MAR 3 7 1995

MEETING MINUTES

BI-MONTHLY EXPLORATORY STUDIES FACILITY MEETING

NOVEMBER 7, 1994

Staff from the Nuclear Regulatory Commission met with representatives of the Department of Energy (DOE) to discuss items of mutual concern regarding the Exploratory Studies Facility (ESF) at Yucca Mountain. This meeting was held at DOE's Yucca Mountain Project Site Characterization Office in Las Vegas, NV. Representatives of the State of Nevada (NV); Nye and Clark Counties, NV; the Nuclear Energy Institute; and DOE contractors also attended the meeting. An attendance list is included as Attachment 1.

The NRC staff requested information on access to the Exploratory Studies Facility (ESF) at Yucca Mountain, now that operation of the Tunnel Boring Machine (TBM) used to excavate the ESF has begun. Concern was expressed by all parties (DOE, NRC, NV, Nye and Clark Counties) that while safety must be the primary concern, access must also be assured. The representatives of DOE agreed to document its access requirements and provide them to NRC.

The representatives from DOE discussed plans for phased start-up of TBM operations. Plans are to begin installation of the mapping gantry as soon as practicable after the pieces arrive on December 5, 1994.

A discussion of the DOE design and construction program was the next topic (Attachment 2). The several design packages 1A through 8B were discussed. The NRC staff requested additional information on the specific test alcoves as they relate to program approach implementation. A representative of NV noted that the TBM roll was ten degrees off line and off grade. A DOE representative noted that this was not uncommon in TBM start-up and that the TBM would be "driven out" of that position.

The next topic was the ongoing discussion between the NRC staff and DOE on quality assurance (QA) and design control issues. The NRC staff commented on its response to the DOE March 30, 1994, letter, noting that it was looking forward to a written response from DOE responding to the issues in the October 13, 1994, (Bernero to Dreyfus) letter. Attachment 3 concerns DOE's plans to respond to the October 13, 1994, NRC letter. The DOE representatives discussed the issues that they believed were raised in the NRC letter and proposed approaches for resolving them. DOE believes that NRC has raised valid concerns about the DOE and Management and Operating contractors QA programs. DOE noted that it is confident that deficiencies identified in the design process leading to Design Package 2C have been addressed and corrected, that the deficiencies were those of procedural implementation rather than an absence of control or lack of procedures, and that Design Package 2C was a quality product. On this basis, the Office of Civilian Radioactive Waste Management Director authorized proceeding with TBM operation.

The NRC staff raised concerns with the method used to close corrective action reports bearing on Design Package 2C. The Clark County representative stated that it was his perception that problems with Design Package 2C were being handled in a piece-meal fashion. DOE noted that the ESF meetings were a good venue to provide additional information bearing upon these concerns. A representative from NV questioned whether Design Package 8A was being prepared under DOE's new system. The DOE staff stated that Design Package 8A was being done under the new system.

DOE discussed its ESF Design Ground Support Systems (Attachment 4). It was stated that DOE's basic assumptions included:

- Portions of the ESF will eventually become part of the geologic repository.
- The ESF design will not jeopardize the integration of the ESF into the geologic repository.
- The four permanent items in the ESF, namely, 1) underground openings, 2) shaft liners, 3) operational seals, and 4) ground support shall be designed and constructed to be incorporated into a repository and must be designed to have a maintainable life and

quality as specified for the repository.

In response to questions from the NRC staff and a representative of NV, the DOE representative stated that it believed that the capability existed, if necessary, to upgrade the ESF's permanent structures, systems and components to meet repository design criteria. In response to another question from the NRC staff, DOE stated that the parts of the ESF that it assumes to be part of an eventual repository are the primary access areas: the north ramp, the main drift, the south ramp, plus the north and south ramp extensions. The NRC staff asked how site characterization data was factored into design. The DOE agreed to address this question at the next bi-monthly ESF meeting.

Attachment 5 contains DOE's presentation on the Drilling, Sampling, and Testing Program update. The DOE representative noted that Drill Hole NAG-4 was to be used by Nye County for pneumatics testing. In response to a question from the NRC staff, the DOE representative noted that no trenching was planned for the Sundance Fault during the next three months.

During closing remarks, a representative of NV requested that DOE discuss at the next ESF meeting whether or not Yucca Mountain Site Characterization Office had performed a validation exercise on Design Package 1.

Mark S. Delligatti, Senior Project Manager
High-Level Waste and Uranium Recovery
Projects Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards
U.S. Nuclear Regulatory Commission

Christian E. Einberg
Regulatory Integration Division
Office of Civilian Radioactive
Waste Management
U.S. Department of Energy

NRC/DOE TECHNICAL MEETING
ON EXPLORATORY STUDIES FACILITY
NOVEMBER 7, 1994

	PRINT NAME	COMPANY	TITLE
1	Ken Gilkerson	SAIC	Sr QA Specialist (YMQAD)
2	Brad Bush	M&O	Intergovernmental Advisor County Relations
3	Tom Fortner	DOE	DOE CONST MGR
4	CARRY MORRISON	M&O	L.O.E – MECHANICAL ENGR
5	Samantha Richardson	DOE	Public Affairs
6	Joe Willis	M & O	QE Manager
7	JERRY HEANEY	M+O	MGDS QA COMPLIANCE
8	Bruce Stanley	PMO	Integrator
9	RICHARD MORISSETTE	PMO	Systems Engineer
10	JIM BRAYLOCK	DOE	YMQAD
11	JACK NESBITT	M+O	ESF PROJ. ENGR. MGR.
12	Jim GRUBB	STATE	ENGINEER
13	APRIL V. GIL	DOE	TEAM LICENSING, YMSCO
14	BANU JAGANNATH	NRC	Sr Geotechnical Engineer
15	Mark Delligatti	NRC	Lic Project Manager
16	Joe Holonich	NRC	Chief, HLUR
17	MYSORE NATARAJA	NRC	Acting Section Chief
18	JAKE PHILIP	NRC	PROJECT MANAGER
19	A. C. Douglas	CLV	SR Geologist
20	PHILIP S. JUSTUS	USNRC	SR Geologist
21			
22			
23			
24			

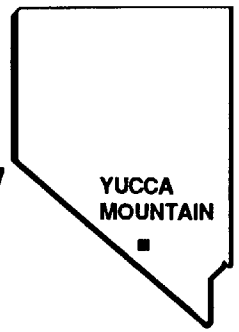
Attachment 1

NRC/DOE TECHNICAL MEETING
ON EXPLORATORY STUDIES FACILITY
NOVEMBER 7, 1994

	PRINT NAME	COMPANY	TITLE
1	NORMAN T. SIMMS	M&O/DUKE	REG. / LICENSING
2	WILLIAM BOYLE	DOE	Physical Scientist
3	Christian E. Einberg	DOE/HQ	General Engineer
4	Asadul H. Chowdhury	CNWRA	Manager - RDCD
5	MICHAEL BELL	NRC/DWM	CHIEF, ENGB
6	E.J. TIESENHAUSEN	CLARK COUNTY	ENG. SPEC.
7	NICK STELLAUNTO	Nye Co.	ON SITE REP
8	MAL MURPHY	"	QA & Licensing Advisor
9	HOMI MINWALLA	LUCSTAR	SI Project Engr
10	Chris Henkel	NEI	Project Manager
11	Randall D. Manteufel	CNWRA	Research Engineer
12	Rex A. Wescott	NRC	Sr Hydrologist
13	PHILIP R. HAMMOND	M&O/Duke	REG / LICENSING
14	Jerry L. Nutt	M&O/TRW	Dept Mgr Subsurface Design
15	DAN MCKENZIE	M&O/MK	REPOSITORY DESIGN
16	RALPH DRESSEL	M&O	Const. Engrg Mgr.
17	ROBERT SAUNDERS	M&O/MK	DESIGN SUPERVISOR-ES&SUBSURFACE
18	W.A. Dudock, Jr.	M&O/TRW	ACD FE
19	Mike Lugo	M&O/TRW	Compliance Interaction Mgr.
20	Sitakanta Mohanty	CNWRA	Sr. Res. Sci.
21	Amitava Ghosh	CNWRA	Senior Research Engineer
22	Bernard J. Verna	DOE	Design Team Lead
23	Bill Sublette	SAIC	Geot. Engr.
24	Steve Dana	BATTELLE	Lead QAE

U.S. DEPARTMENT OF ENERGY

OCRWM



YUCCA MOUNTAIN
SITE CHARACTERIZATION
PROJECT

DOE-NRC TECHNICAL MEETING ON THE EXPLORATORY STUDIES FACILITY

DESIGN AND CONSTRUCTION PROGRESS

PRESENTED BY

JAMES M. REPLOGLE

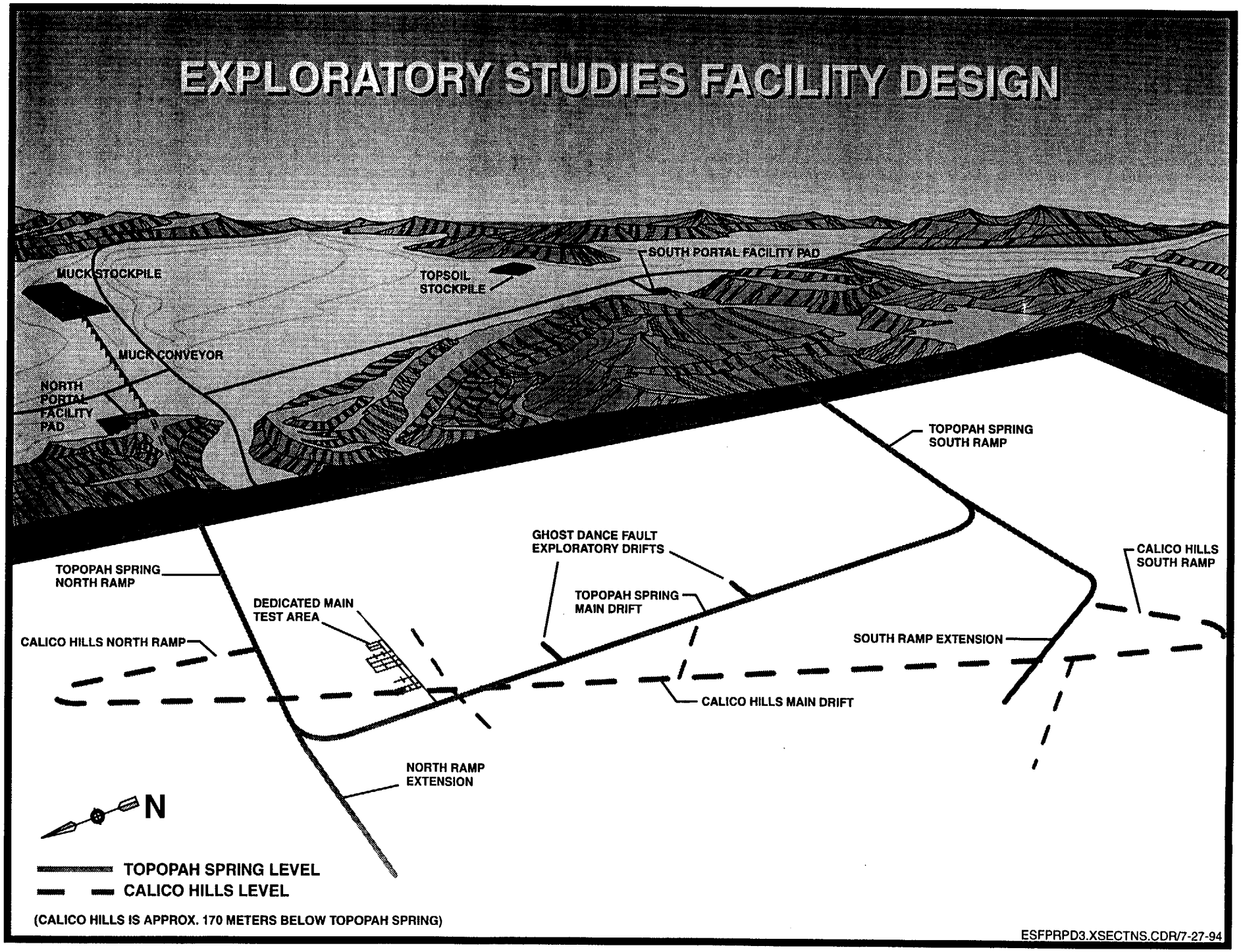
ASSISTANT MANAGER FOR SUITABILITY AND LICENSING

NOVEMBER 7, 1994
LAS VEGAS, NV

Attachment 2

PRESENTATION PARAMETERS

- **ESF design and construction progress information is based on projected budgets of:**
  - **FY94 = $55M**
  - **FY95 = $101M**
  - **FY96 = $114M**
  - **FY97 = $119M**
- **ESF packages are described either by configuration items (where defined) or projected scope**


EXPLORATORY STUDIES FACILITY DESIGN
MUCK STOCKPILE
TOPSOIL STOCKPILE
SOUTH PORTAL FACILITY PAD
MUCK CONVEYOR
NORTH PORTAL FACILITY PAD
TOPOPAH SPRING SOUTH RAMP
GHOST DANCE FAULT EXPLORATORY DRIFTS
CALICO HILLS SOUTH RAMP
TOPOPAH SPRING NORTH RAMP
DEDICATED MAIN TEST AREA
TOPOPAH SPRING MAIN DRIFT
CALICO HILLS NORTH RAMP
SOUTH RAMP EXTENSION
CALICO HILLS MAIN DRIFT
NORTH RAMP EXTENSION
N
TOPOPAH SPRING LEVEL
CALICO HILLS LEVEL
(CALICO HILLS IS APPROX. 170 METERS BELOW TOPOPAH SPRING)
ESFPRPD3.XSECTNS.CDR/7-27-94

PACKAGE 1A:
NORTH PORTAL SITE PREPARATION

Configuration items:

- Tunnel Boring Machine (TBM), TBM starter tunnel, pad and access road, pad water drainage system; switchgear building, underground utilities on pad (electric, sewer, H20, firewater, waste water), rock and topsoil storage area, Test Alcove 1

Design Status

- All items complete and accepted for construction

PACKAGE 1A:
NORTH PORTAL SITE PREPARATION

(CONTINUED)

Construction status:

- Complete
  - TBM starter tunnel
  - TBM launch chamber
  - Pad and access road
  - Rock and topsoil storage area
  - Test Alcove #1
  - TBM Assembly
  - Phase I, TBM operational readiness review
  - Phase II, TBM operational readiness review

- In process
  - Switchgear building
  - Pad water system

Acceptance status: Pending

PACKAGE 1B:
NORTH PORTAL SURFACE FACILITIES AND UTILITIES

Configuration items:

- Change House building, Shop building, pad sewer system, pad electrical system, pad waste water system, pad and access road, water system, surface rail, finish grading and paving

Design Status

- All items complete and accepted for construction

PACKAGE 1B: NORTH PORTAL SURFACE FACILITIES AND UTILITIES

(CONTINUED)

Construction status:

- In process
  - Sewer system
  - Electrical system
  - Waste water system
  - Water systems
    * Potable
    * Non-Potable
- Complete FY95
  - Change House building
  - Pad extension
  - Finish grade

Acceptance status: TBD

PACKAGE 1C:
NORTH PORTAL SURFACE FACILITIES AND UTILITIES

Configuration items:

- Compressed air systems, standby power

Design Status

- All items complete and accepted for construction

Construction Status: Complete FY95

- Compressed air systems
- Standby power

Acceptance Status: TBD

PACKAGE 1D:
NORTH PORTAL SURFACE FACILITIES AND UTILITIES

Design Scope:

- Muck storage area and conveyor access road
- Fuel storage system
- Site lighting continuation
- Site grounding continuation
- Air compressor and stand-by generator foundations
- Compressed air condesate drain system

Design Status

- Completed 90% Review process, in Jul 94
- Completion expected by Dec 94

Construction Status: Start FY95 - Complete FY96

Acceptance Status: Pending

PACKAGE 1E:
NORTH PORTAL SURFACE FACILITIES AND UTILITIES

Design Scope:

- Auxillary generators
- Day tanks and associated piping

Design Status

- 90% Review - Apr 94
- Completed - Jul 95

Construction Status: Start FY96 - Complete FY96

Acceptance Status: Pending

PACKAGE 2A:

Configuration Items: None. Components only

Design Status: Complete

Construction Status: Procurement only, complete FY95

Acceptance Status: Complete

PACKAGE 2B:

Configuration items:

- Mapping Gantry, locomotives, rolling stock, precast concrete inverts, ventilation system

Design Status

- 90% Design Review complete

Construction Status: Procurement only FY94

Acceptance Status: ~~Complete~~ TBD

PACKAGE 2C: NORTH RAMP TO TOPOPAH SPRING LEVEL (TSL)

Configuration items:

- North Ramp Excavation, linings and ground support, subsurface electrical systems, subsurface mechanical systems, subsurface fire protection, subsurface monitoring and warning systems, subsurface conveyor systems

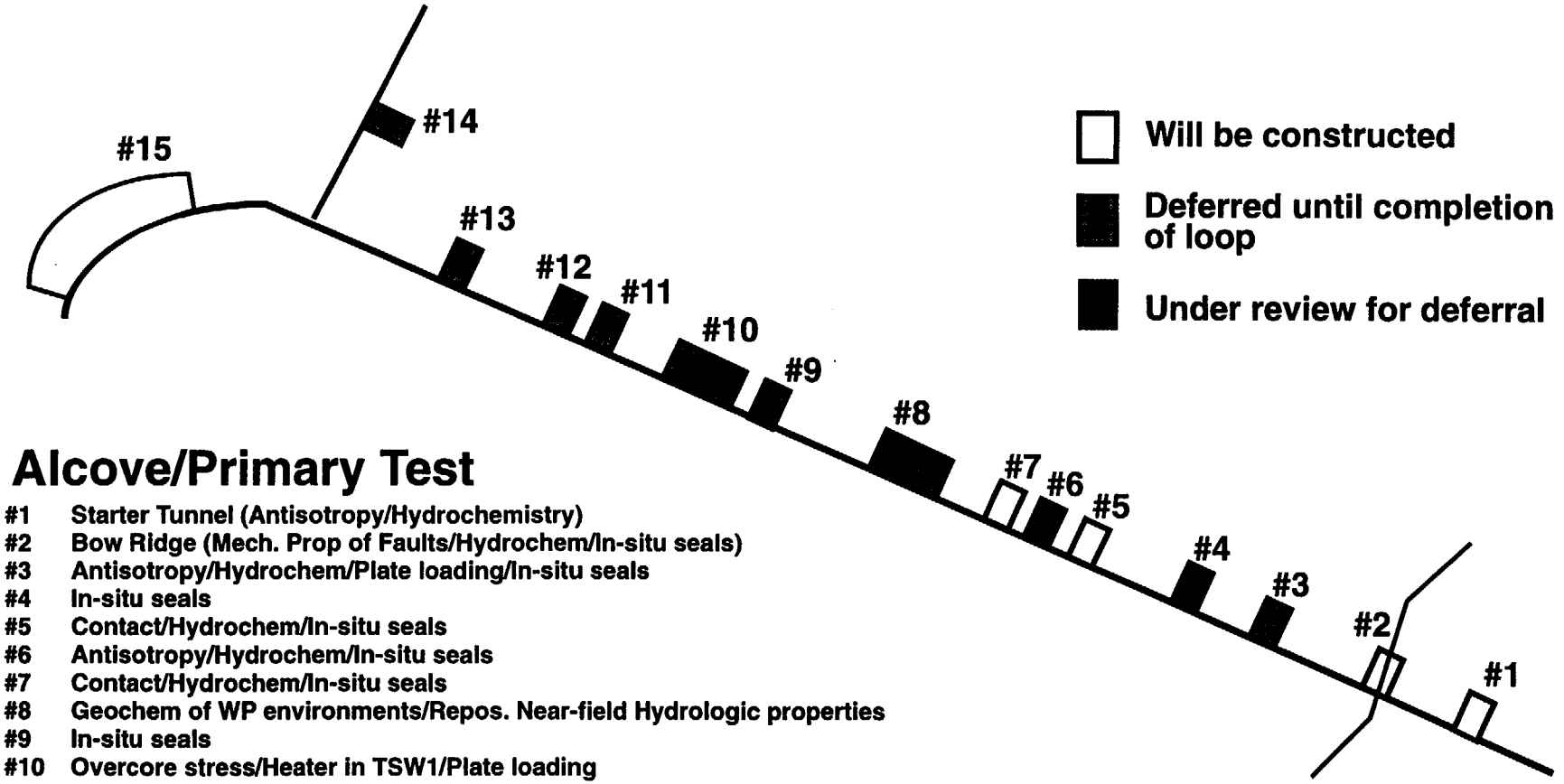
Design Status

- In review process - Complete late FY94
  90% review held May 2, 1994,
  release for construction
  Oct 1994

Construction Status: Start FY94 - Complete FY96

Acceptance Status: Pending

NORTH RAMP ALCOVE CONFIGURATION



Alcove/Primary Test

#1	Starter Tunnel (Antisotropy/Hydrochemistry)
#2	Bow Ridge (Mech. Prop of Faults/Hydrochem/In-situ seals)
#3	Antisotropy/Hydrochem/Plate loading/In-situ seals
#4	In-situ seals
#5	Contact/Hydrochem/In-situ seals
#6	Antisotropy/Hydrochem/In-situ seals
#7	Contact/Hydrochem/In-situ seals
#8	Geochem of WP environments/Repos. Near-field Hydrologic properties
#9	In-situ seals
#10	Overcore stress/Heater in TSW1/Plate loading
#11	Antisotropy/Hydrochemistry
#12	In-situ seals
#13	Hydrochem/In-situ seals
#14	Excavation effects
#15	Hydro Prop of Major Faults/Hydrochemistry

INTEGRATED DATA CONTROL SYSTEM

Design Scope

- Collect data from designated participant ESF tests
- Collect data from facility monitoring and control systems
- Record data in surface IDCS database
- Archive the data as permanent protected records
- Using phased approach procurement to minimize FY costs

Design Status

- Completed 90% Review of IDCS procurement DOCS - Oct 94
- Completion of procurement DOCS - Jan 95
- Phased release of procurement thru FY97

Construction Status: Start FY95 - Complete FY98

Acceptance Status: Pending

PACKAGE 3: SOUTH PORTAL SITE PREPARATION

Design Scope:

- Pad and access roads, electrical substation, portal control building, pad drainage

Design Status

- Start FY96 - Complete FY96

Construction Status: Start FY96 - Complete FY97

Acceptance Status: Pending

PACKAGE 4: SOUTH RAMP TO TOPOPAH SPRING LEVEL (TSL)

Design Scope:

- South Ramp Excavation/breakthrough, linings and ground support, subsurface electrical systems, subsurface mechanical systems, subsurface fire protection, subsurface monitoring and warning systems, subsurface conveyor system

Design Status

- Start FY96 - Complete FY96

Construction Status: Start FY96 - Complete early FY97

Acceptance Status: Pending

PACKAGE 5: NORTH RAMP TO CALICO HILLS LEVEL (CH)

Design Scope:

- North Ramp to Calico Hills excavation, linings and ground support, subsurface electrical systems, subsurface mechanical systems, subsurface fire protection, subsurface monitoring and warning systems, subsurface conveyor system

Design Status

- Start FY97 - Complete FY98

Construction Status: Start FY98 - Complete FY00

Acceptance Status: Pending

PACKAGE 8A: TOPOPAH SPRING LEVEL (TSL) MAIN DRIFT

Design Scope:

- TSL main drift excavation, linings and ground support, subsurface electrical systems, subsurface mechanical systems, subsurface fire protection, subsurface monitoring and warning systems, subsurface conveyor system

Design Status

- Start FY94 - Complete FY95

Construction Status: Start FY96 - Complete FY97

Acceptance Status: Pending

PACKAGE 8B: TOPOPAH SPRING LEVEL (TSL) NORTH RAMP EXTENSION

Design Scope:

- North Ramp Extension excavation, linings and ground support, subsurface electrical systems, subsurface mechanical systems, subsurface fire protection, subsurface monitoring and warning systems, subsurface conveyor system

Design Status

- Start FY97 - Complete FY97

Construction Status: Start FY98 - Complete FY98

Acceptance Status: Pending

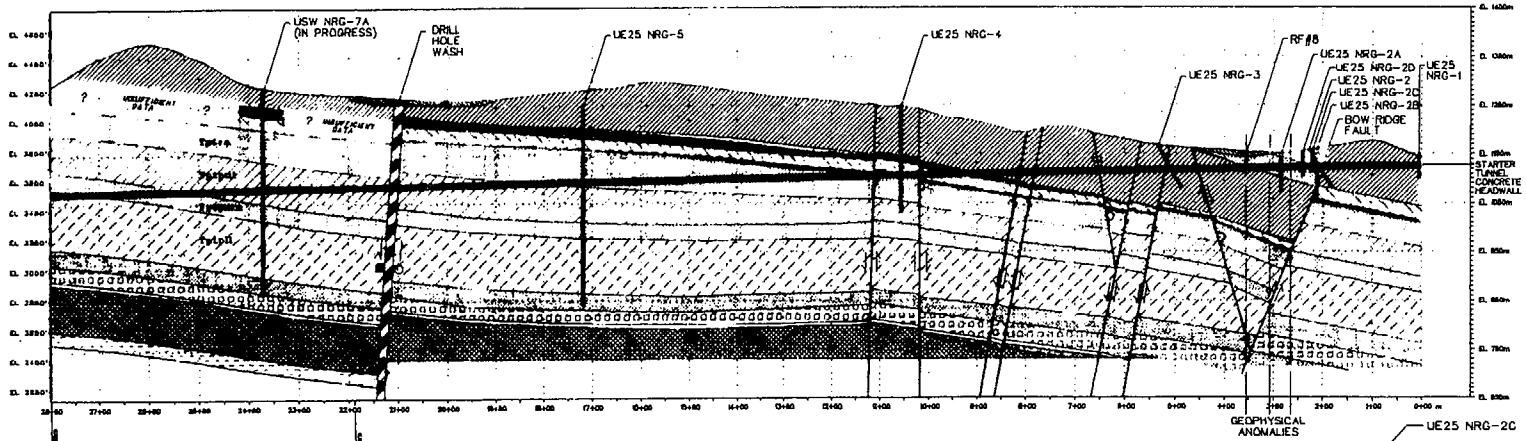
Other Near-Term ESF Design Activities

- Integrated Data Control System (IDCS)
  - 50% Review - Jun 7, 1994 (complete)
    90% Review - Aug, 1994
    Acceptance for construction Dec 19, 94
- Alcove design - (North Ramp test alcoves (5), Ghost Dance drifts, Heater Test drifts)
  - 50% Review - 8/1/95
- Mechanical Excavation Methods Study
  - Recommendation by end of Dec 94
- Calico Hills Access Alternatives Study
  - Early FY95 Start

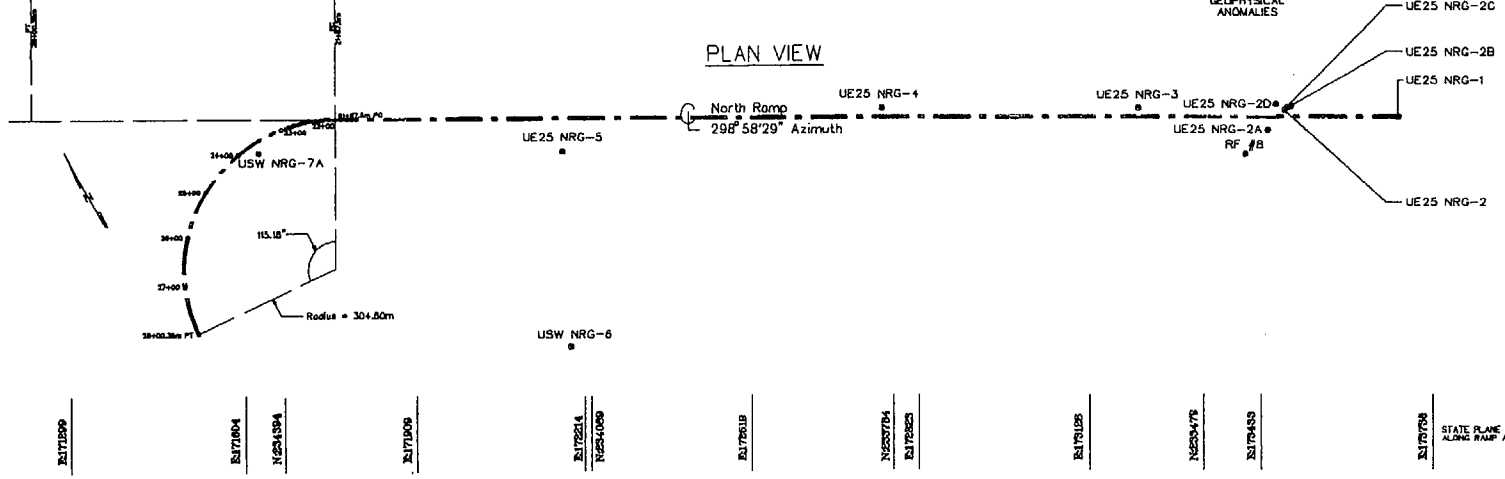
North Ramp Construction Schedule

- TBM start up, testing phases began Sept 20, 1994
- Initial operations can be characterized as a "Startup Testing Phase followed by a Shakedown Phase"
- Advance rate will be low during this period due to:
  - Training of operational personnel
  - Startup testing of the TBM systems
  - Encounter with Bow Ridge Fault at approximately station 1+90 meters
  - Negotiation of "Rainier Mesa" material from Bow Ridge to approximately Station 2+70 meters
  - Rail haulage of muck until conveyor installation FY95
  - Completion of North Ramp (to station 28+00 meters) - Early FY96

SECTION VIEW

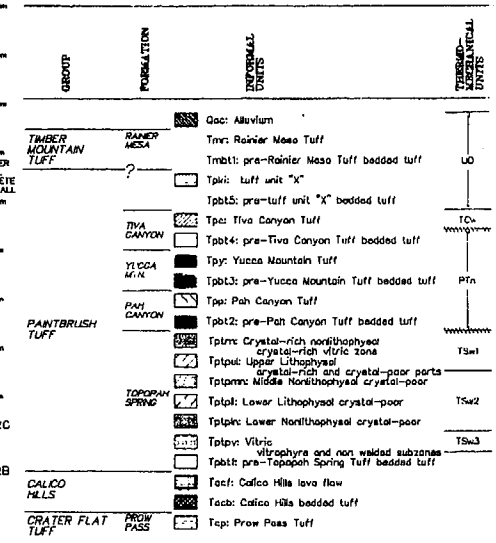


PLAN VIEW



0 100 200m
SCALE

SYMBOLS



STRATIGRAPHIC NOMENCLATURE DEVELOPED BY USGS

DRILL HOLE WASH FAULT ZONE, LOCATION AND ATTITUDE UNCERTAIN

FAULT, ? -ATTITUDE UNCERTAIN

PROPOSED NORTH RAMP ALIGNMENT

APPROXIMATE

● STRIKE-SLIP SEPARATION INTO PAGE

○ STRIKE-SLIP SEPARATION OUT OF PAGE

171899	170804	254394	171809	172214	254069	176518	253784	172825	176185	254478	174433	176758

STATE PLANE COORDINATES ALONG RAMP ALIGNMENT (m)

PRELIMINARY RAMP DATA
QA:NO

Station (m)	Grade	State Plane Coord. (m) Northing	State Plane Coord. (m) Easting	Elevation (m)
0+00 (Portal)		233380.0	173878.8	1129.88
21+87.4 (PC)		234238.4	171788.8	1078.79
22+00		234348.2	171788.8	1078.63
23+00		234376.7	171888.5	1077.68
24+00	-3.05%[1]	234373.0	171861.0	1075.63
25+00		234357.4	171987.7	1073.38
26+00		234271.6	172080.3	1071.32
27+00		234180.2	172137.7	1069.28
28+00.38 (PT)		234083.8	172114.8	1067.32

[1] Reference Dwg. 88-M-SK028.00A and verbal communication from U-K, December, 1993.

