

**U.S. DEPARTMENT OF ENERGY  
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT**

**NUCLEAR WASTE TECHNICAL REVIEW BOARD  
FULL BOARD MEETING**

**SUBJECT: ESF CHANGES UNDER CONSIDERATION**

**PRESENTER: ROBERT M. SANDIFER**

**PRESENTER'S TITLE  
AND ORGANIZATION: MANAGER, MGDS DEVELOPMENT  
CRWMS M&O  
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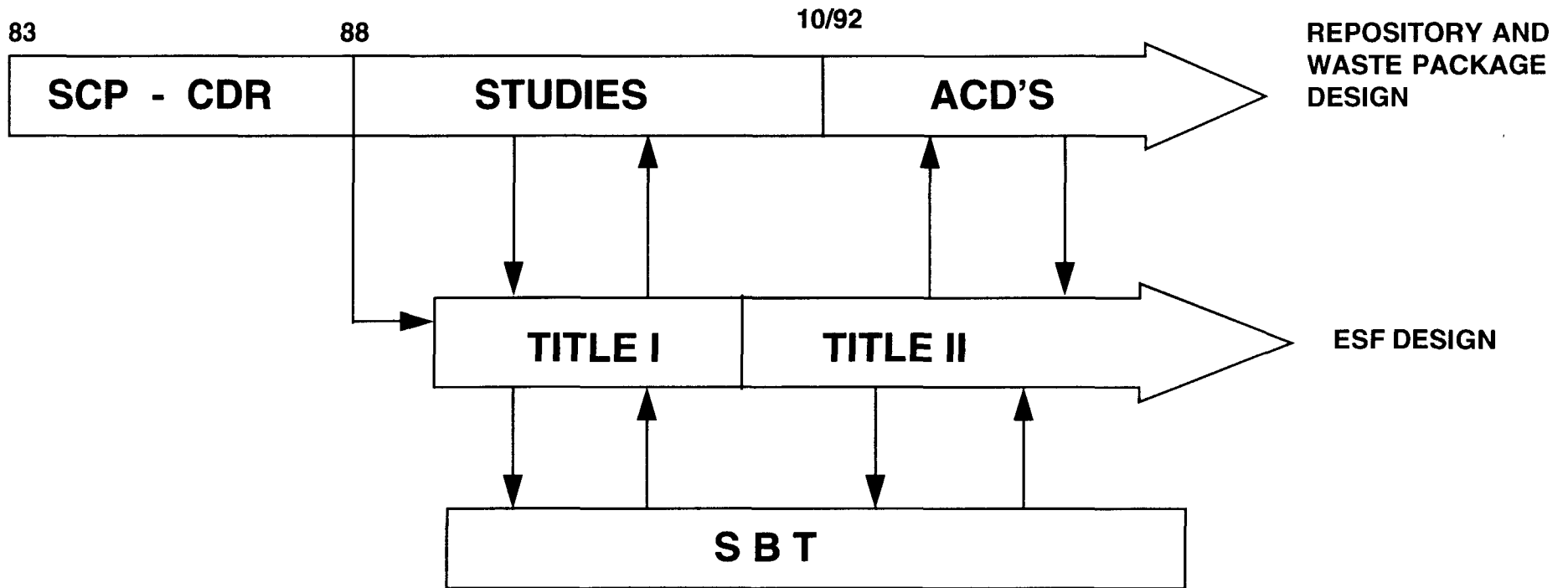
**PRESENTER'S  
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**DENVER, COLORADO  
JULY 13-14, 1993**

# **Exploratory Studies Facility (ESF) Changes Under Consideration June 30, 1993**

- **Introduction: Managing Design Change**
- **ESF Reconfiguration**
- **Surface Based Testing (SBT) Adjustments To Support Reconfiguration**
- **North Portal Entrance Redesign**

# Managing Design Change



**SCP = Site Characterization Plan**  
**CDR = Conceptual Design Report**  
**ACD = Advanced Conceptual Design**  
**SBT = Surface Based Testing**

# Managing Design Change

- **Title I/Title II**
- **Change Drivers**
  - **New Information (ACDs, comments from oversight groups, and SBT)**
  - **Design Refinements**

# **ESF Reconfiguration**

# **Why Do We Need to Adjust the ESF Configuration?**

- **Current design activities must incorporate changes that enhance safety which are identified through design studies and new technical information**
  - **Maximize distance above the water table; recent drilling results confirm the Topopah Spring contact (TSw1 - TSw2) is higher at the north end of the block**
  - **Limit the emplacement drifts crossing Ghost Dance fault; recent mapping suggests that the Ghost Dance fault may be wider**
- **Preserve respository design flexibility**

## **Link to Previous Work**

- **The need for changes of this nature was foreseen at the end of the Exploratory Studies Facility Alternatives Study (ESFAS) and was accounted for in YMP/91-28. This document provides the “bridge” between the selection of current ESF design (Option 30) during the ESFAS and the slightly modified “reference design concept” that was used to begin Title I Design**

# SUMMARY CHART FROM ESFAS

		1	2	3	4	5	6	7	8	9	10	11	12	13
RANK	TOP-RANKED OPTIONS	NUMBER OF RAMP(S)	NUMBER OF SHAFT(S)	NUMBER OF ACCESSES	MTL LOCATION FLEXIBILITY	MECHANICAL MINED ACCESSES	NO GRAVITY FLOW PATHWAY FROM TS UNIT TO CHr	MAXIMIZE DISTANCE FROM EMPLACEMENT LEVEL TO WATER TABLE	AVOID EMPLACEMENT DRIFTS CROSSING GHOST DANCE FAULT	MAXIMIZE EXPOSED ROCK - ON AND OFF BLOCK	FLEXIBILITY FOR EARLY DRIFTING IN TS OR CH OR BOTH	2 INTERCEPTS OF GHOST DANCE FAULT IN TS	E-W DRIFT IN TS	LARGER MTL AREA TO AVOID INTERFERENCES
	OPTION													
1	30	2	0	4	✓	✓	✓	○	○	✓	✓	✓	✓	✓
2	23	2	0	4		✓					✓	✓	✓	✓
3	24	1	1	5		✓					✓	✓	✓	✓
4	13	2	0	4	✓	✓				✓	✓	✓	✓	✓
5	6	2	0	4		✓						✓	✓	✓
6	7	1	1	5		✓						✓	✓	✓
7	2	1	1	5								✓	✓	✓
8	19	1	1	5								✓	✓	✓
9	25	1	1	5		✓					✓	✓	✓	✓
10	4	1	2	5						✓	✓	✓	✓	✓
.	.													
.	.													
20	15	1	1	4				✓	✓			✓	✓	✓



# **What Does the New Information Provide?**

- **A higher TSw1 - TSw2 contact in the North allows the development of a flatter layout which allows the use of conventional rail haulage and allows the distance from emplacement area to water table to be increased**
- **If a heavier waste package was used, rail haulage would provide more flexibility in a potential repository**
- **This design provides better opportunity for flexibility to deal with the character of Ghost Dance fault**

# **How Do We Preserve Repository Design Flexibility?**

- **Develop an ESF configuration that can accommodate various underground repository layouts and transportation concepts while accomplishing the objective of properly characterizing the site**

