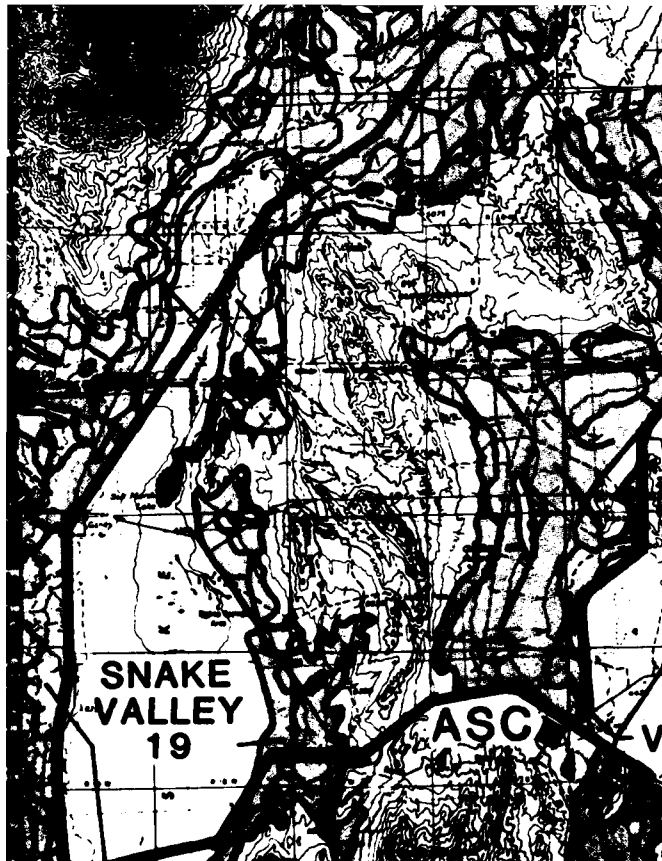
scarps are prominent but age cannot be determined due
faults.

Ref; believed to be faults or fault-related cracks.









DUGWAY
VALLEY 113° 00'

5

40° 00'

SEVIER
DESERT
2

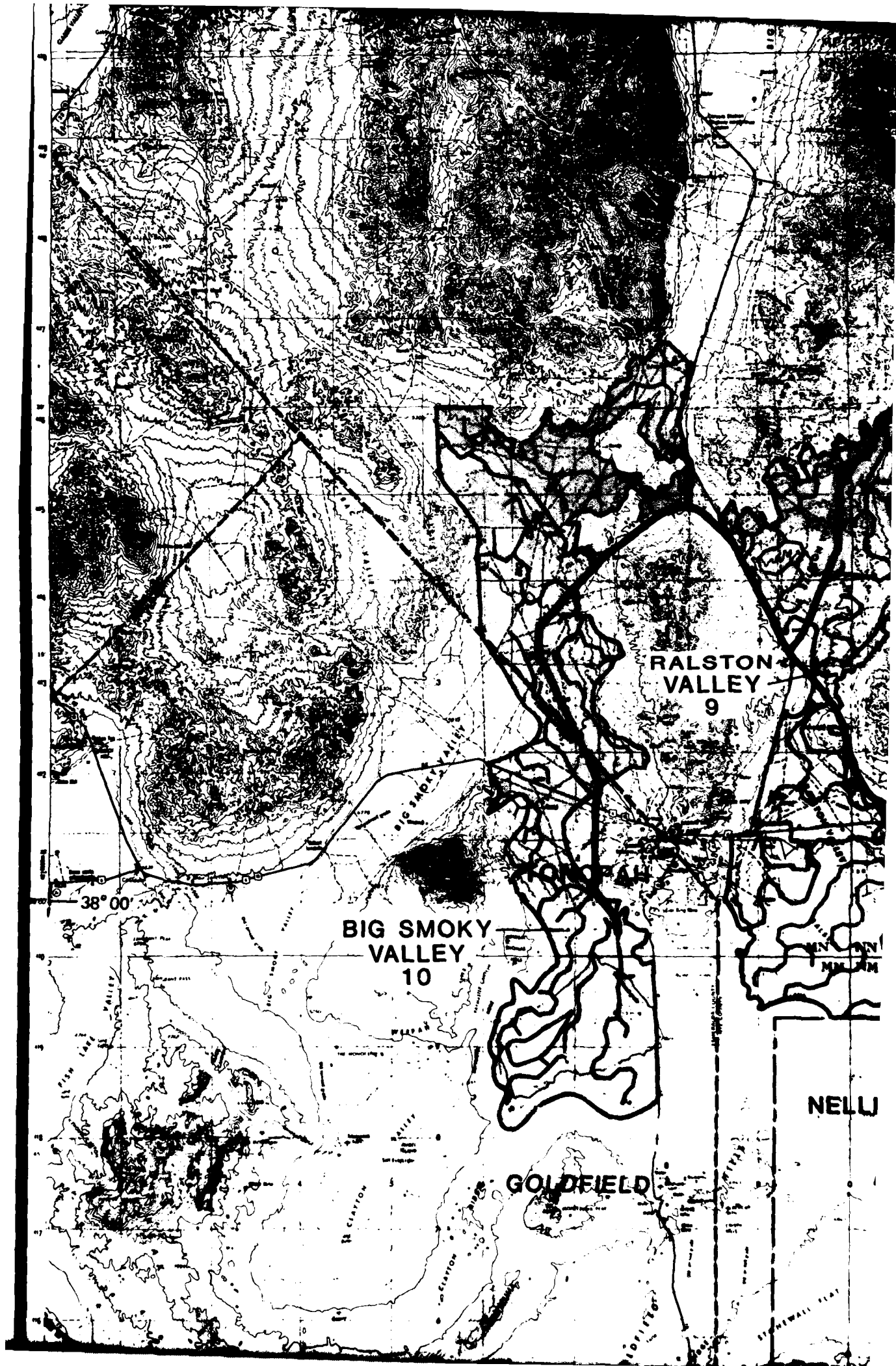
WHIRLWIND
VALLEY
12

DELTA

SEVIER
LAKE
1

38° 00'





AD-A112 532

ERTEC WESTERN INC LONG BEACH CA

F/6 13/2

EXECUTIVE SUMMARY GEOTECHNICAL SITING INVESTIGATIONS FY 81.(U)

