

U.S. DEPARTMENT OF ENERGY

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**YUCCA MOUNTAIN
SITE CHARACTERIZATION
PROJECT**

QA: N/A

**FLOODPLAIN ASSESSMENT
OF SURFACE-BASED INVESTIGATIONS
AT THE YUCCA MOUNTAIN SITE,
NYE COUNTY, NEVADA**



AUGUST 1991

UNITED STATES DEPARTMENT OF ENERGY

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Yucca Mountain Site Characterization Project
Yucca Mountain Site Characterization Project Office
U.S. Department of Energy
Las Vegas, Nevada

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1.0 INTRODUCTION

Pursuant to Executive Order (EO) 11988, Floodplain Management, each federal agency is required, when conducting activities in a floodplain, to take action to reduce the risk of flood damage; minimize the impact of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by the floodplains. U.S. Department of Energy (DOE) regulations implementing this EO are presented in 10 CFR 1022, Compliance with Floodplain/Wetlands Environmental Review Requirements. Wetlands are not discussed in this assessment, however, because the U.S. Fish and Wildlife Service (USFWS) has determined that "...site characterization activities should not affect any wetlands on or near the Yucca Mountain site" (USFWS, 1988). In compliance with 10 CFR 1022, the DOE published a Notice of Involvement in the Federal Register (February 9, 1989 [54 CFR 6318]) that discusses (1) the proposed action, (2) resulting effects on the floodplains, (3) measures that may be taken to mitigate potential adverse effects on the floodplains, and (4) alternatives to the proposed action that may be implemented to avoid harm to floodplains.

Only surface-based investigation activities are addressed in this assessment. Neither Exploratory Studies Facility (ESF) components of the scientific investigation program nor potential repository surface facilities are assessed. Studies of alternative design concepts for the ESF are currently being conducted by the DOE. Once these studies have been finalized, a supplemental floodplain assessment evaluating the cumulative impacts of both the surface-based investigations and ESF facilities will be prepared.

For purposes of clarification, the term "base floodplain," as defined in 10 CFR 1022, is the area inundated by a flood having a one (1) percent or greater chance of occurring in any given year (i.e., the 100-year floodplain). The "critical-action floodplain", defined as the 500-year floodplain (10 CFR 1022.4(i)), was not considered in this assessment because the proposed surface-based investigations will not involve critical-action activities. ("Critical action" is defined in 10 CFR 1022.4 as any activity for which even a slight chance of flooding would be too great, e.g., storage of highly volatile, toxic, or water-reactive materials.)

Section 404 of the Clean Water Act (33 USC 1344) provides requirements for the discharge of dredged or fill material, and 40 CFR Part 230 et seq. provides guidelines for implementing those requirements. On July 31, 1990, the DOE received a General Nationwide Section 404 Permit from the U.S. Corps of Engineers (COE) for site characterization activities related to the Yucca Mountain site.

2.0 PROJECT DESCRIPTION

The Nuclear Waste Policy Act of 1982, as amended, requires that Yucca Mountain, located about 100 road miles northwest of Las Vegas, Nevada (Figure 1) be studied to determine its suitability to house the nation's first