## **An Enhancement to the Current ESF Layout has been Developed That Would:**

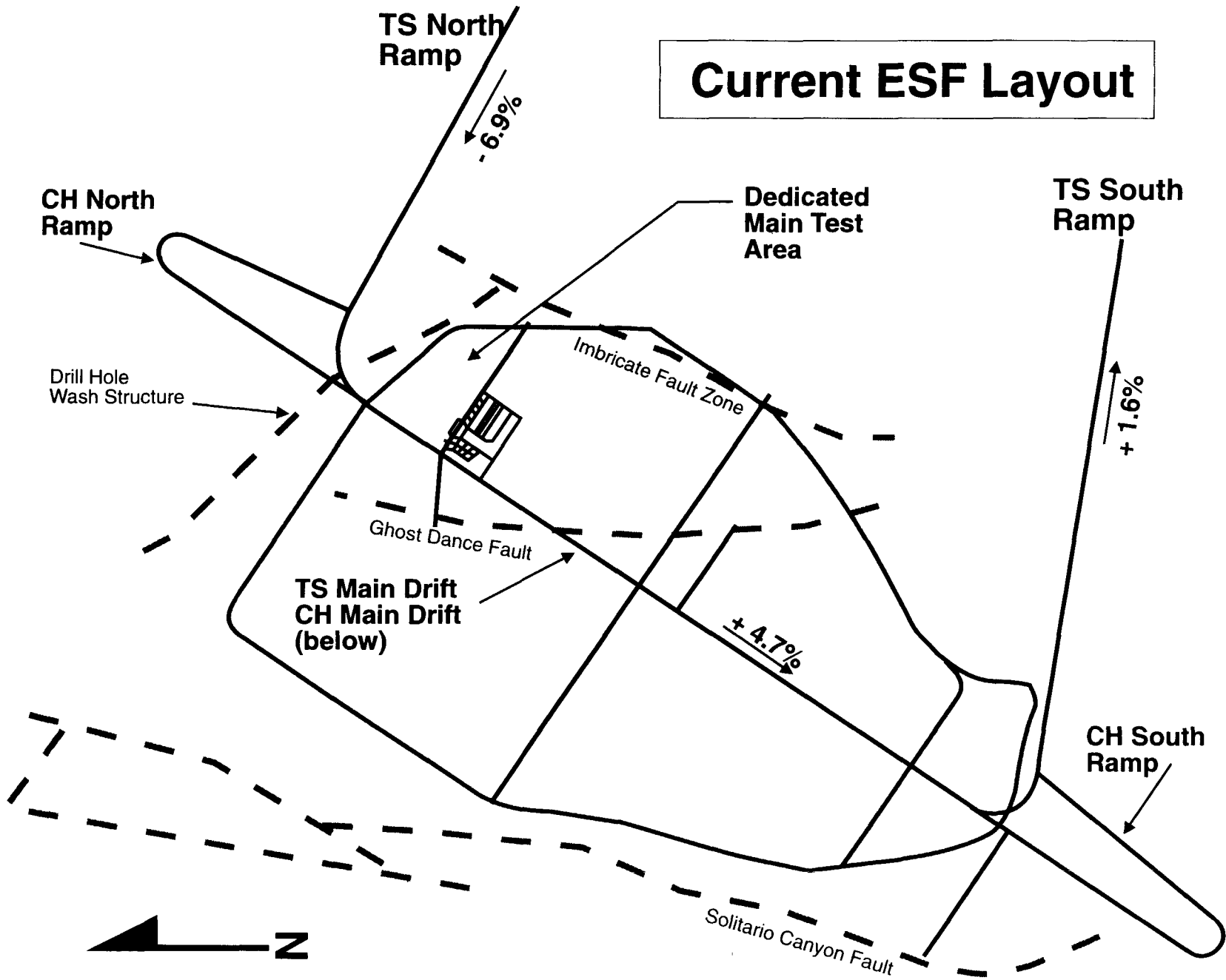
- Maintains the portal location and horizontal direction of the North Ramp**
- Results in having no grade in excess of 2.7% in the North Ramp, Main Topopah Spring Level (TSL) drift, and South Ramp**
- Maintains the full scope of site suitability and characterization testing provided by current ESF design (Option 30) and significantly enhances the characterization of the Ghost Dance fault without affecting repository layout flexibility**

