February 27, 1995

Mr. Ronald A. Milner, Director
Office of Program Management and Integration
Office of Civilian Radioactive Waste Management
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, D.C. 20585

Dear Mr. Milner:

SUBJECT: SUMMARY OF NOVEMBER 1, 1994, MEETING ON DRAFT RESPONSE TO U.S. NUCLEAR REGULATORY COMMISSION'S OCTOBER 13, 1994, LETTER

The purpose of this letter is to transmit the summary for the November 1, 1994, U.S. Department of Energy (DOE)/U.S. Nuclear Regulatory Commission meeting. The purpose of the meeting was to discuss the DOE draft response to NRC's October 13, 1994, letter documenting NRC staff concerns with DOE's Civilian Radioactive Waste Management System Management and Operating Contractor (M&O) Quality Assurance program and DOE's oversight of that program. Representatives of the M&O, State of Nevada, Local Governments, Nuclear Waste Technical Review Board, the media, and other organizations also attended the meeting.

If you have any questions regarding this letter or the enclosed meeting summary, please contact me at (301) 415-7238.

Sincerely,

Joseph J. Holonich, Chief
High-Level Waste and Uranium Recovery
Projects Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

Enclosure: As stated

cc: See Attached List

DISTRIBUTION: (w/attachments)

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DWM r/f	HLUR r/f	RJohnson	JAustin	MBell
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OFC	HLUR*	C	HLUR*	E	HLUR*	C	HLUR		
NAME	WBelke:jk*		JSpraul		JThoma		JHolonich		
DATE	02/16/95	H	02/16/95	H	02/17/95	H	02/27/95		

* Per telecon. OFFICIAL RECORD COPY

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Joseph J. Holonich, Chief
High-Level Waste and Uranium Recovery
Projects Branch
Division of Waste Management
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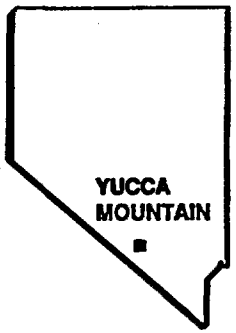
NAME	WLBelke:jk*		JGSpraul		JOThoma for		JJHolonich		
DATE	02/16/95	H	02/16/95	H	02/17/95	H	02/ /95		

* Per telecon.

rec'd with letter dtd. 9/27/95

U.S. DEPARTMENT OF ENERGY

OCRWM



YUCCA MOUNTAIN
SITE CHARACTERIZATION
PROJECT

NRC CONCERN WITH QA PROGRAM

PRESENTED TO

NUCLEAR REGULATORY COMMISSION

PRESENTED BY

DONALD G. HORTON
DIRECTOR, OFFICE OF QUALITY ASSURANCE

1027

ROCKVILLE, MARYLAND
NOVEMBER 1, 1994

PRELIMINARY

AGENDA

- Background
  - NRC Comment and Recommendation
  - NRC Questions
- DOE Response

PRELIMINARY

NRC COMMENT

- Concerned that the CRWMS M&O QA Program is not being effectively implemented
- Concerned about the DOE and CRWMS M&O ability to correct the problems identified
- Concerned about DOE's oversight of the CRWMS M&O's program based on recurrence of problems and inability to correct the problems

PRELIMINARY

NRC RECOMMENDATION

- DOE needs to demonstrate that the work which has been or will be done is acceptable
  - DOE needs to demonstrate that the work on Design Package 2C is acceptable
  - DOE needs to demonstrate that design work on other design packages is acceptable given the problems identified

PRELIMINARY

NRC CONCERNS THAT M&O QA PROGRAM IS NOT EFFECTIVELY IMPLEMENTED

- **DOE and M&O Share NRC's Concern**
  - The M&O and DOE have evaluated CARs for potential impact on Design Package 2C and verified all remedial actions were complete prior to release of design documents for construction
  - The DOE has implemented a training program on how to respond to CARs and effectively perform root cause evaluations
  - The M&O withdrew Design Package 2C from DOE review and instituted a plan whereby additional checks and balances were added to the design process to ensure the quality of the design
  - Design output products are reviewed by DOE prior to release for construction

PRELIMINARY

NRC CONCERNS THAT M&O QA PROGRAM IS NOT EFFECTIVELY IMPLEMENTED

(Continued)

- M&O has implemented a six-point Management Plan to ensure that appropriate corrective action is taken
- DOE performed a management review of the M&O Management Plan
- M&O has strengthened implementation of the M&O Engineering Assurance function within the design organization
- DOE OQA is continuing to evaluate the corrective action taken/being taken on each CAR

PRELIMINARY

CONCERNED ABOUT DOE AND M&O ABILITY TO CORRECT PROBLEMS

- DOE position is that the M&O Design Control Improvement Plan (DCIP) was effective in improving the M&O QA Program Design Control Process
- DOE surveillances provide confidence that the M&O has corrected problems
- Early CARs identified primarily process problems
- Latest CARs identified primarily implementation problems
- Design Package 2C was initiated under procedures that were in place before completion of DCIP implementation
  - Improvements were implemented
  - M&O Engineering Assurance function added
  - Final reviews are conducted by the DOE

PRELIMINARY

CONCERNED ABOUT DOE's OVERSIGHT OF THE M&O QA PROGRAM

- NRC has previously expressed satisfaction with DOE QA Audit and Surveillance program; the NRC concern is with DOE's apparent inability to effect M&O corrective action regarding what the NRC believes are recurring problems

- DOE Position: With few exceptions recent problems are not considered to be recurring problems

  - 15 CARs issued prior to 8/20/93: 11 were process problems

  - 20 CARs issued after DCIP implemented: 16 were implementation problems

  - CAR YM-94-074 and subsequent CAR YM-94-100 were written to address specific 10 CFR 60 issues; flowdown of 10 CFR 60 requirements, in general, is satisfactory

PRELIMINARY

CONCERNED ABOUT DOE's OVERSIGHT OF THE M&O QA PROGRAM

(Continued)

- DOE position: The MGDS DCIP was implemented as planned and was effective in improving the Design Control processes
- Corrective actions resulting from the CARs and the M&O Management Plan will be effective in resolving the present set of problems
- DOE is taking steps to establish an OCRWM-wide trend program
  - Trend conditions adverse to quality, not comments from in-process review of design documents

PRELIMINARY

NRC RECOMMENDATION

- **DOE needs to demonstrate work on Design Package 2C is acceptable**
  - As previously discussed, DOE and M&O have evaluated all open design related CARs for impact on Design Package 2C and taken action to make certain appropriate corrective action is taken prior to release of design documents for construction
  - M&O has added significant additional reviews/checks to ensure compliance with the QA program
  - All 2C design output documents are going through a DOE acceptance review prior to issue for construction
  - DOE OQA is conducting a surveillance on 2C design products as they go through the M&O design verification process

PRELIMINARY

NRC RECOMMENDATION

(Continued)

- **DOE needs to demonstrate that design work on other design packages is acceptable**
  - The additional reviews and checks added to the design process for Design Package 2C will continue to be implemented on other design package development until corrective action verification has ensured effectiveness of action to prevent recurrence
  - DOE is verifying that investigative actions taken as a result of CARs is effective
  - DOE is verifying that corrective actions resulting from CARs have been effective in preventing recurrence of problems via follow-up verifications, audits, and surveillances
  - The NRC will be kept informed regarding these audit and surveillance activities and encouraged to observe the activities

PRELIMINARY

CONCLUSION

- The DOE QA program is being properly implemented
- DOE and M&O are identifying problems and taking action to resolve them
- Because the DOE QA program is functioning properly, DOE is releasing quality design documents for construction
- DOE encourages the NRC to observe any of our activities and DOE will resolve any NRC concerns identified

U.S. DEPARTMENT OF ENERGY

OCRWM

YUCCA MOUNTAIN
SITE CHARACTERIZATION
PROJECT

QUESTION #1
DESIGN AND CONSTRUCTION PHASING

PRESENTED TO

NUCLEAR REGULATORY COMMISSION

PRESENTED BY

J. RUSSELL DYER
ACTING DEPUTY PROJECT MANAGER

ROCKVILLE, MARYLAND
NOVEMBER 1, 1994

PRELIMINARY

AGENDA

- NRC Question #1
- Background on packaging of the ESF Title II design
- Subdivision of Design Packages 1 and 2
- Discussion of TBM operations phasing

PRELIMINARY

QUESTION #1

"What are the differences between the various phases of design and construction proposed under the different phases of Design Package 2C?"

Recommendation:

"DOE should provide a description of the work, including design and construction, that will be completed in each phase of Design Package 2C. This information should relate the completion of construction to significant site features such as the Bow Ridge Fault, or issues raised on ESF construction such as pneumatic pathways"

PRELIMINARY

WHY WAS TITLE II ESF DESIGN DIVIDED INTO PACKAGES?

- DOE recognized that Title II Design would be a lengthy process
- It was considered important to "get underground" as soon as possible in order to acquire needed site information
- It was further recognized that phasing would allow knowledge gained in early excavation work to be used in subsequent design packages

PRELIMINARY

ESF TITLE II DESIGN

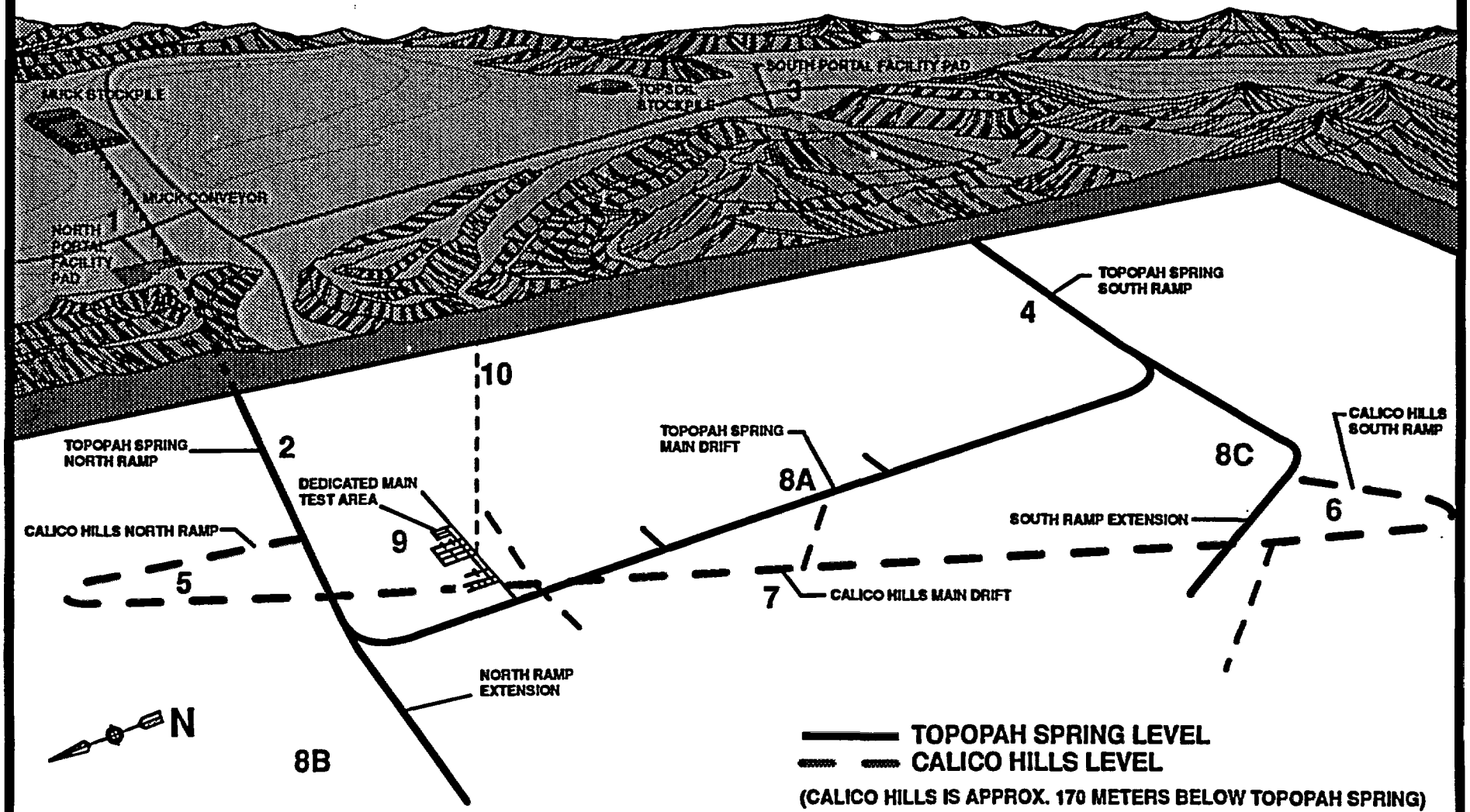
The design of the ESF has been divided into 10 design packages:

1. Site preparation and surface facilities, North Portal
2. North Ramp - surface to Topopah Spring Level (TSL)
3. Site preparation and surface facilities, South Portal
4. South Ramp - surface to TSL
5. North Ramp to Calico Hills Level (CHL)
6. South Ramp to CHL
7. CHL drifting
8. TSL drifting except Main Test Area (MTA)
9. Main Test Area
10. Optional shaft

The numbering of the packages does not indicate the order of either design or construction

PRELIMINARY

EXPLORATORY STUDIES FACILITY DESIGN



ESFQ1JRD.CDR.XSECTNS/11-1-94

PRELIMINARY

ENHANCED ESF LAYOUT DRIFTING

COMPONENT	DESIGN PACKAGE	LENGTH (METERS)	DRIFT GRADIENT (%)	CONFIG. (METERS)
North Ramp, Surface to TSL	2	2,800	-2.05	7.62 Round
South Ramp, Surface to TSL	4	1,835	-2.63	7.62 Round
North Ramp to Calico Hills	5	2,295	-10/-6	5.49 Round
South Ramp to Calico Hills	6	1,805	-10/-6	5.49 Round
TSL Main Drift	8A	3,155	+0.5/2.0/+2.63	7.62 Round
TSL North Ramp Extension	8B	1,615	-1.0/+0.5	7.62 Round
TSL South Ramp Extension	8C	2,005	-0.89/-0.77	7.62 Round
TSL Imbricate Drift	8A	1,275	N/A	5.49 Round
TSL Ghost Dance Drifts (2)	8A	420	+0.5	3.7x6.1
Main Test Area	9	2,865	N/A	3.7x6.1
CH Main Drift	7	3,415	3.8	5.49 Round
CH East Ghost Dance Drift	7	465	0.5	2.7x4.9
CH West Ghost Dance Drift	7	330	0.5	2.7x4.9
CH Imbricate Drift	7	655	0.5	2.7x4.9
CH Solitario Drift	7	670	8.75/0	2.7x4.9
TOTALS		25,605		

