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Liaison 3

EG&G ENERGY MEASUREMENTS

Santa Barbara Operations

EG&G ENERGY MEASUREMENTS, INC., 101 CONVENTION CENTER DRIVE, LAS VEGAS, NEVADA 89109

TEL: (702)794-7463

WBS 1.2.13.4
NQA

July 8, 1993
LV93-RAG-45

Wendy Dixon, Director
Project and Operations Control Division
Yucca Mountain Project Office
DOE Field Office, Nevada
P. O. Box 98518
Las Vegas, NV 89193-8518

I-344265

JUNE 1993 PROGRESS REPORT

Attached is the June 1993 progress report on biological studies and support activities conducted by EG&G/EM for the Yucca Mountain Site Characterization Project. Please contact Tom O'Farrell (293-7762) or me (794-7474) if you have questions regarding this report.

W. Kent Ostler, Manager
Environmental Sciences Department

RG:vk

Attachment

cc: G. Ryder, DOE/YMP
D. Sorensen, SAIC
P. Schilling, SAIC

DIXON
SEARCHED
SERIALIZED
CO: RYDER
CO: HAMILTON-RAY
CO: JORJE/MCCANN-SAIC
CO: SCHRECONGOSI/BROSKY
CO: MORRIS/SONES-S
CO: SIMMONS/GANDT
CO: OCB RC/BERTZ
CO: NEWBURY/JOHNSON-SO

REC'D IN YMP. SMITH-2

7/9/93

1028

ENCLOSURE 1

RPTS 1.10

7-8-93

9309010059

**YUCCA MOUNTAIN PROJECT
BIOLOGICAL RESOURCES PROGRAM
MONTHLY PROGRESS REPORT
JUNE 1993**

Summary of Work Accomplished During Report Period

EG&G Energy Measurements (EG&G/EM) conducted work for the Biological Resources task (WBS 1.2.13.4.11) for the Project Office. Activities included conducting preactivity surveys; continuing site characterization effects studies, support studies for the radiological monitoring program, desert tortoise studies, and habitat reclamation studies; development of work instructions and study designs for new studies; and responding to requests for biological support by Project Office.

KEY ISSUES and CONCERNS

- The Special Forces are scheduled to use the Calico Hills from August 8-23 for training. EG&G/EM has established a "Control Area" on the southwestern edge of the Calico Hills for monitoring site characterization effects on tortoises near Yucca Mountain. Restricted or refusal of access into this area may result in loss of irretrievable data. Lack of coordination could place tortoises at risk, particularly if access is denied without notice. EG&G/EM raised the issue of developing a formal coordination process between the Army and YMP contractors in our December 1992 monthly report to Project Office. The issue is raised again to help ensure that access restrictions are given to EG&G/EM in a timely manner and that we do not have to deal with the Army in an ad hoc process.

MAJOR ACCOMPLISHMENTS

- All work was part of ongoing studies.

PLANNED WORK NOT ACCOMPLISHED

- None.

MAJOR WORK IN PROGRESS

- EG&G/EM conducted eleven preactivity surveys for proposed activities to assess potential impacts on biological resources. One reclamation inventory was completed. Seven biological resource survey and five reclamation inventory reports were submitted to Project Office. Tortoise resurveys were conducted at four sites. EG&G/EM met with Project Office (W. Dixon) to discuss preactivity survey priorities.
- EG&G/EM continued monitoring radiomarked tortoises. Female tortoises are being monitored closely for the Reproduction Success Study. Nineteen tortoise nests have been located. An amended Federal Permit was received that allows EG&G/EM to x-ray female tortoises to determine clutch size. One tortoise was found inside the fence of the borrow pit.
- EG&G/EM continued monitoring animal populations and vegetation communities for the Radiological Monitoring (RMP) and Site Characterization Effects Programs (SCEP). Radiomarked quail were located each week during the month. Small mammal populations were monitored at eight ecological study plots and at three radiological monitoring locations by capturing, marking, and recapturing individual animals. Vegetation studies for the SCEP continued. Production samples continued to be collected on ecological study plots for the SCEP. This task is almost completed and is expected to be completed in July.
- Seedling density was measured on reclamation site 1, on the crest of Yucca Mountain, Well JF3, and Trench A'2. This task is completed for FY93. Soil samples were collected at the borrow pit (second sampling) and UZ-16 (first sampling) topsoil stockpiles to measure soil viability (i.e., biological activity).



Las Vegas Area Operations

EG&G ENERGY MEASUREMENTS, INC., P.O. BOX 1912, LAS VEGAS, NEVADA 89125

WBS 1.2.5.3.6

QA: NA

I-342554

AK

May 28, 1993
NV-93-431

Mr. Carl P. Gertz, Project Manager
U.S. Department of Energy
Yucca Mountain Site Characterization Project Office
101 Convention Center Drive
Las Vegas, NV 89109

APRIL 1 - APRIL 30, 1993 PROGRESS REPORT - EG&G/ENERGY
MEASUREMENTS REMOTE SENSING LABORATORY SUPPORT TO THE
YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

Enclosed is a progress report on the EG&G Energy Measurements (EG&G/EM)
Remote Sensing Laboratory (RSL) support to the Yucca Mountain Site Characterization
Project (YMP) for April 1, 1993 through April 30, 1993.

The progress report for EG&G/EM RSL support to YMP includes the following
sections:

- o Work Accomplished
- o Expenditures
- o Status of Deliverables

If you have any questions, please contact Elaine Ezra at (702) 794-7449.

James Michael, Manager
NV Program

CE:ns

Enclosures

DIVISION DYER

CC: BLANCHARD

CC: DIXON

CC: GRASSMEIER w/o

CC: ROBISON

CC: RYDER

CC: WILLIAMS-D

CC: GERTZ

CC: SOHUSOU

LORENZ
NEWBURY
SIMMONS
WILSON

REC'D IN YMP
6/2/93

ENCLOSURE 2

5/28/93
RPTS 5

Carl P. Gertz

APRIL 1 - APRIL 30, 1993 PROGRESS REPORT - EG&G/ENERGY
MEASUREMENTS REMOTE SENSING LABORATORY SUPPORT TO THE
YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

May 28, 1993

Page 2

cc: S. Ronshaugen, DOE/NV EMD (w/o encl)
M. Blanchard, DOE/YMP (w/o encl)
S. Bodnar, M&O (w/o encl)
W. Dixon, DOE/YMP (w/o encl)
M. Dockter, DOE/NV (w/o encl)
R. Dyer, DOE/NV (w/o encl)
J. Lorenz, REECo/YMP
C. Newbury, DOE/YMP
A. Robison, DOE/YMP (w/o encl)
M. Ryder, DOE/YMP (w/o encl)
A. Simmons, DOE/YMP
D. Williams, DOE/YMP (w/o encl)
W. Wilson, DOE/YMP

PROGRESS REPORT FOR EG&G/EM RSL SUPPORT TO YMP
Work Accomplished

WBS 1.2.3 **SITE INVESTIGATIONS**

WBS 1.2.3.1 **SITE INVESTIGATIONS COORDINATION AND PLANNING**

REPORT PERIOD: April 1, 1993 - April 30, 1993

REPORT DATE: May 24, 1993

RESPONSIBLE INDIVIDUAL: D.W. Brickey

SUMMARY OF WORK ACCOMPLISHED DURING REPORT PERIOD:

1. Simon Houlding (Lynx) provided Dave Brickey with a data file for use in the Dynamic Graphics conversion. Dave sent the file to Dynamic Graphics with a letter describing the format and contents.
2. Dave Brickey spoke with Garth Kirkham (Lynx) to determine if it is possible to output 2-D surface data from a Lynx GMS model built with cross-sections. According to Kirkham, this cannot be done.
3. Dave Brickey attended a Lynx seminar held at the International High Level Radioactive Waste Management Conference on April 30.
4. Jim Nelson (SAIC-Golden) visited the YMP SO offices on April 30 to discuss the YMP 3-D modeling activities.

MAJOR PROBLEMS AND CORRECTIVE ACTION UNDERTAKEN: None.

ANTICIPATED SIGNIFICANT EVENTS PLANNED DURING NEXT REPORT PERIOD:

1. Dynamic Graphics will evaluate the Lynx data formats and compile recommendations as to the required course of action to develop a format conversion.
2. Dave Brickey will attend a demo of Lynx for Morrison-Knudsen.
3. USGS will provide EG&G/EM with a digital tape of the Lynx 3D model for the Topopah Spring Member.

PROGRESS REPORT FOR EG&G/EM RSL SUPPORT TO YMP
Work Accomplished

WBS 1.2.5 **REGULATORY**

WBS 1.2.5.3.5 **TECHNICAL DATABASE INPUT**

REPORT PERIOD: April 1, 1993 - April 30, 1993

REPORT DATE: May 24, 1993

RESPONSIBLE INDIVIDUAL: C.E. Ezra

SUMMARY OF WORK ACCOMPLISHED DURING REPORT PERIOD:

1. None.

MAJOR PROBLEMS AND CORRECTIVE ACTION UNDERTAKEN: None.

ANTICIPATED SIGNIFICANT EVENTS PLANNED DURING NEXT REPORT PERIOD:

1. None.

PROGRESS REPORT FOR EG&G/EM RSL SUPPORT TO YMP
Work Accomplished

WBS 1.2.5 **REGULATORY**

WBS 1.2.5.3.6 **GEOGRAPHIC NODAL INFORMATION STUDY AND
EVALUATION SYSTEM (GENISES)**

SA OE536A **GENISES TECHNICAL DATABASE**

REPORT PERIOD: April 1, 1993 - April 30, 1993

REPORT DATE: May 24, 1993

RESPONSIBLE INDIVIDUAL: J. Beckett

SUMMARY OF WORK ACCOMPLISHED DURING REPORT PERIOD:

1. Representatives from the NRC visited the YMP SO offices on April 29 to discuss the GENISES database and system design. Attendees included Don Chery and John Gilray (NRC), Rawley Johnson and John Russell (NCWRA) and Ardyth Simmons. Feedback from Don Chery was that he was very impressed with the GIS and Technical Database design implementation; and highly complementary of Jim Beckett's presentation and database development activities.

The NRC is planning to equip their San Antonio laboratory with an Silicon Graphics Crimson computer system with Reality Engine graphics software (~\$135K) and Dynamic Graphics EarthVision software. Chery also indicated that the NRC will build a system similar to GENISES, which will be comprised of SUN workstations, Arc/Info, ArcView and INGRES.

2. The ArcView basemaps and their documentation were completed and submitted to DOE/YMPO (Ezra to Simmons, dtd. 4/23/93). ArcView basemaps were installed on systems for Dennis Williams and Ardyth Simmons (DOE/YMPO), John Gauthier (WCFS), and EG&G/EM Environmental Sciences and GENISES systems.
3. Two SEPDB backlog reports were completed and the first of the two was submitted to DOE/YMPO. The first report provided a listing, by Participant organization, of the status of the backlogged SEPDB submittals and any action required by the Participant (e.g. preparation of a TDIF or assignment of a data tracking number). The second report, which details the scope of work required by

EG&G/EM GENISES staff to process backlogged SEPDB data, will be submitted to YMPO the first week in May.

4. The definition and scope of GENISES and its component parts (Technical Database, Non-technical database, and metadata) are currently being refined. The GENISES database design report, in turn, is also under revision. A draft of the GENISES database design report will be submitted to Ardyth Simmons (DOE/YMPO) for review during the first two weeks in June.
5. The following submittals to the GENISES Technical Database were received:
 - LANL - Calcite-Silica Deposits in Trench 14 and Busted Butte on April 7.
 - SAND84-1101 Report - Uniaxial and Triaxial Compression Test Series on the Topopah Spring Tuff from USW G-4, Yucca Mountain, Nevada (SNSAND84220200.000) on April 15.
 - SAND85-0762 Report - Bulk, Thermal, and Mechanical Properties of the Topopah Spring Member of the Paintbrush Tuff, Yucca Mountain, Nevada (SNSAND85076200.000) on April 15.
6. The following submittals to the GENISES Technical Database were processed:
 - GS921208315122.01 - USGS data for site locations; physical and chemical properties; major and some minor ions; and ostracode species presence and absence for 106 spring and wetland sites from the eastern part of the United States on April 19.
7. The following backlogged submittals to the SEPDB were processed administratively into the GENISES Technical Database:
 - SAND86-1131 (SNSAND86113100.000) - accepted by SEPDB on 1/26/88.
 - SAND84-1076 (SNSAND84107600.000) - accepted by SEPDB on 6/9/88.
 - SAND88-0624 (SNSAND88062400.000) - accepted by SEPDB on 5/31/88.
 - SAND88-0811 (SNSAND88081100.000) - accepted by SEPDB on 2/23/89.
 - SAND88-0882 (SNSAND88088200.000) - accepted by SEPDB on 4/14/89.
 - LA-11787-MS (LA000000000002.001) - accepted by SEPDB on 3/31/92.
 - LA-11497-MS (LA000000000018.001) - accepted by SEPDB on 10/31/89.

- LA-10927-MS (LA000000000039.001) - accepted by SEPDB on 5/25/87.

8. The following non-quality affecting tabular reports were generated from the GENISES Technical Database:

- A tabular report of water permeability data available for hydrogeologic units identified at Yucca Mountain was prepared for Sue Braumiller (M&O/INTERA) on April 21.
- A tabular report of the following properties were provided to Carl Bruch (M&O/INTERA) on April 28 from the GENISES Technical Database:

Bulk chemistry/whole rock analyses data for USW G-1, USW G-2, USW GU-3, USW G-4, UE-25a #1 at various sample depths.

Bulk modulus of outcrop samples for the welded, devitrified Topopah Spring member of the Paintbrush Tuff.

Geohydrology/bulk density values for H-1 and G-4.

Note: Some technical data was requested, but is part of the unprocessed SEPDB backlog. Copies of the reports were provided to the requestor.

- A tabular report of the following properties were provided as a partial delivery to Sue Braumiller (M&O/INTERA) on April 28, April 29, and April 30 from the GENISES Technical Database:

Minerals in fractures of the saturated zone from drill core.

Water levels.

Drillhole Surface information.

Thermal conductivity.

Note: Some technical data was requested, but is part of the unprocessed SEPDB backlog. Copies of the reports were provided to the requestor.

MAJOR PROBLEMS AND CORRECTIVE ACTION UNDERTAKEN: None

MAJOR PROBLEMS AND CORRECTIVE ACTION UNDERTAKEN: None

ANTICIPATED SIGNIFICANT EVENTS PLANNED DURING NEXT REPORT PERIOD:

1. A GENISES staff representative will attend a Tracers, Fluids, and Materials Database planning meeting scheduled for May 6.
2. Most of the currently held submittals to the GENISES Technical Database will be processed.
3. Links between the processed SEPDB files and GENISES Technical Database will be established.

PROGRESS REPORT FOR EG&G/EM RSL SUPPORT TO YMP
Work Accomplished

WBS 1.2.5 **REGULATORY**

WBS 1.2.5.3.6 **GEOGRAPHIC NODAL INFORMATION STUDY AND
EVALUATION SYSTEM (GENISES)**

SA OE536B **SITE ATLAS**

REPORT PERIOD: April 1, 1993 - April 30, 1993

REPORT DATE: May 24, 1993

RESPONSIBLE INDIVIDUAL: B. Kistler

SUMMARY OF WORK ACCOMPLISHED DURING REPORT PERIOD:

1. Text page revisions for the FY93 Site Atlas were initiated.
2. New formats for the map frames were designed and initiated.
3. YMPSO was added to the distribution list for the YMP pre-activity survey reports.

MAJOR PROBLEMS AND CORRECTIVE ACTION UNDERTAKEN: None.

ANTICIPATED SIGNIFICANT EVENTS PLANNED DURING NEXT REPORT PERIOD:

1. Drafts of all of the FY93 Site Atlas text pages will be completed.
2. Site Atlas coverage development will be initiated.
3. Continued data collection and map preparation.

PROGRESS REPORT FOR EG&G/EM RSL SUPPORT TO YMP
Work Accomplished

WBS 1.2.5 **REGULATORY**

WBS 1.2.5.3.6 **GEOGRAPHIC NODAL INFORMATION STUDY AND
EVALUATION SYSTEM (GENISES)**

SA OE536C **GIS, MAPPING AND ANALYSIS**

REPORT PERIOD: April 1, 1993 - April 30, 1993

REPORT DATE: May 24, 1993

RESPONSIBLE INDIVIDUAL: C.E. Ezra

SUMMARY OF WORK ACCOMPLISHED DURING REPORT PERIOD:

1. GIS map products were generated to support project participants and are detailed in the "Deliverables" statement.

2. Other "non-map" products include the following:
 - Three 8"x10" color infrared satellite images of Yucca Mountain were provided to Robert Loux on April 1.

 - Three 9"x9" duraflex prints (Perf #6771; frames 8652, 8653, 8654) were provided to Chris Fridrich (USGS) on April 2.

 - Three B&W paper prints of the 1:6,000 scale orthophoto sheet #5, cropped to the north-central area, were provided to David Buesch (USGS) on April 2.

 - One color viewgraph of YMP-93-012.2 "Borehole Summary" was provided to Rick Weeks (SAIC/YMPQAD) on April 2.

 - Three 2X enlarged B&W paper prints of the 1:12,000 scale orthophotos for sheets #4, #5, #10 and #11 were provided to Chris Fridrich (USGS) on April 5.

- One 40"x40" color duraflex print of each of the following were provided to Jim Brune (UNR Seismological Laboratory) on April 6:

<u>Perf#</u>	<u>Frame#</u>
7246	58
7161	101
7161	103
7161	105
7161	107

- One 9"x9" color paper print of each of the following were provided to Scott Lundstrum (USGS) on April 8:

<u>Perf#</u>	<u>Frame#</u>
6766	7423-7430
6766	7496-7504
6766	7505-7508
6766	7589-7593
6767	7708-7710

- One mylar print each of the 1:12,000 scale orthophoto sheets #13, #18, #19, #24, #25, #30, and #31 were provided to Scott Lundstrum (USGS) on April 8.
- One mylar print of the 1:12,000 scale orthophoto sheet #20 was provided to Chris Fridrich (USGS) on April 8.
- A tabular report of existing and planned surface-based activities was prepared for John Gauthier (WCFS) on April 12.
- Two mylar copies of YMP-93-127.0 "Existing and Proposed Boreholes" was provided to Cady Johnson (WCFS) on April 15.
- One 20"x24" color print of EG&G Negative No. 91L1086L was provided to Allison Inglett (SAIC) on April 16.
- Ten 8.5"x11" color prints, five 8"x10", and five 35mm color slides were generated from EG&G Negatives No. 91L1086L and 91L1087L and provided to Carma Hernandez (SAIC) on April 21.
- Forty 8.5"x11" color prints were generated from EG&G Negative No. 667720 and provided to Carma Hernandez (SAIC) on April 21.

- A tabular report of all surface-based activities, listing the activity identifier, status, type and date of completion, was provided to David Tang on April 22.
- Three color prints and three color transparencies of EG&G Negative No. 6301-58 were provided to Jerry Lorenz on April 22.
- Fifteen latitude/longitude coordinates for water table boreholes were projected to Universal Transverse Mercator meter coordinates and a tabular report prepared for Audrey Hughes (EG&G/EM SBO) on April 26.
- One 40"x40" color duraflex print of EG&G Negative No. 7287-013 was provided to Jerry Lorenz on April 27.
- A tabular report was generated listing the activity identifier, Nevada State Plane easting and northing coordinates and ground elevation for existing and planned surface-based activities and provided to Bob Elayer (M&O) on April 27.
- Two viewgraphs of YMP-93-150.0 "YMP Project Boundaries" were provided to Jim Houseworth (M&O) on April 30.

MAJOR PROBLEMS AND CORRECTIVE ACTION UNDERTAKEN:

1. The YMP GIS Map Production group is currently understaffed by 3.0 FTE, due to attrition and difficulty in hiring qualified GIS analysts. Interviews for GIS analysts have been and continue to be conducted. Several offers have been extended. One of these positions will be filled in early May, and a second position will be filled by the end of June. Filling these positions will significantly improve our response time for GIS products.

ANTICIPATED SIGNIFICANT EVENTS PLANNED DURING NEXT REPORT PERIOD:

1. Continued level-of-effort.

PROGRESS REPORT FOR EG&G/EM RSL SUPPORT TO YMP
Work Accomplished

WBS 1.2.5 **REGULATORY**

WBS 1.2.5.3.6 **GEOGRAPHIC NODAL INFORMATION STUDY AND
EVALUATION SYSTEM (GENISES)**

SA OE536D **REMOTE SENSING**

REPORT PERIOD: April 1, 1993 - April 30, 1993

REPORT DATE: May 24, 1993

RESPONSIBLE INDIVIDUAL: C.E. Ezra

SUMMARY OF WORK ACCOMPLISHED DURING REPORT PERIOD:

1. A list of remote sensing data collection systems and their specifications available through the DOE Remote Sensing Laboratory were recompiled as an attachment to the YMP Remote Sensing Requirements survey and submitted to Ardyth Simmons (DOE/YMPO).
2. The response to the O'Leary (USGS) request for a cost estimate to acquire thermal infrared imagery was completed and submitted to DOE/YMPO.
3. The response to the Crowe (LANL) request for a cost estimate to acquire orthophoto and topographic mapping of the volcanic study areas was completed and submitted to DOE/YMPO.

MAJOR PROBLEMS AND CORRECTIVE ACTION UNDERTAKEN: None.

ANTICIPATED SIGNIFICANT EVENTS PLANNED DURING NEXT REPORT PERIOD:

1. If approved, the orthophoto planning for the Crowe volcanic study will be initiated.

PROGRESS REPORT FOR EG&G/EM RSL SUPPORT TO YMP
Work Accomplished

WBS 1.2.5 **REGULATORY**

WBS 1.2.5.3.6 **GEOGRAPHIC NODAL INFORMATION STUDY AND
EVALUATION SYSTEM (GENISES)**

SA OE536E **COMPUTER SUPPORT**

REPORT PERIOD: April 1, 1993 - April 30, 1993

REPORT DATE: May 24, 1993

RESPONSIBLE INDIVIDUAL: C.W. Logan

SUMMARY OF WORK ACCOMPLISHED DURING REPORT PERIOD:

1. The YMP FY94 IRM Short Range Plan was completed and submitted to DOE/YMPO.
2. A meeting was held on April 7 with John Gandi, Mary Ann Jones, Claudia Newbury, and Ardyth Simmons (DOE/YMPO), Jim Beckett, Elaine Ezra and Todd Radermacher (EG&G/EM) and Ed Jorgensen and Jesse Smith (SAIC) to discuss possible impacts of ArcView and on-line access to the Technical Database on the existing network, and future network requirements.
3. Todd Radermacher attended a high resolution CCD Camera system demonstration hosted by the M&O on April 7.
4. Todd Radermacher attended a vendor demonstration on a dual interface protocol analyzer from Wandel and Goltermann on April 8.
5. A meeting was held with Dave Brune (SAIC), Floyd Freeman, Bill Kerr, Chuck Logan and Todd Radermacher (EG&G/EM) to discuss network requirements.
6. Todd Radermacher attended the IRM Council meetings April 27-28.
7. WordPerfect for X-Windows (8 seats) was installed on the YMPSO system.
8. The Colorado Memory System to support data transfers to the FOC facility was received and installed during April.

9. PC-NFS and WordPerfect 5.2 for Windows was installed on the YMPSO 486-PC machine which is available for use by Participants for PC ArcView. NFS software allows the PC to access the GENISES workspaces, and access to the SPARCprinter and Tektronix Phaser III color printers.
10. Two additional ArcView licenses were installed on the YMPSO GENISES system.
11. Drafts of the existing network configuration and the proposed wide area connection configuration drawings were completed and reviewed with John Gandi (DOE/YMPO).
12. Two of the three X-terminal were configured and installed on the GENISES system at the YMPSO offices. The third X-terminal was returned for replacement.

MAJOR PROBLEMS AND CORRECTIVE ACTION UNDERTAKEN: None.

ANTICIPATED SIGNIFICANT EVENTS PLANNED DURING NEXT REPORT PERIOD:

1. Continued progress was made on the hardware/software configuration plan.
2. Dynamic Graphics, Inc., updates to Directed Well Display 3.0 and Display File Output 2.0 software modules will be installed on the SGI 3-D modeling workstation at the YMPSO.
3. EarthVision 1.1 and Explorer will be installed on the SGI 3-D modelling workstation at the YMPSO facility.

PROGRESS REPORT FOR EG&G/EM RSL SUPPORT TO YMP
Work Accomplished

WBS 1.2.5 **REGULATORY**

WBS 1.2.5.3.6 **GEOGRAPHIC NODAL INFORMATION STUDY AND
EVALUATION SYSTEM (GENISES)**

SA OE536F **CAPITAL EQUIPMENT**

REPORT PERIOD: April 1, 1993 - April 30, 1993

REPORT DATE: May 24, 1993

RESPONSIBLE INDIVIDUAL: C.W. Logan

SUMMARY OF WORK ACCOMPLISHED DURING REPORT PERIOD: None.

1. A Calcomp vendor demo was held at the YMPSO offices on April 6 as part of the electrostatic plotter evaluation.
2. A Rastergraphics vendor demo was held at the RSL facility on April 7 as part of the electrostatic plotter evaluation.
3. Todd Radermacher attended a vendor demo for a Roche image scanner system on April 7, hosted by the M&O.
4. Dave Brickey, Bill Demas, and Todd Radermacher attended the National Association of Broadcasters conference vendor displays at the Las Vegas Convention Center on April 22. Scanner, file server and multimedia equipment and software were demonstrated.

MAJOR PROBLEMS AND CORRECTIVE ACTION UNDERTAKEN: None.

ANTICIPATED SIGNIFICANT EVENTS PLANNED DURING NEXT REPORT PERIOD:

1. Research on FY93 capital equipment items will continue.
2. Dave Brickey will meet with Zeh Graphics about plotting software.
3. Discussions with plotter clients that use the plotters we are considering purchasing will be conducted.

PROGRESS REPORT FOR EG&G/EM RSL SUPPORT TO YMP
Work Accomplished

WBS 1.2.5 **REGULATORY**

WBS 1.2.5.3.6 **GEOGRAPHIC NODAL INFORMATION STUDY AND
EVALUATION SYSTEM (GENISES)**

SA OE536G **PROJECT MANAGEMENT**

REPORT PERIOD: April 1, 1993 - April 30, 1993

REPORT DATE: May 24, 1993

RESPONSIBLE INDIVIDUAL: C.E. Ezra

SUMMARY OF WORK ACCOMPLISHED DURING REPORT PERIOD:

1. **Reporting/Tracking/Planning**

- EG&G/EM RSL March Progress report was compiled and submitted to DOE/YMPO.
- March PACS input was compiled and submitted to John Slocum (M&O).
- FY94 budget projections for WBS 1.2.12 were prepared and submitted to DOE/YMPO.

2. **Meetings/Conferences/Training:**

- Technical Data Managers staff meetings were held with Ardyth Simmons (YMPO), Steve Bodnar and Bob Lewis (M&O), and Elaine Ezra and Jim Beckett (EG&G/EM) on April 5 and April 19.
- Elaine Ezra attended the SPIE 1993 Symposium on Aerospace and Remote Sensing during the week of April 12 - 16 for sessions on digital orthophotography.
- Chuck Logan attended the Software Advisory Group (SAG) meeting in Denver on April 13.
- Todd Radermacher attended the IRM Council meeting April 27 - 28.

- Several YMPSO staff members attended the 4th Annual International High Level Radioactive Waste Management Conference and Exposition during the week of April 26 - 30.
3. Employee Actions:
- Todd Radermacher joined the YMPSO on April 5 and will provide on-site computer and network support.
 - Interviews for two Scientist II GIS analyst positions were conducted in April.
 - Christopher Berlien was hired for the assistant GENISES Technical Database Administrator position, and will start on May 3.
 - An offer was extended to Jerry Sommerfeld to fill one of the GIS Scientist I positions. Several interviews conducted for the second Scientist I position were conducted and an offer will be made to one of the applicants. It is anticipated that both Scientist I positions will be hired by the end of May.
4. Records Management:
- Joanna Wiggins attended the Records Coordinators meeting on April 26 - 27.
 - The records management quality assurance procedure has been drafted and is under internal review. A requirements matrix was developed for the revised records management procedure and the applicable requirements of the revised QARD.
5. Quality Assurance:
- A meeting was held with Katherine Hampton (YMPQAD), Elaine Ezra, Debbie Mogar and Eddie Godfrey on April 9 to discuss whether EG&G/EM's QA program should be under the YMP DOE QA program or stand alone.
 - A meeting was held with Joanna Wiggins and Eddie Godfrey on April 15 to review the YMP QMPs and QAAPs.
 - Joanna Wiggins met with Bob Constable (DOE/YMPO) on April 16 to discuss the EG&G/EM QA program and status of outstanding CARs.
 - A meeting was held with Debbie Mogar and Eddie Godfrey on April 20.

- A draft of the QARD Requirements Matrix was prepared and informally submitted to YMPQAD. This matrix was used to generate a status report on the EG&G/EM YMP Quality Assurance Program (Jenkins to Spence, dated 4/21/93). An estimated schedule to complete the revision and/or development of procedures required to bring the existing EG&G/EM QA program into compliance with the requirements of the revised QARD.
- A letter was drafted (Zavattaro to Spence, dated 4/23/93) requesting closure of an action item to provide YMPQAD a copy of the revised EG&G/EM software quality assurance program (SQAP) and its implementing procedures for review.

MAJOR PROBLEMS AND CORRECTIVE ACTION UNDERTAKEN: None.

ANTICIPATED SIGNIFICANT EVENTS PLANNED DURING NEXT REPORT PERIOD:

1. Interviews for the Scientist II positions will continue for qualified external applicants.
2. Efforts to resolve the remaining Conditions Adverse to Quality will continue.
4. YMPSO staff will meet with Jan Statler and Cindy Sellards to discuss technical data records in a meeting scheduled for May 7.
5. Elaine Ezra and Jim Beckett will attend the GeoData Policy Forum in Washington, D.C., during the week of May 10.
6. Todd Radermacher will attend System Administrators Essentials Course in Milpitas, California, during the week of May 17.
7. Dave Brickey will assist at the YMP Technical Information Display at the Geological Society of America conference in Reno, Nevada, during the week of May 17.
8. Rose Broderick and Sue Rohde will attend the ESRI Annual Users Conference in Palm Springs, California, during the week of May 24.

Expenditures from March 28, 1993 to April 25, 1993
(Dollars in thousands)

<u>Task</u>	<u>Budget</u>	<u>April Cost</u>	<u>Total Costs To Date</u>	<u>Remaining</u>
WBS 1.2.3 Site Investigations	\$ 50.0	\$ 0.3	\$ 6.6	\$ 43.4
WBS 1.2.5 Regulatory	\$2,320.0	\$ 117.7	\$ 931.0	\$1,389.0
WBS 1.2.15 Support Services	<u>\$ 176.0</u>	<u>\$ 9.7</u>	<u>\$ 68.1</u>	<u>\$ 107.9</u>
TOTALS	\$2,546.0	\$ 127.7	\$ 1005.7	\$1,540.3

STATUS OF DELIVERABLES FOR EG&G/EM RSL SUPPORT TO YMP

April 1, 1993 through April 30, 1993

GIS MAP SUPPORT

<u>Description</u>	<u>Requested by/ Organization</u>	<u>Date Sent</u>	<u>Size</u>	<u>No. of Copies</u>
YMP-93-026.0 Historical Seismic Activity	Brune, UNR, Reno	4/1/93	Full	2
YMP-93-028.0 Test & Waste Isolation Evaluation Zone	Poulus/TRW	4/1/93	Page	5
YMP-93-040.0 Tortoise Sightings	Loux/State of NV	4/1/93	Full	1
YMP-93-038.0 Ecological Study Plot Number/Average Number of Vehicle Passes Per Day	Loux/State of NV	4/1/93	Full	1
YMP-93-036.0 Home Range of Quail #37 October 1992 to January 1993	Loux/State of NV	4/1/93	Full	1
YMP-93-035.0 Home Range of Quail #25 October 1992 to January 1993	Loux/State of NV	4/1/93	Full	1
YMP-93-034.0 Home Range of Quail #17 October 1992 to January 1993	Loux/State of NV	4/1/93	Full	1
YMP-93-033.0 Home Range of Quail #5 October 1992 to January 1993	Loux/State of NV	4/1/93	Full	1
YMP-93-032.0 Home Range of Quail #10 October 1992 to January 1993	Loux/State of NV	4/1/93	Full	1
YMP-93-031.0 Home Range of Quail #9 October 1992 to January 1993	Loux/State of NV	4/1/93	Full	1

YMP-93-030.0 Planned Trenches in the Site Area (Proposed Locations)	Loux/State of NV	4/1/93	Full	1
YMP-93-029.0 Planned Trenches and Test Pits in Regional Investigations (Proposed Locations)	Loux/State of NV	4/1/93	Full	1
YMP-93-023.0 Trenches	Loux/State of NV	4/1/93	Full	1
YMP-93-022.1 Proposed Locations of Seismic Reflection Profiles, 1993	Loux/State of NV	4/1/93	Full	1
YMP-93-021.0 Existing and Proposed Boreholes within 2 KM of UZ-16	Loux/State of NV	4/1/93	Full	1
YMP-93-007.0 Near-Field Radiological Monitoring Sites	Loux/State of NV	4/1/93	Full	1
YMP-93-002.0 Potentially Useable Areas	Loux/State of NV	4/1/93	Full	1
YMP-92-257.0 Air Quality and Meteorology Monitoring Sites	Loux/State of NV	4/1/93	Full	1
YMP-92-250.1 YMP Tortoise Road Observations	Loux/State of NV	4/1/93	Full	1
YMP-92-245.0 YMP Drillhole and Pits	Loux/State of NV	4/1/93	Full	1
YMP-92-240.0 Existing Drillholes, Repository Block Area	Loux/State of NV	4/1/93	Full	1
YMP-92-233.1 Repository Drifts and CH Ramps	Loux/State of NV	4/1/93	Full	1
YMP-92-192.0 General Reference	Loux/State of NV	4/1/93	Full	1
YMP-92-191.0 Overall Site Plan	Loux/State of NV	4/1/93	Full	1

YMP-92-189.0 Existing Seismic Drillholes in the Vicinity of YM South Area	Loux/State of NV	4/1/93	Full	1
YMP-92-188.0 Existing Seismic Drillholes in the Vicinity of YM North Area	Loux/State of NV	4/1/93	Full	1
YMP-92-187.0 Invertebrate Sampling Plots	Loux/State of NV	4/1/93	Full	1
YMP-92-172.0 Packrat Midden Paleoclimate Study Sites	Loux/State of NV	4/1/93	Full	1
YMP-92-163.0 Relation of 6/29/92 Epicenter to X&Y Tunnels	Loux/State of NV	4/1/93	Full	1
YMP-92-138.0 Selected Geologic Features and Activities	Loux/State of NV	4/1/93	Full	1
YMP-92-137.0 Selected Geologic Features	Loux/State of NV	4/1/93	Full	1
YMP-92-115.0 Biologic Monitoring Stations and Other Existing Activities	Loux/State of NV	4/1/93	Full	1
YMP-92-109.0 Reptile Study Plots	Loux/State of NV	4/1/93	Full	1
YMP-92-100.0 Environmental Sampling Locations	Loux/State of NV	4/1/93	Full	1
YMP-92-095.1 Environmental Sampling Locations, Reclamation Trial Sites, and Existing Activities	Loux/State of NV	4/1/93	Full	1
YMP-92-086.0 Radiological/ Environmental Field Program Monitoring Stations	Loux/State of NV	4/1/93	Full	1

YMP-92-082.0	Location of Proposed Drillholes NRG-6 and UZ-14	Loux/State of NV	4/1/93	Full	1
YMP-92-064.1	Ecological Study Plots	Loux/State of NV	4/1/93	Full	1
YMP-92-061.1	Ecological Study Plots	Loux/State of NV	4/1/93	Full	1
YMP-92-060.1	Small Mammal Study Locations	Loux/State of NV	4/1/93	Full	1
YMP-92-053.0	Geologic Structure and Selected Existing Drillholes	Loux/State of NV	4/1/93	Full	1
YMP-92-038.1	Volcanic Drilling	Loux/State of NV	4/1/93	Full	1
YMP-92-016.0	Approximate Northern Extension of the Desert Tortoise	Loux/State of NV	4/1/93	Full	1
YMP-92-015.0	Boundaries and Basalt Flows	Loux/State of NV	4/1/93	Full	1
YMP-91-081.1	Control Raven Survey Route	Loux/State of NV	4/1/93	Full	1
YMP-91-079.1	Raven Survey Routes	Loux/State of NV	4/1/93	Full	1
YMP-91-075.1	Tortoise Study Areas	Loux/State of NV	4/1/93	Full	1
YMP-89-077.1	Approximate Boundary of Proposed Soil Survey (Legend)	Loux/State of NV	4/1/93	Full	1
YMP-89-076.1	Approximate Boundary of Proposed Soil Survey (Map)	Loux/State of NV	4/1/93	Full	1
YMP-92-089.4	Flood Prone Areas	Einarson/M&O	4/2/93	Full	1

YMP-92-093.3 Existing Drillholes	Einarson/M&O	4/2/93	Full	1
YMP-92-094.4 Proposed Drillholes	Einarson/M&O	4/2/93	Full	1
YMP-92-241.0 Existing Drillholes, Repository Block Area, North Half of YMP-92-240.0	Einarson/M&O	4/2/93	Page	1
YMP-92-242.0 Existing Drillholes, Repository Block Area, South Half of YMP-92-241.0	Einarson/M&O	4/2/93	Page	1
YMP-93-002.2 Potentially Useable Areas	Einarson/M&O	4/2/93	Full	1
YMP-93-021.1 Existing and Proposed Boreholes within 2 KM of UZ-16	Einarson/M&O	4/2/93	Full	1
YMP-93-047.2 Existing Boreholes and UZ-16	Einarson/M&O	4/2/93	Page	1
YMP-93-012.2 Borehole Summary	Weeks/SAIC	4/2/93	Page	1
YMP-93-105.0 YMP, Proposed Seismic Reflection Line Locations & Selected Existing Seismic Shothole and RF Borehole Locations	Gauthier/M&O	4/2/93	Full	2
YMP-93-109.3 YMP, Pump Testing	Sublette/SAIC	4/7/93	Full	4
YMP-93-027.2 Planned FY93 Borehole	Von Seggern/UNR	4/7/93	Page	1
YMP-93-022.0 Proposed Locations of Seismic Reflection Profiles, 1993	Von Seggern/UNR	4/7/93	Page	1
YMP-93-019.0 Basemap	Von Seggern/UNR	4/7/93	Page	1

YMP-93-012.1 Borehole Summary	Von Seggern/UNR	4/7/93	Page	1
YMP-93-005.0 YMP Participants Tour Map	Von Seggern/UNR	4/7/93	Page	1
YMP-93-002.0 Potentially Useable Areas	Von Seggern/UNR	4/7/93	Full	1
YMP-93-001.0 Topography of Yucca Mountain	Von Seggern/UNR	4/7/93	Page	1
YMP-92-306.1 Quaternary Volcanic Center	Von Seggern/UNR	4/7/93	Page	1
YMP-92-301.0 Basemap for Selected Area	Von Seggern/UNR	4/7/93	Full	1
YMP-92-292.0 Proposed Seismic Reflection Line Locations and Proposed Deep Seismic Shothole Locations Northwest Area	Von Seggern/UNR	4/7/93	Full	1
YMP-92-291.0 Proposed Seismic Reflection Line Locations and Proposed Deep Seismic Shothole Locations Southwest Area	Von Seggern/UNR	4/7/93	Full	1
YMP-92-290.0 Proposed Seismic Reflection Line Locations and Proposed Deep Seismic Shothole Locations Southeast Area	Von Seggern/UNR	4/7/93	Full	1
YMP-92-289.0 Proposed Seismic Reflection Line Locations and Proposed Deep Seismic Shothole Locations Northeast Area	Von Seggern/UNR	4/7/93	Full	1
YMP-92-221.0 Structure: Top of the Tram Tuff	Bodvarsson/LBL	4/7/92	Full	1
YMP-92-220.0 Structure: Top of the Bullfrog Tuff	Bodvarsson/LBL	4/7/92	Full	1

YMP-92-219.0 Structure: Top of the Prow Pass Tuff	Bodvarsson/LBL	4/7/92	Full	1
YMP-92-218.0 Structure: Top of the Calico Hills Tuffs	Bodvarsson/LBL	4/7/92	Full	1
YMP-92-217.0 Structure: Top of the Topopah Springs Tuff	Bodvarsson/LBL	4/7/92	Full	1
YMP-92-216.0 Structure: Base of the Tiva Canyon Tuff	Bodvarsson/LBL	4/7/92	Full	1
YMP-92-215.0 Structure: Base of the Caprock of the Tiva Canyon Tuff	Bodvarsson/LBL	4/7/92	Full	1
YMP-92-214.0 Combined Thickness of the Tram Tuff and Lava	Bodvarsson/LBL	4/7/92	Full	1
YMP-92-213.0 Thickness of the Tram Lava	Bodvarsson/LBL	4/7/92	Full	1
YMP-92-212.0 Thickness of the Tram Tuff	Bodvarsson/LBL	4/7/92	Full	1
YMP-92-211.0 Thickness of the Bedded Tuffs under the Bullfrog Tuff	Bodvarsson/LBL	4/7/92	Full	1
YMP-92-205.0 Thickness of the Bullfrog Tuff	Bodvarsson/LBL	4/7/92	Full	1
YMP-92-204.0 Thickness of the Bedded Tuffs under the Prow Pass Tuff	Bodvarsson/LBL	4/7/92	Full	1
YMP-92-203.0 Thickness of the Prow Pass Tuff	Bodvarsson/LBL	4/7/92	Full	1
YMP-92-202.0 Thickness of the Bedded Tuffs under the Calico Hills Tuffs	Bodvarsson/LBL	4/7/92	Full	1

YMP-92-201.0 Combined Thickness of the Topopah Springs and Calico Hills Tuffs	Bodvarsson/LBL	4/7/92	Full	1
YMP-92-199.0 Thickness of the Calico Hills Tuffs	Bodvarsson/LBL	4/7/92	Full	1
YMP-92-198.0 Thickness of the Topopah Springs Tuffs	Bodvarsson/LBL	4/7/92	Full	1
YMP-92-197.0 Thickness of the Tuffs between the Tiva Canyon and Topopah Springs Members	Bodvarsson/LBL	4/7/92	Full	1
YMP-92-196.0 Thickness of the Pah Canyon Tuff	Bodvarsson/LBL	4/7/92	Full	1
YMP-92-195.0 Thickness of the Yucca Mountain Tuff	Bodvarsson/LBL	4/7/92	Full	1
YMP-92-194.0 Thickness of Alluvium	Bodvarsson/LBL	4/7/92	Full	1
YMP-92-242.0 Existing Drillholes, Repository Block Area	Einarson/M&O	4/7/93	Full	1
YMP-92-241.0 Existing Drillholes, Repository Block Area	Einarson/M&O	4/7/93	Full	1
YMP-93-017.0 Existing & Proposed Test Pits	Braumiller/M&O	4/7/93	Full	1
YMP-93-016.0 Potentially Useable Areas with Proposed Boreholes	Braumiller/M&O	4/7/93	Full	1
YMP-93-015.0 Potentially Useable Areas with Existing Boreholes	Braumiller/M&O	4/7/93	Full	1
YMP-93-014.0 Existing & Proposed Trenches	Braumiller/M&O	4/7/93	Full	1

YMP-93-068.0 Three-Dimensional Site-Scale Unsaturated Zone Hydrogeologic Model Boundary and Potentially Useable Areas	Braumiller/M&O	4/7/93	Page	1
YMP-93-067.0 Evaluation of Recommended Boundaries	Braumiller/M&O	4/7/93	Page	1
YMP-93-066.0 Three-Dimensional Site-Scale Unsaturated Zone Hydrogeologic Model Boundary	Braumiller/M&O	4/7/93	Page	1
YMP-93-052.0 Near-Field Meteorological Monitoring Sites	Braumiller/M&O	4/7/93	Page	1
YMP-93-047.0 Basemap	Braumiller/M&O	4/7/93	Page	1
YMP-93-027.6 Borehole Program Activity	Braumiller/M&O	4/7/93	Page	1
YMP-93-022.1 Proposed Locations of Seismic Reflection Profiles, 193	Braumiller/M&O	4/7/93	Page	1
YMP-93-021.1 Existing & Proposed Boreholes within 2 KM of UZ-16	Braumiller/M&O	4/7/93	Page	1
YMP-93-019.1 Basemap	Braumiller/M&O	4/7/93	Page	1
YMP-92-290.0 Proposed Seismic Reflection Line Location and Proposed Deep Seismic Shothole Locations Southeast Area	Braumiller/M&O	4/7/93	Page	1
YMP-92-289.0 Proposed Seismic Reflection Line Location & Proposed Deep Seismic Shothole Locations Northeast Area	Braumiller/M&O	4/7/93	Page	1

YMP-92-255.0 Existing Drillholes & Selected Geologic Features	Braumiller/M&O	4/7/93	Page	1
YMP-92-233.1 Basemap	Braumiller/M&O	4/7/93	Page	1
YMP-92-227.0 Tracer Drillholes	Braumiller/M&O	4/7/93	Page	1
YMP-92-034.0 Basemap	Braumiller/M&O	4/7/93	Page	1
YMP-92-028.0 Regional Area Map	Braumiller/M&O	4/7/93	Page	1
YMP-92-026.0 Local Area Map	Braumiller/M&O	4/7/93	Page	1
YMP-92-016.0 Nevada Test Site	Braumiller/M&O	4/7/93	Page	1
YMP-92-003.2 Regional Water Level and Spring-Discharge Monitoring Sites	Braumiller/M&O	4/7/93	Page	1
YMP-93-114.0 YMP, Figure 1, Location Map for USW SRG-5/SD-11 Borehole (100 ft/10 ft contours)	Biggar/M&O	4/6/93	Page	1
YMP-93-114.1 YMP, Figure 1, Location Map for USW SRG-5/SD-11 Borehole (no/50 ft contours)	Biggar/M&O	4/6/93	Page	1
YMP-92-093.3 Existing Boreholes	Springer/SAIC	4/14/93	Full	1
YMP-92-094.4 Proposed Boreholes	Springer/SAIC	4/14/93	Full	1
YMP-92-289.1	McKinley/USGS	4/14/93	Page	1
YMP-92-290.1	McKinley/USGS	4/14/93	Page	1
YMP-92-291.1	McKinley/USGS	4/14/93	Page	1
YMP-92-292.1	McKinley/USGS	4/14/93	Page	1
YMP-93-027.5	McKinley/USGS	4/14/93	Page	1
YMP-93-027.6	McKinley/USGS	4/14/93	Page	1
YMP-93-029.2	McKinley/USGS	4/14/93	Page	1

YMP-93-030.2	McKinley/USGS	4/14/93	Page	1
YMP-93-042.0	McKinley/USGS	4/14/93	Page	1
YMP-93-047.2	McKinley/USGS	4/14/93	Page	1
YMP-93-048.1	McKinley/USGS	4/14/93	Page	1
YMP-93-049.1	McKinley/USGS	4/14/93	Page	1
YMP-93-052.0	McKinley/USGS	4/14/93	Page	1
YMP-93-053.0	McKinley/USGS	4/14/93	Page	1
YMP-93-055.0	McKinley/USGS	4/14/93	Page	1
YMP-93-058.0	McKinley/USGS	4/14/93	Page	1
YMP-93-059.0	McKinley/USGS	4/14/93	Page	1
YMP-93-065.0	McKinley/USGS	4/14/93	Page	1
YMP-93-066.0	McKinley/USGS	4/14/93	Page	1
YMP-93-067.0	McKinley/USGS	4/14/93	Page	1
YMP-93-068.0	McKinley/USGS	4/14/93	Page	1
YMP-93-069.0	McKinley/USGS	4/14/93	Page	1
YMP-93-102.0	McKinley/USGS	4/14/93	Page	1
YMP-93-103.0	McKinley/USGS	4/14/93	Page	1
YMP-93-104.0	McKinley/USGS	4/14/93	Page	1
YMP-93-106.0	McKinley/USGS	4/14/93	Page	1
YMP-93-026.0 Historical Seismic Activity	Lorenz/REECO	4/15/93	Full	2
YMP-93-128.0 Evaluation of Recommended Boundaries	Morissette/SAIC	4/15/93	Full	1
YMP-92-093.3 Existing Boreholes	Tang/M&O	4/15/93	Full	1
YMP-92-094.4 Proposed Boreholes	Tang/M&O	4/15/93	Full	1
YMP-93-042.0 Near-Field Radiological Monitoring Sites	Ingllett/SAIC	4/15/93	Page	10
YMP-93-071.0 Regional Water Level and Spring- Discharge Sites for Environmental Monitoring	Johnson/M&O	4/15/93	Page	1
YMP-93-129.0 Existing Boreholes (with Depth) and Exploratory Studies Facility	Simmons/YMPO	4/16/93	Full	1

YMP-93-130.0 Proposed Boreholes and Exploratory Studies Facility	Simmons/YMPO	4/16/93	Full	1
YMP-93-134.0 Meteorological Monitoring Site	Prowell/SAIC	4/16/93	Page	1
YMP-92-146.0 Field Planning Map	Holt/EG&G/EM	4/16/93	Full	20
YMP-93-026.0 Historical Seismic Activity	Lorenz/REECO	4/16/93	Full	3
YMP-93-107.0 Proposed Drillholes	Buesch/USGS	4/19/93	Full	2
YMP-93-108.0 Proposed Drillholes	Buesch/USGS	4/19/93	Full	2
YMP-93-132.0 YMP, Reported Activities Completed between 1 October 1992 and 31 March 1993 (Near Field)	Rixford/M&O	4/20/93	Page	3
YMP-93-133.0 YMP, Reported Activities Completed between 1 October 1992 and 31 March 1993 (Far Field)	Rixford/M&O	4/20/93	Page	3
YMP-93-143.0 Existing Boreholes (with Subsurface Access Drifts and Ramps)	Simmons/YMPO	4/20/93	Full	1
YMP-93-144.0 Proposed Boreholes (with Subsurface Access Drifts and Ramps)	Simmons/YMPO	4/20/93	Full	1
YMP-93-145.0 Recent Progress at Yucca Mountain	Lorenz/YMPO	4/22/93	Full	2
YMP-93-146.0 YMP, Relation of 6-29-92 Earthquake Epicenter to X & Y Tunnels and Major Faults in the Vicinity of the Proposed Repository at Yucca Mountain, Nevada	Inglett/SAIC	4/23/39	Page	1

YMP-93-138.0 YMP Nuclear Regulatory Commission Tour Map	Jones/YMPO	4/23/93	Full	3
YMP-93-106.0 YM Area with Emergency Response Grid	Wilson/YMPO	4/26/93	Page	50
YMP-92-093.1 YMP Existing Drillholes	Inglett/SAIC	4/26/93	Full	1
YMP-92-108.0 NV Test Site NNWSI Drillholes	Inglett/SAIC	4/26/93	Full	1
YMP-92-188.0 Existing Seismic Drillholes N Side	Inglett/SAIC	4/26/93	Full	1
YMP-92-189.0 Existing Seismic Drillholes S Side	Inglett/SAIC	4/26/93	Full	1
YMP-92-093.3 YMP, Existing Boreholes	Elayer/M&O	4/26/93	Full	1
YMP-92-094.4 YMP, Proposed Boreholes	Elayer/M&O	4/26/93	Full	1
YMP-91-008.2 Orthophoto Index Map	Elayer/M&O	4/26/93	Full	1
YMP-93-139.0 Existing Boreholes and Trenches and Proposed Ramp Design Boreholes, Map Sheet 10	Skipper/YMPO	4/26/93	Full	3
YMP-93-140.0 Existing Boreholes and Trenches and Proposed Ramp Design Boreholes, Map Sheet 15	Skipper/YMPO	4/26/93	Full	3
YMP-93-141.0 Existing Boreholes and Trenches and Proposed Ramp Design Boreholes, Map Sheet 16	Skipper/YMPO	4/26/93	Full	3
YMP-93-142.0 Existing Boreholes and Trenches and Proposed Ramp Design Boreholes, Map Sheet 17	Skipper/YMPO	4/26/93	Full	3

YMP-93-135.0	YM Area Map	Brandstetter/M&O	4/26/93	Full	3
YMP-93-135.0	YMP	Springer/SAIC	4/27/93	Full	1
YMP-93-138.0	YMP, NRC Tour Map	Springer/SAIC	4/27/93	Full	1
YMP-91-008.2	YMP, Ortho- photo Sheet Index (1:6000)	Springer/SAIC	4/27/93	Full	1
YMP-92-093.3	YMP, Existing Drillholes	Roosa/DOE Research & Study Center	4/27/93	Full	2
YMP-93-147.0	Design Support Boreholes	Distel/M&O	4/27/93	Page	2
YMP-93-148.0	Fortymile Wash Recharge Study	Distel/M&O	4/27/93	Page	2
YMP-92-031.1	Calcite Silica Drillholes	Distel/M&O	4/27/93	Page	2
YMP-92-033.1	Solitario Canyon Fault Study	Distel/M&O	4/27/93	Page	2
YMP-92-037.2	Unsaturated Zone (UZ)	Distel/M&O	4/27/93	Page	2
YMP-92-039.1	Water Table Holes	Distel/M&O	4/27/93	Page	2
YMP-92-040.1	Drillholes for Water Supply and Tests	Distel/M&O	4/27/93	Page	2
YMP-92-041.1	Geologic Holes	Distel/M&O	4/27/93	Page	2
YMP-92-042.1	Southern Tracer Complex	Distel/M&O	4/27/93	Page	2
YMP-92-044.1	Artificial Infiltration	Distel/M&O	4/27/93	Page	2
YMP-93-149.0	Draft Trench Log for Trench 14D - Inner North Wall	Menges/USGS	4/28/93	Full	2

YMP-92-093.3	YMP, Existing Boreholes	Smistad/YMPO	4/30/93	Full	1
YMP-92-094.4	YMP, Proposed Boreholes	Smistad/YMPO	4/30/93	Full	1
YMP-91-008.2	Orthophoto Sheet Index	Nelson/SAIC	4/30/93	Full	1
YMP-93-150.0	YMP, Project Boundaries	Houseworth/M&O	4/30/93	Page	1

Total Maps 322

Total New Maps 25

HISTORICAL SEISMIC ACTIVITY

Natural Events Near Yucca Mountain



This map displays the locations and magnitudes of natural seismic events within a 100 mile radius of Yucca Mountain occurring from 1872 through 1991. Magnitudes smaller than 2.0 are not shown. 1919 events are shown circled for the Nevada Test Site and a three mile buffer to exclude activities attributable to weapons testing activities. Hence some natural tectonic events may not be displayed for that time period but are included in Index Map 2.