# **An Enhancement to the Current ESF Layout has been Developed That Would:**

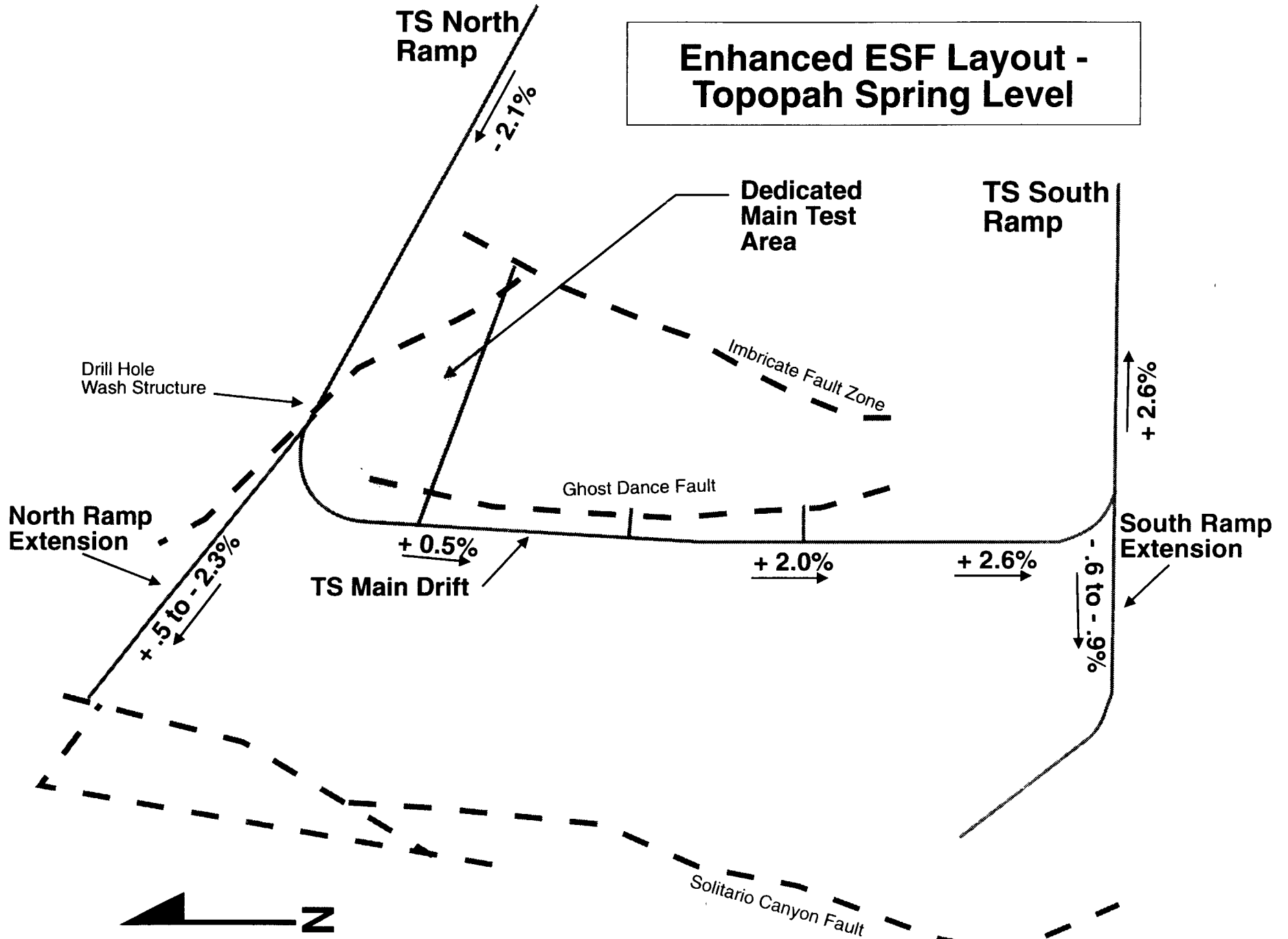
**(Continued)**

- **Preserve repository design flexibility to a much greater degree than the current configuration, including concepts which increase the distance from emplacement drifts to the water table**
- **Better accommodates repository layouts having flat emplacement drifts and layouts that seek to avoid having emplacement drifts cross the Ghost Dance Fault**

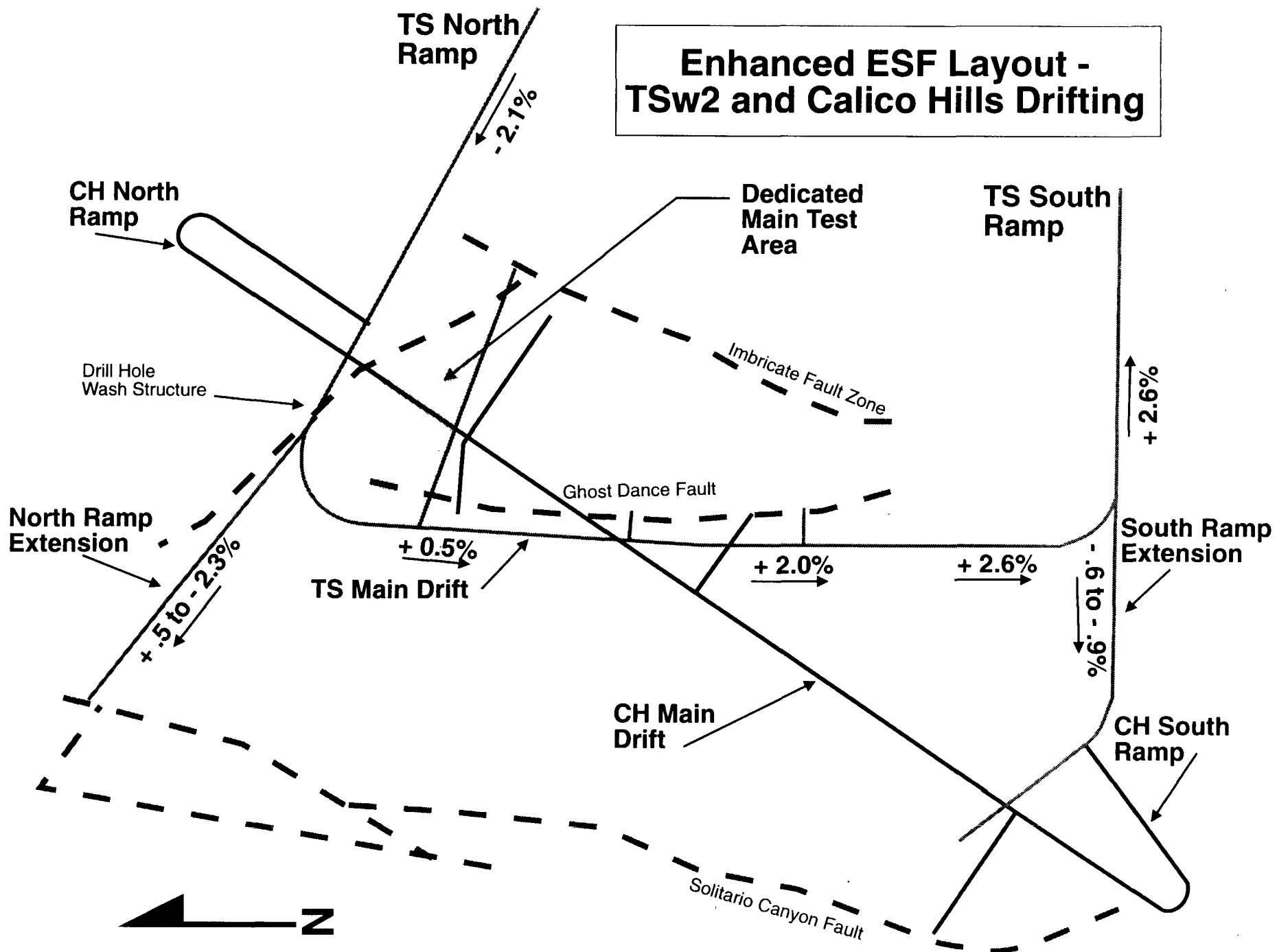
# Current ESF Layout



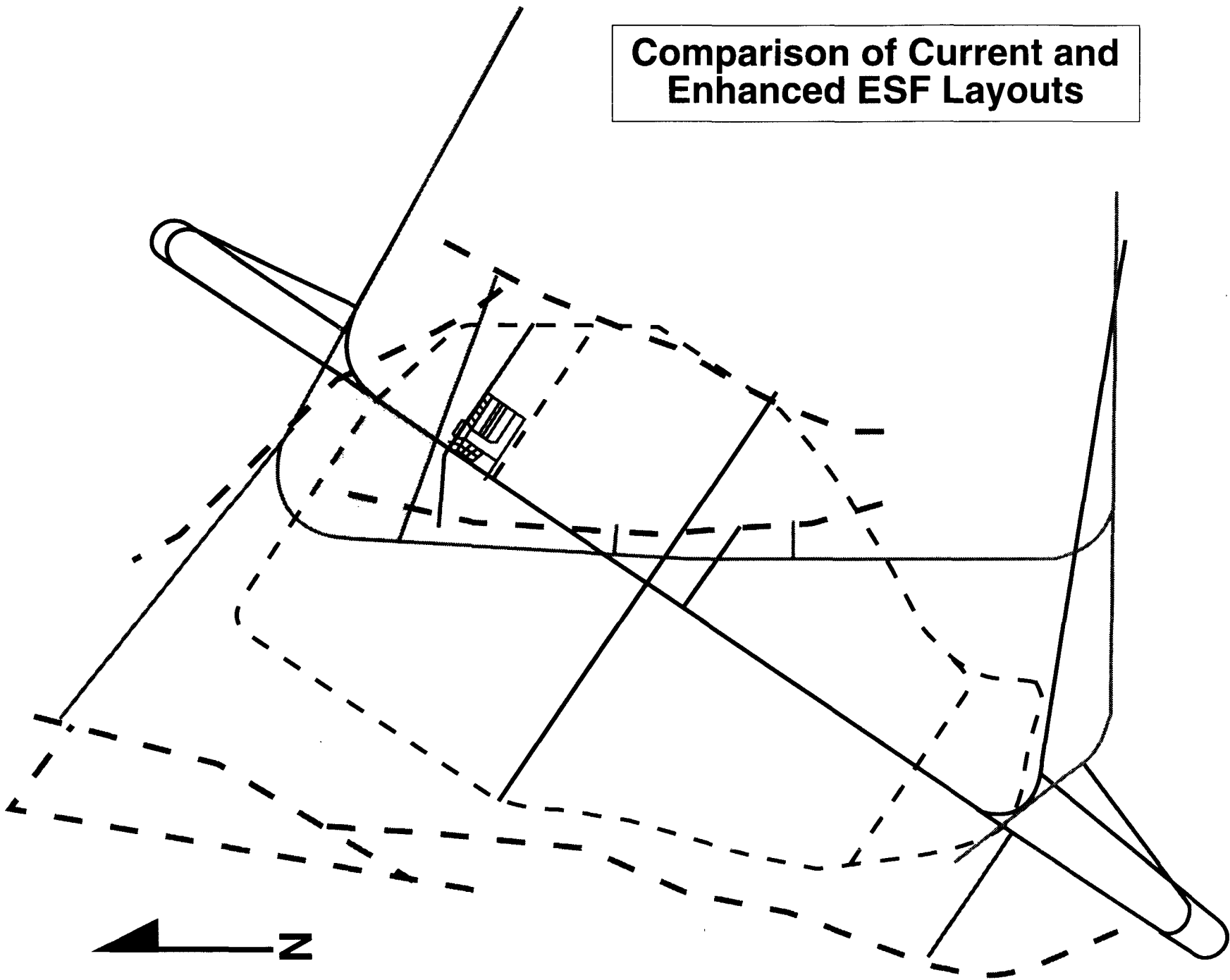
# Enhanced ESF Layout - Topopah Spring Level