PRELIMINARY

SUBDIVISION OF PACKAGES 1 AND 2

- In FY 1992, the program did not have sufficient funding to take on a full ESF Title II Design Package while also maintaining a Surface-Based Testing (SBT) program
- A balanced approach was adopted which allowed both ESF and SBT to proceed, but did not fully fund either area
- Package 1 was subdivided into 5 parts
- Package 2 has likewise been divided into 3 primary parts

PRELIMINARY

PACKAGE 1

Design Package 1: North Portal site preparation and surface facilities (including Determination of Importance Evaluations (DIE))

1A North Portal pad, TBM Starter Tunnel, TBM procurement specifications, utilities, and surface switchgear building

1B Additional surface facilities including: change house and portal control facility

1C Additional surface facilities and utilities for TBM operations support

1D Additional surface facilities and utilities for ESF site support

1E Final ESF surface facilities for ESF operations

PRELIMINARY

PACKAGE 2

Design Package 2: North Ramp excavation - surface to Topopah Spring level (TSL) (including DIEs)

2A Key subsurface studies and evaluations including: transportation, ventilation, power, and ground support *

2B Subsurface procurement specifications (long lead items)

2C Balance of North Ramp design

* Studies encompassed the entire ESF, not just Design Package 2

PRELIMINARY

PACKAGE 2C DIVISIONS

- Design Package 2C drawings and specifications are being released as they complete the review process to enable the constructor to perform testing and phased TBM start-up

- The general content of the Design Package 2C parcels is:

2C-1	Line & grade information, and general construction specifications	(Covers entire ramp)
2C-2	Ground support, including rockbolts and accessories	
2C-3	Steel sets and specifications	
2C-4	Balance of package	

(Related)
40'
Sept 13
Oct 13
10/29
Maybe 11/14

PRELIMINARY

TBM START-UP AND OPERATIONS

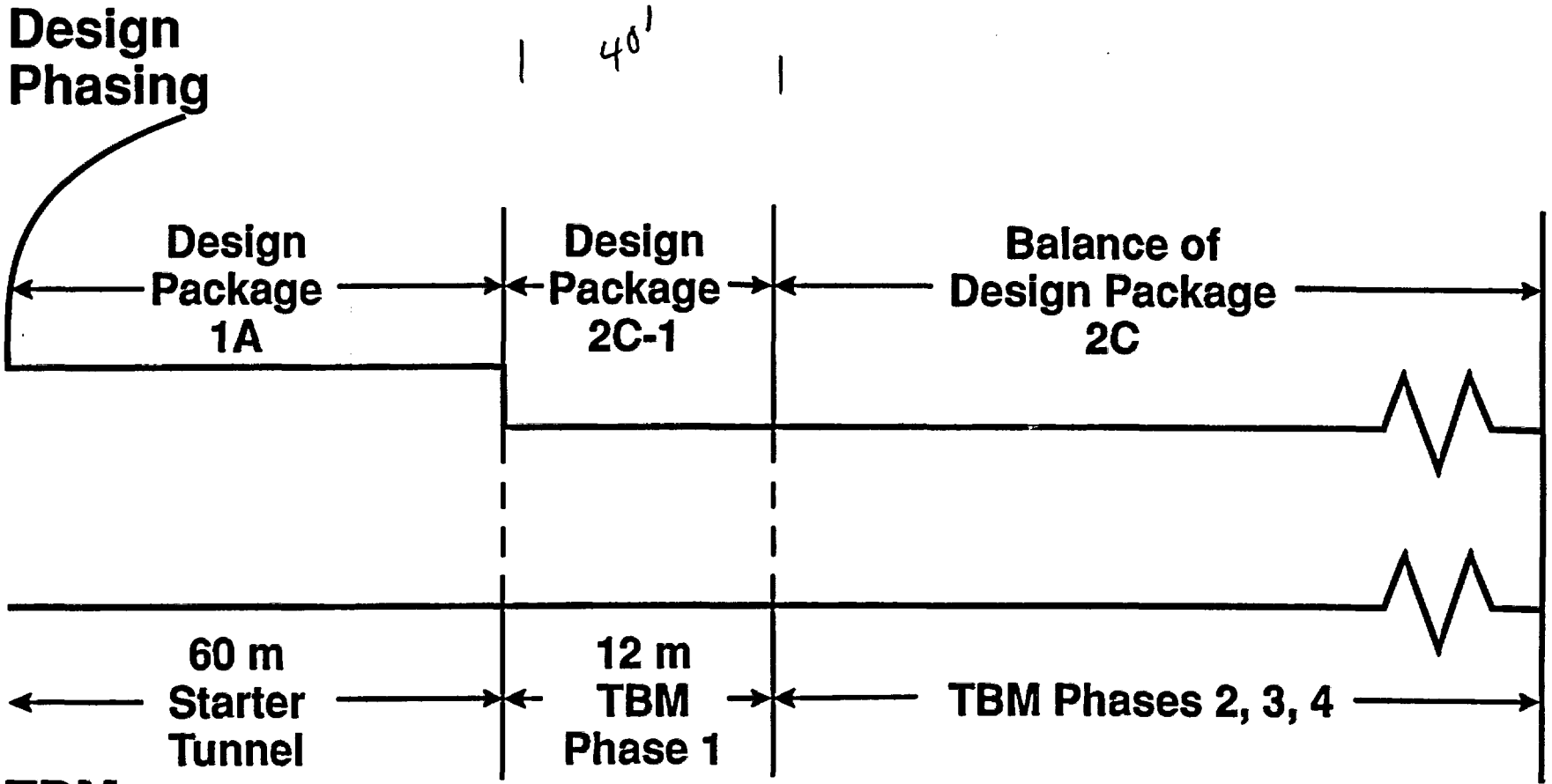
- The start-up and early operations of the TBM have also been described in phases
- TBM start-up phasing was intended to allow the constructor to test the TBM under load in limited early excavation
- Subsequent phases coincide with the arrival and installation of the geologic mapping platform and the muck conveyor

4 Phases TBM Operation
1 – Start up & test phase (1st 40')
2 Operation (Continuous) of TBM
3 Add mapping gantry & platform
4 Subsurface conveyor system &

PRELIMINARY

DESIGN AND TBM PHASING

Design Phasing



TBM Phasing

2C-2 Needed to start TBM Phase 2
2C-3 Needed for poor ground conditions
2C-4 Needed for permanent utility installation and alcove excavation

PRELIMINARY

TBM OPERATIONAL PHASES

TBM Phase 1: Testing

TBM Phase 1 was developed to provide the necessary operational and safety prerequisites for the constructor to fully test and contractually accept the TBM prior to TBM excavation. During this phase, the TBM was assembled, inspected, analyzed, moved into the North Ramp Starter Tunnel, and allowed to excavate up to approximately 12 meters. The excavation permitted in this phase provided the opportunity to test, evaluate, and adjust TBM equipment and operator performance.

PRELIMINARY

TBM OPERATIONAL PHASES

TBM Phase 2: Shakedown

TBM Phase 2 was developed to incorporate requirements identified during Phase 1 and to allow the TBM to excavate the North Ramp at a limited rate since all of the TBM systems are not yet in place and operational. Systems not yet in place include the mapping platform, the muck conveyor system, and the permanent utility systems.

PRELIMINARY

TBM OPERATIONAL PHASES

TBM Phase 3: Limited Operations

TBM Phase 3 incorporates any additional requirements identified in Phase 2 and continues North Ramp excavation with the inclusion of scientific testing from the mapping platform with its associated operational and safety requirements. As in the previous phases, TBM equipment and operator performance testing, evaluations, and adjustments will be identified and incorporated.

PRELIMINARY

TBM OPERATIONAL PHASES

TBM Phase 4: Sustained Operations

TBM Phase 4 incorporates any remaining requirements identified in Phase 3 and continues excavation with the inclusion of the permanent utilities and the muck conveyor system and their associated operational and safety requirements.

PRELIMINARY

SUMMARY

- "Phased" release of Design Package 2C and "phased" TBM operation are different from one another
- Design Package 2C releases are tied to the engineering schedule for release of design products
- TBM phases are tied to testing, shakedown, limited and full operation of the TBM

PRELIMINARY

SUMMARY

- Mechanism is in place for identifying potential test interference and waste isolation impacts - site impact evaluations

- Neither design nor TBM phases are tied to:
  - Significant site features
  - Increased potential for site characterization or waste isolation impacts
  - Any specific construction issues (e.g., pneumatic pathways)

PRELIMINARY

SUMMARY

- It is very important to note that no construction work is started in the field until the activity has been through the DIE process for assessment of potential site impacts, appropriate controls have been applied, and the design products (drawings and specifications) have been through the review and acceptance process

U.S. DEPARTMENT OF ENERGY

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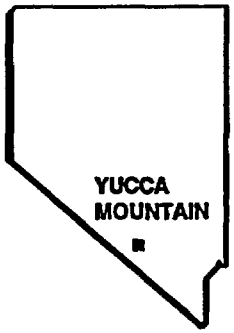


YUCCA MOUNTAIN
SITE CHARACTERIZATION
PROJECT

QUESTION #2
SITE CHARACTERIZATION AND WASTE ISOLATION IMPACTS

PRESENTED TO

NUCLEAR REGULATORY COMMISSION

PRESENTED BY

STEPHAN J. BROCOUM
ASSISTANT MANAGER FOR SUITABILITY AND LICENSING

ROCKVILLE, MARYLAND
NOVEMBER 1, 1994

PRELIMINARY

AGENDA

- Determination of Importance process and criteria
- ESF Package 2C evaluation results
- Examples of control requirements to limit impacts

PRELIMINARY

QUESTION 2

"What are the impacts to site characterization and the waste isolation capability of the site that are associated with the completion of work under Design Package 2C? At what point in the construction of the ESF north ramp is there the potential to impact site characterization and the waste isolation capability of the site?"

<u>Recommendation:</u>

"DOE should provide the requested information along with its rationale for where site characterization or the waste isolation capability of the site could be impacted. If DOE determines that there is no impact from work being completed for Design Package 2C, it should provide justification."

PRELIMINARY

AT WHAT POINT IS THERE POTENTIAL IMPACT - SUMMARY

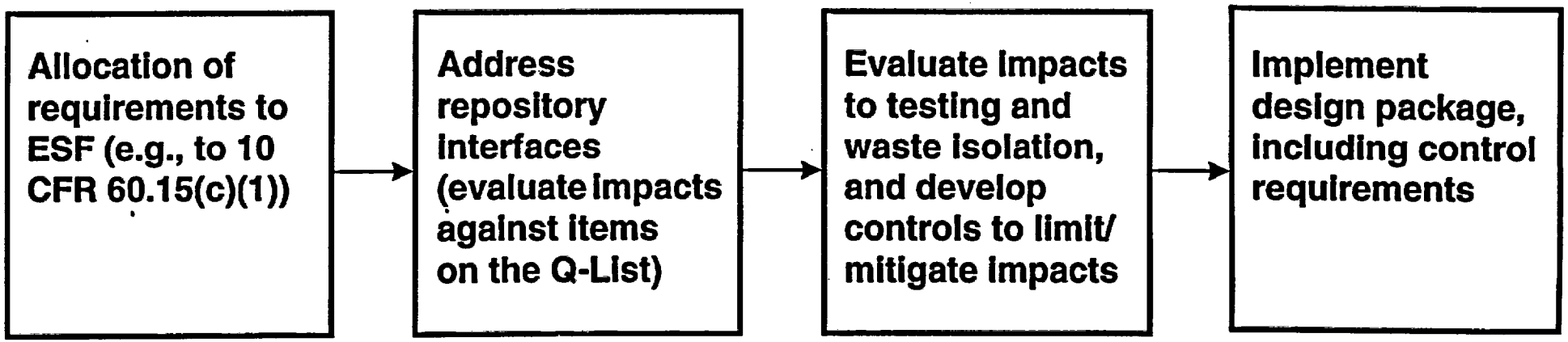
- All activities conducted within the ESF (surface and subsurface), and all structures, systems, and components of the ESF, are subjected to Determination of Importance Evaluations (DIEs)

- ESF Design Package 2C DIE provides for application of controls ***throughout*** the tunnel