BOREHOLE PROJECTIONS
QA:QA

Borehole	Projection to Section along Azimuth	Ground Elevation (m)	Distance to Section (m)
UE25 NRG-1	NP	1145.05	0.0
UE25 NRG-2	183°	1157.23	15.20
UE25 NRG-2A	3°	1152.31	20.88
UE25 NRG-2B	183°	1138.67	24.05
UE25 NRG-2C	183°	1150.00	22.36
UE25 NRG-2D	183°	1150.02	28.06
UE25 NRG-3	311°	1188.39	32.20
UE25 NRG-4	311°	1248.82	18.52
UE25 NRG-5	31°	1251.71	88.44
USW NRG-7A	349°	1203.58	22.44
RF #8	2°	1164.88	88.83

Note: Boreholes projected into cross section along strike of rock units

NP - not projected

REV. NO.	DATE	BY	VERSION	
5	4-20-1994	CEB	QAL5	QAL4
4	3-28-1994	CEB	QAL4	QAL3
3	2-8-1994	CEB	QAL3	QAL2
2	2-1-1994	CEB	QAL2	QAL1
1	1-19-1994	CEB	QAL1	DAI

REVISIONS

QA:QA

ESF NORTH RAMP
YUCCA MOUNTAIN SITE
CHARACTERIZATION PROJECT
CROSS SECTION ALONG RAMP FROM 0+00 to 28+00.38m (PT)

Sandia National Laboratories

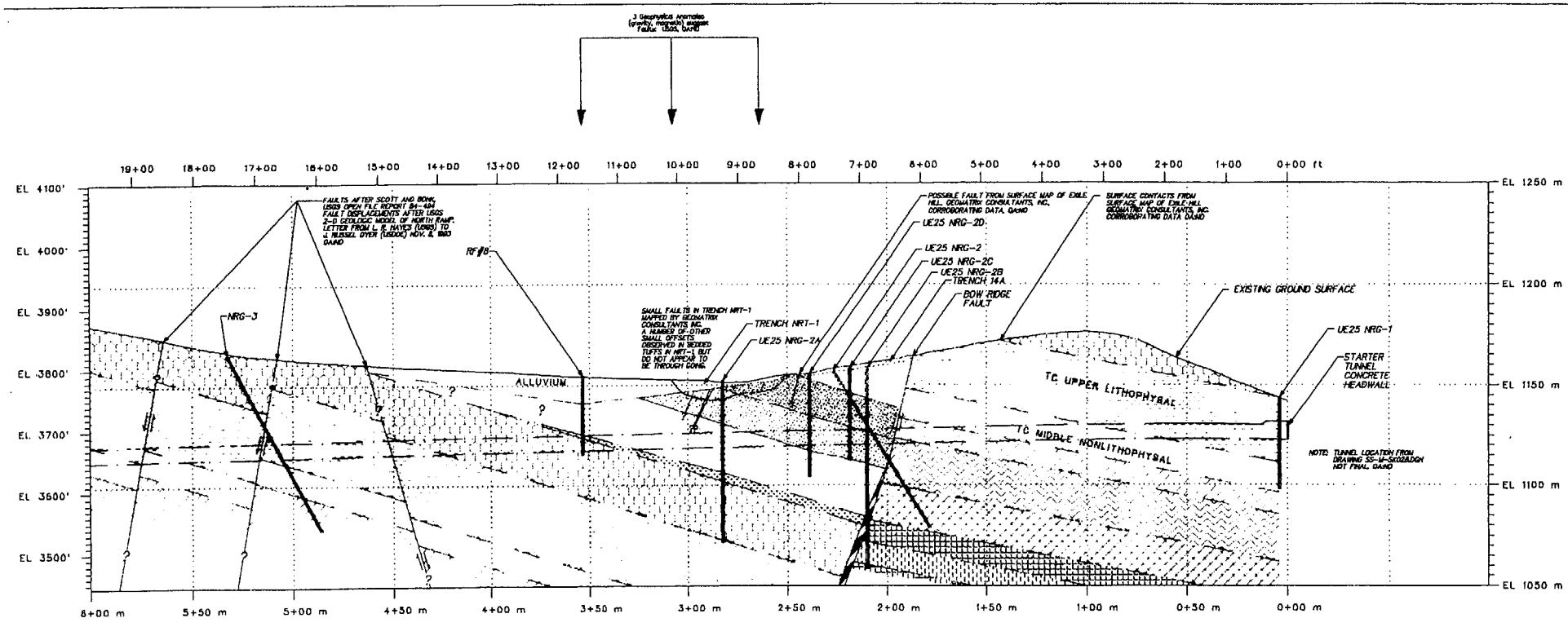
BASE DRAWING: USGS 1-8-93
MODIFICATIONS: CEB 1-3-94
CHECKED BY: MPH/NL

HOR. SCALE: AS SHOWN
VERT. SCALE: AS SHOWN

† 2-D MODEL OF NORTH RAMP, LETTER FROM R. HATES (USGS) TO J. RUSSELL DYER (USDOE) NOVEMBER 8, 1993 (QA:NO)

J. F. T. ALBARTO & ASSOC., INC. GRAND JUNCTION, COLORADO, USA

DRAWING NO: 88-60-
VERSION: QAL5
SHEET 1 OF 1



FORMATION	MEMBER	MAJOR ZONES	CORRELATIVE SUBZONES	FURTHER DESCRIPTION
TIMBER MOUNTAIN TUFF	RAINER MESA			LITHIFIED, NONWELDED
				NONLITHIFIED, TUFF AND FALLOUT
	?	PRE-RAINER MESA BEDDED TUFF		NONLITHIFIED, TUFF AND FALLOUT
		TUFF UNIT "X"		PYROCLASTIC FLOW AND FALLOUT
		PRE-TUFF UNIT "X"		NONLITHIFIED, REWORKED PYROCLASTIC FLOW AND FALLOUT
PAINTBRUSH TUFF	TIVA CANYON	UPPER NONLITHOPHYSAL	CAPROCK UPPER CLIFF	NONWELDED TO DENSELY WELDED
		UPPER LITHOPHYSAL		DENSELY WELDED
		MIDDLE NONLITHOPHYSAL		DENSELY WELDED
		LOWER LITHOPHYSAL		DENSELY WELDED
		HACKLY		DENSELY WELDED
		COLUMNAR		DENSELY WELDED
	PAH CANYON	BEDDED TUFF		NONWELDED
				NONWELDED
		BEDDED TUFF		NONWELDED

STRATIGRAPHIC NOMENCLATURE IN DEVELOPMENT BY USGS

LEGEND

- LITHOLOGIC CONTACT, SOLID LINE WHERE APPROXIMATE, DASHED LINE WHERE INFERRED
- FAULT ZONE
- FAULT, ?-ATTITUDE UNCERTAIN
- PROPOSED TUNNEL OUTLINE

Borehole	Projected to Section along Azimuth	Ground Elevation (m)	Distance to Section (m)
UE25 NRG-1	NP	1144.05	0.0
UE25 NRG-2	182°	1157.23	15.20
UE25 NRG-2A	2°	1152.31	30.85
UE25 NRG-2B	182°	1158.87	24.05
UE25 NRG-2C	182°	1158.80	22.34
UE25 NRG-2D	182°	1155.82	28.88
UE25 NRG-3	211°	1165.35	20.20
RF #8	2°	1154.55	86.52

Note: Boreholes projected into cross section along strike of rock units

NP = Not projected

CROSS SECTION CONSTRUCTED ALONG RAMP ALIGNMENT – AZIMUTH 299°

0 20 40 60 80 100m

1 : 2000

REV. NO.	DATE	BY	VERSION	SUPERCEDES
3	4-25-89	CCB	QA:U	QA:2
2	4-6-89	CCB	QA:U	QA:1
1	12-12-88	CCB	QA:U	QA

REVISIONS

QA:QA

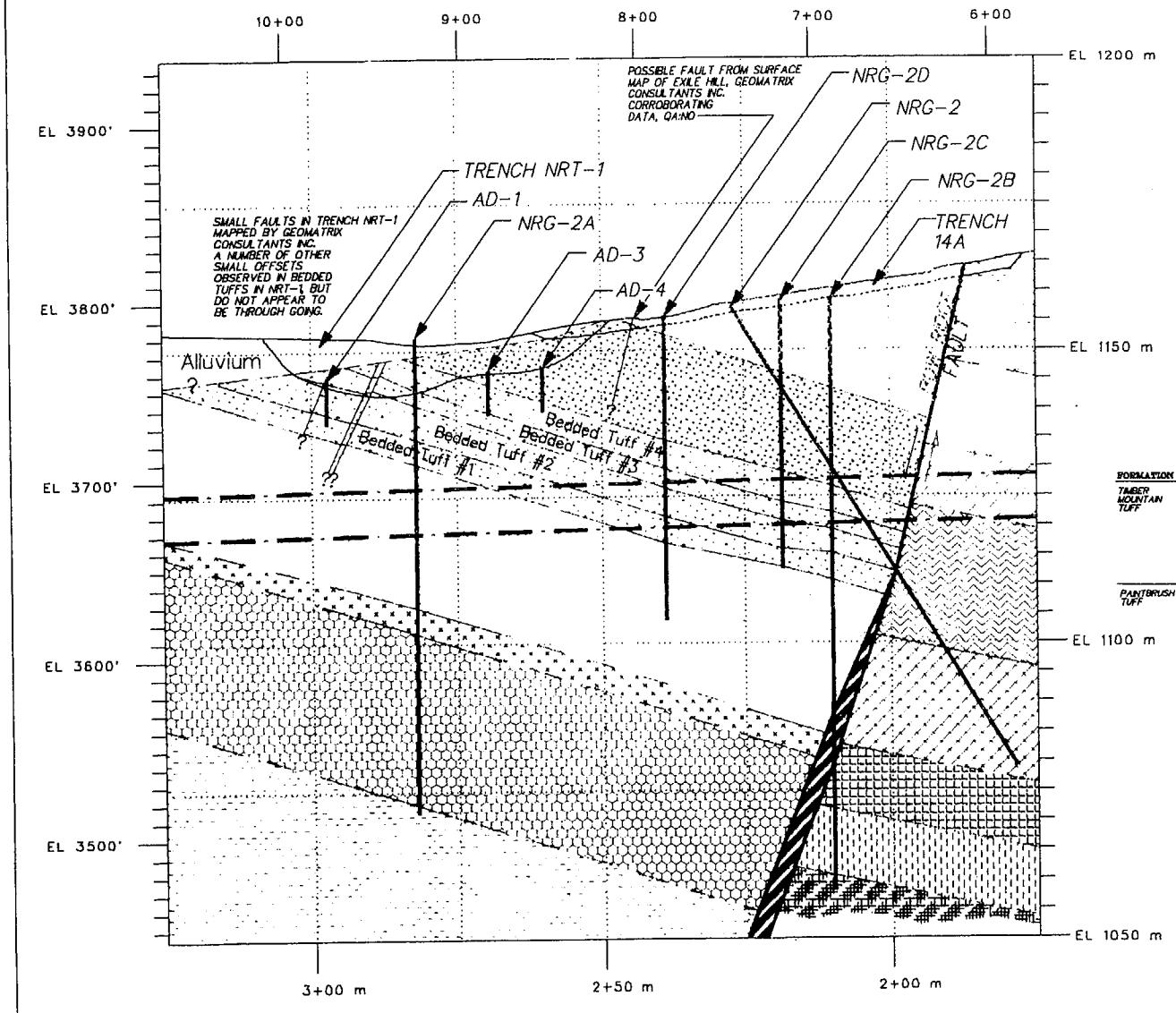
ESF NORTH RAMP
YUCCA MOUNTAIN SITE
CHARACTERIZATION PROJECT
CROSS SECTION THROUGH EXILE HILL
NORTH RAMP 0+00 to 6+00m

Sandia National Laboratories

DRAWN: R.L./12-10-83 HOR. SCALE: AS SHOWN
CHECKED: CEB VERT. SCALE: AS SHOWN

A. F. I. ASAPITO & ASSOC., INC. GRAND JUNCTION, COLORADO, USA

DRAWING NO.: 88-60-08
VERSION: QA:U
SHEET 1 OF 1



North Ramp Stations

CROSS SECTION CONSTRUCTED ALONG RAMP ALIGNMENT – AZIMUTH 299°

0 10 20 30 40 50m

1 : 750

LEGEND

- LITHOLOGIC CONTACT, SOLID LINE WHERE APPROXIMATE, DASHED LINE WHERE INFERRED
- FAULT ZONE
- FAULT, ? - ATTITUDE UNCERTAIN
- PROPOSED TUNNEL OUTLINE

FORMATION	MEMBER	MAJOR ZONES	CORRELATIVE SUBZONES	FURTHER DESCRIPTION
TIMBER MOUNTAIN TUFF	RAINIER MESA			LITHOPHYSAL, NONWELDED
				NONLITHOPHYSAL, TUFF AND FALLOUT
	?			
		PRE-RAINIER MESA BEDDED TUFFS 1-4		NONLITHOPHYSAL, TUFF AND FALLOUT, UNITS U, UNALTERED BY PALEOSOLS
		TUFF UNIT "2"		PYROCLASTIC FLOW AND FALLOUT
		PRE-TUFF UNIT "2"		REWORKED PYROCLASTIC FLOW AND FALLOUT
PAINTBRUSH TUFF	TIVA CANYON	UPPER NONLITHOPHYSAL	CAPROCK UPPER CLIFF	NONWELDED TO DENSELY WELDED
		UPPER LITHOPHYSAL		DENSELY WELDED
		MIDDLE NONLITHOPHYSAL		DENSELY WELDED
		LOWER LITHOPHYSAL		DENSELY WELDED
		HACKLY		DENSELY WELDED
		COLUMNAR		DENSELY WELDED
	PAH CANYON	BEDDED TUFF		NONWELDED
				NONWELDED
		BEDDED TUFF		NONWELDED

STRATIGRAPHIC NOMENCLATURE IN DEVELOPMENT BY USGS

REV. NO.	DATE	BY	VERSION	SUPERCEDES
3				
2				
1				

REVISIONS

QA:QA

ESF NORTH RAMP
YUCCA MOUNTAIN SITE
CHARACTERIZATION PROJECT
CROSS SECTION THROUGH BOW RIDGE FAULT
NORTH RAMP 1+75 to 3+25m

Sandia National Laboratories

DRAWN: EN/4-6-94
CHECKED: CEB

HOR. SCALE: AS SHOWN
VERT. SCALE: AS SHOWN

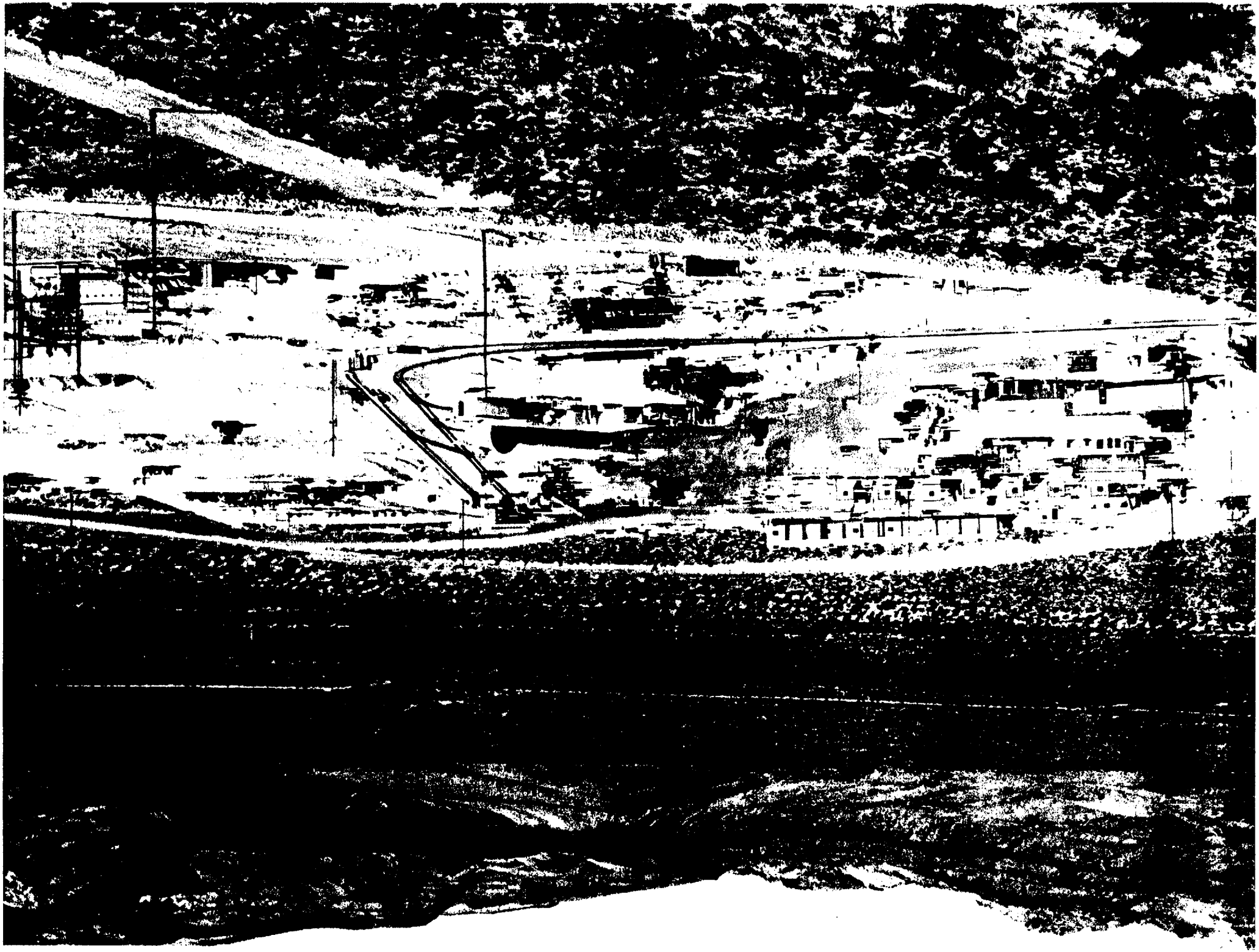
J. F. T. AGAPITO & ASSOC., INC.
GRAND JUNCTION, COLORADO, USA

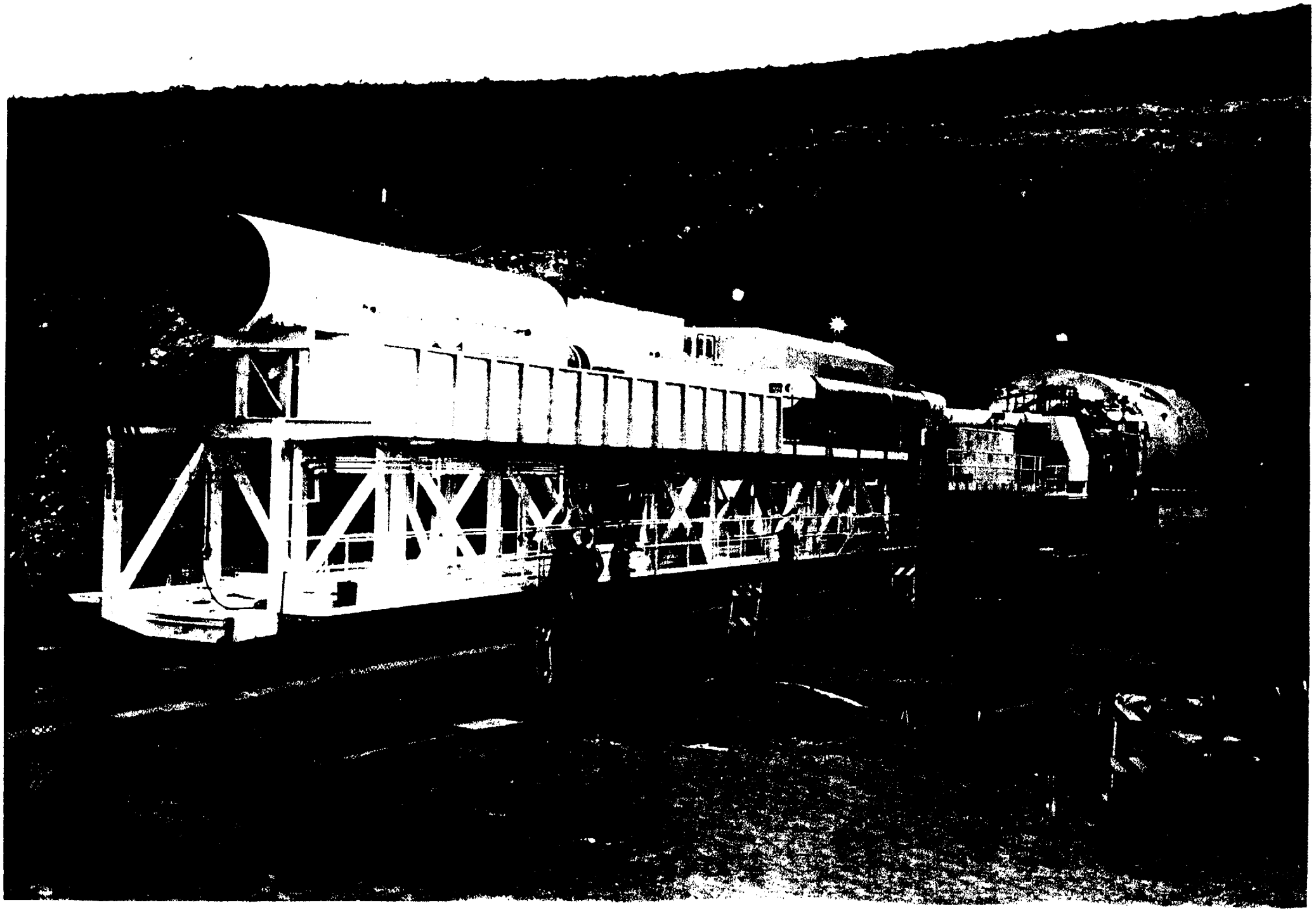
DRAWING NO: EX-DTAIL
VERSION: QA1
SHEET 1 OF 1