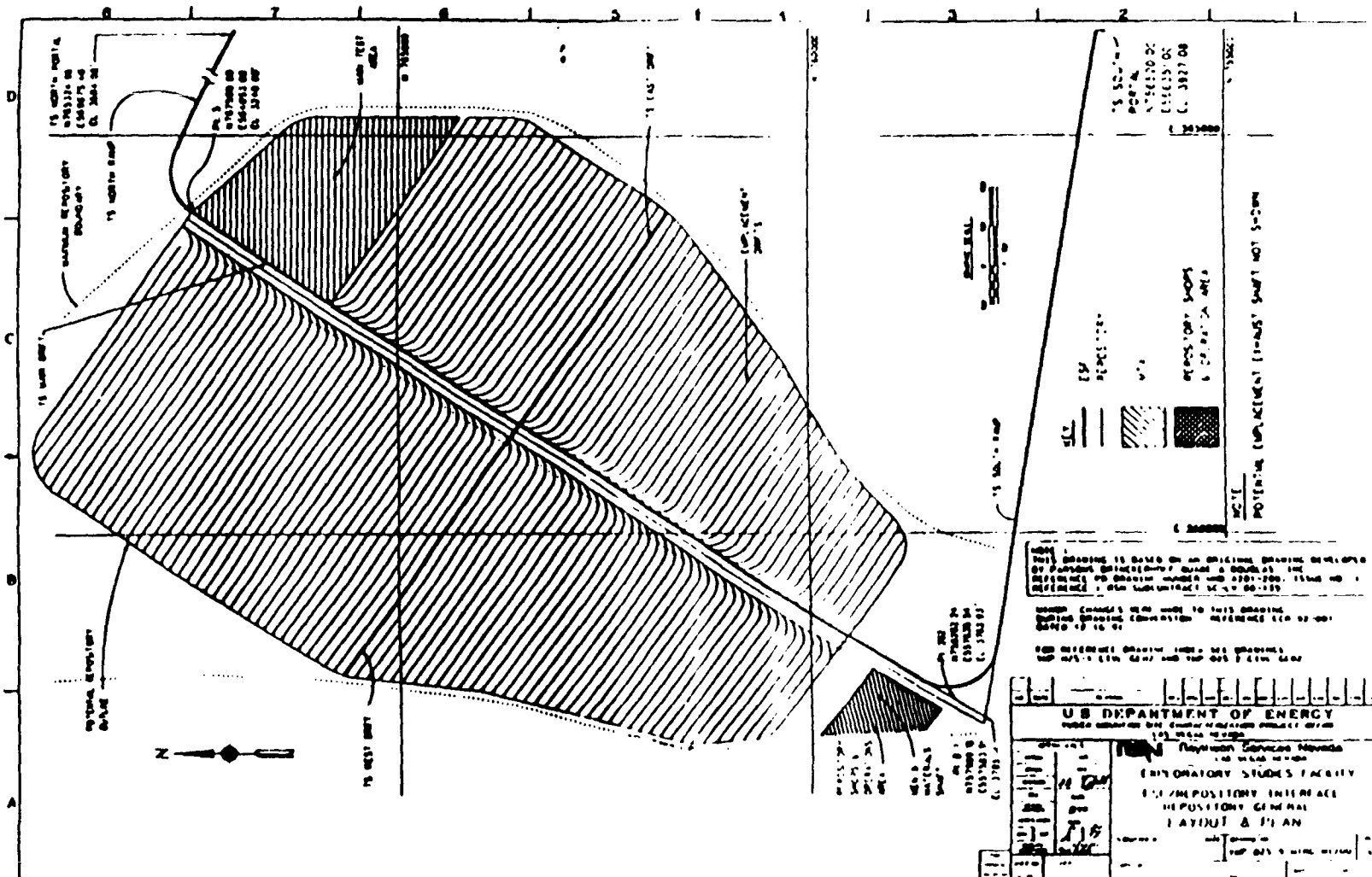
# Enhanced ESF Layout - TSw2 and Calico Hills Drifting