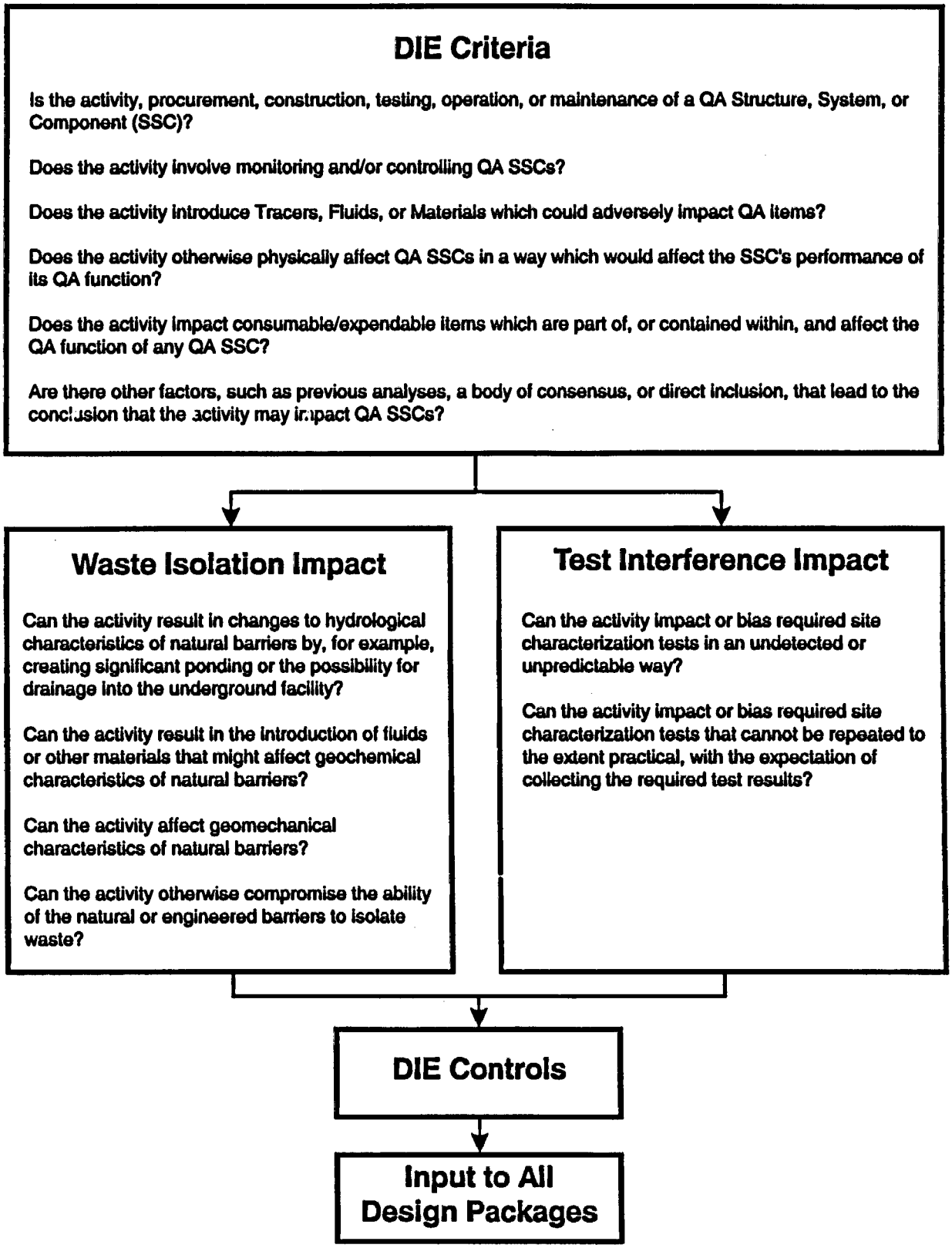
- There is no specific demarcation point beyond which potential impact increases, because DOE limits impacts by applying controls throughout the entire excavation

PRELIMINARY

DETERMINATION OF IMPORTANCE PROCESS



EVALUATION CRITERIA



PRELIMINARY

ESF DESIGN PACKAGE 2C DETERMINATION OF IMPORTANCE EVALUATION (DIE)

- DIE documents potential impacts associated with the excavation and associated activities of Design Package 2C
- Considers potential impact to waste isolation and site characterization test interference
- Provides confidence that DOE understands and has limited/mitigated potential impacts

PRELIMINARY

EXAMPLES OF CONTROLS TO LIMIT IMPACTS

- **Excavation is controlled in such a way as to minimize the likelihood of disturbing potential seal surfaces**

  - As a conservative measure, North Ramp is classified Important to Waste Isolation (by direct inclusion) and maintained on Q-List to account for potential importance of ramp in establishing seals

  - Seals will go in the best rock, and TBM excavation provides for minimal impact

  - Commercial-grade equipment and standard design/ construction practices, applied in a controlled fashion, provide sufficient assurance against significant disturbance

PRELIMINARY

EXAMPLES OF CONTROLS

(CONTINUED)

- Use of organic material is minimized to the extent practical
  - Prohibition on use of organic grout for rockbolts
  - Prohibition on use of shotcrete with organic accelerators or retarders
  - TBM leak mitigation features (e.g., drip pans, conservative design margins on hydraulic systems, etc.)
- Waste isolation impact control derived from conservative calculation designed to avoid perturbation of the natural background organic concentration by more than observed natural variability
- Test interference control prohibits use of chlorides in the North Ramp without Test Coordinator's concurrence - based on conservative assessment of potential impact on Cl-36 measurements

PRELIMINARY

EXAMPLES OF CONTROLS

(CONTINUED)

- **Restrictions on the use of diesel in 2C excavation**
  - Conservative assumptions associated with deeper excavation than in Starter Tunnel have indicated potential impacts from diesel emissions
  - Test plan will be developed to collect data to evaluate in situ impacts of diesel equipment
  - Battery locomotives to be used for muck removal until test plan completed
  - Results of in situ testing of diesel equipment will be used to assess and adjust controls on subsequent use of diesel equipment

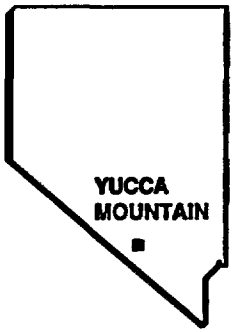
PRELIMINARY

SUMMARY

- DIE process is a key element of the design control process
- DIE for Design Package 2C has been reviewed and accepted, and QA controls have been traced to design outputs (specifications and drawings) as part of review
- Controls applied throughout Design Package 2C; no particular demarcation point beyond which higher/ different impacts are expected

U.S. DEPARTMENT OF ENERGY

OCRWM



YUCCA MOUNTAIN
SITE CHARACTERIZATION
PROJECT

QUESTION #3
ESF/GROA INTERFACE AND ESF TESTING STRATEGY

PRESENTED TO

NUCLEAR REGULATORY COMMISSION

PRESENTED BY

J. RUSSELL DYER
ACTING DEPUTY PROJECT MANAGER

ROCKVILLE, MARYLAND
NOVEMBER 1, 1994

PRELIMINARY

AGENDA

- NRC Question #3
- ESF/GROA physical interfaces
- Control of ESF/GROA compatibility
- ESF testing strategy
- Pneumatic pathways issue

PRELIMINARY

QUESTION #3

- What is the current reference conceptual design for the geologic repository operations area (GROA)?
- What is the current ESF design and testing strategy?
- What is the current control mechanism to ensure compatibility and integration among the GROA conceptual design and the ESF, including design, construction, operation, and the proposed testing strategy?

Recommendations:

1. DOE should provide a description of the conceptual design of the GROA that shows how the individual design packages being prepared for the ESF relate to the repository design
2. DOE should provide the latest thinking on its testing strategy and in situ test locations

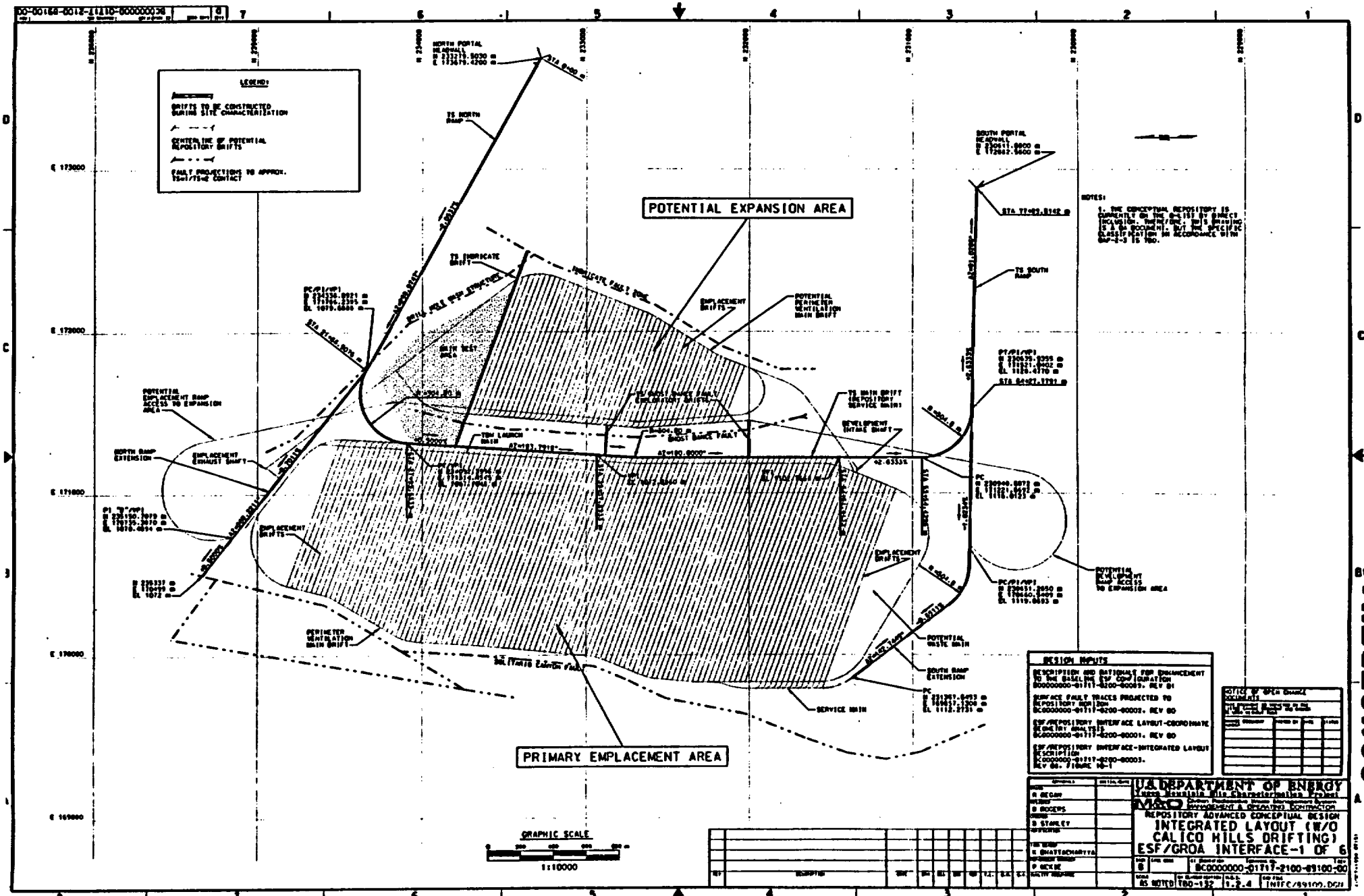
PRELIMINARY

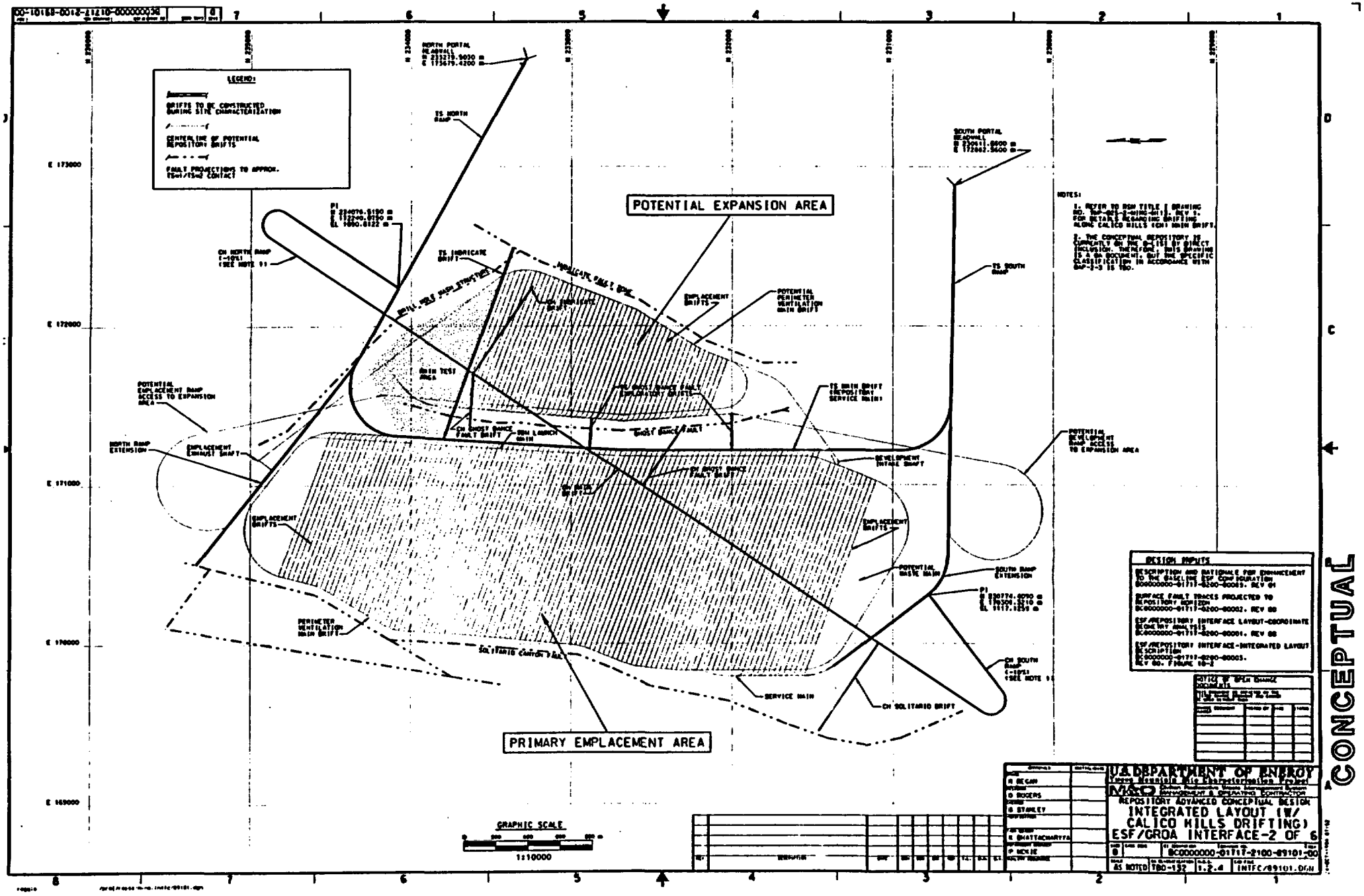
ESF/GROA PHYSICAL INTERFACES

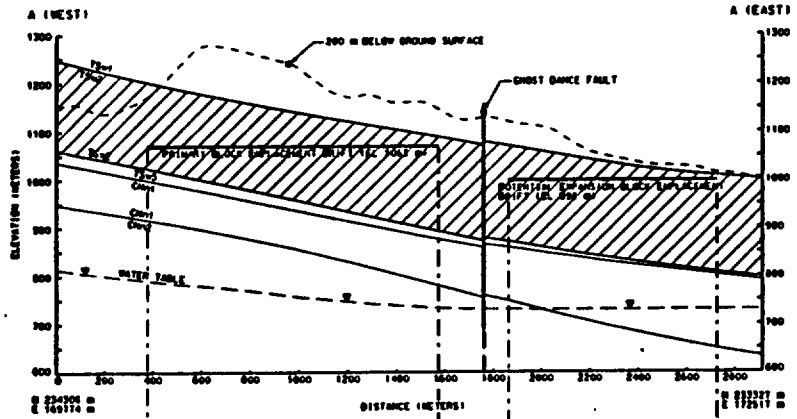
PRELIMINARY

ESF/GROA EVOLUTION

- ESF/GROA concepts have evolved in parallel
- The current ESF/GROA interface concept is contained in six controlled drawings. These drawings show the physical interfaces of the co-located facilities and are referenced in the ESF Design Requirements (ESFDR) document
- The GROA advanced conceptual design continues to evolve. An interim report "Initial Summary Report for Repository/Waste Package Advanced Conceptual Design" B00000000-01717-5705-00015, Rev 00 is available. This document [3 volumes, 700 pages, 200 figures] describes the ACD work in progress
- The reference GROA concept will be updated this fiscal year based on the most current layout