NOV 81

F04704-80-C-0006

UNCLASSIFIED

E-TR-55

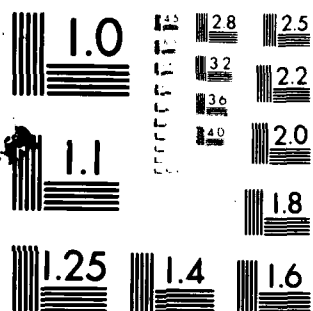
NL

3 x 3

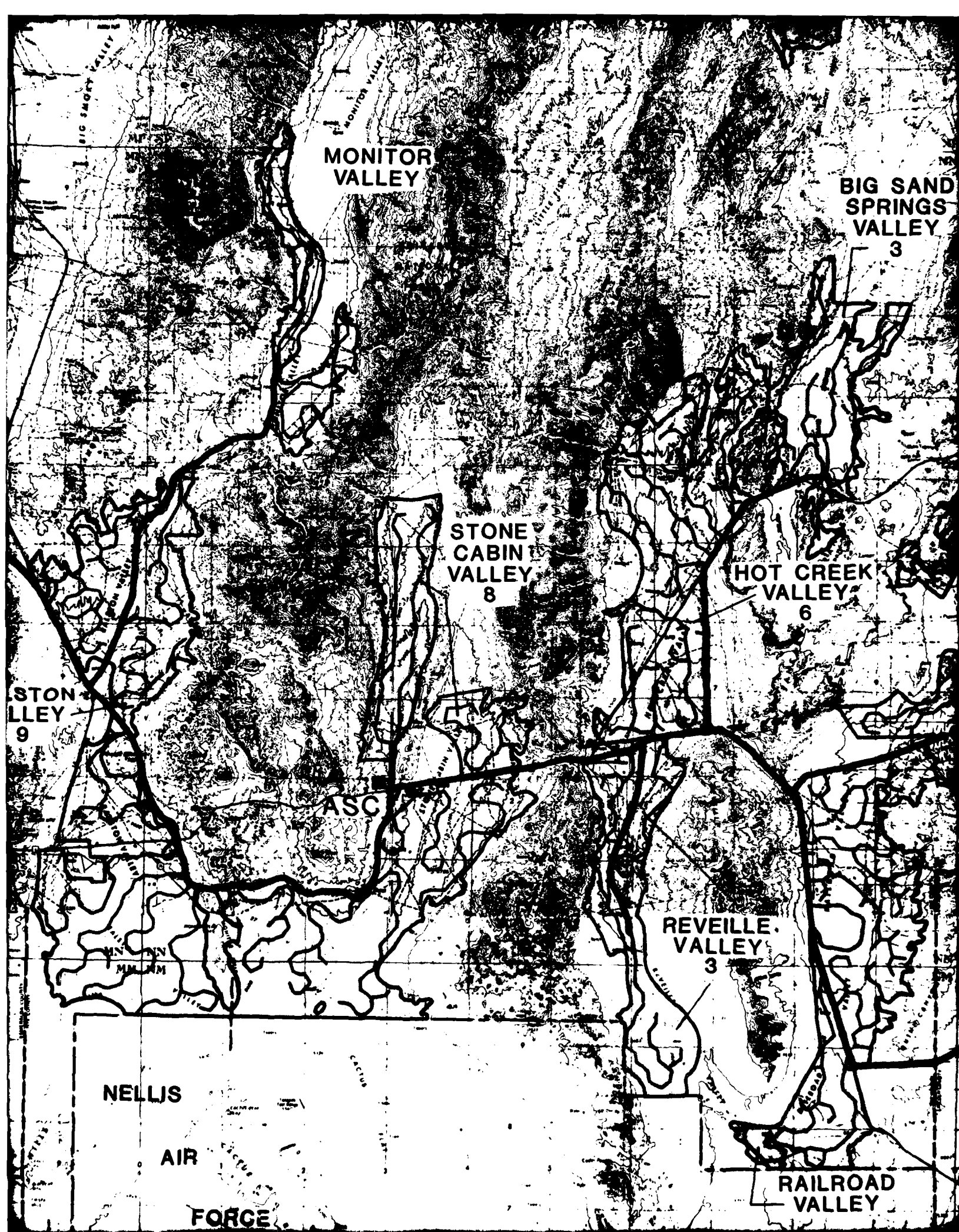
6-10-81



END
DATE
FILMED
5 82
DTIC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



MONITOR
VALLEY

BIG SAND
SPRINGS
VALLEY

3

STONE
CABIN
VALLEY

8

HOT CREEK