# Comparison of Current and Enhanced ESF Layouts

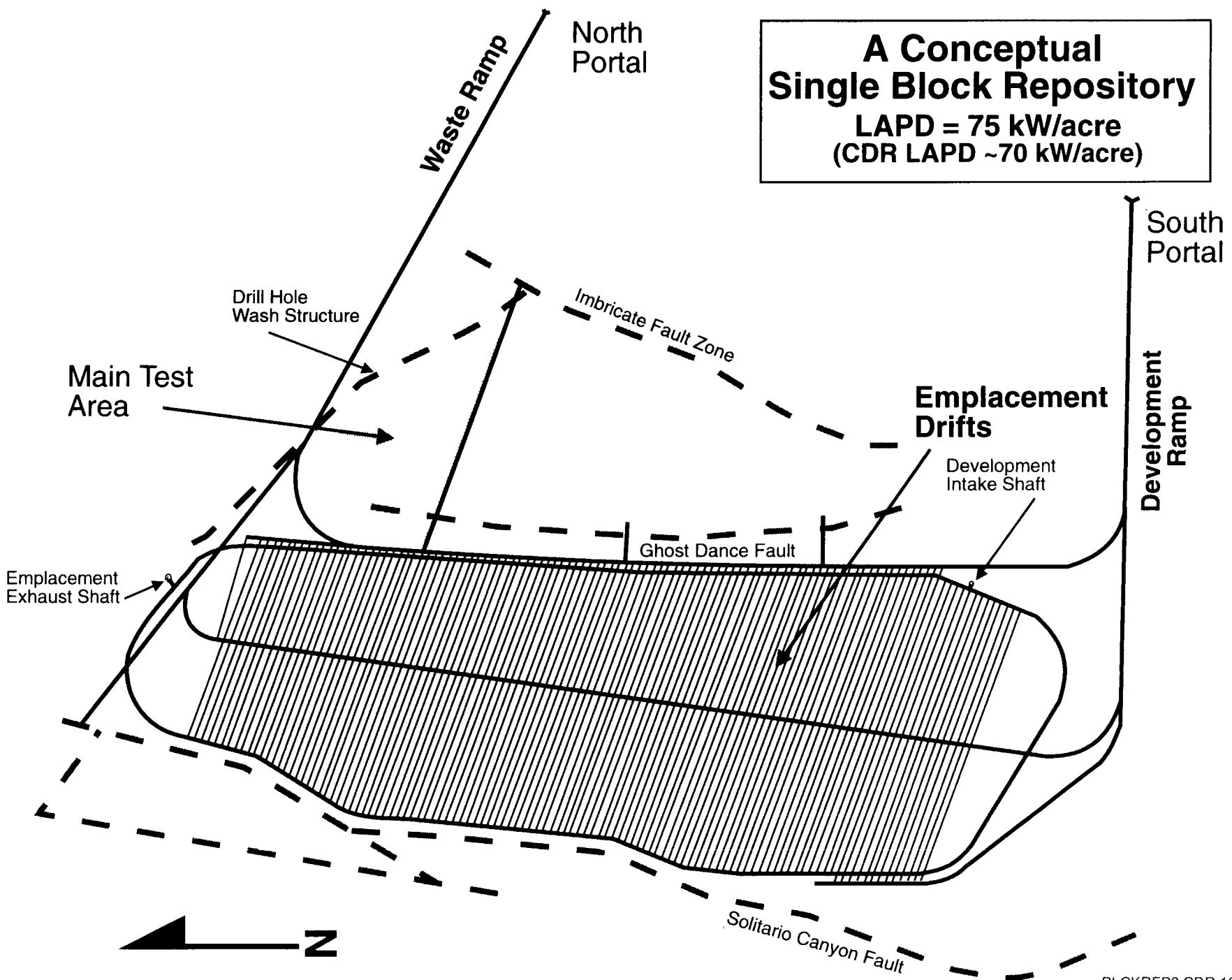






Repository Layout  
Current Baseline

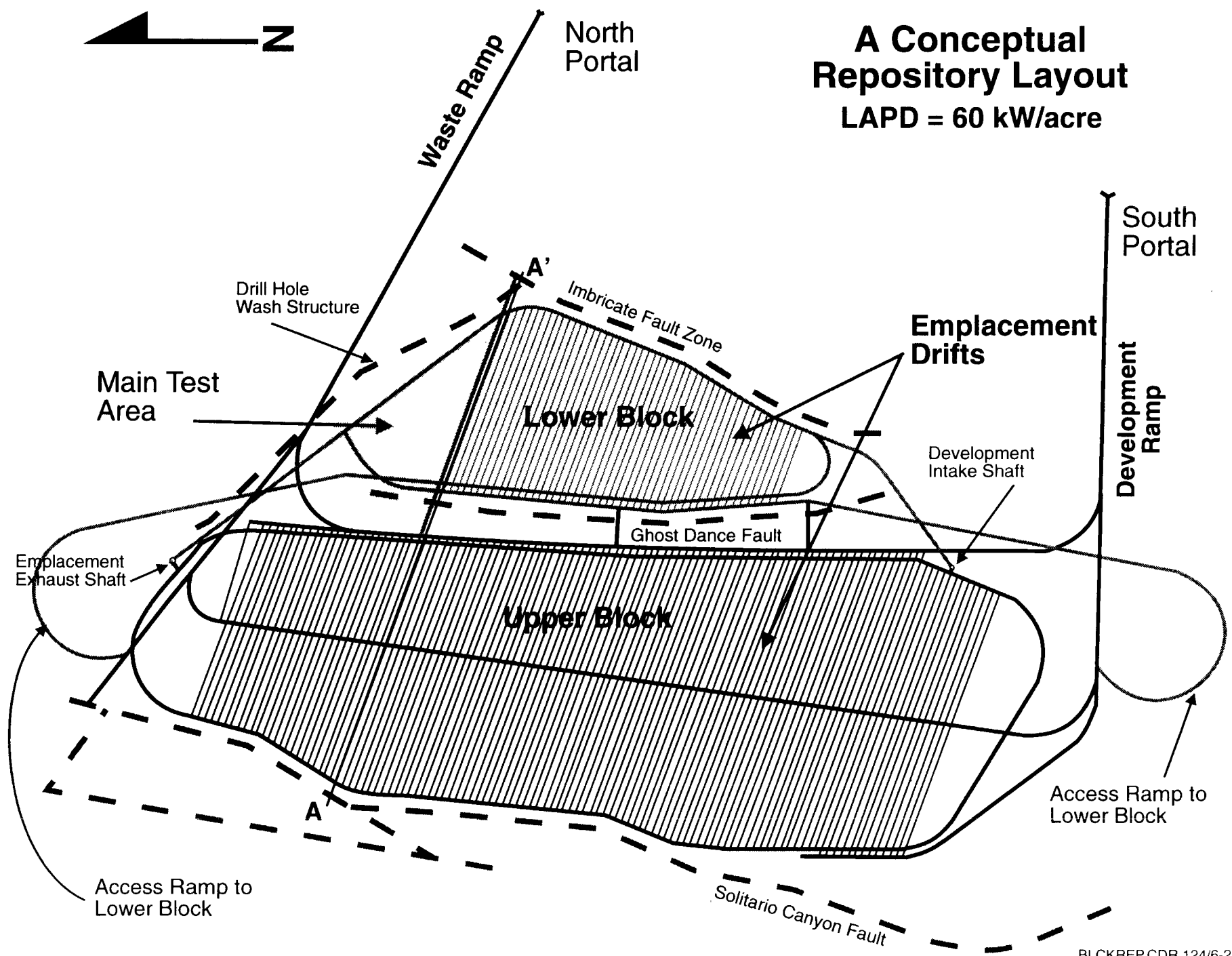
**A Conceptual  
Single Block Repository**  
LAPD = 75 kW/acre  
(CDR LAPD ~70 kW/acre)