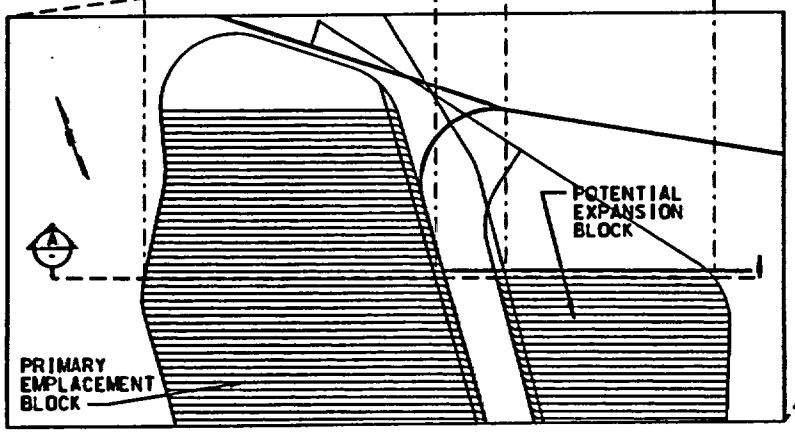

LEGEND
DRIFTS TO BE CONSTRUCTED DURING SITE CHARACTERIZATION
CENTERLINE OF POTENTIAL REPOSITORY DRIFTS
FAULT PROJECTIONS TO APPROX. TSw1/TSw2 CONTACT
POTENTIAL EXPANSION AREA
PRIMARY EMPLACEMENT AREA
NOTES:
DESIGN INPUTS
GRAPHIC SCALE
1:10000
U.S. DEPARTMENT OF ENERGY
Yucca Mountain Site Characterization Project
M&O MANAGEMENT & OPERATING CONTRACTOR
REPOSITORY ADVANCED CONCEPTUAL DESIGN
INTEGRATED LAYOUT (W/O CALICO HILLS DRIFTING)
ESF/GROA INTERFACE-1 OF 6
BC0000000-01717-2100-00100-00
AS NOTED
CONCEPTUAL


LEGEND:
DRIFTS TO BE CONSTRUCTED DURING SITE CHARACTERIZATION
CENTERLINE OF POTENTIAL REPOSITORY DRIFTS
FAULT PROJECTIONS TO APPROX. TSw1/TSw2 CONTACT
POTENTIAL EXPANSION AREA
PRIMARY EMPLACEMENT AREA
NORTH PORTAL
TS NORTH RAMP
SOUTH PORTAL
TS SOUTH RAMP
TS MAIN DRIFT (REPOSITORY SERVICE MAIN)
SOLITARIO CANYON FAULT
GHOST DANCE FAULT
SERVICE MAIN
CH SOLITARIO DRIFT
SOUTH RAMP EXTENSION
NORTH RAMP EXTENSION
PERIMETER VENTILATION MAIN DRIFT
GRAPHIC SCALE
1:10000
NOTES:
1. REFER TO RSN TITLE I DRAWING NO. BCC0000000-01717-0200-00101, REV 1, FOR DETAILS REGARDING DRIFTING ALONG CALICO HILLS TSw1 MAIN DRIFT.
2. THE CONCEPTUAL REPOSITORY IS CURRENTLY ON THE BASIS OF DIRECT EMPLACEMENT. THEREFORE, THIS DRAWING IS A 6m DOCUMENT, BUT THE SPECIFIC CLASSIFICATION IN ACCORDANCE WITH QAP-2-3 IS TBD.
DESIGN INPUTS
DESCRIPTION AND RATIONALE FOR ENHANCEMENT TO THE BASELINE ESF CONFIGURATION BC0000000-01717-0200-00003, REV 01
SURFACE FAULT TRACES PROJECTED TO REPOSITORY HORIZON BC0000000-01717-0200-00002, REV 00
ESF/REPOSITORY INTERFACE LAYOUT-COORDINATE GEOMETRY ANALYSIS BC0000000-01717-0200-00001, REV 00
ESF/REPOSITORY INTERFACE-INTEGRATED LAYOUT DESCRIPTION BC0000000-01717-0200-00003, REV 00, FIGURE 10-2
NOTICE OF DESIGN CHANGE DOCUMENTS
U.S. DEPARTMENT OF ENERGY
Yucca Mountain Site Characterization Project
M&O MANAGEMENT & OPERATING CONTRACTOR
REPOSITORY ADVANCED CONCEPTUAL DESIGN
INTEGRATED LAYOUT (W/ CALICO HILLS DRIFTING)
ESF/GROA INTERFACE-2 OF 6
BC0000000-01717-2100-00101-00
AS NOTED
TBD-132
1.2.4
INTFC/00101.DGN
CONCEPTUAL



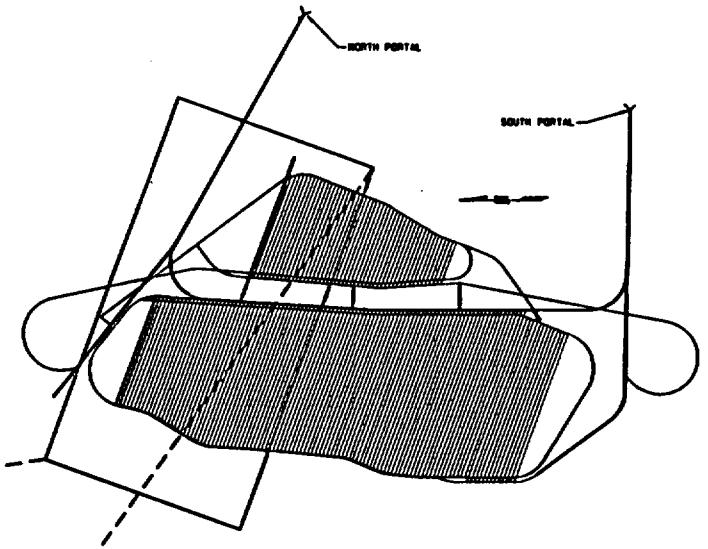
SECTION

SCALE: HORIZ= 1:10000
VERT= 1:5000



ENLARGED PARTIAL PLAN

SCALE: 1:10000



ESF/REPOSITORY INTEGRATED CONCEPTUAL LAYOUT (SEE BC0000000-01717-2100-85100)

PLAN

SCALE: 1:20000

GRAPHIC SCALE

1:10000

NOTES:

1. STATIONS AND ELEVATIONS SHOWN ARE ROUNDED TO NEAREST INTEGER VALUE. REFER TO BC0000000-01717-2100-85100 (SHT 1 OF 6) FOR MORE PRECISE DATA.
2. GEOLOGICAL AND OTHER BACKGROUND INFORMATION SHOWN ON SECTION WAS BEEN DIGITIZED FROM DIS/CAIRO PLOT NO. MAP-94-012.0 PROVIDED BY BSAC.
3. THE CONCEPTUAL REPOSITORY IS CURRENTLY ON THE C-LIST BY DIRECT INCLUSION. THEREFORE, THIS DRAWING IS A QA DOCUMENT, BUT THE SPECIFIC CLASSIFICATION IN ACCORDANCE WITH QAP-2-3 IS TBD.

DESIGN INPUTS

DESCRIPTION AND RATIONALE FOR ENHANCEMENT TO THE BASELINE ESF CONFIGURATION BC0000000-01717-0200-00085, REV 01

SURFACE FAULT TRACES PROJECTED TO REPOSITORY HORIZON BC0000000-01717-0200-00002, REV 00

ESF/REPOSITORY INTERFACE LAYOUT-COORDINATE GEOMETRY SCALE FILE BC0000000-01717-0200-00001, REV 00

ESF/REPOSITORY INTERFACE-INTEGRATED LAYOUT DESCRIPTION BC0000000-01717-0200-00003, REV 00, FIGURE 10-3

DRAWN	R BEDAN
CHECKED	D ROGERS
ENGINEER	G STANLEY
DESIGN AGENCY	N/A
DESIGN MANAGER	K BHATTACHARYYA
PROJECT MANAGER	P MCKIE
QUALITY ASSURANCE	

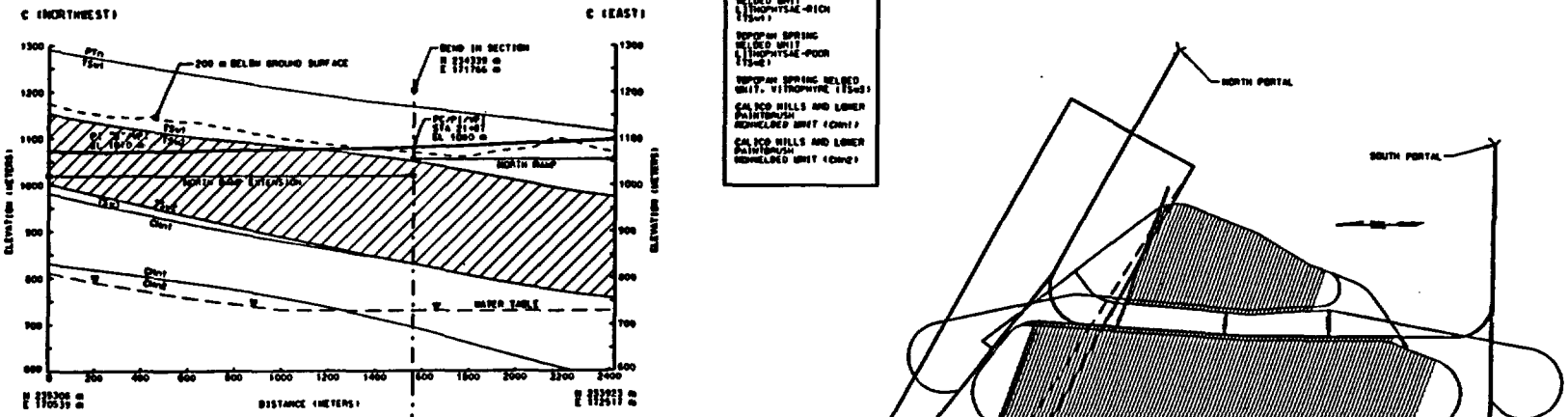
U.S. DEPARTMENT OF ENERGY
Yucca Mountain Site Characterization Project
M&O Management & Operating Contractor

REPOSITORY ADVANCED CONCEPTUAL DESIGN

SECTION "A" THROUGH INTEGRATED LAYOUT ESF/GROA INTERFACE-3 OF 6

SCALE: AS NOTED	TBD-152	U.S.A.	BC0000000-01717-2100-85102-00	INTFC/85102.DGN

CONCEPTUAL



SECTION C

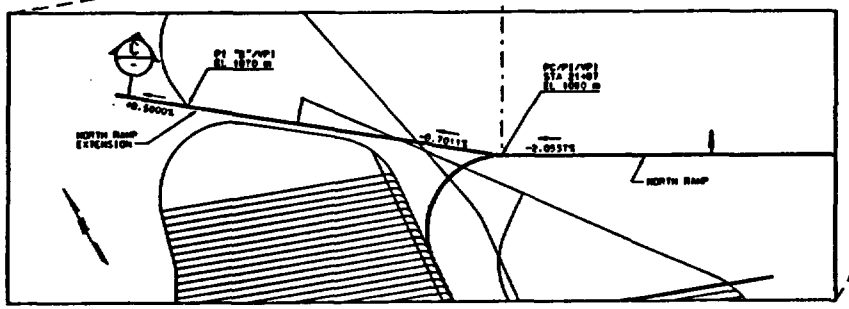
SCALE: HORIZ= 1:10000
VERT= 1:5000

REFERENCE STRATIGRAPHY UNIT NAME (DESIGNATOR)
UPPER PAINTBRUSH BONNELBED UNIT (PTn1)
TOPOPAH SPRING WELDED UNIT LITHOPHYSAE-RICH (Tpw1)
TOPOPAH SPRING WELDED UNIT LITHOPHYSAE-POOR (Tpw2)
TOPOPAH SPRING WELDED UNIT, VITROPHYRE (Tpw3)
CALICO HILLS AND LOWER PAINTBRUSH BONNELBED UNIT (Chn1)
CALICO HILLS AND LOWER PAINTBRUSH BONNELBED UNIT (Chn2)

ESF/REPOSITORY INTEGRATED CONCEPTUAL LAYOUT (SEE BC0000000-01717-2100-89100)

PLAN

SCALE: 1:20000



ENLARGED PARTIAL PLAN

SCALE: 1:10000

NOTES:

1. STATIONS AND ELEVATIONS SHOWN ARE ROUNDED TO NEAREST INTEGER VALUE. REFER TO BC0000000-01717-2100-89100 (SHT 1 OF 6) FOR MORE PRECISE DATA.
2. GEOLOGICAL AND OTHER BACKGROUND INFORMATION SHOWN ON SECTION HAS BEEN DIGITIZED FROM 1615/CALMA PLOT NO. WMP-84-060.0 PROVIDED BY ECRB.
3. THE CONCEPTUAL REPOSITORY IS CURRENTLY ON THE O-LIST BY DIRECT INCLUSION. THEREFORE, THIS DRAWING IS A QA DOCUMENT, BUT THE SPECIFIC CLASSIFICATION IN ACCORDANCE WITH QAP-2-3 IS TBD.