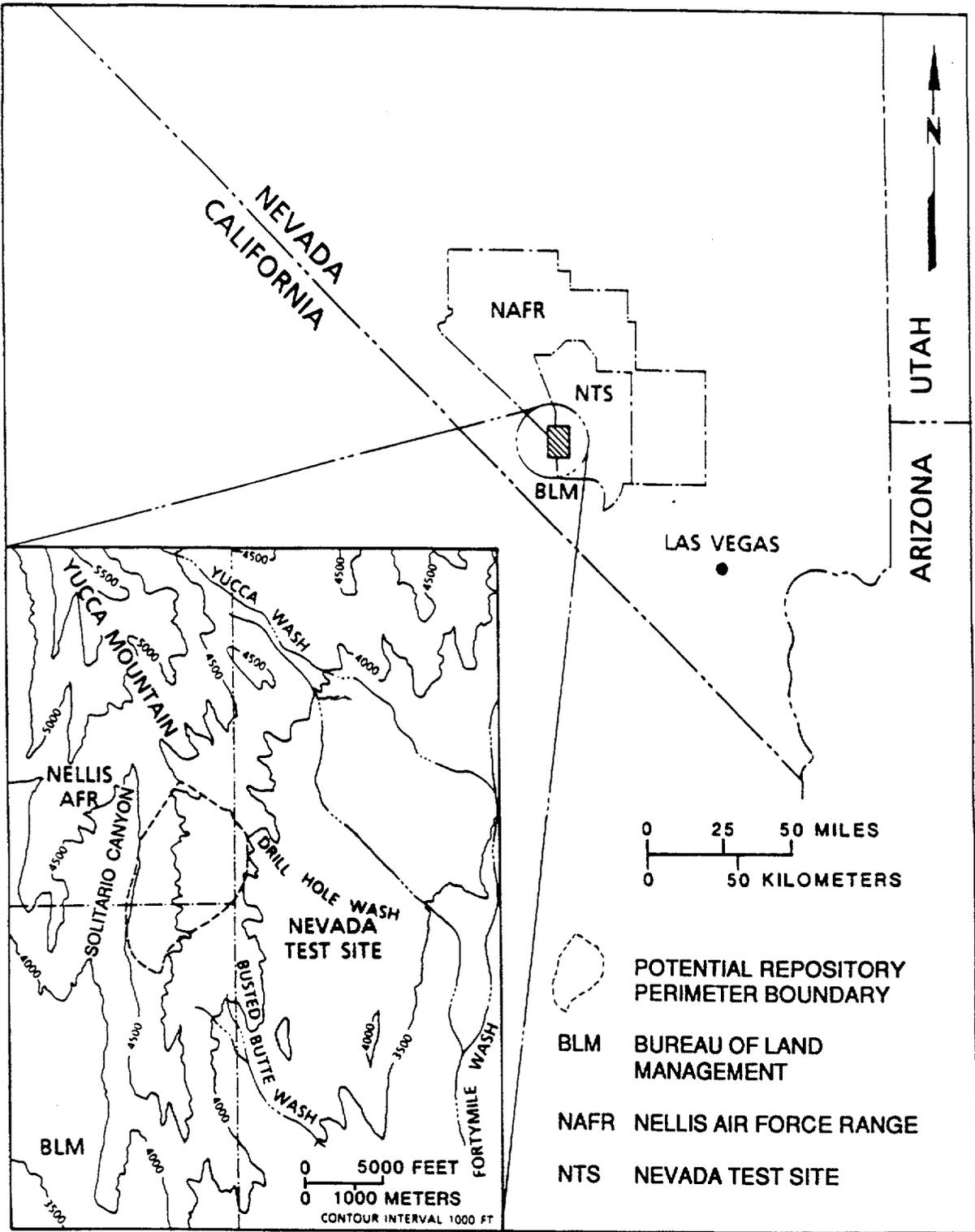


Figure 1. Location of the Yucca Mountain Site.

underground repository for the permanent disposal of high-level radioactive waste and spent nuclear fuel. Before a decision can be made to establish a repository at Yucca Mountain, the geology and hydrology of the site must be scientifically investigated to ensure that the site can safely contain such waste. The initial component of the site characterization program for Yucca Mountain will consist of surface-based investigations involving borehole drilling, dirt-road construction, excavation of trenches across fault zones, and other minor surface disturbances. A complete description of proposed surface-based investigations can be found in the Site Characterization Plan (SCP; DOE, 1988a). A description of the proposed boreholes can be found in the SCP (Pages 8.4.2-65 through 8.4.2-75).

Surfaced-based investigations are comprised of temporary, small-scale activities for which construction of permanent structures or long-term storage of hazardous materials are not necessary. Ten boreholes will be completed on new drill pads with 13 boreholes on existing pads located in or near dry washes. All but two of these washes or drainages were designated as "areas of probable inundation" in a study of the probable characteristics of the 100-year, 500-year, and regional maximum floods on the Nevada Test Site (Squires and Young, 1984). The two exceptions, proposed more recently, lie west of Yucca Mountain and were not part of the 1984 study. Each new borehole pad will require an area of approximately 2.5 acres. Surface disturbance related to trenching would average about 13 feet by 115 feet, and would be approximately 13 feet deep. Approximately 8 miles of new roads are estimated to be constructed for surface-based investigations in flood-prone areas. The new dirt roads will average 50 feet in width. Each pad, trench,

and road will be reclaimed once it is no longer needed, as described in Section 5.0 of this assessment.