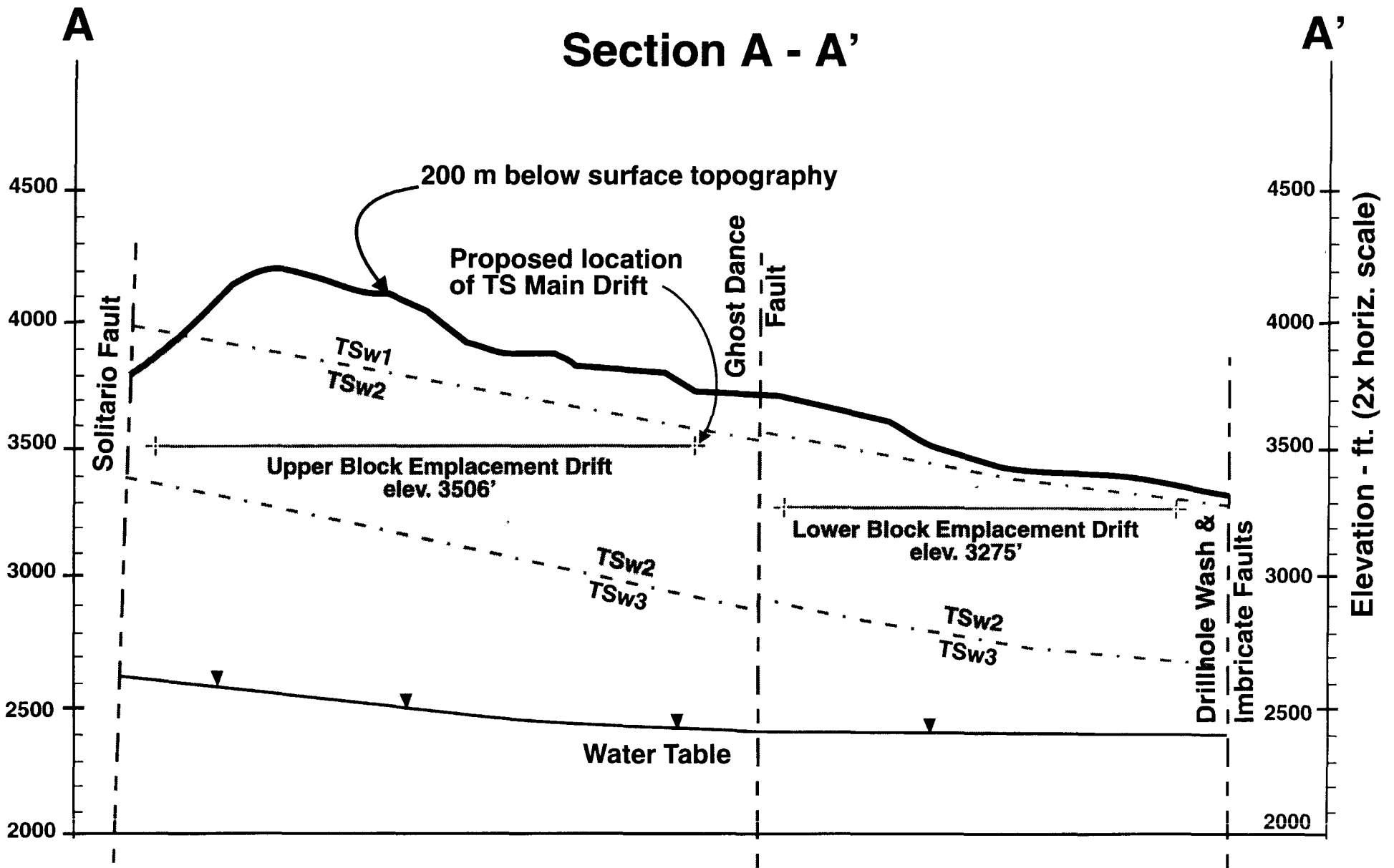




# A Conceptual Repository Layout

LAPD = 60 kW/acre





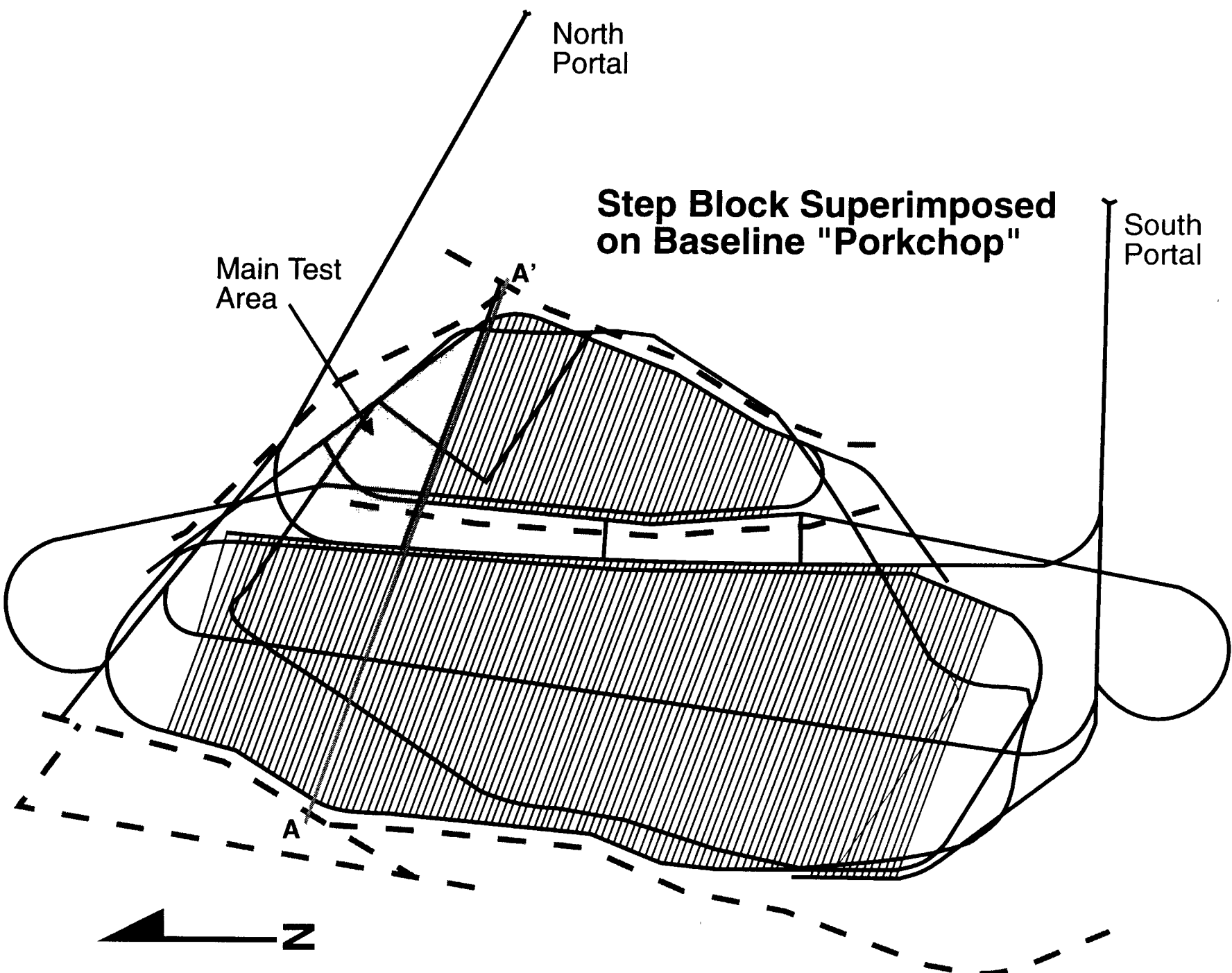
Note: Plane of section cuts through lowest emplacement drift in step-block layout.