DESIGN INPUTS

DESCRIPTION AND RATIONALE FOR ENHANCEMENTS TO THE BASELINE ESF CONFIGURATION BC0000000-01717-0200-00005, REV 01

SURFACE FAULT TRACES PROJECTED TO REPOSITORY HORIZON BC0000000-01717-0200-00002, REV 00

ESF/REPOSITORY INTERFACE LAYOUT-COORDINATE GEOMETRY ANALYSIS BC0000000-01717-0200-00001, REV 00

ESF/REPOSITORY INTERFACE-INTEGRATED LAYOUT DESCRIPTION BC0000000-01717-0200-00003, REV 00, FIGURE 10-1

OFFICE OF RECORD SOURCE DOCUMENTS

DESIGNED	CHECKED	DATE	LEVEL
G BEGAN			
G ROGERS			
G STANLEY			
S BHATTACHARYYA			
P HORNE			

U.S. DEPARTMENT OF ENERGY
Yucca Mountain Site Characterization Project
M&O Management & Operating Contractor

REPOSITORY ADVANCED CONCEPTUAL DESIGN
SECTION "C" ALONG NORTH RAMP AND EXTENSION
ESF/GROA INTERFACE-4 OF 6

QA	DRAWING NO.	REV
B	BC0000000-01717-2100-89103-00	

SCALE	UNITS	SIZE	SHEET
AS NOTED	TBD-132	1.2.4	INTFC/89103.DGN

GRAPHIC SCALE

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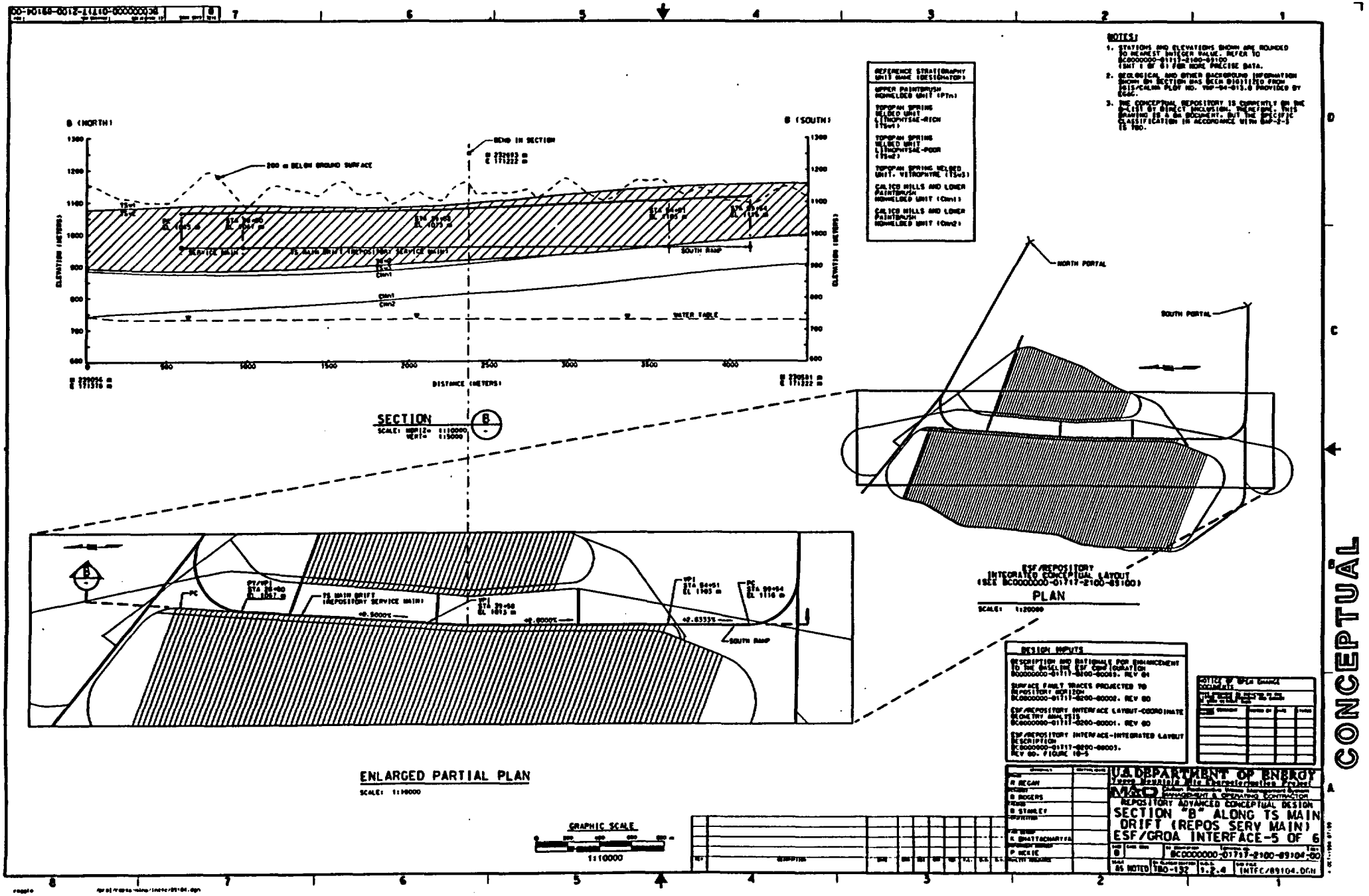
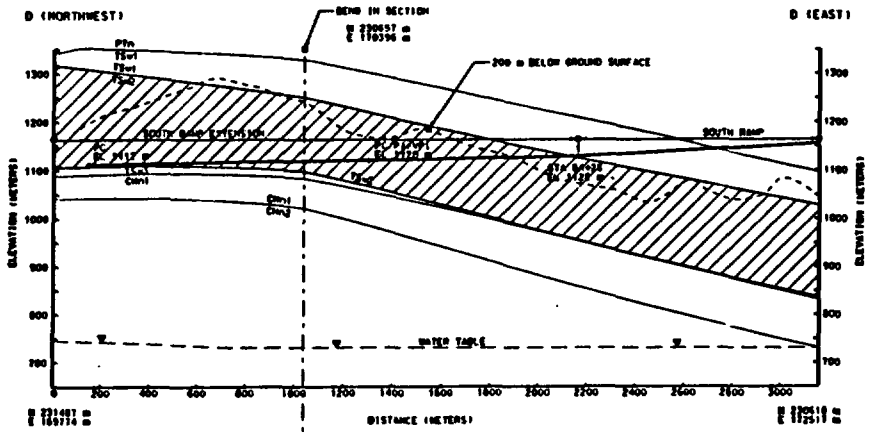
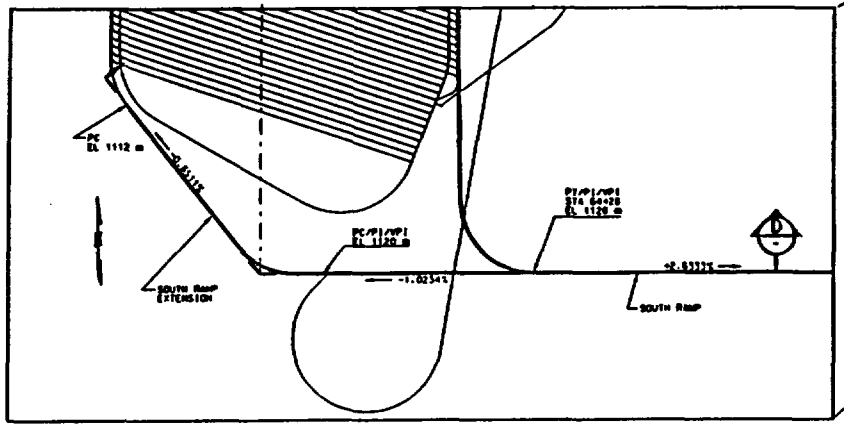
1:10000

CONCEPTUAL


NOTES:
1. STATIONS AND ELEVATIONS SHOWN ARE ROUNDED TO NEAREST INTEGER VALUE. REFER TO BC0000000-01717-2100-89100 SHT 1 OF 01 FOR MORE PRECISE DATA.
2. GEOLOGICAL AND OTHER BACKGROUND INFORMATION SHOWN ON SECTION WAS DIGITIZED FROM GIS/CALMA PLOT NO. YMP-94-013.0 PROVIDED BY SCAI.
3. THE CONCEPTUAL REPOSITORY IS CURRENTLY ON THE QA LIST BY DIRECT INCLUSION. THEREFORE, THIS DRAWING IS A QA DOCUMENT, BUT THE SPECIFIC CLASSIFICATION IN ACCORDANCE WITH QAP-2-3 IS TBD.
REFERENCE STRATIGRAPHY UNIT NAME (DESIGNATOR)
UPPER PAINTBRUSH NONWELDED UNIT (PTn)
TOPOPAH SPRING WELDED UNIT LITHOPHYSAE-RICH (TSw1)
TOPOPAH SPRING WELDED UNIT LITHOPHYSAE-POOR (TSw2)
TOPOPAH SPRING WELDED UNIT, VITROPHYRE (TSw3)
CALICO HILLS AND LOWER PAINTBRUSH NONWELDED UNIT (Cnn1)
CALICO HILLS AND LOWER PAINTBRUSH NONWELDED UNIT (Cnn2)
B (NORTH)
B (SOUTH)
200 m BELOW GROUND SURFACE
BEND IN SECTION
ELEVATION (METERS)
DISTANCE (METERS)
WATER TABLE
SOUTH RAMP
SECTION B
NORTH PORTAL
SOUTH PORTAL
ESF/REPOSITORY INTEGRATED CONCEPTUAL LAYOUT (SEE BC0000000-01717-2100-89100)
PLAN
SCALE: 1:20000
PC
PT MAIN DRIFT (REPOSITORY SERVICE MAIN)
SOUTH RAMP
ENLARGED PARTIAL PLAN
SCALE: 1:10000
GRAPHIC SCALE
1:10000
DESIGN INPUTS
DESCRIPTION AND RATIONALE FOR ENHANCEMENT TO THE BASELINE ESF CONFIGURATION BC0000000-01717-0200-00005, REV 01
SURFACE FAULT TRACES PROJECTED TO REPOSITORY HORIZON BC0000000-01717-0200-00002, REV 00
ESF/REPOSITORY INTERFACE LAYOUT-COORDINATE GEOMETRY ANALYSIS BC0000000-01717-0200-00001, REV 00
ESF/REPOSITORY INTERFACE-INTEGRATED LAYOUT DESCRIPTION BC0000000-01717-0200-00003, REV 00, FIGURE 10-5
R REGAN
B ROGERS
B STANLEY
K BHATTACHARYYA
P MCKIE
U.S. DEPARTMENT OF ENERGY
Yucca Mountain Site Characterization Project
M&O MANAGEMENT & OPERATING CONTRACTOR
REPOSITORY ADVANCED CONCEPTUAL DESIGN
SECTION "B" ALONG TS MAIN DRIFT (REPOS SERV MAIN) ESF/GROA INTERFACE-5 OF 6
BC0000000-01717-2100-89104-00
AS NOTED
TBD-152
9.2.4
INTFC/89104.DGN
CONCEPTUAL

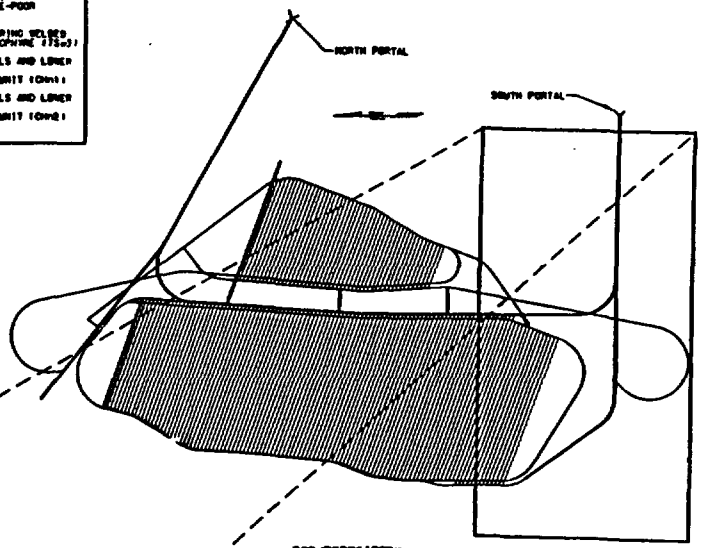


SECTION D



ENLARGED PARTIAL PLAN

SCALE: 1:10000



ESF/REPOSITORY INTEGRATED CONCEPTUAL LAYOUT (SEE BC0000000-01717-2100-85100)