Plate 1 identifies the location of proposed boreholes to be constructed in dry washes in support of surface-based investigations. Trenches and roads are not shown on Plate 1 because, as yet, no trenches are planned in washes and road locations have not been finalized. An estimate of disturbance from trenching is included below because future surface-based investigations may require that trenches be located in the washes.

Acreage to be disturbed in dry washes is estimated as follows:

o Borehole Drill Pads	25 acres
o Trenches	1 acre
o Roads	48 acres
Total	<u>74 acres</u>

Design of all surface-based investigation facilities includes provisions, where necessary, for secondary containment of spilled contaminants, as well as protection of areas utilized for regulated-materials storage in order to prevent spills and subsequent run-off during flood events.

3.0 EXISTING ENVIRONMENT

As described in the Environmental Assessment (EA) for the Yucca Mountain site (DOE, 1986), Yucca Mountain is located in the southern Great Basin of the Basin and Range Province. The hydrologic system of this region is

characterized by low precipitation, high evaporation rates, deep groundwater tables, and closed topographic and groundwater basins. Perennial streams do not exist at or near Yucca Mountain. The EA contains a complete description of the Yucca Mountain site including present use, geologic and hydrologic conditions, land use, terrestrial ecosystems, air quality, noise, archaeological and cultural resources, radiological background, and aesthetics.

The flora and fauna of the dry washes comprising the floodplains do not differ significantly from the biota found in adjacent washes at the same elevation. Vegetation is generally sparse, the dominant species being varieties of Bursage, (Ambrosia dumosa), Creosote bush (Larrea tridentata), Range ratany (Krameria parvifolia), Mormon tea (Ephedra nevadensis), Menodora (Menodora spinescens), and species of Wolfberry (Lycium spp) and Saltbush (Atriplex spp). Sightings and radiotracking of desert tortoises (Gopherus agassizii) on a limited section of the site provide no evidence, to date, indicating that the animals within the area prefer floodplains for their burrows (EG&G/EM, 1991). It is possible, however, that under other than the current drought conditions, tortoises may be more numerous in or near floodplains because of the availability of water and a stable food supply. Only continuing observation of these animals, as well as of tortoises in other areas of the site, will determine whether the species exhibits a preference for the floodplain habitat.

Items of paleontological and archaeological interest have been associated with Fortymile Wash. Packrat (i.e., Woodrat, Neotoma lepida) middens in the walls of the channel contain evidence of climatic and

vegetational changes over many thousands of years. Observations indicate however, that middens are no more numerous in channel walls than in vertical surfaces and rock outcroppings elsewhere (EG&G/EM, 1991). Also, there is likely nothing unique in these middens that cannot be found by examining the contents of middens in adjoining areas. On occasion, human artifacts have been found in the soil at ground level above the wash.

Flood histories of individual drainages in the Yucca Mountain area are not well-known because streamflow data are limited. Precipitation averages approximately 5.7 inches annually, but thunderstorms can produce significant amounts of precipitation for short durations in localized areas (DOE, 1986). Flood Insurance Rate Maps and Flood Hazard Boundary Maps do not exist for the Yucca Mountain area, nor are flood data available for the areas south and west of Yucca Mountain. The U.S. Geological Survey has estimated the 100-year and 500-year floods for the washes on the east side of Yucca Mountain (Plate 1) based on available data (Squires and Young, 1984). These authors based their estimates of 100-year and 500-year flood magnitudes on regression analyses of approximately 20 years of peak-discharge data from 12 gaging stations on ephemeral streams in the Yucca Mountain area. Standard errors for these estimated discharges are relatively large due to the short period of record and extreme areal variability of flood flows in arid climates.

Squires and Young (1984) also examined geomorphic evidence of past flood elevations. Floodplain boundaries were delineated on the basis of flood data at various cross-sections interpolated according to the topography of the area (Plate 1). Estimates of regional maximum floods by Squires and Young

(1984) were based on a graphical boundary curve developed by Crippen and Bue (1977). The graph defines a boundary curve of maximum discharges that have occurred in drainages of varying sizes, and is based on quantitative measurements of flood-flow peaks in the 5-state region of Arizona, California, Nevada, New Mexico, and Utah.