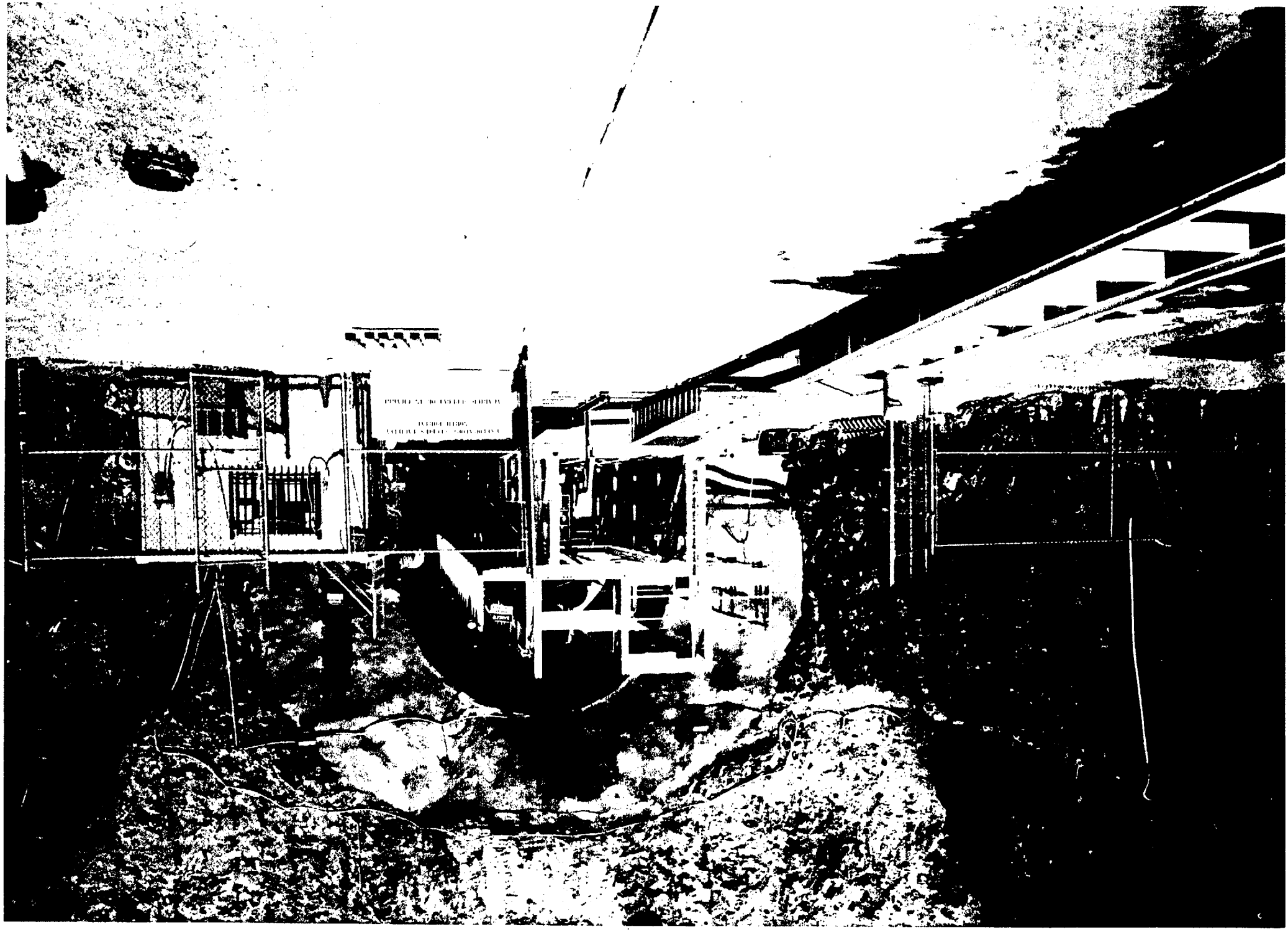
CONSTRUCTION PROGRESS PICTORIALS

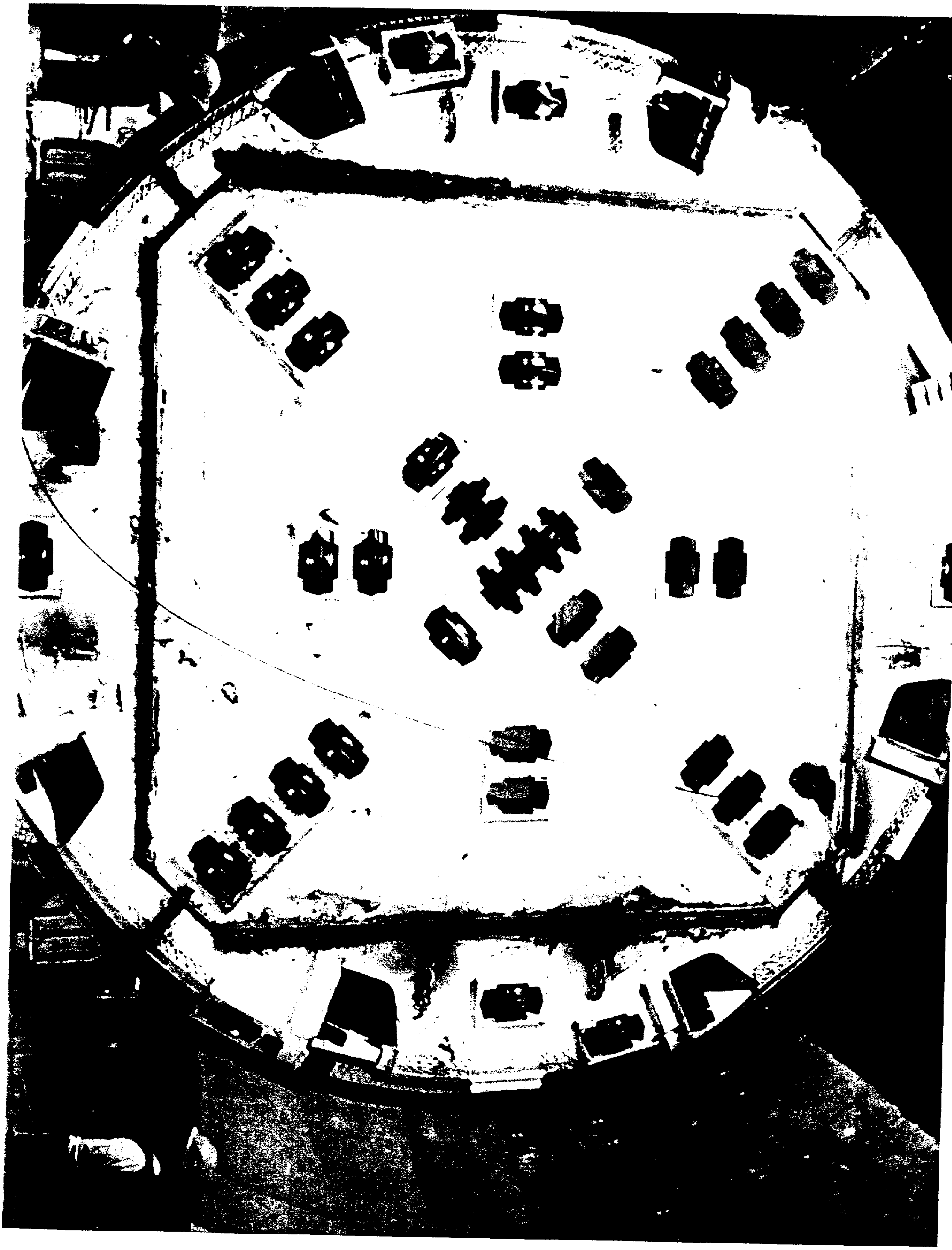
Preliminary Draft Information Only

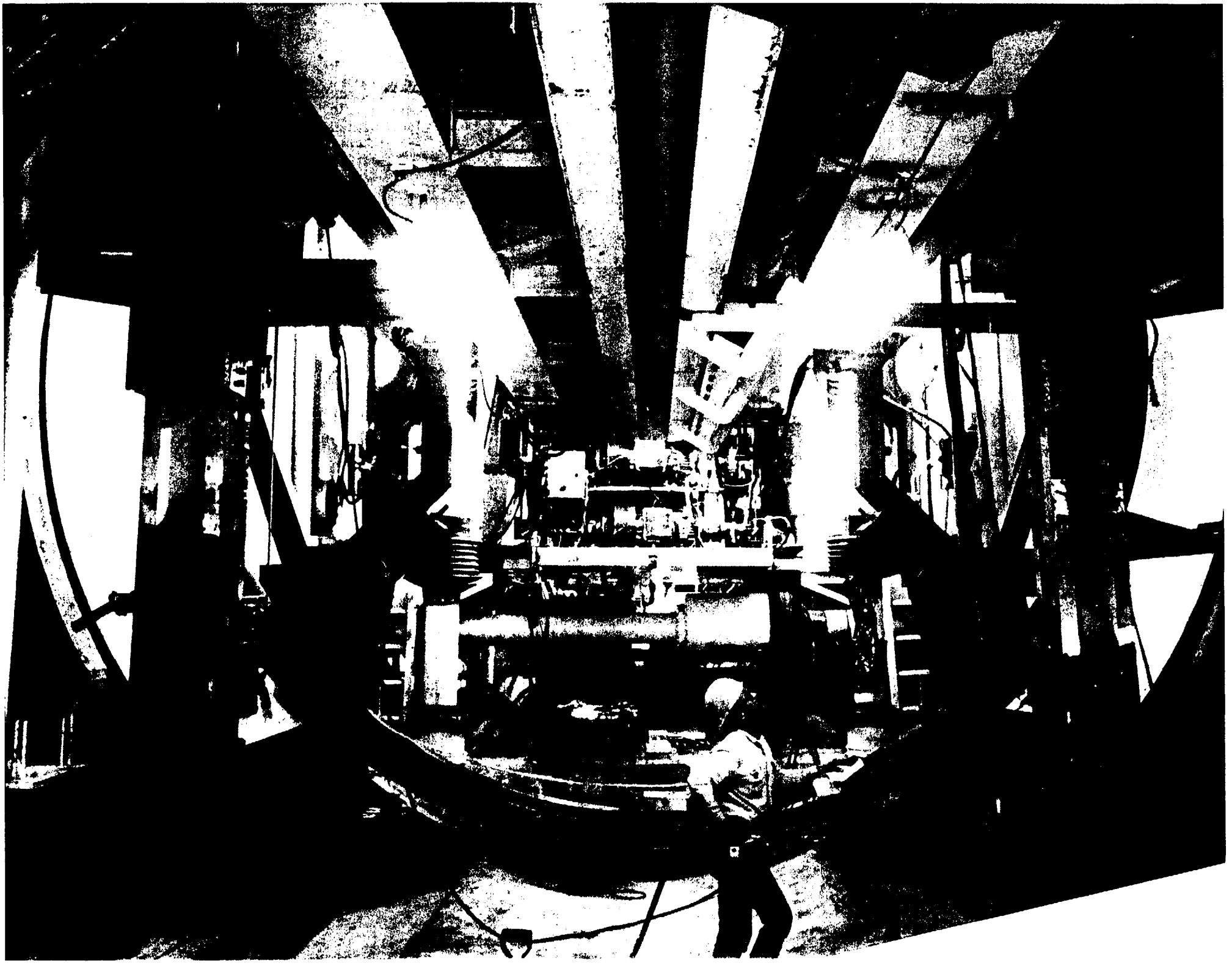
ESFD&CJR22.PM4.126/10-20-94

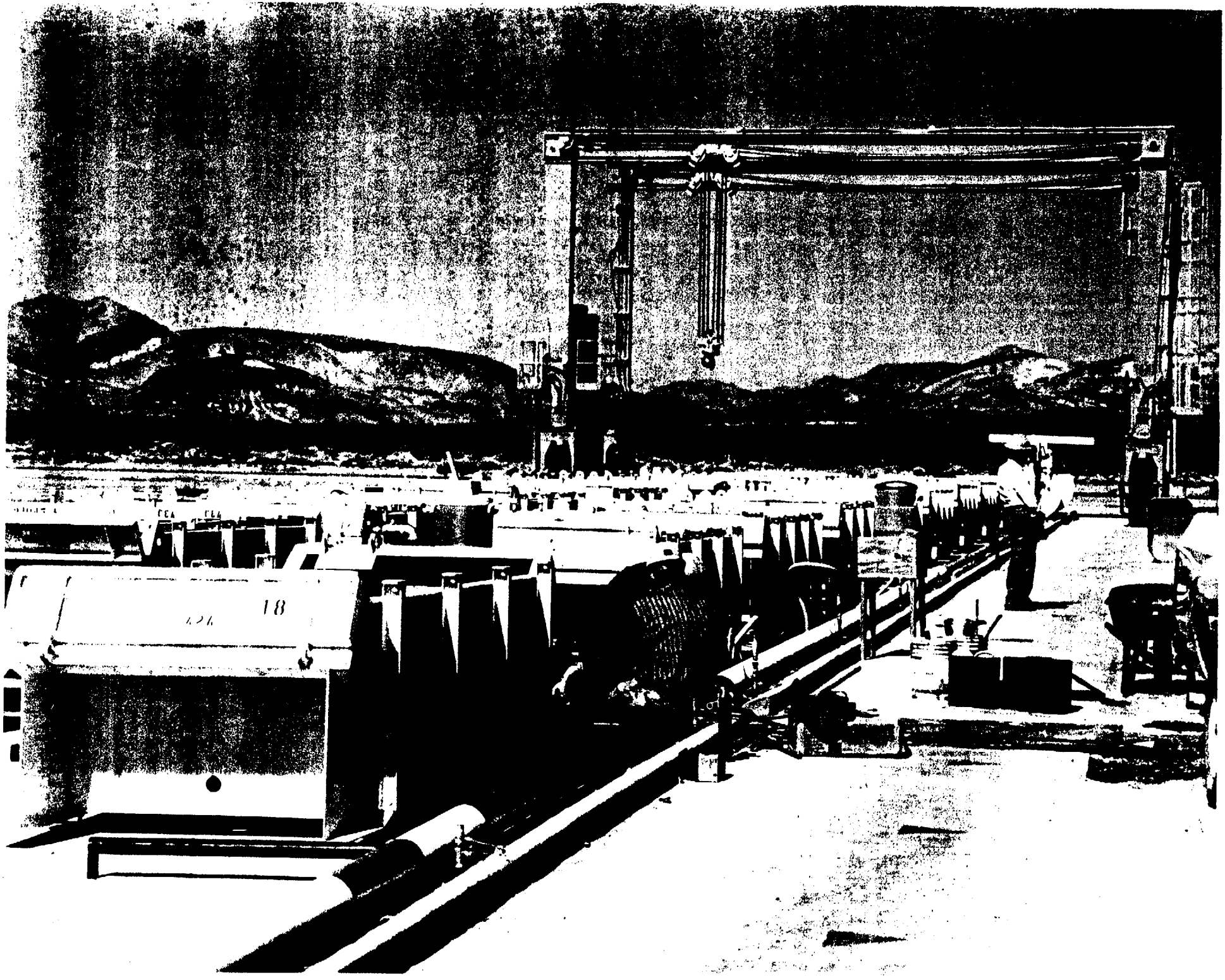












U.S. DEPARTMENT OF ENERGY

OCRWM

YUCCA MOUNTAIN

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

DOE-NRC TECHNICAL MEETING ON THE EXPLORATORY STUDIES FACILITY

MANAGEMENT PLAN FOR RESOLVING QA ISSUES RESULTING FROM M&O AND DOE AUDITS/ SURVEILLANCES

PRESENTED BY

ALDEN M. SEGREST

CRWMS/M&O

NOVEMBER 7, 1994
LAS VEGAS, NV

Attachment 3

OVERVIEW

- Need for plan
  - 11 CARs issued during OQA Conformance Based Audit
  - 12 CARs issued during M&O Surveillance
  - 15 CARs issued during OQA Performance Based Audit
  - M&O Management pulled Design Package 2C from DOE Acceptance Review
  - Management developed a plan to assure compliance with QA Program

OVERVIEW

- Plan implemented in three parts
  - QA portion of Package 2C required for Phase 1 of TBM operation (first 40 feet)
  - Remainder of QA portion and non-QA portions of Package 2C
  - All other design products

SUMMARY OF PLAN

- Section 1 - CAR Analysis
  - Analyze and develop corrective action
    - Total CARs analyzed - 64
    - Early Package 2C CARs - 19
    - Remaining Package 2C CARs - 16
  - Coordinate resolutions with M&O QA and DOE QA
  - Implement corrective action
  - ***Results*** All corrective actions identified, approved by DOE QA, and implemented for 2C

SUMMARY OF PLAN

- **Section 2 - Items Corrected During Recent Audits/Surveillances**
  - **Analyze products for similar problems**
  - **Develop and implement corrective action**
  - ***Results*** **All appropriate corrective action completed**

SUMMARY OF PLAN

- **Section 3 - Design Process Review**
  - **Develop detailed flow chart**
  - **Analyze CARs and develop process revisions**
  - **Revise procedures, if necessary**
  - ***Results*** **Enhancements identified; Implementation not required for Package 2C as process utilized for 2C development was satisfactory**

SUMMARY OF PLAN

- **Section 4 - Classification Process Review**
  - **Develop detailed flow chart**
  - **Analyze CARs and develop process revisions**
  - **Revise procedures, if necessary**

  Results **No deficiencies identified.**

SUMMARY OF PLAN

- **Section 5 - Product Quality Review**
  - **– Internal review**
  - **– Independent review**
  - **– Consolidate results**
  - **– Implement corrective action**

  Results

  - **Internal & external reviews completed**
  - **Corrective actions applicable to Package 2C completed**

SUMMARY OF PLAN

- **Section 6 - Culture Review**
  - **Develop briefing/training**
  - **Brief/Train M&O design personnel**

  Results

  - **Not required for partial release of Package 2C (all noncompliance issues resolved)**
  - **Several meetings have been conducted to collect input from employees on problem areas and solutions, and to emphasize requirement for verbatim compliance**

SUMMARY OF PLAN

- Section 7 - Management Plan Closure
  - Document objective evidence of completion of Sections 1-6
  - Summary report

U.S. DEPARTMENT OF ENERGY

OCRWM

YUCCA MOUNTAIN

YUCCA MOUNTAIN
SITE CHARACTERIZATION
PROJECT

DOE-NRC TECHNICAL MEETING ON THE EXPLORATORY STUDIES FACILITY

ESF DESIGN
GROUND SUPPORT SYSTEMS

PRESENTED BY

JOHN H. PYE

CRWMS/M&O

NOVEMBER 7, 1994
LAS VEGAS, NV

Attachment 4

GROUND SUPPORT SYSTEMS FOR TOPOPAH SPRING (TS) NORTH RAMP

Assumptions and Criteria for Determining Part 60 Applicability

Basic Assumptions

- Portions of the ESF will eventually become part of the geologic repository
- The ESF design shall not jeopardize the integration of the ESF into geologic repository
- The four permanent items in the ESF, namely, 1) underground openings, 2) shaft liners, 3) operational seals, and 4) ground support shall be designed and constructed to be incorporated into the repository and must be designed to have a maintainable life and quality as specified for the repository

GROUND SUPPORT SYSTEMS FOR TS NORTH RAMP

(CONTINUED)

Basic Assumptions

- Any component of the ESF, or any activities relating to that component, which could have an effect on waste isolation shall be subject to the requirements of 10 CFR 60 Subpart G
- DOE is currently conducting an analysis for identifying items important to safety or waste isolation on the applicability for requirements relevant to important to safety or waste isolation
- The ESF shall be designed to accommodate the Site Characterization Program and the Performance Confirmation Program

GROUND SUPPORT SYSTEMS FOR TS NORTH RAMP

(CONTINUED)

- **Requirements, Criteria and Constraints**
  - **The ESFDR requires that the ESF underground openings that will become part of a potential repository have a maintainable life of 100 years**
  - **The primary role of ground support is to ensure safety and maintain the stability of the North Ramp during the life of the facility and potentially during the operational period of the repository**
  - **Difficulties occur in the design process, when groups of key criteria are in potential conflict and cannot easily be reconciled**

ROCK BOLT SELECTION FOR TS NORTH RAMP

Design Issues

- Personnel safety
  - A primary function of the ground support is to ensure that the TBM and alcove excavations are safely excavated and supported. This is consistent with the ESFDR and the BFD safety requirements
- Maintenance
  - A specific requirement which is relevant to the performance of the ground support is the provision of a 100 year maintainable underground structure
- Constructability
  - TBM configuration and operation

GROUND SUPPORT SYSTEMS FOR TS NORTH RAMP

- Selection criteria for ground support systems
  - Verifiable performance of the support system - personnel safety
  - Life cycle cost - minimal impact on the facility maintenance and durability of support systems
  - Constructability - support systems that can be integrated in TBM system without impacting TBM progress

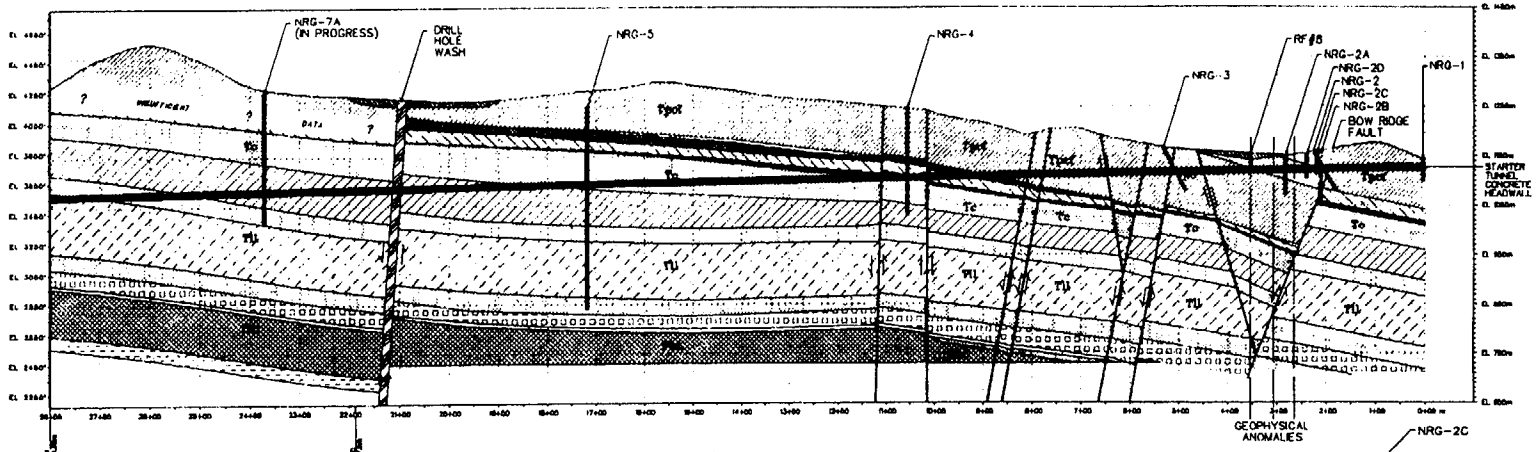
GROUND SUPPORT SYSTEMS FOR TS NORTH RAMP

(CONTINUED)

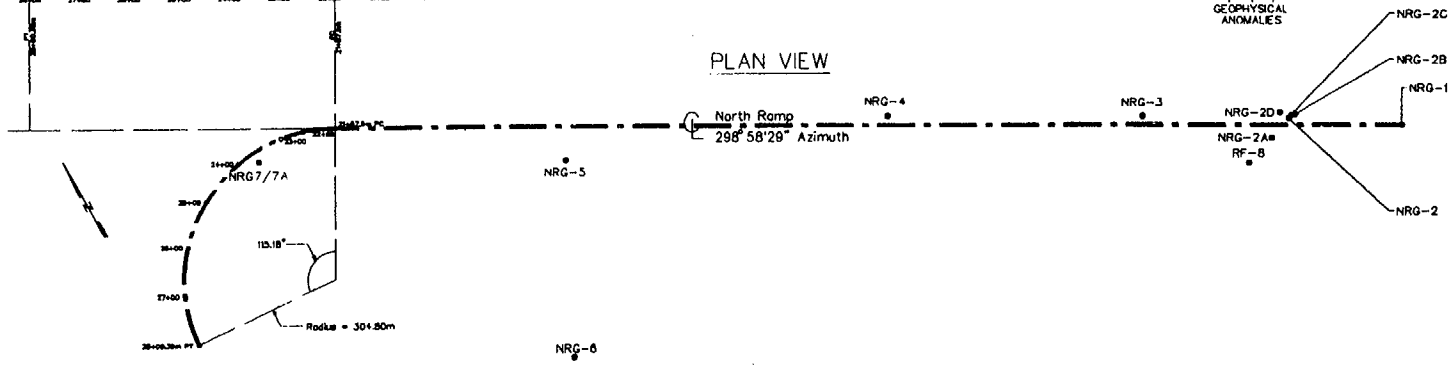
- **Empirical Design Methods**
  - **Rock Mass Quality "Q" (NGI)**
  - **Rock Mass Rating (RMR)**

    Used to determine range of anticipated tunneling conditions
  - **Rock Support Recommendations**
  - **Develop Site Specific Ground Support Categories**

SECTION VIEW



PLAN VIEW



0 100 200m
SCALE

LEGEND

FORMATION	MEMBER	MAJOR ZONES	THERMO-MECHANICAL UNITS
QUATERNARY		Qac : Alluvium	
TIMBER MOUNTAIN TUFF	RAINIER MESA	Tmrt and Tmrt: Rainier Mesa Tuff and Pre-Rainier Bedded Tuff	UD
	?	Tx and Txt: Tuff "X" Ash Flow and Bedded Tuff	
	TIVA CANYON	Tpct : Tiva Canyon Ash Flow Tuff	TCw
		Tpct: Tiva Canyon Bedded Tuff	
	YUCCA MTN.	Tpyt : Yucca Mountain Ash Flow Tuff	PTn
		Tpyt : Yucca Mountain Bedded Tuff	
	PAH CANYON	Tppt : Pah Canyon Ash Flow Tuff	
PAINTBRUSH TUFF		Tppt : Pah Canyon Bedded Tuff	TSw1
		Tc : Caprock	
		Tul : Upper Lithophysal	
		Tmn : Middle Nonlithophysal	TSw2
	TOPOPAH SPRING	Tll : Lower Lithophysal	
		Tln : Lower Nonlithophysal	
		Tv : Vitrophyre	TSw3
		Tptt : Topopah Spring Bedded Tuff	CHn1
	CALICO HILLS	Thf : Calico Hills Lava Flow	CHv2
		Tht : Calico Hills Bedded Tuff	CHv3
CRATER FLAT TUFF	PROW PASS	Tcpf : Prow Pass Ash Flow Tuff	PPu

STRATIGRAPHIC NOMENCLATURE IN DEVELOPMENT BY USGS

FAULT ZONE, ? ATTITUDE UNCERTAIN

FAULT, ?-ATTITUDE UNCERTAIN

PROPOSED NORTH RAMP ALIGNMENT

APPROXIMATE

STATE PLANE COORDINATES ALONG RAMP ALIGNMENT (m)

E171599 E171804 N234394 E171909 E172214 N234089 E172419 N233784 E172623 E172828 N233479 E173033 E173238

PRELIMINARY RAMP DATA
QA:NO

Station (m)	Grade	State Plane Coord. (m) Northing	State Plane Coord. (m) Easting	Elevation (m)
0+00 (Portal)	-2.085°	233380.0	171878.6	1122.85
21+87.5 (PC)		233338.4	171788.6	1078.78
22+00		233348.2	171788.8	1078.53
23+00		233374.7	171888.8	1077.48
24+00		233373.0	171981.0	1076.43
26+00		233337.3	172187.7	1073.38
26+00		233327.5	172288.5	1071.33
27+00		233280.2	172337.7	1068.28
28+00.38 (PT)		233082.0	172516.6	1067.22

[1] Reference Dwg. 55-N-SK026.DGN and verbal communication from M-K, December, 1993.

BOREHOLE PROJECTIONS
QA:NO

Borehole	Projected to Section along Azimuth	Ground Elevation (m)	Distance and Direction to Section (m)
NRG-1	3°	1164.08	0.0
NRG-2	3°	1167.33	18.2 SW
NRG-2A	3°	1157.31	30.85 NE
NRG-2B	3°	1138.67	24.03 SW
NRG-2C	3°	1168.88	33.34 SW
NRG-2D	3°	1160.83	28.88 SW
NRG-3	3°	1168.38	30.5 SW
NRG-4	3°	1169.85	18.52 SW
NRG-5	3°	1181.71	88.44 NE
NRG-7A	340°	1182.28	23.66 NW
RF#8	3°	1184.88	88.03 NE

Note: Boreholes projected into cross section along strike of rock units

REV. NO.	DATE	BY	VERSION	SUPERCODES
4	3-28-1994	CEB	QA:I4	QA:I3
3	2-8-1994	CEB	QA:I3	QA:I2
2	2-1-1994	CEB	QA:I2	QA:I1
1	1-18-1994	CEB	QA:I1	QA:

REVISIONS

QA:QA

ESF NORTH RAMP YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT CROSS SECTION ALONG RAMP FROM 0+00 to 28+00.38m (PT)

Sandia National Laboratories

BASE DRAWING: USGS[1] 11-8-93
MODIFICATIONS: CEB 1-3-94
CHECKED BY: MPH/ML

HOR. SCALE: AS SHOWN
VERT. SCALE: AS SHOWN

[1] 2-D MODEL OF NORTH RAMP, LETTER FROM R. HAYES (USGS) TO J. RUSSELL DYER (USGS) NOVEMBER 8, 1993 (QA:NO)