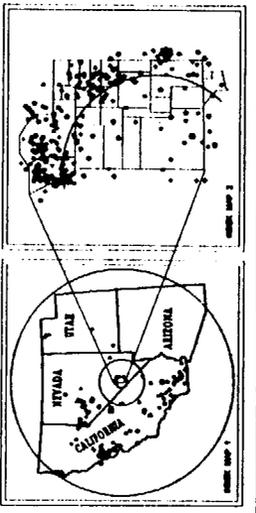
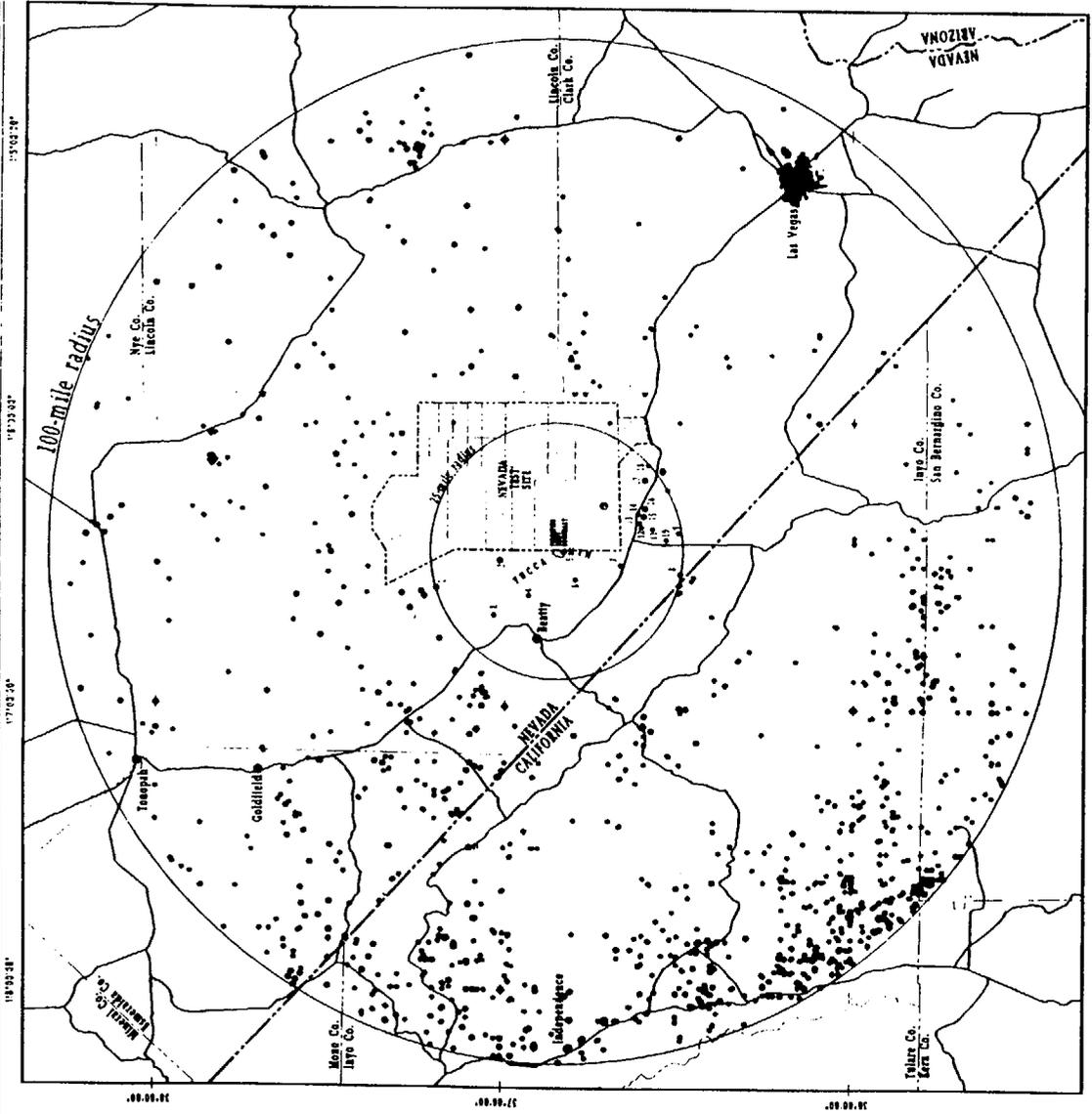
MAGNITUDE
• 7.0 - 7.9
• 6.0 - 6.9
• 5.0 - 5.9
• 4.0 - 4.9
• 3.0 - 3.9
• 2.0 - 2.9

● LANDERS CALIFORNIA INDEX MAP 1)
June 22, 1992
Magnitude 7.6
Profound to 300 km. Epicentre
located 100 miles west of
Yucca Mountain

● LITTLE SKULL MOUNTAIN, NEVADA
June 29, 1982
Magnitude 5.6
Included three tremors above mag 4.0

MAP COMPILED SOURCE DATA

Seismology data obtained from the National Earthquake Information Center (NEIC), Catalogue of Great Earthquakes (CGEQ), International Manual Seismic Data and Information Service (IMSDIS), NGDC is a central clearinghouse for geophysical data.
Road and administrative boundary features obtained from the U.S. Geological Survey (USGS) National Geographic Digital Data (NGDD) and the 25 mile buffer generated from Nevada State Plane Central Zone coordinates around Yucca Mountain. The boundary is located at the approximate center of the Yucca Mountain Perimeter Drift (YMP) and is shown as a dashed line. The boundary area of the activity represents the un-derground area of the activity. The boundary information was generated using a Geographic Information System. Map projection is Transverse Mercator.



ACTIVITY WITHIN 25 MILES OF THE SITE (shown above)

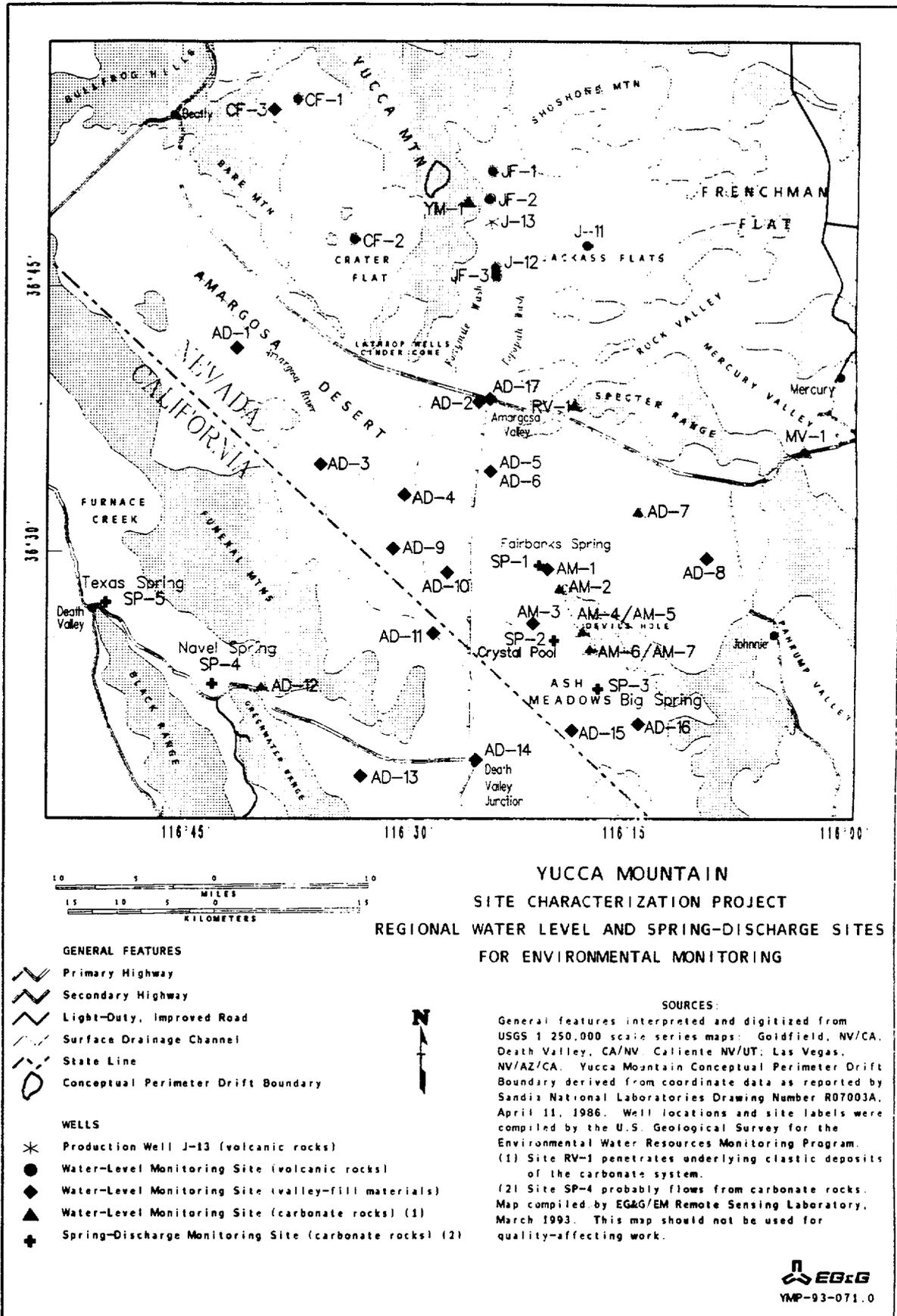
YEAR	MAG	DEPTH	EVENT	YEAR	MAG	DEPTH	EVENT
1936	3.0	unknown	7	1976	3.0	1 km	6
1946	3.4	unknown	6	1976	3.5	6 km	11
1948	3.0	unknown	6	1979	4.1	6 km	11
1948	4.0	unknown	17	1979	4.1	6 km	18
1960	3.0	unknown	9	1981	3.2	6 km	10
1980	4.4	unknown	18	1986	3.0	6 km	14
1981	4.4	unknown	18	1986	3.0	6 km	14
1974	3.0	11 km	4	1986	3.1	6 km	12
1974	3.0	25 km	2				

INDEX MAP 1 shows significant earthquakes in the southwestern United States between 1872 and 1981 with magnitudes greater than 6.0 within a 600 mile radius of the site.
INDEX MAP 2 shows the seismic activity of the Nevada Test Site including a three mile buffer between 1972 and 1981, greater than magnitude 2.0 in the study area. The mean of this activity is attributable to a more sensitive local monitoring network than other nuclear reactor testing activities.



Map compiled in March 1993 by EG&G
Geological Engineering and Physics
Branch Laboratory, for the U.S.
Department of Energy, Yucca Mountain
Site Characterization Project

YMP-93-026.0



**YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT
REGIONAL WATER LEVEL AND SPRING-DISCHARGE SITES
FOR ENVIRONMENTAL MONITORING**

- GENERAL FEATURES**
- Primary Highway
 - Secondary Highway
 - Light-Duty, Improved Road
 - Surface Drainage Channel
 - State Line
 - Conceptual Perimeter Drift Boundary

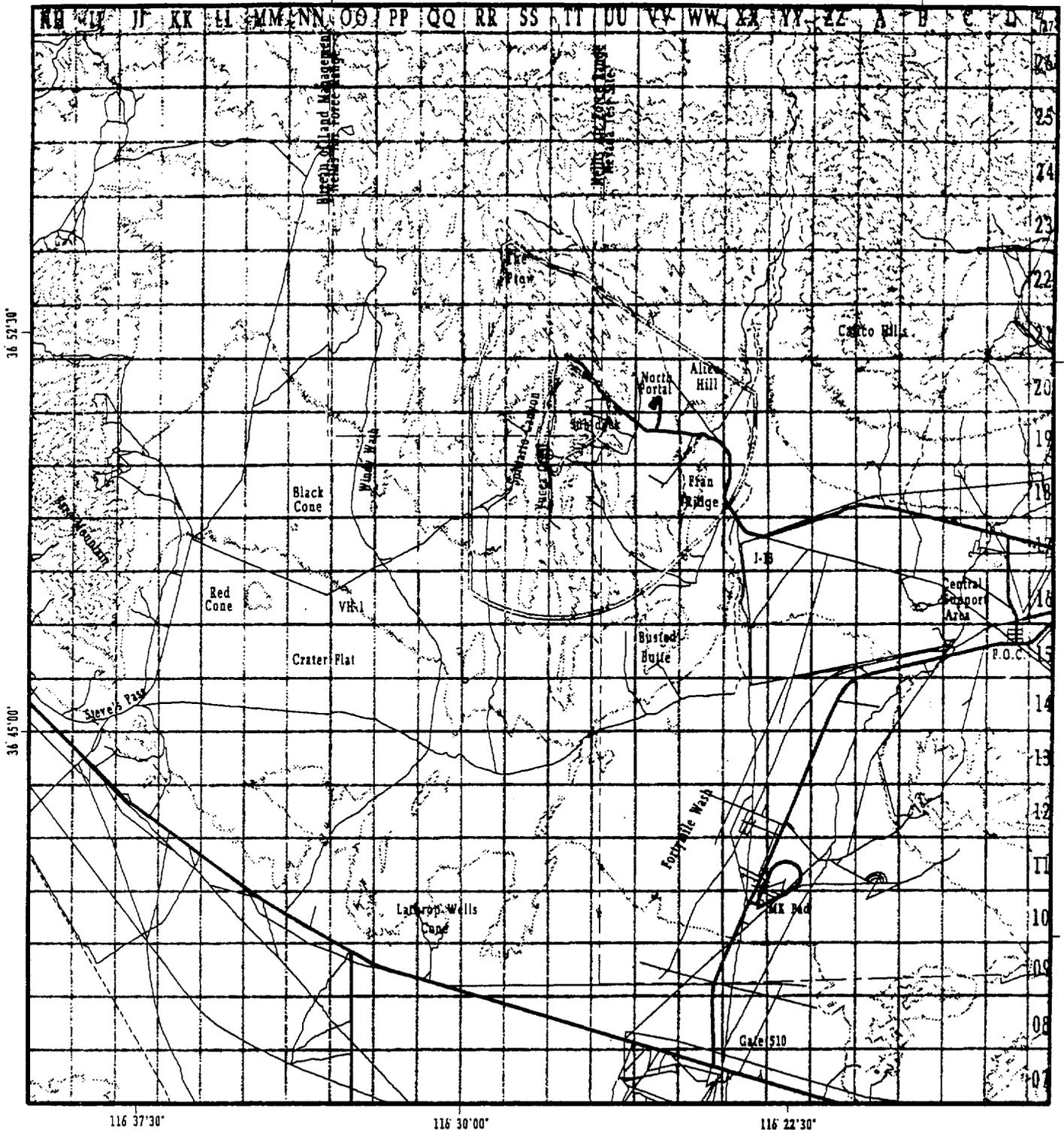
- WELLS**
- Production Well J-13 (volcanic rocks)
 - Water-Level Monitoring Site (volcanic rocks)
 - Water-Level Monitoring Site (valley-fill materials)
 - Water-Level Monitoring Site (carbonate rocks) (1)
 - Spring-Discharge Monitoring Site (carbonate rocks) (2)

SOURCES:

General features interpreted and digitized from USGS 1:250,000 scale series maps: Goldfield, NV/CA; Death Valley, CA/NV; Caliente NV/UT; Las Vegas, NV/AZ/CA. Yucca Mountain Conceptual Perimeter Drift Boundary derived from coordinate data as reported by Sandia National Laboratories Drawing Number R07003A, April 11, 1986. Well locations and site labels were compiled by the U.S. Geological Survey for the Environmental Water Resources Monitoring Program. (1) Site RV-1 penetrates underlying clastic deposits of the carbonate system. (2) Site SP-4 probably flows from carbonate rocks. Map compiled by EG&G/EM Remote Sensing Laboratory, March 1993. This map should not be used for quality-affecting work.

E533840ft
E540000m

E599540ft
E560000m



36 52'30"

36 45'00"

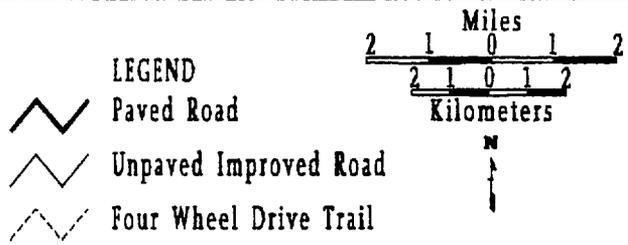
116 37'30"

116 30'00"

116 22'30"

N770340ft
N4080000m

N704550ft
N4080000m

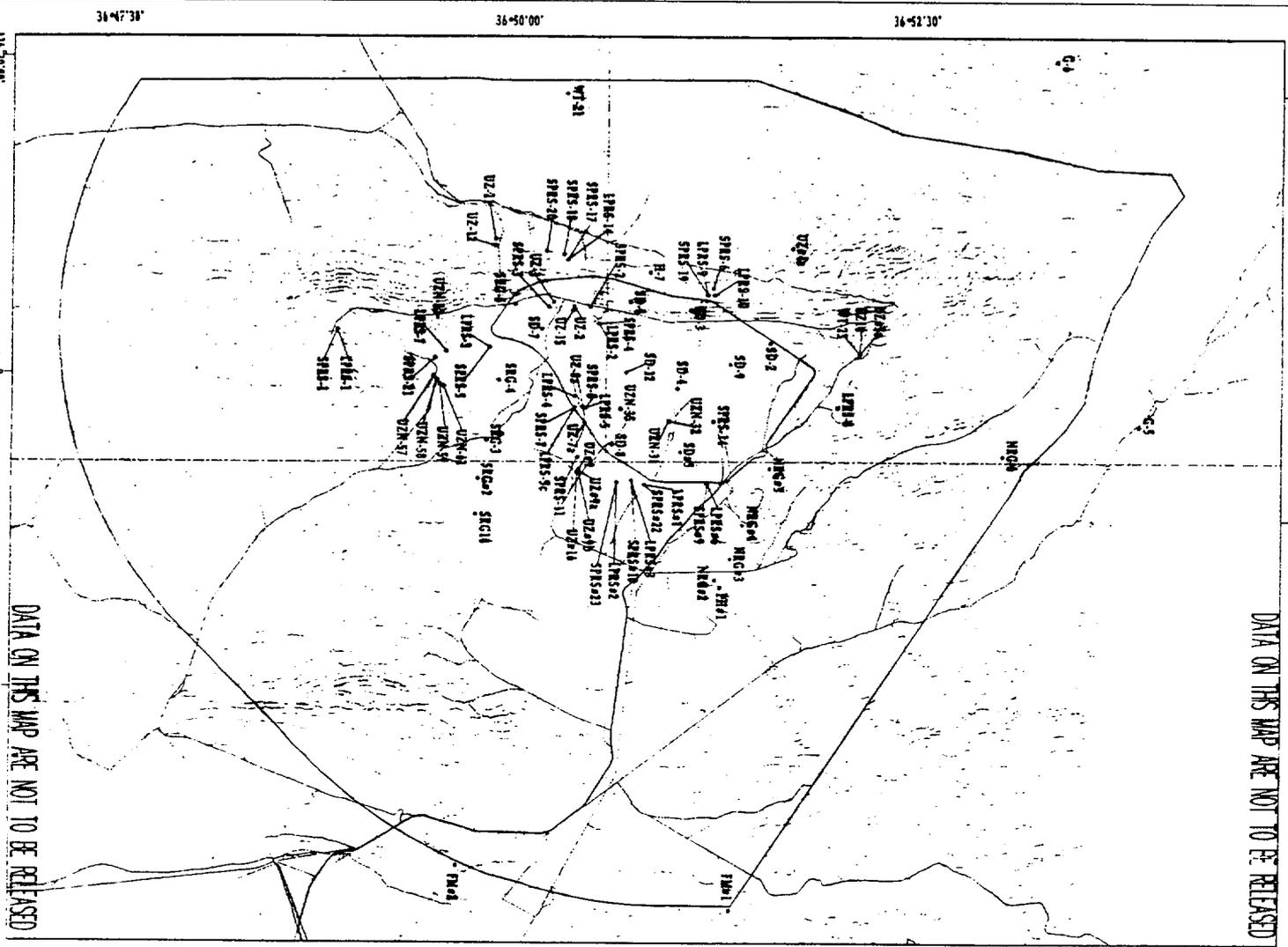


 A. Conceptual Perimeter Drift Boundary
 B. Conceptual Controlled Area Boundary

YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT
YUCCA MOUNTAIN AREA
WITH EMERGENCY RESPONSE GRID

E5304311
E534500M
E53464011
E535000M

DATA ON THIS MAP ARE NOT TO BE RELEASED



DATA ON THIS MAP ARE NOT TO BE RELEASED

**YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT
PROPOSED DRILLHOLES**



DATA ON THIS MAP ARE NOT TO BE RELEASED

PROPOSED DRILLHOLES

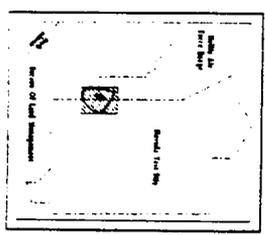
ROAD FEATURES

- Light Duty Road, Class 3, Hard Surface
- Unimproved Road, Class 4, Gravel Surface
- Trail, Class 5, Four Wheel Drive or Other



- A. Conceptual Reflector Drill Boundary
- B. Conceptual Controlled Area Boundary

This figure is based on data from the 1994...
 Conceptual Reflector Drill Boundary...
 Conceptual Controlled Area Boundary...
 Proposed Drill Holes...
 Road Features...
 Topographic contours...
 The map should not be used for geologic engineering work.



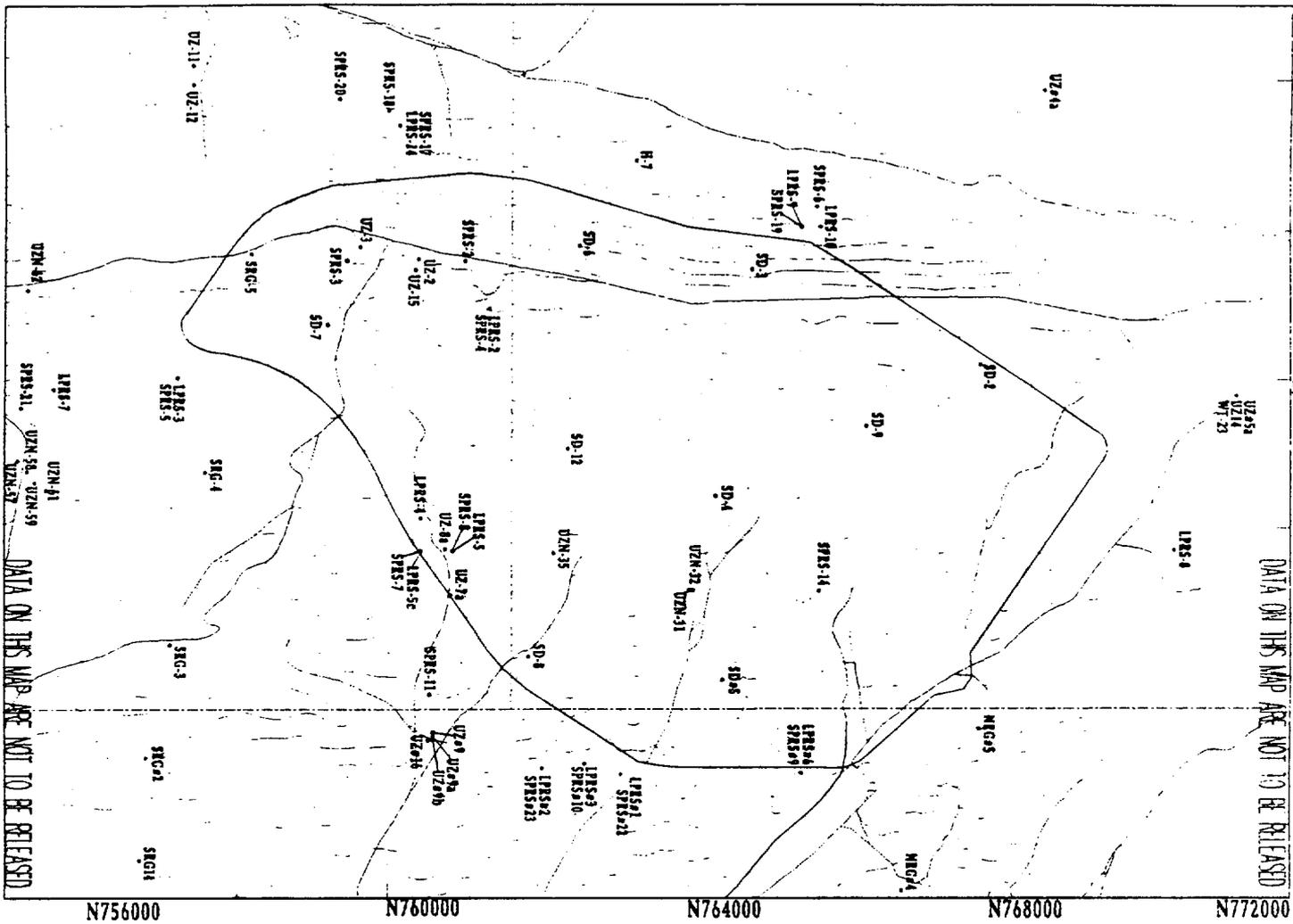
TW-93-107-A

E556000

E560000

E564000

DATA ON THIS MAP ARE NOT TO BE RELEASED



N756000 N760000 N764000 N768000 N772000

**YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT
PROPOSED DRILLHOLES**



DATA ON THIS MAP ARE NOT TO BE RELEASED

PROPOSED DRILLHOLES

- ROAD FEATURES
- Light Duty Road, Class 3, Hard Surface
- Unimproved Road, Class 4, Gravel Surface
- Trail, Class 5, Four Wheel Drive or Other



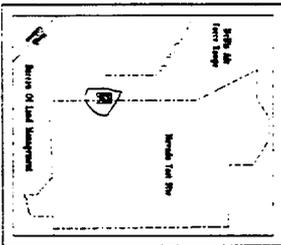
This figure contains information that is not to be released.

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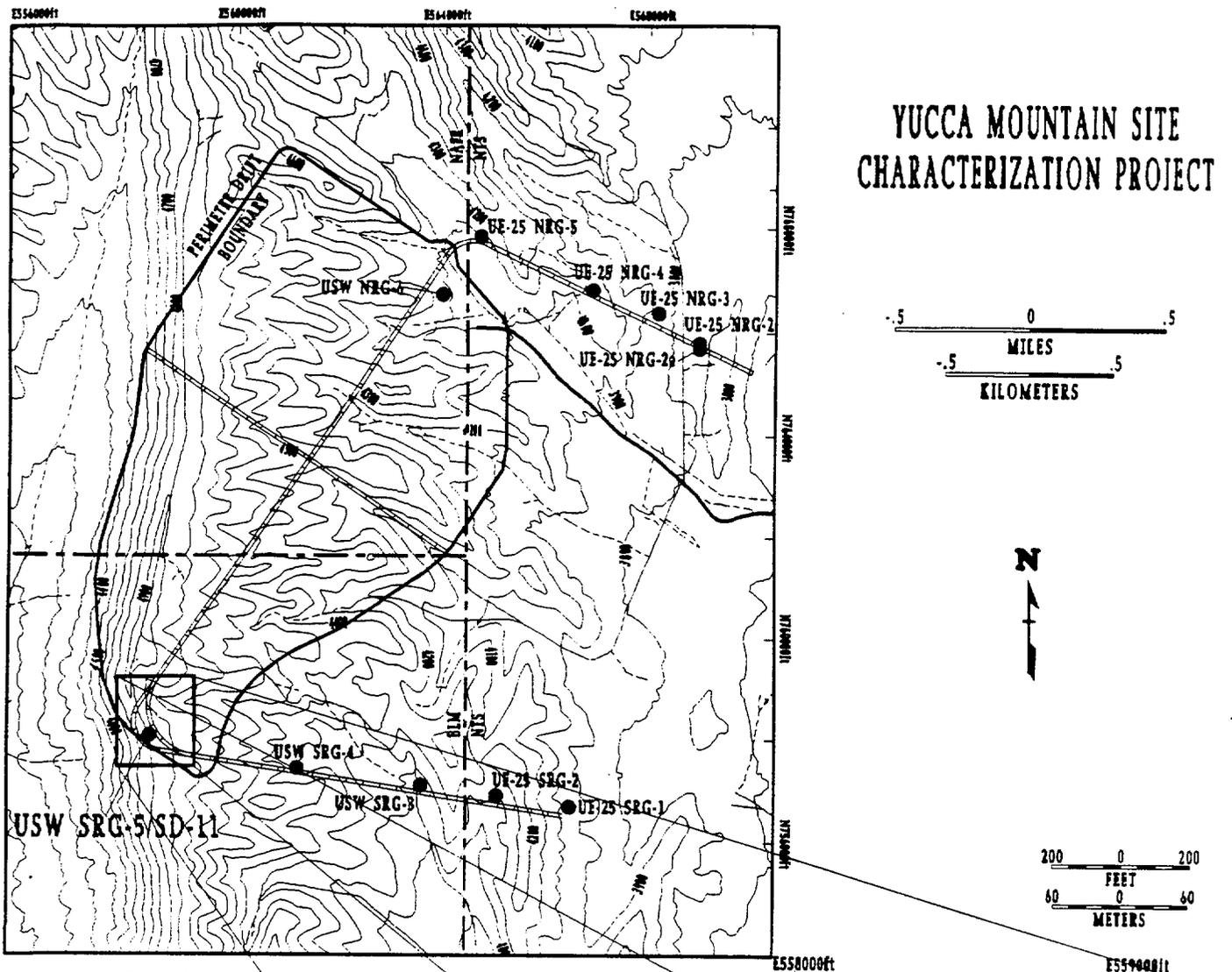
Map scale: 1 inch = 1000 feet.

Map projection: UTM, Zone 18N, Datum: NAD 83, Spheroid: GRS 80, Ellipsoid: Spheroid, Units: Meter.

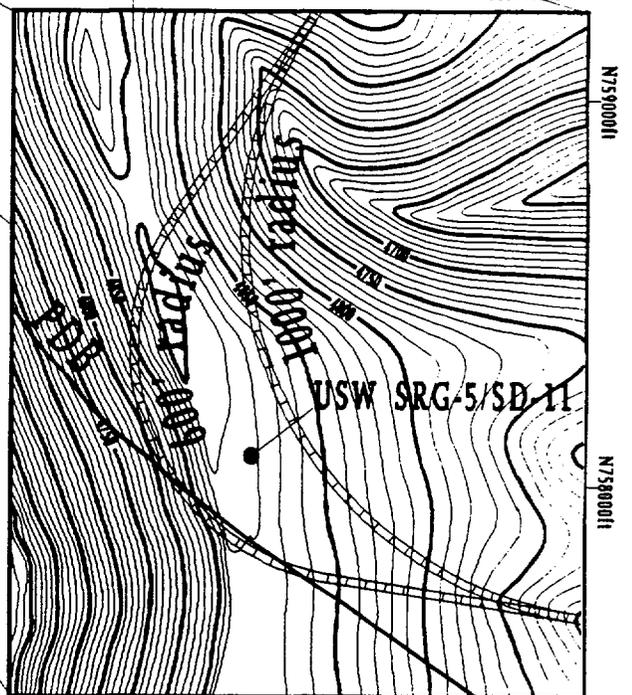
This map should not be used for quality assurance.



YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT



Contour Interval - 100 feet



Contour Interval - 10 feet

LEGEND



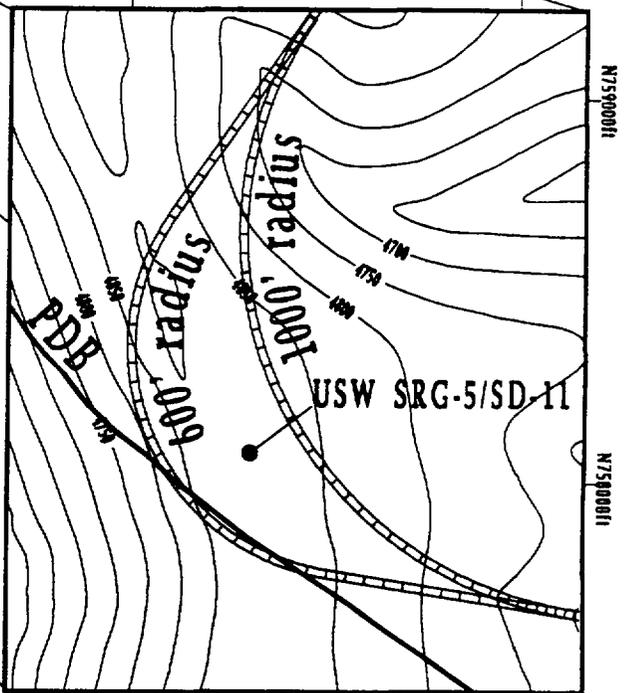
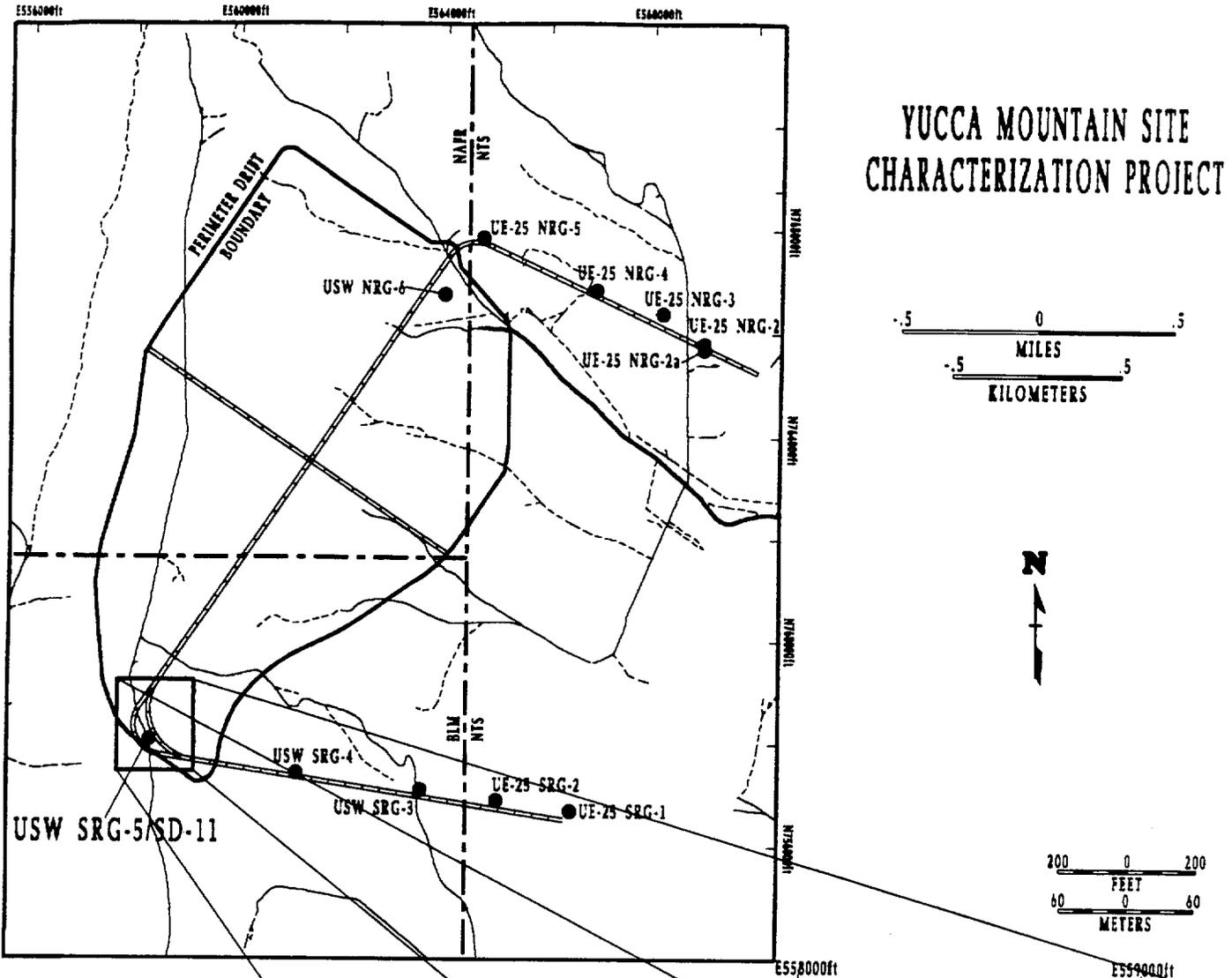
ESF Drifts and Ramps



Ramp Design Exploratory Boreholes

Figure 1 - Location Map for USW SRG-5/SD-11 Borehole.
 Location for borehole is approximate. Actual location will be surveyed after drilling.

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT



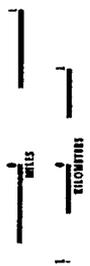
Contour Interval - 50 feet

LEGEND

- ESF Drifts and Ramps
- Ramp Design Exploratory Boreholes

Figure 1 - Location Map for USW SRG-5/SD-11 Borehole.
 Location for borehole is approximate. Actual location will be surveyed after drilling.

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT EXISTING BOREHOLES (WITH DEPTH) AND EXPLORATORY STUDIES FACILITY



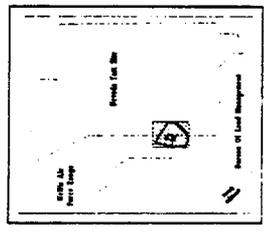
Existing Borehole
Exploratory Studies Facility

ROAD FEATURES

- Light Duty Road, Class 3, Hard Surface
- Unimproved Road, Class 4, Gravel Surface
- Trail, Class 5, Four Wheel Drive or Other

- A. Conceptual Perimeter Drift Boundary
- B. Conceptual Controlled Area Boundary

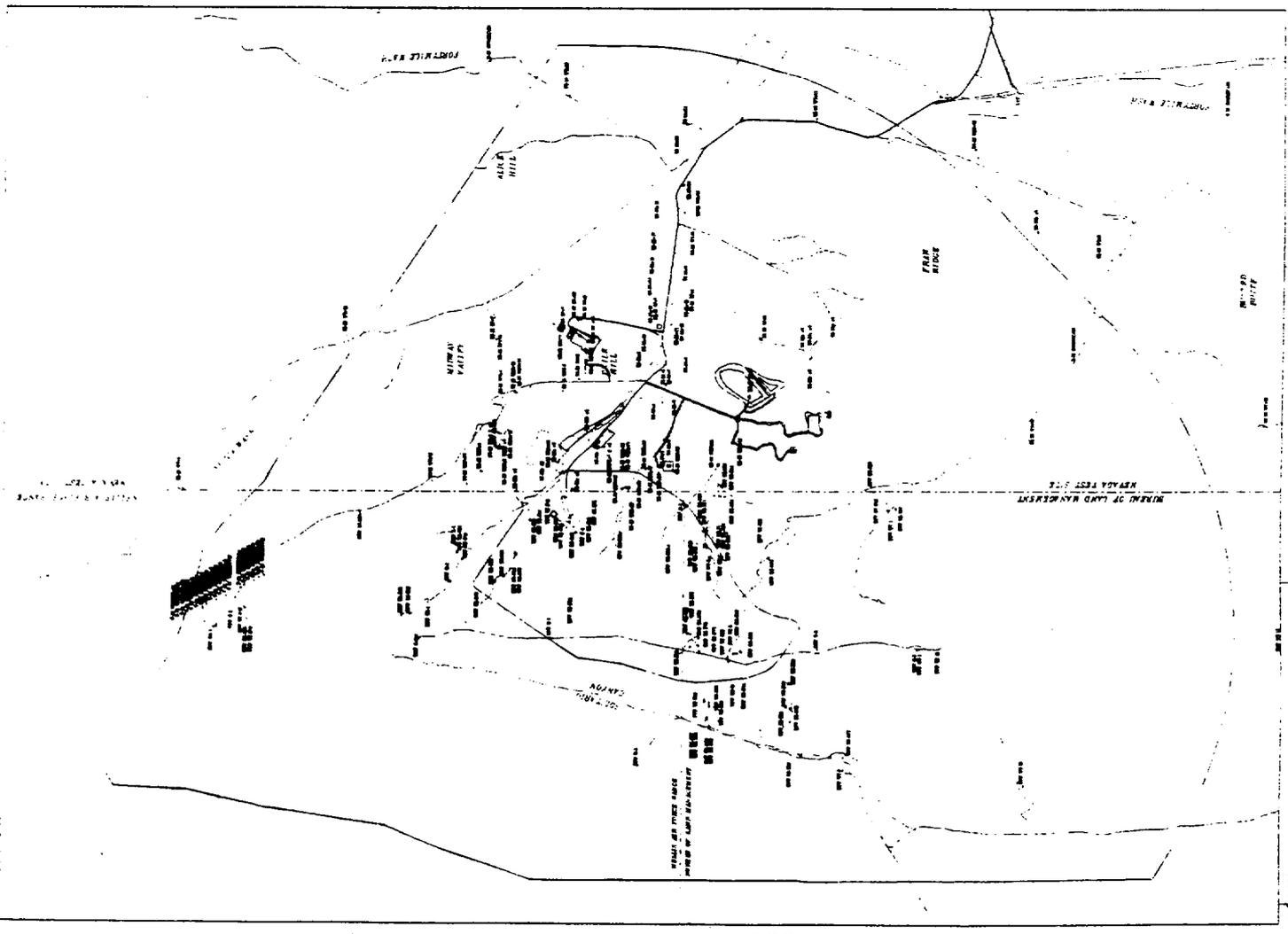
NOTES:
 1. Data were obtained from the U.S. Geological Survey, Nevada District, Reno, Nevada, and the Nevada State Office, Carson City, Nevada.
 2. The location of the facility is shown on the map.
 3. The location of the facility is shown on the map.
 4. The location of the facility is shown on the map.
 5. The location of the facility is shown on the map.
 6. The location of the facility is shown on the map.
 7. The location of the facility is shown on the map.
 8. The location of the facility is shown on the map.
 9. The location of the facility is shown on the map.
 10. The location of the facility is shown on the map.



DEPTH (FEET)	DEPTH (METERS)	DEPTH (FEET)	DEPTH (METERS)
10	3.05	100	30.48
20	6.10	110	33.53
30	9.14	120	36.58
40	12.19	130	39.63
50	15.24	140	42.68
60	18.29	150	45.73
70	21.34	160	48.78
80	24.38	170	51.83
90	27.43	180	54.88
100	30.48	190	57.93
110	33.53	200	60.98
120	36.58	210	64.03
130	39.63	220	67.08
140	42.68	230	70.13
150	45.73	240	73.18
160	48.78	250	76.23
170	51.83	260	79.28
180	54.88	270	82.33
190	57.93	280	85.38
200	60.98	290	88.43
210	64.03	300	91.48
220	67.08	310	94.53
230	70.13	320	97.58
240	73.18	330	100.63
250	76.23	340	103.68
260	79.28	350	106.73
270	82.33	360	109.78
280	85.38	370	112.83
290	88.43	380	115.88
300	91.48	390	118.93
310	94.53	400	121.98
320	97.58	410	125.03
330	100.63	420	128.08
340	103.68	430	131.13
350	106.73	440	134.18
360	109.78	450	137.23
370	112.83	460	140.28
380	115.88	470	143.33
390	118.93	480	146.38
400	121.98	490	149.43
410	125.03	500	152.48
420	128.08	510	155.53
430	131.13	520	158.58
440	134.18	530	161.63
450	137.23	540	164.68
460	140.28	550	167.73
470	143.33	560	170.78
480	146.38	570	173.83
490	149.43	580	176.88
500	152.48	590	179.93
510	155.53	600	182.98
520	158.58	610	186.03
530	161.63	620	189.08
540	164.68	630	192.13
550	167.73	640	195.18
560	170.78	650	198.23
570	173.83	660	201.28
580	176.88	670	204.33
590	179.93	680	207.38
600	182.98	690	210.43
610	186.03	700	213.48
620	189.08	710	216.53
630	192.13	720	219.58
640	195.18	730	222.63
650	198.23	740	225.68
660	201.28	750	228.73
670	204.33	760	231.78
680	207.38	770	234.83
690	210.43	780	237.88
700	213.48	790	240.93
710	216.53	800	243.98
720	219.58	810	247.03
730	222.63	820	250.08
740	225.68	830	253.13
750	228.73	840	256.18
760	231.78	850	259.23
770	234.83	860	262.28
780	237.88	870	265.33
790	240.93	880	268.38
800	243.98	890	271.43
810	247.03	900	274.48
820	250.08	910	277.53
830	253.13	920	280.58
840	256.18	930	283.63
850	259.23	940	286.68
860	262.28	950	289.73
870	265.33	960	292.78
880	268.38	970	295.83
890	271.43	980	298.88
900	274.48	990	301.93

N77021041
N4080000m

N7539501
N4075000m



ES500000
ES450000m

116 35 00

116 27 30

116 30 00

34-47 30

34-50 00

34-52 30



E550245ft
E545000m

E566660ft
E550000m

E583075ft
E555000m

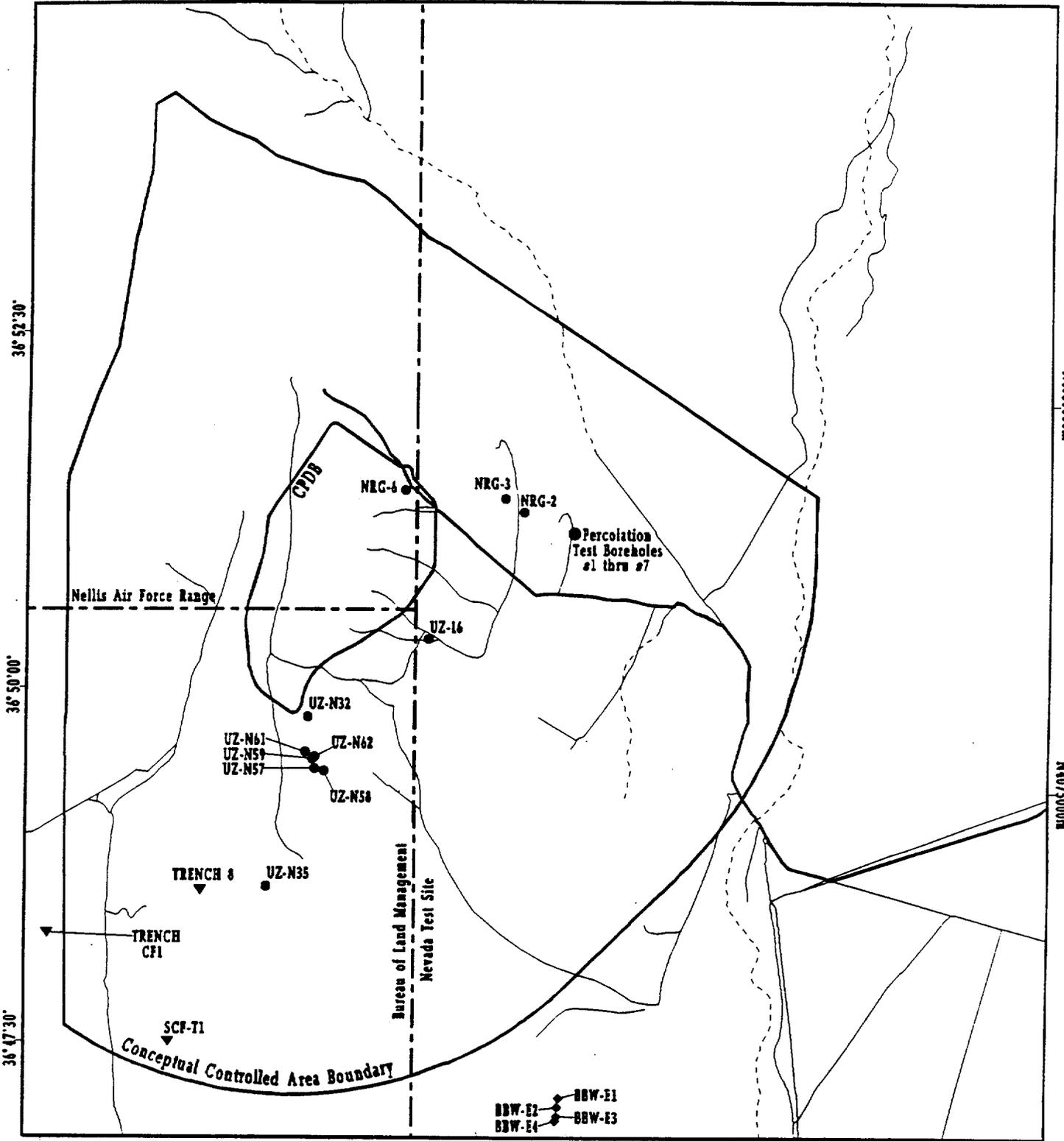
36° 52' 30"

36° 50' 00"

36° 47' 30"

N770210ft
N4000000m

N753950ft
N4075000m



116° 30' 00"

116° 27' 30"

116° 25' 00"

116° 22' 30"

SURFACE ACTIVITIES
1 October 1992 TO 31 March 1993

- Borehole
- ▼ Trench
- ◆ Pavement



YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT
Reported activities completed between 1 October 1992
and 31 March 1993 (Near Field)

E5338400ft
E540800m

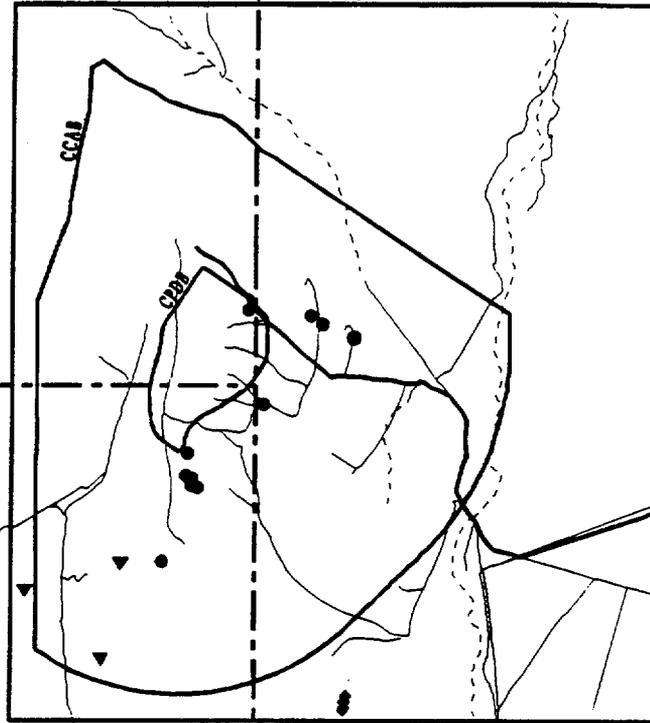
E566640ft
E550800m

BUREAU OF
LAND MANAGEMENT

NELVIS AIR
FORCE RANGE

NEVADA
TEST
SITE

Location of Map YMP-93-133.0



36 52'30"

36 45'00"

N601135ft
N407000m

N770210ft
N407000m

N737355ft
N407000m

SCR-T1

SCR-T2

SCR-T3

TR-3

TR-1

TR-4

TR-2

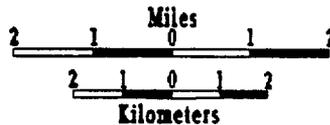
TR-5

HWY 95

116° 37' 30"

116° 30' 00"

116° 22' 30"



N

SURFACE ACTIVITIES

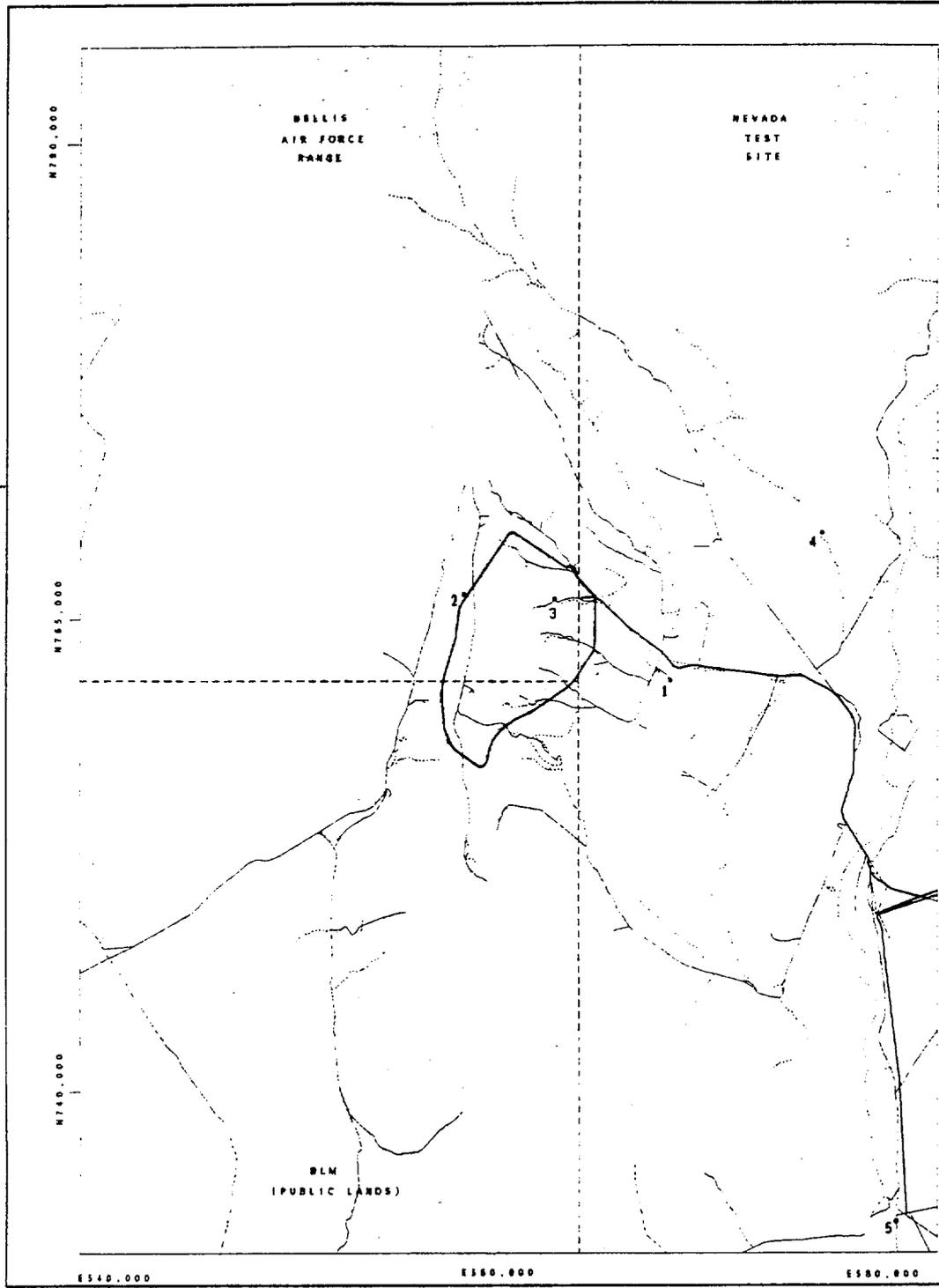
1 October 1992 TO 31 March 1993

- Borehole
- ▼ Trench
- ◆ Pavement

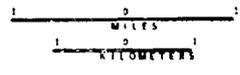
**YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT**
Reported activities completed between 1 October 1992
and 31 March 1993 (Far Field)



YMP-93-133.0



**YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT
METEOROLOGICAL MONITORING SITES**



LEGEND

- METEOROLOGICAL MONITORING SITE
- 1 NTS-60
- 2 YUCCA MOUNTAIN
- 3 COYOTE WASH
- 4 ALICE HILL
- 5 40-MILE WASH

- Light Duty Roads
- - - Unimproved Roads
- ... Trails

- CONCEPTUAL PERIMETER
- - - DRIFT BOUNDARY

SOURCES

Point feature locations obtained from U.S. Department of Energy Report Number DOE/RM-0209, December 1988, Rev. 1.