PLAN

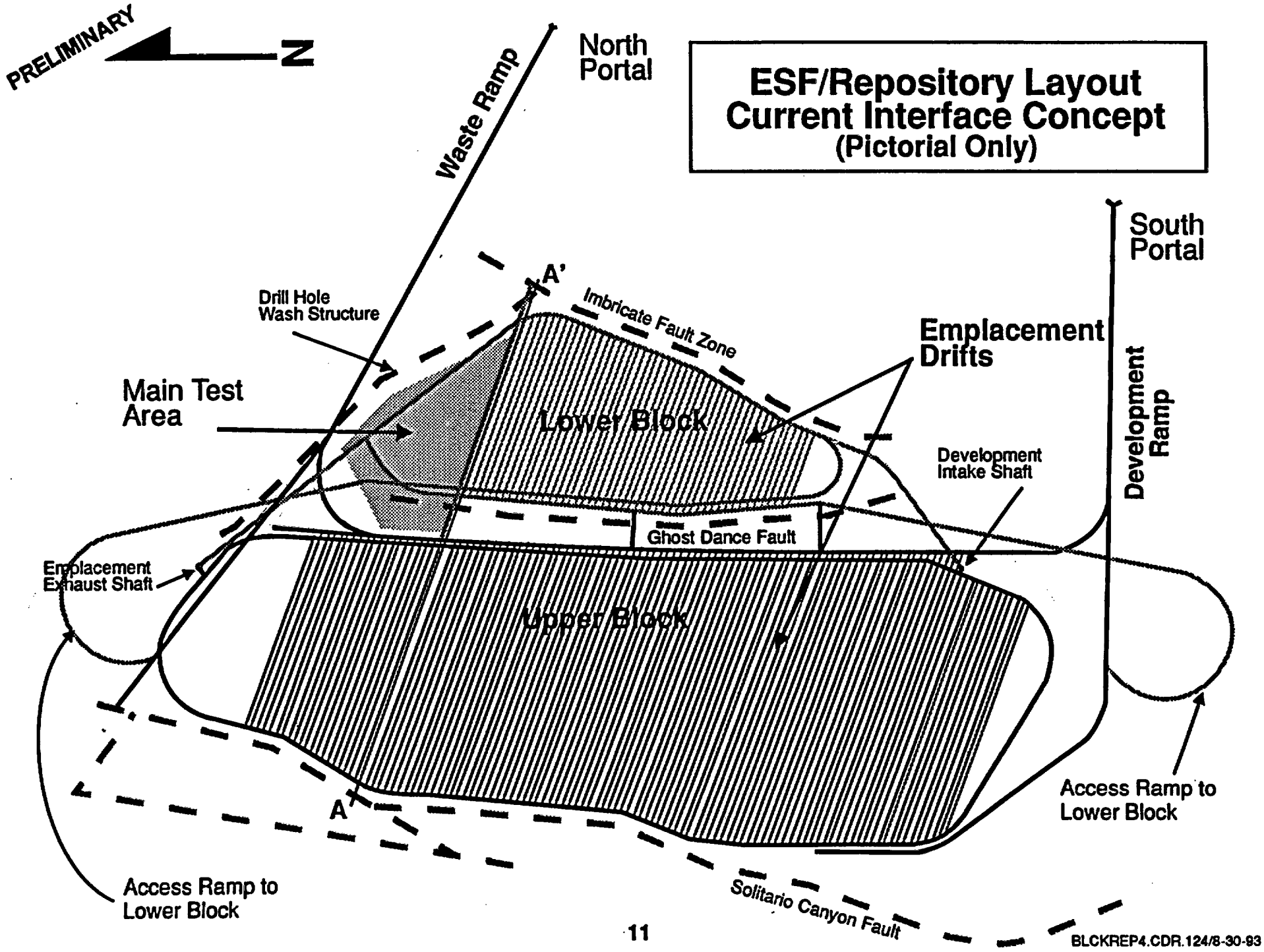
SCALE: 1:20000

GRAPHIC SCALE

1:10000

CONCEPTUAL

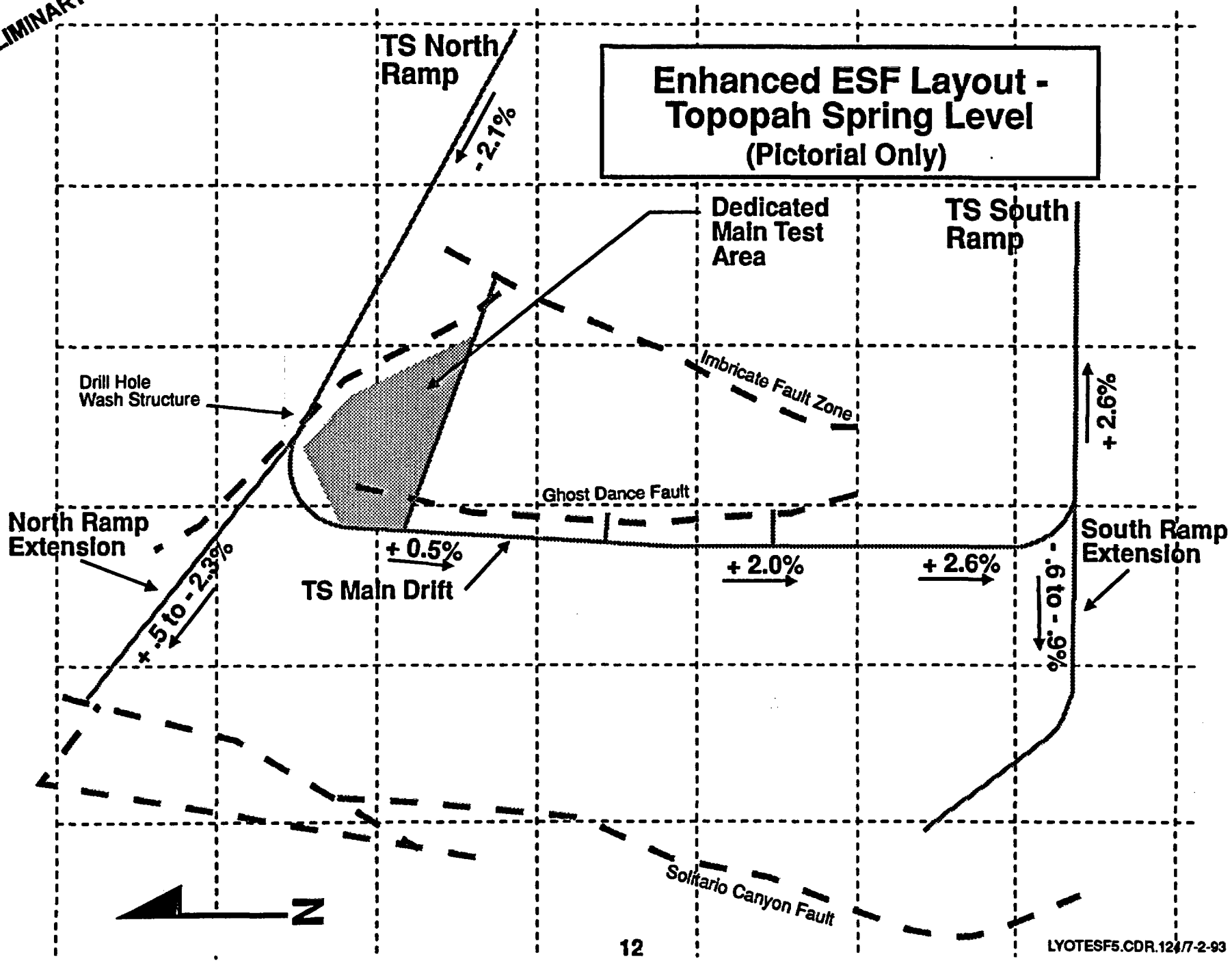
10



BLCKREP4.CDR.124/8-30-93

PRELIMINARY

Enhanced ESF Layout - Topopah Spring Level
(Pictorial Only)



LYOTESF5.CDR.12 7-2-93

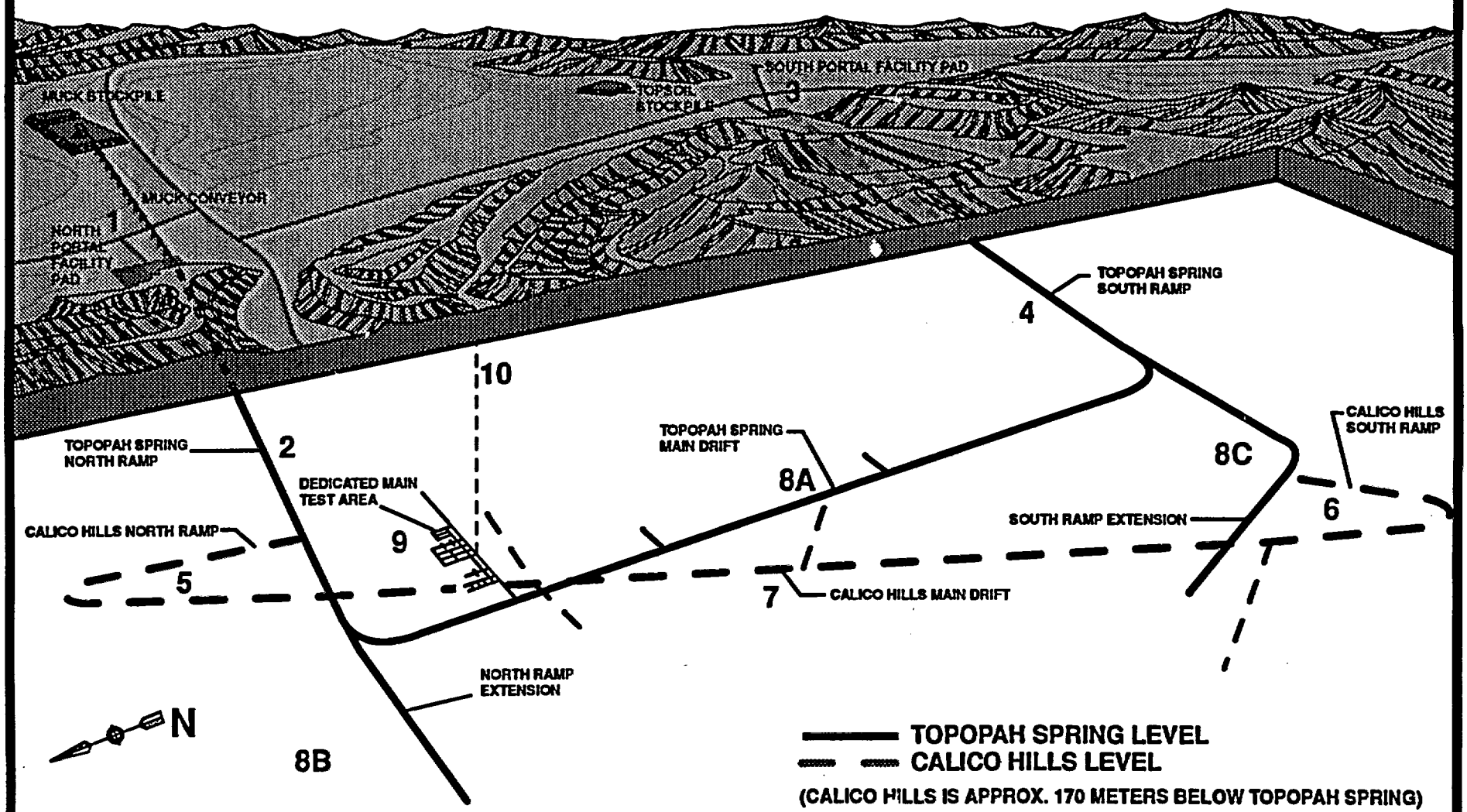
PRELIMINARY

COINCIDENT ESF/GROA DRIFTING

Six primary ESF segments may become parts of a potential repository:

- Package 1A - Starter Tunnel
- Package 2 - ESF North Ramp, surface to Topopah Spring Level (TSL) becomes the repository waste ramp
- Package 8A - ESF main TSL drift becomes the repository service main
- Package 4 - ESF South Ramp, TSL to surface, becomes the repository development ramp
- Package 8B - ESF North Ramp extension, becomes an access to the north end of the primary block, and also provides access to the lower block
- Package 8C - ESF South Ramp Extension, becomes an access to the south end of the primary block, and also provides access to the lower block

EXPLORATORY STUDIES FACILITY DESIGN



ESFQ1JRD.CDR.XSECTNS/11-1-94

PRELIMINARY

CONTROL OF ESF/GROA COMPATIBILITY

PRELIMINARY

ESF/GROA REQUIREMENTS FLOWDOWN

- DOE established a requirements document hierarchy in 1992 to ensure that all requirements, including those of 10 CFR Part 60, are properly captured and allocated to the ESF and repository efforts
- Those Part 60 requirements applicable to the ESF (as identified in NUREG 1439) are flowed down to the ESFDR

PRELIMINARY

ESF/GROA REQUIREMENTS FLOWDOWN

(CONTINUED)

- The flowdown of requirements, including Part 60 requirements, was the subject of a DOE QA surveillance in 1992. This surveillance confirmed the adequacy of requirements flow down from the top level requirements documents through the ESFDR

- The ESF designers develop a Requirements Allocation Analysis (RAA) for each Configuration Item (CI) of the ESF. This is the mechanism which ensures that requirements are ultimately carried all the way from 10 CFR Part 60 (and other sources) to the design output products

PRELIMINARY

CONTROL OF ESF/GROA INTERFACES

- Providing a cohesive explanation of ESF/GROA interfaces has been complicated by the evolving nature of the concepts and the number of documents that define the interfaces
- DOE has established a Technical Baseline Working Group to develop an improved presentation of the technical baseline
- A top level summary document will be developed this fiscal year to replace the current Site Characterization Program Baseline (SCPB) as discussed in the July 27, 1994, DOE-NRC Technical Meeting
- The revised SCPB will contain descriptions of the ESF, Surface-Based Testing (SBT) and GROA concepts and interfaces. This document will also describe how the ESF and SBT will be incorporated into the GROA. The SCPB will more clearly identify the general configuration of all MGDS segments

PRELIMINARY

ESF/GROA INTEGRATION SUMMARY

- ESF design activities were undertaken with explicit knowledge of GROA concepts
- Repository design requirements have been captured in the ESFDR and Determination of Importance Evaluation (DIE) processes
- The reconfiguration of the ESF/GROA concept adopted during FY 1994 was done in a manner which allows considerable flexibility in future potential repository configurations

PRELIMINARY

ESF TESTING STRATEGY

PRELIMINARY

QUESTION 3B

- What is the current ESF design and testing strategy?