A.P.T. MINING & ASSOC., INC. BOULDER JUNCTION, COLORADO, USA

DRAWING NO: SB-80
VERSION: QA:I4
SHEET 1 OF 1

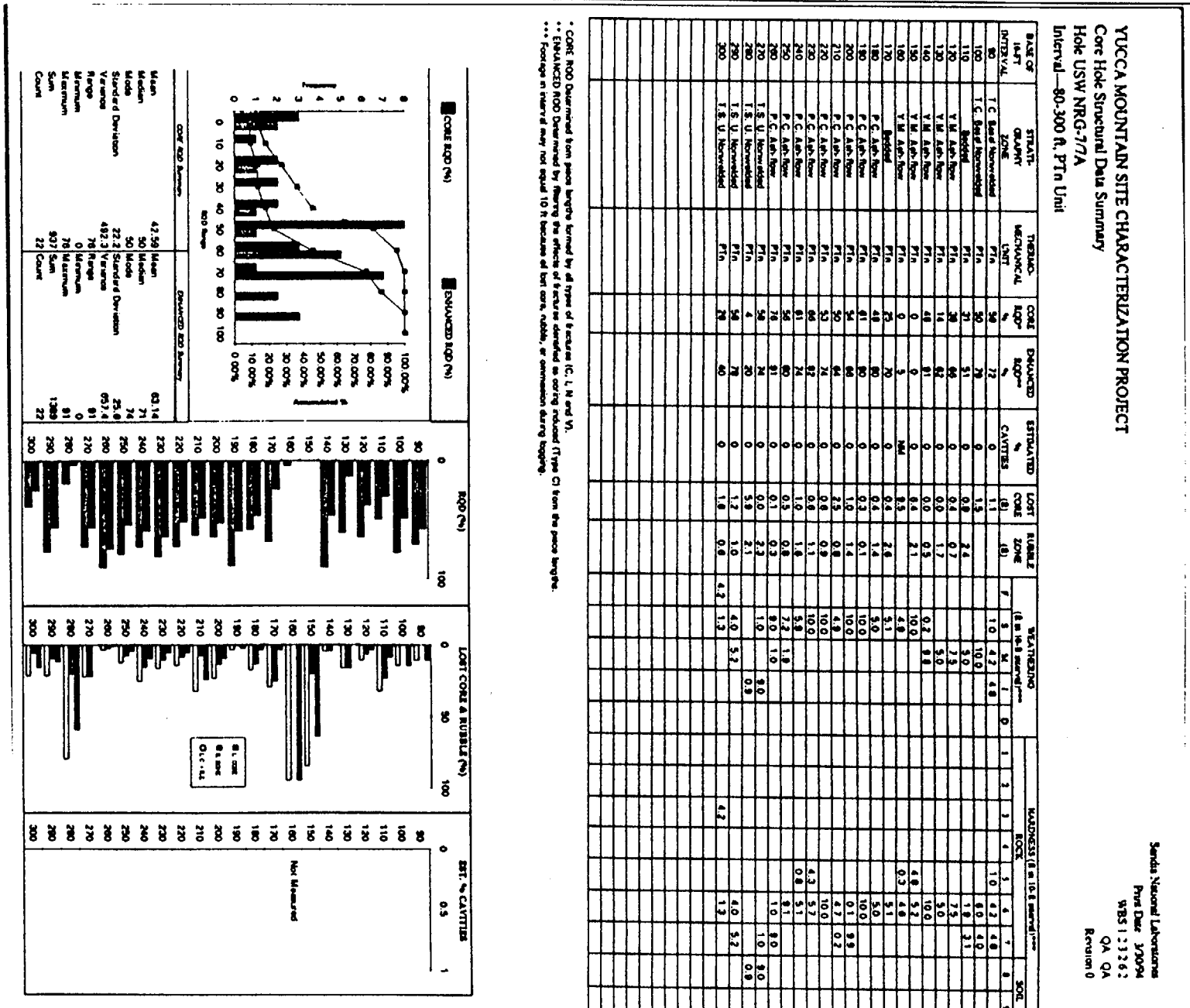
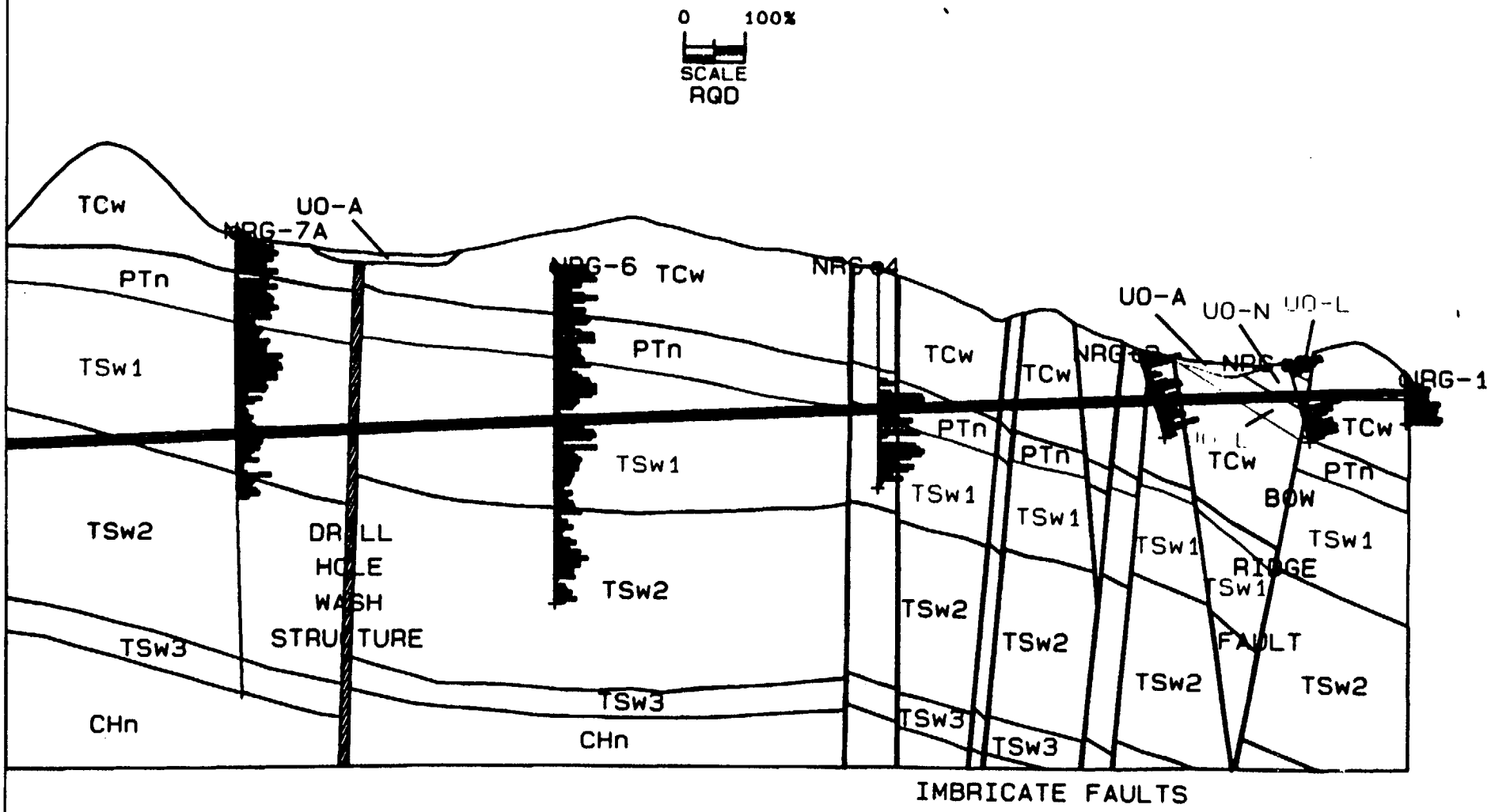


Figure 2. Example of Rock Structure Summary Log

ESF NORTH RAMP CROSS SECTION

LYNX THERMAL/MECHANICAL MODEL (G.N1, M.N1)
ENHANCED ROCK QUALITY DESIGNATION (Erqd) - 1mm = 10%



MGO 04/06/94 rs1

Table 2. Detailed Distances and Volumes for Thermal/Mechanical Units Encountered Along the ESF North Ramp Tunnel

FAULT BLOCK**	THERMAL/MECHANICAL UNIT OR STRUCTURE	START STA. (m)	CALC. TUNNEL DIST. (m)	ESTIMATED VOLUME (m^3)
A	TCw	0+60	136.58	6,228.5
	Bow Ridge Fault			
B	UO-N (nonlithified)	1+97	52.99	2,416.5
	UO-L (lithified)	2+50	91.94	4,193.0
	TCw	3+42	107.88	4,919.5
	Imbricate fault			
C	TCw	4+49	67.36	3,072.0
	Imbricate fault			
D	TCw	5+17	56.80	2,590.5
	Imbricate fault			
E	TCw	5+74	71.87	3,277.5
	Imbricate fault			
F	TCw	6+45	130.55	5,953.5
	Imbricate fault			
G	TCw	7+76	30.29	1,381.5
	Imbricate fault			
H	TCw	8+06	75.88	3,460.5
	PTn	8+82	128.84	5,875.5
	Imbricate fault			
I	PTn	10+11	47.02	2,144.5
	TSw1	10+58	47.78	2,179.0
	Imbricate fault			
J	PTn	*11+06	0.00	3.0
	TSw1	11+06	996.11	45,426.5
	Drill Hole Wash Structure			
K	TSw1	21+02	465.57	21,231.5
	TSw2	25+67	229.81	10,480.0
	End of North Ramp Design Pkg 2C	28+00.182	62.83	
			TOTAL VOLUME (m^3)	124,833.0

Notes: * At station 11+06 m, unit PTN occurs only in the crown of the excavation.
** Fault blocks are identified in Figure 4.

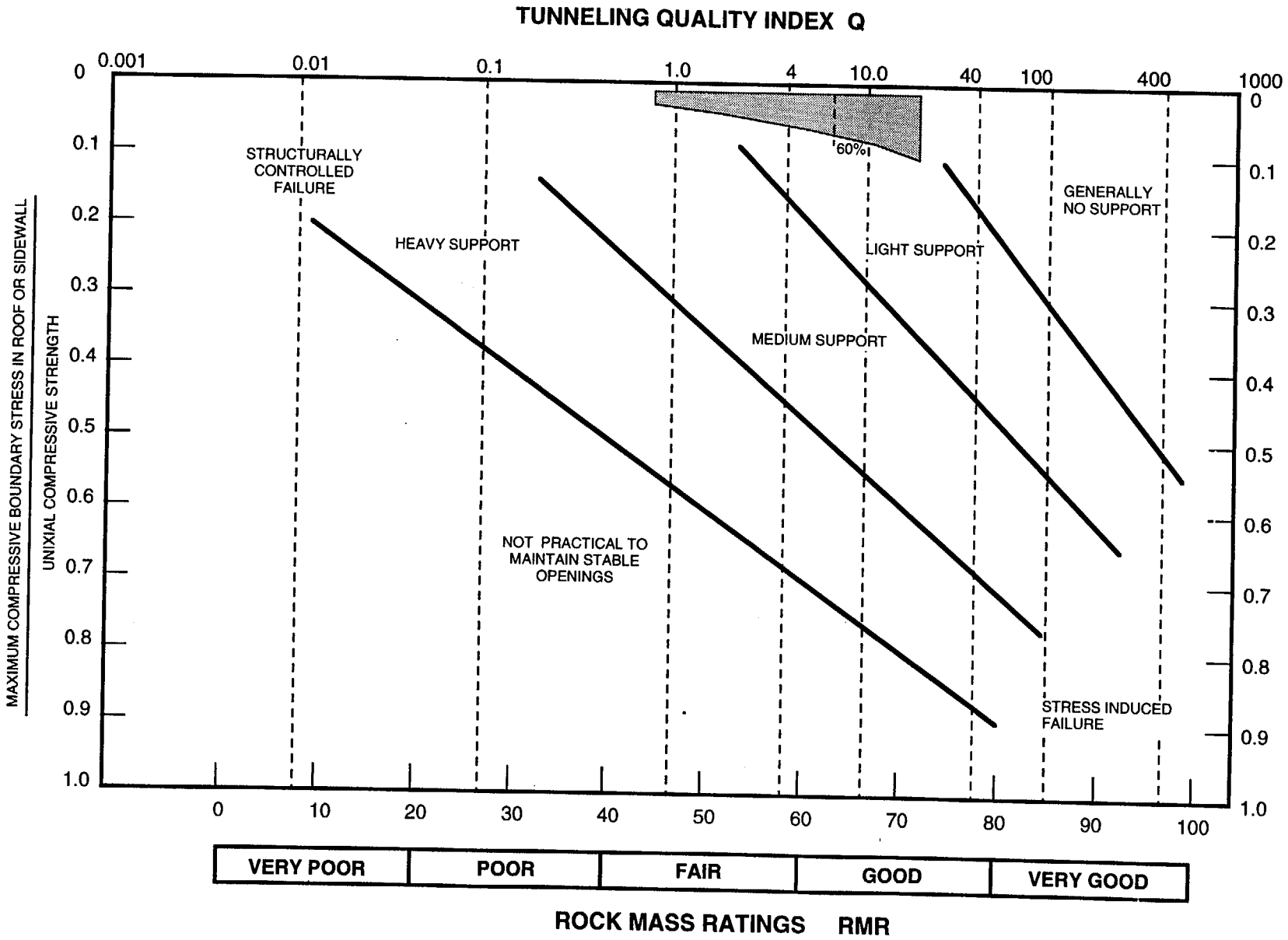


Figure 8. Projected Range of Support for TCw

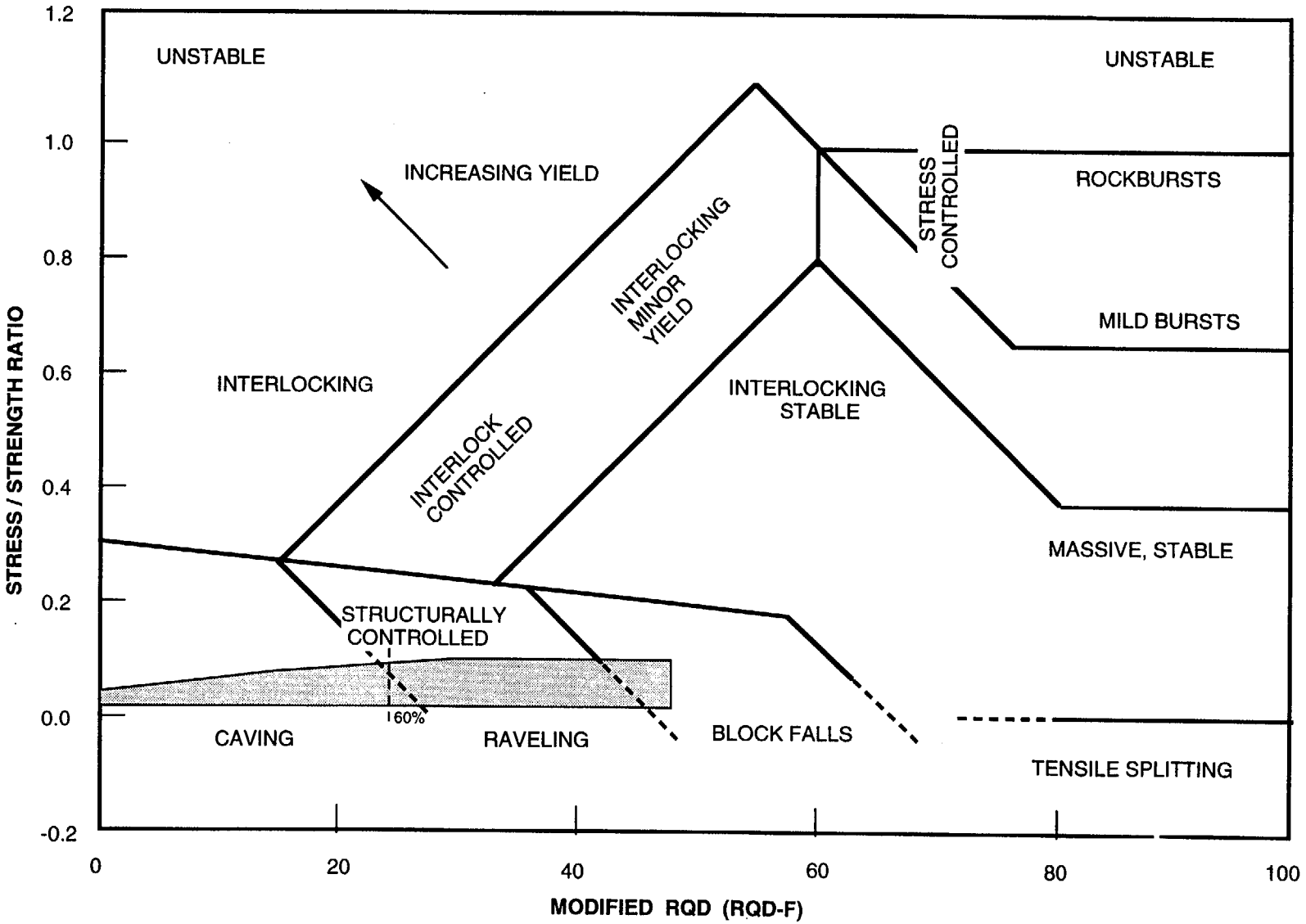


Figure 12. Projected Failure Modes for TCw

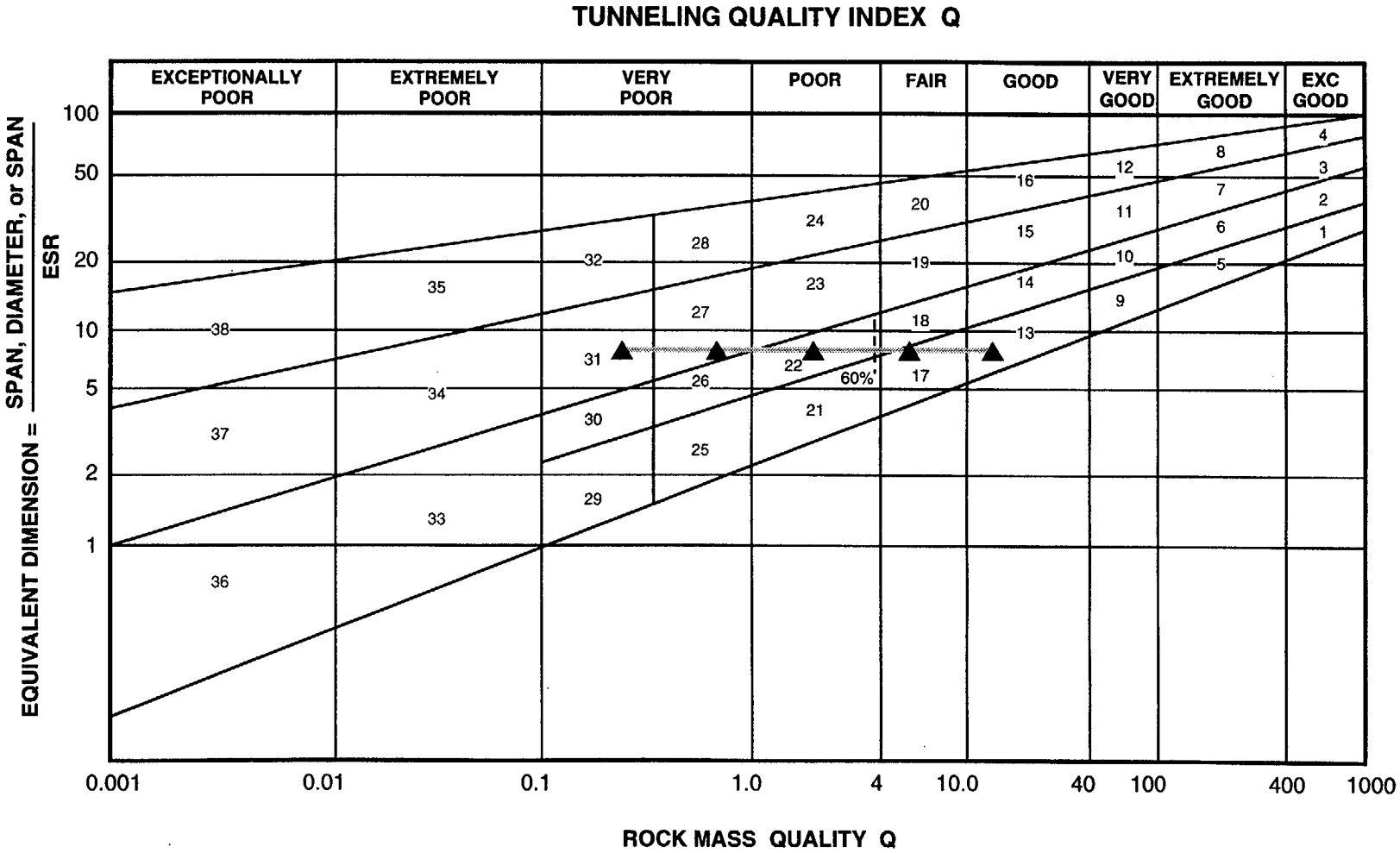


Figure 16. Projected Range of Ground Support for TCw

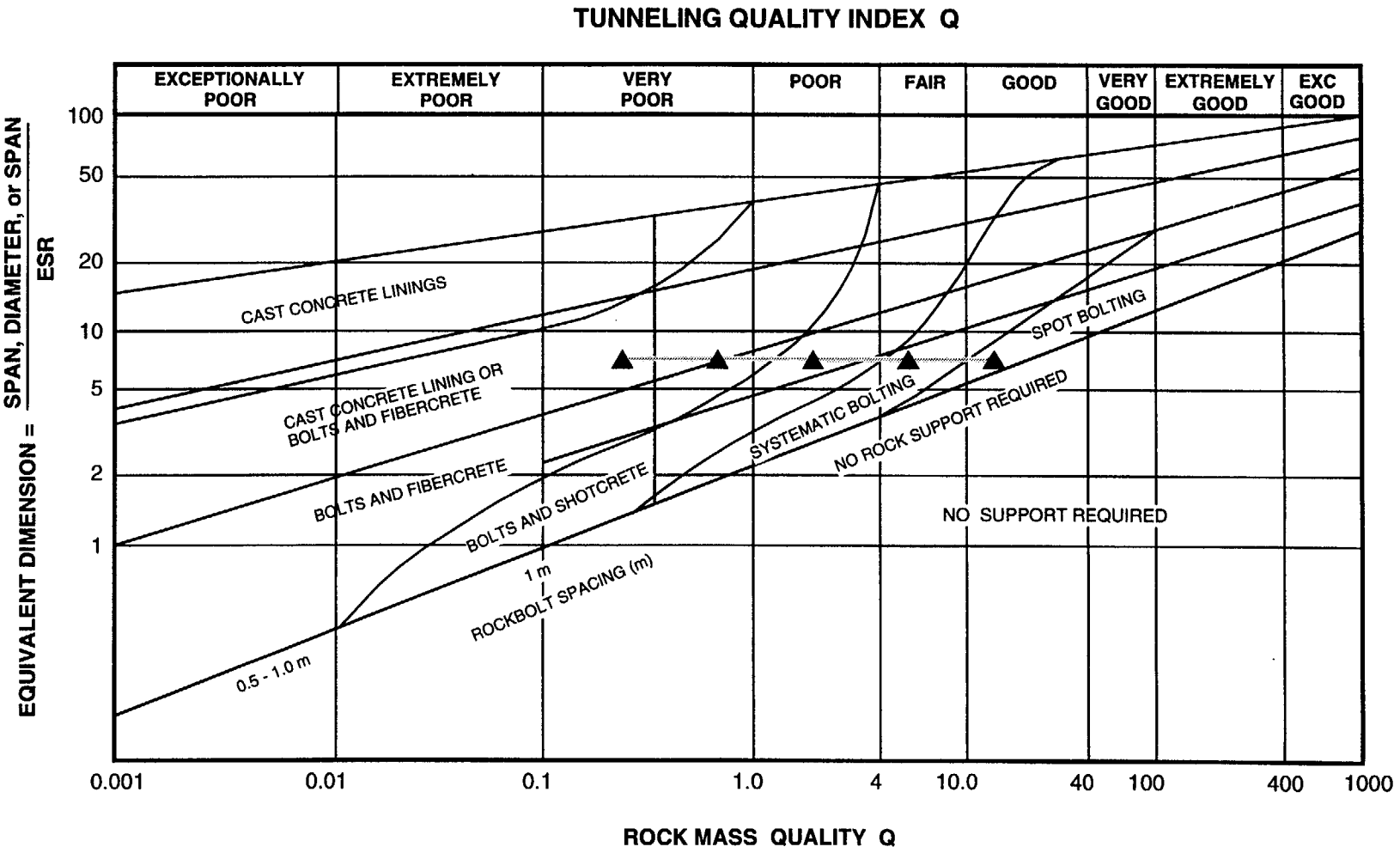


Figure 17. Projected Categories of Ground Support for TCw

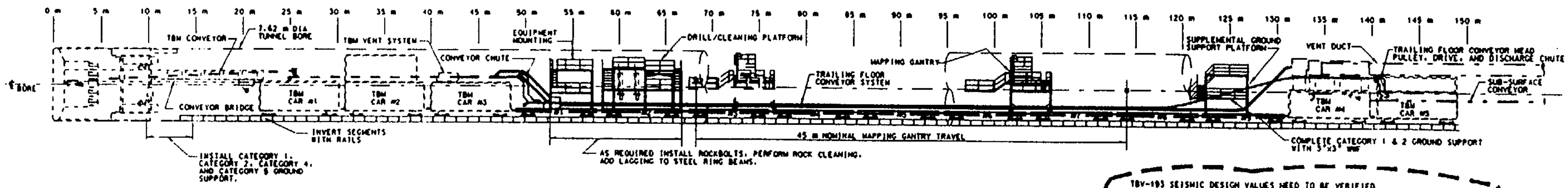
Table 3. Comparison of Q values at 60% frequency of occurrence and minimum Q for ground support design for all NRG data

T-M Unit	Q Value @ 60% frequency of occurrence	Approximate minimum Q value for ground support class	Approximate frequency of occurrence at minimum Q
TCw	3.8	1.0	26%
PTn	18.0	10.0	48%
TSw1	3.5	1.0	21%
TSw2	2.4	1.0	27%

ROCK MASS QUALITY "Q" - SUPPORT INSTALLATION CRITERIA						ESF NORTH RAMP - GROUND SUPPORT RECOMMENDATIONS
	Rock Support Category	RQD Jn	Jr Ja	Span ESR	Type of Support	
Q 10 - 30 GOOD	13	≥10	≥1.5	-	sb(utg)	Category 1 Ground Support (Refer to Drawing 40152) Rock bolt spacing as shown on Drawing, 3000 length, pins and WWF
		≥10	<1.5	-	B(utg)1.5 - 2 m	
		<10	≥1.5	-	B(utg)1.5 - 2 m	Category 1 Ground Support (Refer to Drawing 40152) Rock bolt spacing as shown on Drawing, 3000 length Install pins and WWF Supplement with spot bolting.
		<10	<1.5	-	B(utg)1.5 - 2 m + S 2 - 3 cm	
Q 5.5 - 10 FAIR	Rock Support Category	RQD Jn	Jr Ja	Span ESR	Type of Support	Category 1 Ground Support (Refer to Drawing 40152) Rock bolt spacing as shown on Drawing, 3000 length Install pins and WWF Supplement with spot bolting. up to Category 2 bolt density.
	17	>30	-		sb(utg)	
		≥10	-	-	B(utg)1 - 1.5 m	
		≤30	-	≥6m	B(utg)1 - 1.5 m + S 2 - 3 cm	Category 3 Ground Support (Refer to Drawing 40154) Initiated with Category rockbolt spacing, 3000 length. Supplement with spot bolting up to Category 2 bolt density Omit the installation of pins and 3" x 3"WWF Apply 50-75 shotcrete to tunnel profile. 100-150 in localized spalling and fallout
		<10	-	<6m	S 2 - 3 cm	
Q 4.0 - 5.5 FAIR	Rock Support Category	RQD Jn	Jr Ja	Span ESR	Type of Support	Category 1 Ground Support (Refer to Drawing 40152) Rock bolt spacing as shown on Drawing, 3000 length Install pins and WWF Supplement with spot bolting. up to Category 2 bolt density.
	18*	>5	-	≥10m	B(utg)1 - 1.5 m + clm	
		>5	-	<10m	B(utg)1 - 1.5 m + clm	
		≤5	-	≥10m	B(utg)1 - 1.5 m + S 2 - 3 cm	Category 3 Ground Support (Refer to Drawing 40154) Initiated with Category rockbolt spacing, 3000 length. Supplement with spot bolting up to Category 2 bolt density Omit the installation of pins and 3" x 3"WWF Apply 50-75 shotcrete to tunnel profile. 100-150 in localized spalling and fallout
		≤5	-	<10m	B(utg)1 - 1.5 m + S 2 - 3 cm	
Q 1.0 - 4.0 POOR	Rock Support Category	RQD Jn	Jr Ja	Span ESR	Type of Support	Category 2 Ground Support (Refer to Drawing 40153) Initiated with Category 2 rockbolt spacing, 3000 length Install pins and WWF
	22	>10	>1.0	-	B(utg)1 m + clm	
		<30	>1.0	-	B(utg)1 m + clm	
		≤10	≤1.0	-	S 2.5 - 7.5 cm	Category 3 Ground Support (Refer to Drawing 40154) Initiated with Category rockbolt spacing, 3000 length. Supplement with spot bolting up to Category 2 bolt density Omit the installation of pins and 3" x 3"WWF Apply 50-75 shotcrete to tunnel profile. 100-150 in localized spalling and fallout
		<30	≤1.0	-	B(utg) 1 m + S 2.5 - 5.0 cm	
		≥30		-	B(utg)1 m	
Q 0.4 - 1.0 VERY POOR	Rock Support Category	RQD Jn	Jr Ja	Span ESR	Type of Support	Category 3 Ground Support (Refer to Drawing 40154) Initiated with Category rockbolt spacing, 3000 length. Supplement with spot bolting up to Category 2 bolt density Omit the installation of pins and 3" x 3"WWF Apply 50-75 shotcrete to tunnel profile. 100-150 in localized spalling and fallout
	27	-	-	≥12 m	B(tg)1 m +S(mr) 7.5 - 10.0 cm	
		-	-	<12 m	B(utg)1 m +S(mr) 5.0 - 7.5 cm	
		-	-	>12 m	CCA 20 - 40 cm + B(tg)1 m	
		-	-	<12 m	S(mr)10 - 20 cm + B(tg)1 m	
Q 0.1 - 0.4 VERY POOR	Rock Support Category	RQD Jn	Jr Ja	Span ESR	Type of Support	Category 3 Ground Support (Refer to Drawing 40154) Initiated with Category rockbolt spacing, 3000 length. Supplement with spot bolting up to Category 2 bolt density Omit the installation of pins and 3" x 3"WWF Apply 50-75 shotcrete to tunnel profile. 100-150 in localized spalling and fallout
	31	>4	-	-	B(tg)1 m + S(mr) 5.0 - 12.5 cm	
		≤4,≥1.5	-	-	S(mr) 7.5 - 25cm	
		<1.5	-	-	CCA 20 - 40cm +B(tg)1 m	Category 4 (Refer to Drawing 40155) Install W8 x 31 steel sets 1220 OC with partial or full lagging
		-	-	-	CCA(mr)30 - 50cm + B(tg)1 m	
Q 0.08 - 0.1 EXTREMELY POOR	Rock Support Category	RQD Jn	Jr Ja	Span ESR	Type of Support	Category 3 Ground Support (Refer to Drawing 40154) Initiated with Category rockbolt spacing, 3000 length. Supplement with spot bolting up to Category 2 bolt density Omit the installation of pins and 3" x 3"WWF Apply 50-75 shotcrete to tunnel profile. 100-150 in localized spalling and fallout
	34	≥2	≥0.25	-	B(tg)1m + S(mr) 5.0 - 7.5 cm	
		<2	>0.25	-	S(mr)7.5 - 15 cm	
		-	<0.25	-	S(mr) 15 - 25 cm + B(tg)1m	Category 5 Ground Support (Refer to Drawing 40156) Instal W8 x 31 steel sets. 600 - 1220 OC with full lagging

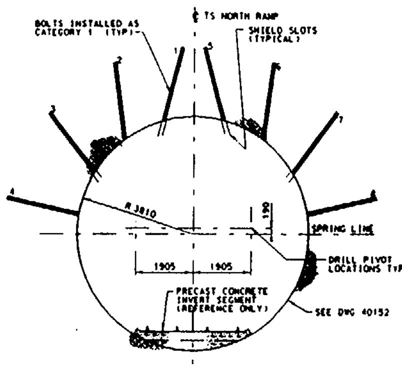
Figure 24. Site-Specific Ground Support Categories