Contour data obtained from U.S. Geological Survey 1:100,000 scale elevation data. Contour interval 50 meters, index contour interval 200 meters.

Conceptual Perimeter Drift boundary digitized from Sandia National Laboratories Drawing Number R07002A, April 1986.

Road features digitized from 1:24,000 scale USGS topographic maps 1956, 1974, 1:100,000 scale USGS topographic map 1983, and 1:24,000 scale uncontrolled aerial photography 7/1988 and 9/1987.

Grid ticks based on Nevada State Plane Coordinate System, Central Zone.

Map compiled in April 1993 by EG&G/BM Remote Sensing Laboratory. This map should not be used for quality-affecting work.

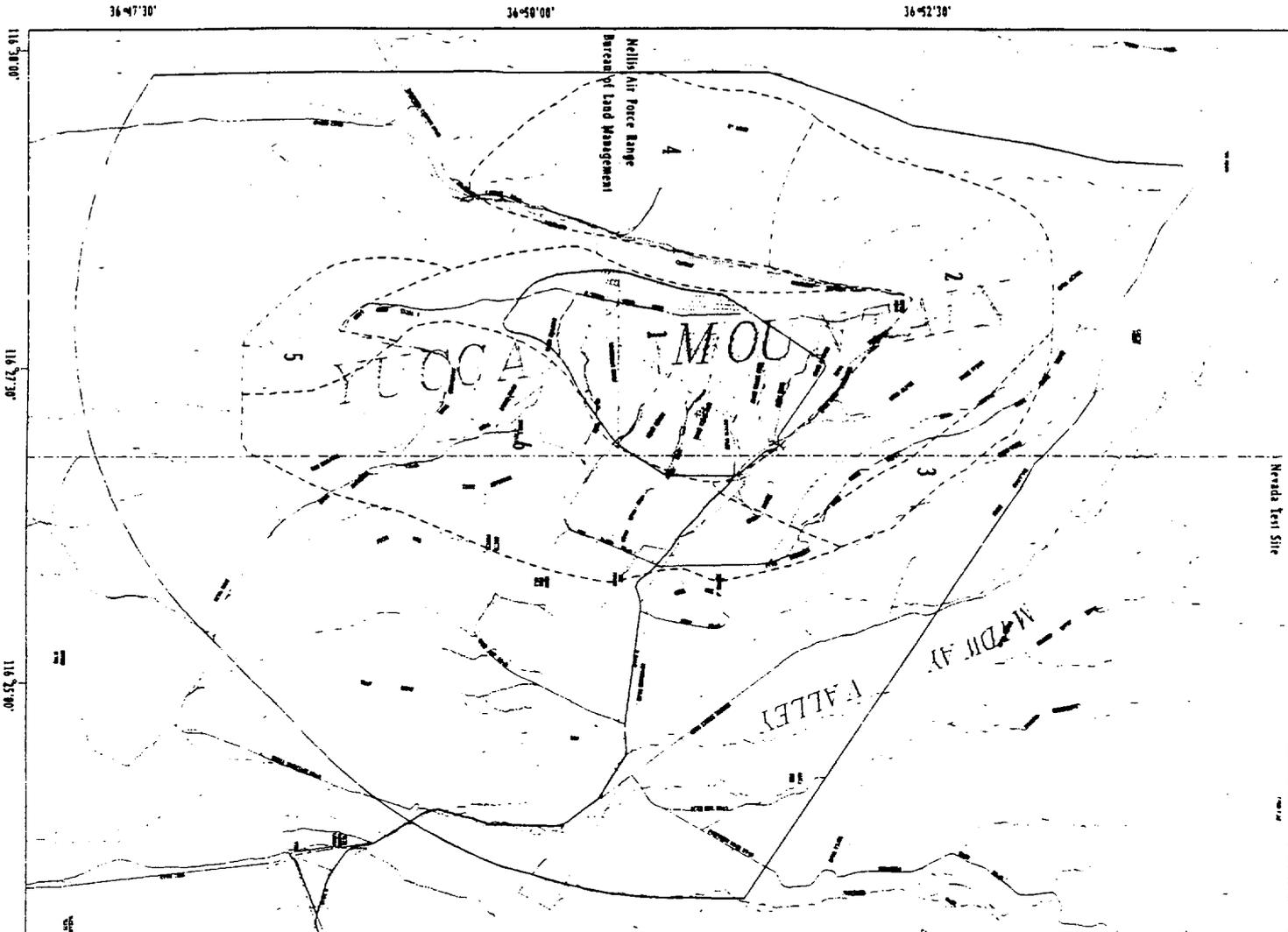


YMP-93-124-B

ES302451
ES4000m

ES44401
ES5000m

Nevada Test Site



M7721011
M4889000
M7595011
M4875000

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT



ROAD FEATURES

- Light Dry Road, Class 3, Best Surface
- Unimproved Road, Class 4, Good Surface
- Trail, Class 5, Poor Wheel Drive or Other

STREAMS

- Epithermal Stream
- Subsurface Access Ramps and Drifts

Potentially Boreable Areas

A. Conceptual Perimeter Drill Boundary

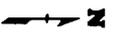
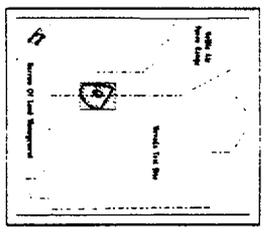
B. Conceptual Controlled Area Boundary

LEGEND



Original features are shown against the background of the Nevada Test Site. The map is overlaid with a grid of UTM coordinates. The grid lines are labeled with Easting coordinates (116 37 30, 116 37 30, 116 37 30) and Northing coordinates (48 77 30, 49 00 00, 49 22 30).

Original features are shown against the background of the Nevada Test Site. The map is overlaid with a grid of UTM coordinates. The grid lines are labeled with Easting coordinates (116 37 30, 116 37 30, 116 37 30) and Northing coordinates (48 77 30, 49 00 00, 49 22 30).



Access

7/24/83

**YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT**
Nuclear Regulatory Commission Tour Map



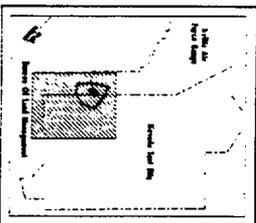
LEGEND

- ~ Heavy Duty Road, Primary Route, Class 1
- ~ Medium Duty Road, Secondary Route, Class 2
- ~ Light Duty Road, Hard Surface, Class 3
- ~ Dampwood Road, Gravel Surface, Class 4
- ~ Trail, Four Wheel Drive or Other, Class 5
- ~ Railroad
- ~ Power Transmission Line
- Existing Boreholes 'C' wells'

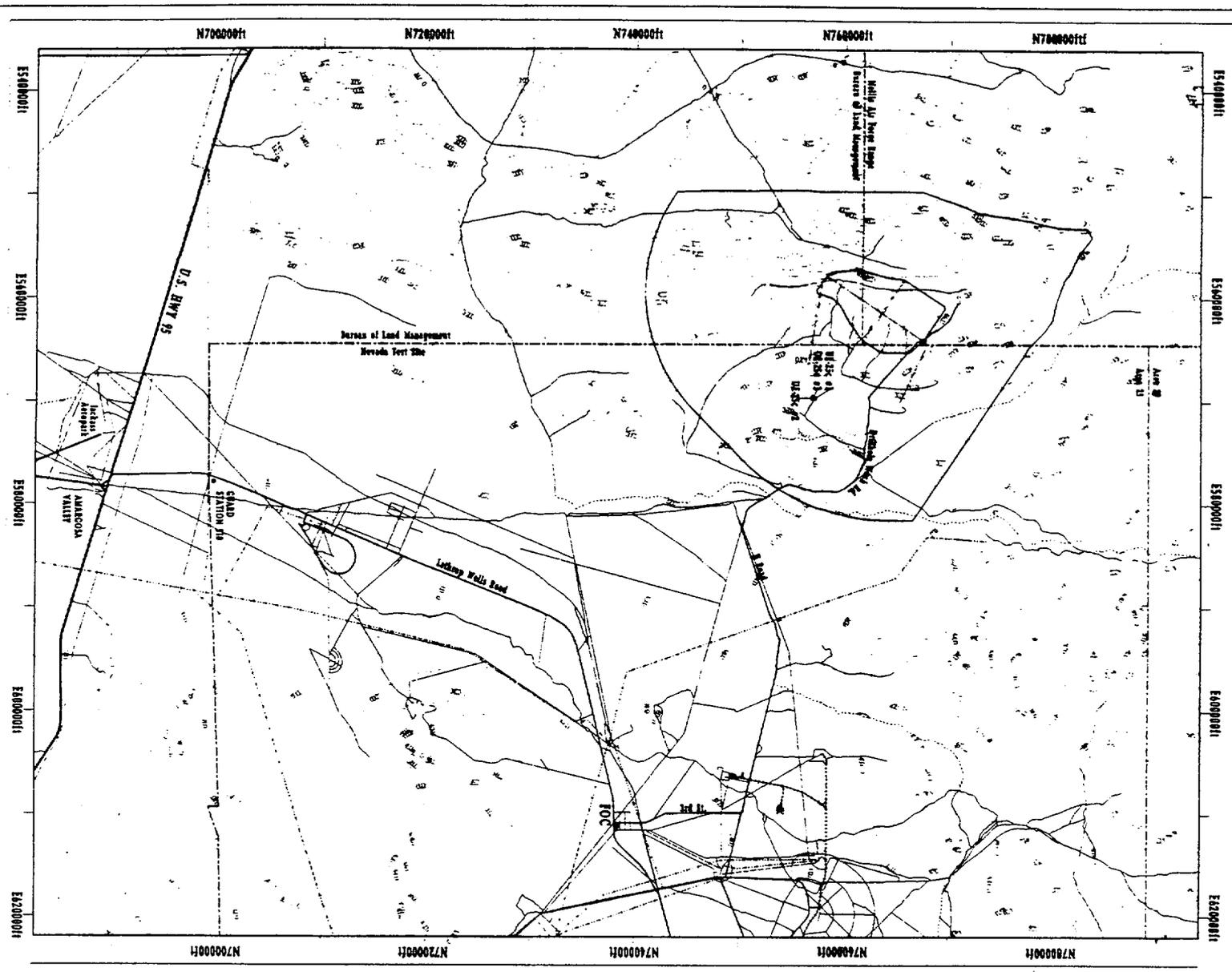


NOTES

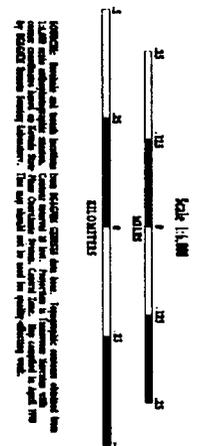
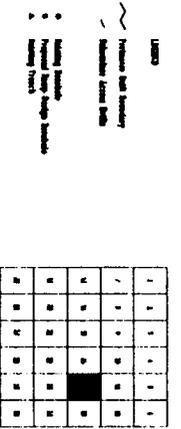
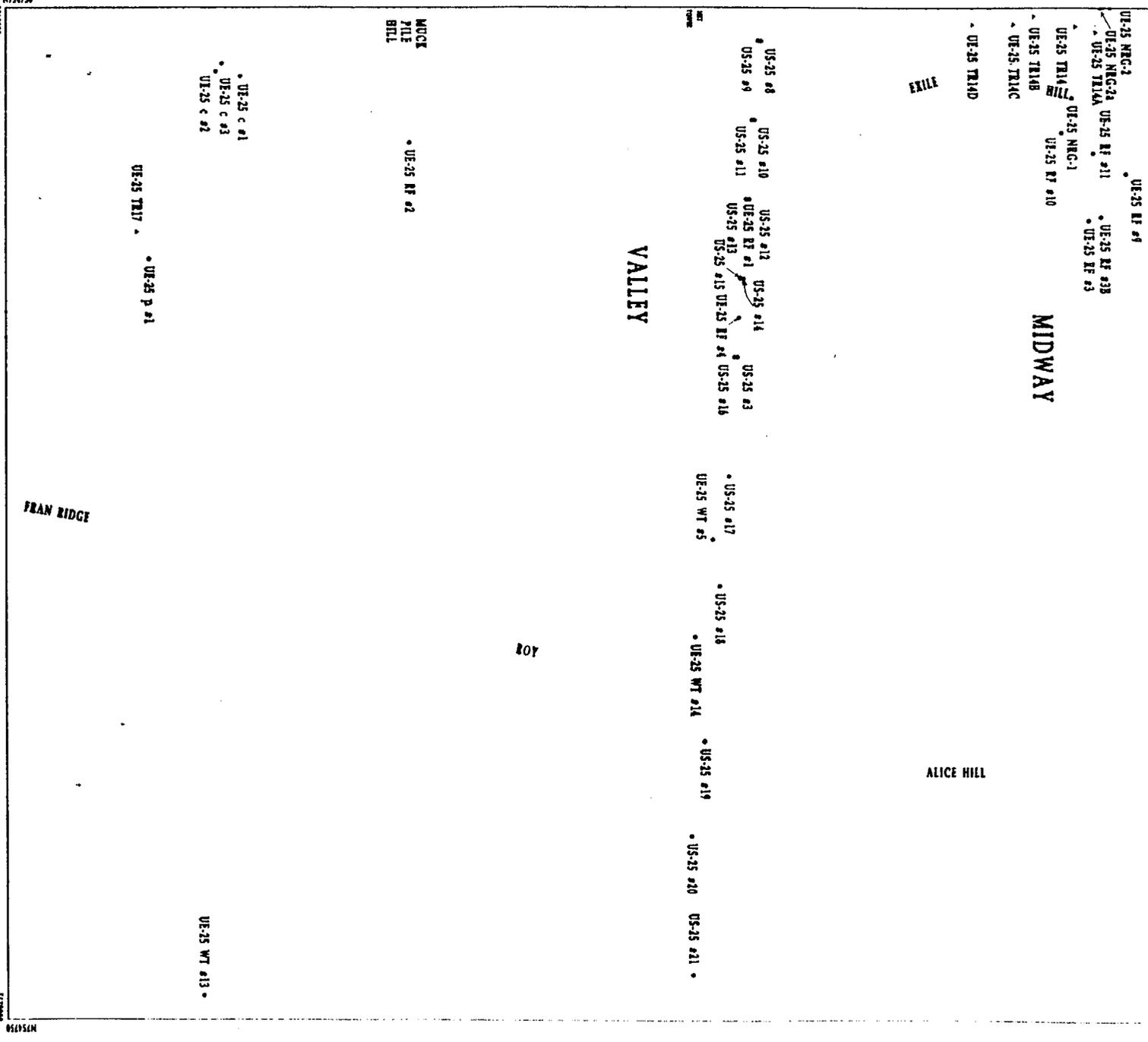
Conceptual Perimeter Drill Boundary (C) is shown. (Reference: NRC Regulatory Guide 1.104, Rev. 10/80.)
 Conceptual Controlled Area Boundary (B) is shown. (Reference: NRC Regulatory Guide 1.104, Rev. 10/80.)
 Subscriber Access Drills (A) are shown. (Reference: NRC Regulatory Guide 1.104, Rev. 10/80.)
 All boundaries are shown as dashed lines. (Reference: NRC Regulatory Guide 1.104, Rev. 10/80.)
 The map should not be used for engineering design.



YMP-43-111A



ESTIMON 8747500
 ESTIMON 8051500
 ESTIMON 8747500
 ESTIMON 8051500



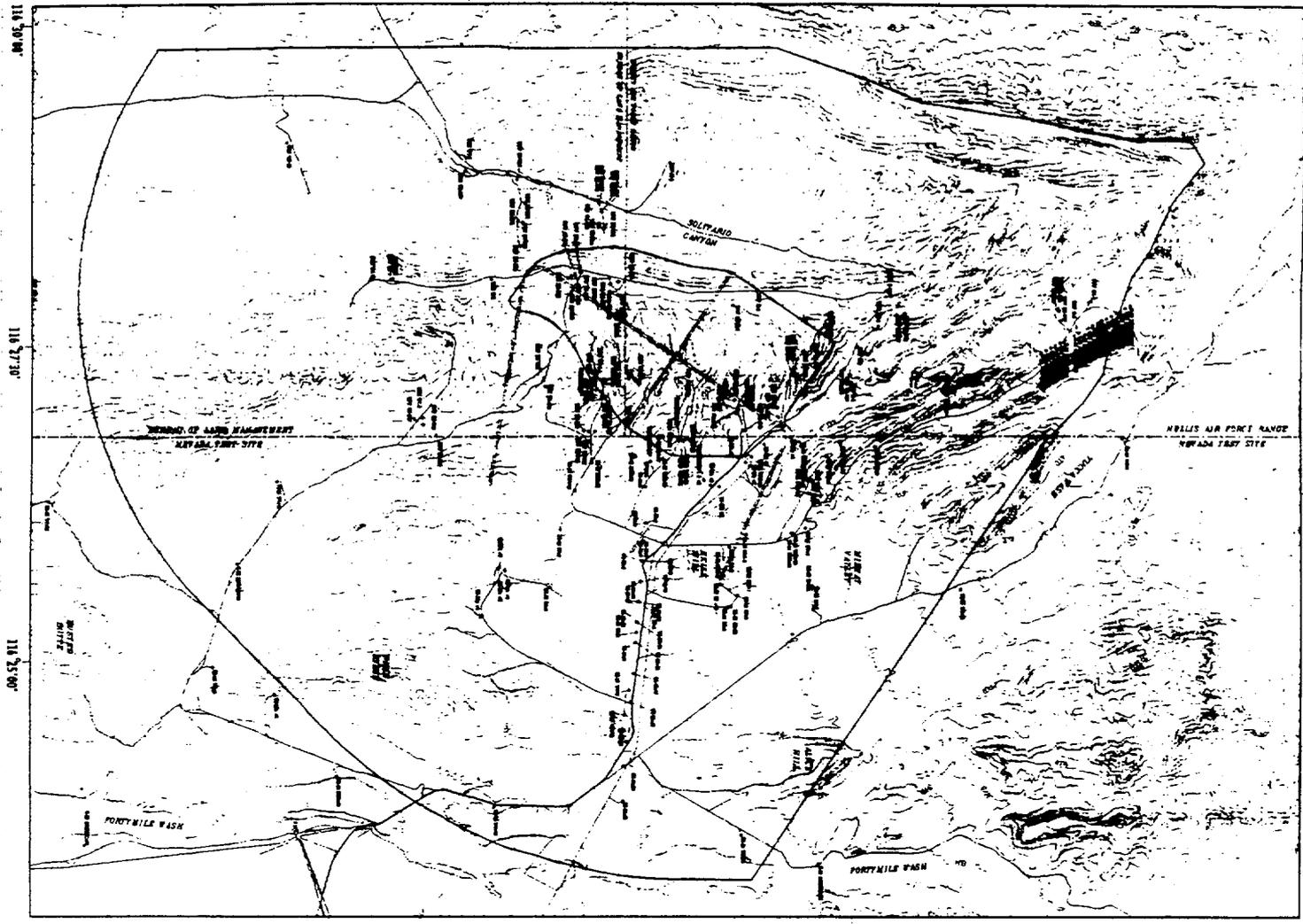
YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT
 Existing Boreholes and Trenches,
 and Proposed Ramp Design Boreholes
 MAY SHEET IV

EG&G TID-41024

85502501
85500000

85440001
85500000

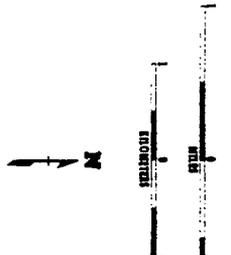
36°47'30" 36°50'00" 36°52'30"



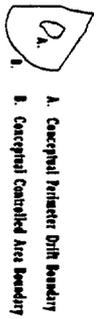
M7702101 M4000000
M7503001 M4000000

POINT	Easting	Northing	Point Description
1	4000000	8550000	...
2	4000000	8550000	...
3	4000000	8550000	...
4	4000000	8550000	...
5	4000000	8550000	...
6	4000000	8550000	...
7	4000000	8550000	...
8	4000000	8550000	...
9	4000000	8550000	...
10	4000000	8550000	...
11	4000000	8550000	...
12	4000000	8550000	...
13	4000000	8550000	...
14	4000000	8550000	...
15	4000000	8550000	...
16	4000000	8550000	...
17	4000000	8550000	...
18	4000000	8550000	...
19	4000000	8550000	...
20	4000000	8550000	...
21	4000000	8550000	...
22	4000000	8550000	...
23	4000000	8550000	...
24	4000000	8550000	...
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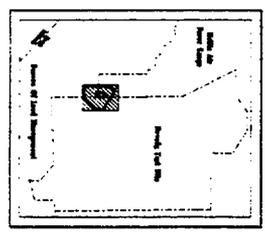
YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT EXISTING ROSEHOLES (WITH DEPTH)



- Existing Rosehole
 - Subsurface Access Ramps and Drifts
- ### ROAD FEATURES
- Light Duty Road, Class 3, Hard Surface
 - Unimproved Road, Class 4, Gravel Surface
 - Trail, Class 5, Four Wheel Drive or Other



NOTE:
This drawing shows the location of the Roseholes, the Subsurface Access Ramps, and the Drifts. It is not intended to show the exact location of the Roseholes, the Subsurface Access Ramps, and the Drifts. The Roseholes, the Subsurface Access Ramps, and the Drifts are shown in their approximate locations. The Roseholes, the Subsurface Access Ramps, and the Drifts are shown in their approximate locations. The Roseholes, the Subsurface Access Ramps, and the Drifts are shown in their approximate locations.



TM-93-103-B

**YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT
PROPOSED BOREHOLES**



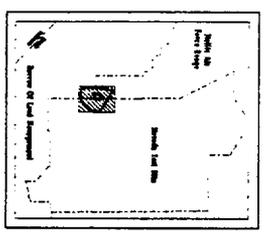
Proposed borehole
Subsurface Access Kamps and Drifts

ROAD FEATURES
 ~ Light Duty Road, Class 3, Hard Surface
 ~ Unimproved Road, Class 4, Gravel Surface
 --- Trail, Class 5, Four Wheel Drive or Other

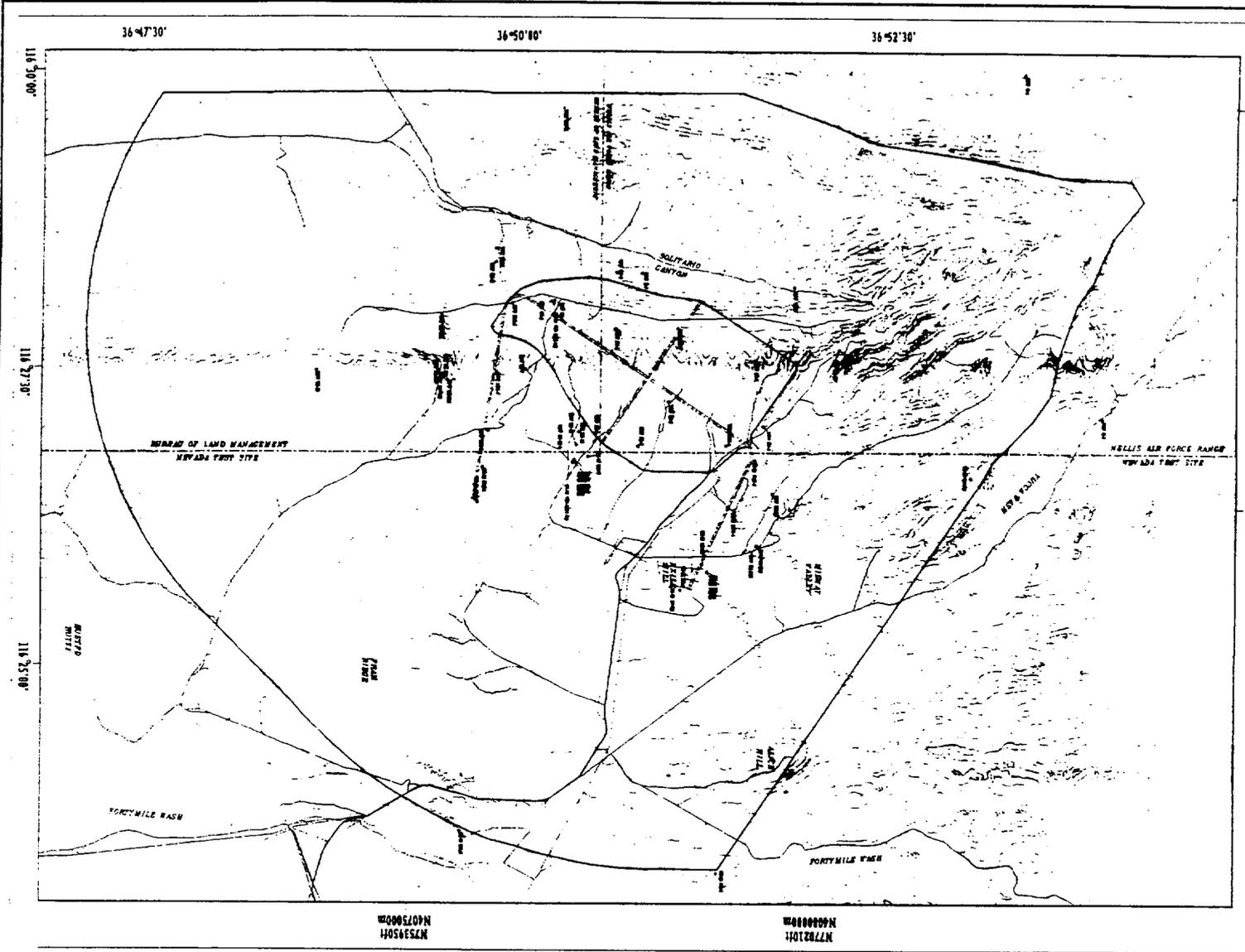
BOUNDARIES
 A. Conceptual Performance Drift Boundary
 B. Conceptual Controlled Area Boundary

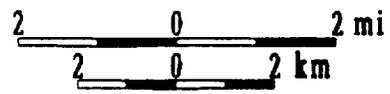
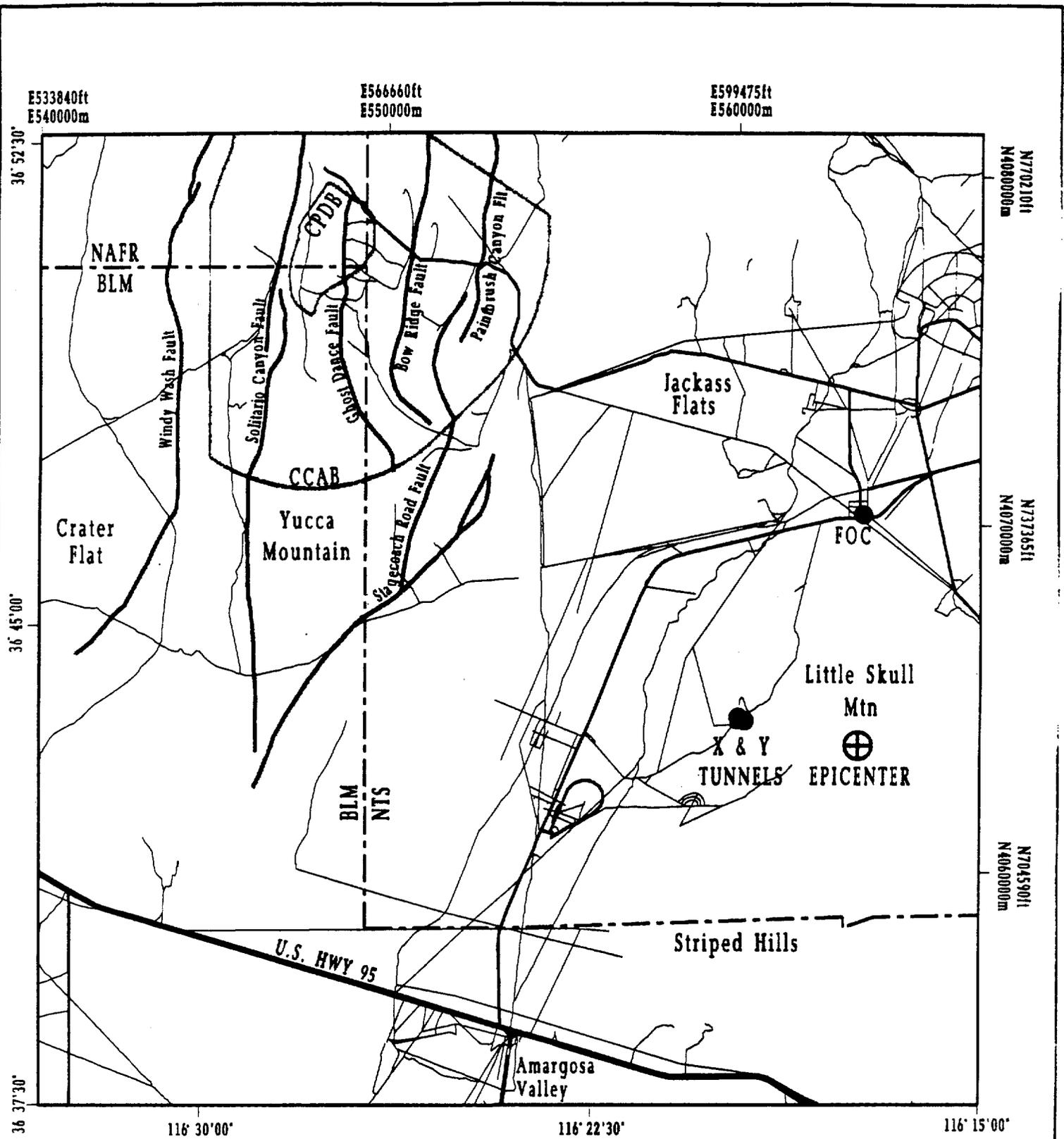
NOTES:

1. All features shown are approximate locations and are not to be used for navigation purposes. The location of features shown on this map is approximate and is not to be used for navigation purposes. The location of features shown on this map is approximate and is not to be used for navigation purposes.



TM 7-93 1440





X Tunnel Orientation: North 36 degrees East
740 feet long

Y-Tunnel Orientation: North 19 degrees East
150 feet long

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

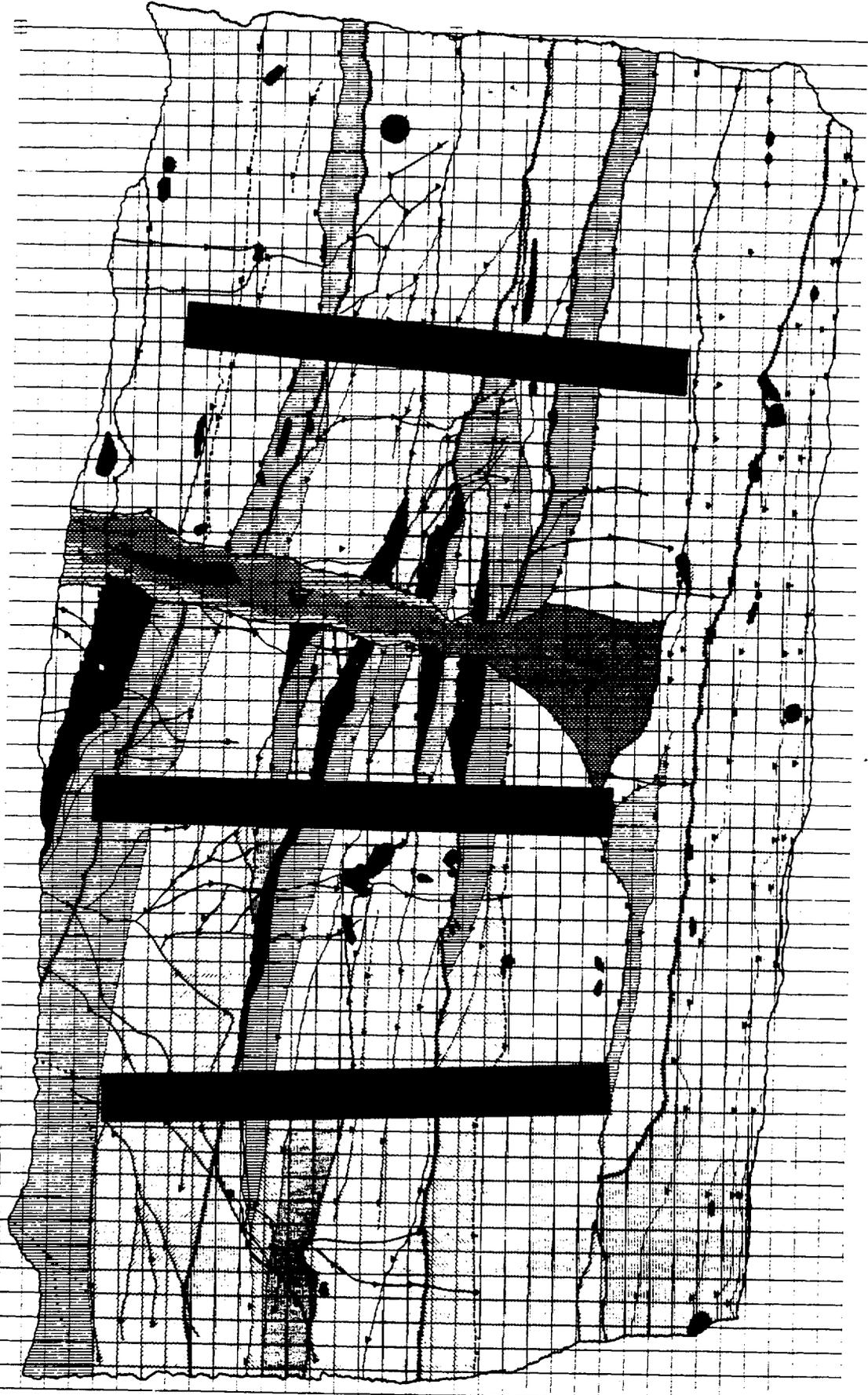
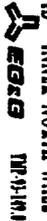
Relation of 6/29/92 Earthquake Epicenter to X & Y Tunnels and Major Faults in the Vicinity of the Proposed Repository at Yucca Mountain, Nevada

THIS IS A DRAFT

SCALE 1:10

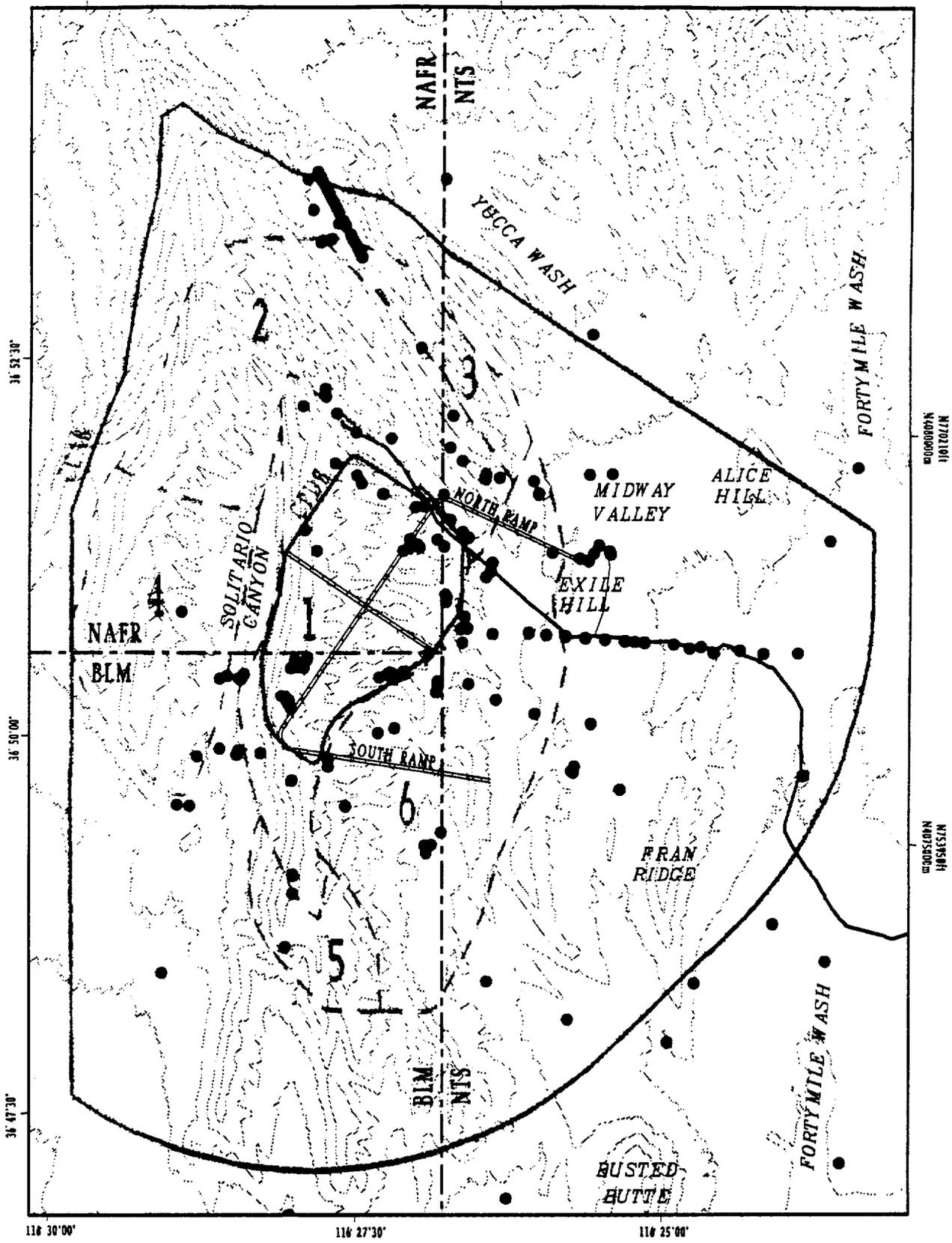
YUCCA MOUNTAIN

SITE CHARACTERIZATION PROJECT
DRAFT TRENCH LOG FOR TRENCH 14D - INNER NORTH WALL



E550245ft
E545000m

E566601t
E550000m



POINT LEGEND
 ● Existing Borehole



Contour Interval 200 Feet

**YUCCA MOUNTAIN
 SITE CHARACTERIZATION PROJECT
 PROJECT BOUNDARIES**



WBS 1.2.5.3.6
QA: NA

June 17, 1993
NV-93-495

I-343453
BANK

Mr. Carl P. Gertz, Project Manager
Department of Energy
Yucca Mountain Site Characterization Project Office
101 Convention Center Drive
Las Vegas, NV 89109

**MAY 1 - MAY 31, 1993 PROGRESS REPORT - EG&G/ENERGY
MEASUREMENTS REMOTE SENSING LABORATORY SUPPORT TO THE
YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT**

6-17-93

Enclosed is a progress report on the EG&G Energy Measurements (EG&G/EM) Remote Sensing Laboratory (RSL) support to the Yucca Mountain Site Characterization Project (YMP) for May 1, 1993, through May 31, 1993.

The progress report for EG&G/EM RSL support to YMP includes the following sections:

- o Work Accomplished
- o Expenditures
- o Status of Deliverables

If you have any questions, please contact Elaine Ezra at (702) 794-7449.

James Michael
James Michael, Manager
NV Program

CE:ns

Enclosures

DIVISION _____
RECORD _____
SOURCE *Dyer*
CC: *See Dist.*
CC: *Just (10)*
CC: *Gerb*
CC: *Johnson - SD*
CC: *Smith, D*
CC: _____
CC: _____

REC'D IN YMP
6/21/93

ENCLOSURE 3

W/10
DOTS 1.10

Carl P. Gertz

MAY 1 - MAY 31, 1993 PROGRESS REPORT - EG&G/ENERGY
MEASUREMENTS REMOTE SENSING LABORATORY SUPPORT TO THE
YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

June 17, 1993

Page 2

cc: S. Ronshaugen, DOE/NV EMD (w/o encl)
M. Blanchard, DOE/YMP (w/o encl)
S. Bodnar, M&O (w/o encl)
W. Dixon, DOE/YMP (w/o encl)
M. Dockter, DOE/NV (w/o encl)
R. Dyer, DOE/NV (w/o encl)
J. Lorenz, REECo/YMP
C. Newbury, DOE/YMP
A. Robison, DOE/YMP (w/o encl)
M. Ryder, DOE/YMP (w/o encl)
A. Simmons, DOE/YMP
D. Williams, DOE/YMP (w/o encl)
W. Wilson, DOE/YMP

PROGRESS REPORT FOR EG&G/EM RSL SUPPORT TO YMP
Work Accomplished

WBS 1.2.3 **SITE INVESTIGATIONS**

WBS 1.2.3.1 **SITE INVESTIGATIONS COORDINATION AND PLANNING**

REPORT PERIOD: May 1, 1993 - May 31, 1993

REPORT DATE: June 15, 1993

RESPONSIBLE INDIVIDUAL: D.W. Brickey

SUMMARY OF WORK ACCOMPLISHED DURING REPORT PERIOD:

1. There does not appear to be an existing method for converting Lynx generated output files to a compatible format with Dynamic Graphics. To develop a conversion would require software development efforts by the respective vendors.
2. Dave Brickey attended a Lynx GMS demonstration on May 14, presented to Morrison-Knudsen (Bob Elayer).
3. Kelly Coyle, a mechanical engineering summer intern, has been tasked by the M&O to develop site description models for Yucca Mountain as part of the Reference Information Base effort. Kelly inquired about the use of the Dynamic Graphics (DGI) 3-D modeling system to create a geologic, thermal-mechanical, geochemical, etc. models for Yucca Mountain using the best available data. It was recommended that she be sent to training to learn the fundamentals of the Dynamic Graphics software. Dave Brickey spent several hours demonstrating the system and providing the materials he received from his training.

MAJOR PROBLEMS AND CORRECTIVE ACTION UNDERTAKEN: None.

ANTICIPATED SIGNIFICANT EVENTS PLANNED DURING NEXT REPORT PERIOD:

1. Dave Brickey will demonstrate the Dynamic Graphics EarthVision software to Bob Elayer (M&O) on June 4.

PROGRESS REPORT FOR EG&G/EM RSL SUPPORT TO YMP
Work Accomplished

WBS 1.2.5 **REGULATORY**

WBS 1.2.5.3.5 **TECHNICAL DATABASE INPUT**

REPORT PERIOD: **May 1, 1993 - May 31, 1993**

REPORT DATE: **June 15, 1993**

RESPONSIBLE INDIVIDUAL: **C.E. Ezra**

SUMMARY OF WORK ACCOMPLISHED DURING REPORT PERIOD:

1. **None.**

MAJOR PROBLEMS AND CORRECTIVE ACTION UNDERTAKEN: **None.**

ANTICIPATED SIGNIFICANT EVENTS PLANNED DURING NEXT REPORT PERIOD:

1. **None.**

PROGRESS REPORT FOR EG&G/EM RSL SUPPORT TO YMP
Work Accomplished

WBS 1.2.5 **REGULATORY**

WBS 1.2.5.3.6 **GEOGRAPHIC NODAL INFORMATION STUDY AND
EVALUATION SYSTEM (GENISES)**

SA OE536A **GENISES TECHNICAL DATABASE**

REPORT PERIOD: May 1, 1993 - May 31, 1993

REPORT DATE: June 15, 1993

RESPONSIBLE INDIVIDUAL: J. Beckett

SUMMARY OF WORK ACCOMPLISHED DURING REPORT PERIOD:

1. Jim Beckett attended the Tracers, Fluids and Materials Database planning meeting on May 6.
2. Claudia Newbury (DOE/YMPO) visited the YMPSO offices on May 6 to train on the ArcView system and YMP demonstration dataset.
3. A meeting was held on May 21 at the YMPSO offices to discuss methods for integrating data into the GIS database that are collected during pre-activity surveys. Attending the meeting were Bill Jacobs, Christine Robinson and Martin Rose (SAIC), Paul Buck and Hal Rager (DRI), Audrey Hughes (EG&G/ESD) and Elaine Ezra (EG&G/RSL). A topic of interest was discussed regarding the determination of locations for the survey plots. Desert Research Institute, SAIC and EG&G/EM SBO each use different methods for identifying the locations of the surveys. This is an area that possibly could be improved by a coordinated GPS survey as part of the pre-activity survey process.
4. A meeting was held with the M&O Site Investigations group on May 21 to discuss the process by which planned activities are initiated and their locations incorporated into the GIS database. The development of a process for information flow was discussed, with concepts such as acquiring GPS locations as part of the pre-activity survey requirements offered. Attending the meeting were Norma Bigger, Bill Distel, and John Gauthier (M&O) and Elaine Ezra and Barbara Kistler. The M&O took action items to prepare flow diagrams of processes for development of the annual plans, test planning and test interferences.

5. Links between the processed SEPDB files and GENISES Technical Database were established.
6. The requirements for GENISES staff to process the SEPDB backlog were identified and transmitted to YMPO (Ltr. Ezra to Simmons, dtd. 5/6/93). The SEPDB backlog was defined as the data that were submitted to the SEPDB but were not automated nor entered. There are 68 backlogged SEPDB submittal packages comprised of 375 tables containing 2,302 pages. A recommended approach for automating and entering the data into the GENISES TDB was provided.
7. The following submittal to the GENISES Technical Database was received:
 - LA00000000014.002 - Calcite Deposits in Drill Cores USW G-2 and USW GU-3/G-3 at Yucca Mountain Nevada.
8. The following submittals to the GENISES Technical Database were processed:
 - SAND82-1723 (SNSAND87172300.000) processing into GENISES was completed on May 6, 1993.
 - YMP/92-41-TPR - Topical Report-Evaluation of the Potentially Adverse Condition "Evidence of Extreme Erosion During the Quaternary Period" at Yucca Mountain, Nevada (TMTPR00000001.001) processing into GENISES was completed on May 19, 1993.
 - SAND83-1646 - Uniaxial Compression Test Series on Topopah Spring Tuff from USW GU-3, Yucca Mountain, Southern Nevada (SNSAND 83164600.000) processing into GENISES was completed on May 24.
 - OFR 91-478 - Simulated water-level declines caused by withdrawals from wells J-13 and J-12 near Yucca Mountain, Nevada by J.B. Czarnecki (DTN GS910983116214.001) processing into GENISES was completed on May 26, 1993.
 - SAND84-0860 - Preliminary Characterization of the Petrologic, Bulk and Mechanical Properties of a Lithophysal Zone within the Topopah Spring Member of the Paintbrush Tuff (DTN SNSAND84086000.000, TDIF 300805) processing into GENISES was completed on May 26, 1993.
 - SAND84-1471 - Fracture and Matrix Hydrologic Characteristics of Tuffaceous Materials from Yucca Mountain, Nye County, Nevada (DTN SNSAND84147100.000) processing into GENISES was completed on May 27, 1993.