Preliminary studies have also been performed to evaluate the probable maximum flood discharge for the Yucca Mountain site (Bullard, 1986) on the basis of estimated probable maximum precipitation and detailed characterization of the drainage basin. Results of this study, coupled with a consideration of the topographic features of the area, made possible the delineation of approximate flood boundaries in the washes beyond the study area of Squires and Young (1984).

Squires and Young (1984) described projected flood conditions in their study area as follows:

1. Fortymile Wash is a well-defined incised channel, with a cross-section 15 to 21 m deep and 300 to 450 m wide. The estimated values of the 100-yr, 500-yr, and regional maximum floods indicate that the flow would stay within the confines of the wash. Estimated flood water depths and velocities in the stream channel are:

	<u>Water depth (m)</u>	<u>Velocity (m/s)</u>
100-year flood	0.9 to 2.4	1.8 to 2.7
500-year flood	1.8 to 3.3	3.3 to 4.3
Regional maximum flood	6.4 to 8.8	7.0 to 8.5

2. The drainage basin of Busted Butte Wash varies from a shallow valley with meandering ephemeral streams to a deeply incised canyon in the upstream reaches. Drill Hole Wash is characterized by deep canyons extending from Yucca Mountain to its mid-drainage area. Estimated floodwater values for both washes are listed below.

	<u>Water depth (m)</u>	<u>Velocity (m/s)</u>
100-year flood	0.3 to 1.2	1.2 to 2.4
500-year flood	0.9 to 3.0	1.5 to 3.3
	(Channel breached in several places)	
Regional maximum flood	1.5 to 3.7	2.1 to 4.9
	(All flat-fan areas inundated)	

3. Yucca Wash is an incised channel about 14 m deep and 240 m wide at its confluence with Fortymile Wash. The 100-yr, 500-yr, and regional maximum floods would stay within the steep side-slope stream banks of the flood plain.

	<u>Water depth (m)</u>	<u>Velocity (m/s)</u>
100-year flood	0.9 to 1.5	1.5 to 2.7
500-year flood	1.5 to 2.7	2.4 to 3.7
Regional maximum flood	2.7 to 7.0	2.7 to 6.7

High-hazard areas are defined as those portions of riverine and coastal floodplains nearest the source of flooding which are frequently flooded and where the likelihood of flood losses and adverse impacts on natural and beneficial values served by floodplains is greatest (10 CFR 1022.4[m]). No high-hazard areas exist in the Yucca Mountain area.

4.0 FLOODPLAIN EFFECTS

According to 10 CFR Part 1022.12(a)(2), a floodplain/wetlands assessment is required to discuss the positive and negative, direct and indirect, and long- and short-term effects of the proposed action on the floodplain. Also, the effects on lives and property, and on natural and beneficial floodplain values shall be evaluated. All of the proposed surface-based investigation activities at the Yucca Mountain site were reviewed for potential effects should a flood occur. For each activity that might be undertaken in a potential 100-year flood area, the effects to the floodplain at that location and to downstream floodplain areas were evaluated.

Surface-based investigations will require the construction of trenches, dirt roads, and drill pads. The total area subject to possible disturbance in floodplains at the Yucca Mountain site is estimated to be approximately 74 acres. Impacts from construction are thoroughly described in the EA (DOE, 1986). Some vegetation will be lost and surface soils will be disturbed. However, siltation can be expected to remain approximately the same as might occur without disturbances. Impacts to vegetation and associated wildlife from construction activities are not expected to be significant (DOE, 1986).

In contrast to storms in less arid regions, the majority of desert storms are quite localized, and the resulting high-velocity flood waters tend to slow substantially once downstream of the affected tributaries. The load-bearing capacity of the water diminishes rapidly, and rocks, gravel, and silt are generally deposited before damage and siltation can occur much beyond the confluences of the contributing waterways. It is highly unlikely,

therefore, that any slight disturbances caused by the few surface-based investigations proposed for the floodplain will influence lives and property downstream. The nearest population center is 12 miles downstream, and long-time residents of the west understand desert storms sufficiently to avoid construction in or near washes.