Recommendation:

- DOE should provide the latest thinking on its testing strategy and in situ test locations

PRELIMINARY

USES OF INFORMATION OBTAINED IN THE ESF

- The information obtained in the ESF will be used to support:
  - Technical Site Suitability findings
  - Repository Design
  - Waste Package Design
  - License Application
  - Performance Confirmation
- These uses of the information were valid before the Program Approach and are still valid
- The Program Approach has changed the emphasis in the timing of obtaining the information

PRELIMINARY

WHAT INFORMATION WILL BE OBTAINED IN THE ESF

- The SCP describes the issues to be addressed, the information to be obtained to address the issues, and the methods to be used to obtain the information
- To permit controlled implementation in the ESF, the SCP test program was elaborated in Test Planning Package 91-5 (TPP 91-5), entitled "Preliminary Test Planning Package for Support of Pre-Title II Design Studies, Planned Exploratory Studies Facility Tests"
- The program approach has placed earlier priority on those parts of TPP 91-5 that address the critical data for Technical Site Suitability and License Application

PRELIMINARY

HOW, WHEN, AND WHERE

- The details have progressed with time, from the SCP-CDR, through the ESF Alternative Study, to the Program Approach
- For Technical Site Suitability, the Program Approach is to collect irretrievable data and conduct critical tests in seven alcoves. All of the alcoves are dedicated to investigating fluid flow at Yucca Mountain, particularly in faults and across geologic contacts
- The critical tests are in the alcoves at contacts and faults intersected by, or located near, the North Ramp and Main Drift

PRELIMINARY

CRITICAL DATA FROM THE ESF FOR TSS AND LICENSE APPLICATION

Geohydrology

- Tests in nondeferred alcoves and perched water testing will be used to investigate the flow of fluids in the mountain to investigate barriers to flow, potential fast pathways, and permeability

Rock characteristics

- Geologic mapping and sample collection will be used to determine the distribution and the properties of the rocks for use in other programs such as geochemistry and tectonics

PRELIMINARY

CRITICAL DATA FROM THE ESF FOR TSS AND LICENSE APPLICATION

Construction monitoring

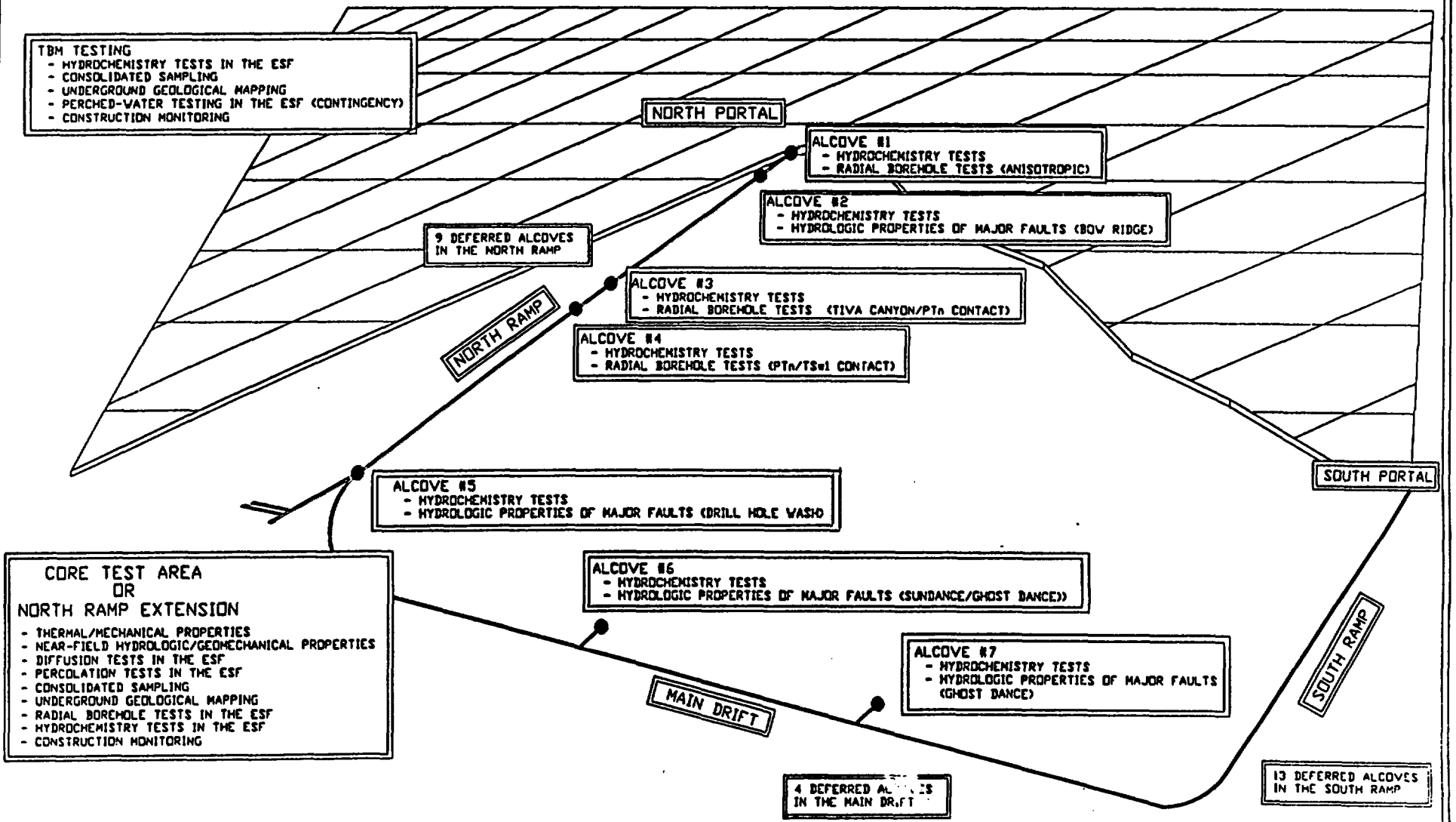
- These are measurements of irretrievable data of rock mass response to excavation

Thermal tests

- The Technical Site Suitability findings will be based on information from lab tests and the Large Block Test. The license application will be based also on data from in situ thermal tests.

PRELIMINARY

ESF TEST PROGRAM LOCATIONS



NOTES: FINAL DECISIONS ON DEFERRAL: TEST/EXCAVATION, AND TESTING IN DEFERRED ALCOVES IS DEPENDENT ON OBSERVATIONS DURING EXCAVATION, EVALUATION OF EARLY TEST RESULTS, AND PROGRAM PRIORITIES.

SUMMARY TABLE OF PLANNED ESF TESTS
GROUPED BY CONSOLIDATED PROGRAM
(SOURCE: ESF TPP 91-5)

PRELIMINARY

SCP TEST ACTIVITY	SCPB REFERENCE NUMBER	SCP PROGRAM NAME
*Consolidated Sampling**		
• Chloride & Chlorine-36 Measurements of Percolation at YM	8.3.1.2.2.2.1	Geochemistry
• Matrix Hydrologic Properties Testing	8.3.1.2.2.3.1	Geohydrology
• Petrologic Stratigraphy of the Topopah Spring Member	8.3.1.3.2.1.1	Geohydrology
• Mineral Distribution Between Host Rock and Accessible Environment	8.3.1.3.2.1.2	Geohydrology
• Fracture Mineralogy Studies of the ESF	8.3.1.3.2.1.3	Geohydrology
• History of Mineralogic and Geochemical Alteration of YM	8.3.1.3.2.2.1	Geohydrology
• Biological Sorption and Transport	8.3.1.3.4.2	Geohydrology
• Laboratory Tests (Thermal & Mechanical) Using Samples	See Note 1	Thermal & Mech. Rock Prop.
• Repository Horizon Rock-Water Interaction	8.3.4.2.4.4.2	Waste Package Characteristics
Intact-Fracture Test	8.3.1.2.2.4.1	Geohydrology
Percolation Tests in the ESF	8.3.1.2.2.4.2	Geohydrology
Radial Borehole Tests in the ESF	8.3.1.2.2.4.4	Geohydrology
Bulk Permeability Test in the ESF	8.3.1.2.2.4.3	Geohydrology
Excavation Effects Test	8.3.1.2.2.4.5	Geohydrology
Perched-Water Testing in the ESF	8.3.1.2.2.4.7	Geohydrology
Hydrochemistry Tests in the ESF	8.3.1.2.2.4.8	Geohydrology
Hydrologic Properties of Major Faults Encountered in the ESF	8.3.1.2.2.4.10	Geohydrology
Diffusion Test in the ESF	8.3.1.2.2.5.1	Geohydrology
Field Scale Experiments to Study Radionuclide Transport at YM	8.3.1.3.7.2.2	Geochemistry
Underground Geological Mapping	8.3.1.4.2.2.4	Rock Characteristics
Seismic Tomography/Vertical Seismic Profiling at the ESF	8.3.1.4.2.2.5	Rock Characteristics
*Construction Monitoring**		
• Access Convergence Test at the ESF	8.3.1.15.1.5.1	Thermal & Mech. Rock Prop.
• Evaluation of Mining Methods	8.3.1.15.1.8.1	Thermal & Mech. Rock Prop.
• Monitoring of Ground Support Systems	8.3.1.15.1.8.2	Thermal & Mech. Rock Prop.
• Monitoring Drift Stability	8.3.1.15.1.8.3	Thermal & Mech. Rock Prop.
*Thermal/Mechanical Properties**		
• Heater Experiment in TSw1	8.3.1.15.1.6.1	Thermal & Mech. Rock Prop.
• Canister-Scale Heater Experiment	8.3.1.15.1.6.2	Thermal & Mech. Rock Prop.
• Yucca Mountain Heated Block	8.3.1.15.1.6.3	Thermal & Mech. Rock Prop.
• Thermal Stress Measurements	8.3.1.15.1.6.4	Thermal & Mech. Rock Prop.
• Sequential Drift Mining	8.3.1.15.1.5.3	Thermal & Mech. Rock Prop.
• Heated Room Experiment	8.3.1.15.1.6.5	Thermal & Mech. Rock Prop.
• Plate Loading Tested Block	8.3.1.15.1.7.1	Thermal & Mech. Rock Prop.
• Rock-Mass Strength Experiment	8.3.1.15.1.7.2	Thermal & Mech. Rock Prop.
• Overcore Stress Experiment in the ESF	8.3.1.15.2.1.2	Thermal & Mech. Rock Prop.
Air Quality and Ventilation Experiment	8.3.1.15.1.8.4	Thermal & Mech. Rock Prop.
In Situ Testing of Seal Components	8.3.3.2.2.3	Seal Characteristics
*Near-Field Hydrologic/Geomechanical Properties**		
• Mechanical Attributes of the Waste Package Environment	8.3.4.2.4.3	Waste Package Characteristics
• Repository Horizon Near-Field Hydrologic Properties	8.3.4.2.4.4.1	Waste Package Characterisitcs

NOTE:
1) 8.3.1.15.1.1.1; 8.3.1.15.1.1.2; 8.3.1.15.1.1.3; 8.3.1.15.1.2.1; 8.3.1.15.1.3.1; 8.3.1.15.1.3.2; 8.3.1.15.1.4.1; 8.3.1.15.1.4.2
2) ESF locator test names (Calico Hills Test, Demonstration Breakout Room) are not separately listed.
3) *Multi-Purpose Borehole Test* (Optional ESF Shaft Test) is not listed.
4) *Development and Demonstration of Required Equipment Test* is not currently planned.
* Consolidated Test Program Name

IN SITU TEST LOCATIONS AND IMPLEMENTATION LOGISTICS FOR ESF TESTS/PROGRAMS

(SOURCES: SITE PROGRAM ANNUAL PLAN 1994 & 1995, OMB 5-YEAR PLAN)

YEARS IN PARENTHESIS INDICATE INITIAL START (PLANNED OR ACTUAL) OF TEST OR FIRST PROGRAM COMPONENT

I. CONSTRUCTION PHASE (NON-DEFERRABLE) TESTS CONDUCTED IN TBM ENVELOPE

- Consolidated Sampling (1993)
- Perched Water Testing in the ESF (Contingency) (1993)
- Hydrochemistry Tests in the ESF (1995)
- Underground Geological Mapping (1993)
- Construction Monitoring (1993)

II. CONSTRUCTION PHASE (NON-DEFERRABLE) TESTS IN ALCOVES

- Consolidated Sampling (1994)
- Radial Borehole Tests in the ESF (1994)
- Hydrochemistry Tests in the ESF (1994)
- Hydrologic Properties of Major Faults Encountered in the ESF (1995)
- Underground Geological Mapping (1994)
- Construction Monitoring (1994)

III. DEFERRED (POST "INITIAL LOOP") TESTS IN THE ESF RAMPS/MAIN DRIFT

- Consolidated Sampling (1997)
- Excavation Effects Test (1997)
- Intact-Fracture Test in the ESF (1997)
- Seismic Tomography/Vertical Seismic Profiling at the ESF (1997)
- Construction Monitoring (1997)
- Air Quality and Ventilation Experiment (1996)
- In Situ Testing of Seal Components (1998)

IV. IN SITU ALCOVE TESTS IN THE CORE TEST AREA/RAMP EXTENSIONS (TSw2)
(Including Deferred Ramp Alcoves)

- Consolidated Sampling (1994)
- Radial Borehole Tests in the ESF (1994)
- Hydrochemistry Tests in the ESF (1994)
- Hydrologic Properties of Major Faults Encountered in the ESF (1995)
- Underground Geological Mapping (1994)
- Construction Monitoring (1994)
- Percolation Test in the ESF (1996)
- Diffusion Test in the ESF (1996)
- Thermal/Mechanical Properties (1996)
- Near-Field Hydrologic/Geomechanical Properties (1997)

V. PLANNED TESTS IN CALICO HILLS NONWELDED UNIT (All Tests TBD)

- Underground Geological Mapping
- Consolidated Sampling
- Field Scale Experiments to Study Radionuclide Transport at YM *
- Intact-Fracture Test
- Percolation Tests in the ESF
- Radial Borehole Tests in the ESF/Bulk Permeability Tests in the ESF
- Hydrochemistry Tests in the ESF
- Diffusion Test in the ESF
- In Situ Testing of Seal Components

* First Phase of Field Testing

PRELIMINARY

CONSOLIDATED ESF TEST PROGRAMS

CATEGORIZED BY LICENSE APPLICATION AND MAJOR SITE SUITABILITY REPORTS SUPPORTED*

(SOURCE: OMB 5-YEAR PLAN [PROGRAM APPROACH])

PRELIMINARY

ESF TEST/PROGRAM	TECHNICAL BASIS REPORTS SUPPORTING HIGHER LEVEL FINDINGS
Consolidated Sampling	• Geochemistry/Postclosure Rock Characteristics • Geohydrology/Transport • Preclosure Rock Characteristics
Intact-Fracture Test	• Geohydrology/Transport
Percolation Tests in the ESF	• Geohydrology/Transport
Radial Borehole Tests in the ESF/ Bulk Permeability Test in the ESF	• Geohydrology/Transport
Excavation Effects Test	• Geohydrology/Transport
Perched-Water Testing in the ESF	• Geohydrology/Transport
Hydrochemistry Tests in the ESF	• Geohydrology/Transport
Hydrologic Properties of Major Faults Encountered in the ESF	• Geohydrology/Transport
Diffusion Test in the ESF	• Geohydrology/Transport
Field Scale Experiments to Study Radionuclide Transport at YM	• Geohydrology/Transport
Underground Geological Mapping	• Preclosure Rock Characteristics • Geochemistry/Postclosure Rock Characteristics
Seismic Tomography/Vertical Seismic Profiling at the ESF	• Geochemistry/Postclosure Rock Characteristics
Construction Monitoring	• Preclosure Rock Characteristics • Reasonably Available Technology
Thermal/Mechanical Properties	• Geochemistry/Postclosure Rock Characteristics
Air Quality and Ventilation Experiment	
In Situ Testing of Seal Components	• Reasonably Available Technology
Near-Field Hydrologic/Geomechanical Properties	• License Application

* All tests and Consolidated Test Programs identified in the left column support elements of Total System Performance Assessment, Final Site Recommendation Report, and License Application, as well as the Technical Basis Reports identified in the right column.