- SAND82-1314 - Uniaxial and Triaxial Compression Test Series on Calico Hills Tuff (DTN SNSAND82131400.000) processing into GENISES was completed on May 28, 1993.
 - OFR 90-369 - Geohydrologic data from Test Holes UE-25 UZ#4 and UZ#5, Yucca Mountain Area, Nye County, Nevada by Carole Laskot and Dale Hammermeister (DTN GS921008312211.008) processing was completed on May 28, 1993.
9. The following backlogged submittals to the SEPDB were processed administratively into the GENISES Technical Database:
- SAND91-7031 (TDIF 301232) - accepted by SEPDB on April 25, 1991.
 - SAND89-2270 (TDIF 301233) - accepted by SEPDB on December 13, 1989.
 - SAND88-3033 (TDIF 301234) - accepted by SEPDB on October 23, 1989.
 - SAND87-2380 (TDIF 300837) - accepted by SEPDB on July 26, 1989.
 - SAND85-0703 (TDIF 300852) - accepted by SEPDB on September 24, 1987.
 - UCRL-102127 (TDIF 200189) - accepted by SEPDB on February 14, 1991.
 - HEDL-TME 85-22 (TDIF 200188) - accepted by SEPDB on January 22, 1991.
 - PNL 7169 (TDIF 200188) - accepted by SEPDB on January 22, 1991.
 - PNL 7170 (TDIF 200188) - accepted by SEPDB on January 22, 1991.
 - LA-10188-MS (TDIF 301149) - accepted by SEPDB on October 3, 1990.

MAJOR PROBLEMS AND CORRECTIVE ACTION UNDERTAKEN: None

ANTICIPATED SIGNIFICANT EVENTS PLANNED DURING NEXT REPORT PERIOD:

1. GENISES staff will meet with Roger Eckhardt, administrator from Los Alamos National Laboratories on June 2 to discuss formats for TDB submittals.

2. GENISES staff will meet with Jim Hall (LANL) on the Tracers, Fluids and Materials database on June 2.
3. Elaine Ezra, Jim Beckett and Chris Berlien will attend the Technical Database Working group meeting scheduled for June 3.
4. Howard Oliver (USGS) will visit YMPSO on June 10 to review available digital elevation model and elevation contour data for Yucca Mountain.
5. GENISES staff will meet with Greg Fasano (SAIC) and USGS representatives about data transfer formats on June 14.
6. GENISES staff will prepare input for the Quarterly Report.

PROGRESS REPORT FOR EG&G/EM RSL SUPPORT TO YMP
Work Accomplished

WBS 1.2.5 **REGULATORY**

WBS 1.2.5.3.6 **GEOGRAPHIC NODAL INFORMATION STUDY AND
EVALUATION SYSTEM (GENISES)**

SA OE536B **SITE ATLAS**

REPORT PERIOD: **May 1, 1993 - May 31, 1993**

REPORT DATE: **June 15, 1993**

RESPONSIBLE INDIVIDUAL: **B. Kistler**

SUMMARY OF WORK ACCOMPLISHED DURING REPORT PERIOD:

1. Drafts of all of the FY93 Site Atlas text pages have been completed.
2. Site Atlas coverage development has been initiated.
3. Continued data collection and map preparation.

MAJOR PROBLEMS AND CORRECTIVE ACTION UNDERTAKEN: None.

ANTICIPATED SIGNIFICANT EVENTS PLANNED DURING NEXT REPORT PERIOD:

1. A draft of the FY93 Site Atlas will be completed.

PROGRESS REPORT FOR EG&G/EM RSL SUPPORT TO YMP
Work Accomplished

WBS 1.2.5 **REGULATORY**

WBS 1.2.5.3.6 **GEOGRAPHIC NODAL INFORMATION STUDY AND**
EVALUATION SYSTEM (GENISES)

SA OE536C **GIS, MAPPING AND ANALYSIS**

REPORT PERIOD: **May 1, 1993 - May 31, 1993**

REPORT DATE: **June 15, 1993**

RESPONSIBLE INDIVIDUAL: **C.E. Ezra**

SUMMARY OF WORK ACCOMPLISHED DURING REPORT PERIOD:

1. GIS map products were generated to support project participants and are detailed in the "Deliverables" statement.
2. Other "non-map" products include the following:
 - An INGRES report was generated for Norma Biggar (M&O/WCFS) on May 5 including the following information:
 - Proposed boreholes as of January 26, 1993.
 - Proposed boreholes as of May 6, 1993.
 - Proposed monitoring stations as of May 6, 1993
 - Proposed trenches as of May 6, 1993.
 - Proposed pits as of May 6, 1993.
 - Additional proposed data not yet in the TDB as of May 6.
 - An INGRES report listing the activity identifier, type and Nevada State Plane coordinates was provided to Tom Reynolds (M&O/WCFS) on May 7 for the following activities:
 - Meteorological monitoring stations
 - Precipitation and streamflow monitoring stations
 - Water-level and spring discharge monitoring sites
 - Ecological study plots
 - Radiological monitoring plots
 - Deer forage areas with other study activities
 - Reclamation trial plots
 - Predator survey routes

- One 40" x 40" duraflex print, eleven 8" x 10" prints, three viewgraphs and three 35mm slides were prepared of EG&G Negative No. 93D-101L for Jerry Lorenz (REECO/YMP) on May 10.
- Ten 8" x 10" prints, three viewgraphs and three 35mm slides of the following were provided to Jerry Lorenz (REECO/YMP) on May 10:

EG&G Negative No:	93-011L	93A-009L	92I-418L
	92G-361L	92G-359L	91L-1087L
	93A-010L	91L-1085L	92B-0038L
- Ten 9" x 9" prints, three viewgraphs and three 35mm slides of the following were provided to Jerry Lorenz (REECO/YMP) on May 19:

Perf#: 6301 Frames: 031, 069, 074, and 075.
- Four color slides of the following products were provided to Chris Menges (USGS) on May 17:
 - YMP-93-160.0 - Trench 14D Bow Ridge Fault
 - YMP-93-161.0 - Trench 14D Bow Ridge Fault: Tectonic Features
 - YMP-93-162.0 - Trench 14D Bow Ridge Fault: Fault Displacements
 - YMP-93-163.0 - Trench 14D Bow Ridge Fault: Soil Stratigraphy
 - YMP-93-164.0 - Trench 14D Bow Ridge Fault: Most Recent Event
- A listing of the UTM coordinates for five Solitario Canyon trenches was provided to Audrey Hughes (EG&G/ESD) on May 18.
- Two viewgraphs of EG&G MRSD 90137.01 - Yucca Mountain Image Map were provided to Mark Tynan (DOE/YMP) on May 20.
- The depth to the planned repository for the point at which the Yucca Crest Road crosses the South Ramp was derived and provided to John Peck (SAIC) on May 20.
- Six color slides and six color viewgraphs of EG&G Negative No. 888-182 were provided to Carma Hernandez (SAIC) on May 24.
- Four INGRES tabular reports were provided to Kathy Mrotek (M&O/WCFS) of the following on May 21:
 - Existing boreholes prior to 1987
 - Existing boreholes after 1986
 - All existing trenches
 - All existing pits
- Thirteen color viewgraphs of the following maps were provided to Mark Tynan (DOE/YMP) on May 24.

YMP-93-167.0 - YMP and Vicinity map
YMP-93-168.0 - YMP Regional Area map
YMP-93-169.0 - YMP Near Field Area map
YMP-93-170.0 - YMP Site Area map

- One color viewgraph of YMP-93-171.0 (YMP Regional Area Map) was provided to Charles Schlinger (SAIC) on May 24.
- Ten 9" x 9" color prints of EG&G Negative No. 93E-171L were provided to Jerry Lorenz (REECO/YMP) on May 28.
- Four 20" x 24" PMTs were prepared for Allison Inglett (SAIC) on May 13.
- One 3.5" diskette containing digital versions of the Site Atlas data supplement pages for pavements, pits and trenches was provided to Tom Rey

MAJOR PROBLEMS AND CORRECTIVE ACTION UNDERTAKEN:

ANTICIPATED SIGNIFICANT EVENTS PLANNED DURING NEXT REPORT PERIOD:

1. Continued level-of-effort.

PROGRESS REPORT FOR EG&G/EM RSL SUPPORT TO YMP
Work Accomplished

WBS 1.2.5 REGULATORY

**WBS 1.2.5.3.6 GEOGRAPHIC NODAL INFORMATION STUDY AND
EVALUATION SYSTEM (GENISES)**

SA OE536D REMOTE SENSING

REPORT PERIOD: May 1, 1993 - May 31, 1993

REPORT DATE: June 15, 1993

RESPONSIBLE INDIVIDUAL: C.E. Ezra

SUMMARY OF WORK ACCOMPLISHED DURING REPORT PERIOD:

1. Responses to the remote sensing survey were received.
2. The orthophoto mission to support Bruce Crowe's volcanic study was approved.

MAJOR PROBLEMS AND CORRECTIVE ACTION UNDERTAKEN: None.

ANTICIPATED SIGNIFICANT EVENTS PLANNED DURING NEXT REPORT PERIOD:

1. Results from the remote sensing survey will be compiled.
2. A funding transfer from LANL to EG&G/EM and RSN will be initiated.
3. Planning for the RSN ground control survey and EG&G/EM photo mission will be initiated and work scheduled.
4. Procurement documentation for the orthophoto processing subcontract will be compiled.

PROGRESS REPORT FOR EG&G/EM RSL SUPPORT TO YMP
Work Accomplished

WBS 1.2.5 **REGULATORY**

WBS 1.2.5.3.6 **GEOGRAPHIC NODAL INFORMATION STUDY AND
EVALUATION SYSTEM (GENISES)**

SA OE536E **COMPUTER SUPPORT**

REPORT PERIOD: **May 1, 1993 - May 31, 1993**

REPORT DATE: **June 15, 1993**

RESPONSIBLE INDIVIDUAL: **C.W. Logan**

SUMMARY OF WORK ACCOMPLISHED DURING REPORT PERIOD:

1. Continued progress was made on the hardware/software configuration plan. The network configuration schematic and hardware configuration diagrams are complete.
2. WordPerfect and WordPerfect Office for Unix were installed on the SUN workstations at the YMPSO.
3. Three X-terminals were installed and configured on the YMPSO GENISES system
4. EarthVision 1.1 was installed on the SGI 3-D modelling workstation at the YMPSO facility.
5. Schematics for the proposed EG&G/EM RSL YMPSO network configuration to interface with the rest of the YMP participants were reviewed by DOE/YMPO and SAIC. DOE/YMPO is purchasing the required router.
6. NOTE: Environmental Systems Research Institute has bad news and good news. The bad news is that ArcView 2 is currently scheduled for release by the end of the year; it was previously scheduled for release sometime in July. The tentative good news is that holders of ArcView 1 will only have to pay ~\$300 for an upgrade to ArcView 2; originally ESRI was suggesting a complete replacement cost of \$1000-1500.

MAJOR PROBLEMS AND CORRECTIVE ACTION UNDERTAKEN: None.

ANTICIPATED SIGNIFICANT EVENTS PLANNED DURING NEXT REPORT PERIOD:

1. The Compliance Evaluation Plan review comments will be completed and provided to DOE/YMP IRM.

PROGRESS REPORT FOR EG&G/EM RSL SUPPORT TO YMP
Work Accomplished

WBS 1.2.5 **REGULATORY**

WBS 1.2.5.3.6 **GEOGRAPHIC NODAL INFORMATION STUDY AND
EVALUATION SYSTEM (GENISES)**

SA OE536F **CAPITAL EQUIPMENT**

REPORT PERIOD: May 1, 1993 - May 31, 1993

REPORT DATE: June 15, 1993

RESPONSIBLE INDIVIDUAL: C.W. Logan

SUMMARY OF WORK ACCOMPLISHED DURING REPORT PERIOD:

1. A meeting with Chris Franks and Bill Atkinson (INGRES) and Chris Berlien, Todd Radermacher and Dave Brickey (EG&G/EM) was held on May 12 to discuss software products required for the planned fileserver. Procedures for using WindowView with INGRES on the SUN were also discussed.
2. Discussions with a Zeh Graphics software vendor were conducted on May 24 as part of the electrostatic plotter evaluation.
3. Procurement documents for a file server, electrostatic plotter, image processing system, SUN workstation, additional Silicon Graphics disk, 37" monitor,

MAJOR PROBLEMS AND CORRECTIVE ACTION UNDERTAKEN: FY93 capital equipment funds are still not available, nor has DOE/YMP approval been received. If the capital funding is not identified in the June FIN Plan, the procurement of the fileserver, electrostatic plotter, and workstations during the FY93 fiscal cycle is in jeopardy of not being accomplished. Ardyth Simmons, John Gandi, Mary Ann Jones and Wayne Kozai have been informed.

ANTICIPATED SIGNIFICANT EVENTS PLANNED DURING NEXT REPORT PERIOD:

1. A vendor representative from Silicon Graphics will visit YMPSO on June 9.
2. A vendor representative from Rastergraphics, an electrostatic plotter, will visit the YMPSO on June 10.

PROGRESS REPORT FOR EG&G/EM RSL SUPPORT TO YMP
Work Accomplished

WBS 1.2.5 **REGULATORY**

WBS 1.2.5.3.6 **GEOGRAPHIC NODAL INFORMATION STUDY AND
EVALUATION SYSTEM (GENISES)**

SA OE536G **PROJECT MANAGEMENT**

REPORT PERIOD: **May 1, 1993 - May 31, 1993**

REPORT DATE: **June 15, 1993**

RESPONSIBLE INDIVIDUAL: **C.E. Ezra**

SUMMARY OF WORK ACCOMPLISHED DURING REPORT PERIOD:

1. Reporting/Tracking/Planning

- **EG&G/EM RSL April Progress report was compiled and submitted to DOE/YMPO.**
- **April PACS input was compiled and submitted to John Slocum (M&O).**

2. Meetings/Conferences/Training:

- **Technical Data Managers staff meetings were held with Ardyth Simmons (YMPO), Steve Bodnar and Bob Lewis (M&O) and Elaine Ezra and Jim Beckett on May 17, May 25 and May 31.**
- **Elaine Ezra and Jim Beckett attended the GeoData Policy Forum during the week of May 10 - 12 in Washington DC.**
- **Chris Berlien attended YMP Orientation training on May 12.**
- **Todd Radermacher attended the SUN System Administrators Essentials Course in Milpitas, California during the week of May 17.**
- **Dave Brickey assisted at the YMP Technical Information Display at the Geological Society of America conference in Reno, Nevada, during the week of May 17.**

- Rose Broderick attended the ESRI Annual Users Conference in Palm Springs, California, during the week of May 24.
3. Employee Actions:
- Christopher Berlien joined the YMP SO on May 3 and will provide Technical Database administration support.
 - Jerry Sommerfeld joined the YMP SO on May 17 as a GIS Scientist I for mapping support.
 - David Walrath accepted a GIS Scientist I position and will join the RSL on June 2.
4. Records Management:
- Elaine Ezra, Joanna Wiggins and Jim Beckett (EG&G/EM) met with Jan Statler and Cindy Sellards on May 7 to discuss a concept presented at the Records Coordinators Meetings to minimize redundant submittals of technical data to the Central Records Facility for technical data. Currently, Participants are required to send a data records package to the Central Records Facility and to the Technical Database for technical data submittals. Several alternative options were discussed. The consensus of the group was that the Participants should send their data records packages to the Technical Database Administrator, who will process the data, add the processing records as a supplement, and forward the package to the Central Records Facility. This option will be carried forward as a recommendation.
 - The records management quality assurance procedure has been drafted and is under internal review. A requirements matrix was developed for the revised records management procedure and the applicable requirements of the revised QARD.
5. Quality Assurance:
- A workshop was held on May 18 with the YMP QA Division to present the YMP Technical Data Management System.
 - Internal reviews of YMP Quality Management Procedures have been conducted to assess the impact of EG&G/EM working directly under the YMP/DOE QA program.

MAJOR PROBLEMS AND CORRECTIVE ACTION UNDERTAKEN: The EG&G/EM YMP QA Program development is on-hold until the decision is made as to whether EG&G/EM RSL will work to DOE OCRWM approved implementing procedures or will continue to develop an EG&G/EM program. DOE YMQAD is preparing a draft Technical Directive for review directing EG&G/EM to convert to the YMP OCRWM implementing procedures. The Technical Directive will be reviewed by EG&G/EM and comments/questions provided to DOE/YMP for consideration.

ANTICIPATED SIGNIFICANT EVENTS PLANNED DURING NEXT REPORT PERIOD:

1. Interviews for the Scientist II positions will continue for qualified external applicants.
2. Joanna Wiggins will meet with the YMP Local Records Center to discuss records management requirements and records transmittal procedures.
3. Joanna Wiggins will attend the DOE Records Management Conference in Seattle, Washington, during the week of June 14-17.
4. EG&G/EM RSL technical procedures are under review to identify possible improvements and efficiencies.
5. Jerry Sommerfeld will attend YMP Orientation training on June 9.

Expenditures from April 26, 1993 to May 30, 1993
(Dollars in thousands)

<u>Task</u>	<u>Budget</u>	<u>May Cost</u>	<u>Total Costs To Date</u>	<u>Remaining</u>
WBS 1.2.3 Site Investigations	\$ 50.0	\$ 0.4	\$ 7.0	\$ 43.0
WBS 1.2.5 Regulatory	\$2,320.0	\$ 167.6	\$ 1098.6	\$ 1,221.4
WBS 1.2.15 Support Services	<u>\$ 176.0</u>	<u>\$ 18.5</u>	<u>\$ 86.6</u>	<u>\$ 89.4</u>
TOTALS	\$2,546.0	\$ 186.5	\$ 1,192.2	\$1,353.8

STATUS OF DELIVERABLES FOR EG&G/EM RSL SUPPORT TO YMP
 May 1, 1993 through May 31, 1993

GIS MAP SUPPORT

<u>Description</u>	<u>Requested by/ Organization</u>	<u>Date Sent</u>	<u>Size</u>	<u>No. of Copies</u>
YMP-92-301.0 YMP, Basemap for Selected Area	Morris/YMPO	5/3/93	Full	1
YMP-92-303.0 Existing Drillholes (Depth Greater than 500ft) and Geologic Structure	Elayer/M&O	5/4/93	Full	1
YMP-92-274.0 Field Verification Map Sheet 17	Elayer/M&O	5/4/93	Full	1
YMP-92-273.0 Field Verification Map Sheet 16	Elayer/M&O	5/4/93	Full	1
YMP-92-272.0 Field Verification Map Sheet 15	Elayer/M&O	5/4/93	Full	1
YMP-92-268.0 Field Verification Map Sheet 11	Elayer/M&O	5/4/93	Full	1
YMP-92-267.0 Field Verification Map Sheet 10	Elayer/M&O	5/4/93	Full	1
YMP-92-266.0 Field Verification Map Sheet 9	Elayer/M&O	5/4/93	Full	1
YMP-92-146.2 Field Planning Map	Rautenstrauch/ EG&G/EM	5/4/93	Full	20
YMP-92-240.0 Existing Drillholes, Repository Block Area	Roosa/DOE Research & Study Area	5/4/93	Full	2

YMP-93-146.0 YMP, Relation of 6/29/92 Earthquake Epicenter to X & Y Tunnels & Major Faults in the Vicinity of the Proposed Repository at Yucca Mountain	Schlinger/SAIC	5/5/93	Page	1
YMP-93-010.1 Area Overview, North	Stephan/YMPO	5/6/93	Full	1
YMP-93-127.0 Existing & Proposed Boreholes	Stephan/YMPO	5/6/93	Full	1
YMP-89-064.1 Location of Schlumberger Resistivity Soundings Acquired, by Greenhaus and Zablocki	Schlinger/SAIC	5/6/93	Full	1
YMP-89-044.2 Location of Geoelectric Traverses in the YM Site Area	Schlinger/SAIC	5/6/93	Full	1
YMP-89-039.1 Geoelectric Surveys	Schlinger/SAIC	5/6/93	Full	1
YMP-93-114.1 Figure 1 - Location Map for USW SRG-5/SD-11 Borehole	Ennis/RSN	5/6/93	Page	1
YMP-93-133.1 Reported Activities Completed between 1 October 1992 and 31 March 1993 (Far Field)	Rixford/M&O	5/6/93	Page	3
YMP-92-003.2 Regional Water Level and Spring-Discharge Monitoring Sites	Johnson/USGS	5/7/93	Full	2
YMP-93-112.0 Air Quality and Meteorology Monitoring Sites	Prowell/SAIC	5/7/93	Full	1

YMP-93-146.0 Relation of 6/29/92 Earthquake Epicenter to X & Y Tunnels and Major Faults in the Vicinity of the Proposed Repository at YM, NV	Smistad/YMPO	5/11/93	Page	1
YMP-92-255.0 Existing Drillholes and Selected Geologic Features	Houseworth/M&O	5/12/93	Full	1
YMP-93-148.1 Fortymile Wash Recharge Study Area	Reynolds/M&O	5/13/93	Page	2
YMP-93-147.1 Design Support Boreholes	Reynolds/M&O	5/13/93	Page	2
YMP-92-031.2 Calcite Silica Boreholes	Reynolds/M&O	5/13/93	Page	2
YMP-92-033.2 Solitario Canyon Fault Study	Reynolds/M&O	5/13/93	Page	2
YMP-92-039.2 Water Table Boreholes	Reynolds/M&O	5/13/93	Page	2
YMP-92-044.2 Artificial Infiltration Boreholes	Reynolds/M&O	5/13/93	Page	2
YMP-92-042.2 Southern Tracer Complex	Reynolds/M&O	5/13/93	Page	2
YMP-92-041.2 Geologic Boreholes	Reynolds/M&O	5/13/93	Page	2
YMP-92-038.2 Volcanic Drilling Program	Reynolds/M&O	5/13/93	Page	2
YMP-92-043.2 In Situ Stress Drilling	Reynolds/M&O	5/13/93	Page	2
YMP-92-040.2 Water Supply and Test Boreholes	Reynolds/M&O	5/13/93	Page	2

YMP-92-037.3 Unsaturated Zone Boreholes	Reynolds/M&O	5/13/93	Page	2
YMP-92-036.1 Systematic Drilling Boreholes	Reynolds/M&O	5/13/93	Page	2
YMP-93-165.1 YMP Air Quality and Meteorology Monitoring Sites	Prowell/SAIC	5/14/93	Page	5
YMP-93-112.0 Air Quality and Meteorology Monitoring Sites	Fransioli/SAIC	5/17/93	Page	12
YMP-93-160.0 Trench 14D Bow Ridge Fault	Menges/USGS	5/17/93	Full	1
YMP-93-161.0 Trench 14D Bow Ridge Fault: Tectonic Features	Menges/USGS	5/17/93	Full	1
YMP-93-162.0 Trench 14D Bow Ridge Fault: Fault Displacements	Menges/USGS	5/17/93	Full	1
YMP-93-163.0 Trench 14D Bow Ridge Fault: Soil Stratigraphy	Menges/USGS	5/17/93	Full	1
YMP-93-164.0 Trench 14D Bow Ridge Fault: Most Recent Event	Menges/USGS	5/17/93	Full	1
YMP-93-021.1 Existing and Proposed Boreholes within 2 KM of UZ-16	Ennis/RSN	5/19/93	Page	1
YMP-93-106.0 YM Area with Emergency Response Grid	White/YMPO	5/20/93	Page	50
YMP-91-005.1 Roads Approved for Use Based on Completed Desert Tortoise Surveys	McCormick/SAIC	5/21/93	Page	1

YMP-92-125.0 Potential Hazards Map	McCormick/SAIC	5/21/93	Page	1
YMP-93-026.0	McKinley/USGS	5/21/93	Page	1
YMP-93-071.0	McKinley/USGS	5/21/93	Page	1
YMP-93-105.0	McKinley/USGS	5/21/93	Page	1
YMP-93-106.0	McKinley/USGS	5/21/93	Page	1
YMP-93-107.0	McKinley/USGS	5/21/93	Page	1
YMP-93-108.0	McKinley/USGS	5/21/93	Page	1
YMP-93-109.3	McKinley/USGS	5/21/93	Page	1
YMP-93-114.0	McKinley/USGS	5/21/93	Page	1
YMP-93-114.1	McKinley/USGS	5/21/93	Page	1
YMP-93-127.0	McKinley/USGS	5/21/93	Page	1
YMP-93-128.0	McKinley/USGS	5/21/93	Page	1
YMP-93-129.0	McKinley/USGS	5/21/93	Page	1
YMP-93-130.0	McKinley/USGS	5/21/93	Page	1
YMP-93-132.0	McKinley/USGS	5/21/93	Page	1
YMP-93-133.0	McKinley/USGS	5/21/93	Page	1
YMP-93-134.0	McKinley/USGS	5/21/93	Page	1
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YMP-93-138.0	McKinley/USGS	5/21/93	Page	1
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YMP-93-141.0	McKinley/USGS	5/21/93	Page	1
YMP-93-142.0	McKinley/USGS	5/21/93	Page	1
YMP-93-143.0	McKinley/USGS	5/21/93	Page	1
YMP-93-144.0	McKinley/USGS	5/21/93	Page	1
YMP-93-146.0	McKinley/USGS	5/21/93	Page	1
YMP-93-149.0	McKinley/USGS	5/21/93	Page	1
YMP-93-150.0	McKinley/USGS	5/21/93	Page	1
YMP-93-165.1 Air Quality and Meteorology Monitoring Sites	Prowell/SAIC	5/21/93	Page	5
YMP-93-109.3 YMP Testing	Rohde/EG&G/EM	5/21/93	Full	1
YMP-93-026.0 Potentially Useable Areas with Existing Boreholes	Rohde/EG&G/EM	5/21/93	Full	1
YMP-93-015.0 Historic Seismic Activity, Natural Events Near YM	Rohde/EG&G/EM	5/21/93	Full	1

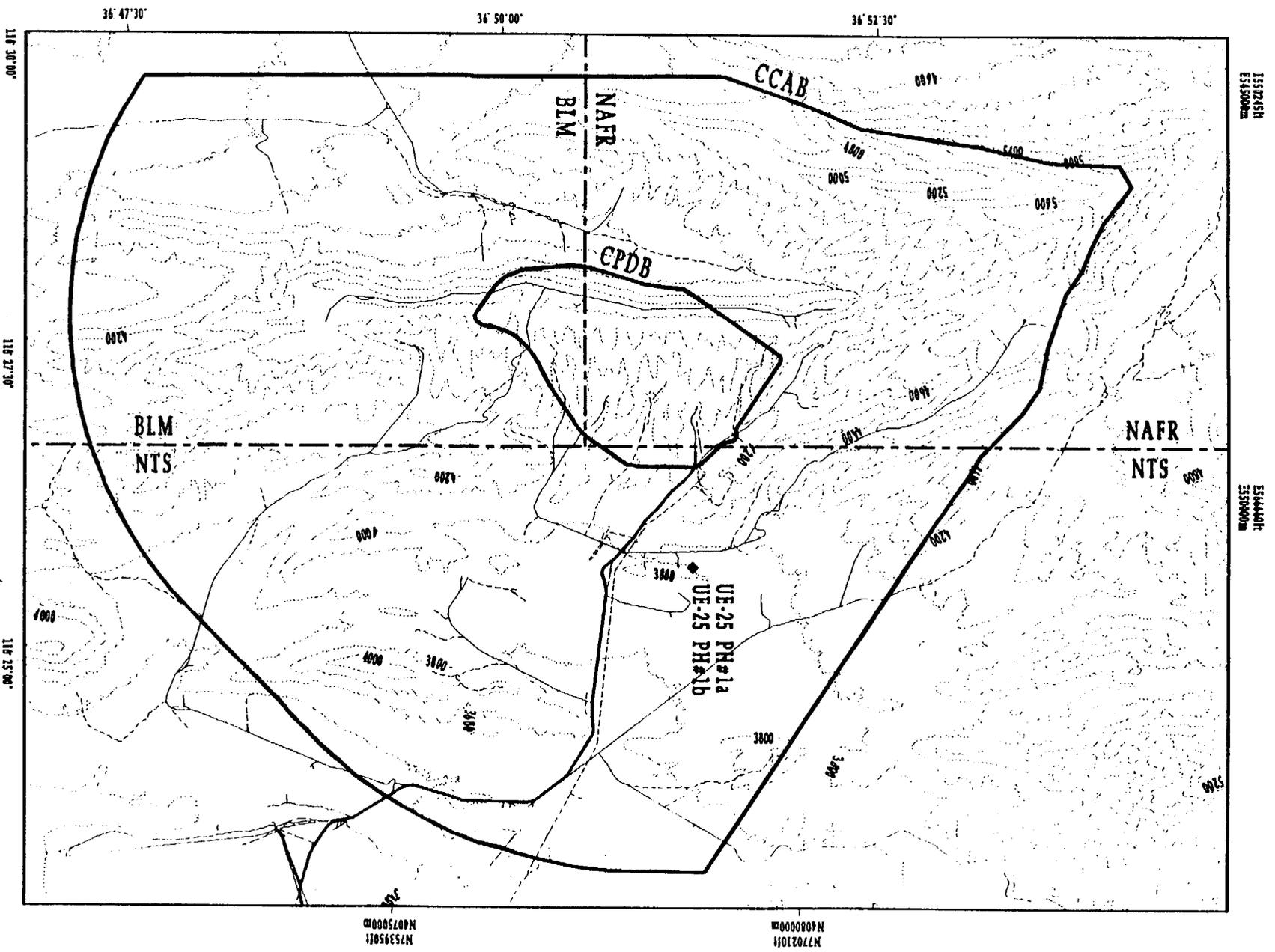
YMP-92-255.0 Existing Drillholes and Selected Geologic Features	Rohde/EG&G/EM	5/21/93	Full	1
YMP-92-193.0 Basemap 1:100,000 Scale Digital Linegraph Roads	Rohde/EG&G/EM	5/21/93	Full	1
YMP-92-156.1 Regional Investigations and Earthquake Epicenter	Rohde/EG&G/EM	5/21/93	Full	1
YMP-92-095.1 Environmental Sampling Locations, Reclamation Trial Sites, and Existing Activities	Rohde/EG&G/EM	5/21/93	Full	1
YMP-92-089.3 Flood Prone Areas	Rohde/EG&G/EM	5/21/93	Full	1
YMP-92-073.1 Tortoise Signposts Designating Limited Access	Rohde/EG&G/EM	5/21/93	Full	1
YMP-92-003.2 Regional Water Level and Spring-Discharge Monitoring Sites	Rohde/EG&G/EM	5/21/93	Full	1
YMP-93-166.0 YM and Vicinity (with Seismic Lines)	Tynan/YMPO	5/21/93	Page	1
YMP-93-167.0 YM and Vicinity (without Seismic Lines)	Tynan/YMPO	5/21/93	Page	1
YMP-93-168.0 YMP, Regional Area	Tynan/YMPO	5/21/93	Page	1
YMP-93-169.0 YMP, Near Field	Tynan/YMPO	5/21/93	Page	1
YMP-93-170.0 YMP, Site Area	Tynan/YMPO	5/21/93	Page	1

YMP-93-171.0 YMP, Regional Area	Schlinger/SAIC	5/24/93	Page	1
YMP-93-169.0 YMP, Near Field	Schlinger/SAIC	5/24/93	Page	1
YMP-93-170.0 YMP, Site Area	Schlinger/SAIC	5/24/93	Page	1
YMP-93-093.3 - Existing Boreholes	Nance/SAIC	5/24/93	Full	1
YMP-93-094.4 Proposed Boreholes	Nance/SAIC	5/24/93	Full	1
YMP-93-106.0 YM Area with Emergency Response Grid	White/YMPO	5/24/93	Page	50
YMP-93-087.0 YMP, Test Interference, Map Sheet 16	Olsen/RSN	5/25/93	Full	4
YMP-93-070.0 Surface Disturbances	Kistler/YMPSO	5/26/93	Page	1
YMP-93-070.1 Surface Disturbances	Kistler/YMPSO	5/26/93	Page	1
YMP-93-106.0 YM Area with Emergency Response Grid	White/YMPO	5/26/93	Page	50
YMP-93-053.1 Far-Field TLD Station Locations	Tappen/SAIC	5/27/93	Full	1
YMP-92-240.0 Location Map 1	Coleman/YMPO	5/28/93	Full	1
YMP-92-240.0 Location Map 2	Coleman/YMPO	5/28/93	Full	1
YMP-92-240.0 Cross Section Sheet 3	Coleman/YMPO	5/28/93	Full	1

YMP-92-240.0 Cross Section Sheet 4	Coleman/YMPO	5/28/93	Full	1
YMP-92-240.0 Location Map 1	Oliver/YMPO	5/28/93	Full	1
YMP-92-240.0 Location Map 2	Oliver/YMPO	5/28/93	Full	1
YMP-92-240.0 Cross Section Sheet 3	Oliver/YMPO	5/28/93	Full	1
YMP-92-240.0 Cross Section Sheet 4	Oliver/YMPO	5/28/93	Full	1
YMP-93-134.0 Meteoro- logical Monitoring Sites	Prowell/SAIC	5/28/93	Page	12
YMP-92-240.0 Location Map 1 and 2, Cross Section 3 and 4	Agnew/M&O	5/28/93	Full	1
YMP-93-173.0 YMP, Planned SD Boreholes	Biggar/M&O	5/28/93	Page	2

Total New Maps 31

Total Maps 328



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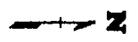
116 25 00

36 47 30

36 50 00

36 52 30

LEGEND
◆ Calcite Silica Borehole



Contour Interval 200 Feet

YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT
CALCITE SILICA BOREHOLES

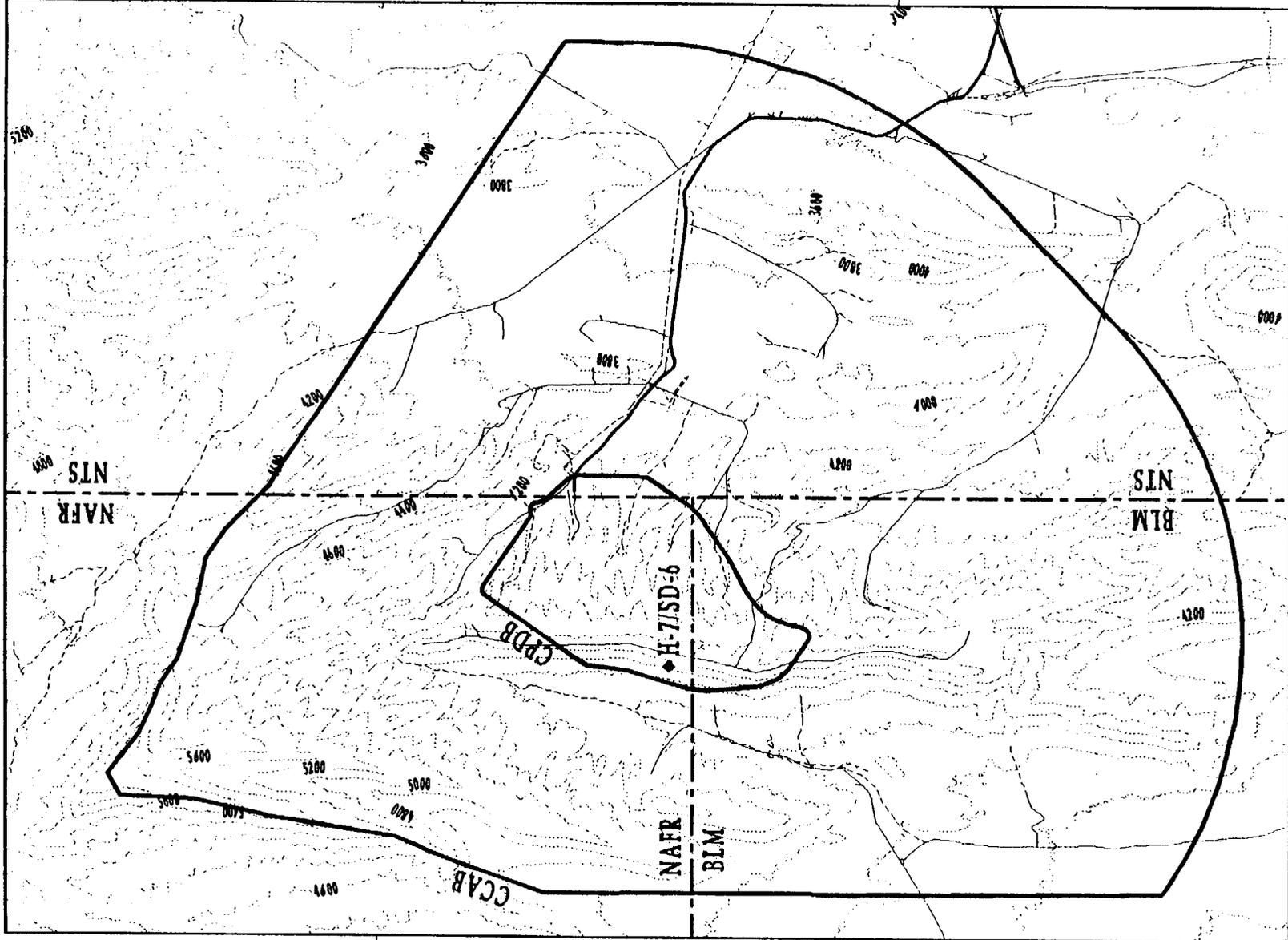
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E545000m

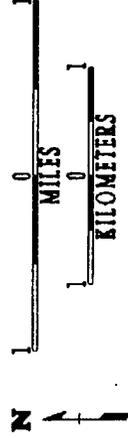
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N4080000m

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LEGEND

- ◆ Solitario Canyon Fault Study Borehole



YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT

SOLITARIO CANYON FAULT STUDY

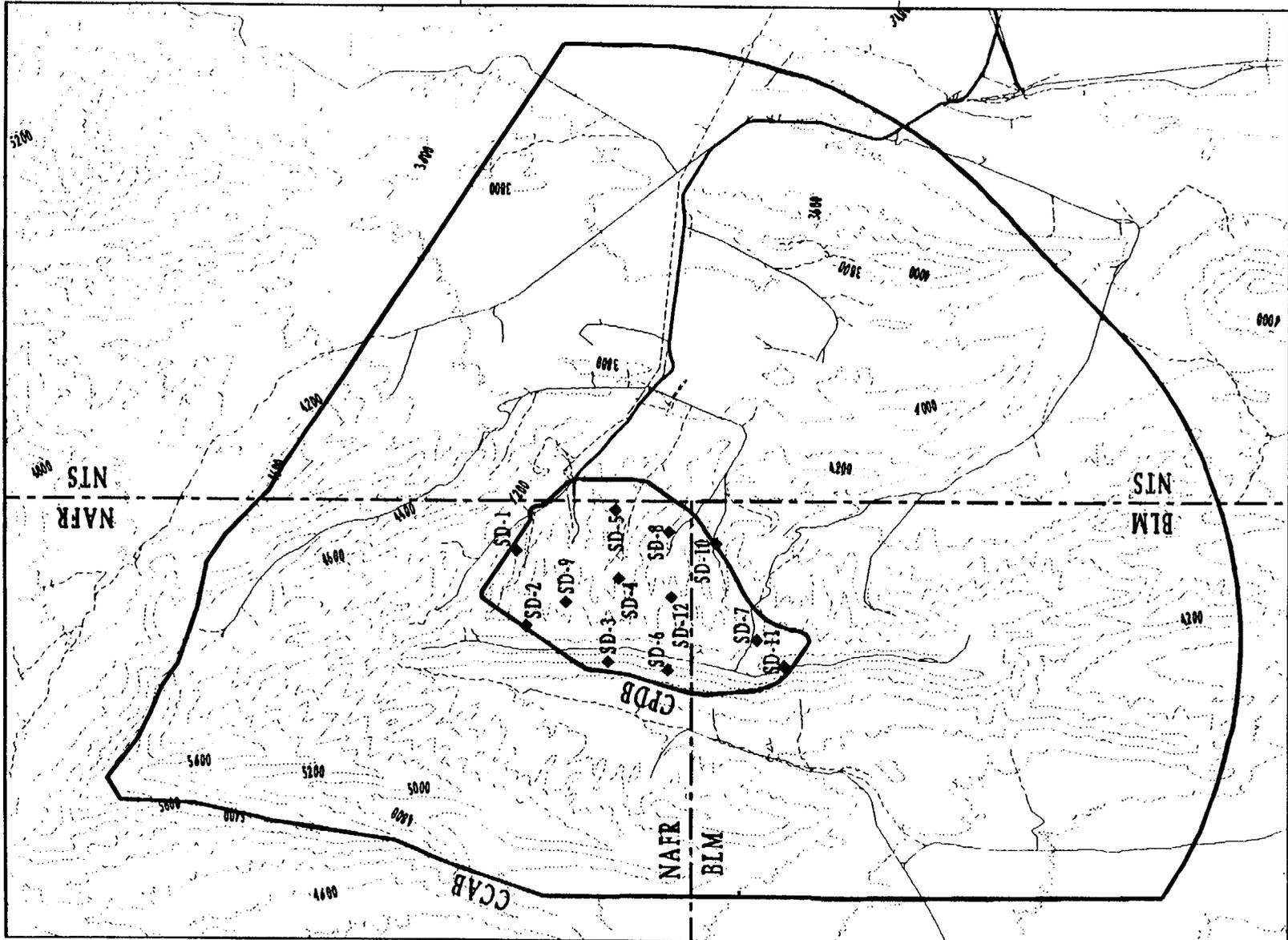
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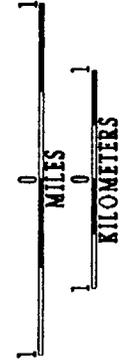
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N4080000m

N753950I
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LEGEND

- ◆ Systematic Drilling Borehole



TUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT

SYSTEMATIC DRILLING BOREHOLES

Contour Interval 200 Feet



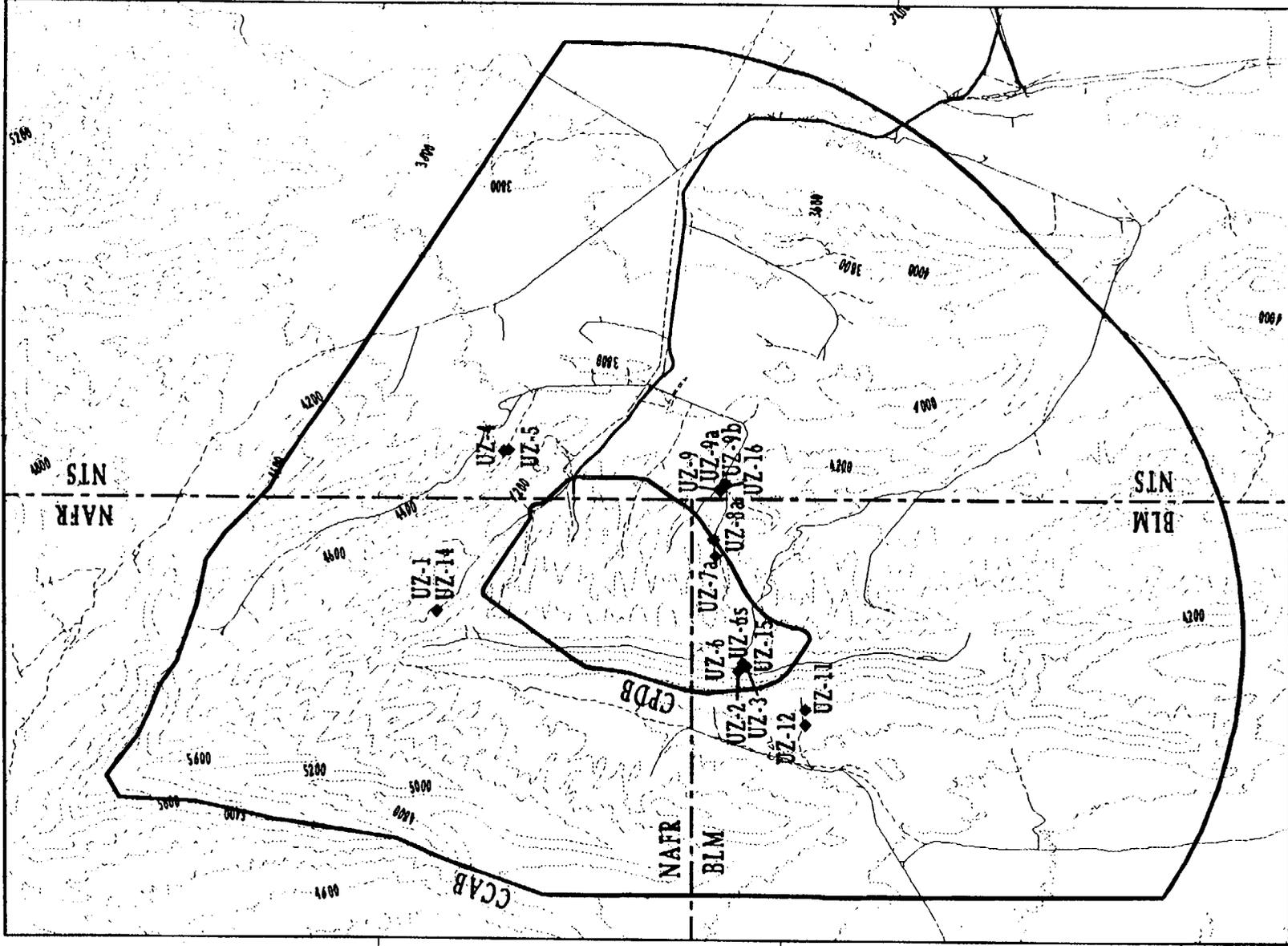
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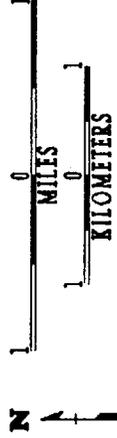
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116 30'00" 116 27'30" 116 25'00"

LEGEND

- ◆ Unsaturated Zone Borehole



Contour Interval 200 Feet

YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT
UNSATURATED ZONE BOREHOLES

E533840ft
E540000m

E566440ft
E550000m

E599475ft
E560000m

36° 52' 30"

36° 45' 00"

36° 37' 30"

N770210ft
N4080000m

N737365ft
N4070000m

N704530ft
N4060000m

N671765ft
N4050000m

Nellis
Air Force
Range

Nevada
Test
Site

Bureau of
Land Management

CCAB

V-1

BLM
NTS

Lathrop Wells Rd.

U.S. Hwy 95

Amargosa
Valley

V-2

State Rte. 373

V-3

V-4

Nevada, Nye Co.
California, Inyo Co.