North Portal

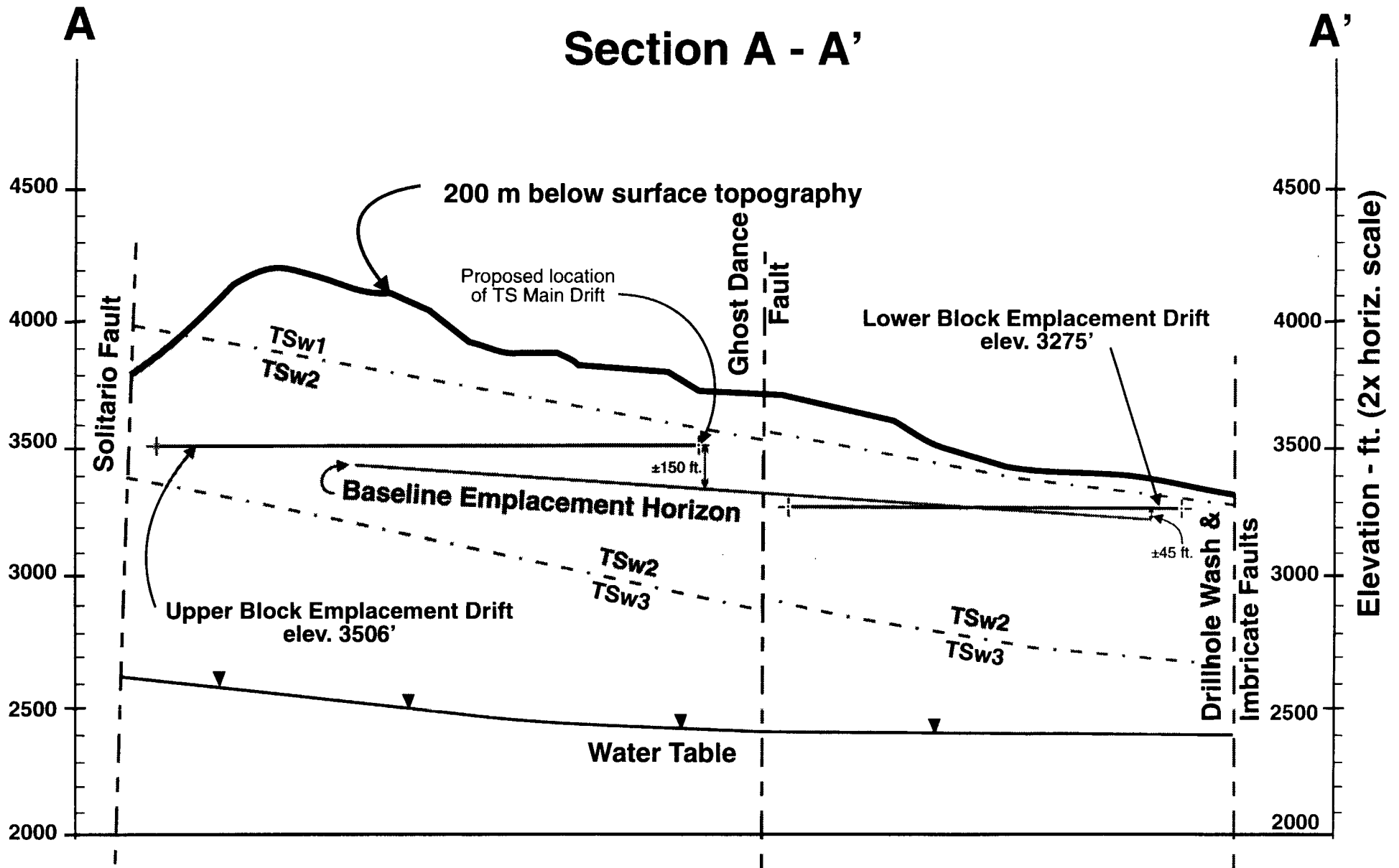
### Step Block Superimposed on Baseline "Porkchop"

South Portal

Main Test Area



# Section A - A'



Note: Plane of section cuts through lowest emplacement drift in step-block layout.

# **Advantages of the Enhanced ESF Layout**

- **Enhances site characterization ability**
  - **Multiple Ghost Dance Fault crossings can be made with relative ease**
  - **Two Solitario Canyon Fault crossings are planned instead of one**
  - **Ramp extensions give a good look at a large percentage of the vertical extent of the TSw2 interval**

# **Advantages of the Enhanced ESF Layout**

(Continued)

- **Enhances Repository Design Flexibility**
  - **Preserves option for conventional rail haulage**
  - **Preserves option to increase distance from emplacement drifts to water table**
  - **Preserves option to avoid multiple crossings of Ghost Dance Fault with emplacement drifts**
  - **Allows consideration of more potential repository layouts**



# **Advantages of the Enhanced ESF Layout**

(Continued)

- **Enhances ESF constructability**
  - **Flatter slopes improves safety aspects of underground operations**
  - **Flatter slopes allow servicing the Tunnel Boring Machine (TBM) using conventional rail haulage**
- **Minimal impact on the amount of ESF excavation; therefore, minimal impact on cost & schedule**

# **Technical and Programmatic Impacts**

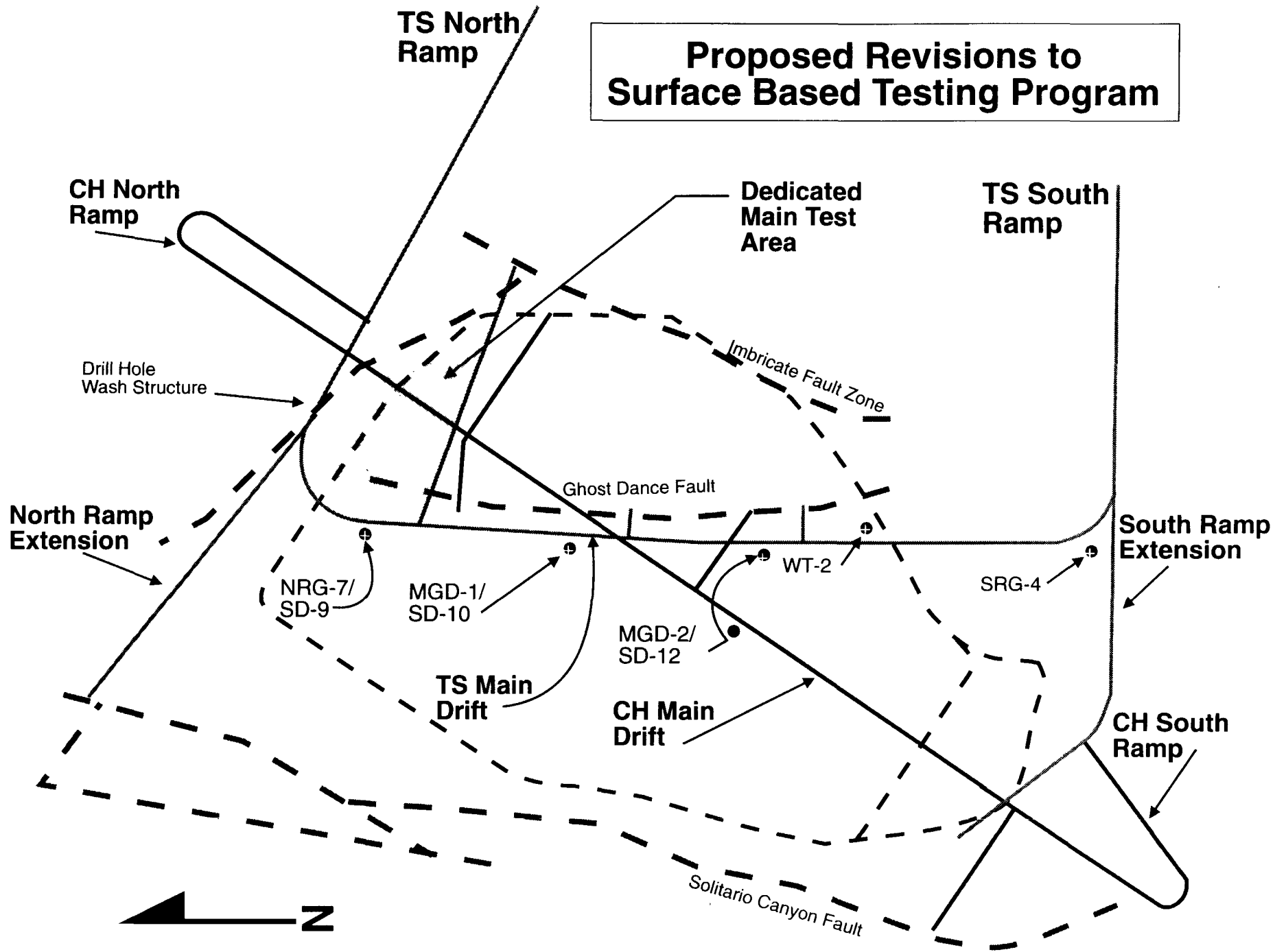
- **Requires limited resequencing of Surface Based Testing (SBT) program**
- **Delays gathering of drill-hole data regarding water table gradient and unsaturated zone conditions**
- **Requires definitive understanding of Ghost Dance fault prior to excavation of TS main drift**