PRELIMINARY

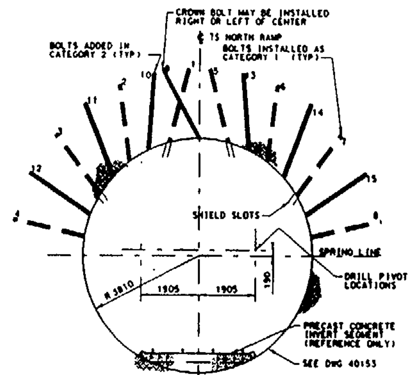


ELEVATION
SCALE: NONE
(FOR REFERENCE ONLY)

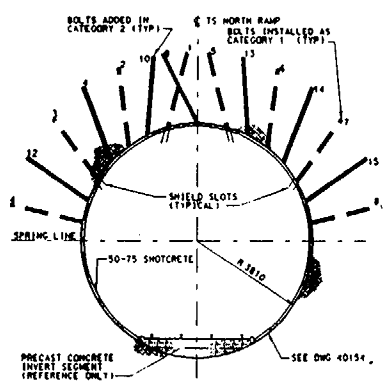
TBV-193 SEISMIC DESIGN VALUES NEED TO BE VERIFIED
TBV-194 ROCK MASS PROPERTIES AT RAINIER MESA UNIT NEED TO BE VERIFIED



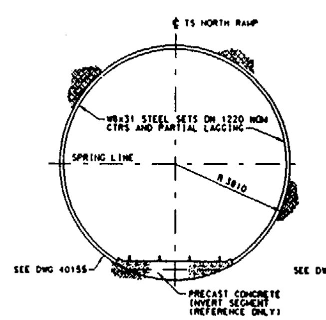
CATEGORY 1 GROUND SUPPORT
SCALE: 1:75



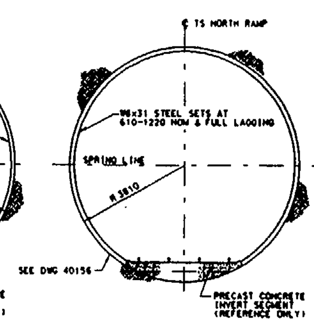
CATEGORY 2 GROUND SUPPORT
SCALE: 1:75



CATEGORY 3 GROUND SUPPORT
SCALE: 1:75



CATEGORY 4 GROUND SUPPORT
SCALE: 1:75



CATEGORY 5 GROUND SUPPORT
SCALE: 1:75

GRAPHIC SCALE
1:75

M&O ACCEPTANCE FOR CONSTRUCTION
By________ Date________

ALL DIMENSIONS ARE SHOWN IN MILLIMETERS UNLESS OTHERWISE NOTED

ESF TS NORTH RAMP GROUND SUPPORT GUIDELINES

Q	CONDITIONAL FACTORS (RQD/Jn; Jr/Ja)	GROUND SUPPORT CATEGORIES
Q 10-30 GOOD	RQD/Jn ≥10, ≥10; Jr/Ja ≥1.5, <1.5	CATEGORY 1 GROUND SUPPORT (REFER TO DRAWING 40152) ROCKBOLTS SPACING AS SHOWN ON DRAWING. 3000 LENGTH, PINS AND WWF.
	RQD/Jn <10, <10; Jr/Ja ≥1.5, <1.5	CATEGORY 1 GROUND SUPPORT (REFER TO DRAWING 40152) ROCKBOLTS SPACING AS SHOWN ON DRAWING. 3000 LENGTH. INSTALL PINS AND WWF. SUPPLEMENT WITH SPOT BOLTING.
Q 5.5-10 FAIR	RQD/Jn ≥30, ≥10; Jr/Ja -, -	CATEGORY 1 GROUND SUPPORT (REFER TO DRAWING 40152) ROCKBOLTS SPACING AS SHOWN ON DRAWING. 3000 LENGTH. INSTALL PINS AND WWF. SUPPLEMENT WITH SPOT BOLTING UP TO CATEGORY 2 BOLT DENSITY.
	RQD/Jn ≤30, <10; Jr/Ja -	CATEGORY 3 GROUND SUPPORT (REFER TO DRAWING 40154) INITIATED WITH CATEGORY 1 ROCKBOLTS SPACING. 3000 LENGTH. SUPPLEMENT WITH SPOT BOLTING UP TO CATEGORY 2 BOLT DENSITY. OMIT THE INSTALLATION OF PINS AND 3" x 3" WWF. APPLY 50-75 SHOTCRETE TO TUNNEL PROFILE. 100-150 IN LOCALIZED SPALLING & FALLOUT
Q 4.0-5.5 FAIR	RQD/Jn >5, >5; Jr/Ja -, -	CATEGORY 1 GROUND SUPPORT (REFER TO DRAWING 40152) ROCKBOLTS SPACING 1500 x 1500 SPACING. 3000 LENGTH. AND WWF. SUPPLEMENT WITH SPOT BOLTING UP TO CATEGORY 2 BOLT DENSITY
	RQD/Jn ≤5, ≤5; Jr/Ja -, -	CATEGORY 3 GROUND SUPPORT (REFER TO DRAWING 40154) INITIATED WITH CATEGORY 1 ROCKBOLTS SPACING. 3000 LENGTH. SUPPLEMENT WITH SPOT BOLTING UP TO CATEGORY 2 BOLT DENSITY. OMIT THE INSTALLATION OF PINS AND 3" x 3" WWF. APPLY 50-75 SHOTCRETE TO TUNNEL PROFILE. 100-150 IN LOCALIZED SPALLING & FALLOUT
Q 1.0-4.0 POOR	RQD/Jn >10, <30; Jr/Ja >1.0, >1.0	CATEGORY 2 GROUND SUPPORT (REFER TO DRAWING 40153) INITIATED WITH CATEGORY 2 ROCKBOLTS SPACING. 3000 LENGTH. INSTALL PINS AND WWF.
	RQD/Jn ≤10, <30, ≥30; Jr/Ja >1.0, ≤1.0	CATEGORY 3 GROUND SUPPORT (REFER TO DRAWING 40154) INITIATED WITH CATEGORY 2 ROCKBOLTS SPACING. 3000 LENGTH. OMIT THE INSTALLATION OF PINS AND 3" x3" WWF. APPLY 50-75 SHOTCRETE TO TUNNEL PROFILE. 100-150 IN LOCALIZED SPALLING & FALLOUT
Q 0.4-1.00 VERY POOR	RQD/Jn -; Jr/Ja -	CATEGORY 3 GROUND SUPPORT (REFER TO DRAWING 40154) INITIATED WITH CATEGORY 2 ROCKBOLTS SPACING. 3000 LENGTH. OMIT THE INSTALLATION OF PINS AND 3"x 3" WWF. APPLY 50-75 SHOTCRETE TO TUNNEL PROFILE. 100-150 IN LOCALIZED SPALLING & FALLOUT.
Q 0.1-0.4 VERY POOR	RQD/Jn >4, ≤4, ≥1.5; Jr/Ja -, -	CATEGORY 3 GROUND SUPPORT (REFER TO DRAWING 40154) INITIATED WITH CATEGORY 2 ROCKBOLTS SPACING. 3000 LENGTH. OMIT THE INSTALLATION OF PINS AND 3" x 3" WWF. APPLY 50-75 SHOTCRETE TO TUNNEL PROFILE. 100-150 IN LOCALIZED SPALLING & FALLOUT
	RQD/Jn <1.5, -; Jr/Ja -, -	CATEGORY 4 (REFER TO DRAWING 40155) INSTALL W8x31 STEEL SETS 1220 OC WITH PARTIAL OR FULL LAGGING.
Q 0.08-0.1 EXTREMELY POOR	RQD/Jn ≥2; Jr/Ja ≥0.25	CATEGORY 3 GROUND SUPPORT (REFER TO DRAWING 40154) INITIATED WITH CATEGORY 2 ROCKBOLTS SPACING. 3000 LENGTH. OMIT THE INSTALLATION OF PINS AND 3" x3" WWF. APPLY 50-75 SHOTCRETE TO TUNNEL PROFILE. 100-150 IN LOCALIZED SPALLING & FALLOUT.
	RQD/Jn <2, -; Jr/Ja ≥0.25, <0.25	CATEGORY 5 (REFER TO DRAWING 40156) INSTALL W8x31 STEEL SETS, 400-1220 WITH PARTIAL OR FULL LAGGING.

TSw1, TSw2, PTn, TCw, PRE-RAINIER MESA, BOW RIDGE

FOR DRAWING INDEX SEE DRAWING 39002

NOTES:

1. THE ESF NORTH RAMP GROUND SUPPORT GUIDELINES ARE ESTIMATES BASED UPON PROJECTED INFORMATION AND APPLY TO THE EXPECTED "NORMAL" CONDITIONS. THE DECISION ON SUPPORT CATEGORY INSTALLED SHALL BE BASED UPON OBSERVATION OF ACTUAL CONDITIONS, INCLUDING LOCAL "OFF NORMAL" OR "ANOMALOUS CONDITIONS," AND MAY VARY FROM THE SUPPORT GUIDELINES. SEE SPECIFICATION BAB000000-01717-6300-01501.
2. ELEVATION ILLUSTRATING CONSTRUCTION IS FOR GENERAL INFORMATION ONLY SEE OTHER DRAWINGS FOR INDIVIDUAL GROUND SUPPORT CATEGORIES AND DETAILS. ACTUAL CONSTRUCTION SEQUENCE MAY BE ADJUSTED, AS APPROVED TO MEET FIELD CONDITIONS.

DESIGN INPUTS

ESF BFD DOCUMENT NO. BAB000000-01717-6300-00002 SECTION 7.5.1.2

TS NORTH RAMP ROCK MASS CLASSIFICATION BABEA0000-01717-0200-00005

TS NORTH RAMP STABILITY ANALYSIS BABEA0000-01717-0200-00004

NOTICE OF OPEN CHANGE DOCUMENTS

00 ISSUED FOR CONSTRUCTION

J M HERRERA
J W KEIFER
R SKORSETH
J TAIPALE
J WILLIS
J NAAF

U.S. DEPARTMENT OF ENERGY
Yucca Mountain Site Characterization Project
M&O Civilian Radioactive Waste Management System MANAGEMENT & OPERATING CONTRACTOR

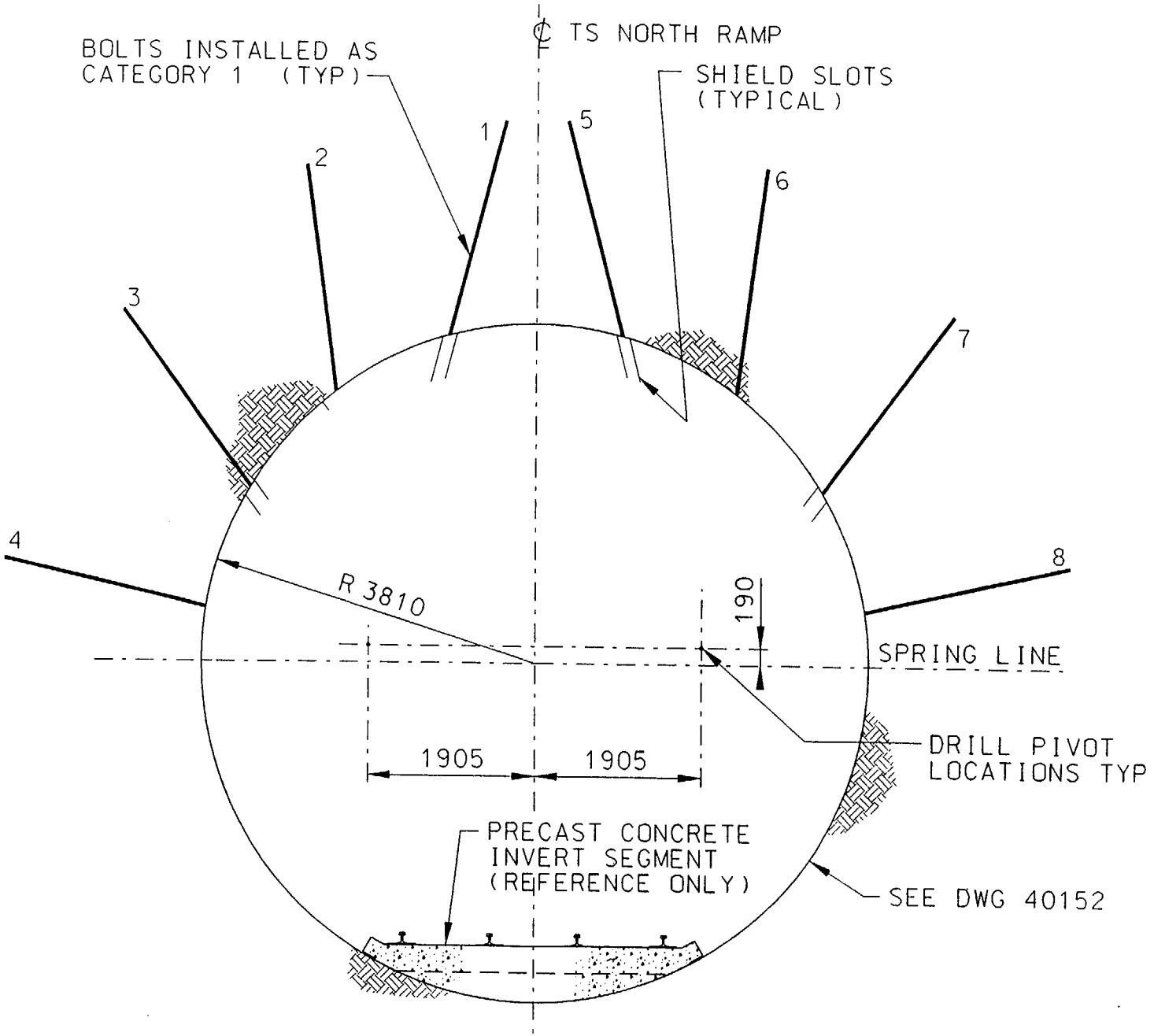
EXPLORATORY STUDIES FACILITY PACKAGE 2C
TS NORTH RAMP GROUND SUPPORT MASTER ELEVATION AND SECTIONS

SIZE D DOCUMENT IDENTIFIER: BABEA0000-01717-2100-40151-00
SCALE NOTED | QA-1.5 | 1,2,6

ESF TS NORTH RAMP GROUND SUPPORT GUIDELINES

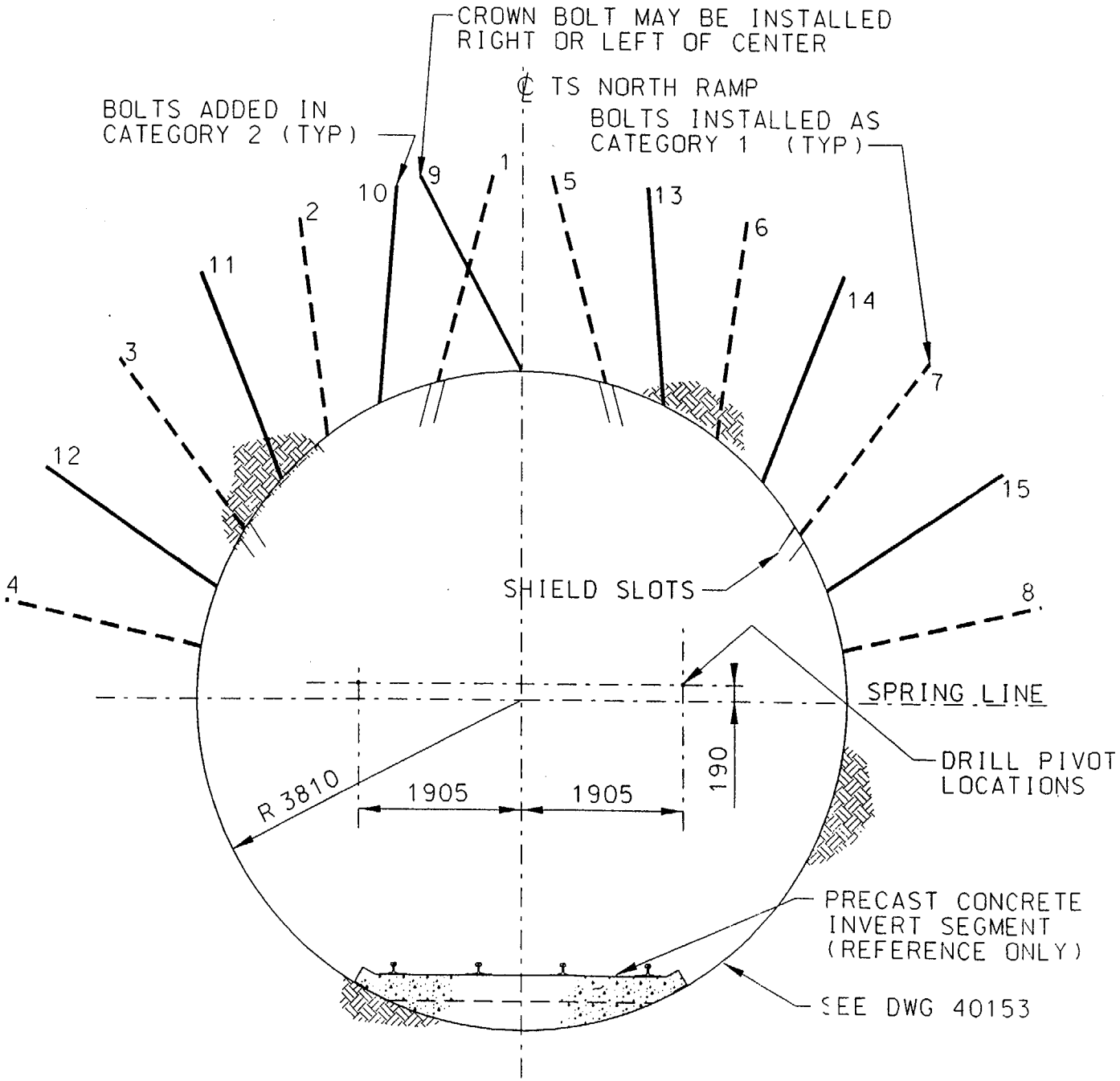
	CONDITIONAL FACTORS		GROUND SUPPORT CATEGORIES
Q 10-30 GOOD	RQD Jn	JR Ja	
	≥10	≥1.5	CATEGORY 1 GROUND SUPPORT (REFER TO DRAWING 40152) ROCKBOLTS SPACING AS SHOWN ON DRAWING. 3000 LENGTH. PINS AND WWF.
	≥10	<1.5	
	<10	≥1.5	
	<10	<1.5	CATEGORY 1 GROUND SUPPORT (REFER TO DRAWING 40152) ROCKBOLTS SPACING AS SHOWN ON DRAWING. 3000 LENGTH. INSTALL PINS AND WWF. SUPPLEMENT WITH SPOT BOLTING.
Q 5.5-10 FAIR	RQD Jn	JR Ja	
	>30	-	CATEGORY 1 GROUND SUPPORT (REFER TO DRAWING 40152) ROCKBOLTS SPACING AS SHOWN ON DRAWING. 3000 LENGTH. INSTALL PINS AND WWF. SUPPLEMENT WITH SPOT BOLTING UP TO CATEGORY 2 BOLT DENSITY.
	≥10	-	
	≤30		
	<10	-	CATEGORY 3 GROUND SUPPORT (REFER TO DRAWING 40154) INITIATED WITH CATEGORY 1 ROCKBOLTS SPACING. 3000 LENGTH. SUPPLEMENT WITH SPOT BOLTING UP TO CATEGORY 2 BOLT DENSITY. OMIT THE INSTALLATION OF PINS AND 3" x 3" WWF. APPLY 50-75 SHOTCRETE TO TUNNEL PROFILE. 100-150 IN LOCALIZED SPALLING & FALLOUT
Q 4.0-5.5 FAIR	RQD Jn	JR Ja	
	>5	-	CATEGORY 1 GROUND SUPPORT (REFER TO DRAWING 40152) ROCKBOLTS SPACING 1500 x 1500 SPACING. 3000 LENGTH. AND WWF. SUPPLEMENT WITH SPOT BOLTING UP TO CATEGORY 2 BOLT DENSITY
	>5	-	
	≤5	-	
	≤5	-	CATEGORY 3 GROUND SUPPORT (REFER TO DRAWING 40154) INITIATED WITH CATEGORY 1 ROCKBOLTS SPACING. 3000 LENGTH. SUPPLEMENT WITH SPOT BOLTING UP TO CATEGORY 2 BOLT DENSITY. OMIT THE INSTALLATION OF PINS AND 3" x 3" WWF. APPLY 50-75 SHOTCRETE TO TUNNEL PROFILE. 100-150 IN LOCALIZED SPALLING & FALLOUT
Q 1.0-4.0 POOR	RQD Jn	JR Ja	
	≥10	≥1.0	CATEGORY 2 GROUND SUPPORT (REFER TO DRAWING 40153) INITIATED WITH CATEGORY 2 ROCKBOLTS SPACING. 3000 LENGTH. INSTALL PINS AND WWF.
	<30	≥1.0	
	≤10	≥1.0	
	<30	≤1.0	
	≥30		CATEGORY 3 GROUND SUPPORT (REFER TO DRAWING 40154) INITIATED WITH CATEGORY 2 ROCKBOLTS SPACING. 3000 LENGTH. OMIT THE INSTALLATION OF PINS AND 3" x3" WWF. APPLY 50-75 SHOTCRETE TO TUNNEL PROFILE. 100-150 IN LOCALIZED SPALLING & FALLOUT
Q 0.4-1.0 VERY POOR	RQD Jn	JR Ja	
	-	-	CATEGORY 3 GROUND SUPPORT (REFER TO DRAWING 40154) INITIATED WITH CATEGORY 2 ROCKBOLTS SPACING. 3000 LENGTH. OMIT THE INSTALLATION OF PINS AND 3"x 3" WWF. APPLY 50-75 SHOTCRETE TO TUNNEL PROFILE. 100-150 IN LOCALIZED SPALLING & FALLOUT.
Q 0.1-0.4 VERY POOR	RQD Jn	JR Ja	
	>4	-	CATEGORY 3 GROUND SUPPORT (REFER TO DRAWING 40154) INITIATED WITH CATEGORY 2 ROCKBOLTS SPACING. 3000 LENGTH. OMIT THE INSTALLATION OF PINS AND 3" x 3" WWF. APPLY 50-75 SHOTCRETE TO TUNNEL PROFILE. 100-150 IN LOCALIZED SPALLING & FALLOUT
	≤4.21.5	-	
	<1.5	-	
	-	-	CATEGORY 4 (REFER TO DRAWING 40155) INSTALL W8x31 STEEL SETS 1220 OC WITH PARTIAL OR FULL LAGGING.
Q 0.08-0.1 EXTREMELY POOR	RQD Jn	JR Ja	
	≥2	>0.25	CATEGORY 3 GROUND SUPPORT (REFER TO DRAWING 40154) INITIATED WITH CATEGORY 2 ROCKBOLTS SPACING. 3000 LENGTH. OMIT THE INSTALLATION OF PINS AND 3" x3" WWF. APPLY 50-75 SHOTCRETE TO TUNNEL PROFILE. 100-150 IN LOCALIZED SPALLING & FALLOUT.
	<2	>0.25	
	-	<0.25	
			CATEGORY 5 (REFER TO DRAWING 40156) INSTALL W8x31 STEEL SETS. 600-1220 WITH PARTIAL OR FULL LAGGING.

TSw1
TSw2
PTn
TCw
PRE-RAINIER MESA
BOW RIDGE



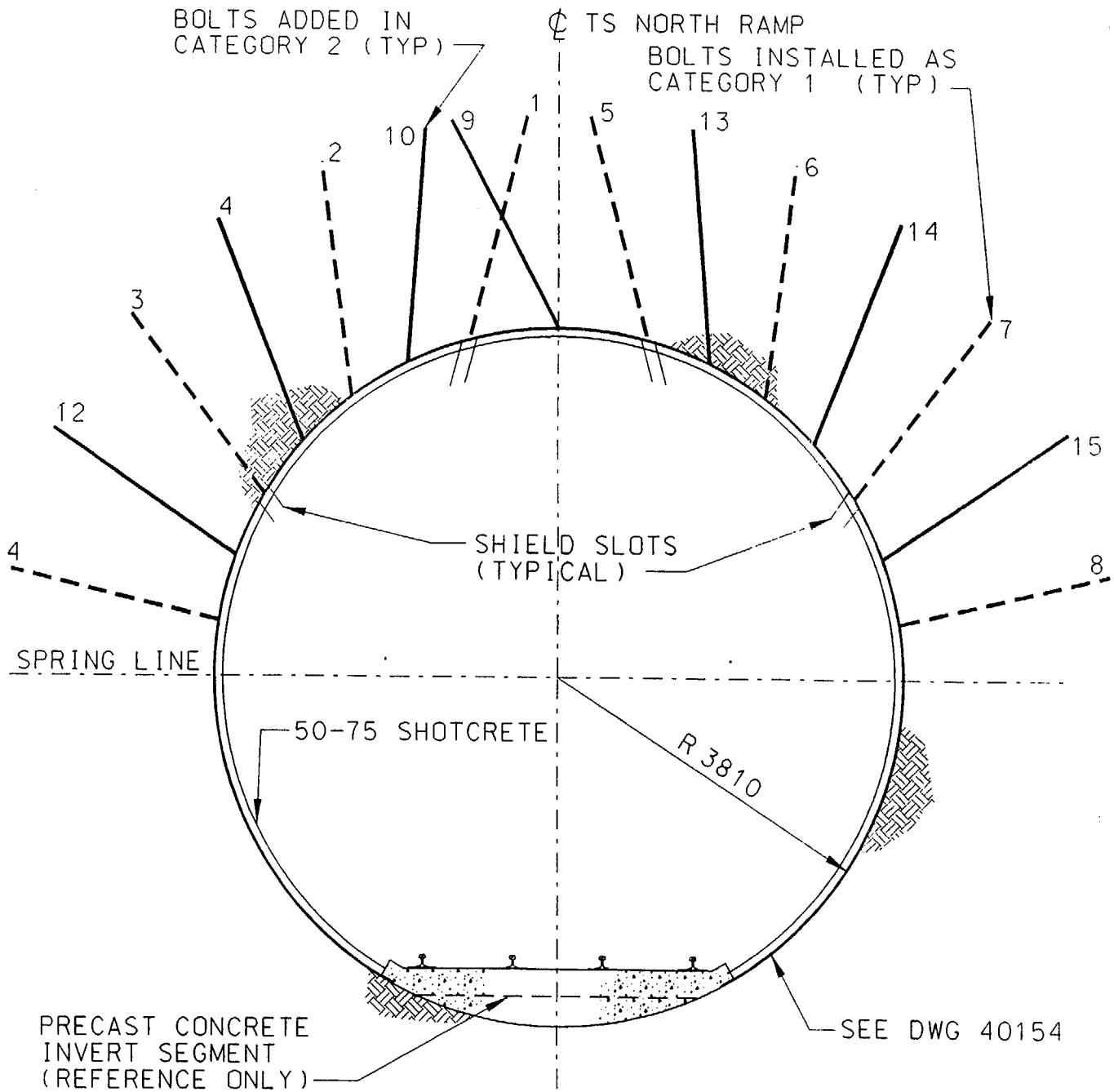
CATEGORY 1 GROUND SUPPORT

SCALE: 1:75



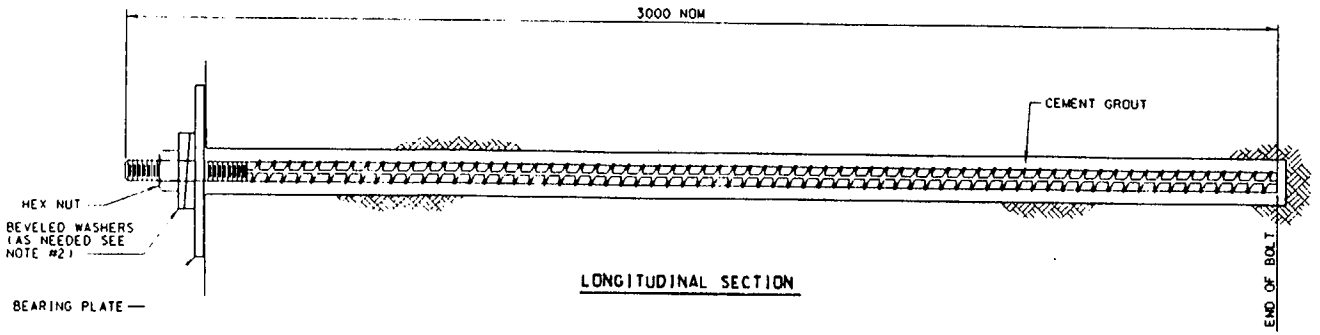
CATEGORY 2 GROUND SUPPORT

SCALE: 1:75



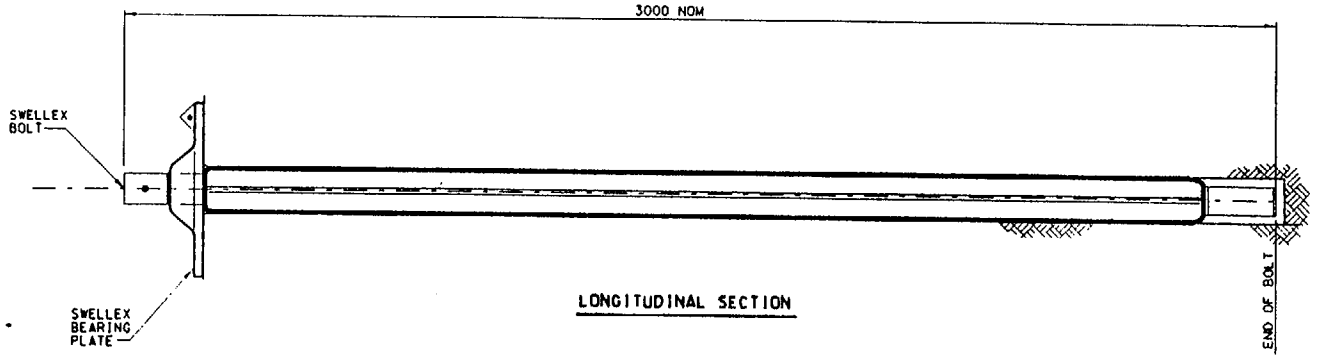
CATEGORY 3 GROUND SUPPORT

SCALE: 1:75



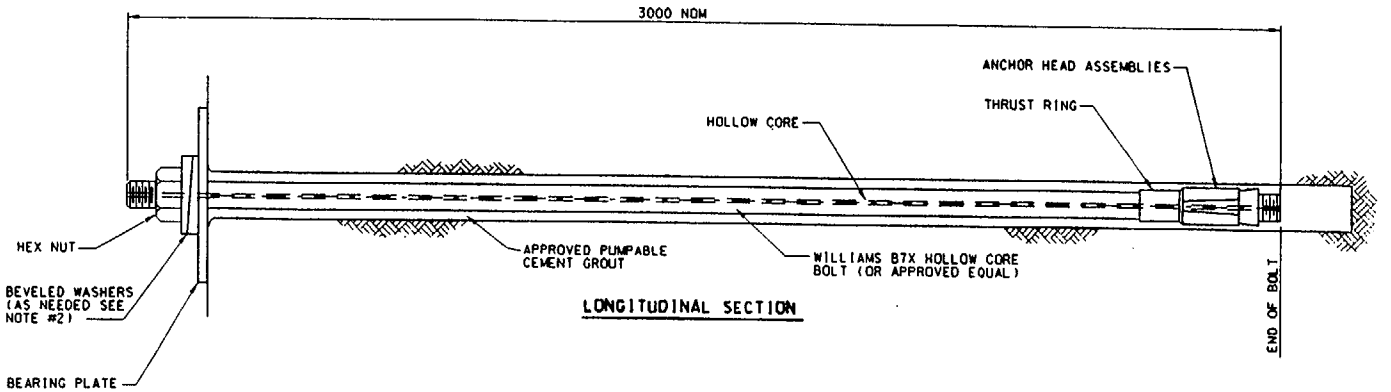
INSTALLATION DETAILS FOR SOLID BAR ROCKBOLT WITH PRE-INSTALLED THIXOTROPIC GROUT