116° 37' 30"

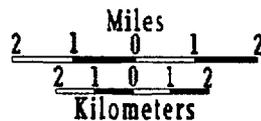
116° 30' 00"

116° 22' 30"

116° 15' 00"

LEGEND

◆ Volcanic Borehole

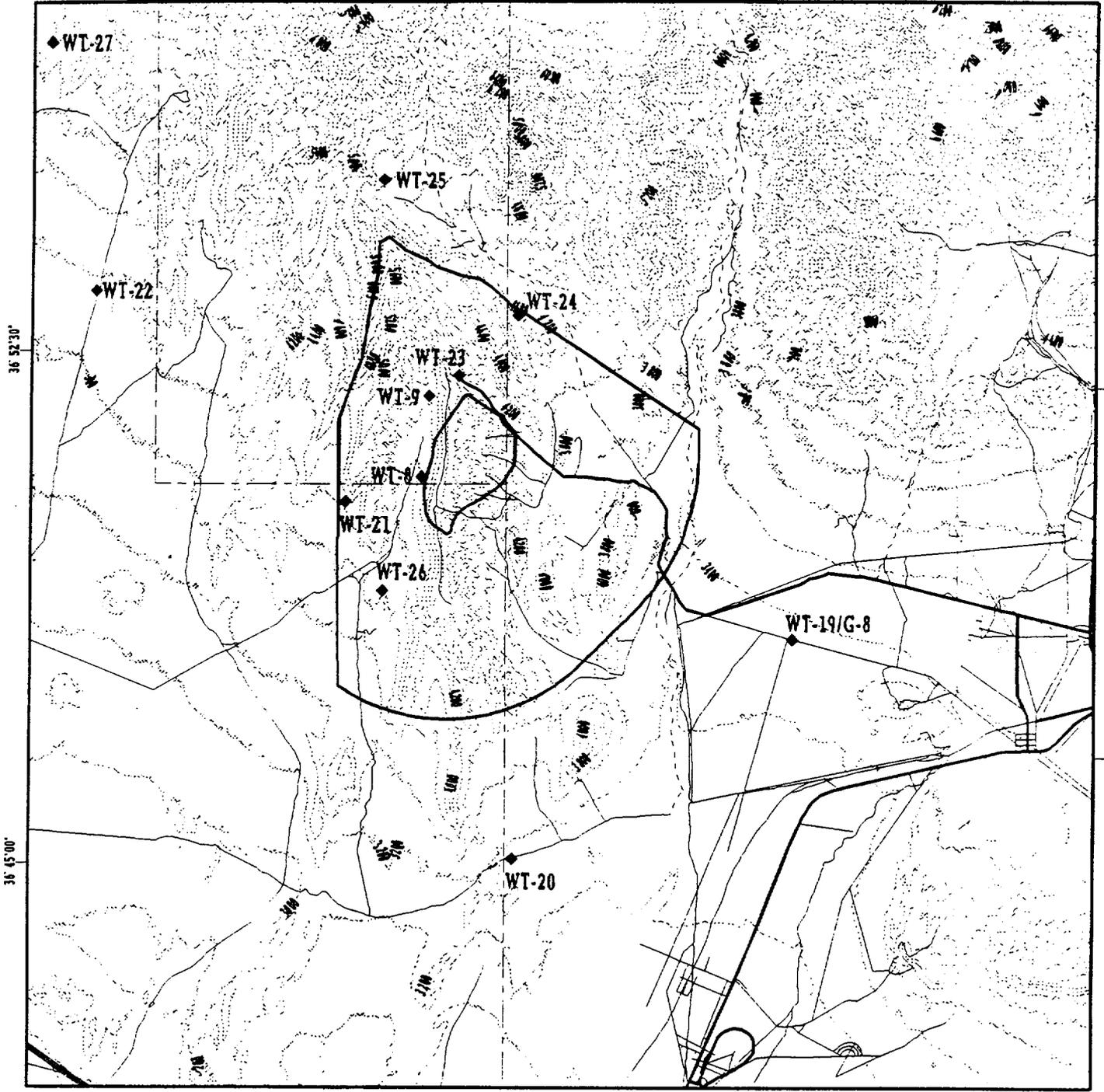


YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT
VOLCANIC DRILLING PROGRAM

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E56640ft
E554000m

E599475ft
E560000m



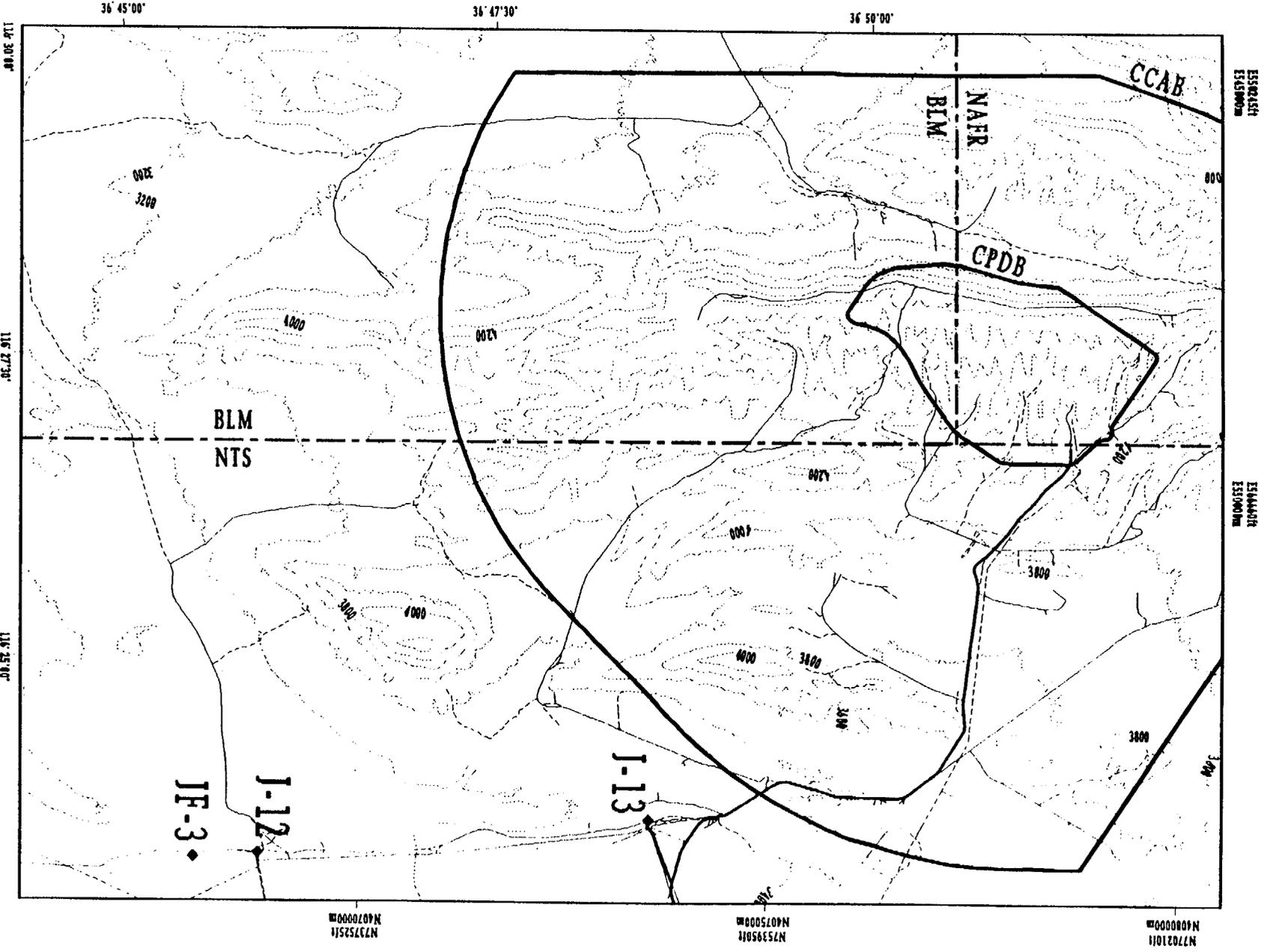
LEGEND

◆ Water Table Borehole

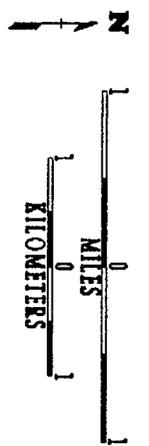


Contour Interval 200 Feet

YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT
WATER TABLE BOREHOLES



LEGEND
 ◆ Water Supply and Test Borehole



Contour Interval 200 Feet

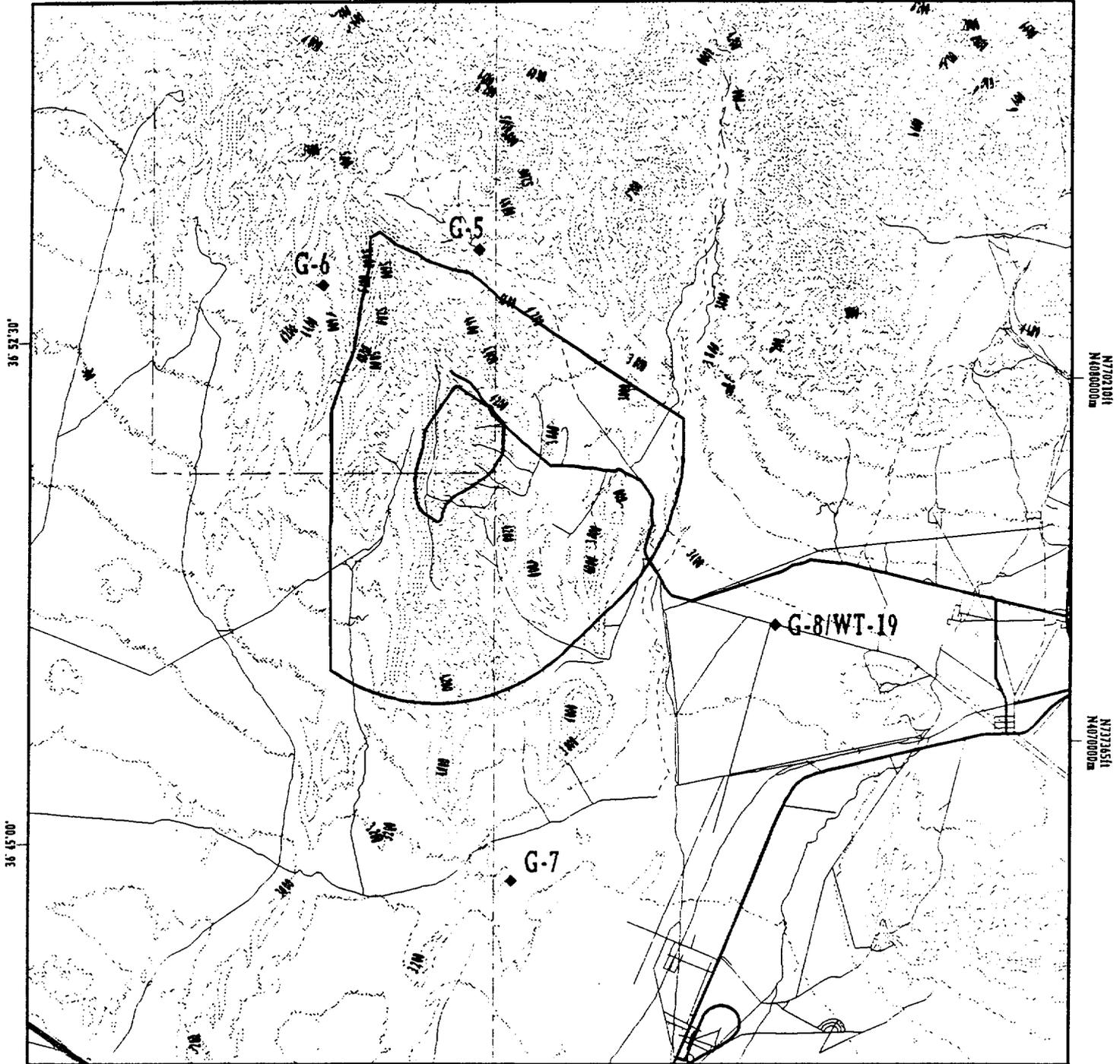
YUCCA MOUNTAIN
 SITE CHARACTERIZATION PROJECT
 WATER SUPPLY AND TEST BOREHOLES

EG&G WPD-92-040.2

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ES66660F1
ES50000m

ES99475F1
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36 45'00"

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N407000m

N737351E
N407000m

116 30'00"

118 22'30"

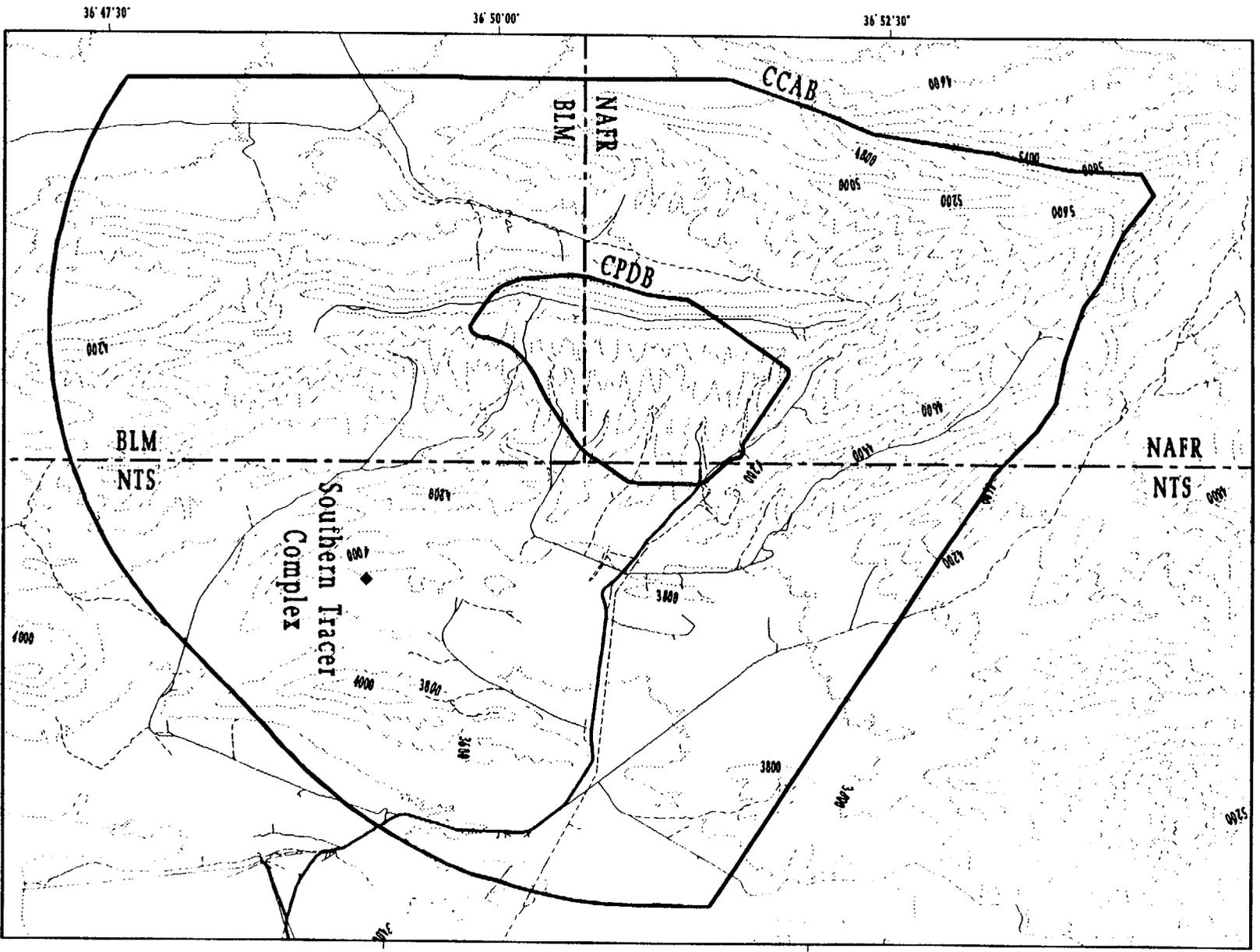
LEGEND

◆ Geologic Borehole



Contour Interval 200 Feet

**YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT
GEOLOGIC BOREHOLES**

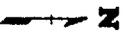


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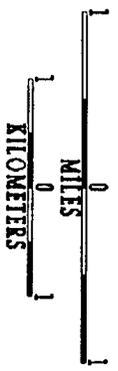
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◆ Southern Tracer Complex

LEGEND



N



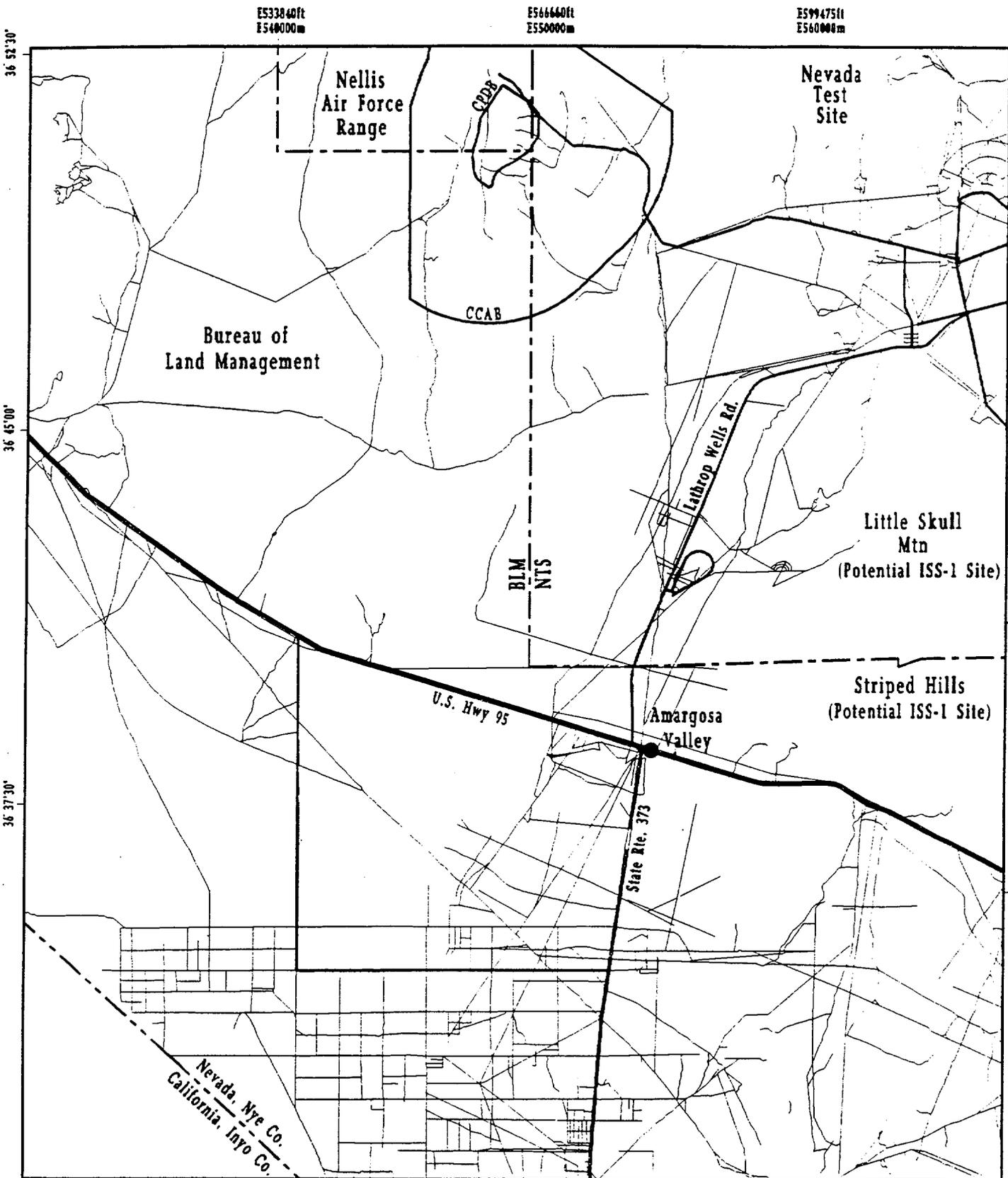
Contour Interval 200 Feet

YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT
SOUTHERN TRACER COMPLEX

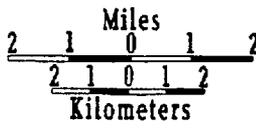
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N4025000

N702101
N4080000



116° 37' 30" 116° 30' 00" 116° 22' 30" 116° 15' 00"



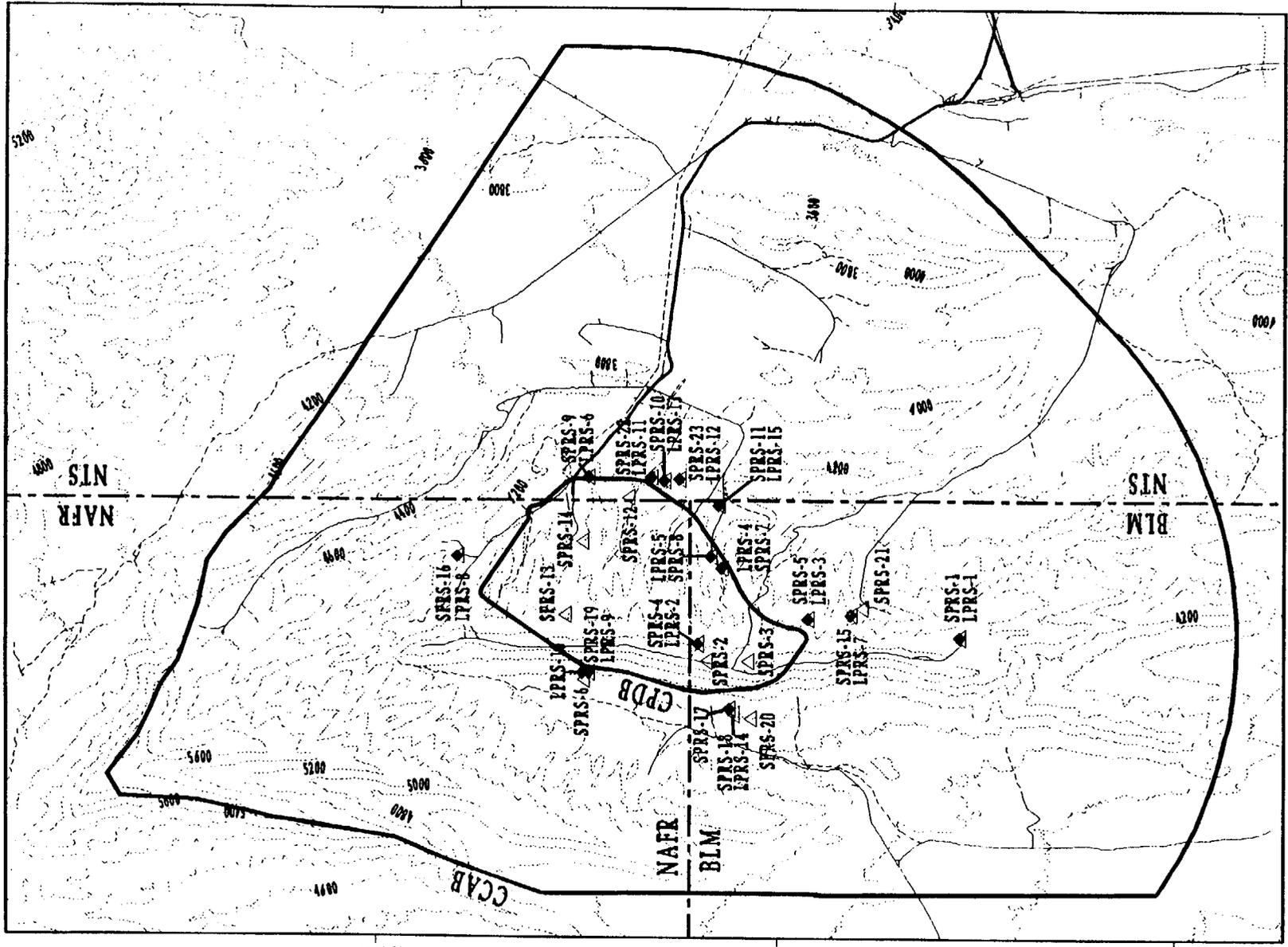
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SITE CHARACTERIZATION PROJECT
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N4080000m

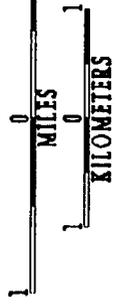
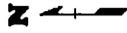
N7539501I
N4075000m



36 49 30
116 30 00
116 27 30
116 25 00

LEGEND

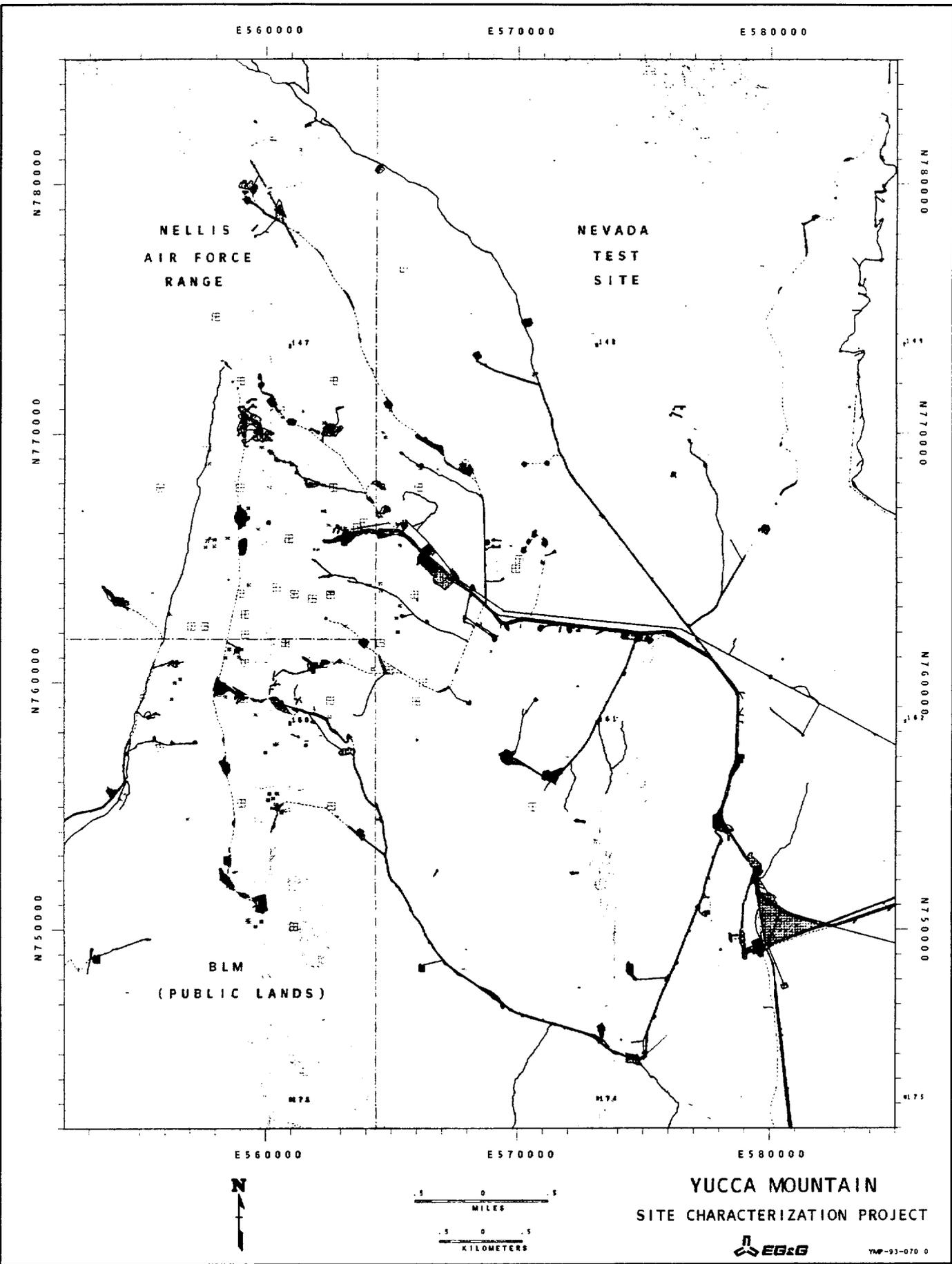
- ◆ LPRS Borehole
- △ SPRS Borehole



YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT
ARTIFICIAL INFILTRATION BOREHOLES



Contour Interval 200 Feet



E 560000 E 70000 E 80000

N 780000

N 780000

NELLIS
AIR FORCE
RANGE

NEVADA
TEST
SITE

N 770000

N 770000

N 760000

N 760000

N 750000

N 750000

BLM
(PUBLIC LANDS)

E 560000

E 70000

E 80000



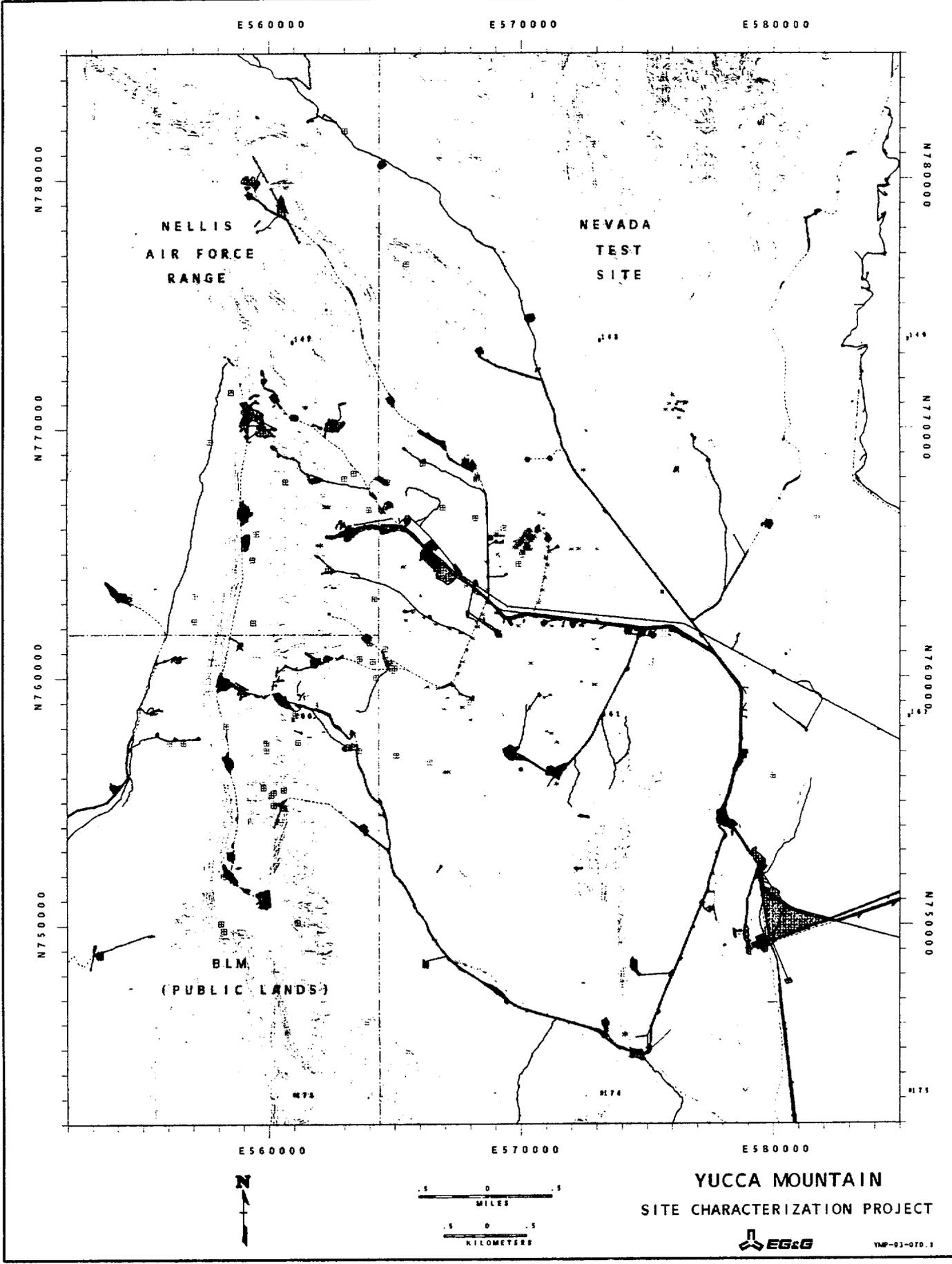
0 0.5 1
MILES

0 0.5 1
KILOMETERS

YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT



YMP-93-070 0



NELLIS
AIR FORCE
RANGE

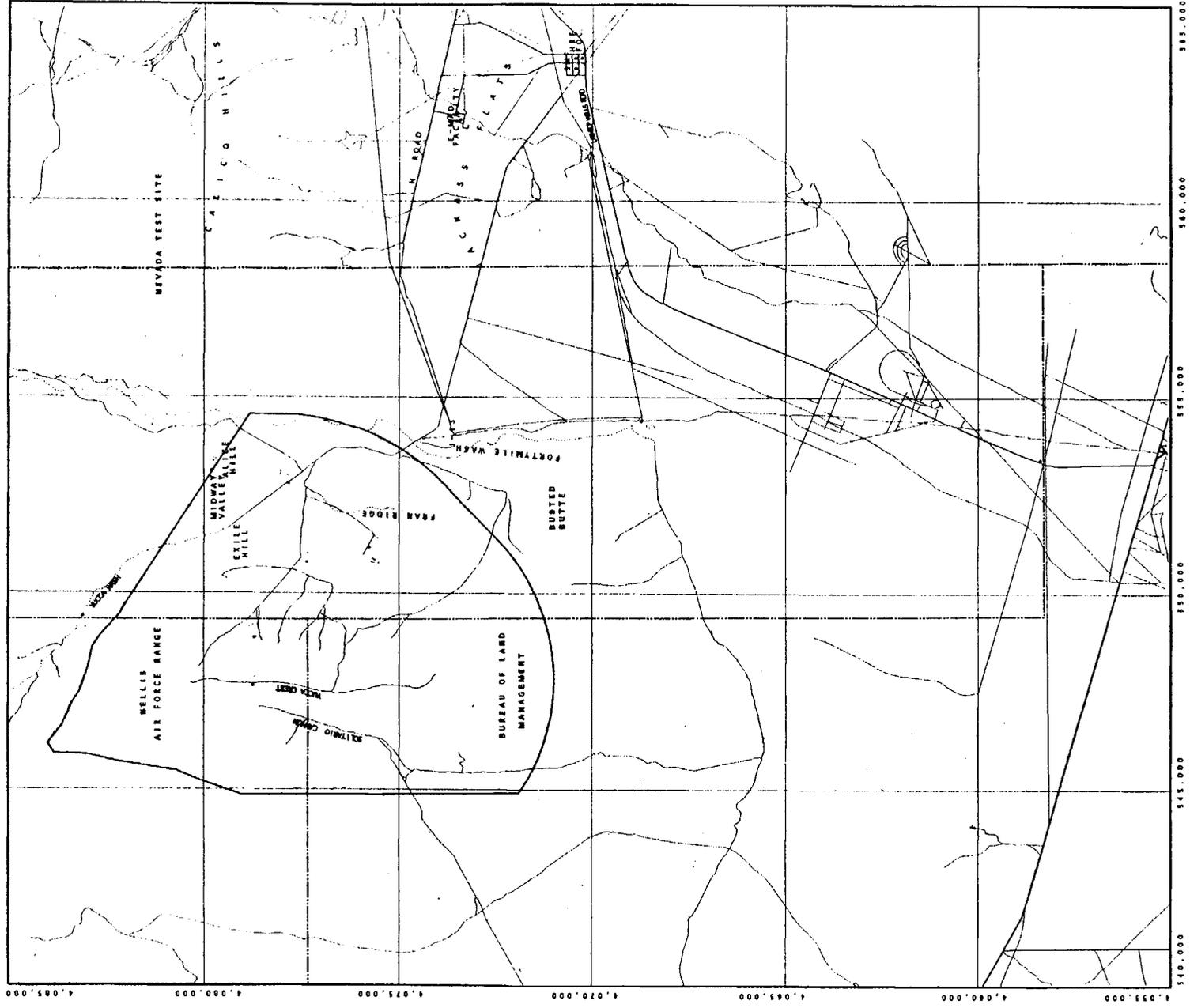
NEVADA
TEST
SITE

BLM
(PUBLIC LANDS)

YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT



YMP-03-070.1



AIR QUALITY AND METEOROLOGY MONITORING SITES

- 1 NTS-60
- 2 Yucca Mountain
- 3 Coyote Wash
- 4 Alice Hill
- 5 40-Mile Wash
- 6 WT-6
- 7 Sever Wash
- 8 Knothole Gap
- 9 Gate 510

Projection is Universal Transverse Mercator;
grid ticks are in meters at a 5000 meter interval.

E533840ft
E540000m

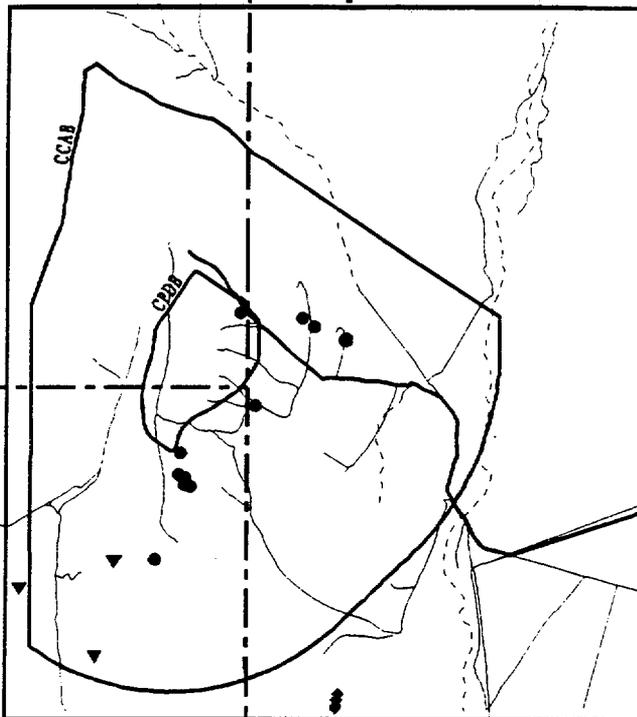
E566660ft
E550000m

BUREAU OF
LAND MANAGEMENT

NELLIS AIR
FORCE RANGE

NEVADA
TEST
SITE

Location of Map YMP-93-132.0



36 52'30"

36 45'00"

N801331E
N409000m

N770210E
N406000m

N737365E
N407000m

SCR-T1

SCR-T2

SCR-T3

Hwy 95

TR-3

TR-1

TR-4

TR-2

TR-5

Lathrop Wells
Volcanic Center

116° 37'30"

116° 30'00"

116° 22'30"



Kilometers

N

SURFACE ACTIVITIES

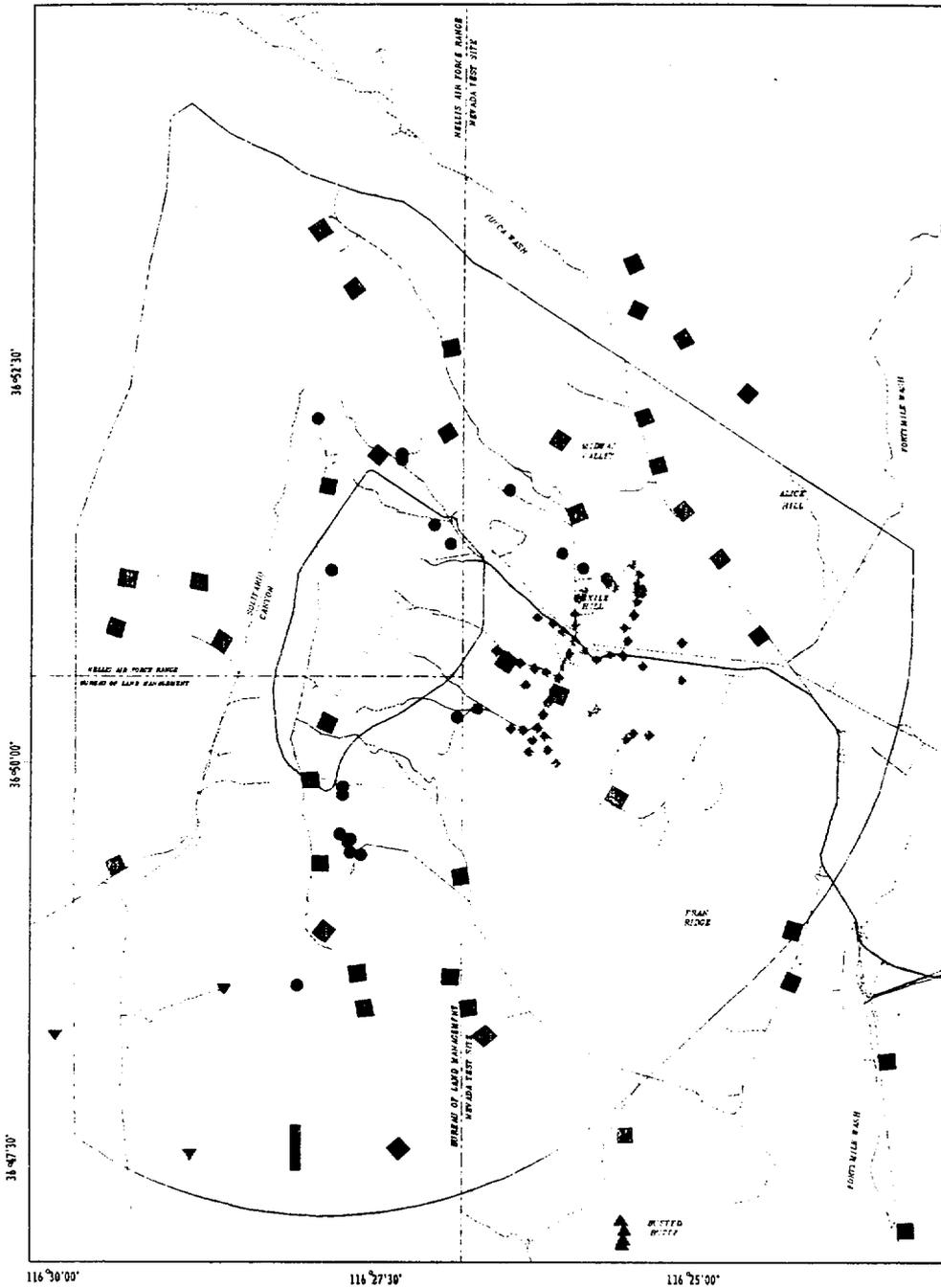
1 October 1992 TO 31 March 1993

- Borehole
- ▼ Trench
- ◆ Pavement

**YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT**
Reported activities completed between 1 October 1992
and 31 March 1993 (Far Field)

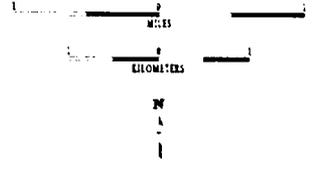
E550245ft
E545090m

E564680ft
E550000m



RECENT PROGRESS AT YUCCA MOUNTAIN

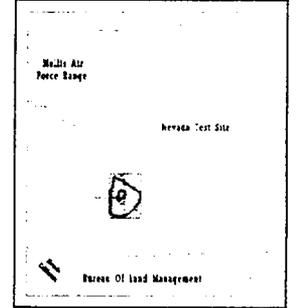
Site Characterization Activities Completed
April 1 1992 - March 31 1993



- Active Ecological Study Area
- ◆ Soil Study Pit
- ▲ Soil Pavement Study Area
- ▼ Fault Investigation Trench
- Major Unsaturated Zone Borehole
- Water Table Borehole
- Water Infiltration Borehole
- North-Ramp Design Borehole
- Neutron-Access Borehole

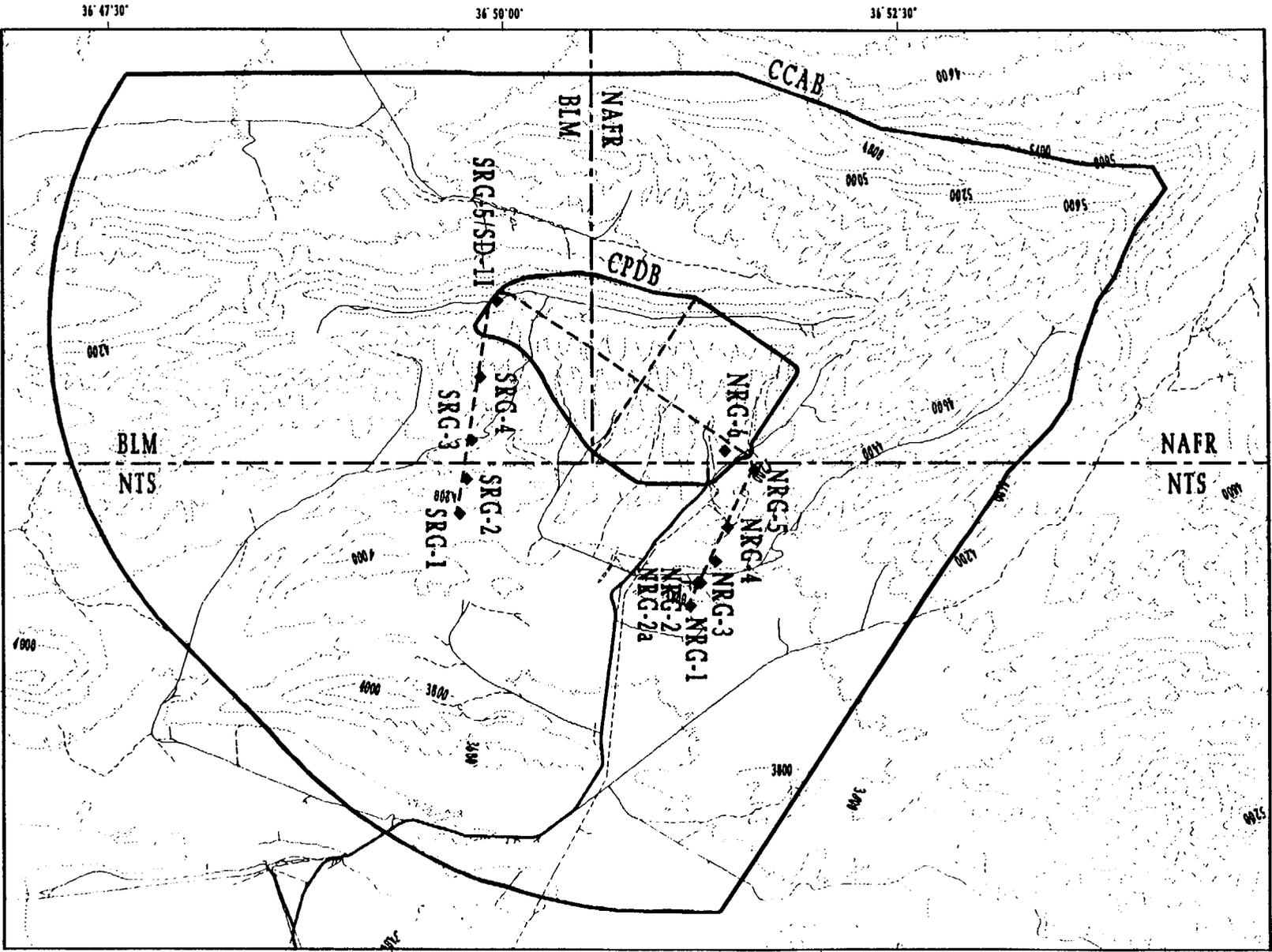
- ▭ Planned Subsurface Access Ramps and Drifts for the Proposed Exploratory Studies Facility
- Conceptual Perimeter Drift Boundary
- Conceptual Controlled Area Boundary

Some completed activities may not appear on this map, pending closure of studies and work packages.

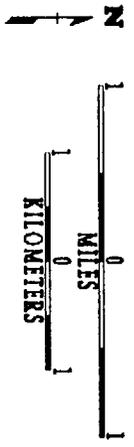


E55215H
E35000N

E55444H
E35000N



LEGEND
 ◆ Design Support Borehole



Contour Interval 200 Feet

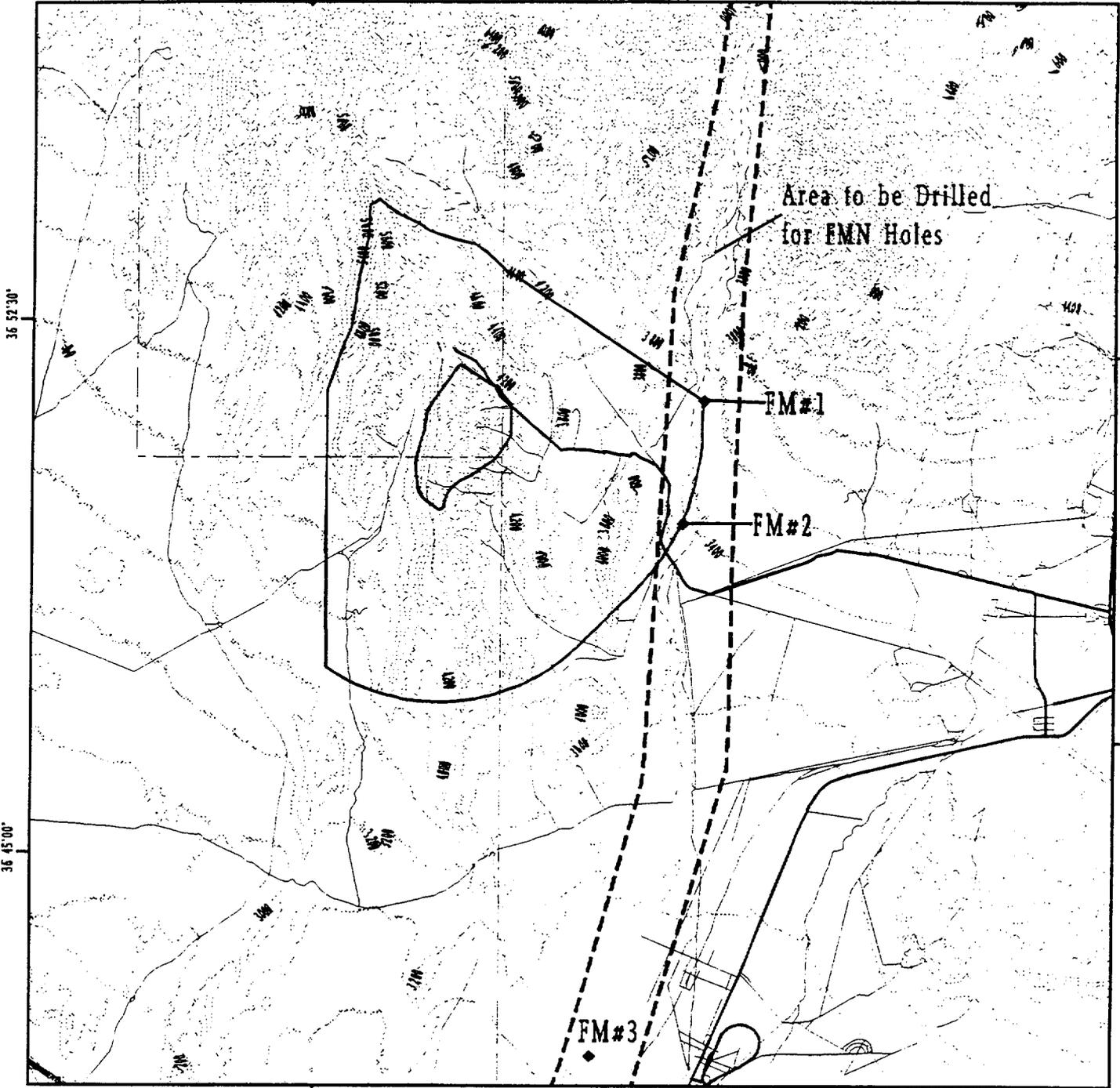
**YUCCA MOUNTAIN
 SITE CHARACTERIZATION PROJECT
 DESIGN SUPPORT BOREHOLES**

EG&G EXP-93-147.1

E53384011
E540000m

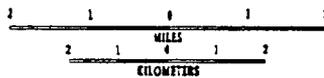
E55666011
E550000m

E59947511
E560000m



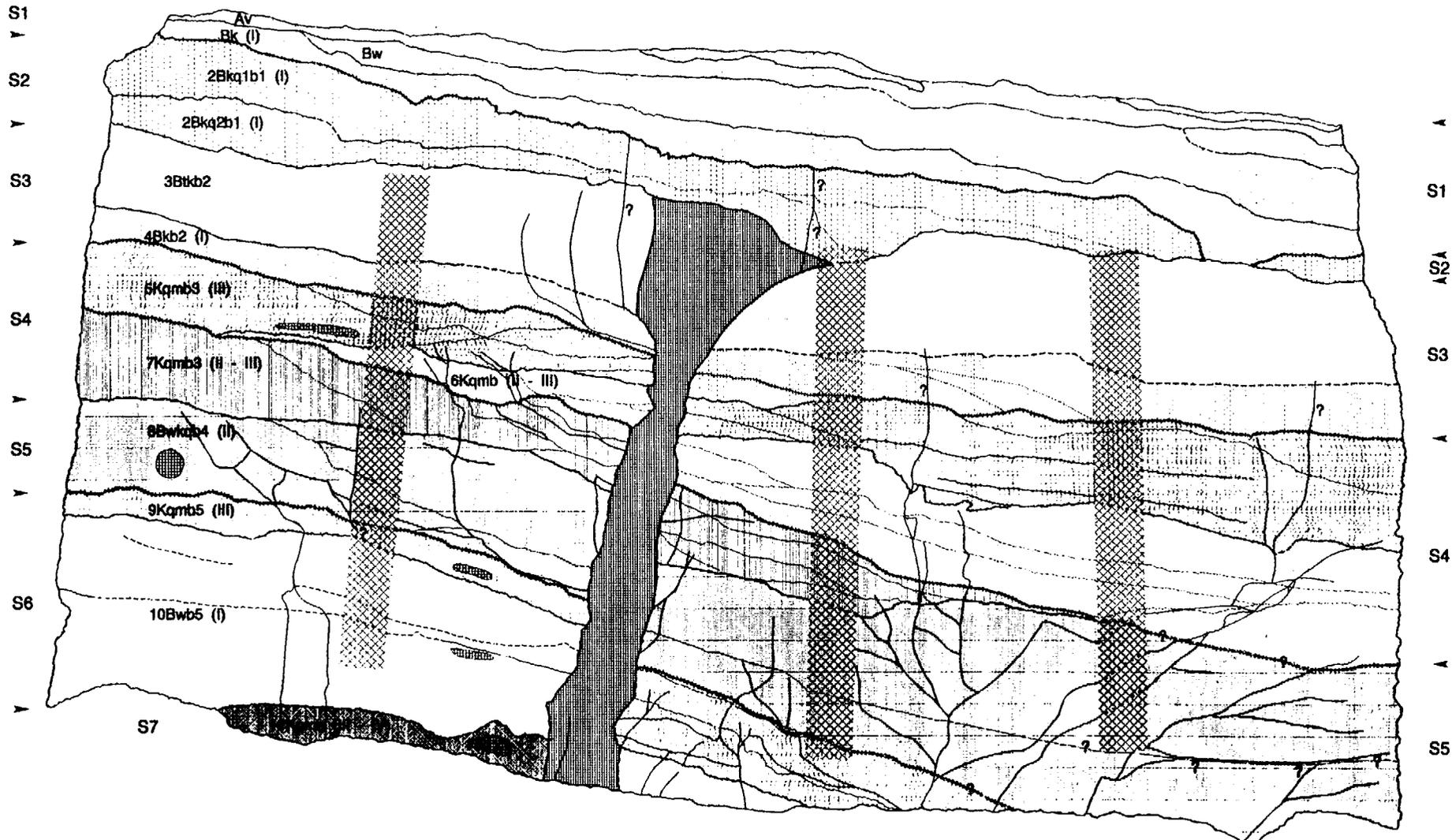
LEGEND

- ◆ Fortymile Wash Recharge Study Borehole



Contour Interval 200 Feet

YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT
FORTYMILE WASH RECHARGE STUDY



LEGEND

- Soil or feature marked in main field area, necessarily marked with carbonate-delta horizon
- Fracture, typically carbonate coated, dated where concealed
- Boundary, sub-soil or secondary biologic with dashed where approximate, dotted where concealed, shaded where uncertain
- Soil horizon boundary, dashed where approximate, dotted where concealed, shaded where uncertain
- Carbonate lenses, dashed where approximate, dotted where concealed
- Paleosol along boundary associated with buried soil scarp near field area

Sample location for age dating
 Uranium Series - HD 502, HD503, HD504, HD505 collected by J. Pense 08/29/92
 Thermoluminescence dating TL-06 collected by S. Waksar 02/26/93

Shorey

**TRENCH LOG FROM THE NORTHERN BOW RIDGE FAULT
 TRENCH 14D, INNER (SOUTH) WALL, NORTH BRANCH**

By
 C. M. Menges, R. Cress, G. Vadurro, F. W. Smonde, and J. Coe
 Prepared between July, 1992 and December, 1992