VALLEY

6

STON
LEY

9

ASC

REVILLE
VALLEY

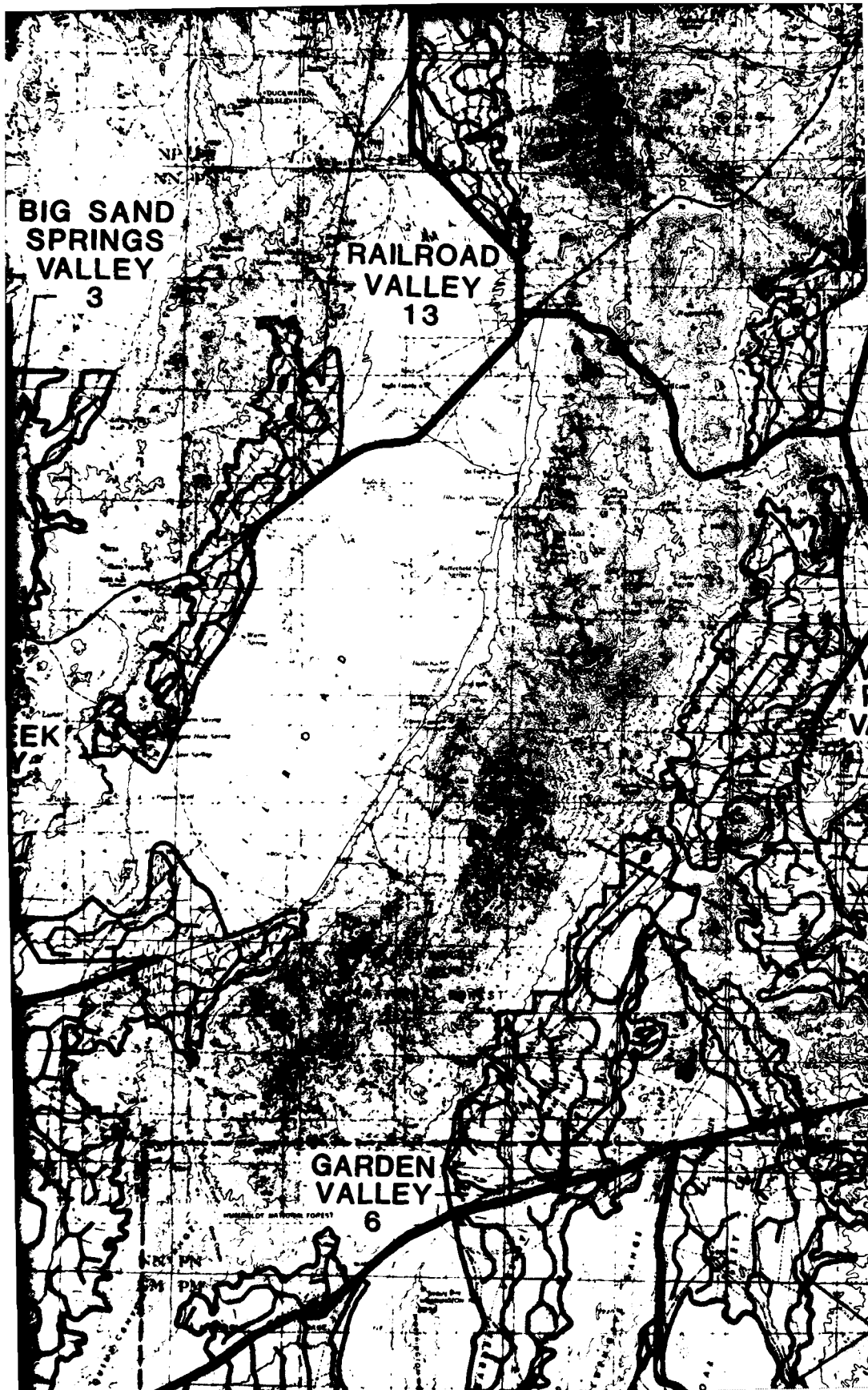
3

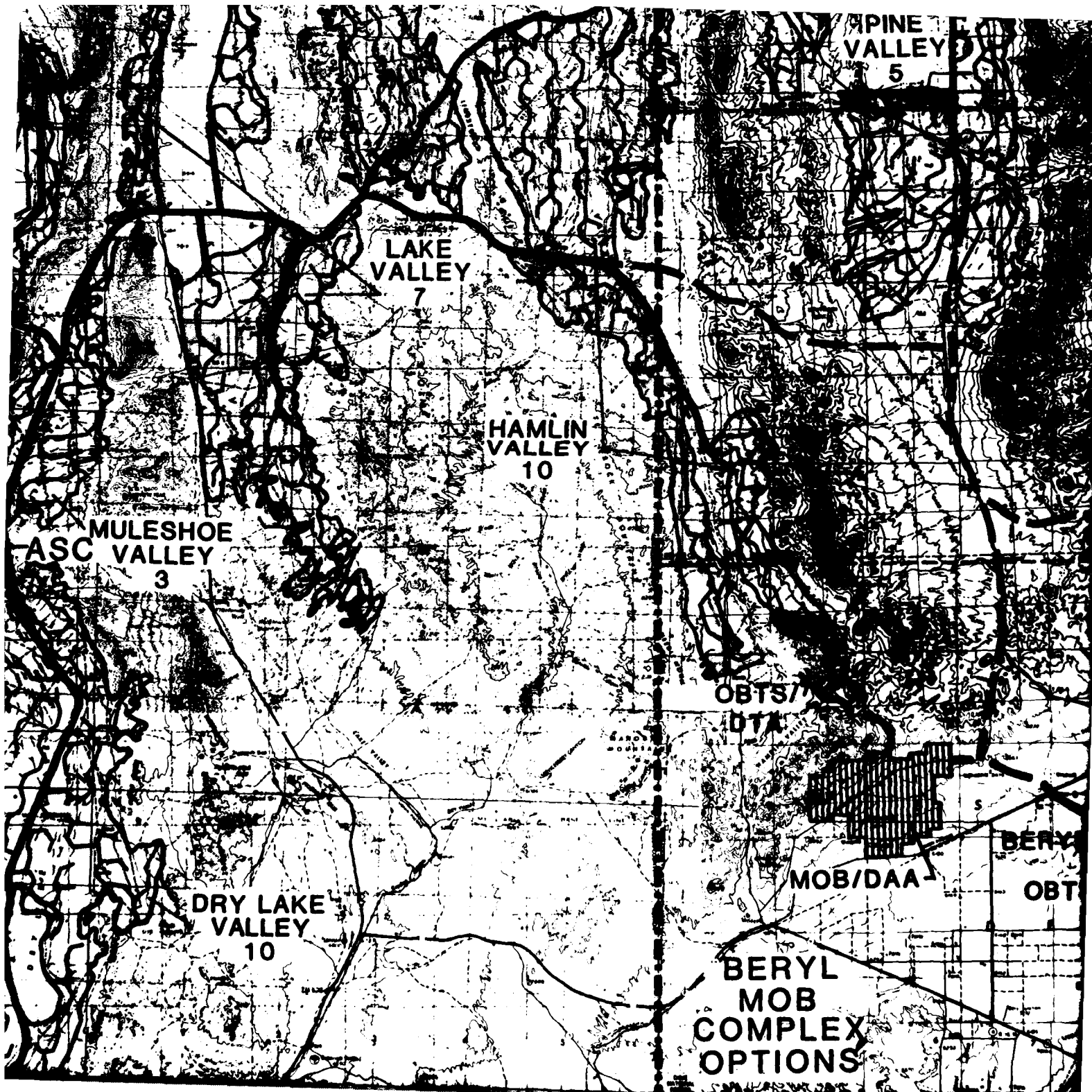
NELLIS

AIR

FORCE

RAILROAD
VALLEY





APINE VALLEY 5

LAKE VALLEY 7

HAMLIN VALLEY 10

MULESHOE VALLEY 3

DRY LAKE VALLEY 10

OBTS/DTA



MOB/DAA

BERYL
OBT

BERYL
MOB
COMPLEX
OPTIONS