NOT TO SCALE



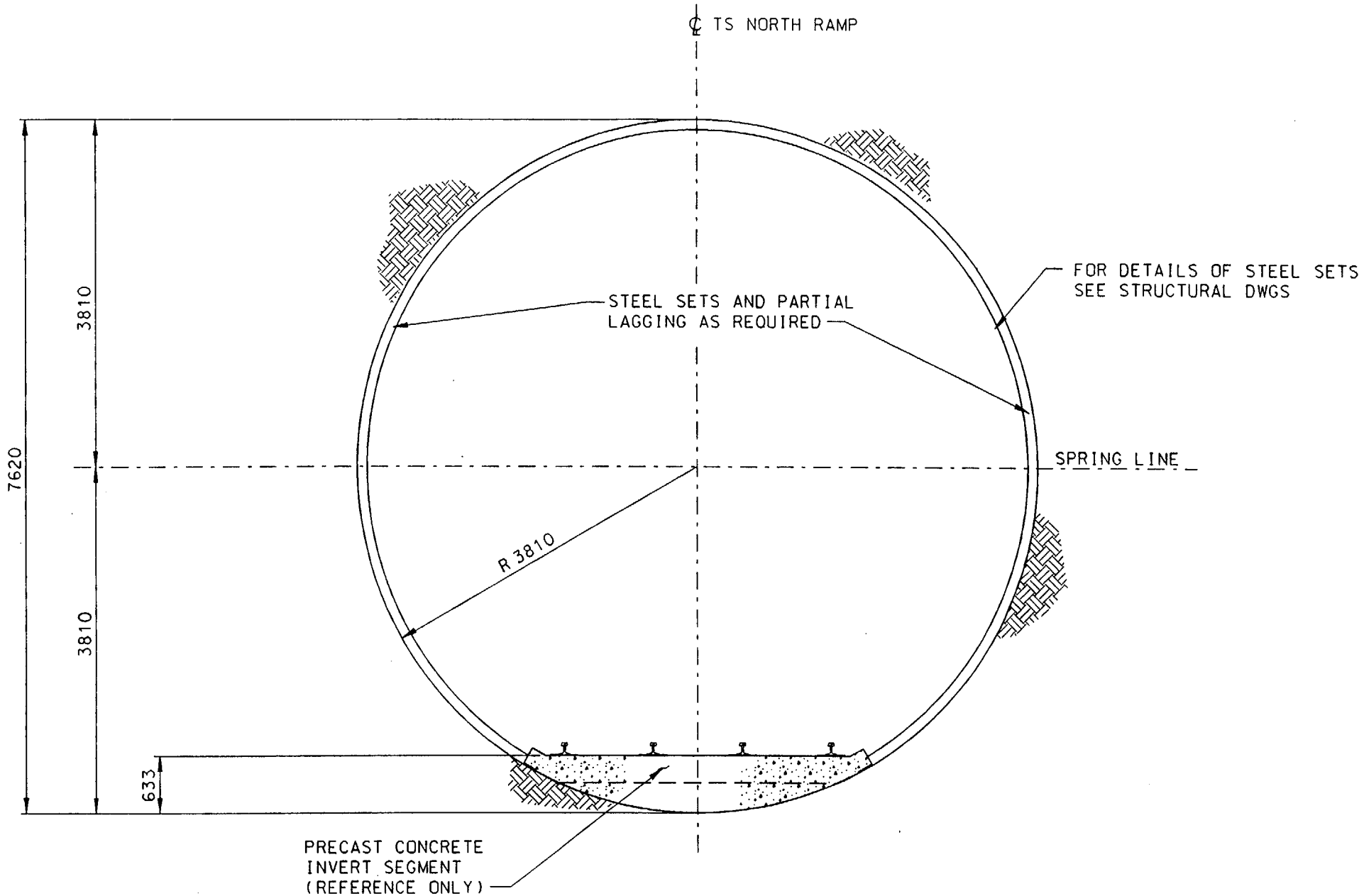
INSTALLATION DETAILS FOR SUPER SWELLEX ROCKBOLT

NOT TO SCALE



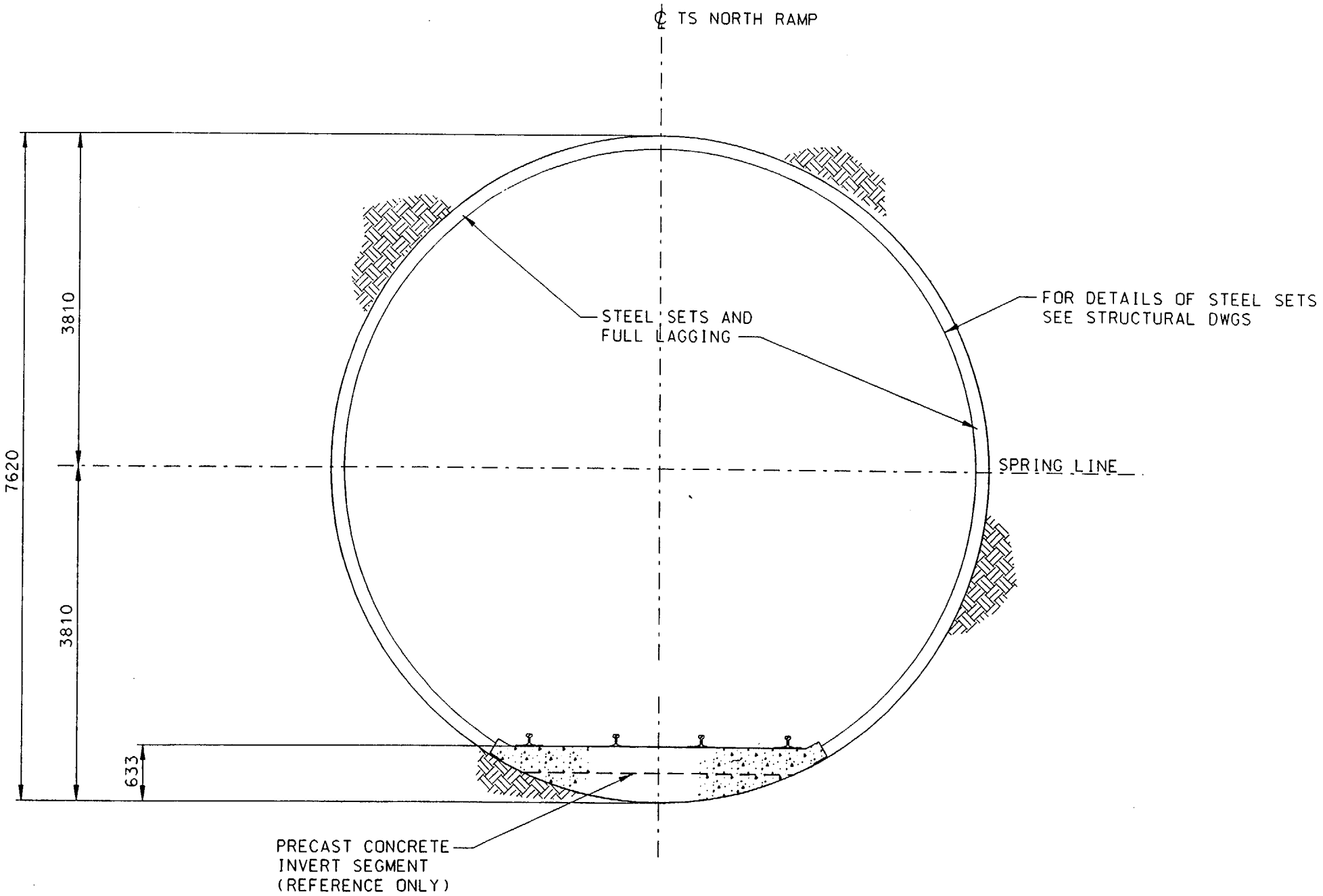
INSTALLATION DETAILS FOR HOLLOW CORE ROCKBOLT WITH MECHANICAL ANCHORS AND THIXOTROPIC GROUT

NOT TO SCALE SINGLE ANCHOR SHOWN



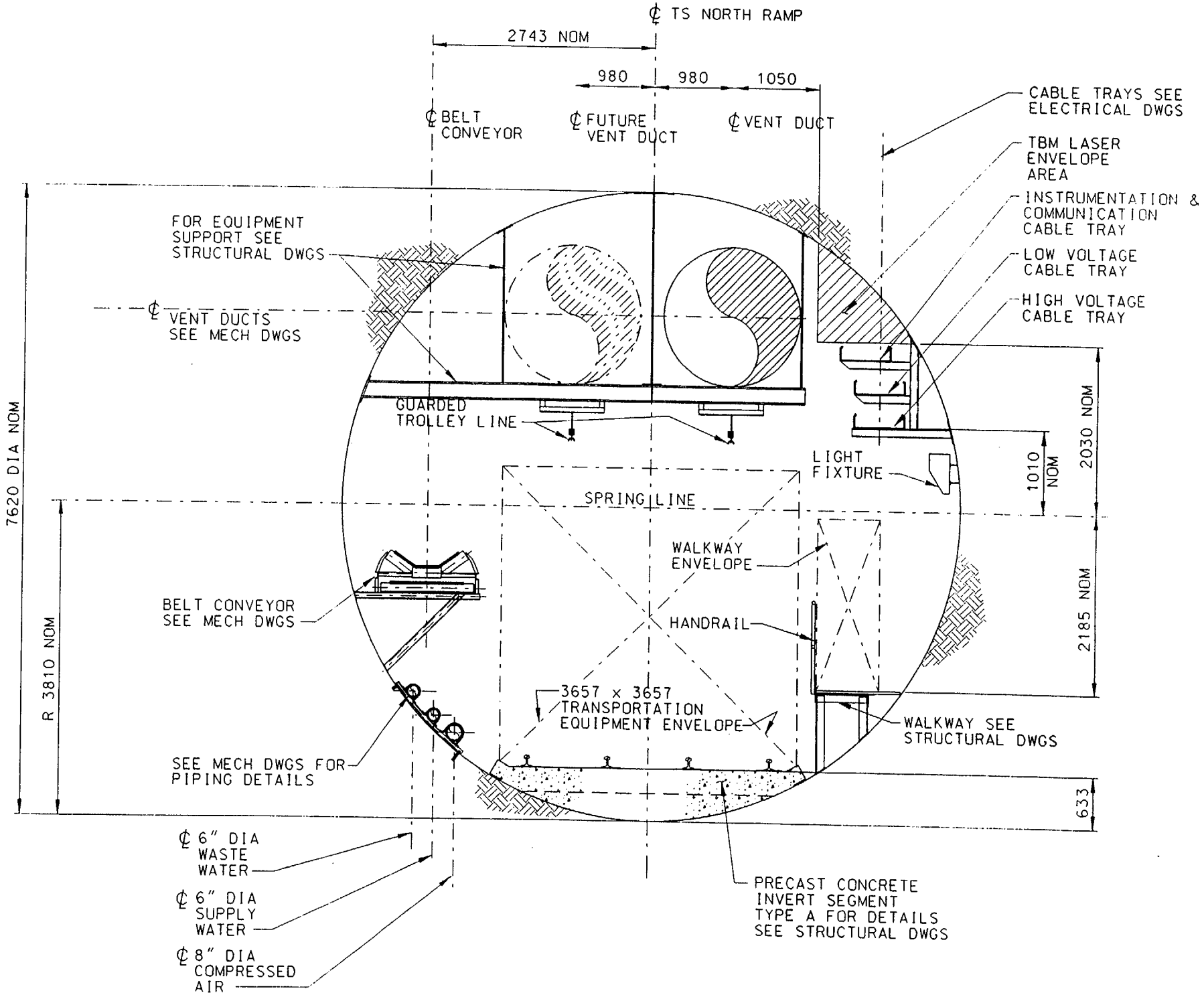
TYPICAL TUNNEL CROSS SECTION-CATEGORY 4. GROUND SUPPORT

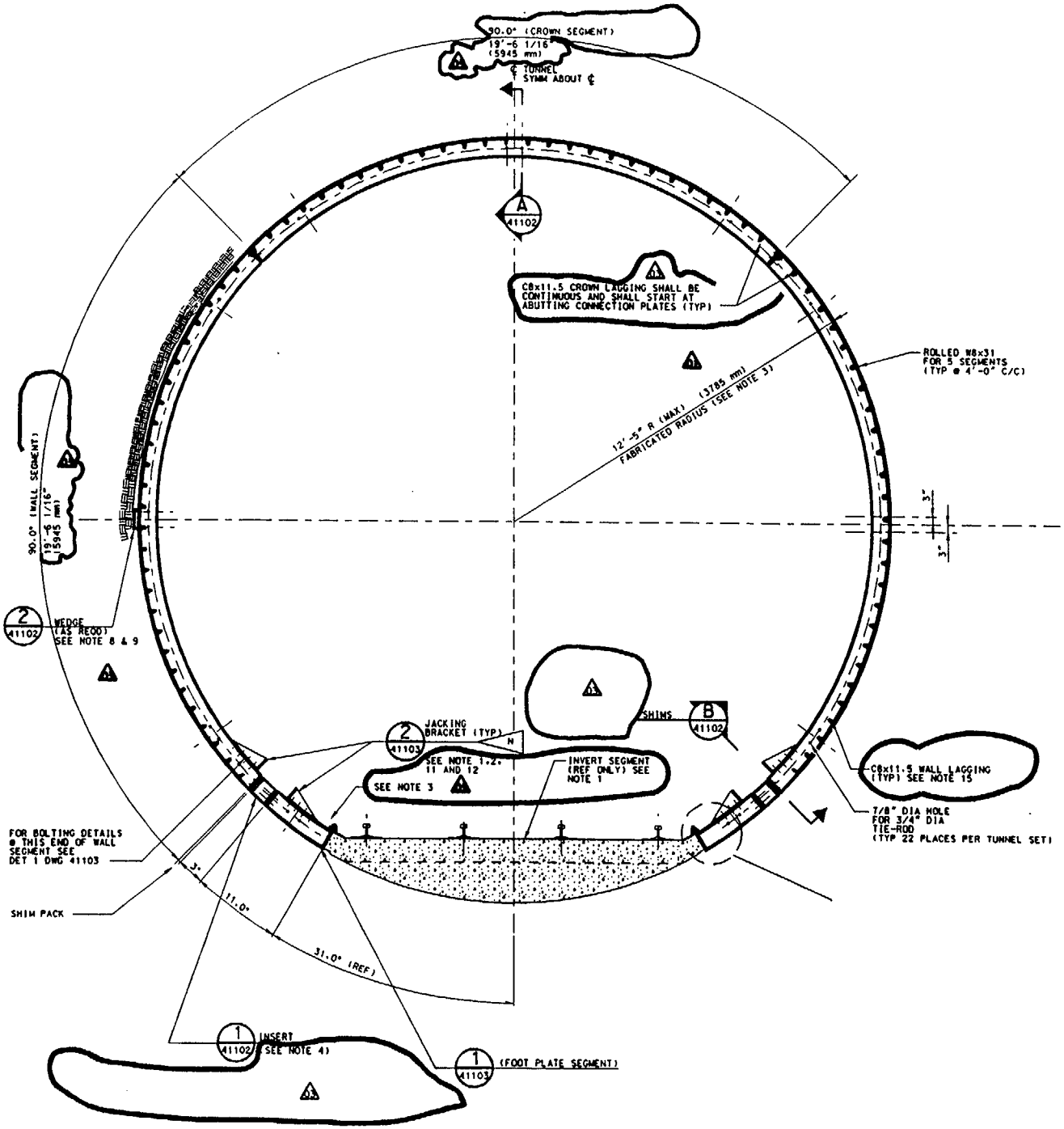
SCALE: 1:50



TYPICAL TUNNEL CROSS SECTION CATEGORY 5. GROUND SUPPORT

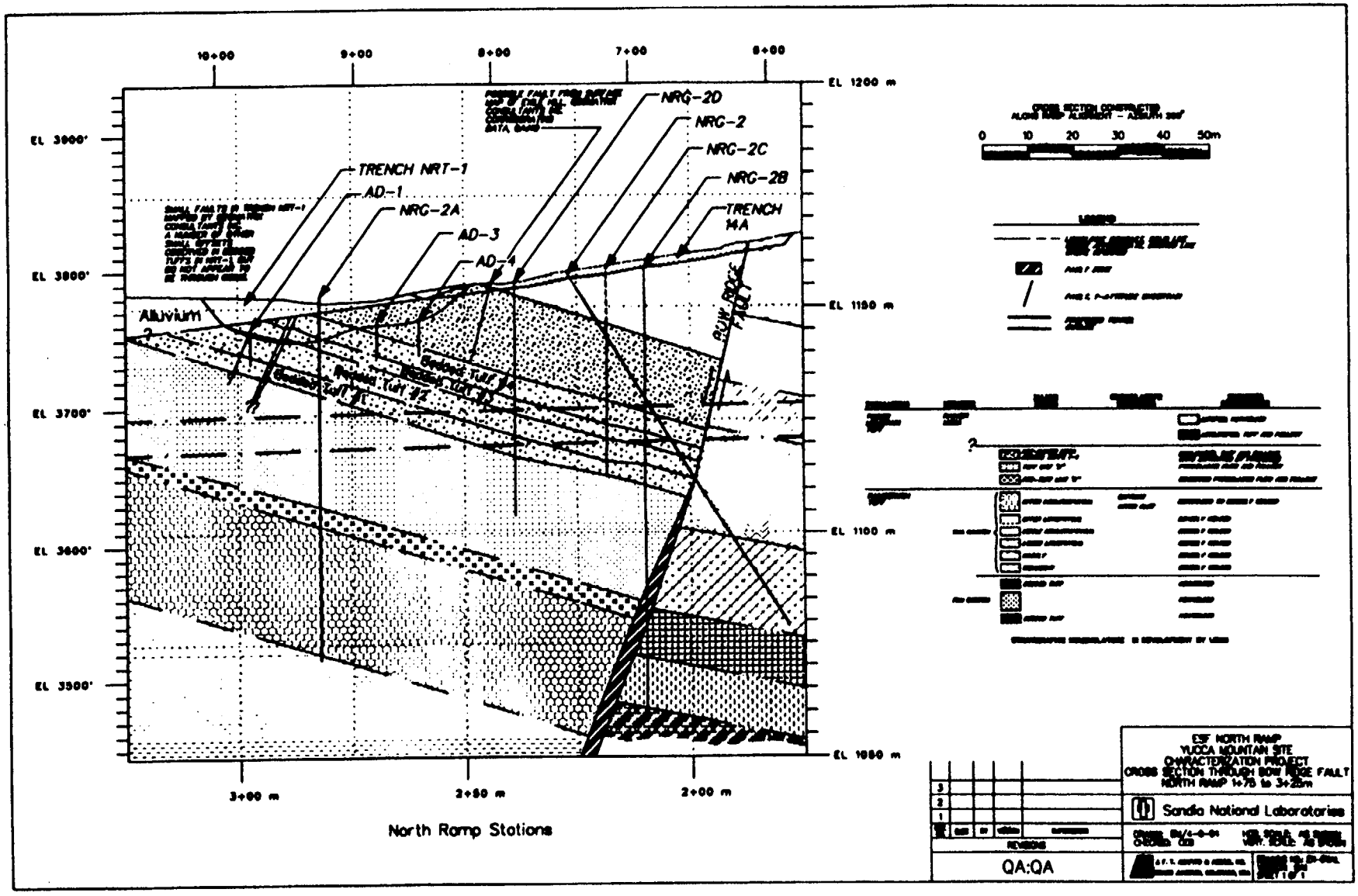
SCALE: 1:50


℄ TS NORTH RAMP
2743 NOM
980
980
1050
℄ BELT CONVEYOR
℄ FUTURE VENT DUCT
℄ VENT DUCT
CABLE TRAYS SEE ELECTRICAL DWGS
TBM LASER ENVELOPE AREA
INSTRUMENTATION & COMMUNICATION CABLE TRAY
LOW VOLTAGE CABLE TRAY
HIGH VOLTAGE CABLE TRAY
FOR EQUIPMENT SUPPORT SEE STRUCTURAL DWGS
℄ VENT DUCTS SEE MECH DWGS
GUARDED TROLLEY LINE
7620 DIA NOM
2030 NOM
1010 NOM
LIGHT FIXTURE
SPRING LINE
WALKWAY ENVELOPE
BELT CONVEYOR SEE MECH DWGS
HANDRAIL
2185 NOM
R 3810 NOM
3657 x 3657 TRANSPORTATION EQUIPMENT ENVELOPE
WALKWAY SEE STRUCTURAL DWGS
SEE MECH DWGS FOR PIPING DETAILS
633
℄ 6" DIA WASTE WATER
℄ 6" DIA SUPPLY WATER
℄ 8" DIA COMPRESSED AIR
PRECAST CONCRETE INVERT SEGMENT TYPE A FOR DETAILS SEE STRUCTURAL DWGS

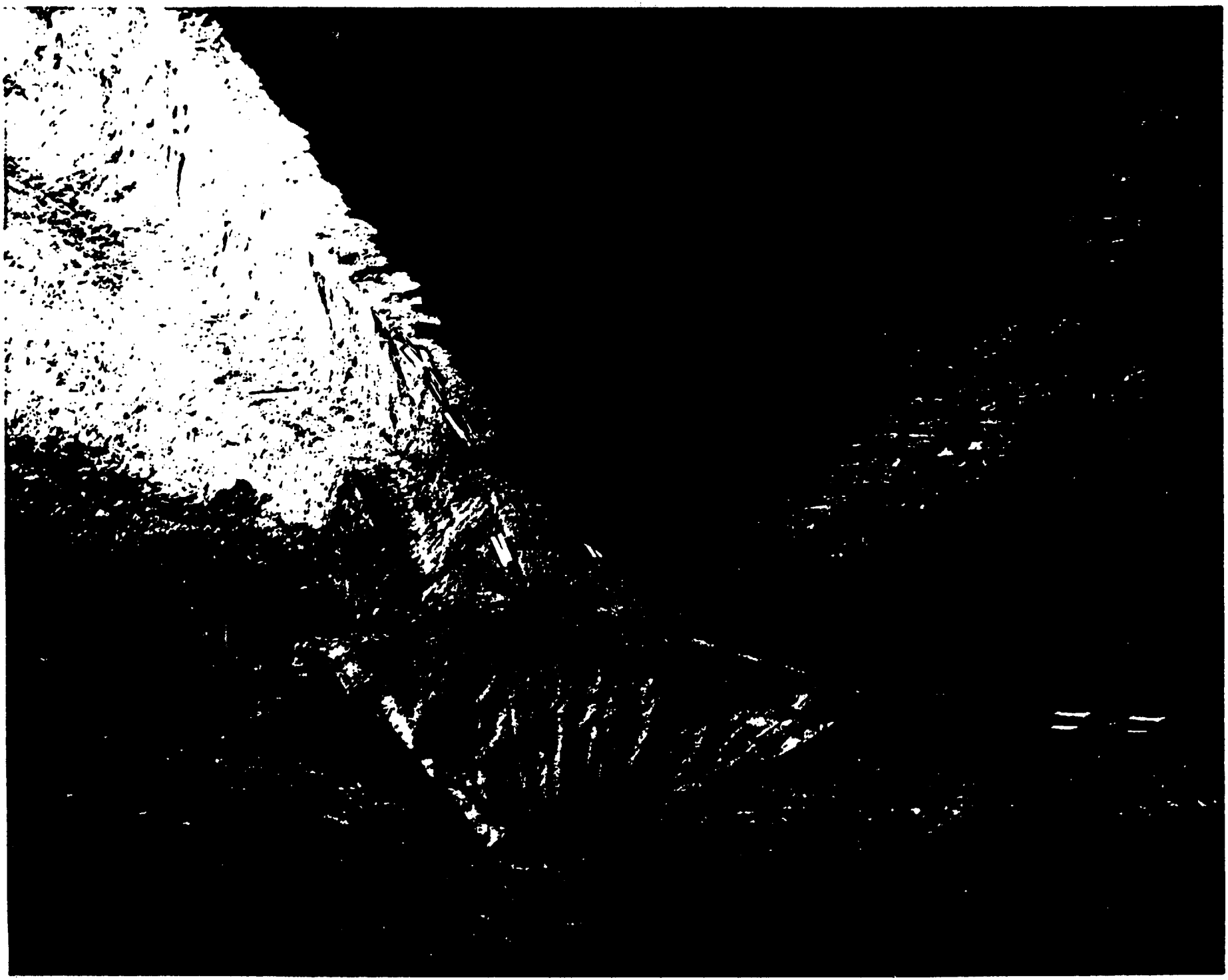


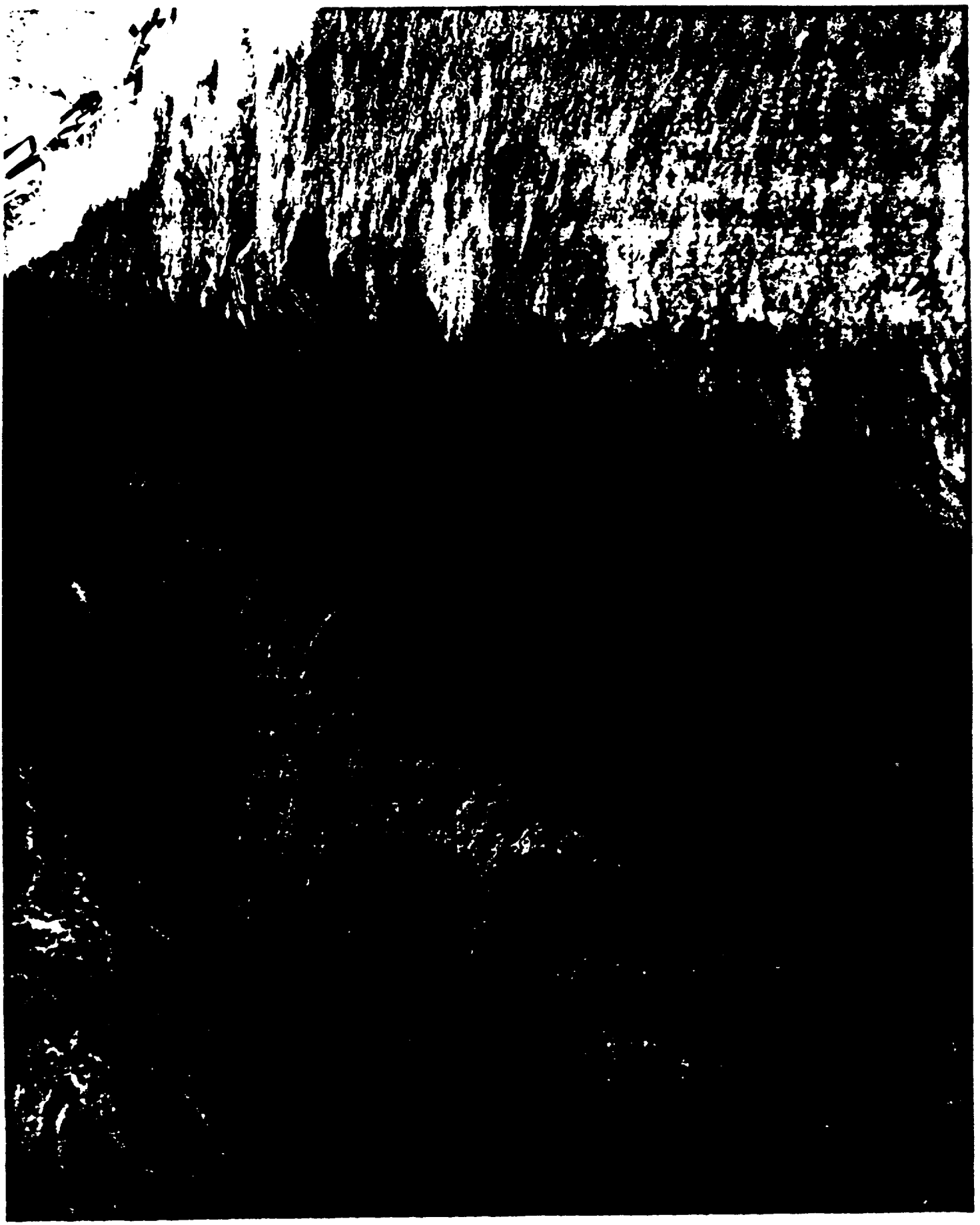
TUNNEL SET ELEVATION

SCALE: 1/2" = 1'-0"