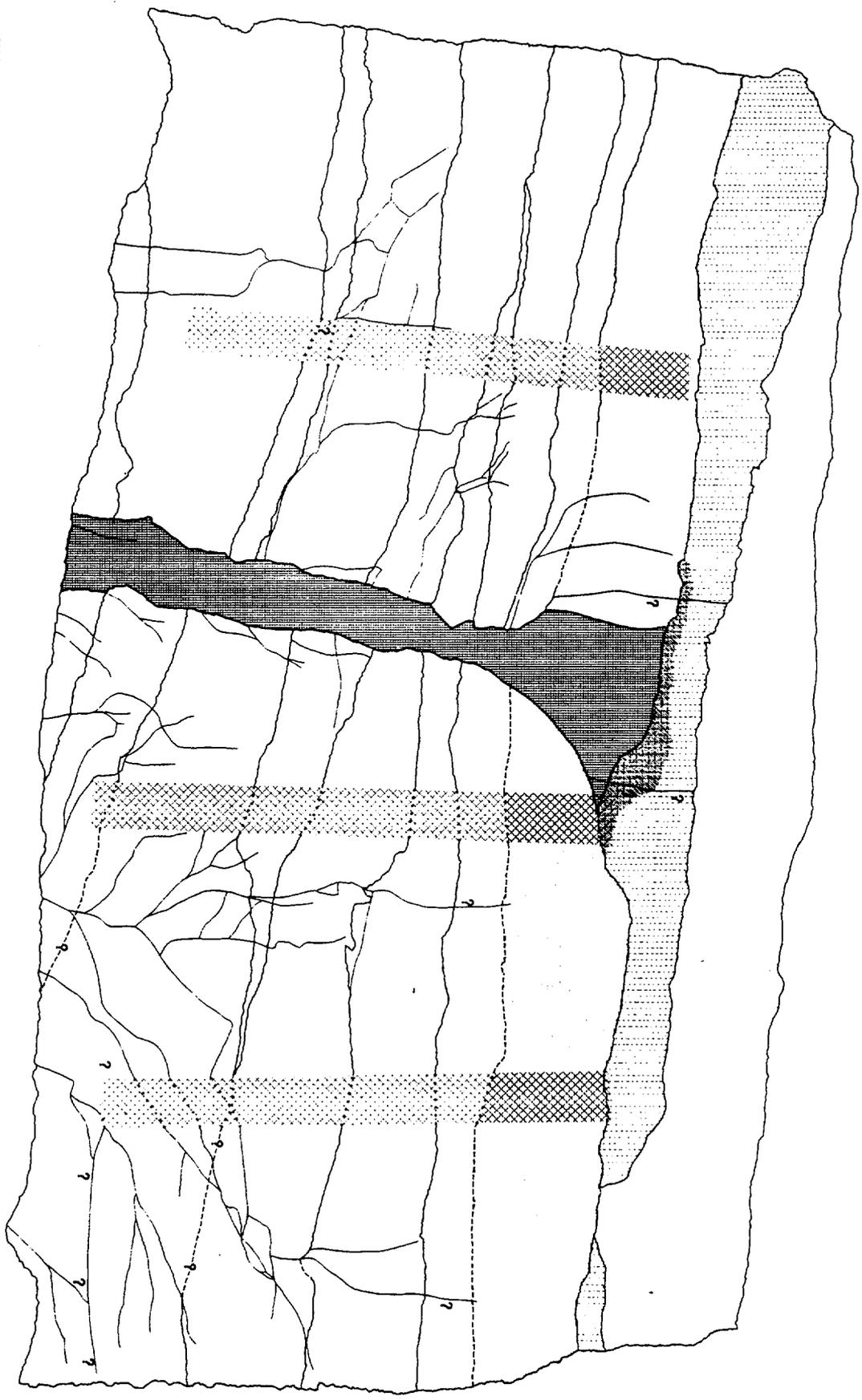
by the
 U. S. Geological Survey
 Yucca Mountain Project Branch
 SCP 8.3.1.17.4.8.2

Scale 1:10 (Horizontal and Vertical)



**YUCCA MOUNTAIN
 SITE CHARACTERIZATION PROJECT
 TRENCH 14D - BOW RIDGE FAULT
 SOIL STRATIGRAPHY**

Compiled May, 1993
 by
 EG&EM Remote Sensing Laboratory



LEGEND

- ~ Fault of known extent to north and east, generally covered by Quaternary deposits
- ~ Faulting, probably extension related, dated from stratigraphic, geologic, geologic, and other data; extensional, dated from stratigraphic, geologic, geologic, and other data
- ~ Faulting, probably extension related, dated from stratigraphic, geologic, geologic, and other data; extensional, dated from stratigraphic, geologic, geologic, and other data
- ~ Faulting, probably extension related, dated from stratigraphic, geologic, geologic, and other data; extensional, dated from stratigraphic, geologic, geologic, and other data

**TRENCH LOG FROM THE NORTHERN BOW RIDGE FAULT
TRENCH 14D, INNER (SOUTH) WALL, NORTH BRANCH**

By
C. M. Morgan, R. Ossa, G. Vadim, F. W. Smoot, and J. Cox
Proposed between July, 1982 and December, 1982

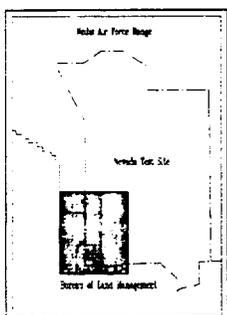
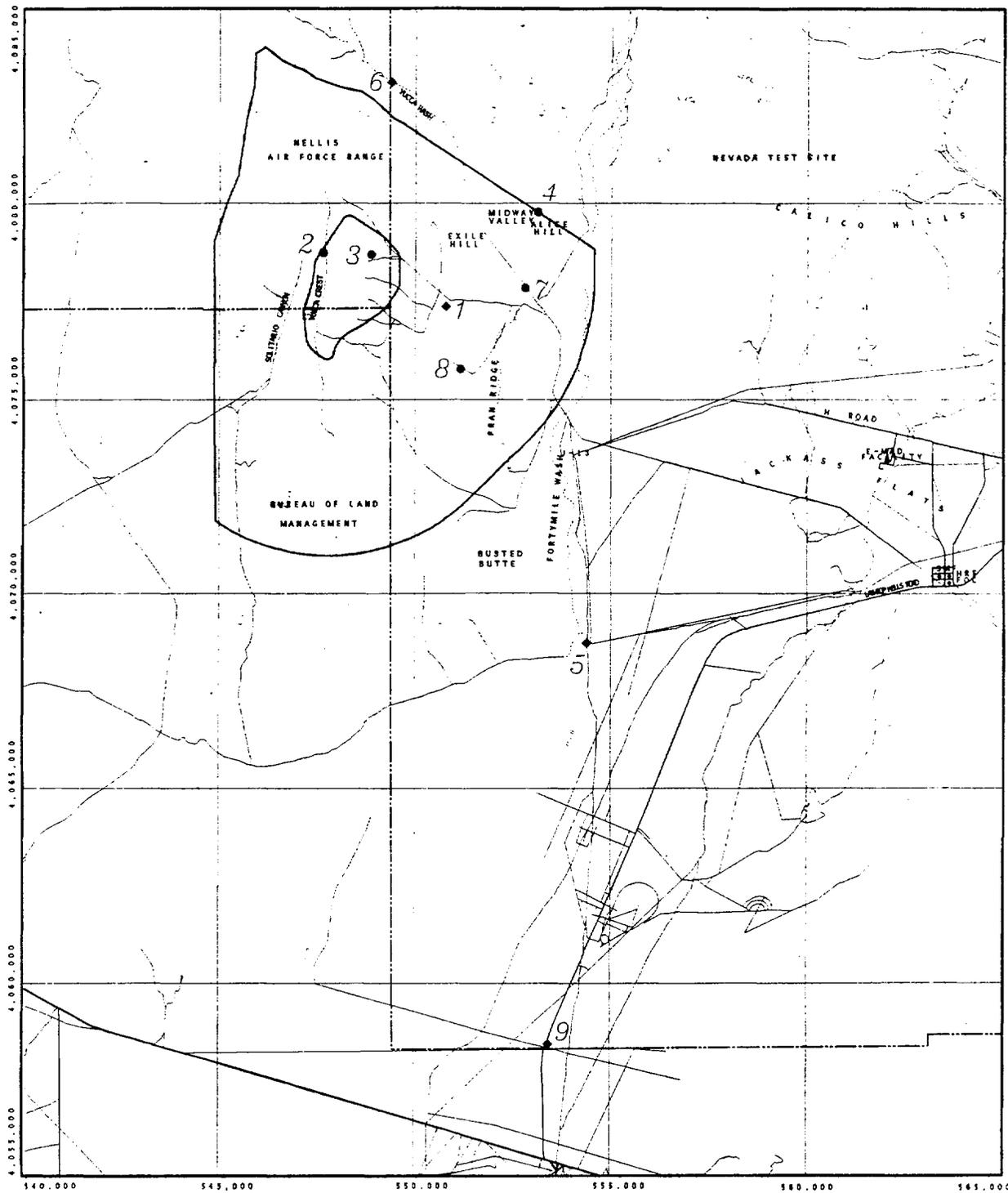
U. S. Geological Survey
Yucca Mountain Project Branch
SCP 83117482

Scale 1:10 (Horizontal and Vertical)



**YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT
TRENCH 14D - BOW RIDGE FAULT
MOST RECENT EVENT**

Compiled May, 1983
by
EG&A Environmental Sciences Laboratory



- Meteorology Monitoring Site
 - ◆ Air Quality and Meteorology Monitoring Site
- | | |
|------------------|----------------|
| 1 NTS-60 | 6 WT-6 |
| 2 Yucca Mountain | 7 Sever Wash |
| 3 Coyote Wash | 8 Knothead Gap |
| 4 Alice Hill | 9 Gate 510 |
| 5 40-Mile Wash | |



YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT AIR QUALITY AND METEOROLOGY MONITORING SITES

Projection is Universal Transverse Mercator; grid ticks are in meters at a 5000 meter interval. Contour interval is 200 feet.

N770210ft
N4080000m

N737365ft
N4070000m

E566660ft
E550000m

E533840ft
E540000m

36.52.30

116° 22' 30"

116° 30' 00"

116° 37' 30"

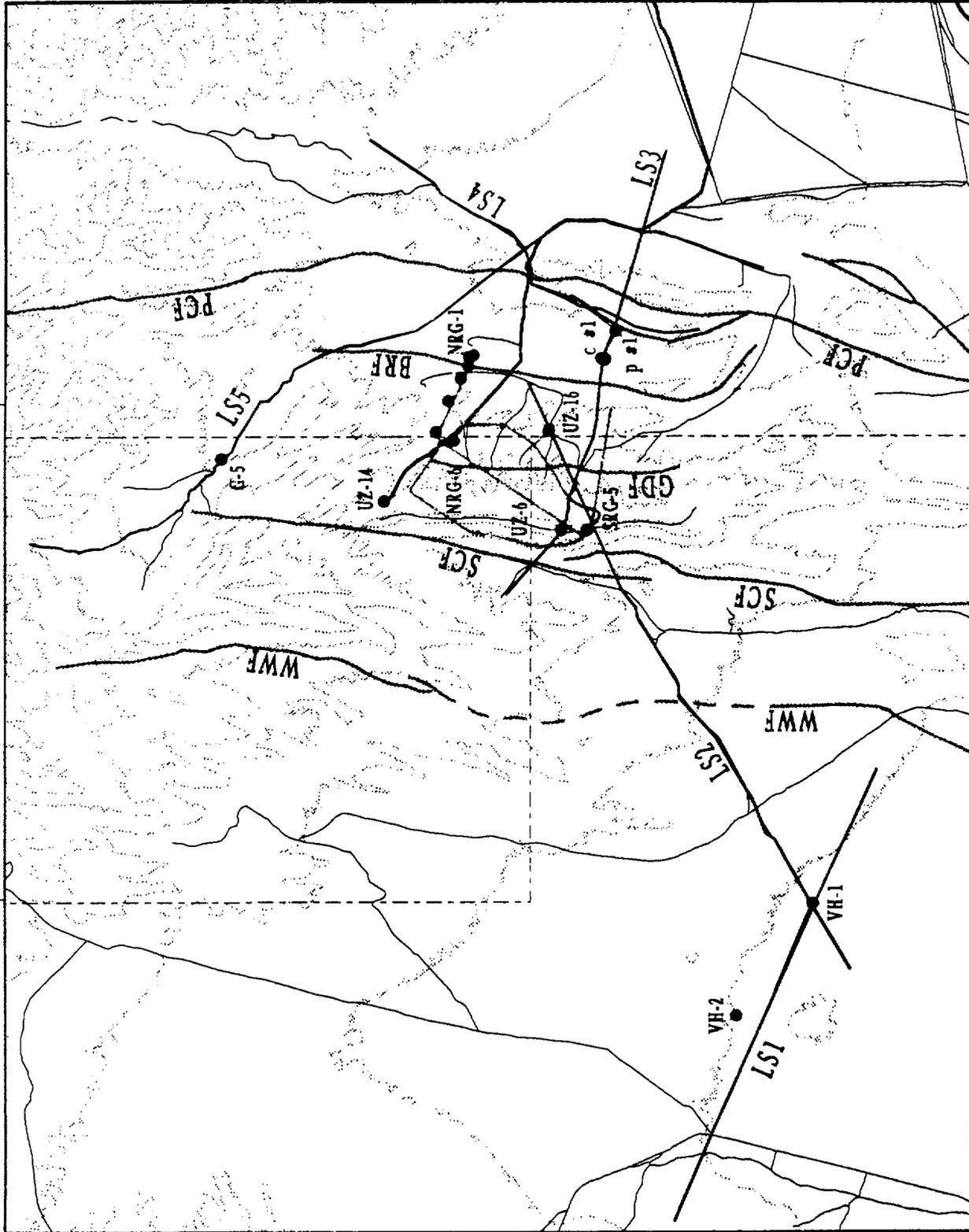
YUCCA MOUNTAIN AND VICINITY SITE CHARACTERIZATION PROJECT

YUCCA MOUNTAIN



LEGEND

- Existing Borehole
- Proposed Borehole
- Proposed Seismic Reflection Line



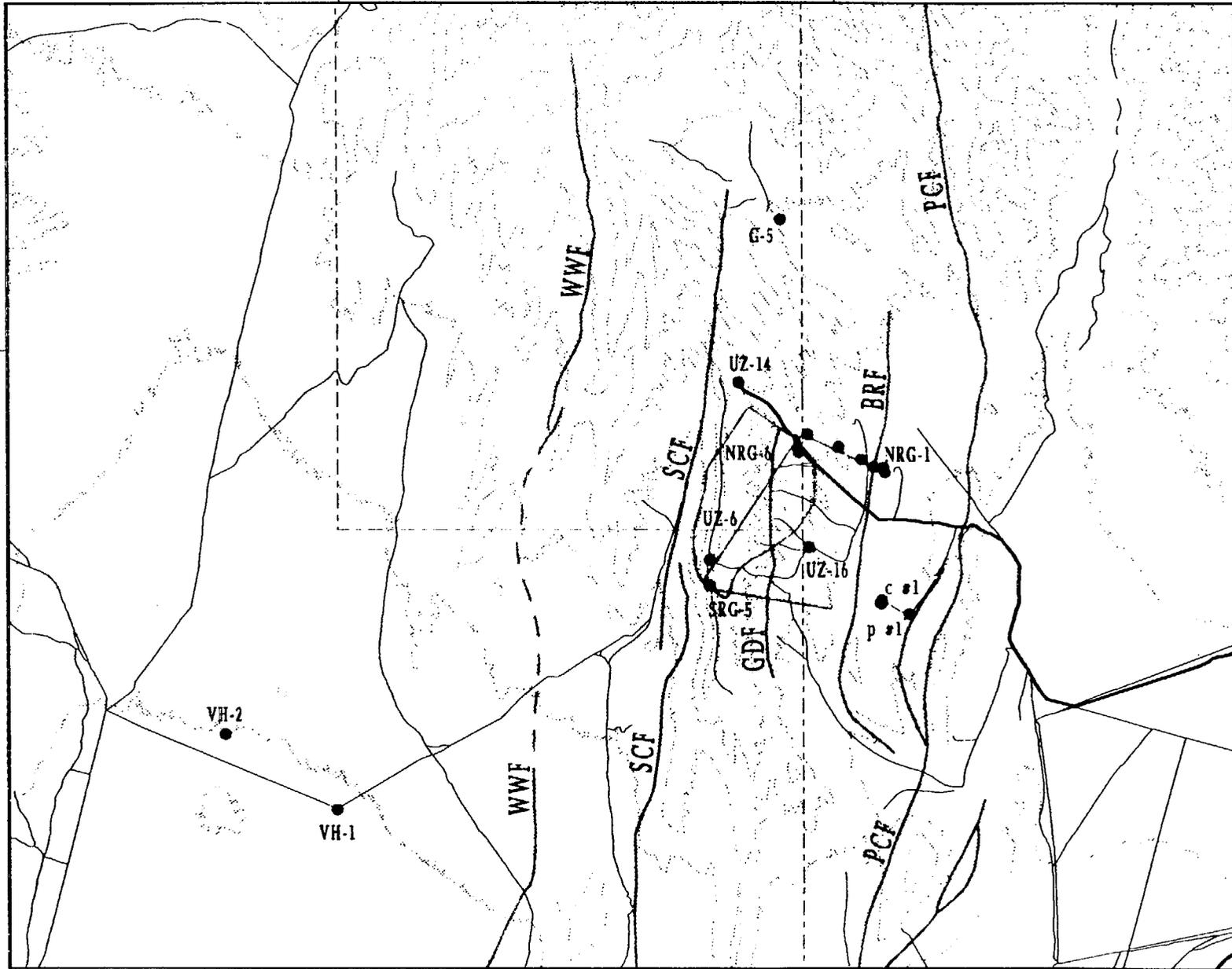
E533840ft
E540000m

E566660ft
E550000m

36° 52' 30"

N770210ft
N4080000m

N737365ft
N4070000m



116° 37' 30"

116° 30' 00"

116° 22' 30"

LEGEND

- Existing Borehole
- Proposed Borehole

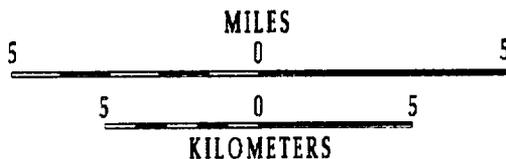
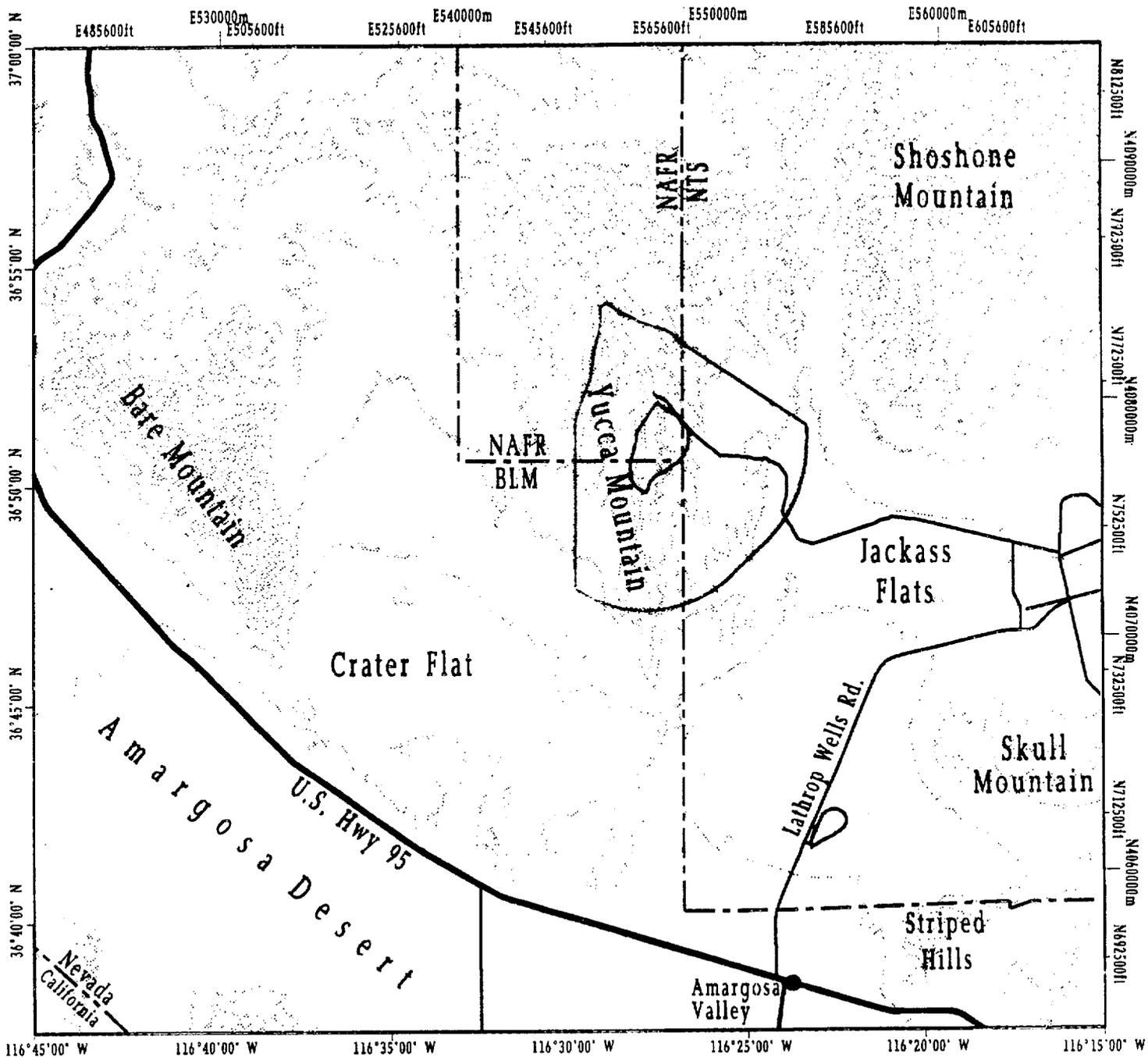


Contour Interval 400 ft

**YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT
YUCCA MOUNTAIN AND VICINITY**



YVP-93-167.0

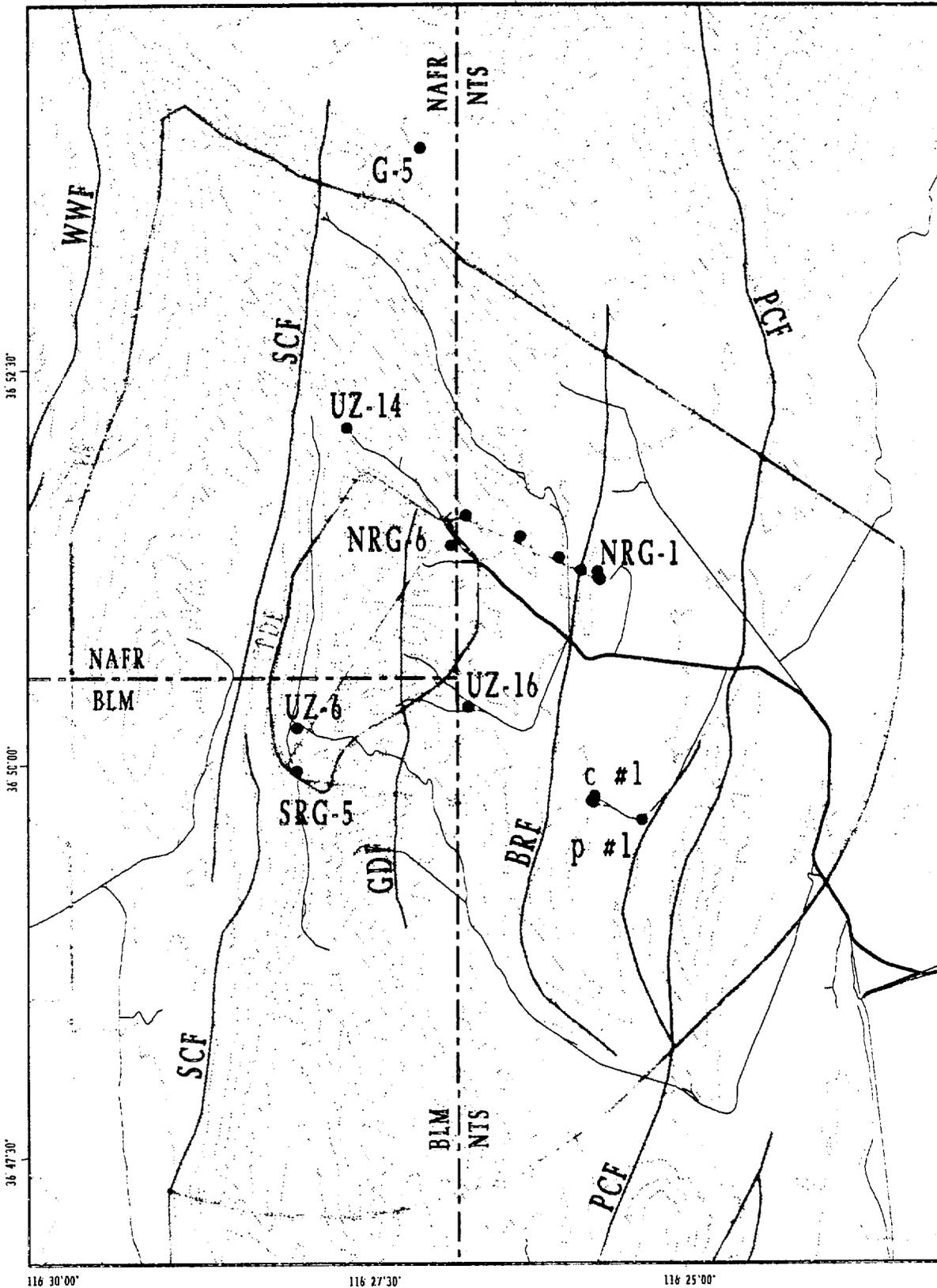


Contour Interval 400 Feet

YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT
REGIONAL AREA

E550245ft
E545000m

E566660ft
E550000m



LEGEND

- Existing Borehole
- Proposed Borehole



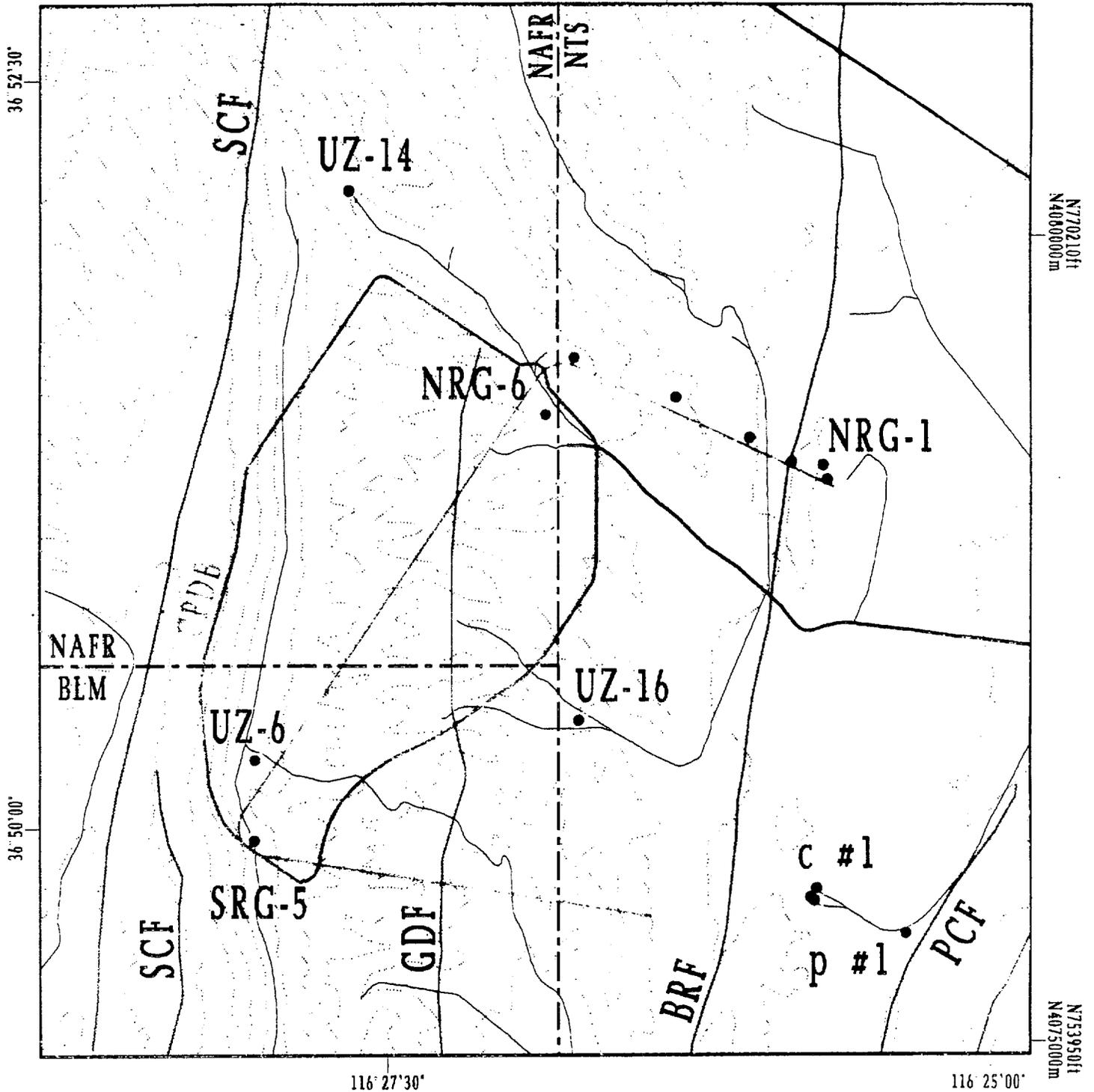
Contour Interval 200 Feet

**YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT
NEAR FIELD**



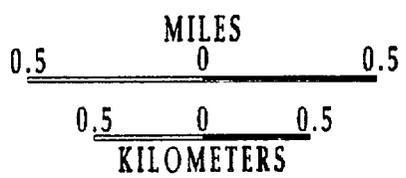
YMF-93-169 0

E566660ft
E550000m



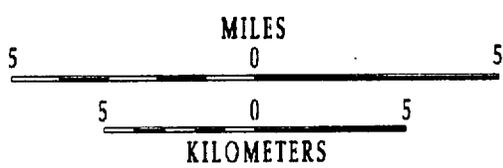
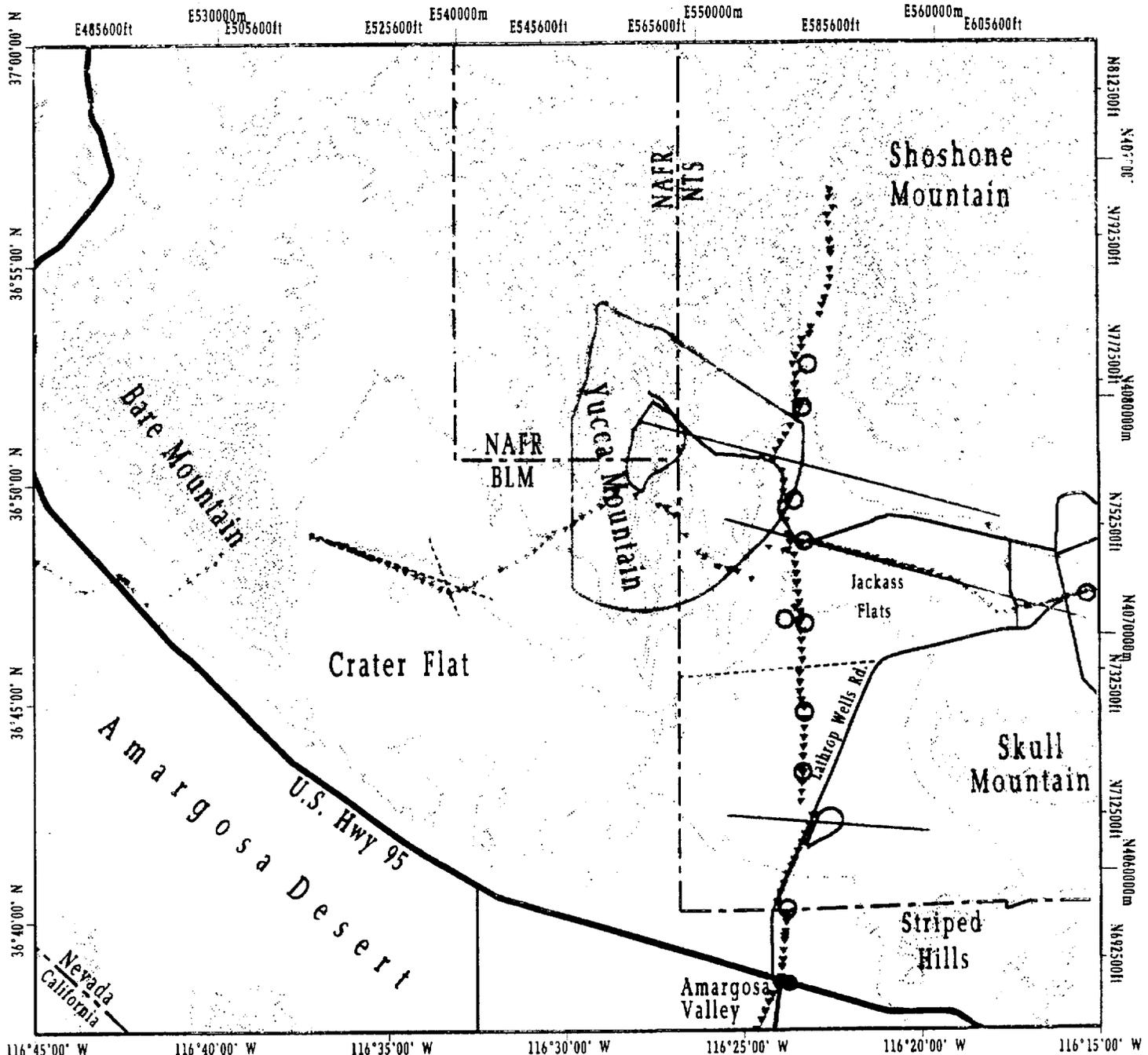
LEGEND

- Existing Borehole
- Proposed Borehole



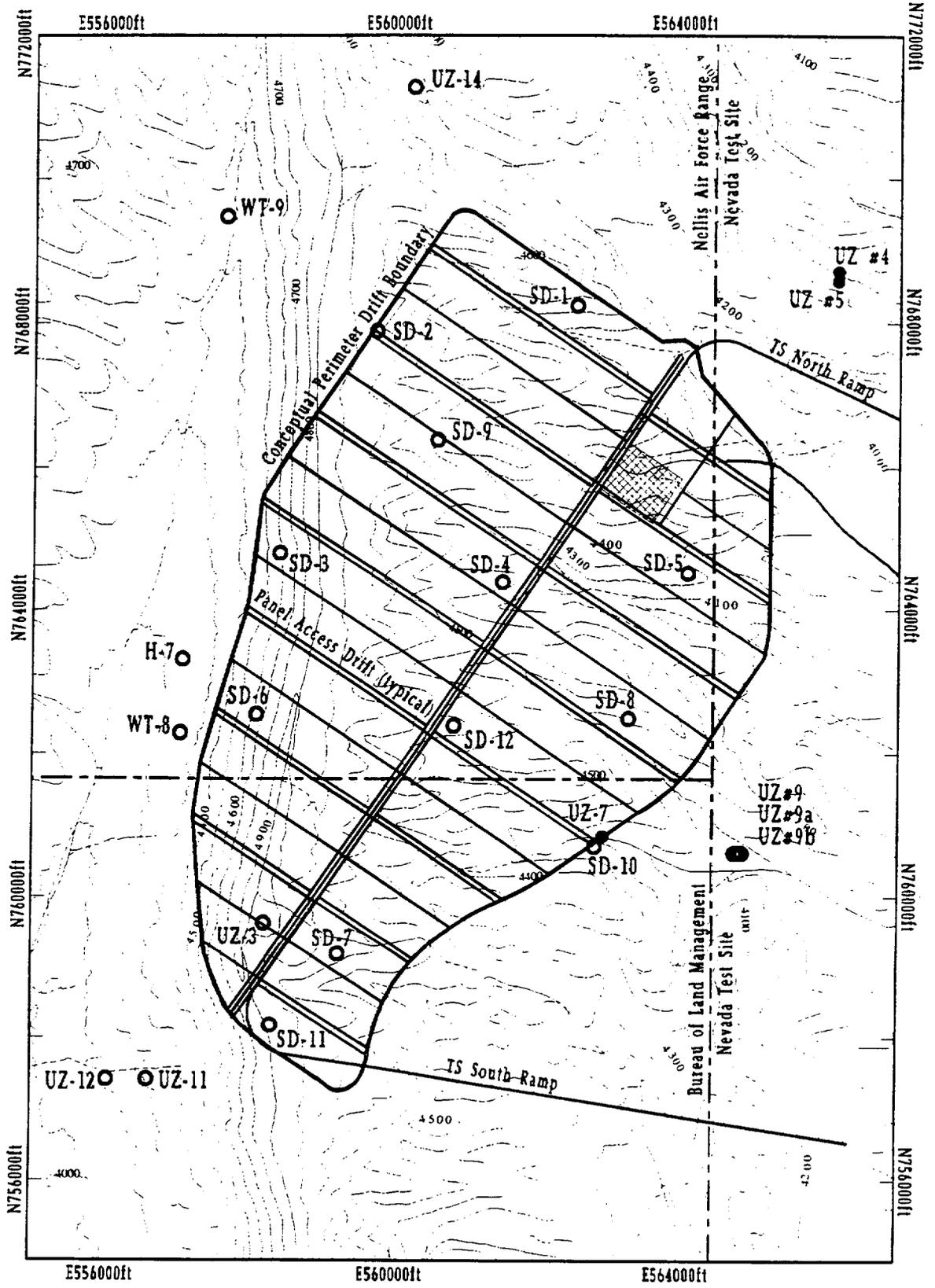
Contour Interval 200 Feet

**YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT
SITE AREA**

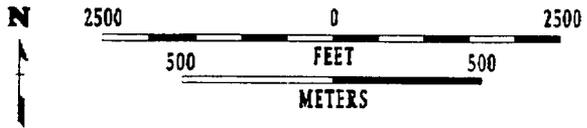


Contour Interval 400 Feet

YUCCA MOUNTAIN
 SITE CHARACTERIZATION PROJECT
 REGIONAL AREA



- LEGEND**
- Existing Borehole
 - Proposed Borehole
 - ▣ Main Test Area



Contour Interval 100 Feet

**YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT
PLANNED SD BOREHOLES**



Lawrence Livermore National Laboratory

JUL 20 2 23 PM '93

LLYMP9307023
July 14, 1993

WBS 1.2.9
QA: N/A"

Carl Gertz, Project Manager
Department of Energy
Yucca Mountain Project Office
P.O. Box 98518
Las Vegas, Nevada 89193-8518

I-344655

BMH

SUBJECT: Yucca Mountain Project Status Report - June 1993
SCP: N/A

Attached is the June Project Status Report for LLNL's participation in the Yucca Mountain Project.

If further information is required, please contact Elizabeth Campbell of my staff at 510-422-7854 or Jim Blink in Las Vegas at 702-794-7157.

Sincerely,

318
 DIVISION _____
 CO: Dyer
 CO: Smecta W.L. Clarke
 CO: Blanchard
 CO: Spax
 CO: Wynn
 CO: Caru/Brudsky
 CO: Summit/Jones, S
 CO: Spistad/Gertz
 CO: Smecta - wp

John Podol for
 W. L. Clarke
 LLNL Technical Project Officer
 for YMP

WC/EC

cc:
Distribution

REC'D IN YMP
7-20-93

DISCLAIMER

The LLNL Yucca Mountain Project cautions that any information is preliminary and subject to change as further analyses are performed or as an enlarged and perhaps more representative data base is accumulated. These data and interpretations should be used accordingly.

ENCLOSURE 4

9307280195 28 pp

LAWRENCE LIVERMORE NATIONAL LABORATORY YUCCA MOUNTAIN PROJECT
JUNE 1993 TECHNICAL HIGHLIGHTS AND STATUS REPORT

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LAWRENCE LIVERMORE NATIONAL LABORATORY
(LLNL)
YUCCA MOUNTAIN PROJECT (YMP) STATUS REPORT

JUNE 1993

EXECUTIVE SUMMARY
(Items Proposed for Reporting in YMPO or OGD Reports)

1) **1.2.2.2.4 Engineered Barrier System (EBS) Field Tests. (Large Block Test (LBT))** D. Wilder, W. Lin, S. Blair and J. Blink assisted by LANL, SNL, RSN and REECO personnel visited NTS on June 1-2 to map fractures and select a test area. W. Lin and D. Wilder continued mapping the fractures on June 10 and 15. W. Glassley visited NTS on June 28-29 to map and sample the fracture system. Emphasis was on identifying mineralogy of fractures, number of fracture generations, and characteristics of fracture alteration haloes and fracture surfaces.

2) **1.2.2.2.1 Chemical and Mineralogical Properties of the Waste Package Environment.** The contract for the work on the New Zealand natural analog site was initiated. The screening process to select specific sites for study has been started, with initial work focusing on Champagne Pool, where fluid mixing is occurring. The first sampling and simulation activities will consider the ability of the EQ3/6 code to simulate mixing in a setting where diverse chemistries, changes in temperature, and interaction with the atmosphere influence reaction progress. Discussions are underway with the principal corporations controlling proprietary data to schedule a meeting to discuss how best to handle requests for such information.

3) **1.2.2.3.1.1 Waste Form Testing - Spent Fuel. (Spent Fuel Dissolution)** The last subset of eight UO₂ dissolution experiments in the LLNL initial UO₂ flow-through test matrix were completed at the prescribed test matrix conditions in late May. These tests were continued at room temperature using the same buffers to obtain additional test replications and data. These results will provide additional data to test intrinsic UO₂ dissolution models that are developed. These continuations, plus the original test matrix runs, gives 35 experimental runs under a wide variety of conditions to develop dissolution response models.

4) **1.2.5.4.2 Waste Package Performance Assessment.** Information on the source term was presented to SNL for use in TSPA 93. As part of this effort, Near Field and PA staff modeled an important near-field hydrological process, localized water penetration beyond a boiling front, through a dried-out zone, down to the level of a repository. At random locations, this flux could wet some waste packages. In order for penetration to happen at some location, it is necessary that the localized water flux be greater than the amount of water that can be evaporated by the heat flux from the repository. This heat flux is assumed to be essentially uniform, whereas water fluxes are known to exhibit spatial heterogeneity. Using the lognormal distribution to characterize this heterogeneity (as is suggested in the literature), numerical results for the fraction of waste packages that get wet under the assumptions of 57 and 114 kilowatts per acre initial area power density, both at the

center and edge of the repository have been derived. For representative assumed input values, the fraction of waste packages in the repository center zone that get wet is on the order of a few per thousand for the first 50 to 100 years. The fraction then drops by about an order of magnitude in the 57 kW/acre case. The fraction drops by about three orders of magnitude in the 114 kW/acre case, to an expected value well below one waste package in the whole repository center zone after a few hundred years.

5) **1.2.2.2.2 Hydrologic Properties of the Waste Package Environment.** Work has begun to develop an analytical model that represents transient (or cyclic) refluxing and boiling in fractures. This model calculates the distance that channelized flow travels down the fracture before water in the fracture is boiled away. It also calculates the fluxes for those fractures with flows capable of reaching the repository.

6) **1.2.2.2.2 Hydrologic Properties of the Waste Package Environment.** Small scale, buoyant vapor flow in low thermal load repositories (10-20 kW/acre, 30-yr-old) was studied. This flow is driven by the difference in temperature of the emplacement drifts and the pillars between the drifts. For bulk permeabilities greater than about 10 darcy (10-11m²), the resulting convection cells can increase saturation above the repository horizon and challenge condensate drainage towards waste packages for about 1000 years, even though drift wall temperatures do not approach the boiling point of water. In order to diagnose the potential for these effects to impact WP performance and radionuclide transport, in situ heater tests conducted under sub-boiling conditions will be required.

7) **1.2.2.2.5 Characterization of the Effects of Man-Made Materials on Chemical & Mineralogical Changes in the Post-Emplacement Environment.** LLNL staff met with P. Gottlieb, J. Peters, P. Mariner and J. Houseworth (M&O), to discuss concerns regarding organic materials in general. They also reviewed the present diesel fuel experiments and visited the organic materials experimental facilities. Interest was expressed in obtaining information regarding the stability of hydraulic fluids. J. Peters agreed to supply information regarding the range of hydraulic fluids that may be used during the construction of the ESF.

1.2.1 SYSTEMS ENGINEERING

1.2.1.1 Systems Engineering Coordination and Planning

No significant activities.

1.2.1.5 Special Studies

Thermal hydrology calculations were provided to the M&O for the thermal loading systems study. More details are provided in the WBS element 1.2.2.2.2 section of this report.

1.2.1.6 Configuration Management

No significant activities.

1.2.2 WASTE PACKAGE

1.2.2.1 Waste Package Coordination and Planning

No significant activities.

1.2.2.2 Waste Package Environment

1.2.2.2.1 Chemical and Mineralogical Properties of the Waste Package Environment

The contract for the work on the New Zealand natural analog site was initiated. The screening process to select specific sites for study has been started, with initial work focusing on Champagne Pool, where fluid mixing is occurring. The first sampling and simulation activities will consider the ability of the EQ3/6 code to simulate mixing in a setting where diverse chemistries, changes in temperature, and interaction with the atmosphere influence reaction progress. Discussions are underway with the principal corporations controlling proprietary data to schedule a meeting to discuss how best to handle requests for such information.

Work continued on the revised draft Study Plan 8.3.4.2.4.1 Characterization of the Chemical and Mineralogical Changes in the Post-Emplacement Environment. Completion of the Study Plan was delayed because of project budget exercises. The study plan will be completed in July.

Software for converting graphical displays to video images was obtained. Installation will occur in July. This capability will allow time sequences to be studied in detail such that regions of particular interest in the near-field environment can be better identified and examined. This capability will also allow visual presentation to the technical and public communities, in order to enhance comprehension of the nature of the problems being addressed.

The abstract entitled "Validation of Geochemical Codes Using Natural Systems: New Zealand Geothermal Systems" by C. Bruton, W. Bourcier and W. Glassley for submittal to the MRS Fall meeting in Boston, MA on November 29-December 3, was approved by YMPO on June 14.

1.2.2.2.2 Hydrologic Properties of the Waste Package Environment

Model Calculations

Over the past months, LLNL has been examining the sensitivity of thermo-hydrological performance of the repository-unsaturated zone-saturated zone (UZ-SZ) system to a broad range of thermal loading design parameters, thermo-hydrological properties of the UZ and SZ, and boundary conditions. In general, the only significant source of liquid water reaching a Waste Package (WP) and transporting radionuclides to the water table is from nonequilibrium fracture flow from three potential origins:

- 1) meteoric sources,
- 2) drainage of condensate generated under boiling conditions, and

3) drainage of condensate generated by buoyant vapor flow under sub-boiling conditions.

The second and third sources are generated by repository heat. Infiltration of meteoric water can be affected by repository-heat-driven changes to the moisture distribution and the intrinsic hydrological properties. Whether by boiling or buoyant vapor flow, the generation of condensate can either occur at a sub-repository scale (small-scale) or at the scale of the UZ (mountain-scale).

In recent months, sensitivity analyses of mountain-scale, buoyant vapor flow have been described. Mountain-scale, buoyant, gas-phase convection occurs within fracture networks having a connectivity with length scale comparable to the UZ thickness and repository width. Buoyant gas-phase convection cells develop as the warmer, less dense column of gas within the footprint of the repository is displaced by the cooler, denser column of gas outside of the repository footprint. As the initially cooler gas is heated up, its relative humidity is lowered, causing it to evaporate water from the rock matrix below the repository. This warm moist air is convected upward to where it cools above the repository, generating condensate that drains down fractures back towards the repository horizon, and/or is imbibed by the matrix, causing a saturation buildup above the repository horizon. Because water removed below the repository may be replenished by water imbibed from the SZ, this process can result in a net saturation buildup in the UZ. It was found that mountain-scale buoyant vapor flow can dominate moisture movement for on the order of 100,000 yrs.

Work began on a sensitivity analysis of small-scale, buoyant vapor flow. Small-scale, buoyant, gas-phase convection occurs within fracture networks having a connectivity with length scale comparable to the distance between the hot and cold regions of the repository. Buoyant gas-phase convection cells develop as the warmer, less dense column of gas within the footprint of the hot WPs is displaced by the cooler, denser column of gas in the adjacent areas (areas without WPs or with cooler WPs). As the initially cooler gas column is heated up, its relative humidity is lowered, causing it to evaporate water from the rock matrix below the hot regions of the repository. This warm moist air is convected upward to where it cools above the repository, generating condensate that drains down fractures back towards the repository horizon, and/or is imbibed by the matrix, causing a saturation buildup above the repository horizon. Small-scale, buoyant, gas-phase convection continues as long as significant temperature differences persist within the repository. It was found that small-scale, buoyant vapor flow can dominate moisture movement for up to 1000 years. At the outer edge of the repository, the distinction between small-scale and mountain-scale buoyant vapor flow is somewhat blurred. Because substantial temperature gradients persist at the outer edge of the repository, small-scale buoyant vapor flow may persist for thousands of years even if the fracture connectivity is not sufficient to support substantial mountain-scale vapor flow.

The sensitivity analysis included Areal Power Densities (APDs) of 10 and 20 kW/acre for 30-yr-old Spent Nuclear Fuel (SNF) and bulk permeability, k_b , values of 10, 20, 40, 84, and 168 darcy (1 darcy $\sim 10^{-12}m^2$). The two-dimensional, cross-sectional, drift-scale model which assumes an infinite array of 4.8-m-high x 6.0-m-wide emplacement drifts with a uniform spacing between drift centerlines of

38.4 m and a WP cross-section of 1.6 x 1.6 m, was applied. The model represents the symmetry element from the WP centerline to pillar centerline. Because the effect of "edge-cooling" does not effect temperatures in the center of the repository for thousands of years, the drift-scale model is applicable to the center of the repository. The drift-scale model is primarily intended to examine hydrothermal behavior when significant temperature differences persist within the repository which is generally for the first 1000 years. If WPs are placed end-to-end with a 4.6 m spacing, the thermal load in the 20 kW/acre drift-scale model is equivalent to just one PWR SNF assembly per package. For 10 kW/acre, the thermal load is equivalent to only one-half of a PWR SNF assembly placed end-to-end down the emplacement drift. As with mountain-scale, buoyant gas-phase convection, the threshold bulk permeability ($k_{b,hyd}$) where buoyant vapor flow begins to dominate moisture movement is about 10 darcy. If $k_b > 10$ darcy within a fracture network having a connectivity with a length scale comparable to half the drift spacing (in this example, 19.2 m), then buoyant vapor flow is sufficient to result in regions of net dry-out below the WPs and regions of net saturation buildup above the WPs. This may result in significant nonequilibrium fracture flow of condensate back to the WPs. Incidentally, the peak drift-wall temperature, T_{peak} , for the 20 kW/acre case is 60°C. Although T_{peak} is well below the nominal boiling point, repository-heat-driven flow could result in condensate drainage in the vicinity of WPs for on the order of 1000 years. For larger drift spacing, temperature differences between the drift-wall and pillar centerline will persist even longer, prolonging the period during which small-scale, buoyant vapor flow will drive condensate drainage and saturation buildup effects. For an APD of 10 kW/acre, a $k_{b,hyd}$ of about 20 darcy can cause similar effects. For the 10 kW/acre case, although T_{peak} is only 42°C, small-scale, buoyant vapor flow may drive significant condensate drainage and saturation buildup effects in the vicinity of WPs. In order to diagnose the potential for these effects to impact WP performance and radionuclide transport, in situ heater tests conducted under sub-boiling conditions will be required.