TULE
VALLEY

SEVIER
LAKE
1

WAH WAH
VALLEY
5

MILFORD

MOB/DAA

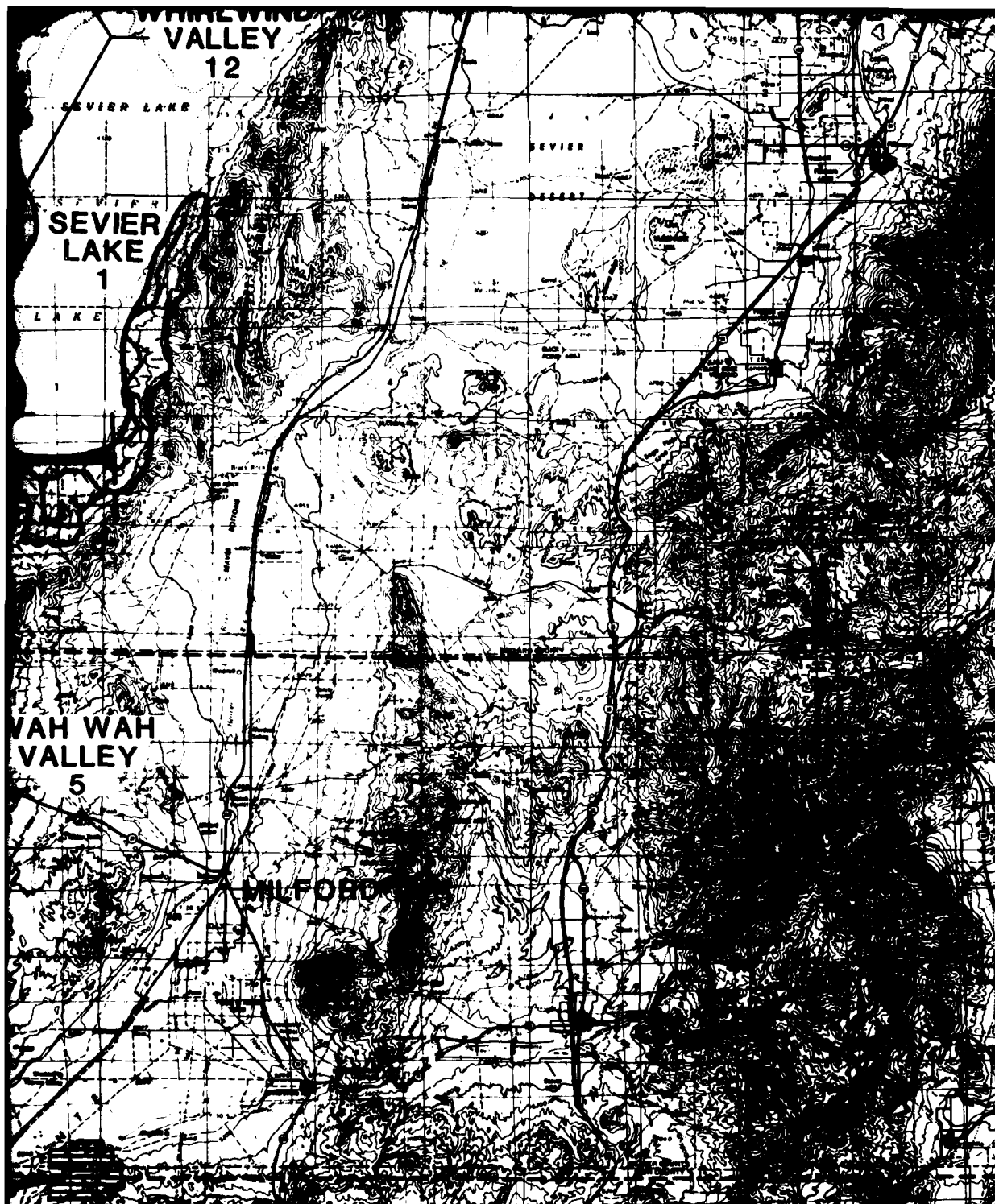
OBTS/DTA

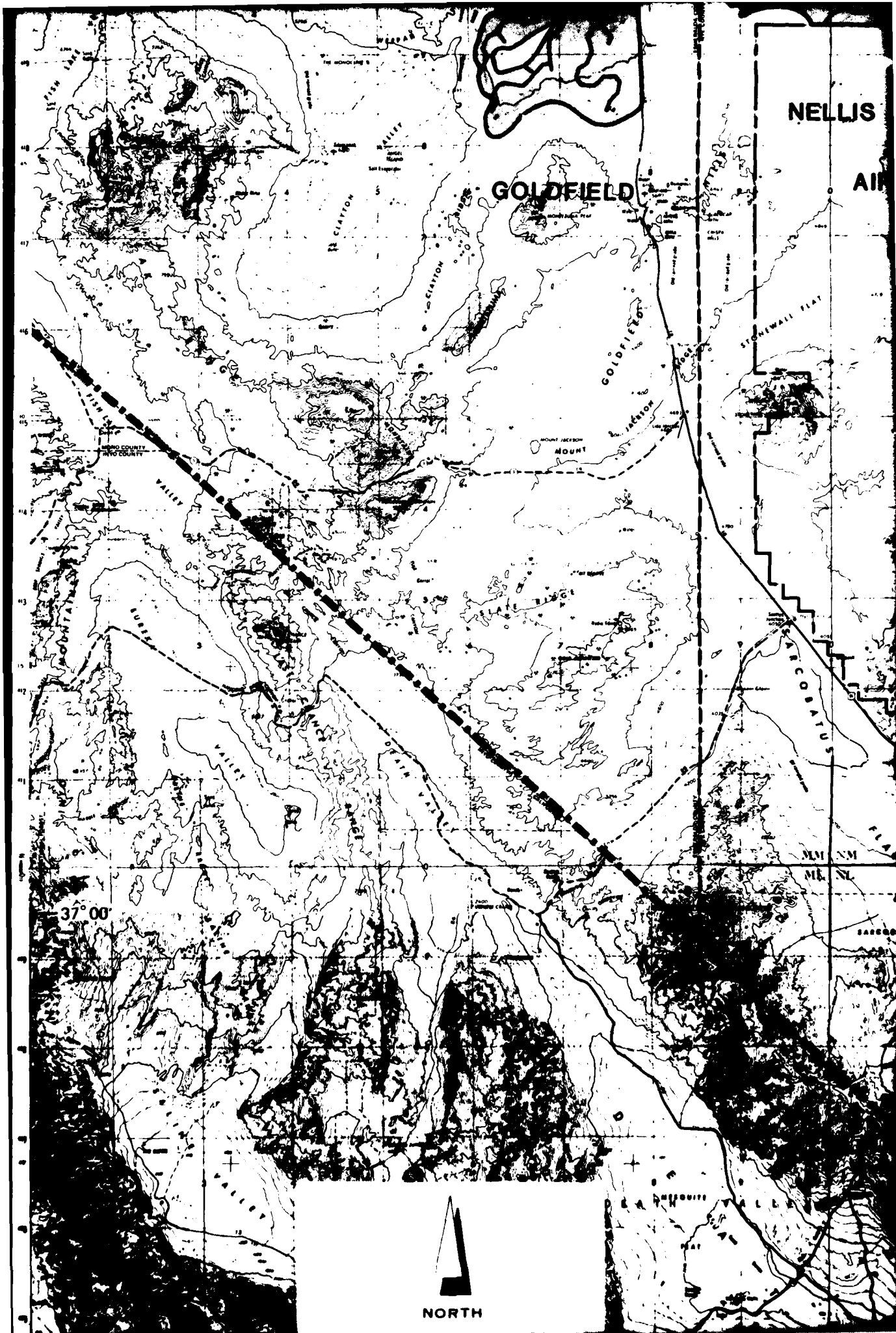
MILFORD
MOB
COMPLEX
OPTIONS

MOB/DAA

BERYL

OBTS/DTA





NELLIS

AIR

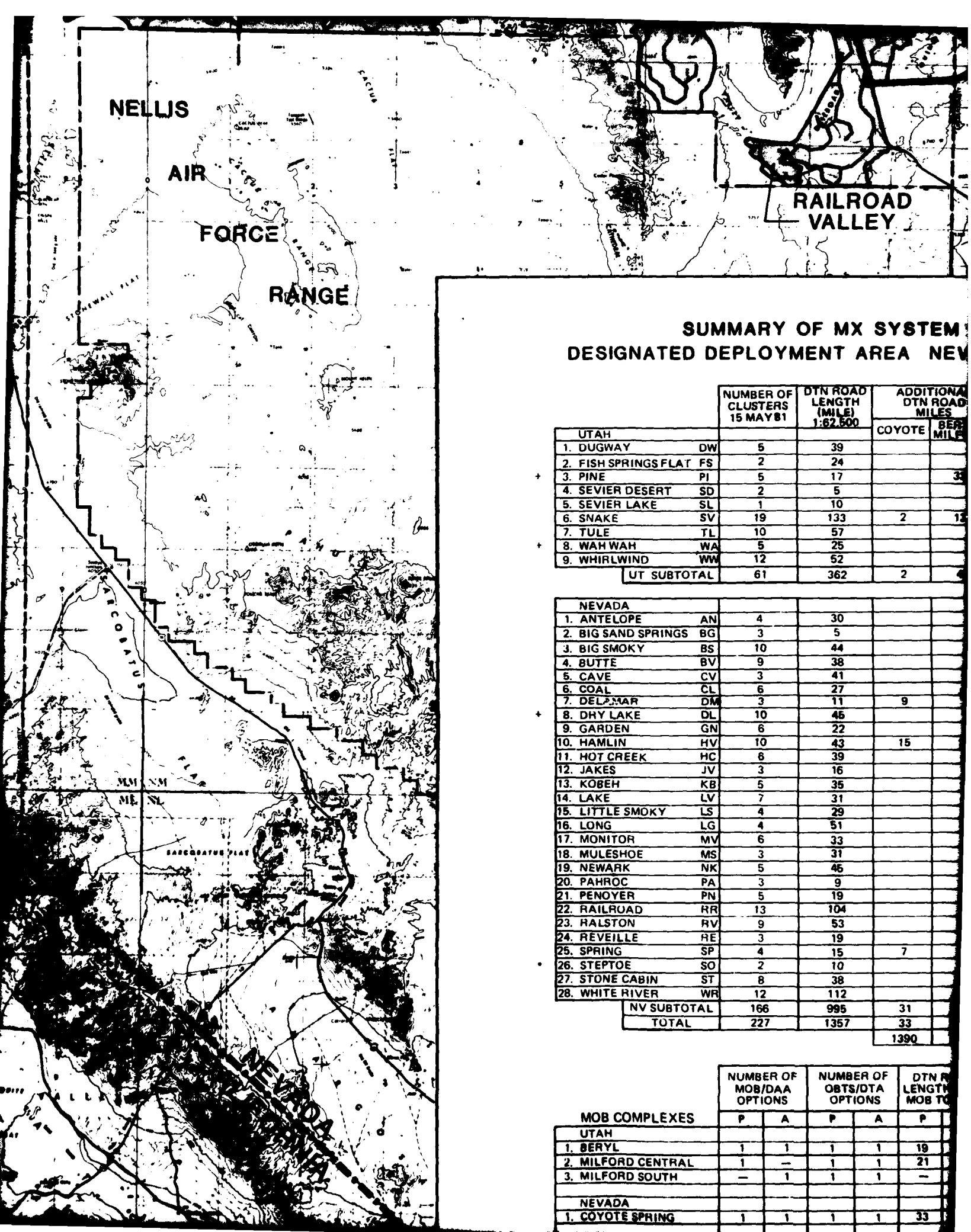
GOLDFIELD

GOLDFIELD

MOUNT JACKSON

37°00'