North Ramp Stations





JOB TITLE : TS NORTH RAMP MOHR-COULOMB MODEL STATION 18+00 M (H/V=1) GROUND SUPPORT

FLAC (Version 3.22)

LEGEND

5/02/1994 14:34
step 4100
-1.000E+01 <x< 1.000E+01
-1.000E+01 <y< 1.000E+01

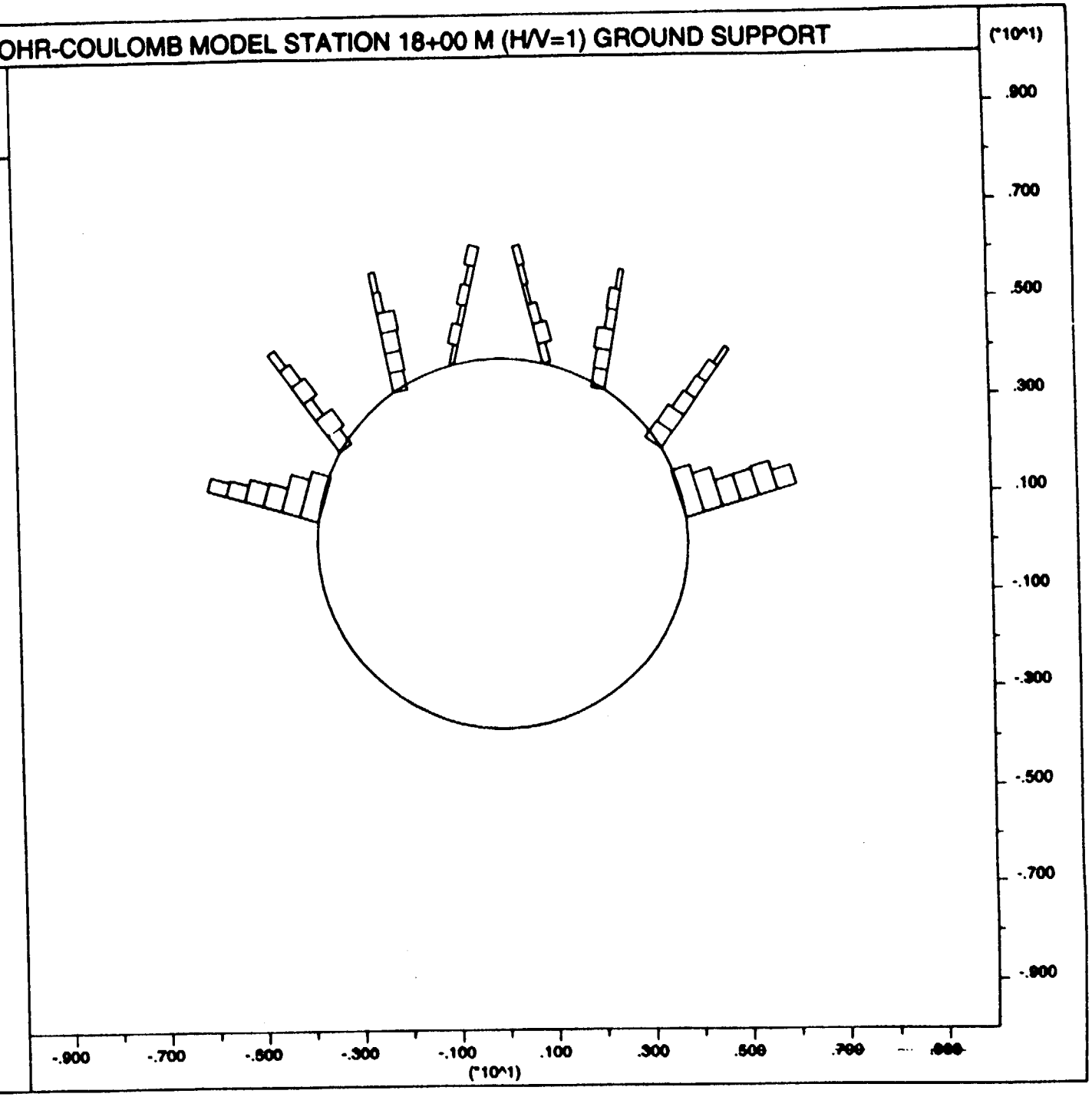
Boundary plot

0 5E 0

Axial Force on

Structure	Max. Value
Cable # 1	-7.351E+02
Cable # 2	-3.126E+02
Cable # 3	-2.748E+02
Cable # 4	-1.629E+02
Cable # 5	-7.522E+02
Cable # 6	-3.051E+02
Cable # 7	-2.567E+02
Cable # 8	-2.191E+02

CRWMS M & O



JOB TITLE : TS NORTH RAMP STATION 18+00 M (H/V=1) SEISMIC ANALYSIS

FLAC (Version 3.22)

LEGEND

5/02/1994 14:48
step 10100
-1.000E+01 <x< 1.000E+01
-1.000E+01 <y< 1.000E+01

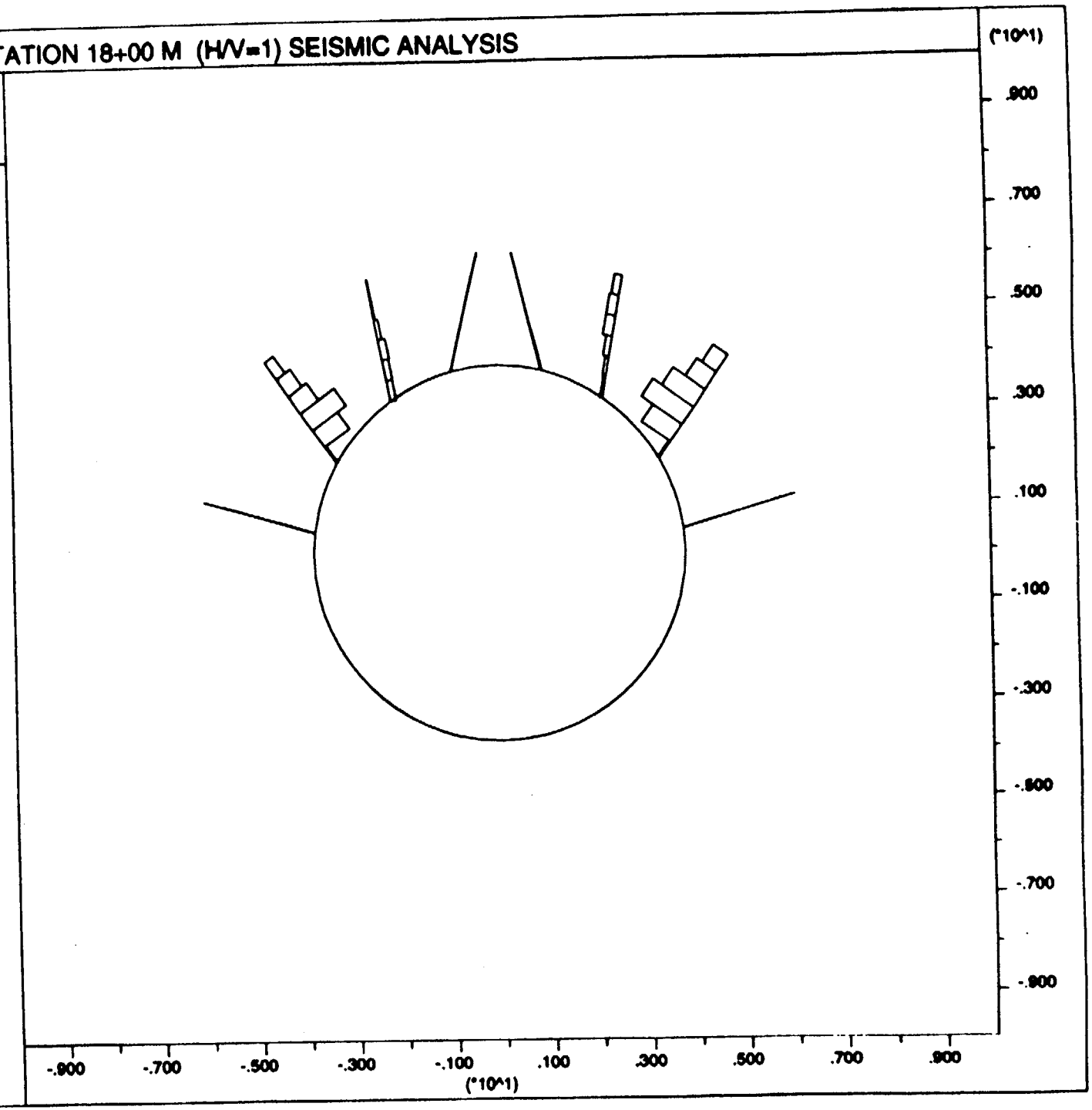
Boundary plot

0 5E 0

Axial Force on

Structure	Max. Value
Cable # 1	-1.426E+03
Cable # 2	-1.308E+05
Cable # 3	-2.303E+04
Cable # 4	-2.340E+03
Cable # 5	-1.423E+03
Cable # 6	-1.523E+05
Cable # 7	-2.925E+04
Cable # 8	-3.294E+03

CRWMS M & O



JOB TITLE : TS North Ramp Stability Analysis Station 18+00 m - Excavated & Unsupported

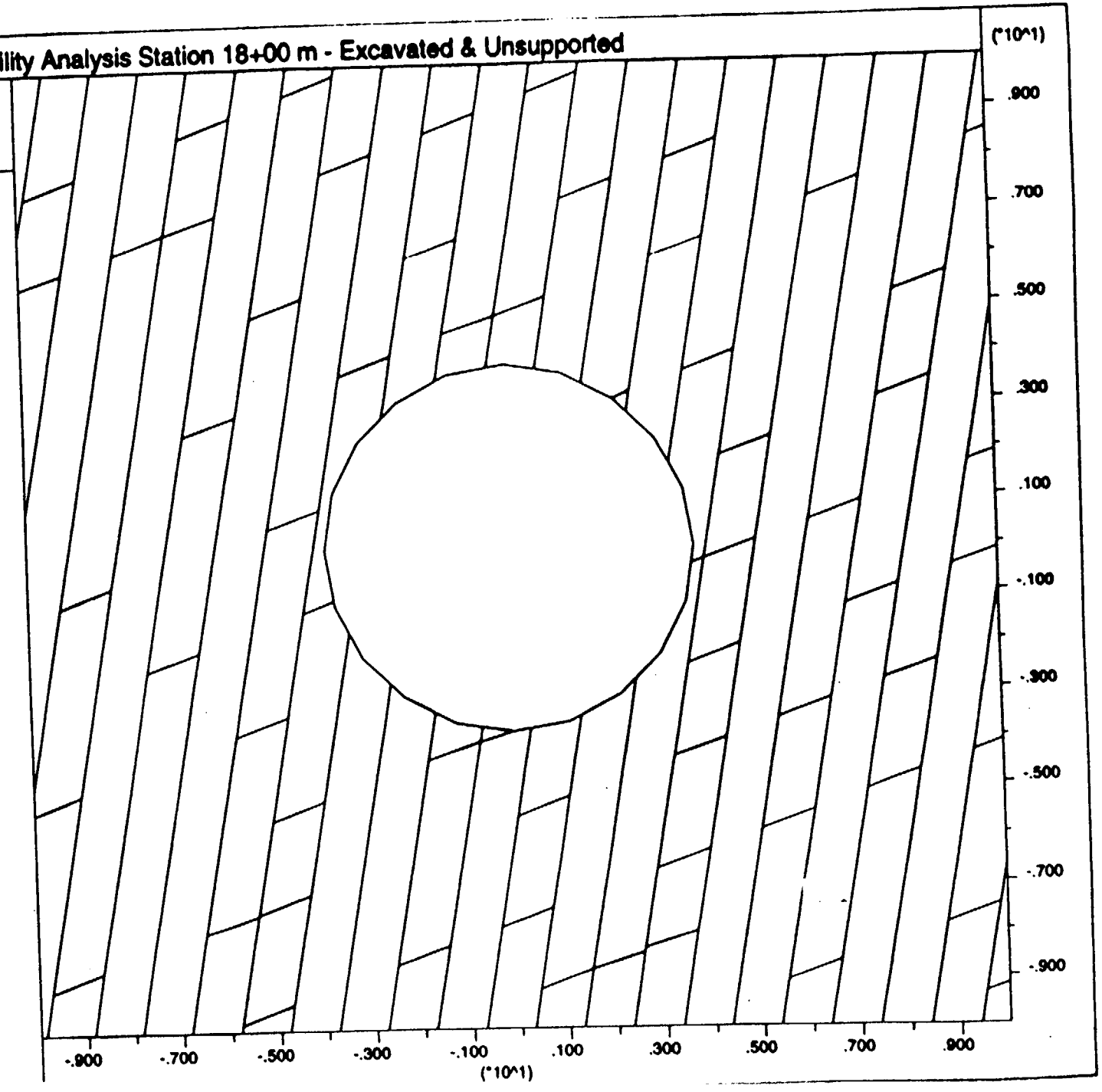
UDEC (Version 2.00)

LEGEND

5/02/1994 14:53
cycle 6000
time 1.280E+00 sec

block plot

CRWMS M & O



JOB TITLE : TS North Ramp Stability Analysis Station 18+00 m - Excavated & Unsupported

UDEC (Version 2.00)

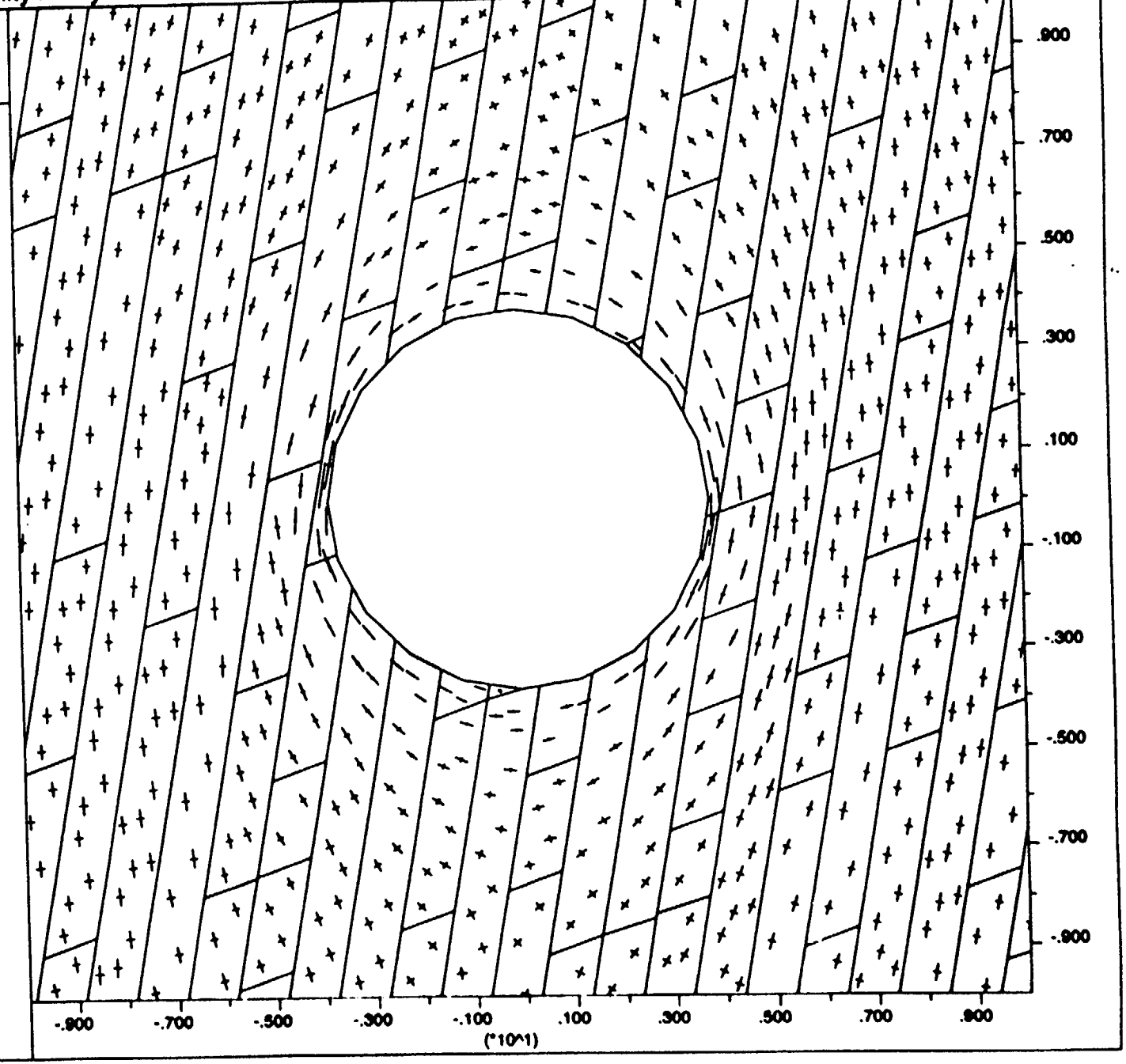
LEGEND

5/02/1994 14:57
cycle 6000
time 1.280E+00 sec

block plot
principal stresses
minimum = -1.135E+07
maximum = 5.845E+05

0 5E 7

CRWMS M & O



JOB TITLE : TS North Ramp Stability Analysis Station 18+00 m - Excavated & Unsupported

UDEC (Version 2.00)

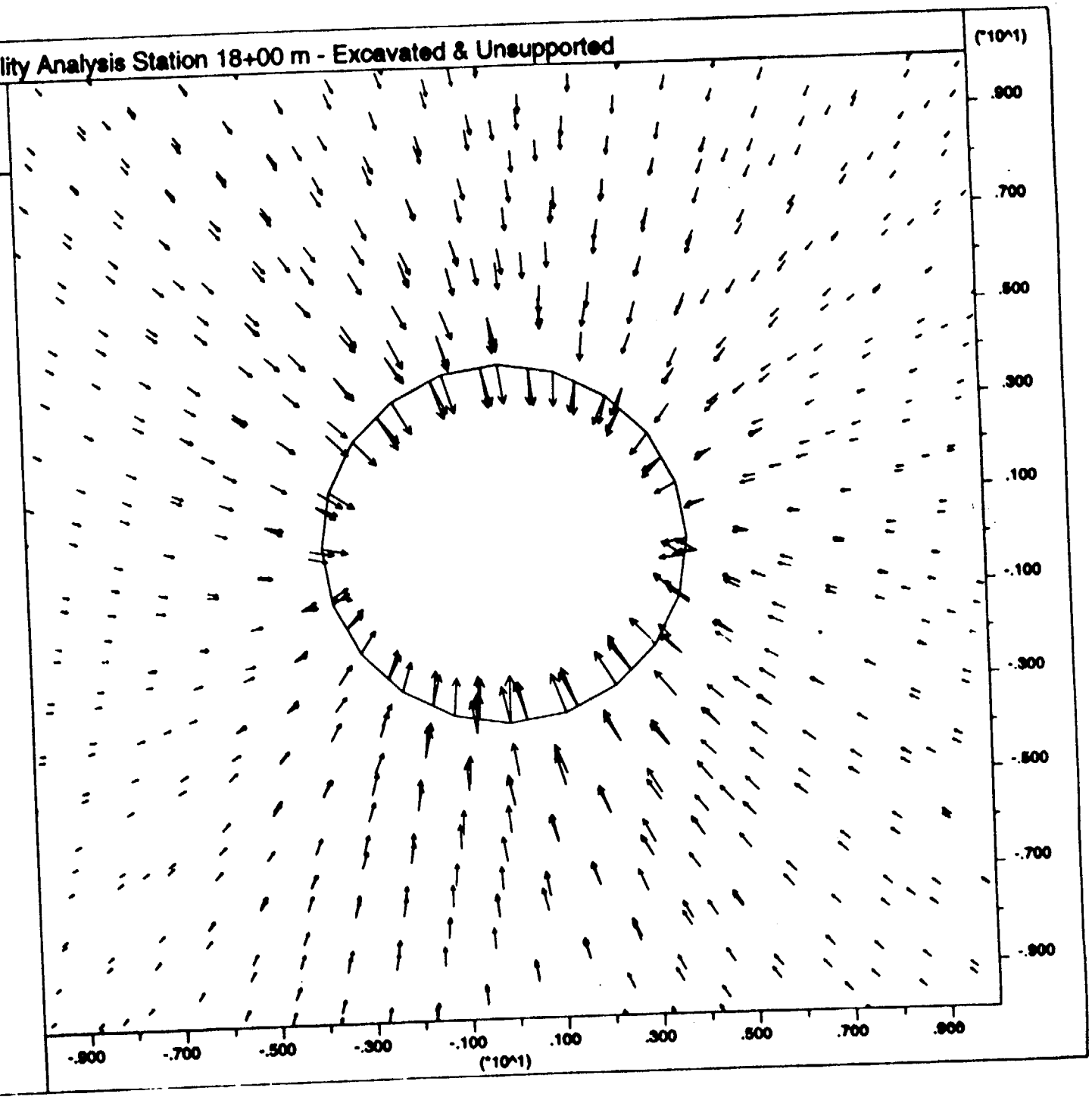
LEGEND

5/02/1994 14:58
cycle 6000
time 1.280E+00 sec

boundary plot
displacement vectors
maximum = 1.519E-03

0 5E -3

CRWMS M & O



JOB TITLE : TS North Ramp Stability Analysis Station 18+00 m - Excavated & Unsupported

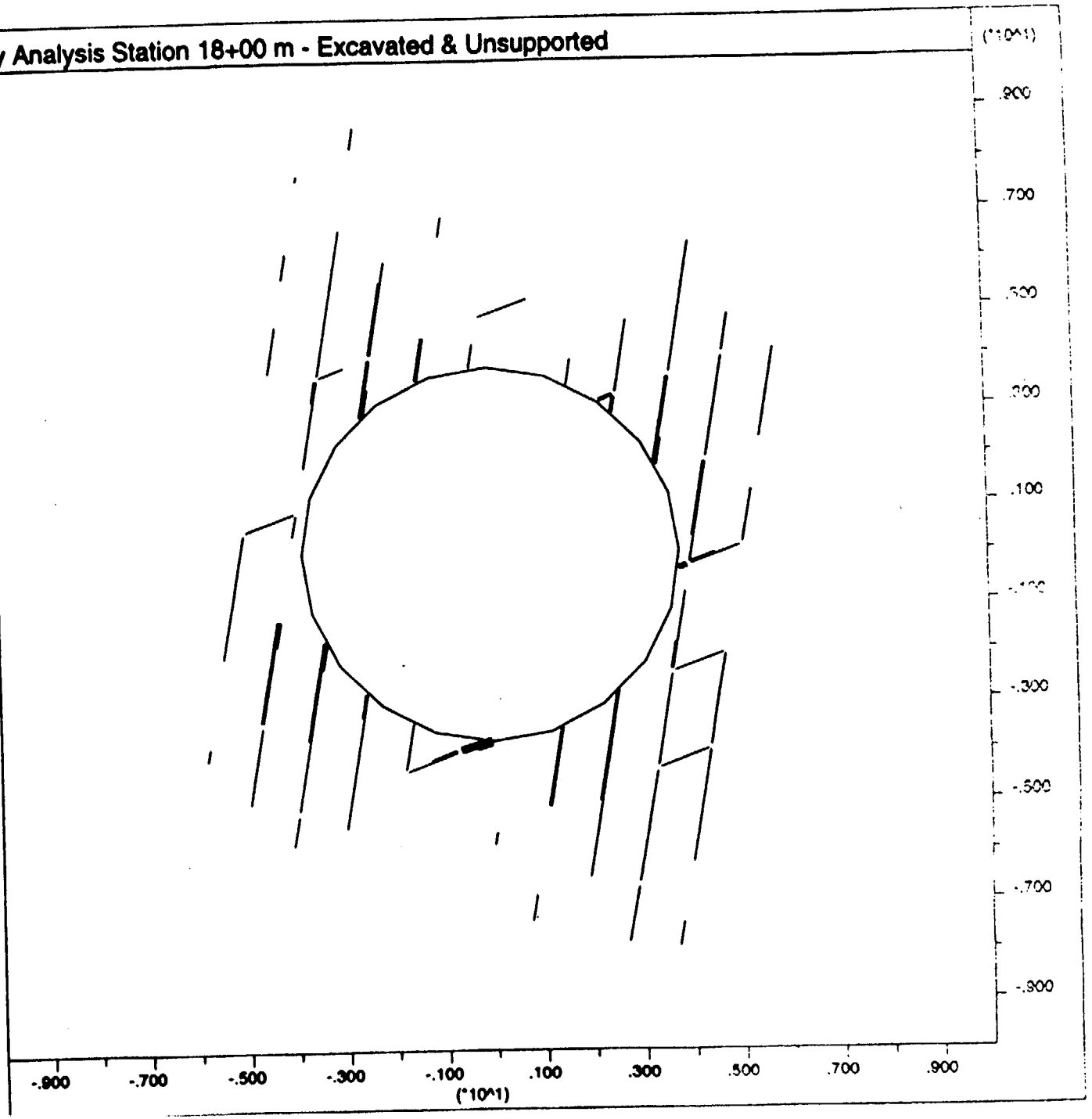
UDEC (Version 2.00)

LEGEND

5/02/1994 14:58
cycle 6000
time 1.280E+00 sec

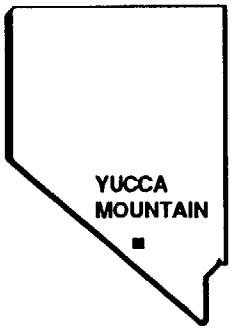
boundary plot
shear displacements on joints
max shear disp = 3.611E-04
each line thick = 7.222E-05