With the use of the UZ-repository-SZ-scale model, a suite of calculations to support the Total Systems Performance Assessment II (TSPA II) was conducted. A blended repository thermal loading history provided by the M&O was applied; it is based on the oldest fuel first (OFF) waste receipt scenario yielding an average SNF age of 26 years. Calculations were conducted for APDs of 28.5, 57, and 114 kW/acre (yielding Areal Mass Loadings (AMLs), of 29, 58, and 116 MTU/acre). The results, which were provided to both SNL and the M&O included detailed temperature, liquid saturation, and liquid flux histories throughout the repository, and throughout the various units between the repository horizon and the water table. Incidentally, the 57 kW/acre case (which falls within the thermal loadings described in the SCP-CDR) has a boiling period duration, t_{bp} , of 2600 years at the repository center.

Work continued to develop a suite of analytical approaches to modeling the statistical variability in condensate drainage. This work has been supporting both TSPA II and the thermal loading systems study. In this approach, condensate flow as a log-normal random field is idealized. The analytical models estimate the variability about the mean of the condensate flux computed by the UZ-repository-SZ-scale and drift-scale numerical models. One of the analytical models represents steady-state focusing of condensate concentrated over a localized region. This

model estimates the probability that mean condensate flow averaged over an area with a given correlation length exceeds the local average condensate flux. The probability that a WP is wet and the expected value of the condensate flux on that WP are then calculated.

Work has begun to develop an analytical model that represents transient (or cyclic) refluxing and boiling in fractures. This model calculates the distance that channelized flow travels down the fracture before water in the fracture is boiled away. It also calculates the fluxes for those fractures with flows capable of reaching the repository.

Laboratory Experiments

Work continued to measure electrical resistivity as a function of moisture content of Topopah Spring Tuff samples from the G-4 and GU-3 holes using J-13 water as pore fluid. The samples from GU-3 are being used for the high temperature measurements. The determination of electrical resistivity as a function of water saturation was completed using G-4 samples at room temperature. The specimens are machined both parallel and perpendicular to the axis of the core. Isotropy in electrical resistivity will be determined. For the GU-3 samples, the experiments are at 40°C, in the increasing saturation phase. The electrical conductivity of J-13 water at high temperatures has been determined to be near 100°C.

The experiment of determining the moisture retention curve and one-dimensional imbibition using G-4 core continued. The data from this experiment will be used to calculate relative permeability as a function of water saturation. The samples for the determination of moisture retention curves are at 35% relative humidity. The one-dimensional imbibition experiment using J-13 water is complete. The sample is saturated with water, some of which will be extracted for chemical analysis. Data analysis and evaluation of the experiment will be started next month. A gas bubble developed at the bottom of the sample during the experiment. The chemistry of the gas was sampled and analyzed. The gas is very similar to normal air except that its CO₂ content is about one order of magnitude greater than that in normal air. This information will be evaluated later.

An intact Topopah Spring tuff sample from the G-4 hole has been put in the pressure vessel under a confining pressure of about 5 MPa. The sample will be re-saturated with J-13 water before the permeability will be measured.

Meetings and Publications

T. Buscheck participated in the dry-run presentations on June 1 and June 16-17 in Las Vegas for the upcoming Nuclear Waste Technical Review Board (NWTRB) full-board meeting on thermal loading to be held in Denver on July 13 and 14.

T. Buscheck and J. Nitao made presentations at the model validation workshop held in Las Vegas on June 29. T. Buscheck presented a paper entitled "Repository-Heat-Driven Hydrothermal Flow: Modeling and Analysis". J. Nitao presented two

papers, "Analytical Expressions Quantifying the Influence of Convection on Fluid and Heat Flow" and "Modeling Statistical Variability in Condensate Drainage".

The paper by J. Nitao, T. Buscheck and D. Chesnut entitled "Implications of Episodic Nonequilibrium Fracture-Matrix Flow on Repository Performance" for submittal to the Journal of Nuclear Technology was approved by YMPO on June 2.

1.2.2.2.3 Mechanical Attributes of the Waste Package Environment

Work continued on responses to the NRC comments and associated revisions to Study Plan 8.3.4.2.4.3 and on Activity Plans for both laboratory and numerical studies of the geomechanics of the near-field environment.

S. Blair attended the 34th U.S. Symposium on Rock Mechanics in Madison, WI, June 28-30.

1.2.2.2.4 Engineered Barrier System (EBS) Field Tests

Large Block Test (LBT)

The draft Scientific Investigation Plan for the LBT has been revised in response to comments by YMPO reviewers. The procurement package for the load-retaining frame has been sent to potential vendors. A topographic survey and fracture mapping of the site at Fran Ridge was completed. Determination of the strike and dip of the fractures will continue next month. The preparations for laboratory tests on smaller blocks and quarrying of the large block are continuing.

D. Wilder, W. Lin, S. Blair and J. Blink assisted by LANL, SNL, RSN and REECo personnel visited NTS on June 1-2 to map fractures and select a test area. W. Lin and D. Wilder continued mapping the fractures on June 10 and 15. W. Glassley visited NTS on June 28-29 to map and sample the fracture system. Emphasis was on identifying mineralogy of fractures, number of fracture generations, and characteristics of fracture alteration haloes and fracture surfaces.

Set-up of laboratory apparatus was initiated for testing of small blocks to be taken from the outcrop site. Review of specifications continued for several diagnostic systems for the LBT.

1.2.2.2.5 Characterization of the Effects of Man-Made Materials on Chemical & Mineralogical Changes in the Post-Emplacement Environment

Draft of the Man-Made Materials Study Plan (8.3.4.2.4.5) continues.

K. Jackson and S. Carroll have initiated the first series of diesel fuel stability experiments. Their preliminary results demonstrate that diesel fuel is comprised of a vast array of constituents of varying stabilities.

K. Jackson, K. Knauss and A. Meike (LLNL) met with P. Gottlieb, J. Peters, P. Mariner and J. Houseworth (M&O), to discuss concerns regarding organic materials in general. They also reviewed the present diesel fuel experiments and visited the organic materials experimental facilities. Interest was expressed in obtaining information regarding the stability of hydraulic fluids. J. Peters agreed to supply information regarding the range of hydraulic fluids that may be used during the construction of the ESF.

The abstract entitled "Introduced Materials and Colloid Formation, A Report on the Current State of Knowledge" by A. Meike and C. Wittwer for submittal to the MRS Fall meeting in Boston, MA on November 29-December 3 was approved by YMPO on June 18.

The abstract entitled "Chemical Implications for the Presence of Introduced Materials in the Post-Emplacement Environment" by A. Meike for submittal to the MRS Fall meeting in Boston, MA on November 29-December 3 was approved by YMPO on June 10.

1.2.2.3 Waste Form and Materials Testing

1.2.2.3.1 Waste Form

1.2.2.3.1.1 Waste Form Testing - Spent Fuel

Spent Fuel Dissolution

The last subset of eight UO₂ dissolution experiments in the LLNL initial UO₂ flow-through test matrix were completed at the prescribed test matrix conditions in late May. These tests were continued at room temperature using the same buffers to obtain additional test replications and data. These results will provide additional data to test intrinsic UO₂ dissolution models that are developed. These continuations, plus the original test matrix runs, gives 35 experimental runs under a wide variety of conditions to develop dissolution response models.

Work is continuing on the two long-term, room-temperature dissolution experiments ongoing since early last Fall. These experiments use UO₂ powder from a batch provided by PNL that were used by them in similar experiments. Our Canadian colleagues at Pinawa, Manitoba are performing similar experiments. The first buffer composition is 0.02M sodium bicarbonate at a pH of 8. The second composition is a 'standard' saline solution with 0.01M sodium bicarbonate and 0.1M sodium chloride saturated with air; the pH is not controlled. Since February, the uranium dissolution rate for the first non-saline solution slowly increased to about 2 mg/m²-day in mid-April. The experiments were stopped for about one month during a move of the equipment to another building. Upon resuming the experiment in mid-May, the dissolution rate has increased to 2.5-4.0 mg/m²-day. The UO₂ dissolution rate in the saline solution did not change during the one month stoppage. Its dissolution rate has also slowly increased over time, but is less variable at about 4-5 mg/m²-day.

Documentation is being completed to begin a new sequence of experiments to examine the effects of oxidation state on uranium oxide dissolution. A prototype experiment is being assembled to measure the dissolution of schoepite at room temperature. These experiments will be similar to experiments beginning at PNL on spent fuel.

A test matrix for flow-through dissolution tests at PNL with three different spent fuels (ATM-104, ATM-105, and ATM-106), three oxidation states (UO_2 , O_4O_{9+x} and O_3O_8), two temperatures (25° and 75°C), and three carbonate/bi-carbonate concentrations (0.2, 2, and 20 millimolar) was developed and approved. Some preparation of test specimens that will be used in these tests is in progress, but other preparations have been delayed as noted below.

Changes in the mission for the PNL Bldg. 325 analytical hot cells have required a transfer of a portion of the spent fuel test specimen preparations into a different shielded hot cell located in another building. Equipment needed for the work in the new hot cell is being purchased, fabricated, or transferred from the previous hot cell. This will incur a delay of three to four weeks and cost about \$10K.

The abstract entitled "Modeling of UO_2 Aqueous Dissolution Over a Wide Range of Conditions" by S. Steward and H. Weed for submittal to the MRS Fall meeting in Boston, MA on November 29-December 3 was approved by YMPO on June 17.

Spent Fuel Oxidation

Dry Bath Testing

Two interim examinations were conducted on the 255°C drybath tests. The Turkey Point fuel has the fastest weight gain. It has reached an O/M of ~2.47; no powder was observed in any of the fragment samples. The weight curves are leveling off but at an O/M greater than those samples oxidized at 175°C. The 175°C samples are showing little or no weight gain. A subsample was taken of the sample at O/M = 2.47 for x-ray diffraction (XRD) analysis. An interim examination will be conducted next month on the main drybath tests.

The abstract entitled "Effects of Air/Steam Oxidation on the Initial Dissolution of Soluble Radionuclides from Spent LWR Fuel" by W. Gray, L. Thomas and R. Einziger (PNL) for submittal to the MRS Fall meeting in Boston, MA on November 29-December 3 was approved by YMPO on June 14.

Thermogravimetric Apparatus (TGA)

Work continues on bringing the TGAs out of mothballs. An $^{18}\text{O}_2$ run indicated that the equipment was leak tight. Fluctuations in the balance are still above the desired range but are well within tolerable limits. These fluctuations, apparently caused by thermal convections, were also present in previous TGA runs.

Materials Characterization Center (MCC) Hot Cell Activities

PNL has determined the inventory of MCC spent fuel Approved Test Materials (ATMs) that should be retained to support the YMPO program. The ATM number and quantities of the fuels that should be retained are as follows:

- 1) ATM-103, 24 inch-long section
- 2) ATM-104, 24 inch-long section
- 3) ATM-105, 24 inch-long section
- 4) ATM-106, 24 inch-long section
- 5) ATM-108, 24 inch-long section, and section "EE", rod ADN0106, 18 inches long.

Based on past, current and projected budgets, these samples should be sufficient to meet the current and projected needs of the spent fuel oxidation and spent fuel dissolution tests. These fuels should provide sufficient cladding for performance testing should the need arise.

The paper entitled "Rationale for Determining Spent Fuel MCC Acquisitions" by S. Marschman, R. Einziger (PNL) and R. Stout (LLNL) was sent to YMPO for approval.

1.2.2.3.1.2 Waste Form Testing - Glass

D-20-27 Unsaturated Testing of WVDP and DWPF Glass

The N2 tests (SRL actinide-doped glass) continue with no sampling period occurring this month. These tests have been in progress for 86 months. The N3 tests (ATM-10, a West Valley actinide-doped glass) continue and have been in progress for 67 months.

A QA surveillance on the N2/N3 activities at ANL was performed on June 30. All Scientific Notebooks and logs were reviewed. M&TE were checked for proper labels identifying calibration due dates. It was noted by the QA personnel that no sampling has occurred during this surveillance period.

1.2.2.3.2 Metal Barriers

Work is progressing to complete the installation of the G.E. slow crack growth monitoring system in the new corrosion testing laboratory. The assembly of the flow system was nearly completed. The initial system operation was checked out for the pump, heater assemblies, system leak check, and the efficiency of the heat exchangers. The heaters and heat exchanger operated as designed, and the pump appears to operate at a maximum of 7 gallons/hr, a flow rate better than expected. A missing switch that controls the interlocks for pump and heater shutdown was ordered and is expected in July. The G.E. data acquisition and reversing DC system was turned on. Work is proceeding on running shake-down tests to evaluate the software performance. Work is planned for conducting slow crack growth studies on carbon steels and other ferrous materials under repository relevant environment conditions.

An experimental arrangement is being designed for use in conjunction with the thermal gravimetric analysis (TGA) system for monitoring the low corrosion and oxidation rates in low and high humidity environments. Experiments are planned over a temperature range from ambient to above the normal boiling point of water and humidities ranging from very dry to saturation. A check is being made in the LLNL procurement department on the status of the TGA unit, which was ordered in April.

The draft of the degradation mode survey on ferrous-base materials (carbon steels, low alloy steels, cast irons) is nearing completion. It is expected to be submitted for internal review in July.

J. Mitchell and other LLNL personnel visited the Yucca Mountain site on June 10. He and R. Van Konynenburg made arrangements to visit the REECo sub-dock in Area 25 to observe the carbon steel tubing string exposed to the USW H-5 well. Their visit is planned for July 7, and they will obtain samples from different parts of the string. The samples will be characterized for the amount of corrosion loss and the pattern of corrosion attack. The string had been exposed for ten years; part of it was exposed in the saturated zone and part in the unsaturated zone.

Meetings were held on June 17 with representatives from the M&O (H. Benton, D. Stahl, R. Fish and P. Gottlieb) to discuss the budget for the EBS materials characterization activities in FY94. On June 18, meetings were held with the M&O (R. Fish, D. Stahl and K. McCoy) to review the current technical progress and forecast for the next year.

Principal investigators and the task leader attended a meeting on June 29 with J. Podobnik, LLNL-YMP Project Control, to review the financial status of this task. The Metal Barrier expenditures and work progress are tracking reasonably well.

The abstract entitled "Limitations on the Development of a Scientific Basis for Nuclear Waste Management" by R. Van Konynenburg for submittal to the MRS Fall meeting in Boston, MA on November 29-December 3, was approved by YMPO on June 14.

1.2.2.3.3 Other Materials

This WBS element has not been funded in FY93.

1.2.2.3.4 Integrated Testing

1.2.2.3.4.1 Integrated Radionuclide Release: Tests and Models

Activities in this element for June will be reported in the July report.

1.2.2.3.4.2 Thermodynamic Data Determination

The abstract entitled "Collinear Photothermal Deflection Spectroscopy of Liquid Samples at Varying Temperature" by J. Spear, R. Silva, G. Klunder and R. Russo for submittal to Applied Spectroscopy was approved by YMPO on June 18.

1.2.2.3.5 Nonmetallic Barrier Concepts

This WBS element has not been funded in FY93.

1.2.2.4 Design, Fabrication, and Prototype Testing

1.2.2.4.3 Container/Waste Package Interface Analysis

This WBS element has not been funded in FY93.

1.2.3 SITE INVESTIGATIONS

1.2.3.1 Site Investigations Coordination and Planning

This WBS element has not been funded in FY93. A Cost and Schedule Change Request (C/SCR) has been submitted requesting addition of LLNL to the list of participants for this WBS element in the WBS Dictionary.

1.2.3.2 Geology

1.2.3.2.1.2.1 Natural Analogue of Hydrothermal Systems in Tuff

This WBS element has not been funded in FY93.

1.2.3.4 Geochemistry

1.2.3.4.2 Geochemical Modeling

At the request of the database group, the release of Version 7.2 of EQ3/6 was postponed. A new set of data files is being prepared to correct minor inconsistencies with the published NEA data. These data files will be incorporated into the code package, which will now be released in July.

Work is continuing on Version 8.0. As specified in the Software Design Description (SDD), this version is a major re-write, incorporating major changes in the data structure to accommodate improvements in numerical methods and the addition of new functional capabilities. The new capabilities planned for Version 8.0 include:

1) allowing for redox disequilibrium in reaction-path calculations (important to treating the metastable persistence of dissolved components such as sulfate, nitrate, and organics,

2) a generic ion-exchange model, and

3) correction of supporting data, mostly thermodynamic, to pressures off the 1.013 bar-steam saturation curve.

1.2.3.5 Drilling

1.2.3.5.2.2 Engineering, Design, and Drilling Support

NTS personnel were indoctrinated into the YMP and personnel files were established.

1.2.3.10 Altered Zone Characterization

The principal effort has been on obtaining information on coupled codes. Emphasis has been on the code PRECIP.

Evaluation is proceeding on methodology used for examining changes in permeability and porosity.

1.2.5 REGULATORY

1.2.5.1 Regulatory Coordination and Planning

This WBS element has not been funded in FY93. A Cost and Schedule Change Request (C/SCR) has been submitted requesting addition of LLNL to the list of participants for this WBS element in the WBS Dictionary.

1.2.5.2 Licensing

1.2.5.2.2 Site Characterization Program

D. McCright attended meetings at YMPO on June 2, 15 and 16 to plan for the upcoming July 13-14 meeting of the Nuclear Waste Technical Review Board (NWTRB) to be held in Denver, CO. The meetings involved a scoping session and a two day dry run. His talk for the NWTRB will be on "Corrosion Aspects Under Various Thermal Scenarios". T. Buscheck will give a talk entitled "Numerical Modeling of Proposed Yucca Mountain Repository Under Various thermal Loads". D. Wilder will give a talk entitled "Waste Package Environment Thermal Tests". Completed viewgraphs were submitted to YMPO for eventual distribution at the July meeting.

D. Chesnut verified his comments on Study Plan 8.3.1.2.2.9, Site Unsaturated-Zone Modeling and Synthesis.

W. Lin has completed his review of Study Plan 8.3.1.3.6.1, Dynamic Transport Column Experiments.

J. Savy has completed his review of Study Plan 8.3.1.17.4.12, Tectonic Models and Synthesis.

1.2.5.3 Technical Data Management

1.2.5.3.4 Geologic and Engineering Materials Bibliography of Chemical Species (GEMBOCHS)

The GEMBOCHS Change Requests 3, 7, 8, 10 and 11 which were submitted using the CNGBOCHS system were resolved. These requests and their resolution history are filed in CNGREQ; their summary fields are as follows:

- 1) CR-3, request for minor change of data0 format
- 2) CR-7, request to revise naming convention of organics
- 3) CR-8, request to capitalize native-element species
- 4) CR-10, invalid request, and
- 5) CR-11, update U data from 92gre/ful to reflect final publication.

Work continued to develop a WINDOWS/4GL (mouse-driven) version of JEWEL. This program facilitates interactive point-and-click generation of thermodynamic datafiles for EQ3/6, GT, and other geochemical modeling packages.

J. Johnson attended a meeting of the YMP-TDB Radionuclide Solubility Working Group in Las Vegas on June 16.

1.2.5.3.5 Technical Data Base Input

A correction was submitted to YMPO on June 1 to the request for completion of the Site and Engineering Properties Database (SEPDB) Backlog Submittal Packages.

J. Blink attended the Technical Data Working Group Meeting in Las Vegas on June 3.

1.2.5.4 Performance Assessment

1.2.5.4.2 Waste Package Performance Assessment

Information on the source term was presented to SNL for use in TSPA 93. As part of this effort, Near Field and PA staff modeled an important near-field hydrological process, localized water penetration beyond a boiling front, through a dried-out zone, down to the level of a repository. At random locations, this flux could wet some waste packages. In order for penetration to happen at some location, it is necessary that the localized water flux be greater than the amount of water that can be evaporated by the heat flux from the repository. This heat flux is assumed to be essentially uniform, whereas water fluxes are known to exhibit spatial heterogeneity. Using the lognormal distribution to characterize this heterogeneity (as is suggested in the literature), numerical results for the fraction of waste packages that get wet under the assumptions of 57 and 114 kilowatts per acre initial area power density, both at the center and edge of the repository have been derived. For representative assumed input values, the fraction of waste packages in the repository center zone that get wet is on the order of a few per thousand for the first 50 to 100 years. The fraction then drops by about an order of magnitude in the 57 kW/acre case. The fraction drops by about three orders of magnitude in the

114 kW/acre case, to an expected value well below one waste package in the whole repository center zone after a few hundred years.

Thermal hydrology calculations were provided to the SNL and the M&O for the TSPA II. More details are provided in the WBS element 1.2.2.2.2 section of this report.

W. Halsey contributed information to the 1994 Annual Plans for both Waste Package WBS 1.2.2 and Regulatory (Performance Assessment WBS 1.2.5).

The following two workshops were hosted at LLNL to develop models and data for Total System Performance Assessment - II. LLNL is responsible for a NFE/EBS Source Term which incorporates thermal processes:

- 1) June 11, Thermal History Workshop (participants from LLNL, DOE, SNL and M&O)
- 2) June 23, Hydrothermal Water Flux Workshop (participants from LLNL, SNL and M&O)

1.2.9 PROJECT MANAGEMENT

1.2.9.1 Management and Coordination

1.2.9.1.2 Technical Project Office Management

J. Blink reviewed AP-5-38 R2, Environmental, Safety and Health Appraisal".

J. Blink provided LLNL-YMP NTS population projections to RSN on June 3. He worked with SAIC Socio-Economic staff members to streamline the Employee Survey to be conducted in July 1993. He attended the YMP Safety Committee meeting on June 3 and the ESF Enhancement Meeting on June 28 in Las Vegas. He attended Infrastructure Reduction Assessment Team (IRAs) meetings in Albuquerque on June 17-18 and in Las Vegas on June 23. He also participated on June 28-30 in the ESF backup power valve engineering study.

J. Blink coordinated LESSON teacher training workshops at Valley High School (for Clark County teachers) and at NTS (for Nye County teachers). He also taught the physics portion of the courses and acted as a tour guide for tours of the NTS and Yucca Mountain.

1.2.9.2 Project Control

1.2.9.2.2 Participant Project Control

The May Cost/FTE report was submitted to YMPO. The Cost Plan was updated to include May actuals. The May actual schedule progress and costs were submitted via the PACS workstation. Variance analysis explanations were developed for four P&S accounts:

- 1) Man-Made Materials, 1.2.2.2.5
- 2) Waste Form Testing-Glass, 1.2.2.3.1.2
- 3) Project Control, 1.2.9.2.2
- 4) Administrative Support, 1.2.15.2

The FY93 Estimate at Completion analysis is being conducted. A series of meetings with the Technical Area Leaders and their Principal Investigators were held to discuss current status and forecasts for expenditures through the end of the FY.

Staff met with representatives of the M&O on June 17 in Livermore to discuss FY94 Waste Package budgets. The M&O proposed two budget cases with distribution of workscope, deliverables and budgets at the P&S account level. The proposals were modified and presented to the Engineering Development Division Director in Las Vegas on June 23.

Two candidates were interviewed for the Engineering/Scientific Coordinator. Difficulties are being encountered in finding a candidate with the appropriate background. It is anticipated that it will be necessary to submit a job posting for these positions through the internal employees posting. To date, all candidates have been "displaced persons".

A review was completed of the Compliance Evaluation Plan for the DOE-IRM activity. LLNL's comments address the need to be funded for the IRM activity if this Compliance Evaluation is to be implemented. IRM activity is now being undertaken as an "overhead function"; however the requirements and time expended are becoming significant and should be recognized as a budget area.

A Basis of Estimates package is being assembled that was previously provided to YMPO in June of 1992. The second submittal is required for M&O records.

A modified acquisition plan to reflect a change in the FY93 IRM Short Range Plan was submitted. Two IBM 370s are being purchased instead of Sun SPARCstations as specified in previous capital planning documents.

1.2.11 QUALITY ASSURANCE

1.2.11.1 Quality Assurance Coordination and Planning

A response was made to the YMPO request to verify that the LLNL internal procurement procedures comply with DOE procurement controls.

R. Monks and B. Bryan attended the QARD Orientation Meeting in Las Vegas on June 28.

1.2.11.2 Quality Assurance Program Development

The Grading Report LLNL-QAG-L070 for Activity N-20-1, Direct Geotechnical Data Acquisition Support of Testing at NTS, was completed and distributed.

The Activity Plan for Flow-Through Dissolution Tests on UO₂, D-20-53b, Rev. 1, was completed and distributed.

1.2.11.3 Quality Assurance Verification

1.2.11.3.1 Quality Assurance Verification - Audits

Audit 93-02, an internal audit of LLNL-YMP covering Criteria 2-9, 12, 13, and 17, was conducted on June 15 - 30.

Audit 93-03, an independent audit of the LLNL-YMP QA organization covering Criteria 1, 2, 15, 16, and 18, was conducted on June 23 - 25 by (non-YMP) LLNL Quality Assurance staff.

1.2.11.3.2 Quality Assurance Verification - Surveillance

No significant activities.

1.2.11.4 Field Quality Assurance/Quality Control

This WBS element has not been funded in FY93.

1.2.11.5 Quality Assurance - Quality Engineering

No significant activities.

1.2.12 INFORMATION MANAGEMENT

1.2.12.2 Records Management

1.2.12.2.2 Local Records Center Operation (LRC)

Four new revisions were issued by Document Control. There were no change notices issued.

1.2.12.2.3 Participant Records Management

A total of 216 items were logged into the LLNL-YMP tracking system. This includes 15 records/records packages that were processed through to the CRF. Ten action items were closed.

The records staff reviewed and commented on AP-1.17Q.

1.2.12.2.5 Document Control

LLNL received no funding under this WBS. Work performed to complete LLNL's obligation in this WBS is funded under WBS 1.2.12.2.2.

1.2.13 ENVIRONMENT, SAFETY AND HEALTH

1.2.13.1 Environment, Safety and Health Coordination and Planning

A request was submitted for FY94 funding for this WBS element in anticipation of work needed to support the Large Block Test at NTS.

1.2.15 SUPPORT SERVICES

1.2.15.2 Administrative Support

HQ comments were received on the first draft of PR 8, Site Characterization Progress Report: Yucca Mountain, Nevada. LLNL reviewed the report and responded to these comments on June 24 as requested.

1.2.15.3 Yucca Mountain Site Characterization Project (YMP) Support for the Training Mission

Twenty one different self-study assignments were issued, and 21 people were trained to these assignments. Currently, there are 85 participants on the project who are to be trained and/or tracked.

LLNL PROJECT STATUS REPORT DISTRIBUTION

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JUN 9 12 18 PM '93

IN REPLY REFER TO:
580-01-472

WBS 1.2.9.1
QA: N/A

June 4, 1993

Carl P. Gertz, Project Manager
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Post Office Box 98608
Las Vegas, NV 89193-8608

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT (YMP) STATUS REPORT (SCP: N/A)

Attached is the May YMP Status Report for Reynolds Electrical & Engineering Co., Inc.'s participation in the YMP.

If further information is required, please contact Rene' R. Knott at 794-7193.

RFP Pritchett

R. F. Pritchett, Manager
Yucca Mountain Project Division
YMP Technical Project Officer

RFP:RRK:mab

Enclosure
Status Report (3 pages)

cy: See page 2

DIVISION _____
CC: *Yerb*
CC: *See Distribution*
CC: *Test (13)*
CC: *Berkhoff*
CC: *Bradsky*
CC: *H-Ray*
CC: *Stecker-ew22*
CC: _____

REC'D IN YMP
6-8-93

I-342885

6/4/93

RPTS 1.2

Carl P. Gertz
580-01-472
Page 2
June 4, 1993

cy w/encl.

Information Services Center, M/S 408

L. M. Smith, DOE/NV, M/S 505
M. B. Blanchard, DOE/YMP, M/S 523
W. R. Dixon, DOE/YMP, M/S 523
J. R. Dyer, DOE/YMP, M/S 523
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S. L. Hughes, REECo, M/S 408
D. L. Knight, REECo, M/S 408
D. L. Koss, REECo, M/S 408
R. B. Land, REECo, M/S 585
T. M. Leonard, REECo, M/S 751
K. L. Limon, REECo, M/S 408
C. J. Mason, REECo, M/S 751
S. O. Straub, REECo, M/S 408
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M. Brodeur, SAIC, M/S 517/T-23
J. J. Brogan, SAIC, M/S 517/T-12
R. D. Hutton, SAIC, M/S 517
S. C. Smith, SAIC, M/S 517/T-10
J. W. Teak, SAIC, M/S 517
J. E. Therien, SAIC, M/S 517



REYNOLDS ELECTRICAL & ENGINEERING CO., INC.
(REEC Co)

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT (YMP)

MAY 1993 - STATUS REPORT

Reeco has no reportable Level 0 or Level 1 Milestones.

SITE (1.2.3)

WBS 1.2.3.2

Task: USGS Integrated Data Acquisition System (IDAS)

Continued support of IDAS to include technical support, equipment testing, maintenance and repairs.

WBS 1.2.3.5

Task: Capital Equipment to support Drilling Programs

Prepared requisitions for tubing tongs, breakout table/rotary tool service and dust collector. Items were approved in Capital Equipment Requirements Plan but funding transfer of \$100,000 has not occurred.

Task: Quaternary Trenching (Job Package 92-12)

Completed Quaternary Trench at Bare Mountain.

Task: USW UZ-14 Drilling (Job Package 92-17)

Continued drilling/coring operations. Borehole was continuously cored to a depth of 669.97 feet. The 12 1/4 inch reamed hole was advanced to 661.64 feet. Scheduled total depth of UZ-14 is 2,000 feet.

Task: UE-25 NRG-2 North Portal Ramp Borehole (Job Package 92-19)

Received Field Change Request (FCR) to deepen original borehole from 215 feet to approximately 315 feet May 27, 1993. Presently coring at 228.61 feet.

Task: UE-25 NRG-4 Access Road (Job Package 93-2)

Completed rough grade on NRG-4 Borehole Access Road.

Task: UE-25 NRG-5 North Portal Ramp Borehole (Job Package 93-3A)

Reached total depth of 955 feet on May 10, 1993. Received FCR to deepen hole to approximately 1,300 feet on May 27, 1993. Presently coring at 971.38 feet.

Task: UE-25 NRG-2A, North Portal Ramp Borehole (Job Package 93-05)

Utilizing the CME-850 drill rig, continuously cored from surface to total depth of 220 feet with 5 1/2 inch odex casing to 159 feet. Received FCR to deepen borehole on May 20, 1993. Completed deepening to 265.74 feet on May 23, 1993.



Procurement Actions

Services of Central Fishing Tool, Inc. were required on May 7, 1993, to initiate fishing activities to resolve problems encountered in the USW UZ-14 borehole.

Developed Special Conditions for the Technical Support Services Subcontractor to provide onsite technical expertise to repair, modify and calibrate the prototype Caltrol Gas Injection System built for use on the LM-300 Drill Rig.

REGULATORY (1.2.5)

WBS 1.2.5.2.4

Task: Site Characterization Plan (SCP) Reference Library and Database

Continued distribution and database maintenance for the SCP and Progress Reports. Distributed two SCP sets during this reporting period.

EXPLORATORY STUDIES (1.2.6)

WBS 1.2.6.1

Task: Exploratory Studies Facility (ESF)

Continued administrative support for ESF activities to include planning, scheduling and management. Participated in RSN Design Reviews for Rotary Drill Rig and C-Well Complex; completed 50% Title II Package 2 Design Review; and performed Facility Manager Environmental Inspection.

Task: Technical Support and Underground Excavation for the ESF (RFP 1-DH-92)

Completed a manpower and audit review on RFP 1-DH-92 and conducted a Fact Finding on May 17, 1993. Reduced the scope of work for Fiscal Year 1993 due to funding limitations, and transmitted new scope to the Subcontractor on May 28, 1993.

Task: Procurement of a Tunnel Boring Machine (RFP 2-DH-93)

Concluded Procurement Review Cycle and awarded on May 27, 1993, to Construction and Tunneling Services, Inc.

Task: ESF North Portal Pad & Facilities (Job Package 92-20)

Completed first lift of aggregate base course on North ESF Portal Access Road; began rework of North Portal ESF Drainage Channel; drilled and blasted 31 rounds; advanced Pilot Drift to Construction Station (CS) 0+99; advanced the North and South Slashes to CS 0+50; pull-tested 12 split set rock bolts; installed 34 split set rock bolts; installed 45 Williams patten rock bolts; installed 20 Tital rock bolts; and installed lattice girders.

RFP 7-DH-93, Arch Structure, was started through the procurement review process.

RFP 12-DH-93, Prefabricated Switchgear Building, closed on May 4, 1993, with thirteen proposals received. Awarded May 14, 1993.

Request for Quotation (RFQ) 4-RFQ-DH-93 for Rockbolts issued on May 4, 1993 and closed May 10, 1993. Award has been delayed due to a pending specification change.



TEST FACILITIES (1.2.7)

Task: Field Operations Support

Continued logistical and tour support for DOE Yucca Mountain Site (YMSO) staff. Seventeen tours were held during this period with 617 people attending. Support included but was not limited to arrangements for buses, registration of guests, coordination of lunches/beverages, medical service, furniture, and mechanical service. Continued preparations for upcoming tours.

Continued support services to participants and maintenance of YMP utilized facilities, utilities, equipment and roads in Area 25. Resumed installation of new chiller unit and auxiliary units for Building 4015, Area 25 Field Operations Center, which was suspended in May due to funding limitations. Installed two additional 13-ton portable air-conditioning units. Due to lack of capacity and higher ambient temperatures, rented and installed a 200-ton portable chiller pending completion of permanent chiller system.

PROJECT MANAGEMENT (1.2.9)

WBS 1.2.9

Task: Technical Project Office Management/Project Control

Continued normal administrative level of effort support. Continued status and update of Planning and Control System (PACS); supported ESF Construction activities, drilling activities and completed cost estimates as required.

QUALITY ASSURANCE (1.2.11)

WBS 1.2.11

Task: Quality Assurance

Continued normal administrative level of effort support. A response to the Corrective Action Report (CAR) identifying a significant condition adverse to quality in the area of Control of Material was received and determined to be unacceptable. A revised response is to be submitted in early June.

The responses to the CARs issued as a result of the March 1993 YMP Inspection Audit have been evaluated as acceptable. Actions are in progress to implement the planned corrective actions.

ENVIRONMENT, SAFETY & HEALTH (1.2.13)

WBS 1.2.13

Task: Safety & Occupational Health

Provided medical, occupational safety, industrial hygiene and fire protection support.

SUPPORT SERVICES (1.2.15)

WBS 1.2.15

Task: Administrative Support and Training

Continued to provide procurement, logistical, and information management administrative level of effort support; continued support services to various YMP participants.

Staffed the Technical Information Display at the combined Rocky Mountain and Cordilleran sections of the Geological Society of America annual meeting in Reno, Nevada.

MONTHLY HIGHLIGHTS AND STATUS REPORT



The logo features a stylized mountain peak on the left. To its right, the text "U.S. DEPARTMENT OF ENERGY" is written in a curved path. Below that, "YUCCA MOUNTAIN PROJECT" is written in a similar curved path. To the right of the mountain, the words "Yucca Mountain Site Characterization Project" are stacked vertically in a large, bold, sans-serif font.


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April 1993

98-06270-359-43A



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YUCCA
MOUNTAIN

YUCCA
MOUNTAIN
SITE
CHARACTERIZATION
PROJECT

Monthly Status Report

April 1993

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April Highlights

SNL staff examined the impact of emplacement drift diameters on predicted wall temperatures.

See **1.2.2.4.3 Container/Waste Package Interface Analysis** on page 2.

SNL staff commenced work in support of the Soil and Rock Properties study.

See **1.2.3.2.6.2 Soil and Rock Properties of Potential Locations of Surface Facilities** on page 6.

SNL staff submitted two study plans to the Project Office.

See **1.2.3.2.7.1.1 Laboratory Thermal Properties and 1.2.3.2.7.1.2 Laboratory Thermal Expansion Testing** on pages 7 and 8.

April Highlights, Continued

SNL staff wrote a SAND report to help determine the appropriateness for TOSPAC calculations of one-dimensional calculational approximations of water flow through Yucca Mountain.

See **1.2.5.4.1 Total System Performance Assessment** on page 18.

SNL staff is migrating VAX 3600 Calma models to alternate platforms. Staff also drafted the data dictionary and initiated development of the user interface document.

See **1.2.5.4.5 Interactive Graphics Information System** on page 21.

SNL staff submitted to the Project Office a SAND report estimating surface water migration near the potential repository perimeter.

See **1.2.5.4.7 Supporting Calculations for Postclosure Performance Analyses** on page 23.

SNL staff qualified five computer codes.

See **1.2.5.4.9 Development and Verification of Flow and Transport Codes** on page 24.

SNL QA staff revised the Employee Orientation Manual QA section and the procedure training abstracts. SNL QA staff also revised six procedures.

See **1.2.11 Quality Assurance** on page 29.

APRIL 1993



DISCLAIMER

Quality assurance checks on data contained in this report have been performed only to determine that the data have been obtained and documented properly. The SNL Project Department cautions that any information is preliminary and subject to change as further analyses are performed or as an enlarged and perhaps more representative data base is accumulated. These data and interpretations should be used accordingly. Milestones have not been baselined and are included only to show status.

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MOUNTAIN

APRIL 1993

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT EXECUTIVE SUMMARY

WBS 1.2.2.4.3 Container/Waste Package Interface Analysis

- A preliminary examination of the impact of differing emplacement drift diameters on predicted wall temperatures was carried out for an in-drift emplacement scenario.

WBS 1.2.3.2.6.2 Soil and Rock Properties of Potential Locations of Surface Facilities

- The transition plan for this element was submitted to the Project Office for approval as work commenced in support of the Soil and Rock Properties study.

WBS 1.2.3.2.7.1.1 Laboratory Thermal Properties

- Study plan 8.3.1.15.1.1, R1, "Laboratory Thermal Properties" (Level 3 Milestone 0S43), was completed and submitted on April 1, 1993.

WBS 1.2.3.2.7.1.2 Laboratory Thermal Expansion Testing

- Study Plan 8.3.1.15.1.2, R1, "Laboratory Thermal Expansion Testing" (Level 3 Milestone 0S44), was completed and submitted on April 1, 1993.

WBS 1.2.5.4.1 Total System Performance Assessment

- SAND93-0852, "The Appropriateness of One-Dimensional Yucca Mountain Hydrologic Calculations," has been written to help define the calculational regimes in which one-dimensional calculations are appropriate for approximating the flow of water through Yucca Mountain for TSPA calculations.

WBS 1.2.5.4.5 Interactive Graphics Information System

- SNL has initiated an effort to identify users of the VAX 3600 to help plan the retirement of that computer. The Calma/DDM thermal/mechanical model is not scheduled to be made available beyond FY93. SNL is migrating the Calma models that reside on the VAX 3600 to alternate platforms.
- The initial draft of the data dictionary has been completed and development of the user interface has begun.

WBS 1.2.5.4.7 Supporting Calculations for Postclosure Performance Analysis

- SAND92-2248, "Estimations of the Extent of Migration of Surficially Applied Water for Various Surface Conditions Near the Potential Repository Perimeter" (Level 3 Milestone 0S13), was completed and submitted to the Project Office.

WBS 1.2.5.4.9 Development and Verification of Flow and Transport Codes

- Five computer codes were qualified during the month of April.

WBS 1.2.11 Quality Assurance

- SNL QA staff revised the QA section of the Employee Orientation Manual and revised and updated procedure training abstracts to reflect current procedures. Additionally, six specific QA implementing procedures were revised as a part of the QARD transition plan implementation.

1.2.1 SYSTEMS ENGINEERING

The objective of the Systems Engineering element is to apply the systems engineering discipline to transform the regulatory requirements into functional needs of the MGDS design, system configuration, and site characterization activities. The Systems Engineering element is comprised of four tasks: Systems Engineering Coordination and Planning (1.2.1.1), Program-Level Requirements Document Development (1.2.1.2.1), Project-Level Requirements Documents Development and Maintenance (1.2.1.2.2), and Special Studies (1.2.1.5), which includes development of items important to safety and waste isolation.

1.2.1.1 SYSTEMS ENGINEERING COORDINATION AND PLANNING

1.2.1.2.1 PROGRAM-LEVEL REQUIREMENTS DOCUMENT DEVELOPMENT

1.2.1.2.2 PROJECT-LEVEL REQUIREMENTS DOCUMENTS DEVELOPMENT AND MAINTENANCE

1.2.1.5 SPECIAL STUDIES

Status Report on Ongoing Activities

While all major activities and deliverables within the Systems Engineering element have been completed, additional support was requested for Sandia National Laboratories (SNL) staff to review Draft C of the Site Design and Test Requirements Document, YMP/92-33 under WBS element 1.2.1.2.2.

Publication of SAND92-2334, "Preclosure Radiological Safety Evaluation: Exploratory Studies Facility," by F. J. Schelling and J. D. Smith, is still pending Project Office approval.



1.2.2 WASTE PACKAGE

The objective of the Waste Package element includes support to the Container/Waste Package Interface Analysis element (1.2.2.4.3) in the conduct of thermal and structural analyses of the near-field environment that will support evaluations of emplacement orientation, the effects of backfill properties and timing, as well as other thermal loading issues related to waste package design.

1.2.2.4.3 CONTAINER/WASTE PACKAGE INTERFACE ANALYSIS

Major Accomplishments

A preliminary examination of the impact of differing emplacement drift diameters on predicted wall temperatures was performed for an in-drift

emplacement scenario. These calculations are being refined to reflect more realistic geometries and multiple material designations. Once completed, these results will be transmitted to the Management and Operations (M&O) contractor's waste package design team for use with the more-detailed waste package models.



1.2.3 SITE INVESTIGATIONS

The objective of the Site Investigations element includes work scope related to site data collection and analysis to support site suitability evaluation, design, licensing, performance assessment requirements, and the natural barrier system component of the multiple barrier system described in the physical system. The Site Investigations element is comprised of eleven tasks: Site Investigations Coordination and Planning (1.2.3.1), Systematic Acquisition of Site-Specific Subsurface Information (1.2.3.2.2.1), Three-Dimensional Rock Characteristics Models (1.2.3.2.2.2), Surface Facilities Exploration Program (1.2.3.2.6.2.1), Surface Facilities Laboratory Tests and Material Property Measurements (1.2.3.2.6.2.2), Surface Facilities Field Tests and Characterization Measurements (1.2.3.2.6.2.3), Laboratory Thermal Properties (1.2.3.2.7.1.1), Laboratory Thermal Expansion Testing (1.2.3.2.7.1.2), Laboratory Determination of Mechanical Properties of Intact Rock (1.2.3.2.7.1.3), Laboratory Determination of the Mechanical Properties of Fractures (1.2.3.2.7.1.4), and Future Regional Climate and Environments (1.2.3.6.2.1.6).

1.2.3.1 SITE INVESTIGATIONS COORDINATION AND PLANNING

Major Accomplishments

SNL staff participated in the April Sample Overview Committee (SOC) meeting. Various core requests were acted upon.

Status Report on Ongoing Activities

Routine oversight of site investigations coordination and planning was conducted.

1.2.3.2.2.1 SYSTEMATIC ACQUISITION OF SITE-SPECIFIC SUBSURFACE INFORMATION

Major Accomplishments

The summary paper entitled "Influence of Deterministic Geologic Trends on Spatial Variability of Hydrologic Properties in Tuff," by C. A. Rautman (SNL), J. D. Istok (Oregon State University), A. L. Flint (U.S. Geological Survey) (USGS), L. E. Flint (Raytheon Services-Nevada) (RSN), and M. P. Chornack (USGS), was presented at the 1993 International High-Level Radioactive Waste Management Conference and published in the *Proceedings* volume (SCP Activities 8.3.1.4.3.1.1 and 8.3.1.3.2.2).

Significant Meetings Attended

SNL staff attended the week-long 1993 International High-Level Radioactive Waste Management Conference on April 26 through 30, 1993.

Status Report on Ongoing Activities

SNL staff normally assigned to this activity spent a significant amount of time providing geologic support to the work being conducted under WBS element 1.2.3.2.6.2, Soil and Rock Properties of Potential Locations of Surface Facilities (SCP Activities 8.3.1.14.2.1, 8.3.1.14.2.2, and 8.3.1.14.2.3). The Soil and Rock Properties study is the basis for preparing geologic and engineering logs for the core obtained as a result of drilling the north and south ramp borehole sequence. Because both activities are focused on engineering aspects of the immediate repository block and its access ramps, close coordination between the two studies



is essential. Geologic logging related to the two studies will be virtually identical in scope and format (SCP Activity 8.3.1.4.3.1).

Significant time was dedicated to preparation of slides and presentation materials for the 1993 International High-Level Radioactive Waste Management Conference. SNL staff met with USGS and contractor co-authors to revise a draft journal article being prepared as a result of the transect-sampling work presented at the conference. The journal article will include the results of more recent sampling that serves as a hypothesis test (generally favorable) of the quantitative spatial trends described by the conference paper (SCP Activity 8.3.1.4.3.1.1).

Completion of the draft data reports, "Physical and Hydrologic Properties of Outcrop Samples From a Nonwelded to Welded Tuff Transition, Yucca Mountain, Nevada," and "Physical and Hydrologic Properties of Surface Outcrop Samples at Yucca Mountain, Nevada," has been deferred temporarily. These reports summarize the two-dimensional transect sampling from the shardy base unit of the Tiva Canyon Member of the Paintbrush Tuff. Some of the samples from this transect are still being reevaluated for unsaturated flow properties at the USGS Hydrologic Research Facility, and this work must be completed before final oven-dried bulk properties can be obtained. Although the hydrologically important information has already been obtained from relative-humidity oven drying, the 105°C-dried properties will be reported as well

for consistency with older work on the Yucca Mountain Project (SCP Activities 8.3.1.4.3.1.1 and 8.3.1.2.2.3.1).

Major Activities Upcoming Next Three Months

Emphasis over the next several months will be placed on ensuring that all prerequisites are in place for initiating drilling activities for joint hole SD-11/SRG-5 near the south entry point from the south ramp to the Exploratory Studies Facility (ESF), tentatively scheduled to begin July 1. Preparation of the Test Planning Package and Job Package is underway. Technical procedures that have been prepared in draft form will be finalized early next month (SCP Activity 8.3.1.4.3.1).

The FY94 budget cycle is anticipated to begin next month. This annual activity will consume considerable time and resources, because the imminent onset of drilling activities requires that plans and coordination with other site characterization activities be drawn more tightly than has been required in the past. This is particularly important with respect to the Systematic Drilling Program, as more than a dozen other SCP studies require core from this program for sample materials (SCP Activity 8.3.1.4.3.1.1).

Additional geologic support (core logging) for the Soil and Rock Properties study (SCP Activity 8.3.1.14.2) will continue. Cross-fertilization between this study and the Systematic Drilling Program (SCP Activity 8.3.1.4.3.1.1) will continue.



1.2.3.2.2.2.2 **THREE-DIMENSIONAL ROCK CHARACTERISTICS MODELS**

Major Accomplishments

The summary paper entitled "Recent Developments in Stochastic Modeling and Upscaling of Hydrologic Properties in Tuff," by C. A. Rautman (SNL) and T. H. Robey (Spectra Research Institute), was presented at the 1993 International High-Level Radioactive Waste Management Conference and published in the *Proceedings* volume (SCP Activity 8.3.1.4.3.2.1).

Significant Meetings Attended

SNL staff attended the week-long 1993 International High-Level Radioactive Waste Management Conference on April 26 through 30, 1993. The conference included a special session on Geostatistical and Related Methods, which was the forum for a presentation by SNL staff. Most papers presented at this session included geostatistical simulation and stochastic modeling of geologic phenomena important to the repository program, indicating wider acceptance of these methodologies (SCP Activity 8.3.1.4.3.2.1).

Status Report on Ongoing Activities

The theoretical justification for the intended approach to integrating software developing will be confirmed by discussions with researchers from the Stanford Center for Reservoir Forecasting (SCRF) and the SCRF Annual Review Workshop early in May, and plans will be finalized after that time (SCP Activity 8.3.1.4.3.2.1).

A significant number of staff was dedicated to preparation of presentation materials for the 1993 International High-Level Radioactive Waste Management Conference.

Major Activities Upcoming Next Three Months

Emphasis will be placed on integrating several of the more frequently used GSLIB subroutines into a coherent package suitable for production

simulations. A proposal to closely integrate "soft" information from the three-dimensional geologic model being developed by the USGS (SCP Activity 8.3.1.4.2.1) into the stochastic models of material properties produced by this activity has been deferred because of other commitments.

Preparation of the FY94 budget is anticipated to begin during May. A major effort is underway at SNL to integrate more closely site characterization, ESF design support analyses, and total systems performance assessment activities. Considerable effort will be devoted to defining and refining the links among the diverse suite of Yucca Mountain Site Characterization Project (YMP) activities at SNL and elsewhere as part of the budgeting and networking process. Several specific three-dimensional rock characteristics models appear to be required during FY94 (SCP Activity 8.3.1.4.3.2.1).

SNL staff will contribute text sections to the 1993 Total Systems Performance Assessment (TSPA) over the next several months. These text sections will detail construction of the repository-scale three-dimensional indicator simulations of lithology that have been detailed during previous months. These simulations form the basis for an evaluation of sensitivity of TSPA computations to uncertainty in stratigraphic models. A paper summarizing the development and construction of these models may be prepared for stand-alone publication (SCP Activity 8.3.1.4.3.2.1).

Preparation of the study plan for this activity will continue at an accelerated pace now that the 1993 International High-Level Radioactive Waste Management Conference is concluded. The Project Office has formally issued new guidelines for the preparation of study plans (based on a new U.S. Nuclear Regulatory Commission/U.S. Department of Energy [NRC/DOE] Level-of-Detail Agreement) that should alleviate earlier difficulties in presenting plans for this study. The new guidelines specifically address modeling studies, such as this one, in addition to the more classical field- and laboratory-oriented investigation studies (SCP Activity 8.3.1.4.3.2.1).

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**1.2.3.2.6.2.1 SURFACE FACILITIES
EXPLORATION PROGRAM**

**1.2.3.2.6.2.2 SURFACE FACILITIES
LABORATORY TESTS AND
MATERIAL PROPERTY
MEASUREMENTS**

**1.2.3.2.6.2.3 SURFACE FACILITIES FIELD
TESTS AND CHARACTERIZATION
MEASUREMENTS**

Major Accomplishments

The Transition Plan for Soil and Rock Properties of Potential Locations of Surface Facilities was prepared and submitted to the Project Office.

Status Report on Ongoing Activities

Rock samples have been selected from NRG-2 and NRG-6 for mechanical and thermal properties laboratory testing. Laboratory tests are currently being performed. Geotechnical core logging has been completed for NRG-2. Logging activities for NRG-6 and RF-8 are underway. An updated section for the north ramp was prepared. Six in situ soil percolation tests were performed.

Major Activities Upcoming Next Three Months

Staff will continue to perform mechanical and thermal properties laboratory tests for north ramp borehole rock samples and geotechnical core logging for north ramp boreholes. Soil resistivity tests for the north portal power grid and soils laboratory tests and field tests for the booster pump station and water storage facilities will also be performed.

1.2.3.2.7.1.1 LABORATORY THERMAL PROPERTIES

Major Accomplishments

Resolutions to the technical comments for Study Plan (SP) 8.3.1.15.1.1, R1 "Laboratory Thermal Properties," have been incorporated into the document. The submittal of this SP to the Project Office on April 1, 1993, completes Level 3 Milestone OS43. Comment resolution is being verified.

Status Report on Ongoing Activities

Nine samples have been machined and inspected for the experiments to study the effects of sample saturation on thermal conductivity. Three samples of welded devitrified tuff and three samples of nonwelded zeolitic tuff will be used for this study. The thermal conductivity of each sample will be measured at nominal temperatures of 30°C, 50°C, and 70°C, at five different saturation states (fully saturated, oven-dry, air-dry, and two other intermediate states). These experiments are necessary to determine whether thermal conductivity has a predictable dependence on the saturation state of the sample and, if so, to describe the nature of the relationship. Results from these experiments will be used to determine the optimal baseline test conditions for thermal conductivity characterization.

Thermal conductivity measurements using the guarded-heat-flow-meter method will be made with the C-Matic low temperature (LT) instrument and moisture containment cell.

Permanent and reference thermocouples were calibrated and the controllers tuned. After completion of the system calibration (in progress), testing of air-dry samples will begin (SCP Activity 8.3.1.15.1.1.3).