NORTH

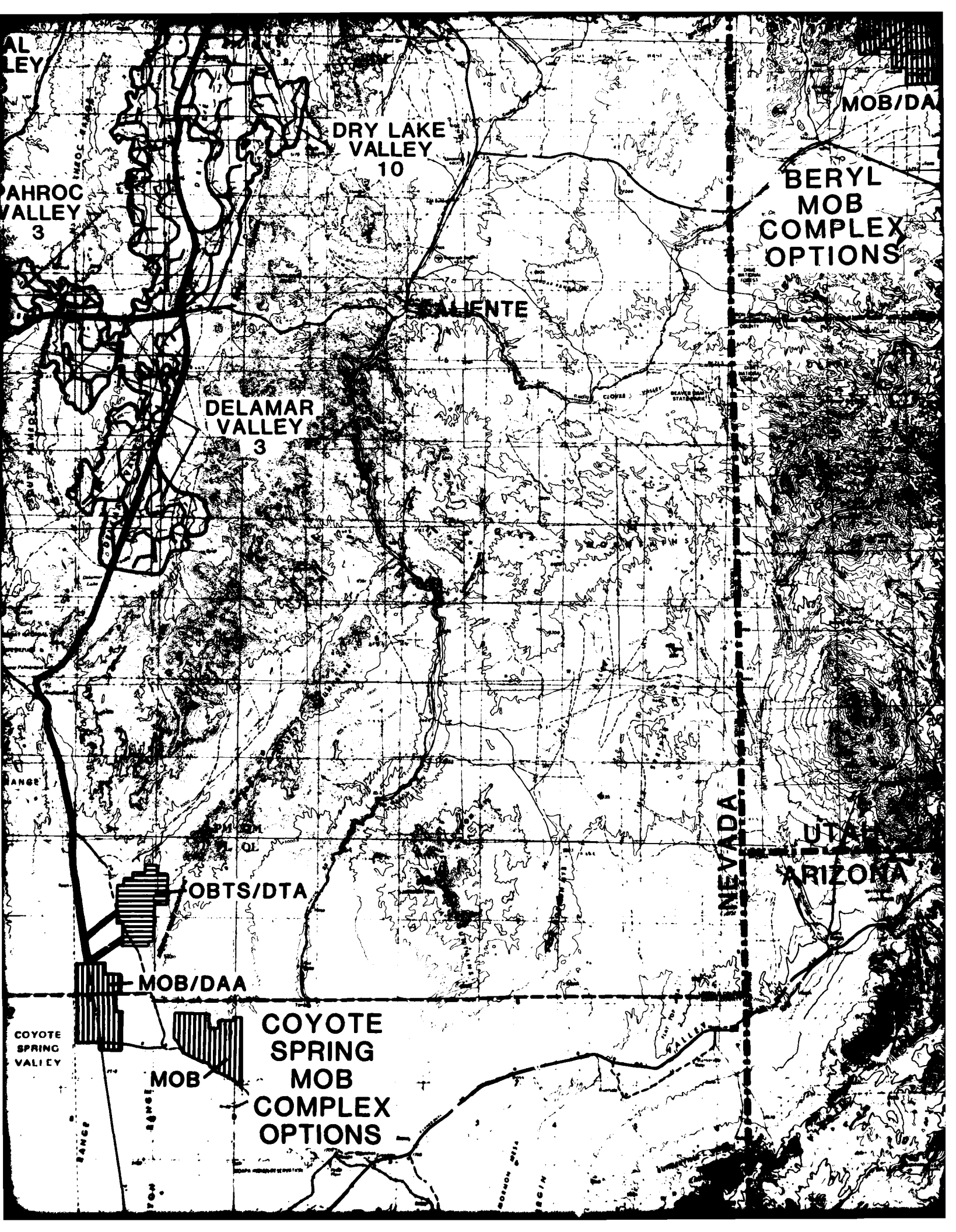


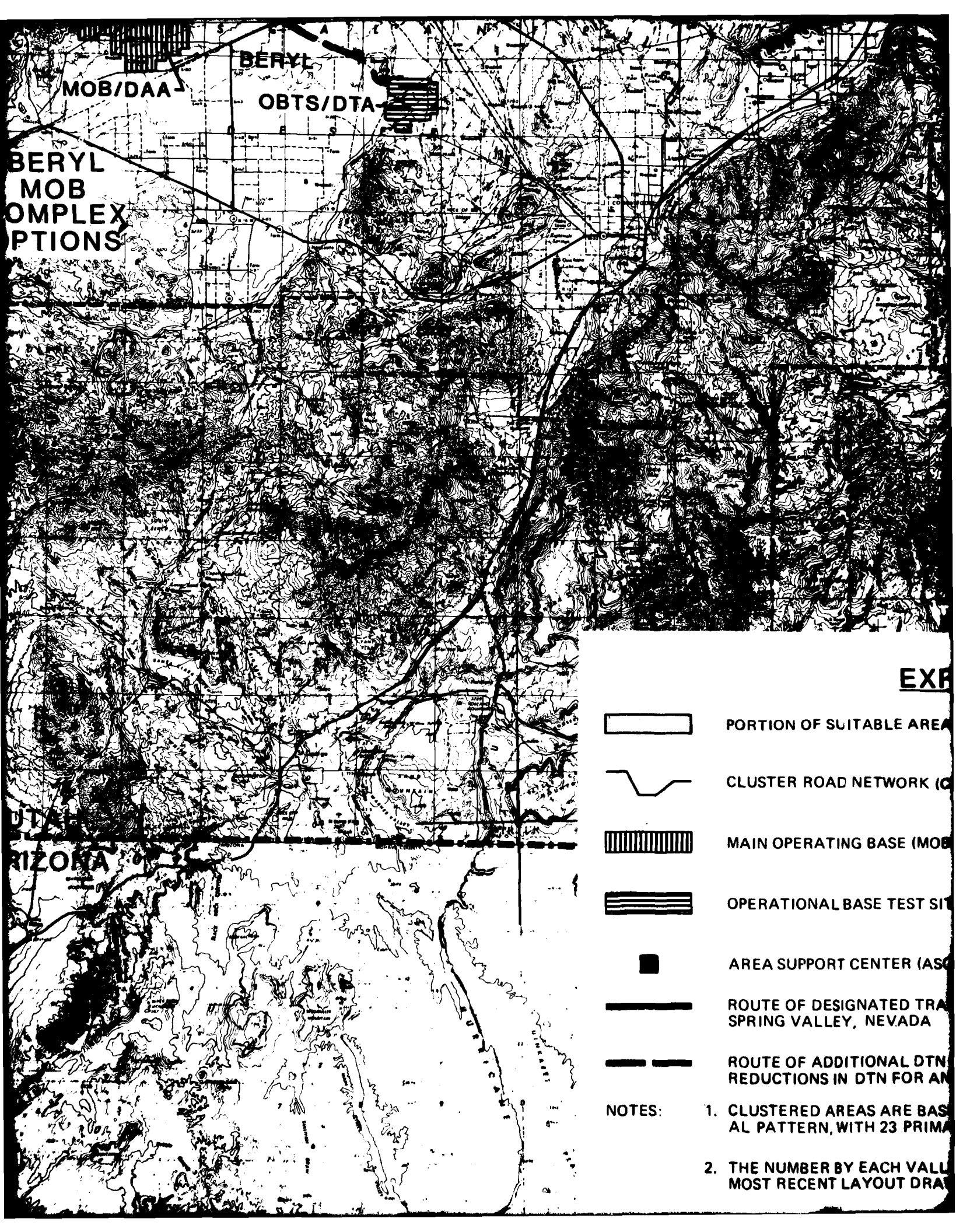
SUMMARY OF MX SYSTEM DESIGNATED DEPLOYMENT AREA NEV

		NUMBER OF CLUSTERS 15 MAY81	DTN ROAD LENGTH (MILE) 1:62,500	ADDITIONAL DTN ROAD MILES	
UTAH				COYOTE	BER MILE
1. DUGWAY	DW	5	39		
2. FISH SPRINGS FLAT	FS	2	24		
3. PINE	PI	5	17		3
4. SEVIER DESERT	SD	2	5		
5. SEVIER LAKE	SL	1	10		
6. SNAKE	SV	19	133	2	13
7. TULE	TL	10	57		
8. WAH WAH	WA	5	25		
9. WHIRLWIND	WW	12	52		
UT SUBTOTAL		61	362	2	