Among the "natural and beneficial floodplain values" to be evaluated were those of flora and fauna (endangered species, in particular) and cultural resources. The most significant, current wildlife concern in the Yucca Mountain vicinity is the status of the desert tortoise, officially designated as "threatened" by the USFWS in April of 1990. After formal consultations with the DOE (in compliance with the Endangered Species Act), the USFWS declared on February 9, 1990 that site characterization activities are not likely to jeopardize the continued existence of the species. Providing that certain stipulations protecting the tortoise are observed, the DOE may proceed with its proposed site investigations.

Regarding cultural resources, the Desert Research Institute has conducted an intensive archaeological survey of all areas likely to be disturbed by surface-based investigations (Pippin, 1984). Two sites containing significant cultural resources were identified in Drill Hole Wash. Both sites have been collected in consultation with the State Historic Preservation Officer, and surface-based investigations will proceed under the provisions of a Programmatic Agreement with the Advisory Council on Historic Preservation (DOE, 1988b).

Potential indirect impacts of proposed activities on flora and fauna include increased fugitive dust emissions, elevated noise levels, and increased human activities associated with construction. The EA, considering the impacts of all activities anticipated at the site, concluded that construction emissions are not expected to create adverse air quality effects; no significant long-term noise impacts to wildlife are anticipated; and wildlife displaced by human activities would probably return to the area once the activity has ceased (DOE, 1986). Since those few activities that might take place in the floodplain are included in the EA evaluation, it is apparent that such activities are not expected to make a significant contribution to overall indirect impacts. Further, in the unlikely event that an indirect impact on flora or fauna did occur, it is probable that it would be no more severe than that caused by the same activity outside the floodplain. It is possible, however, that human activity could increase the potential for range fires and subsequent effects to vegetation and wildlife (DOE, 1986).

No perennial sources of surface water exist at Yucca Mountain. Heavy precipitation may cause locally accelerated erosion (DOE, 1986) and, subsequently, an increase in suspended materials in the runoff water. Erosion control measures are expected to decrease erosion and thereby improve water quality. In addition, the EA found that neither the quality nor the quantity of groundwater would be affected significantly by site characterization activities (DOE, 1986).

5.0 MITIGATION MEASURES

As required by 10 CFR 1022.12(a)(3), the DOE has adopted measures to mitigate the adverse effects of activities in floodplains. Before a proposed activity is approved, the Yucca Mountain Project Office requires that a preactivity survey be conducted to establish that the proposed work will not significantly impact any biological or archaeological resources, and that the work is not expected to conflict with the commitments to environmental safeguards set forth in the Environmental Monitoring and Mitigation Plan for Site Characterization (EMMP; DOE, 1988c). In addition, the site's reclamation potential is determined.

In the event that a proposed activity is found to pose a significant threat to a biological or archaeological resource, and modification or relocation of the activity cannot be accomplished without loss of essential data and information, appropriate mitigation measures are developed. Site-specific mitigation measures developed from preactivity surveys of individual locations are incorporated into the design of the activity.

Because precipitation is so infrequent and highly localized in southern Nevada, it is considered unlikely that heavy-rainfall effects (flooding, erosion, sedimentation, etc.) commonly observed elsewhere will be experienced at the Yucca Mountain site. However, mitigation measures adopted to prevent such effects would include diversion channels to direct water away from areas subject to flooding and erosion, rip-rapp to support slopes or access roads, and berms around activity sites to prevent access of water to the testing or

drilling areas. If deemed necessary, sedimentation settling basins could be constructed immediately downstream of the activity.

To mitigate against adverse effects that might occur once the site investigation has been completed, reclamation guidelines will be developed and included as design criteria for each surface-based testing activity. These reclamation guidelines will be developed in concert with DOE's Reclamation Program Plan (RPP; DOE, 1989) and Reclamation Implementation Plan (RIP; DOE, draft in review). The RPP describes DOE's policy for reclaiming disturbed areas, and the RIP describes the implementation of reclamation practices at the Yucca Mountain site.

The reclamation guidelines include procedures for site clearance, topsoil salvage, erosion control, drainage control, recontouring, revegetation, road siting, construction, and maintenance. Further, measures designed to minimize impacts on floodplains and mitigate the effects associated with construction activities in the floodplain are provided. Disturbance of surface areas and vegetation will be minimized, and natural contours will be maintained to the maximum extent possible. Slopes will be stabilized to minimize erosion. Unnecessary off-road vehicular travel will be avoided.