Purchase orders were placed for rock crushing and grinding equipment that will be used to prepare powdered rock samples for chemical analysis and mineralogic determination by X-ray diffraction. These analyses will be used to aid in the interpretation of the thermal conductivity data (SCP Activity 8.3.1.15.1.1.3).

Compilation and analysis of petrography, petrology, and chemistry data by thermal/mechanical unit are continuing (SCP Activity 8.3.1.14.1.1.1).

Major Activities Upcoming Next Three Months

Testing activities for the scoping study on the effects of saturation on thermal conductivity will be completed. The thermal conductivity of each sample will be measured at nominal temperatures of 30°C, 50°C, and 70°C, at five different saturation states (fully saturated, oven-dry, air-dry, and two other intermediate states) (SCP Activity 8.3.1.15.1.1.3).

The rock crushing and grinding equipment for preparation of powdered rock samples will be installed at the University of New Mexico (UNM).

J. Connolly of UNM will present the analysis on the petrography, petrology, and chemistry data of tuff samples to the Institute of Meteoritics in May.



1.2.3.2.7.1.2 LABORATORY THERMAL EXPANSION TESTING

Major Accomplishments

Resolutions to the technical comments for SP 8.3.1.15.1.2, R1, "Laboratory Thermal Expansion Testing," have been incorporated into the document. The submittal of this SP to the Project Office on April 1, 1993, completes Level 3 Milestone OS44. Comment resolution is being verified.

Status Report on Ongoing Activities

Thermal expansion testing of 0.25-in.-diameter by 1-in. and 1-in.-diameter by 4-in. samples from USW-G1 (388.8 ft) to establish the maximum heating rate ($\leq 1^\circ\text{C}$) for samples containing tridymite and cristobalite was completed. The results indicate that the α - β transformations of these silica polymorphs, indicated by a significant change in the instantaneous coefficient of thermal expansion (CTE), are detected at approximately the same temperature for a given sample size when heating rates of 0.25°C and 1°C are used. There may be a sample size effect on the temperature ranges over which the inversions are measured. The shifting of the inversion temperatures after the first test run was observed for both sample sizes. The inversions for tridymite and cristobalite were measured as low as 150°C and 175°C , respectively, on subsequent test runs (SCP Activity 8.3.1.15.1.2.1).

A 1-in.-diameter by 4-in. sample from Busted Butte was tested to establish the time required to dehydrate an initially saturated sample before measuring the thermal expansion above 100°C . The results of these test runs are being evaluated.

Eight 1-in.-diameter by 4-in. samples are being vacuum-saturated for the experiments to study sample size effects on thermal-expansion behavior. These experiments are necessary to determine whether the thermal expansion of tuff has a predictable dependence on the sample size and, if so, to describe the nature of the relationship. Data relevant to this topic are necessary to determine the optimal baseline test conditions for thermal expansion characterization.

Thermal expansion measurements will be made using a single push rod dilatometer. The thermocouples, thermocouple board, and A/D board were calibrated. System calibration of the dilatometer is in progress.

Major Activities Upcoming Next Three Months

Experiments to study the effects of sample size on thermal expansion will be initiated after system calibration of the dilatometer is completed. Five samples of each of four different lithologies (welded devitrified, welded vitric, nonwelded vitric, and nonwelded zeolitic) will be tested for each sample size. The samples will be right cylinders of two sizes: 0.25-in.-diameter by 1 in. and 1-in.-diameter by 4 in. nominally. The samples will be fully saturated before experiments are started. The samples will be heated, and the atmosphere surrounding the sample during testing will be controlled (i.e., high humidity) in a saturation test apparatus to minimize sample dehydration at temperatures below the nominal boiling temperature of 100°C . When this temperature is reached, temperature will be held constant and the sample allowed to dehydrate until the length stabilizes, and the heating will then be restarted. Heating will continue until the temperature reaches 300°C , and then the sample will be cooled to ambient temperature (25°C) (SCP Activity 8.3.1.15.1.2.1).

1.2.3.2.7.1.3 LABORATORY DETERMINATION OF MECHANICAL PROPERTIES OF INTACT ROCK

Major Accomplishments

R. Price and two members of New England Research, Inc. (NER) staff were in Las Vegas, Nevada, in April to attend the 1993 International High-Level Radioactive Waste Management Conference (April 26 through 30, 1993). They presented a paper entitled "Characterization of Porosity in Support of Mechanical Property Analysis" (SCP Activities 8.3.1.15.1.3.1 and 8.3.1.15.1.3.2).

Status Report on Ongoing Activities

NER is conducting a study of time-dependent deformation involving high-temperature experiments at creep and low strain rate conditions. The most recent series of experiments consist of at least six samples of TSw2 to be tested at a pore pressure of 4.5 MPa, a confining pressure of 5 MPa, and a maximum constant differential stress of 80 MPa. The experiments are performed initially at room temperature and then at 250°C. The third experiment was initiated in early March. The sample has completed the series of stress steps at room temperature. This sequence was followed by an increase in the test temperature and the beginning of creep loading of the sample under a stepped approach to loading (50, 60, 70, and 80 MPa differential stress). Very little creep (inelastic deformation in response to the constant loading) has been observed as yet.

The test will continue at a differential stress of 80 MPa throughout May (SCP Activity 8.3.1.15.1.3.2).

SAND92-1810, "Unconfined Compression Experiments on Topopah Spring Member Tuff at 22°C and a Strain Rate of 10^{-9} s $^{-1}$: Data Report," is in management review (SCP Activity 8.3.1.15.1.3.2).

Mechanical properties laboratory tests are currently being performed on rock samples from NRG-2 and NRG-6.

Major Activities Upcoming Next Three Months

R. Price will be in White River Junction, Vermont, on May 19 and 20, 1993, to visit with the staff at NER. The discussions will center on results from testing for time-dependent mechanical properties and to examine rock and test results from core recovered from the series of NRG drillholes (SCP Activities 8.3.1.15.1.3.1 and 8.3.1.15.1.3.2).

R. Price and two members of NER staff will be in Madison, Wisconsin, in late June to attend the 34th U.S. Symposium on Rock Mechanics (June 27 through 30, 1993, at the University of Wisconsin-Madison). They will be presenting a paper entitled "The Influence of Strain Rate and Sample Inhomogeneity on the Moduli and Strength of Welded Tuff" (SCP Activity 8.3.1.15.1.3.2).

Staff will continue to perform mechanical properties laboratory tests on samples from NRG holes as samples become available.

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**1.2.3.2.7.1.4 LABORATORY DETERMINATION
OF THE MECHANICAL
PROPERTIES OF FRACTURES**

Major Accomplishments

A revision of SP 8.3.1.15.1.4, "Laboratory Determination of the Mechanical Properties of Fractures," was submitted to the Project Office on April 15, 1993. The revision was a result of comments received from a Project Office review (SCP Activities 8.3.1.15.1.4.1 and 8.3.1.15.1.4.2).

Status Report on Ongoing Activities

Several studies have produced data relating to the time-dependent mechanical properties of fractures and to the effect of roughness on the mechanical properties. The data is being analyzed and future reports are being considered (SCP Activity 8.3.1.15.1.4.2).

SAND92-2333, "The Effect of Sliding Velocity on the Mechanical Response of Artificial Joints in Topopah Spring Member Tuff," (Level 3 Milestone OS49) is being revised in response to the comments generated during technical and editorial review (SCP Activity 8.3.1.15.1.3.2).

Major Activities Upcoming Next Three Months

A journal article entitled "Simple Mathematical Model of a Rough Fracture" (SAND92-2216J) is being drafted and will be submitted for review in the next two months (SCP Activities 8.3.1.15.1.4.1 and 8.3.1.15.1.4.2).

**1.2.3.6.2.1.6 FUTURE REGIONAL CLIMATE AND
ENVIRONMENTS**

Status Report on Ongoing Activities

The transition plan to consolidate the work by Pacific Northwest Laboratory (PNL) into a single SNL effort has been prepared.

A presentation on Regional Climate Modeling was made to the Nuclear Waste Technical Review Board (NWTRB) in Reno, NV, on April 22, 1993.

Major Activities Upcoming Next Three Months

The SP for this activity will be drafted and other actions taken in preparation to resume modeling work.

1.2.4 REPOSITORY

The objective of the Repository element includes work scope related to the repository component of the physical system including the repository operations system, the underground facility component of the engineered barrier system, the access/borehole seals, and the monitoring system component of the performance evaluation system. The Repository element is comprised of nine tasks: Repository Coordination and Planning (1.2.4.1.1), Excavation Investigations (1.2.4.2.1.1.1), In Situ Thermomechanical Properties (1.2.4.2.1.1.2), In Situ Mechanical Properties (1.2.4.2.1.1.3), In Situ Design Verification (1.2.4.2.1.1.4), Rock Mass Analysis (1.2.4.2.1.2), Certification of Design Methods (1.2.4.2.3.1), Design Analysis (1.2.4.2.3.2), and Sealing and Design Requirements (1.2.4.6.1).

1.2.4.1.1 REPOSITORY COORDINATION AND PLANNING

Status Report on Ongoing Activities

Work on the initial drafts of SPs 8.3.1.15.1.6, "In Situ Thermomechanical Properties," and 8.3.1.15.1.7, "In Situ Mechanical Properties," continued.

SNL staff continues to work with the M&O and staff from Lawrence Livermore National Laboratories (LLNL) to develop a plan for resolving numerous issues related to the thermal loading of the potential repository. As part of this work, SNL is participating in an effort to review current thermal goals and to develop a tentative set of revised goals for the Advanced Conceptual Design (ACD). SNL is leading the effort to examine two goals related to thermal/structural interactions. Simplified numerical computations are underway to define some bounds on the near-field temperatures because of large changes in thermal expansion of the host rock at elevated temperatures.

Recommendations for revised thermal goals will be transmitted to the DOE in May for incorporation in their study.

SNL staff continued work on a series of analyses in support of the design of the ESF north ramp. Three-dimensional thermal/structural analyses of the repository to assess the impact of the potential repository thermal loading on the ESF drifts has been completed. These results will support two-dimensional analyses of several cross sections of the ESF north ramp to evaluate long-term stability. A meeting was held on April 28, 1993, to review progress on analyses and to better define the scope. Geotechnical data from the NRG holes will be incorporated into the analyses. The analyses are expected to provide input for the 90% design review in August 1993.

Major Activities Upcoming Next Three Months

Significant effort will be required to implement the geotechnical monitoring effort in the starter tunnel (SP 8.3.1.15.1.8).

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1.2.4.2.1.1.1 EXCAVATION INVESTIGATIONS

Major Activities Upcoming Next Three Months

Staff will work with Project Office reviewers to finalize SP 8.3.1.15.1.5, "Excavation Investigations."

1.2.4.2.1.1.2 IN SITU THERMOMECHANICAL PROPERTIES

Status Report on Ongoing Activities

Staff continued work on the rough draft of SP 8.3.1.15.1.6, "In Situ Thermomechanical Properties."

Technical comments from internal SNL technical review were written and are being addressed for the SAND report entitled "Test Instrumentation for the ESF In Situ Thermomechanical Experiments."

Staff presented a paper on "Test Instrumentation for the ESF In Situ Thermomechanical Experiments" at the 4th Annual International High-Level Radioactive Waste Management Conference.

Major Activities Upcoming Next Three Months

Staff will continue drafting SP 8.3.1.15.1.6.

Staff will produce a final draft of "Test Instrumentation for the ESF In Situ Thermomechanical Experiments" that incorporates comments from reviewers.

Under Los Alamos National Laboratory (LANL) coordination, SNL and LLNL staff will work to consolidate SNL's ESF thermomechanical testing with LLNL's hydrothermal testing, if possible.



1.2.4.2.1.1.3 IN SITU MECHANICAL PROPERTIES

Status Report on Ongoing Activities

Staff continued work on the rough draft of SP 8.3.1.15.1.7, "In Situ Mechanical Properties."

Major Activities Upcoming Next Three Months

Staff will continue drafting SP 8.3.1.15.1.7.

1.2.4.2.1.1.4 IN SITU DESIGN VERIFICATION

Status Report on Ongoing Activities

The extended abstract, "Construction Monitoring Activities in the Yucca Mountain ESF Starter Tunnel," to be presented at the 34th U.S. Rock Mechanics Symposium, was finalized in response to reviewers.

Staff commenced construction monitoring of the ESF north ramp starter tunnel. The monitoring plans include seismic monitoring for blasting, rock quality determination, ground support system performance evaluations, and excavation closure monitoring for stability assessments. In this reporting period, seismic blast monitoring and rock quality determination were conducted.

Major Activities Upcoming Next Three Months

Staff will continue to field construction monitoring activities and to procure and design instrumentation and a data acquisition system needed for future monitoring activities.

A paper on construction monitoring activities will be presented at the 34th U.S. Rock Mechanics Symposium (June 27-30).

As an activity separate from construction monitoring, staff will field additional excavation convergence monitoring activities in the north ramp starter tunnel to address safety concerns.



1.2.4.2.1.2 ROCK MASS ANALYSES

Significant Meetings Attended

R. Price and S. Brown (SNL) visited staff at the University of Colorado (CU) at Boulder on April 10 and 20, 1993. The progress on the data and analysis reports and the results from the ongoing study were discussed.

J. Jung, L. S. Costin, and E. E. Ryder briefed the M&O on the north ramp design support activities on April 28, 1993.

Status Report on Ongoing Activities

Laboratory work continued on the experiments testing small polycarbonate models constructed in layers. These tests allow staff to study in detail the sliding behavior of highly jointed structures. In April, a new pair of loading platens were built to allow loading of the sample in a direction inclined at 10 degrees to the plates. An experiment using this inclined loading was performed in April and will be analyzed in May.

A report entitled "Geometrical Moiré Method of Strain Analysis with Displacement Discontinuities" is in preparation, and a draft will be available by May 1. This report describes the methods used and software developed to acquire and analyze the data for this application.

A study of the surface characteristics of natural fractures and how to relate these to the frictional data gathered on replicas on the surface is continuing. This study will place special emphasis on determining whether the fitting parameters in the Barton Model for frictional behavior have physical significance by investigating the effect on fracture shear strength and dilation with variation in three parameters: normal stress, roughness, and the strength of the rock material. The majority of the experimental work is being carried out by a CU graduate student in the Geomechanics Department laboratory at SNL.

The series of eleven rotary shear experiments was completed in March. The results are being organized, and analysis will continue for the next several weeks, leading to the data being presented in a SAND report.

A series of experiments designed to study the effects of a nonstandard loading condition on frictional properties was conducted at CU in 1992. SAND92-1853, "Effect of Boundary Conditions on the Strength and Deformability of Replicas of Natural Fractures in Welded Tuff: Data Report," detailing the experiment techniques and the resulting data, has completed management review and is being revised. The first of two analysis SAND reports, SAND92-2247, "Effect of Boundary Conditions on the Strength and Deformability of Replicas of Natural Fractures in Welded Tuff: Comparison Between Predicted and Observed Behavior," has completed technical review and is in management review. The second analysis report is being drafted and should begin SNL review soon.

SNL's support to the M&O's design efforts for the north ramp began in earnest in April. J.F.T. Agapito and Associates staff worked with SNL staff to calculate the temperatures, thermal loads, and seismic loads that the north ramp is expected to experience. Linear and nonlinear static analyses will be conducted at approximately five locations along the ramp. In April, the first linear analyses were conducted. It is clear that the dominant load on the north ramp is due to a seismic event (0.4g). The majority of the remaining static analyses will be completed in May. J.F.T. Agapito and Associates will be conducting a series of dynamic analyses in May, also.

Major Activities Upcoming Next Three Months

Testing, data reduction, and analysis will begin for a set of layered plate experiments.

Static and dynamic analyses will be conducted to support the design of the north ramp.

1.2.4.2.3.1 CERTIFICATION OF DESIGN METHODS

Status Report on Ongoing Activities

The analysis codes JAC3D and UDEC received quality assurance (QA) certification in April. Also, several auxiliary codes, FASTQ, BLOT, and ALGERBA (mesh generators, results visualization, and data manipulator), were entered into the QA system. Many of these codes will be used in the north ramp analysis being performed in WBS elements 1.2.4.2.1.2 and 1.2.4.2.3.2.

Work at CU in developing joint constitutive models is continuing. This work began by CU conducting a literature search to identify the best available joint constitutive model in the literature. This month, experimental data developed in WBS element 1.2.4.2.1.2 has been fitted to Plesha's joint constitutive model. By driving this model through prescribed joint strain histories, CU researchers have found it can represent the prepeak joint behavior quite well. The model, though, has problems representing postpeak behavior. Earlier work had identified an apparent error in the model. CU students have contacted the model developers at the University of Wisconsin to track down the discrepancies, but UW has not replied.

In other work, J. Jung (SNL) wrote a small two-dimensional research block code to test a new block formulation. In particular, the concept of breaking rock blocks into sub-blocks to obtain higher accuracy is being explored. At SNL, the basic equations for the blocks have been reformulated to facilitate the sub-block concept, and general penalty and augmented Lagrangian

formulations have been derived for the sub-block constraints.

This theory was implemented in a research code in April. Initial tests indicate that the sub-blocking concept works quite well. More testing will be needed to identify any pathologies or limitations. In other work at CU, modifications to the discrete-element code DDA are being performed to implement the sub-block concept.

In a separate activity, the coupled finite-element/boundary-element research is continuing. J. R. Koterak (SNL) has begun work to solve some nonlinear problems. Unfortunately, the work has not progressed enough to have any definitive results to report.

B. J. Thorne (SNL) has been working to improve SNL's continuum joint model. This month has been spent reviewing other models to assess whether there are features that should be included. It does appear that there are a number of features that could be added to improve the physics and numerical stability of the continuum joint model.

Major Activities Upcoming Next Three Months

Testing of a discrete-element code sub-blocking concept will continue as will implementation of the sub-blocking concept into the DDA code.

Development of a coupled finite-element/boundary-element technology will continue to assess coupling nonlinear finite elements to linear boundary elements.

Recommendations will be issued on improving the continuum joint model.

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1.2.4.2.3.2 DESIGN ANALYSIS

Status Report on Ongoing Activities

The development of near-field thermal/structural/seismic models for use in supporting the design of the ESF's north ramp continued. Thermal, in situ, and seismic loads are being defined.

Work to investigate the importance on structural predictions of an observed increase in measured thermal expansion due to polymorph silica phase transformations has begun. The results of the analyses are intended for incorporation into the ongoing reevaluation of Site Characterization Plan (SCP) thermal goals.

1.2.4.6.1 SEALING AND DESIGN REQUIREMENTS

Status Report on Ongoing Activities

Staff continued to finalize SAND92-0960, "Initial Seal Test Definition of Subsurface Sealing and Backfilling Tests in Unsaturated Tuff." An extended abstract was also prepared for the upcoming rock mechanics symposium. The abstract is entitled "An Overview of the Yucca Mountain Site Characterization Project, Field-Test Program for Evaluating Seal Performance."



1.2.5 REGULATORY

The objective of the Regulatory element is to assure site-related compliance with Nuclear Regulatory Commission agreements, requirements, and policies, evaluate the performance of the natural barriers, engineered barriers, and total systems for meeting regulatory standards; and manage, maintain, and accumulate technical data and information produced by site characterization, design development, and performance assessment activities for the project. The Regulatory element is composed of 11 tasks: Regulatory Coordination and Planning (1.2.5.1), Site Characterization Program (1.2.5.2.2), Technical Database Input (1.2.5.3.5), Total System Performance Assessment (1.2.5.4.1), Repository Performance Assessment (1.2.5.4.3), Site Performance Assessment (1.2.5.4.4), Interactive Graphics Information System (1.2.5.4.5), Development and Validation of Flow and Transport Models (1.2.5.4.6), Support Calculations for Postclosure Performance Analyses (1.2.5.4.7), Development and Verification of Flow and Transport Codes (1.2.5.4.9), and Special Projects (1.2.5.5).

1.2.5.1 REGULATORY COORDINATION AND PLANNING

Status Report on Ongoing Activities

Routine coordination activities continued during this month, although no special meetings took place.

Major Activities Upcoming Next Three Months

The FY94 budget process will require significant effort from the SNL managers and task leaders for regulatory activities.

1.2.5.2.2 SITE CHARACTERIZATION PROGRAM

Significant Meetings Attended

Staff attended several dry runs for the NWTRB presentation on DOE's approach to resolving difficult issues, using the effect of future climate on net infiltration as an example. The NWTRB meeting was held in Reno, Nevada, on April 21 and 22, 1993.



1.2.5.3.5 TECHNICAL DATABASE INPUT

Significant Meetings Attended

Staff attended the YMP technical integration workshop on April 8 and 9, 1993, at which technical database issues were raised.

Major Activities Upcoming Next Three Months

Staff will meet with Geographic Nodal Information Study and Evaluation System (GENISES) personnel to discuss database information exchanges.

Staff will meet to discuss FY94 budget needs for Technical Database Input.

Issues/Potential Problems Needing Resolution and Potential Impacts

Modification of Technical Data Information Forms (TDIFs) is required to facilitate usage by technical personnel.

1.2.5.4.1 TOTAL SYSTEM PERFORMANCE ASSESSMENT

Major Accomplishments

The following papers were presented at the 4th Annual International High-Level Radioactive Waste Management Conference in Las Vegas, Nevada, on April 26 through 30, 1993:

- "Scenario Development for Performance Assessment - Questions for the Near Field Modelers," by R.W. Barnard and G. E. Barr;
- "A Working Definition of Scenario and Method of Scenario Construction," by G. E. Barr and E. Dunn;
- "Sensitivity Analyses for Total-System Performance Assessment," by M. L. Wilson;
- "Implications of Stability Analysis for Heat Transfer at Yucca Mountain," by B. Ross, Y. Zhang, and N. Lu; and
- "The Most Likely Groundwater Flux Through the Tuff Matrix at USW H-1," by J. H. Gauthier.

One of the plenary sessions at the conference, "Effects of the '92 Nevada Earthquake," was moderated by H. Dockery, who also served as lead organizer for the natural systems section of the conference.

SAND92-2431, "Review of Radionuclide Source Terms Used for Performance Assessment Analyses," has completed management review and was transmitted to the Project Office on April 22, 1993.

Significant Meetings Attended

An SNL staff member attended a meeting in Richland, WA, on the development of the AREST source-term code. The plans and capabilities for the code (written by PNL) were discussed. Currently, it is anticipated that AREST will have both low-level (process) model capability and higher-level (performance-assessment) features. Because of these ambitious plans, the code will not be available for a while. The waste-package and near-field portions of the SNL features, events, and processes (FEPs) diagrams were also discussed. A member of PNL has characterized near-field environments in terms of amount and rate of moisture, oxygen, and heat around the waste

package. This information is necessary to complete the FEP diagrams.

SNL hosted a meeting on April 13, 1993, to elicit from LANL personnel distributions for solubility to be used for the current cycle of the Total System Performance Assessment (TSPA). Probability density models of the distribution of solubility were generated for 15 radionuclides through elicitation of a panel of experts from LANL. However, there was insufficient time during the day to complete the sorption-coefficient distributions as well. A follow-up meeting to elicit sorption coefficients will be held in mid-May. The models will be used as input to the current TSPA. A memo documenting the elicitation and the results will be prepared during the next month. As a result of this interaction, changes to the software used to generate the distributions will be made to facilitate the elicitation process.

SNL personnel met in Albuquerque, New Mexico, with LLNL personnel to determine container and emplacement assumptions to use for the upcoming TSPA calculations.

Status Report on Ongoing Activities

Drafting of drawings for the nominal-flow scenarios report is approximately 55% complete. The Principal Investigator is approximately three-quarters finished checking the text against all drawings for consistency. Drafting is proceeding rapidly, and the text is essentially complete.

Work was completed on the colloid sensitivity analysis to be presented at the YMP Colloid Workshop in May. The purpose of the analysis is to examine the question of whether transport of radionuclides by colloids will be significant for repository performance at Yucca Mountain. There is no definitive conclusion, but results will help to put the issue in perspective for the Colloid Workshop attendees.

A short graphic about the total system performance assessment computer code (TOSPAC) was written for inclusion in the Sandia Software Catalog. Also, a new automatic mesh generator for TOSPAC was

completed. The mesh generator will allow TSPA-2 to efficiently calculate flow and transport for problems with different water-table heights and a wide range of percolation rates.

SAND93-0852, "The Appropriateness of One-Dimensional Yucca Mountain Hydrologic Calculations," has been written to help define the calculational regimes in which one-dimensional calculations are appropriate for approximating the flow of water through Yucca Mountain for TSPA calculations. The report is in technical review. A summary is being written for the 1993 TSPA report.

A study is being initiated to investigate the effect of multiphase transport of water at Yucca Mountain. This study will attempt to answer questions regarding the possible significance of including multiphase transport in the TSPA. An input data deck for the multiphase code VTOUGH has been obtained. This two-dimensional, 14,000-line-plus input file has been reduced to a one-dimensional geometry and run with the SNL version of the TOUGH2 code. Computational results for long times have been extremely difficult to obtain thus far because of time-step size limitations.

Work on the development of a model for barometric pumping has consisted mainly of reviewing past research and data in this area and formulating a model capable of treating fractures and matrix explicitly. The objective is to develop a model for moisture (liquid and vapor) movement in fractured media driven by fluctuations in barometric pressure. The movement of contaminants in the gas phase is also being considered. A simplified analytical model for the latter problem, assuming a periodic temporal variation, has been developed. The solution illustrates the relation between the net amount of contaminant expelled and fracture-to-matrix capacitance ratios as a time lag between fracture transport and matrix diffusion.

Two-dimensional stratigraphies were generated for the gas-flow calculations and given to Disposal Safety Inc. Small modifications were made to the column stratigraphies. Much of the stratigraphy documentation has been written.

1.2.5.4.3 REPOSITORY PERFORMANCE ASSESSMENT

Significant Meetings Attended

SNL and M&O staff met to determine the status of the ESF north ramp calculations. Discussions focused on the importance of seismic loads on the definitions of ground support requirements.

SNL and M&O personnel also met to discuss analyses needed to support the M&O's thermal loading systems study. Waste stream information needed to assist in the development of specific analyses was discussed and should be available within two weeks.

Status Report on Ongoing Activities

Progress continued on an evaluation of the LLNL extended dry concept. Calculations completed during this reporting period address issues regarding the importance of multiple material property designations (layering) in thermal models. The results should be available for transmittal to the M&O within the next month.

Progress continued on the setup of thermal analyses defined to support the 90% design review of the ESF north ramp. Thermal loads along the proposed north ramp have been established and are now being incorporated into structural evaluations of ramp cross sections.

1.2.5.4.4 SITE PERFORMANCE ASSESSMENT

Major Accomplishments

The following paper was presented at the 4th Annual International High-Level Radioactive Waste Management Conference in Las Vegas, NV, on April 26 through 30, 1993:

- "Numerical Methods for Fluid Flow in Unsaturated Heterogeneous Tuff," by T. Robey.

SNL staff attended the SIAM Geoscience conference. "Geostatistics and Upscaling of Hydrologic Properties for an Adaptive Mixed Finite Element Method Applied to Unsaturated Porous Media Flow" was presented by T. Robey.

Status Report on Ongoing Activities

A report entitled "Progress Report On Stochastic Modeling: Generation of Correlated Random Vectors With Multivariate Normal and Beta Distributions," by J. Sun and M. Harr, was received at SNL and is being entered into technical review. The report describes work that has been supported under a research grant to Purdue Research Foundation.

SNL staff performing modeling and analysis for the TSPA have requested probability distributions for both bulk and matrix hydrologic data. There is a growing concern that the relatively abundant matrix hydrologic values do not provide the true characterization of Yucca Mountain because it does not include information on fractures. The existing data in the Performance Assessment Data Base have been reviewed. Data required for TSPA analyses have been extracted for statistical reduction and depicted as probability distributions. This year's review of hydrologic data availability highlights a critical need for bulk hydrologic conductivity data from the units above the Calico Hills horizon. The available bulk data for the Topopah Springs units are minimal to nonexistent. Even where bulk data are available, particularly in the lower units, informal sources at the USGS have indicated that the values obtained from older pump and injection tests may be questionable.

During the month of April, basic data reduction and analysis has continued to provide probability distributions to TSPA analysts. The data reduction and preparation were concentrated in two primary areas, matrix hydrologic properties and bulk



hydrologic properties. For the matrix properties, porosity and hydraulic conductivities have been reduced. The data sets have been grouped according to one of nine units that are in the stratigraphic model. The data were statistically reduced to provide the input parameters to run probability distributions using BETA entropy and exponential fits. The same approach has been used for porosity, conductivity, and bulk density. For the desaturation parameters, Van Genuchten fits have been generated for desaturation tests published by Peters et al. (SAND84-1471), Rutherford et al. (SAND87-2380), and the data generated by Flint and Flint (USGS-OFR-90569) currently being used for the INTRAVAL exercise.

The bulk hydrologic data have been reviewed and a very limited reduction of the data accomplished due to the lack of extensive data availability. Statistical reduction and subsequent generation of probability distributions have been accomplished. Additionally, correlations have been started between the different hydrologic parameters to determine whether there is correlation between the variance of the log values of these parameters. If the correlation is determined to exist, it may be possible to derive or infer values for apertures based on bulk properties, as suggested by Wang (1992).

Development has continued on the east-west INTRAVAL cross section. Most of the indicator simulations have been converted to porosities. The north-south cross section was rerun with the third INTRAVAL data set and other corrections incorporated. Graphics were produced for the north-south cross section.

Configuration of the INGRES system continues to facilitate ease of data retrieval and presentation of the data in the format required by the analysis for the Performance Assessment Data Base. Assistance has been provided to the analysts for the retrieval and reconfiguration of data. Work is continuing on the configuration of information in ARC/INFO to make coverages available from the Yucca Mountain data.

1.2.5.4.5 INTERACTIVE GRAPHICS INFORMATION SYSTEM

Major Accomplishments

The initial draft of the data dictionary has been completed and development of the user interface has begun.

Status Report on Ongoing Activities

Work continues on the development of the data dictionary for existing Graphics Information System (GIS) coverages. Information about the coverages have been added where possible. Other information will be obtained from GENISES when needed.

The development is continuing on a series of coverages showing the starter tunnel, alcoves, and instrument locations.

The VAX 3600 contains Calma models of Yucca Mountain. SNL has initiated an effort to identify users of the VAX 3600 to help plan the retirement of that computer. The Calma/DDM thermal/mechanical model is not scheduled to be made available beyond FY93. SNL is migrating the Calma models to alternate platforms.

Major Activities Upcoming Next Three Months

Staff will find alternate platforms for users of the VAX 3600 and migrate to the other platform. Staff will store the Calma models on tape and eliminate the Calma software.

The implementation of a user environment that provides access to data obtained from instruments placed in the tunnels at Yucca Mountain will be planned and initiated. This will enable users to use several tools to manipulate, visualize, and output the data as needed.

The following jobs are in progress:

- Job 397 for D. L. Eley - Convert GTMs to ARC/INFO
- Job 398 for D. Guerin - Hydrogeologic drill holes
- Job 401 for L. H. Skinner - Contours of Yucca Mountain
- Job 404 for D. L. Eley - Create ESF starter tunnel plan
- Job 405 for C. A. Rautman - Rebuild TSw1 model per new input

1.2.5.4.6 DEVELOPMENT AND VALIDATION OF FLOW AND TRANSPORT MODELS

Significant Meetings Attended

R. J. Glass, M. D. Siegel, and V. C. Tidwell attended and made presentations at the 1993 International High-Level Radioactive Waste Management Conference held in Las Vegas, Nevada, during the week of April 26 through 30, 1993.

Status Report on Ongoing Activities

Flow and transport through single fractures:

The following papers were presented at the International High Level Radioactive Waste Management Conference, April 26 through 30, 1993, at the Mirage Hotel in Las Vegas, Nevada:

- "Wetting Front Instability in an Initially Wet Unsaturated Fracture," by M. J. Nicholl, R. J. Glass, and H. A. Nguyen.
- "Small-Scale Behavior of Single Gravity-Driven Fingers in an Initially Dry Fracture," by M. J. Nicholl, R. J. Glass, and H. A. Nguyen.
- "Modeling Gravity-Driven Fingering Using Modified Percolation Theory," by R. J. Glass.

Development of a methodology to produce epoxy casts of natural fractures continued. Tests to assure the wetting properties of various epoxy formulations and preparation techniques were evaluated. The necessary materials were ordered and testing should begin in May. Development of techniques to control boundary conditions along the edges of the epoxy replicas continued; a previously cast replica of a natural tuff fracture was used as a test bed. No-flow boundaries were implemented along the fracture sides through the use of external seals. External manifolds were used to control inflow and outflow boundary conditions. Refinement of manifold design is proceeding and will continue in May.

Development of experimental techniques to explore the effects of air entrapment on fracture permeability and tracer migration continued. Software controlling introduction of tracer pulses to the test fracture was refined. Work was begun on hardware and software to allow acquisition of both

high- and low-resolution images of the test fracture at controlled intervals during the experiment. The low-resolution system will be able to acquire images rapidly, yielding information on system dynamics, while the slower high-resolution system will be used to explore structural details. Work on the hardware and software modifications necessary to control both cameras will continue in May.

Fracture/matrix interaction:

V. C. Tidwell presented "Investigation of Fracture-Matrix Interaction: Preliminary Experiments in a Simple Systems" at the 1993 International High-Level Radioactive Waste Management Conference held in Las Vegas, Nevada.

A suite of studies were performed using LUVIA II to investigate the sensitivity of modeling results to various system parameters (saturated conductivity, relative permeability, porosity, and others) and mesh configurations. These investigations were conducted for the simple one-dimensional imbibition of water from a fracture into oven-dry matrix (analogous to the experiment performed earlier in the year).

Construction continued on an enlarged test chamber to facilitate larger scale investigations of fracture-matrix interaction. The new test chamber will be capable of securing multiply fractured rock slabs measuring 2 ft by 2 ft with thicknesses ~1 in.

Efforts have also continued on the development of real-time x-ray analysis capabilities.

Field, lab, and numerical experimentation to determine scaling laws for effective-media properties in heterogeneous media:

V. C. Tidwell presented "Scale Dependence of Effective Media Properties" at the 1993 International High-Level Radioactive Waste Management Conference held in Las Vegas, Nevada.

Efforts are continuing on the development of software to drive the automated gas permeameter test system as well as the development of a test procedure that addresses such issues as sampling strategy, calculation of gas permeability from permeameter data, and data reduction protocols.

Caisson test:

Studies aimed at refining the sorption curve for nickel (Ni) by Wedron 510 sand under nominally carbon dioxide (CO₂)-free conditions have yielded two independent and consistent data sets. These define a smooth curve over the pH range 4.5-10 with a sorption edge between pH 6 and 7. Studies of Ni and lithium (Li) sorption under ambient CO₂ conditions gave poor results for Li. These results were not consistent with previous work, but do suggest that Li at high concentration can compete effectively with Ni for sorption sites, shifting the significant leachable Ni, accounting for as much as 24% of the total Ni in solution at low pH but probably falling to 15% at high pH. Further studies to more precisely quantify analytical blanks are in progress. The atomic absorption results for Ni and Li analyses were independently checked on a number of samples by inductively-coupled plasma mass spectrometry, with good agreement between the two methods.

Reactive transport experimentation:

A measurement protocol has been developed for making reproducible pH measurements in batch-sorption systems. For Orion ROSS 8102 electrodes, an equilibration period of 90 s achieves a reasonable compromise between competing affects of electrode equilibration and pH drift caused by loss or gain of CO₂.

Additional modifications to the argon (Ar) scrubber for the autotitration system have improved overall system stability by an order of magnitude, with typical drift rates of better than ± 0.0001 pH units/min at a pH 7.

Satisfactory solubility data for Ni has been obtained over the pH range 7-10. The measured solubility exceeds that for crystalline Ni(OH)₂ by an order of magnitude or more, and suggests that there is no danger of precipitation occurring in the batch sorption studies using 100 ng/m initial Ni for pH < 8.5.

"Preliminary Characterization of Materials for a Reactive Transport Model Validation Experiment" was presented at the International High-Level Radioactive Waste Management Conference in Las Vegas, Nevada, on April 26 through 29, 1993.

1.2.5.4.7 SUPPORTING CALCULATIONS FOR POSTCLOSURE PERFORMANCE ANALYSES

Major Accomplishments

SAND92-2248, "Estimations of the Extent of Migration of Surficially Applied Water for Various Surface Conditions Near the Potential Repository Perimeter" (ESF analysis 12), has completed management review and has been sent to the Project Office for programmatic review (Level 3 Milestone 0S13).

ESF performance assessment (PA) analysis 13 has been submitted for technical review. This analysis addresses concerns regarding underground water usage for dust control during excavation and fire fighting in the north ramp tunnels and future ESF tunnels (Level 3 Milestone 0S14).

Significant Meetings Attended

Staff attended the 1993 International High-Level Radioactive Waste Management Conference in Las Vegas, Nevada, on April 28 and 29, 1993.

Status Report on Ongoing Activities

Preliminary efforts for model validation exercises in isothermal flow in collaboration with WBS element 1.2.5.4.6 are continuing. One-dimensional calculations using the code LLUVIA-II investigating the sensitivity to numerical grid design and material properties are being performed in conjunction with a series of experiments investigating matrix/fracture interaction by modeling flow through a discrete fracture.

Some preliminary results were presented by V. Tidwell at the conference. The experiments are being performed by Department 6115.

Preliminary efforts have begun for model validation exercises in nonisothermal flow in collaboration with WBS element 1.2.5.4.3 and with the Department 6115 Flow Laboratory. A series of experiments using two different constant temperature boundaries have begun. The code TOUGH2 will be used for these early efforts.

ESF analysis 15 has been initiated. The analysis, "Far-Field Thermal/Structural Evaluations of North Ramp in Support of the M&O's Design of the ESF," is being performed under WBS element



1.2.4.2.3.2, and the results will be integrated into Appendix I of the ESF Design Requirements (ESFDR) document.

ESF PA analysis 14, which will investigate the sensitivity of previous analyses to uncertainty in the hydrologic properties of the nonwelded Paintbrush Tuff, has been postponed to May or June.

Major Activities Upcoming Next Three Months

ESF analysis 13 will be continuing, with recommendations for Appendix I of the ESFDR to be written and reviewed in May and a SAND report to complete technical and management review by the end of FY93.

SAND92-2248, "Estimations of the Extent of Migration of Surficially Applied Water for Various Surface Conditions Near the Potential Repository Perimeter," will be published.

Testing and numerical simulations for the nonisothermal experiments planned with WBS element 1.2.5.4.3 will begin.

1.2.5.4.9 DEVELOPMENT AND VERIFICATION OF FLOW AND TRANSPORT CODES

Major Accomplishments

Five codes have been qualified this month.

- Name: JACD3D
Version: 61-04
Type: SES
- Name: UDEC
Version: 1.82
Type: SES
- Name: FASTQ
Version: 2.0x
Type: Non-SES Computational
- Name: BLOT
Version: 1.13s
Type: Non-SES Computational
- Name: Algebra
Version: 2.01
Type: Auxiliary

Software QA (No SCP activity):

A new draft of the SNL YMP Quality Assurance Implementing Procedure for Software (QAIP 3-2) has been written in accordance with the new Supplement I of the Office of Civilian Radioactive Waste Management (OCRWM) Quality Assurance Requirements and Description (QARD). The main contribution of Department 6312 staff has been to push for a flexible "prototyping" software life cycle.

QA documentation is being written to qualify JAC3D. Also, processing of software QA records is continuing.



1.2.5.5 SPECIAL PROJECTS

Major Accomplishments

No significant activity this reporting period.



1.2.6 EXPLORATORY STUDIES FACILITY

The objective of the Exploratory Studies Facility element includes work scope related to the design, construction, and operation of the Exploratory Studies Facility. The Exploratory Studies Facility element includes the Exploratory Studies Facility Coordination, Planning, and Technical Assessment (1.2.6.1.1) task.

1.2.6.1.1 ESF COORDINATION, PLANNING, AND TECHNICAL ASSESSMENT

Major Accomplishments

Funds to support construction monitoring plans for the ESF north ramp starter tunnel, reported under WBS 1.2.4.2.1.1.4, were received late this month.

Major Activities Upcoming Next Three Months

Under LANL coordination, SNL and LLNL staff will work to consolidate SNL's ESF thermomechanical testing with LLNL's hydrothermal testing, if possible.



1.2.9 PROJECT MANAGEMENT

The objective of the Project Management element includes work scope related to project-level planning and control, and management of contract activities. The Project Management element includes two tasks: Technical Project Office Management (1.2.9.1.2) and Project Control (1.2.9.2.2).

1.2.9.1.2 TECHNICAL PROJECT OFFICE MANAGEMENT

Significant Meetings Attended

Staff participated in a number of ad hoc and regularly scheduled meetings, including the Quality Integration Group, the Assessment Team, the ESF Weekly Status, the ALARA Committee, and Records Management meetings. Staff also participated in the April 21 and 22, 1993, NWTRB meeting in Reno, Nevada, and on the American Society of Mechanical Engineers/Nuclear Quality Assurance (ASME/NQA) Working Group on High-Level Waste, which met in San Francisco, California, on April 19 through 22, 1993.

At DOE request, a review of the status of 1.2.9 and 1.2.15 activities was presented on April 14, 1993, in Las Vegas, Nevada.

Status Report on Ongoing Activities

SNL staff are working with the Operations and Safety Group of the SCP Thermal Goals Reassessment, which expects to complete work by the end of May.

1.2.9.2.2 PROJECT CONTROL

Major Accomplishments

Members of the SNL/YMP Project Control Staff attended the Humphrey's three-day Project Management Class covering the DOE requirements for project management reporting.

A database of level 2 and level 3 milestones was developed for use by the task leaders (TLs) and department managers. This concise list not only tracks closure of level 3 commitments, but also provides an at-a-glance reference for TLs in prioritizing their work.

To date, 17 of 52 milestones have been completed.

Significant Meetings Attended

SNL staff gave a mid-year review presentation to YMP Project Control staff on April 14, 1993. The review covered year-to-date costs in the 1.2.9 and 1.2.15 WBS elements, as well as projected budget requirements for FY94. Action items assigned to SNL were completed and transmitted on April 27, 1993.

SNL staff attended a two-day TL integration workshop hosted by the Technical Project Officer (TPO), L. Shephard, on April 8 and 9, 1993.

Status Report on Ongoing Activities

Work continues on the planning and preparation of data for the upcoming budget planning exercise. Out-year data from the 2001 planning exercise is being converted to the new WBS structure and prepared for use by SNL managers to support future planning activities. Work is progressing on developing the capability to produce graphic plots of project status from the Planning and Control System (PACS) workstation data files. When programming is complete, plots will be generated from the project level down to the summary account level.

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Major Activities Upcoming Next Three Months

The FY94 budget exercise, originally expected to begin in April, is now expected to begin in late May.

Work will begin on the first draft of the SNL Configuration Management Plan.

1.2.11 QUALITY ASSURANCE

The objective of the Quality Assurance element includes work scope related to the development and maintenance of project participants' assurance programs consisting of all those planned and systematic actions necessary to provide adequate confidence that the information to obtain a license for siting, constructing, and operating a geologic repository and monitored retrievable storage facility will be met and complies with Federal regulations.

1.2.11 QUALITY ASSURANCE

Major Accomplishments

QA staff revised the QA section of the Employee Orientation Manual and revised and updated procedure training abstracts to reflect current procedures.

Significant Meetings Attended

All SNL Nuclear Waste Management Program QA Department personnel participated in a facilitated Organization Development meeting to help focus activities and establish new goals.

Status Report on Ongoing Activities

QA staff are currently writing QAIP 20-3, "Sample Control," to replace QAIP 8-1 and QAIP 3-5 "Design Verification/Analysis," to replace DOP 3-5. They are also working with the training manager to revise QAIP 2-5, "Training," and they have revised QAIP 2-2, "Study Plan Requirements," to meet the new AP-1.10Q.

Major Activities Upcoming Next Three Months

QAIP 20-4, "Sample Library Operation," will be written to replace DOP 8-2. Other procedure revisions necessary to complete the QARD Transition Plan will be finished, and QARD matrix

data will be input into the YMP Quality Assurance Division (QAD) database.

A new policy statement and QARD exceptions will be issued in some form to replace the Quality Assurance Program Description (QAPD).

The annual SNL YMP internal QA audit will be conducted, and staff will maintain and improve readiness for the next QAD audit of SNL.

A supplier-qualification evaluation will be conducted of the SNL Secondary Standards Laboratory organizations that would support the SNL YMP.

Issues/Potential Problems Needing Resolution and Potential Impacts

The Massachusetts Institute of Technology (MIT) Audit Report (MIT-A93-1) was issued on April 29, 1993, and resulted in the issuance of four Corrective Action Reports (CARs) (three Deviations, one of which was a "Significant Condition Adverse to Quality," and one Observation) that require corrective action, to be coordinated by the SNL Principal Investigator.

The audit of Caley and Whitmore, an NER subtier supplier for calibration services, resulted in CAR 93-15 being issued to NER for response.



1.2.12 INFORMATION MANAGEMENT

The objective of the Information Management element includes work scope related to the project-level establishment of systems to facilitate organization, storage, and retrieval of information/documents. The Information Management element is comprised of four tasks: Information Management coordination and Planning (1.2.12.1), Local Records Center Operation (1.2.12.2.2), Participant Records Management (1.2.12.2.3), and Document Control (1.2.12.2.5).

1.2.12.1 INFORMATION MANAGEMENT COORDINATION AND PLANNING

Major Accomplishments

Input to the Information Resources Management (IRM) Strategic Plan was compiled and provided to the YMP.

Significant Meetings Attended

Staff attended and presented a paper at the IRM Council meeting in Las Vegas, Nevada, on April 27 and 28, 1993.

Status Report on Ongoing Activities

Routine oversight of information management coordination and planning was conducted.

1.2.12.2 LOCAL RECORDS CENTER OPERATION

Significant Meetings Attended

Staff met with Project Control staff to discuss the in-process management of procurement records.

Staff attended a meeting to discuss and determine solutions for the problems related to the required records processing for closed Design Investigation Memo (DIM) files.

All staff attended the Department 6352 meeting.

Status Report on Ongoing Activities

Twenty-seven cited references for 5,661 pages of publications were copied and submitted to the Central Records Facility (CRF).

Forty-seven record packages were quality-checked and 17 record packages were prepared and submitted to the CRF.

In-process documents (those not yet completed as record packages) are being placed into dual storage, and the Local Records Center (LRC) staff members are more involved with the record sources at generation of documents. This new process was initiated last month for the areas of Training and Qualification and Document Control. This month Procurement has been included. Processes and QAIPs were reviewed and discussed and flow charts created to ensure that responsibilities and records were properly identified.

Five Technical Data Information Forms (TDIFs) were prepared and submitted to the records management system (RMS), and 14 TDIFs were entered into the YMP Automated Technical Data Tracking System (ATDT).

Three submittals were prepared for GENISES.



Staff verified 4,053 pages of materials against the Project and SNL microfilm, and those pages were boxed for storage awaiting approval to destroy.

Training for an assistant in the Participant Data Archives (PDA) was initiated to assist in the review and associated processing of 897 reports to identify "developed data" and prepare TDIFs.

Major Activities Upcoming Next Three Months

All Desk Guidances will be completed.

All microfilm will be verified against records from 1989 to the beginning of the Project. Verified hardcopy will be destroyed, if approvals are issued, or boxed and sent to the SNL Archives.

Verification of 1987 SAND report publications will be initiated against microfilm.

Staff will research and propose a phased approach to development of a Disaster Preparedness and Recovery Plan for the YMP Records Management Program.

SNL has published 897 SAND reports in the YMP Program. Seven of these reports have had TDIFs prepared and submitted to the ATDT. All 897 reports must be reviewed and, as appropriate, TDIFs must be prepared. A plan will be established for completion of this activity.

Staff will also establish a technical data team to evaluate SNL YMP processes and integrate requirements, technical efforts, and support efforts for improved efficiency of personnel.

Staff will review and revise Desk Guidance for PDA activities. STATUS: Final Draft being prepared for review and approval.

Issues/Potential Problems Needing Resolution and Potential Impacts

The Project Office continues to initiate letters requesting cleanup of various pieces of the technical data base without providing associated required funding and without first requesting Participant work impacts prior to issuance. A mechanism must be identified by which appropriate funding is issued with the request to implement the work. EXAMPLE: April 22nd letter "Request For Completion of Site and Engineering Properties Database (SEPDB) "Backlog" Submittal Packages."

No direction has been issued by OCRWM regarding ownership and disposition of dual-storage YMP records.

The funding that was authorized in March to develop TDIFs for data in old SAND reports was rescinded.



1.2.12.2.3 PARTICIPANT RECORDS MANAGEMENT

Major Accomplishments

Staff co-chaired the OCRWM Technology Integration and Methodology Analysis (TIMA) committee on "Communication." A final report was prepared and submitted.

Significant Meetings Attended

Staff met with the QA Manager to discuss programmatic concerns.

Staff attended the Rio Grande Chapter of the American Records Management Association (ARMA) Spring Seminar and participated in the panel discussion and presented "Identifying Potential QA Records."

Staff attended the YMPO Records Coordinators and Information Resources Council meetings in Las Vegas, Nevada.

Status Report on Ongoing Activities

FY94 budget exercises were initiated, and resumes of candidates for the position of Supervisor for the YMP Records Management Support efforts were identified.

Major Activities Upcoming Next Three Months

Staff will obtain SNL and OCRWM approval/authorization for the identification of YMP Project

duplicate storage records as Federal nonrecords. When so designated, approval/authorization for the verification and destruction of said records will be obtained.

Staff will also research and prepare FY94 budget information.

Issues/Potential Problems Needing Resolution and Potential Impacts

A new version of AP 1.18Q, Records Management, is being issued by the Project Office and implementation will be required in the near future. It is possible that a new requirement may have extensive impact on the QA staff. When an individual QA record or an QA record package is unable to meet the requirements for legibility or completeness, contains NAs in blanks, or does not comply with the correction process, it will be subject to a non-conformance action. This new requirement has the potential of a significant impact.

An OCRWM Records Management Council has been established for the purpose of "establishing a forum for program-wide guidance and direction for the records management and document control issues and requirements to ensure consistent interpretation and implementation of the records management and document control programs." It should be clearly identified in FY94 budgeting efforts that financial support of this effort (an estimated six meetings per year and 240 person-hours) should come through the Project Office from OCRWM.



1.2.12.25 DOCUMENT CONTROL

Status Report on Ongoing Activities

The "second notice" listings of all active Controlled Documents were sent to all active recipients on April 9, 1993, in response to CAR #93-021 from the YMP audit (YMP 93-03). To date, the response is about 65%. Staff has discussed whether or not to recall the documents of all recipients who didn't respond. A decision is forthcoming.



1.2.15 SUPPORT SERVICES

The objective of the Support Services element includes work scope related to project-level general administrative and project support activities. The Support Services element is comprised of three tasks: Support Services Coordination and Planning (1.2.15.1), Administrative Support (1.2.15.2), and YMP Support for the Training Mission (1.2.15.3).

1.2.15.1 SUPPORT SERVICES COORDINATION AND PLANNING

Significant Meetings Attended

A monthly status meeting with one of the primary support contractors for this element was conducted on April 22, 1993.

Status Report on Ongoing Activities

Routine oversight of support service activities was conducted.

1.2.15.2 ADMINISTRATIVE SUPPORT

Major Accomplishments

The semiannual Socio-Economic Monitoring reports were transmitted to the Project, in both hardcopy and on floppy disk media. Corrections to the labor full-time equivalent (FTE) portion of the Socio-Economic Forecast reports were also transmitted to the project.

During the month of April, two SAND reports were published and a total of seven publications were approved by the Project Office.

Status Report on Ongoing Activities

Work has begun on designing a new procurements tracking database to replace the existing database, which needs revising to support new socio-economic reporting requirements.

A total of 30 Nuclear Waste Fund (NWF)/YMP property items in Areas 25 and 6 at the Nevada Test Site (NTS) were inventoried and tagged with the new red metal tags. This brings the total number of NWF/YMP items tagged with the new tags to approximately 200.

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**1.2.15.3 YMP SUPPORT FOR THE TRAINING
MISSION**

Maior Accomplishments

Staff gave a presentation to the TPO and managers on the revised training plan and the associated processes that will support the plan.

Status Report on Ongoing Activities

A meeting was held with SNL staff to discuss the merger of the "People" data base with the training and document control data bases.