NEVADA					
1. ANTELOPE	AN	4	30		
2. BIG SAND SPRINGS	BG	3	5		
3. BIG SMOKY	BS	10	44		
4. BUTTE	BV	9	38		
5. CAVE	CV	3	41		
6. COAL	CL	6	27		
7. DEL MAR	DM	3	11	9	
8. DRY LAKE	DL	10	45		
9. GARDEN	GN	6	22		
10. HAMLIN	HV	10	43	15	
11. HOT CREEK	HC	8	39		
12. JAKES	JV	3	16		
13. KOBEH	KB	5	35		
14. LAKE	LV	7	31		
15. LITTLE SMOKY	LS	4	29		
16. LONG	LG	4	51		
17. MONITOR	MV	6	33		
18. MULESHOE	MS	3	31		
19. NEWARK	NK	5	45		
20. PAHROC	PA	3	9		
21. PENoyer	PN	5	19		
22. RAILROAD	RR	13	104		
23. HALSTON	RV	9	53		
24. REVEILLE	RE	3	19		
25. SPRING	SP	4	15	7	
26. STEPTOE	SO	2	10		
27. STONE CABIN	ST	8	38		
28. WHITE RIVER	WR	12	112		
NV SUBTOTAL		166	995	31	
TOTAL		227	1357	33	
				1390	

		NUMBER OF MOB/DAA OPTIONS		NUMBER OF OBT/DTA OPTIONS		DTN R LENGTH MOB TO
MOB COMPLEXES		P	A	P	A	P
UTAH						
1. BERYL		1	1	1	1	19
2. MILFORD CENTRAL		1	—	1	1	21
3. MILFORD SOUTH		—	1	1	1	—
NEVADA						
1. COYOTE SPRING		1	1	1	1	33





MOB/DAA

BERTL

OBTS/DTA

BERTL
MOB
COMPLEX
PTIONS

UTAH
ARIZONA

EXP



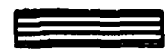
PORTION OF SUITABLE AREA



CLUSTER ROAD NETWORK (C)



MAIN OPERATING BASE (MOB)



OPERATIONAL BASE TEST SITE



AREA SUPPORT CENTER (ASC)



ROUTE OF DESIGNATED TRAFFIC
SPRING VALLEY, NEVADA



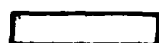
ROUTE OF ADDITIONAL DTN
REDUCTIONS IN DTN FOR AN

NOTES:

1. CLUSTERED AREAS ARE BASED ON A PATTERN, WITH 23 PRIMARY
2. THE NUMBER BY EACH VALLEY IS THE MOST RECENT LAYOUT DRAWING



EXPLANATION



PORTION OF SUITABLE AREA CLUSTERED



CLUSTER ROAD NETWORK (CRN)



MAIN OPERATING BASE (MOB)/DESIGNATED ASSEMBLY AREA (DAA) OPTIONS



OPERATIONAL BASE TEST SITE (OBTS)/DESIGNATED TRAINING AREA (DTA) OPTIONS



AREA SUPPORT CENTER (ASC)



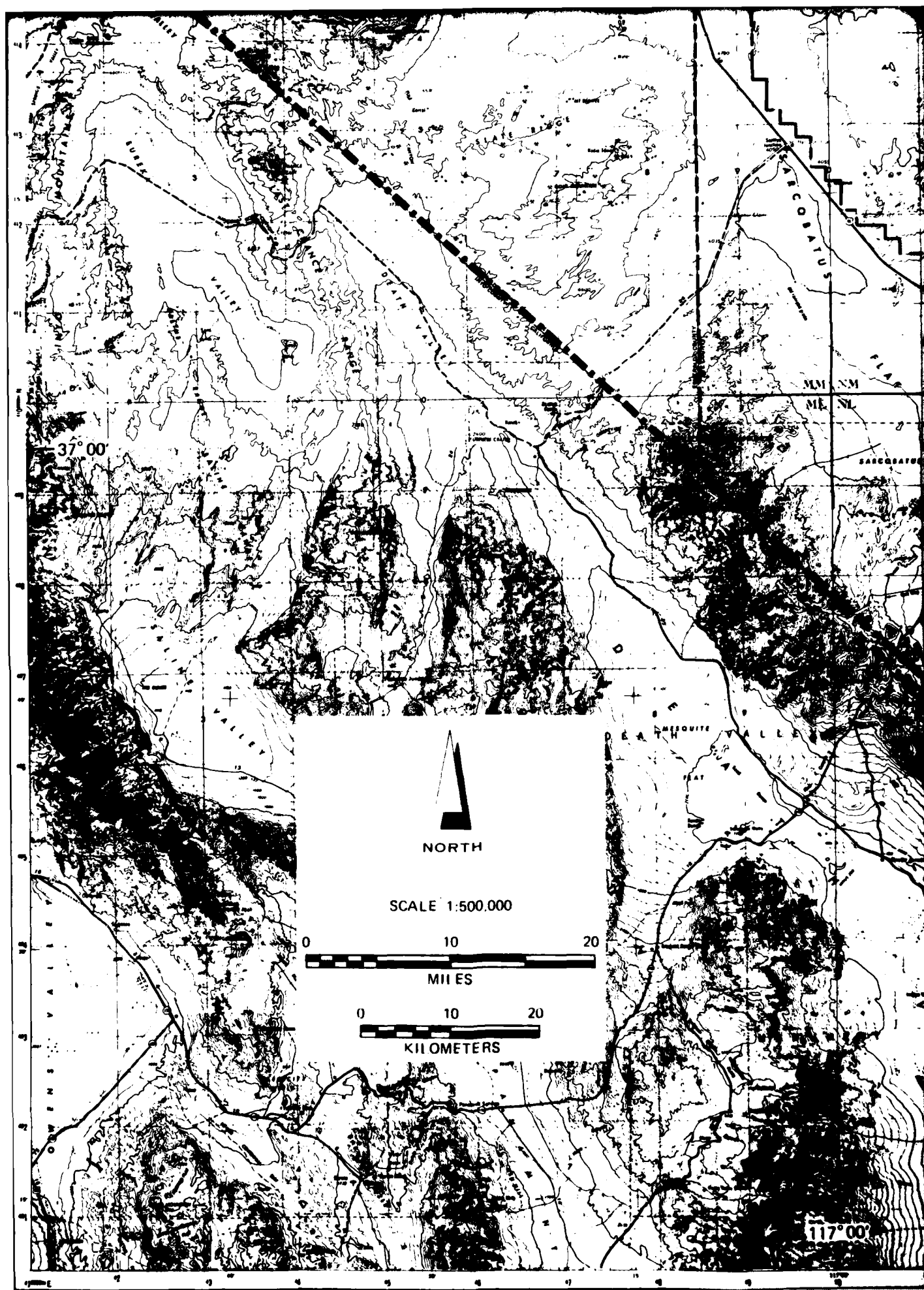
ROUTE OF DESIGNATED TRANSPORTATION NETWORK (DTN) FOR MOB SITE IN COYOTE SPRING VALLEY, NEVADA