CRWMS M & O



U.S. DEPARTMENT OF ENERGY

OCRWM



YUCCA MOUNTAIN
SITE CHARACTERIZATION
PROJECT

DOE/NRC TECHNICAL MEETING ON THE EXPLORATORY STUDIES FACILITY

DRILLING, SAMPLING, AND TESTING PROGRAM UPDATE

PRESENTED BY

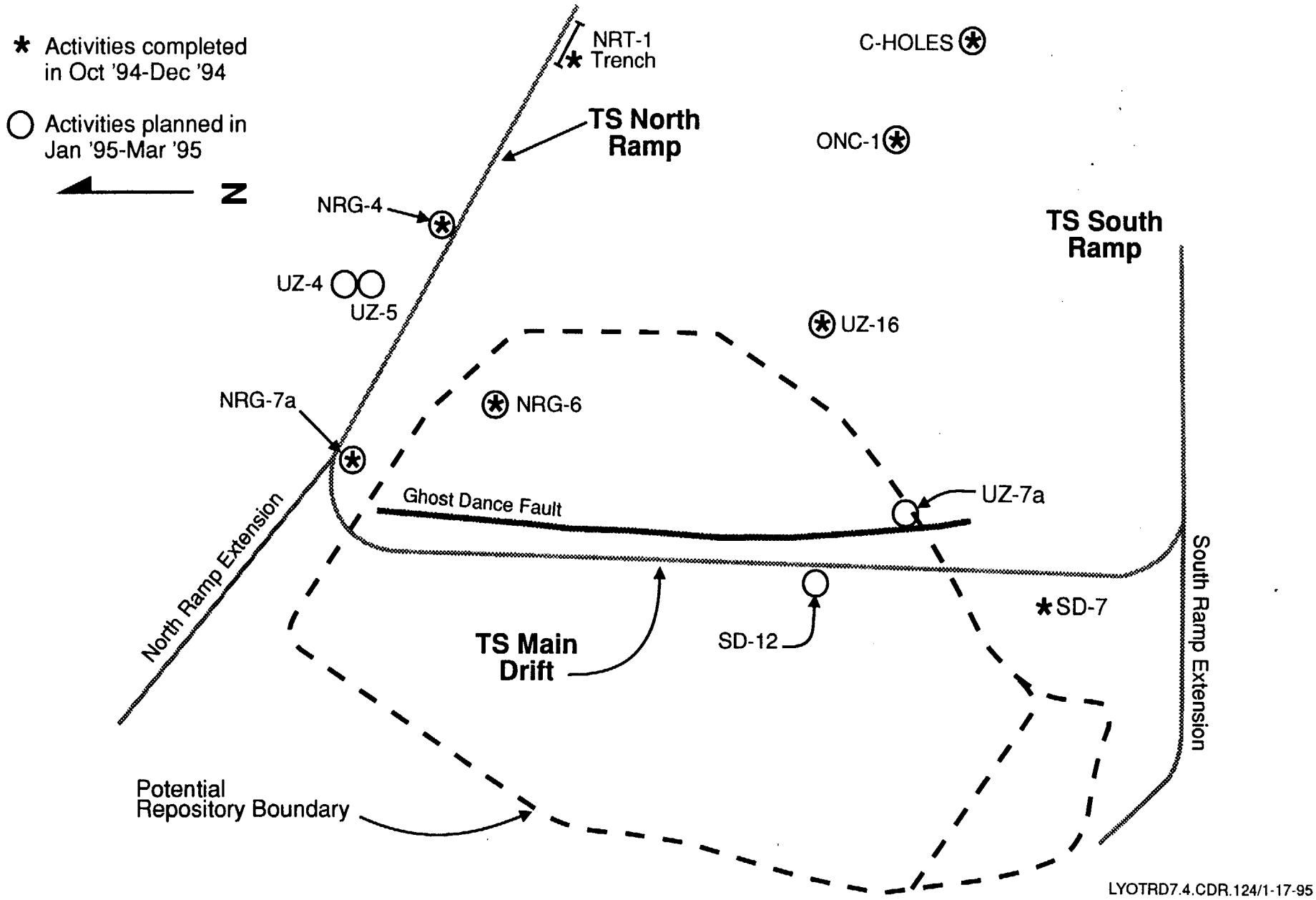
WILLIAM J. BOYLE

PHYSICAL SCIENTIST

JANUARY 24, 1995
ROCKVILLE, MD

Attachment 5

Borehole and Trench Locations in the Repository Area



LYOTRD7.4.CDR.124/1-17-95

Drilling\Sampling\Testing Completed October 15, 1994 - December 31, 1994

NRG-7A	Completed pneumatic instrumentation and began monitoring
NRG-6	Completed air permeability testing; completed pneumatic instrumentation; and began monitoring
UZ-16	Attempted borehole clean out without success; made plans to proceed with instrumentation
SD-7	Drilling started, cored to 256 ft and began reaming borehole to enlarge it to 12 1/4 inch diameter to that depth

Drilling\Sampling\Testing Completed October 15, 1994 - December 31, 1994

(Continued)

ONC #1	Prepared Test Planning Package for Nye County Drilling (Nye County completed borehole to TD of 1458 ft)
NRG-4	Cleaned out borehole for instrumentation by Nye County
Regional Seismic Survey	Completed shot hole drilling and completed seismic field work
Repository Geophysics	Began surface geophysical surveys (seismic reflection, gravity, electromagnetics and magnetics) over the repository area

Drilling\Sampling\Testing Completed October 15, 1994 - December 31, 1994

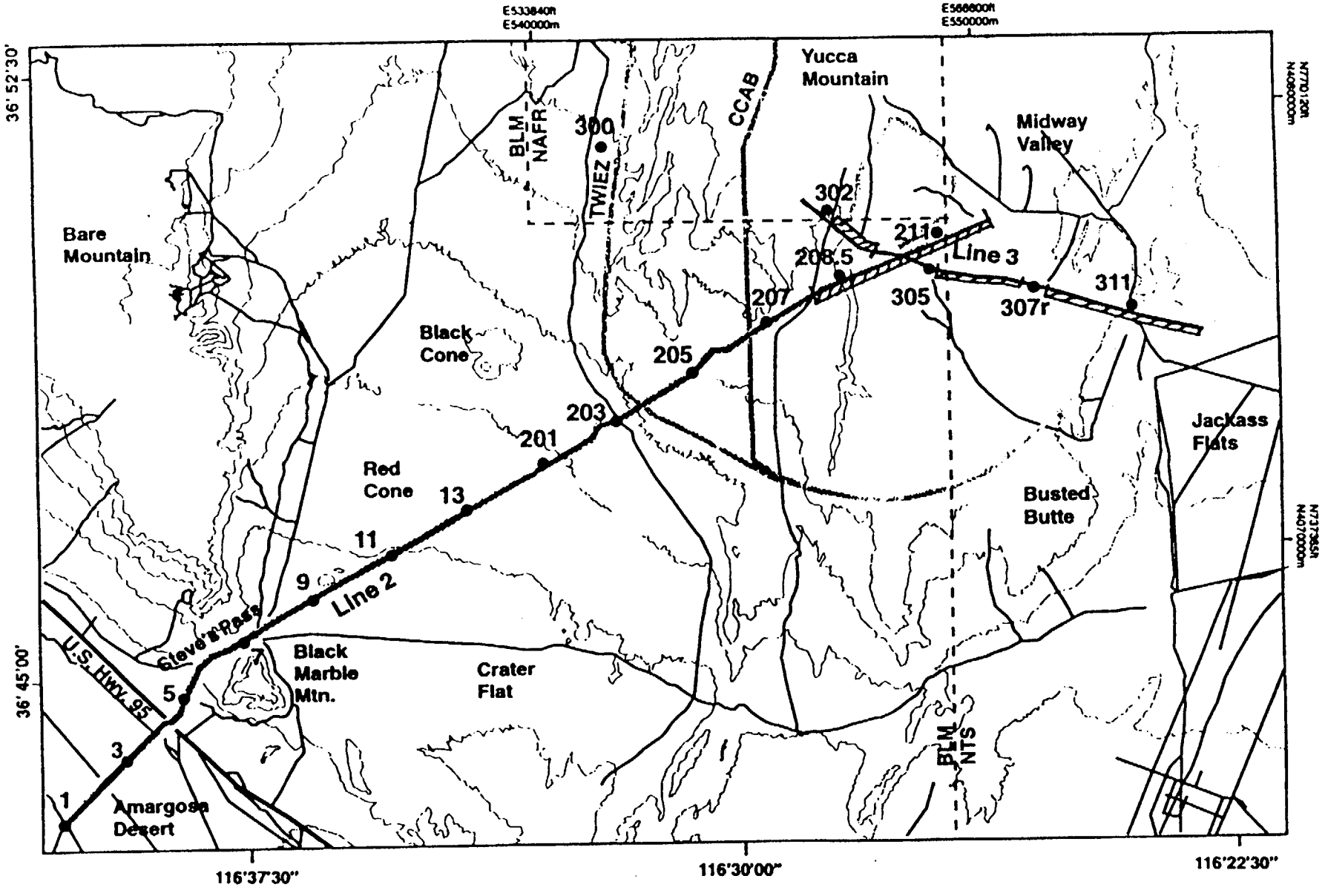
(Continued)

Rock Valley Fault Study	Excavated and mapped 3 trenches
Trench NRT-1	Backfilled trench with controlled, compacted fill
ESF Leach Field	Conducted percolation tests and standard penetration test
C-Hole Complex	Pulled and refurbished instrumentation and packers in C#1 and C#2. Subsequent information indicates a need for remedial work in C#2.

Borehole Geophysical Logging Completed October 15, 1994 - December 31, 1994

- None

  (No contracts were in place to procure logging services)



LEGEND
- Proposed Shothole
- VIBROSEIS LINE
- OFF ROAD (MINIHOLES & POULTER CHARGES

N

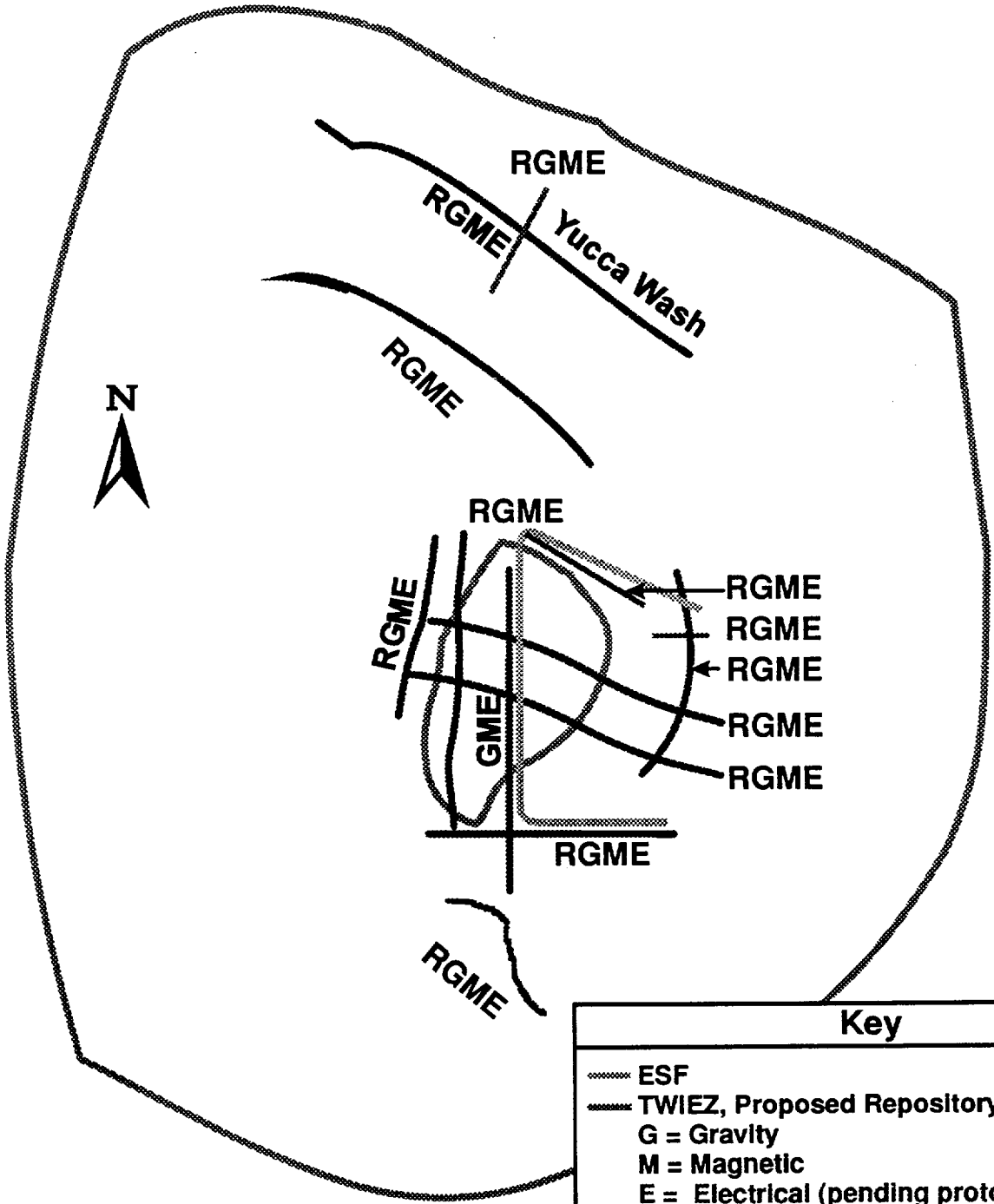
2 1 0 1 2 Mi

2 1 0 1 2 Km

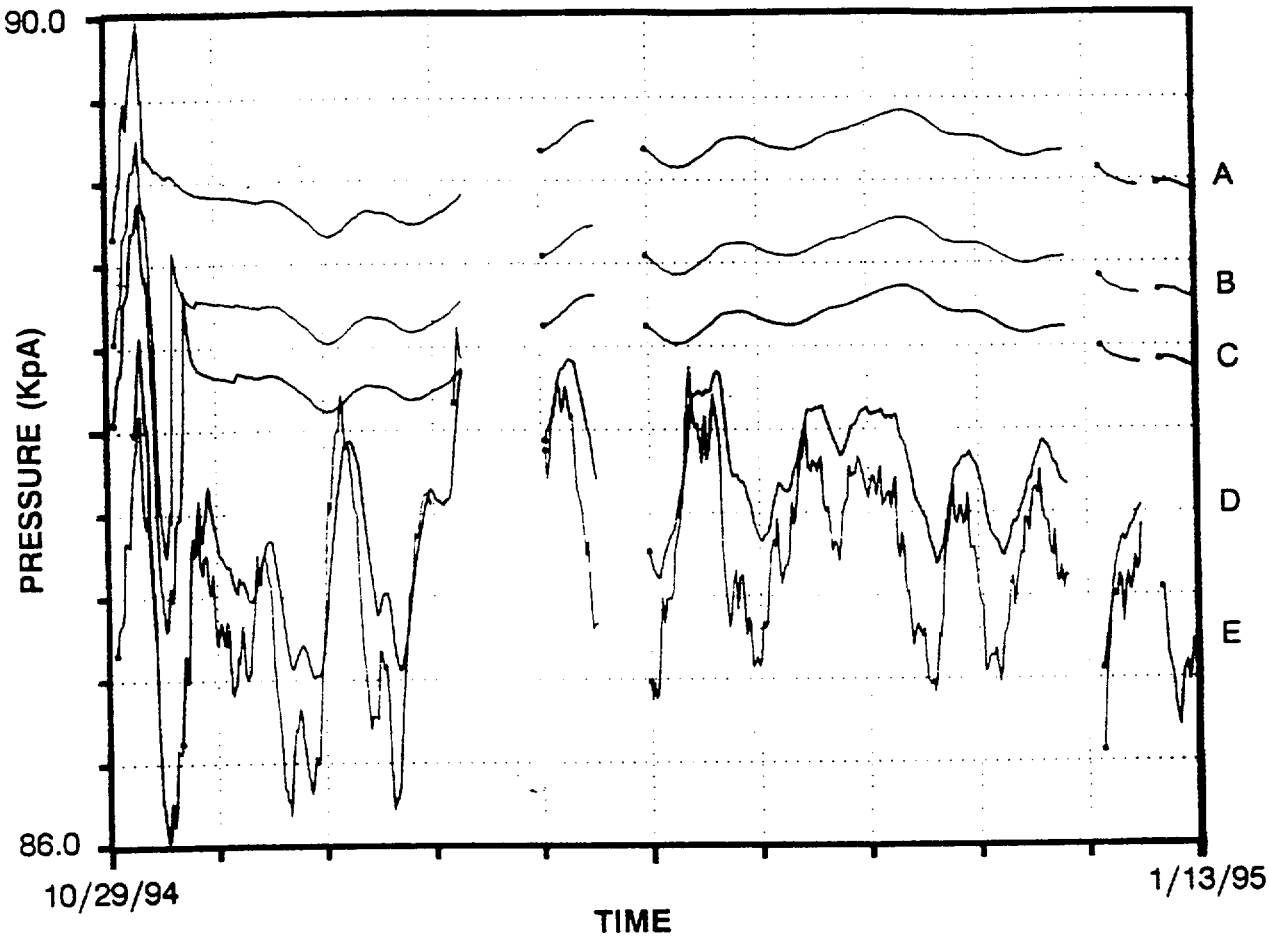
YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT
PROPOSED SEISMIC REFLECTION LINES

SAVIMP.121.cdr/8-17-94

SCHEMATIC MAP PROPOSED 1995 GEOPHYSICS PROGRAM



FY95GPMT.CDR.123/1-17-95



Station E	17.7 feet	Alluvium/Hackly Unit of Tiva Canyon
Station D	152.7 feet	Yucca Mountain Member Bedded Tuff
Station C	387.7 feet	Upper Non-Lithophysal Topopah Spring
Station B	493.7 feet	Upper Non-Lithophysal/Upper Lithophysal TS
Station A	667.7 feet	Upper Lithophysal Topopah Spring

NOTE: These data are preliminary and subject to revision. Technical and quality-assurance reviews have not been performed. Pressure values are subject to adjustment during final application of calibration equations. (J. Rousseau, USGS, Project Chief)

Pneumatic Pressure Record for Borehole NRG-7a
October 29, 1994 to January 13, 1995

Drilling\Sampling\Testing Planned January 1, 1995 - March 31, 1995

NRG-7a	Continue monitoring pneumatic instrumentation
NRG-6	Continue monitoring pneumatic instrumentation
UZ-16	Install seismic instrumentation for future vertical seismic profiling tests
SD-12	Air permeability testing of the upper 1400 ft of the borehole
ESF Muck Conveyor	Conduct standard penetration tests and test pits to establish bearing values for the conveyor foundation

Drilling\Sampling\Testing Planned January 1, 1995 - March 31, 1995

(Continued)

UZ-4	Begin workover of the existing borehole for subsequent testing and instrumentation
UZ-5	Workover the existing borehole for subsequent testing and instrumentation
UZ-7a	Begin drilling
NRG-4 and ONC #1	Nye County plans to instrument the two boreholes with Westbay instruments

Drilling\Sampling\Testing Planned January 1, 1995 - March 31, 1994

(Continued)

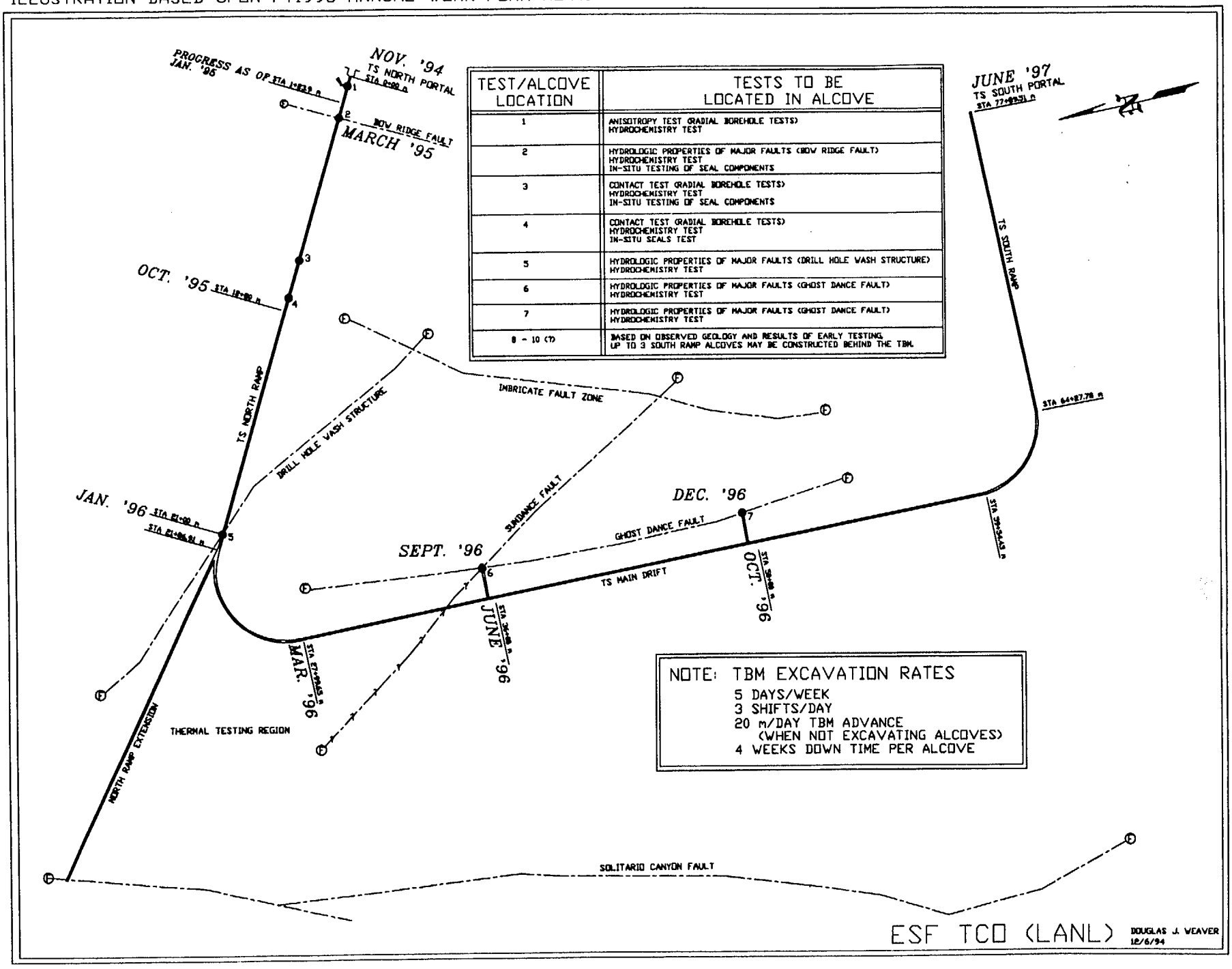
Repository Geophysics Test Program	Complete all planned geophysical tests
Bare Mountain Fault Study	Excavate and map 2 trenches and 5 test pits
Crater Flat Fault Study	Excavate and map 4 trenches
C-Hole Complex	Complete remedial work on instruments and packers for C#2

Borehole Geophysical Logging Planned January 1, 1995 - March 31, 1995

- **Conventional, gyro and/or video logging at the following boreholes:**
  - **SD-7**
  - **SD-9**
  - **SD-12**
  - **UZ-4**
  - **UZ-5**
  - **UZ-14**
  - **G-2**

EXPLORATORY STUDIES FACILITY

ILLUSTRATION BASED UPON FY1995 ANNUAL WORK PLAN REV.0



TEST/ALCOVE LOCATION	TESTS TO BE LOCATED IN ALCOVE
1	ANISOTROPY TEST (RADIAL BOREHOLE TESTS) HYDROCHEMISTRY TEST
2	HYDROLOGIC PROPERTIES OF MAJOR FAULTS (BOV RIDGE FAULT) HYDROCHEMISTRY TEST IN-SITU TESTING OF SEAL COMPONENTS
3	CONTACT TEST (RADIAL BOREHOLE TESTS) HYDROCHEMISTRY TEST IN-SITU TESTING OF SEAL COMPONENTS
4	CONTACT TEST (RADIAL BOREHOLE TESTS) HYDROCHEMISTRY TEST IN-SITU SEALS TEST
5	HYDROLOGIC PROPERTIES OF MAJOR FAULTS (DRILL HOLE WASH STRUCTURE) HYDROCHEMISTRY TEST
6	HYDROLOGIC PROPERTIES OF MAJOR FAULTS (GHOST DANCE FAULT) HYDROCHEMISTRY TEST
7	HYDROLOGIC PROPERTIES OF MAJOR FAULTS (GHOST DANCE FAULT) HYDROCHEMISTRY TEST
8 - 10 (?)	BASED ON OBSERVED GEOLOGY AND RESULTS OF EARLY TESTING, UP TO 3 SOUTH RAMP ALCOVES MAY BE CONSTRUCTED BEHIND THE TBM.

NOTE: TBM EXCAVATION RATES

5 DAYS/WEEK
3 SHIFTS/DAY
20 m/DAY TBM ADVANCE
(WHEN NOT EXCAVATING ALCOVES)
4 WEEKS DOWN TIME PER ALCOVE

ESF TEST ACTIVITIES SUMMARY
ACCOMPLISHMENTS AND NEAR TERM OBJECTIVES

I. GEOHYDROLOGY (PERMEABILITY) TESTS IN ALCOVE #1

- DRILLING/CORING OF 3 RADIAL BOREHOLES (30m) ACCOMPLISHED FEBRUARY - MARCH, 1994
  - CORING
  - NEUTRON LOGGING
  - TV LOGGING
- VACUUM TESTING (INITIAL GAS HYDROCHEMISTRY) COMPLETED MAY, 1994
- INITIAL TEMPERATURE/PRESSURE BASELINE DEVELOPED DURING JUNE, 1994
- SINGLE-HOLE PACKER TESTING AT VARIABLE DEPTH IN ALL THREE HOLES COMPLETED SEPTEMBER, 1994
- SECOND PHASE HYDROCHEMISTRY TESTING AT VARIABLE DEPTH IN ALL THREE HOLES COMPLETED SEPTEMBER, 1994
- HIGH CAPACITY AIR COMPRESSOR/PURIFIER FOR CROSS-HOLE TESTING ARRIVED ON-SITE, NOVEMBER, 1994
- TBM SHUTDOWN FOR MAPPING GANTRY INSTALLATION RESULTED IN 10-WEEK DELAY IN INITIATION OF CROSS-HOLE RADIAL BOREHOLE TESTING (PACKERS IN ALL 3 HOLES) (FROM MID-NOVEMBER TO EARLY FEBRUARY, 1995)
- INITIAL TESTING AND MONITORING PHASE TO CONTINUE FOR 3-4 MONTHS

ESF TESTING ACCOMPLISHMENTS AND NEAR-TERM OBJECTIVES (Cont'd)
II. CONSTRUCTION MONITORING ACTIVITIES

- INSTALLATION OF ALL MULTI-POINT BOREHOLE EXTENSOMETERS IN TBM STARTER TUNNEL AND ALCOVE #1 COMPLETED JANUARY, 1994
- COMPLETION OF SHELL BOLT AND BOLT LOAD CELL INSTALLATION IN ALCOVE #1 ACCOMPLISHED BY END FEBRUARY
- MONITORING OF ALL STARTER TUNNEL/ALCOVE #1 INSTRUMENTATION (CONVERGENCE PIN STATIONS, MPBX'S, ROCK BOLT LOAD CELLS) ONGOING
- BOREHOLE PRESSURE CELLS (IN ADVANCE OF TBM START-UP) ACTIVATED AND INITIALIZED AT FACE DURING AUGUST, 1994
- INITIATED TBM DATA COLLECTION ON OCTOBER 20 (TBM START)
- MONITORING ROCK RESPONSE TO TBM GRIPPER PRESSURE IS ONGOING
- PREPARATION FOR FIRST NORTH RAMP INSTRUMENTATION SECTION (ESF DESIGN VERIFICATION), 20m IN FROM BROW IS UNDERWAY. SCHEDULED START OF SECTION INSTRUMENTATION IS LAST WEEK OF NOVEMBER (DEPENDENT ON TBM ADVANCE RATE)
- FOLLOWING TBM SHUT DOWN FOR MAPPING GANTRY INSTALLATION, TBM CONSTRUCTION MONITORING ACTIVITIES RESUMED IN JANUARY, 1995
- INITIAL INSTRUMENTATION OF STEEL SETS (STRAIN GAGES, CONVERGENCE PINS) TO BEGIN ON JANUARY 17, 1995
- ROCK MASS QUALITY EVALUATIONS FOR ESF DESIGN VERIFICATION ARE ONGOING

ESF TESTING ACCOMPLISHMENTS AND NEAR-TERM OBJECTIVES (Cont'd)

III. OTHER ESF TESTING ACTIVITIES

- MAPPING OF TBM OPENING USING MAPPING PLATFORM/GANTRY TO COMMENCE IN JANUARY (INITIAL GANTRY USE SCHEDULED FOR CONSTRUCTION STATION 01+45m)

- FORMAL TEST PLANNING AND PREPARATION FOR FOLLOWING ESF TESTS IS UNDERWAY:

  - DIESEL EMISSIONS/EXHAUST VENTILATION (APRIL START)

  - INTACT FRACTURE (ESF UZ PERCOLATION) (JULY/AUGUST START)

  - CONTACT RADIAL BOREHOLES (TIVA/PAINTBRUSH NON-WELDED AND PAINTBRUSH/TOPOPAH SPRING) (SEPTEMBER/OCTOBER START)

- EXCAVATION FOR ALCOVE #2 (BOW RIDGE FAULT) SCHEDULED FOR MARCH, 1995

  - DRILLING/INSTALLATION OF TEST INSTRUMENTATION PLANNED MARCH-APRIL, 1995

- ENGINEERED BARRIER SYSTEM FIELD TESTS - LARGE BLOCK TEST AT FRAN RIDGE

  - BLOCK EXCAVATION AND INITIAL DRILLING COMPLETED OCTOBER, 1994

  - PLANNING FOR FINAL INSTRUMENTATION DRILLING/INSTALLATION AND HEATER INSTALLATION IS ONGOING

  - HEATER ACTIVATION SCHEDULED LATE FY 1995 OR EARLY FY 1996