PRELIMINARY

PNEUMATIC PATHWAYS ISSUE

PRELIMINARY

REASONS FOR CHARACTERIZING PNEUMATIC PATHWAYS

- Characterization of pneumatic pathways is a necessary step in understanding the likelihood of gas-phase releases of radionuclides (e.g., ^{14}C) to the accessible environment, and in placing bounds on the quantities of gas-phase radionuclides which could be transported
- Pneumatic pathways may return significant portions of infiltration flux from depth to the atmosphere. A knowledge of the quantity of moisture which may be transported through pneumatic pathways will help bound calculations of flux through the repository horizon

PRELIMINARY

ONGOING DATA COLLECTION

- Instrumented UZ-1 for gas sampling and to measure air temperature, air pressure, and humidity (1984)
- Open hole monitoring of air velocity, temperature, and humidity since 1986 in UZ-6, -6s
- Air-permeability (K) testing and gas-phase geochemical sampling in UZ-16, completed 1993
- Air-K testing in NRG-7/7a completed summer 1994. NRG-7/7a is currently being instrumented (expected completion 11/5/94)
- Radial borehole testing in Alcove #1, began summer 1994

PRELIMINARY

SCHEDULE OF TESTING/INSTRUMENTATION

1994

- Complete Air-K testing in NRG-6
- Instrument NRG-4, -6, -7/7a

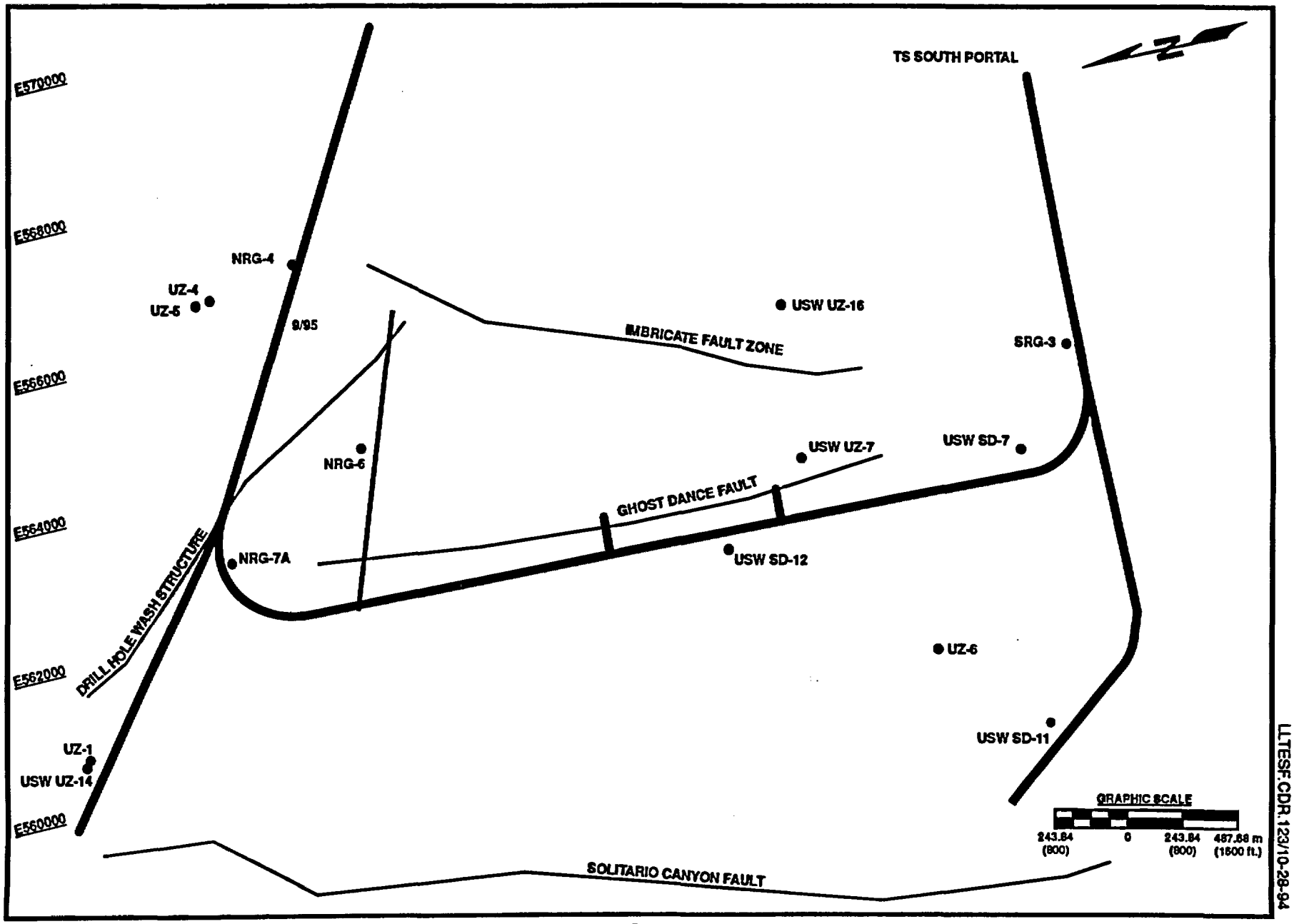
1995

- Complete Air-K testing in UZ-4, -5, -7, SD-7, -12, SRG-3
- Instrument UZ-4, -5, -7, SD-7, -12

- 1994-95 season ambient conditions will be monitored in boreholes NRG-4, -6, -7/7a
- 1995-96 season ambient conditions will be monitored in boreholes UZ-7, SD-7, -12
- It is planned to monitor a full winter season of ambient conditions in each of the above listed boreholes

PRELIMINARY

BOREHOLES FOR AIRFLOW MONITORING



ATTACHMENT 4

Civilian Radioactive Waste Management System
Management and Operating Contractor

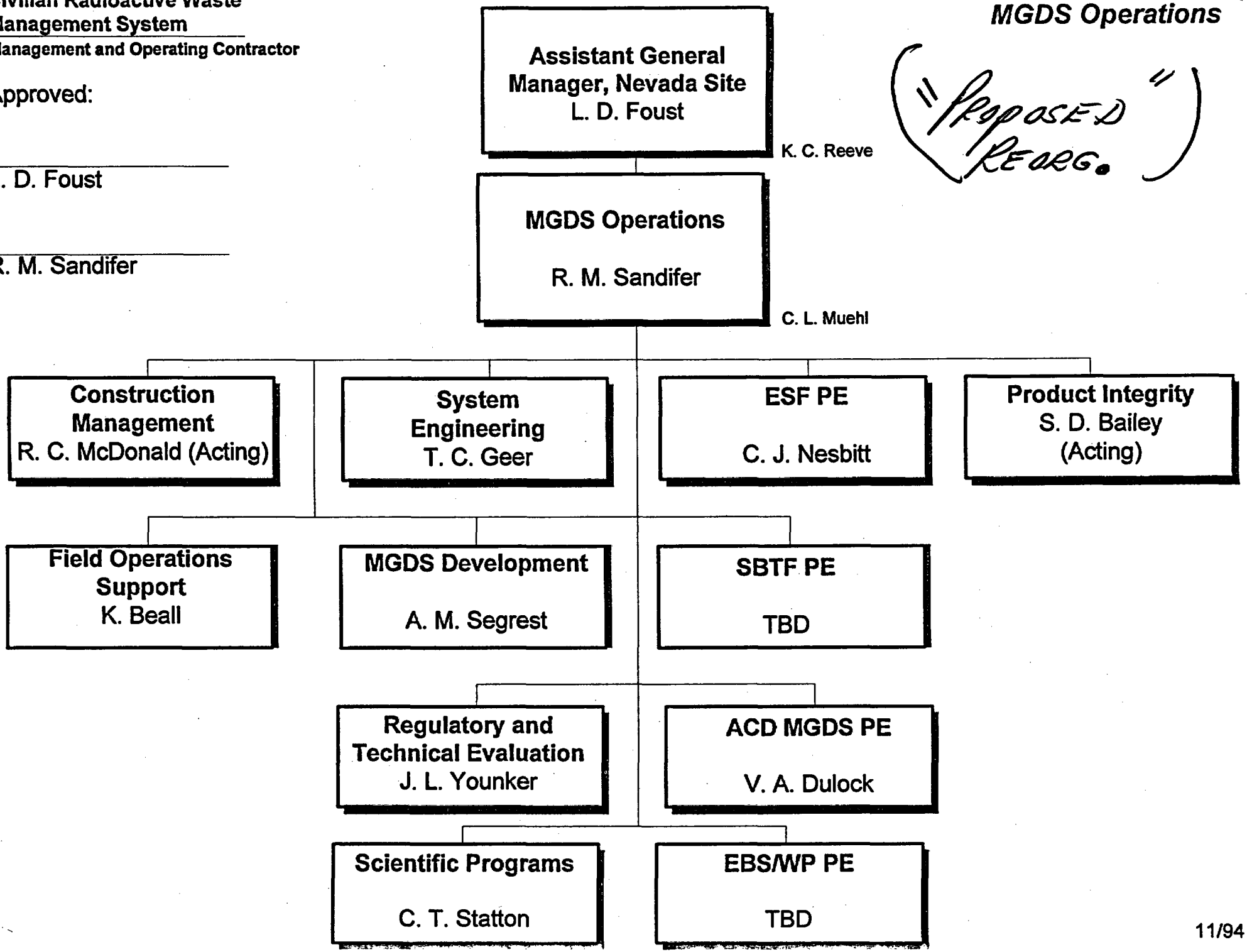
Approved:

L. D. Foust

R. M. Sandifer

MGDS Operations

("Proposed Reorg.")



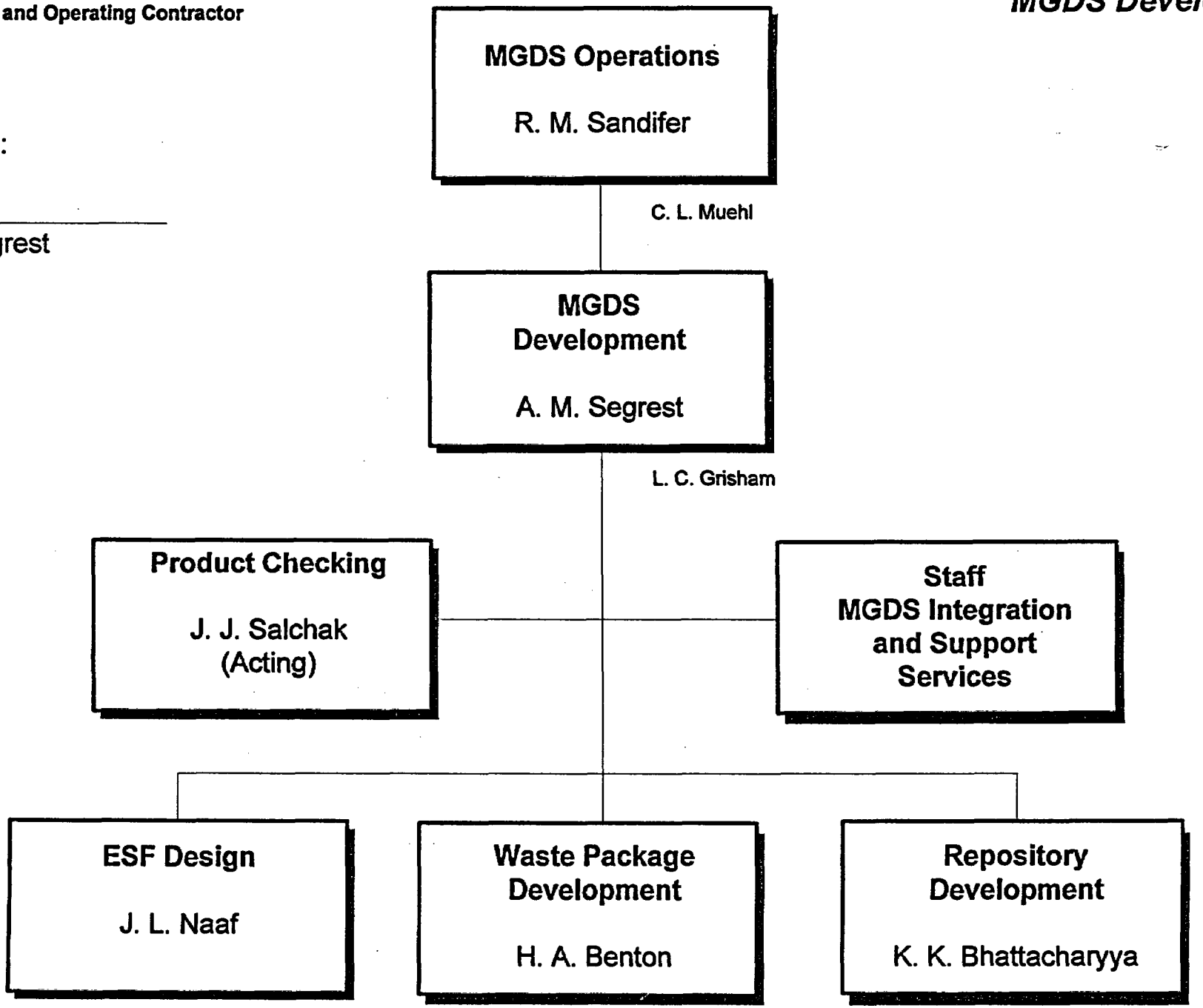
11/94

Civilian Radioactive Waste
Management System
Management and Operating Contractor

MGDS Operations
MGDS Development

Approved:

A. M. Segrest



10/94

Approved:

S. D. Bailey