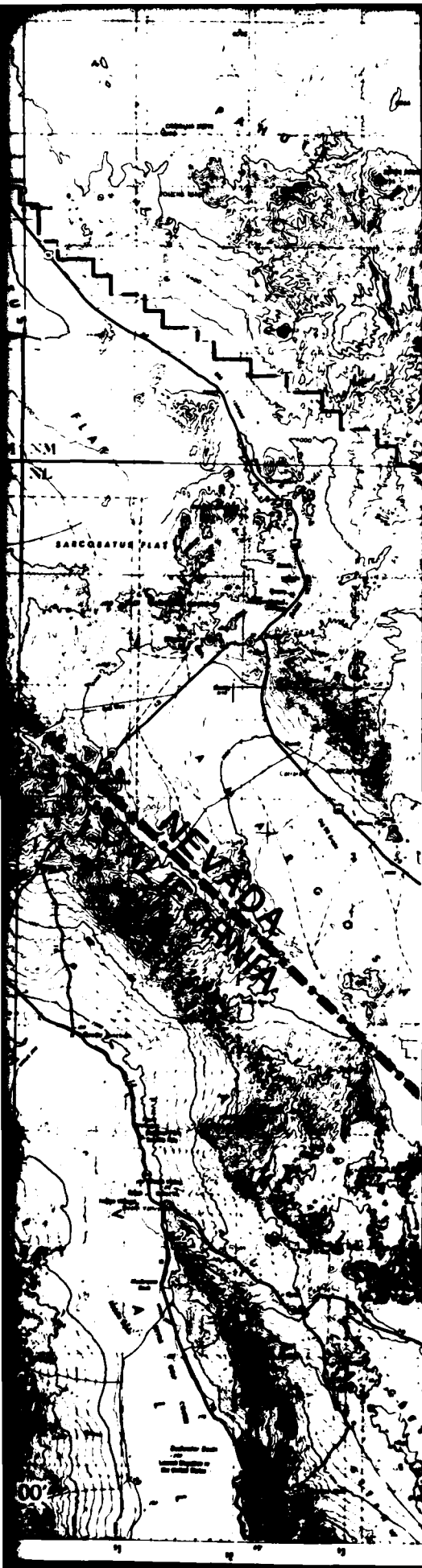


ROUTE OF ADDITIONAL DTN FOR MOB SITE AT BERYL OR MILFORD, UTAH.
REDUCTIONS IN DTN FOR AN MOB SITE IN COYOTE SPRING VALLEY ARE NOT SHOWN.

NOTES:

1. CLUSTERED AREAS ARE BASED ON 5200 x 200- FOOT SPACING, 2/3 FILLED HEXAGON-AL PATTERN, WITH 23 PRIMARY MULTIPLE PROTECTIVE STRUCTURES (SHELTERS).
2. THE NUMBER BY EACH VALLEY NAME IS THE NUMBER OF CLUSTERS BASED ON THE MOST RECENT LAYOUT DRAWINGS.
3. MOB/DAA AND OBTS/DTA OPTIONS REPRESENT LAND PARCEL DESCRIPTIONS DE-PICTED IN LAND ACQUISITION PACKAGE (17 SEPT 81).





3. PINE	PI	5	17		33	
4. SEVIER DESERT	SD	2	5			
5. SEVIER LAKE	SL	1	10			
6. SNAKE	SV	19	133	2	13	
7. TULE	TL	10	57			640 (1)
8. WAH WAH	WA	5	25			
9. WHIRLWIND	WW	12	52			
UT SUBTOTAL		61	362	2	46	640 (1)

NEVADA						
1. ANTELOPE	AN	4	30			
2. BIG SAND SPRINGS	BS	3	5			
3. BIG SMOKY	BS	10	44			
4. BUTTE	BV	9	38			
5. CAVE	CV	3	41			
6. COAL	CL	6	27			
7. DELAMAR	DM	3	11	9		
8. DRY LAKE	DL	10	46			
9. GARDEN	GN	6	22			
10. HAMLIN	HV	10	43	15	13	
11. HOT CREEK	HC	6	39			
12. JAKES	JV	3	16			
13. KOBEH	KB	5	35			
14. LAKE	LV	7	31			
15. LITTLE SMOKY	LS	4	29			
16. LONG	LG	4	51			
17. MONITOR	MV	6	33			
18. MULESHOE	MS	3	31			400 (1)
19. NEWARK	NK	5	46			640 (1)
20. PAHROC	PA	3	9			
21. PENoyer	PN	5	19			
22. RAILROAD	RR	13	104			
23. HALSTON	RV	9	53			
24. REVEILLE	RE	3	19			
25. SPRING	SP	4	15	7		
26. STEPTOE	SO	2	10			
27. STONE CABIN	ST	8	38			640 (1)
28. WHITE RIVER	WR	12	112			
NV SUBTOTAL		166	995	31	13	1680 (3)
TOTAL		227	1357	33	59	2320 (4)
				1390	1416	

MOB COMPLEXES	NUMBER OF MOB/DAA OPTIONS		NUMBER OF OBTS/DTA OPTIONS		DTN ROAD LENGTH (mile) MOB TO DDA		DTN ROAD LENGTH (mile) MOB TO OBTS/DTA	
	P	A	P	A	P	A	P	A
UTAH								
1. BERYL	1	1	1	1	19	19	8	18
2. MILFORD CENTRAL	1	—	1	1	21	—	7	7
3. MILFORD SOUTH	—	1	1	1	—	15	9	
NEVADA								
1. COYOTE SPRING	1	1	1	1	33	33	3	3

*STEPTOE VALLEY DELETED FROM FURTHER STUDIES AS OF SEPTEMBER 1981

+IOC VALLEYS

Notes:

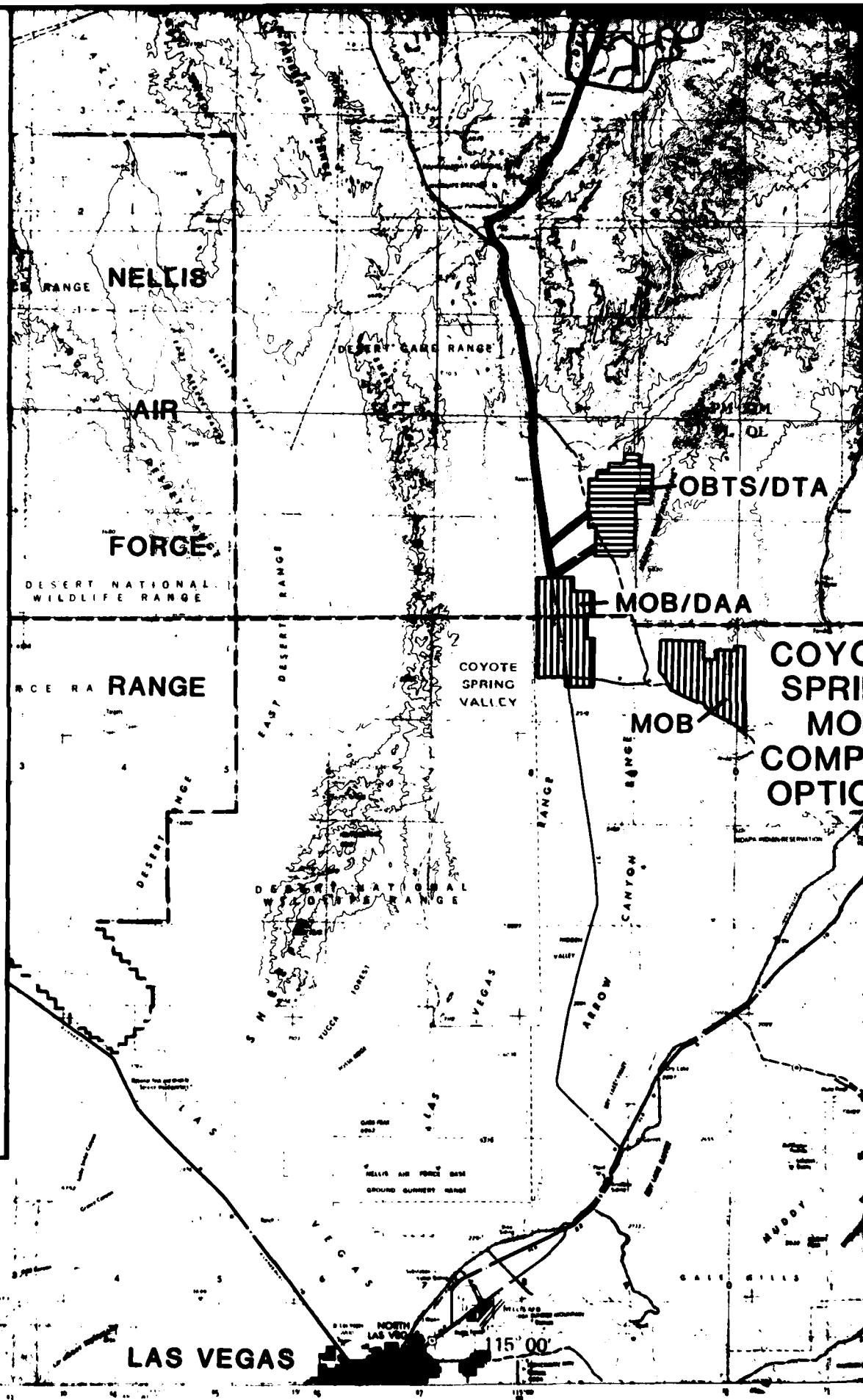
P is Preferred Option

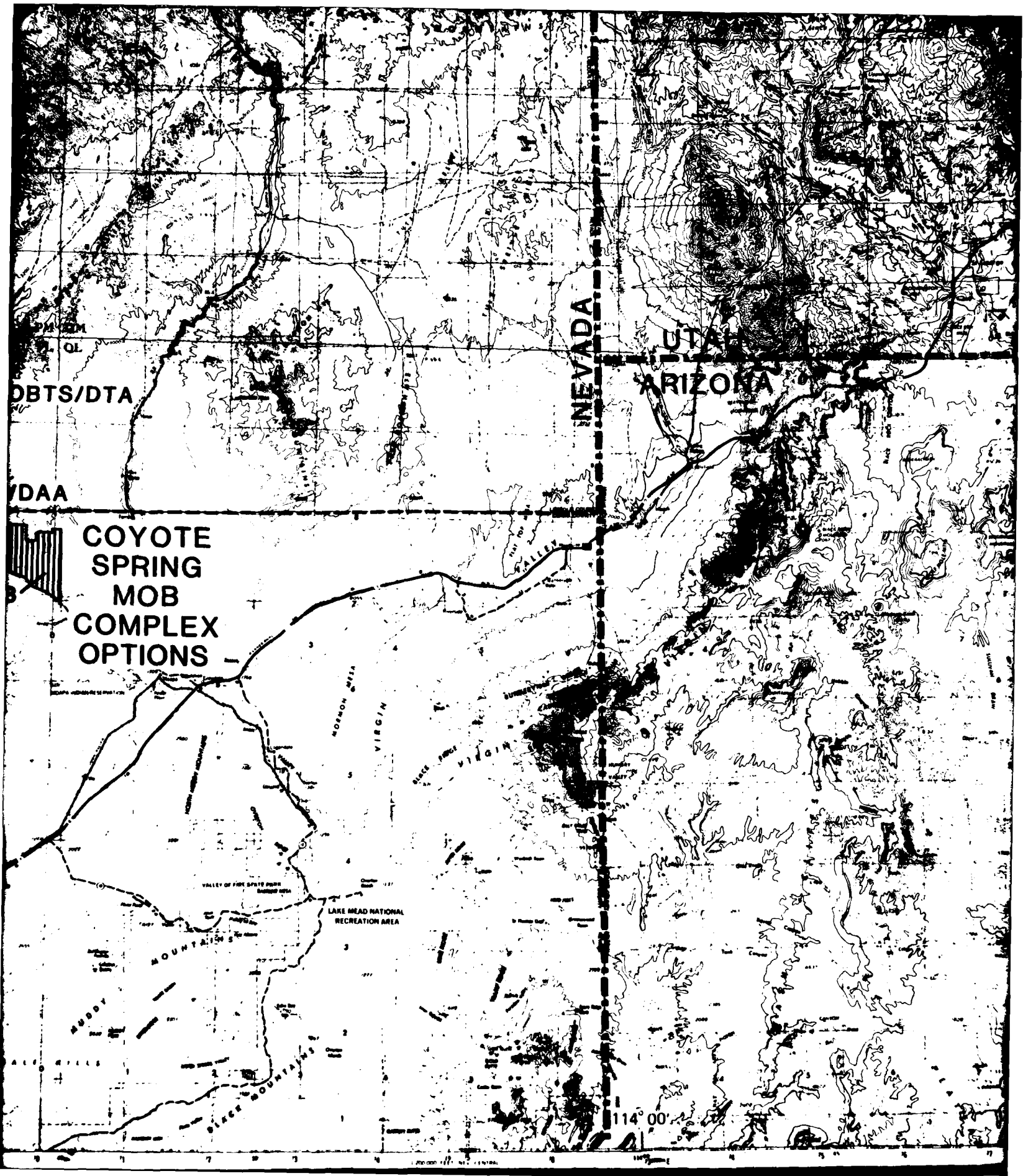
A is Alternate Option

(1) Number of ASC's

13	
	400 (1)
	640 (1)
	640(1)
13	1680(3)
59	2320(4)
1416	

N ROAD GTH (mile) S TO DDA		DTN ROAD LENGTH (mile) MOB TO OBTS/ DTA	
	A	P	A
	19	8	18
	—	7	7
	15	9	
	33	3	3







EXPLANATION



PORTION OF SUITABLE AREA CLUSTERED



CLUSTER ROAD NETWORK (CRN)



MAIN OPERATING BASE (MOB)/DESIGNATED ASSEMBLY AREA



OPERATIONAL BASE TEST SITE (OBTS)/DESIGNATED TRAIL



AREA SUPPORT CENTER (ASC)



ROUTE OF DESIGNATED TRANSPORTATION NETWORK (DTN)
SPRING VALLEY, NEVADA



ROUTE OF ADDITIONAL DTN FOR MOB SITE AT BERYL OR
REDUCTIONS IN DTN FOR AN MOB SITE IN COYOTE SPRING

NOTES:

1. CLUSTERED AREAS ARE BASED ON 5200 + 200- FOOT SPACIAL PATTERN, WITH 23 PRIMARY MULTIPLE PROTECTIVE
2. THE NUMBER BY EACH VALLEY NAME IS THE NUMBER OF MOST RECENT LAYOUT DRAWINGS.
3. MOB/DAA AND OBTS/DTA OPTIONS REPRESENT LAND PICTURED IN LAND ACQUISITION PACKAGE (17 SEPT 81).

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____



The Earth Technology Corporation

MX SITE
DEPARTMENT

MX SYSTEM
DESIGNATED DEPLOYMENT
NEVADA/

6 NOV 81

EXPLANATION



PORTION OF SUITABLE AREA CLUSTERED



CLUSTER ROAD NETWORK (CRN)



MAIN OPERATING BASE (MOB)/DESIGNATED ASSEMBLY AREA (DAA) OPTIONS



OPERATIONAL BASE TEST SITE (OBTS)/DESIGNATED TRAINING AREA (DTA) OPTIONS



AREA SUPPORT CENTER (ASC)



ROUTE OF DESIGNATED TRANSPORTATION NETWORK (DTN) FOR MOB SITE IN COYOTE SPRING VALLEY, NEVADA



ROUTE OF ADDITIONAL DTN FOR MOB SITE AT BERYL OR MILFORD, UTAH.
REDUCTIONS IN DTN FOR AN MOB SITE IN COYOTE SPRING VALLEY ARE NOT SHOWN.

NOTES:

1. CLUSTERED AREAS ARE BASED ON 5200 + 200- FOOT SPACING, 2/3 FILLED HEXAGON-AL PATTERN, WITH 23 PRIMARY MULTIPLE PROTECTIVE STRUCTURES (SHELTERS).
2. THE NUMBER BY EACH VALLEY NAME IS THE NUMBER OF CLUSTERS BASED ON THE MOST RECENT LAYOUT DRAWINGS.
3. MOB/DAA AND OBTS/DTA OPTIONS REPRESENT LAND PARCEL DESCRIPTIONS DE-PICTED IN LAND ACQUISITION PACKAGE (17 SEPT 81).

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____



MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE
BMO/AFRCE-MX

MX SYSTEM DESIGNATED DEPLOYMENT AREA NEVADA/UTAH

6 NOV 81

DRAWING 5-1

157

157