# Project Action Plan

- **Proceed with construction of the starter tunnel at the reduced gradient (Package 2A)**
- **Proceed with normal design review process**
- **Prepare impact analysis that defines changes to baseline cost and schedule resulting from implementation of the proposed enhancement**
- **Present to the Project Change Control Board (CCB)**
- **If approved by the CCB, proceed with change to Technical Baseline using normal change control procedures**
- **DOE will report changes to the program in the SCP Semi-Annual Progress Reports**

# **SBT Adjustments to Support ESF Reconfiguration**

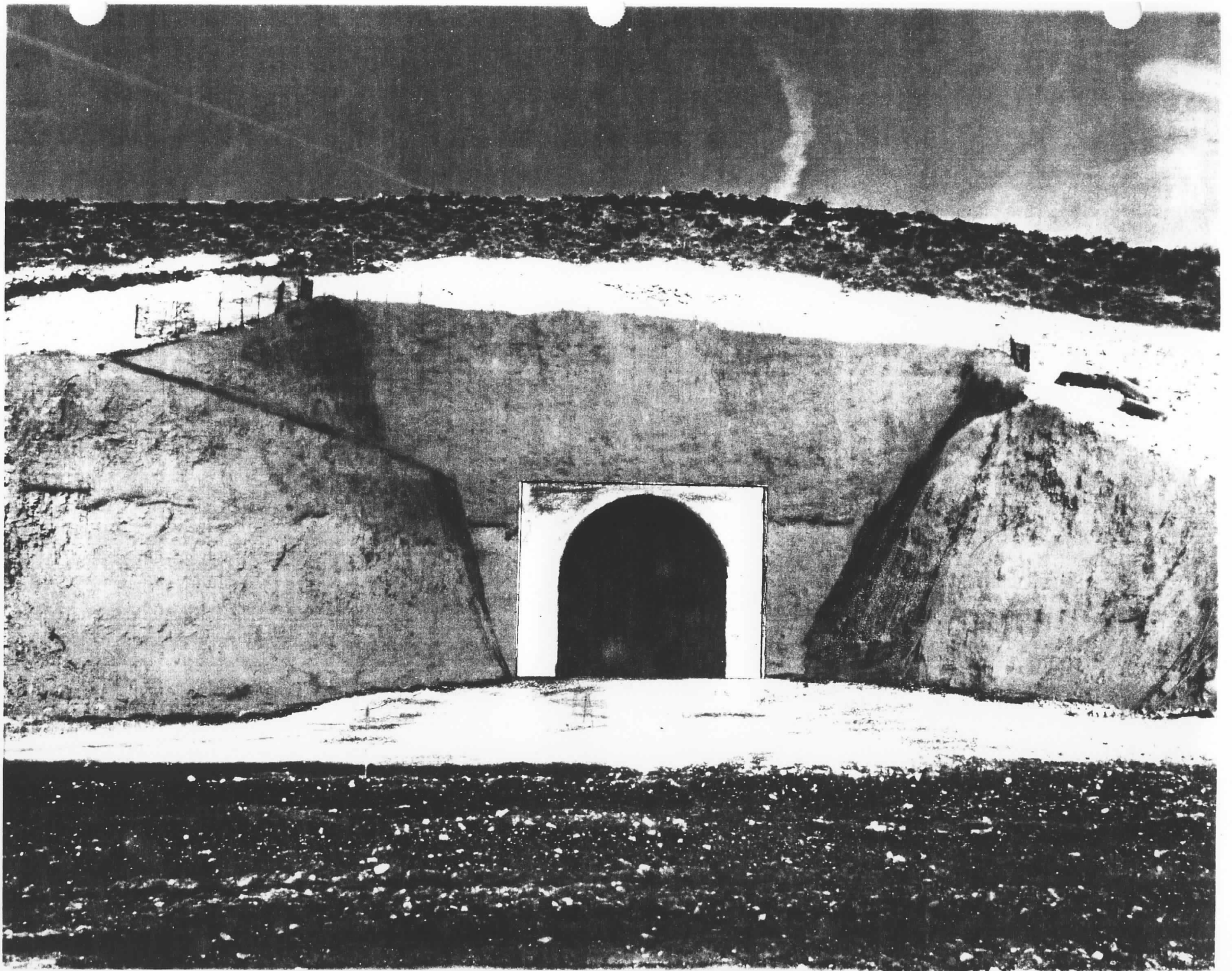
# Proposed Revisions to Surface Based Testing Program



# **North Portal Entrance Redesign**

# **Why Re-Evaluate North Portal Entrance Design?**

- **Design process is inherently interactive and subject to re-evaluation**
- **Opportunity to use less costly, but just as safe solution**





# **Consideration Regarding Proposed ESF Changes**

# Considerations Regarding Proposed ESF Changes

- **Orientation of main drifts relative to fracture orientation and *in situ* stress could cause support problems**
- **Upper limit of potential repository horizon is raised which may cause disqualification under 10 CFR Part 960 (200m depth)**
- **Changes require demonstration that alternative design features have been considered (10 CFR 60.21) with respect to waste isolation capability**

# **Considerations Regarding Proposed ESF Changes**

(Continued)

- **Need documentation that the proposed concept can function with a minimum number of accesses**
  - **NRC suggested four openings**
- **Proposed changes may not provide representative data or adequate east-west exploration (NRC/NWTRB concern)**
- **New data on Ghost Dance faulting needs to be assessed**
  - **Offset data for Ghost Dance fault may be needed for parallel drifting**
  - **Development in SE quadrant may be precluded by other major faulting**

# **Considerations Regarding Proposed ESF Changes**

(Continued)

- **Address concerns about test program implementation**
  - **West ramp extension versus east-west drift**
  - **Core test area access difficult and costly**
  - **Representativeness of testing for south emplacement**
- **East-west step in repository could induce perturbations in system performance, especially at high thermal loads**
- **Changes to the baseline concepts should be managed and should reflect an effective design control program**