Reclamation activities at each disturbed area will commence with the completion of surface-based investigations. Field compliance inspections will be conducted to verify that the activities are located and performed in

accordance with the design requirements and criteria developed during preactivity surveys.

6.0 ALTERNATIVES

DOE's regulations for floodplain/wetlands compliance (10 CFR 1022.12[a][3]) require that alternatives to the proposed action be addressed.

6.1 ALTERNATIVE LOCATIONS FOR SITE CHARACTERIZATION

The Nuclear Waste Policy Act describes the process whereby Yucca Mountain was selected as one of several possible sites for a nuclear waste repository. In passing the Nuclear Waste Policy Amendments Act of 1987 (NWPAA), Congress modified the site-selection process by selecting Yucca Mountain as the only site to be characterized. Consequently, no alternative sites for site characterization were evaluated.

6.2 ALTERNATIVE LOCATIONS FOR SURFACE-BASED INVESTIGATIONS

Alternative locations at Yucca Mountain will be considered for each proposed surface-based investigation if preactivity surveys reveal that the

activity might adversely affect the floodplain. It may be possible to move an activity out of the floodplain, thereby benefiting downstream areas without significantly changing the surface area or ecosystem disturbed at the site.

Alternative locations may be desirable from the standpoint of protecting floodplains but may be unsuitable due to conflicts with other resources. For example, certain special resources (e.g., desert tortoises and their habitat, kit fox dens, Native American artifacts) are of such significance that their presence automatically initiates a consideration of alternative actions. These resources, and the protocol for making decisions that affect them, are discussed in the EMMP (DOE, 1988c). Situations involving such sensitive resources will be evaluated on a site-by-site basis, and the alternative creating the least adverse impact, while enhancing long-term ecological stability, will be selected.

6.3 NO ACTION ALTERNATIVE

Selection of the no-action alternative would avoid the minor impacts to the floodplain associated with construction activity. However, the positive aspects of taking no action are considered small when compared to the benefits of the proposed action, i.e., obtaining sufficient scientific data to determine the suitability of the site for a repository. The consequences of the no-action alternative are very significant and include non-compliance with the NWPAA.

6.4 PROPOSED ACTION ALTERNATIVE

Locating some facilities and activities (described in Section 2.0) in the floodplains at Yucca Mountain is an important component of the DOE's proposed site characterization program. To scientifically characterize the site, investigations must be conducted in areas representative of all portions of the site. Additional reasons for working in the floodplain include avoidance of the repository block and protection of resources outside the floodplain. The information gathered during these investigations will benefit the program by providing a better database upon which to determine the suitability of Yucca Mountain as a repository. Long-term public health and safety will also benefit. By performing certain activities in the floodplains, the DOE will better fulfill its legal obligations as specified by the NWPAA.

The proposed action alternative is not expected to cause any significant adverse effects to floodplains, people, or property. Surface-based investigations will be designed to minimize the potential for adverse impacts to the floodplain using mitigation measures such as erosion control, drainage diversion, reclamation, and revegetation. Location plans will incorporate design and monitoring measures to ensure that operations safety is not compromised. Biological and archaeological surveys will be conducted prior to commencement of any surface-disturbing activities. These surveys include identification of any threatened, endangered, or special-interest plant or animal species, as well as designation of sensitive and/or unique areas.

7.0 CONCLUSIONS

The potential impacts of proposed surface-based investigations on floodplains adjacent to Yucca Mountain and their various components (biological and archaeological resources, downstream drainage areas, etc.) were considered. Such impacts are expected to be insignificant and of short duration only. Mitigation measures will be implemented to minimize any potential impacts. Based on this assessment, the benefits of locating certain surface-based investigations in floodplains outweigh the minor adverse impacts that could occur. It is, therefore, concluded that the proposed action alternative is environmentally sound and will adequately protect floodplain environments.

8.0 REFERENCES

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**Plate 1. Map of Yucca Mountain Project
Flood-Prone Areas.**

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
SPECIAL INSTRUCTION SHEET

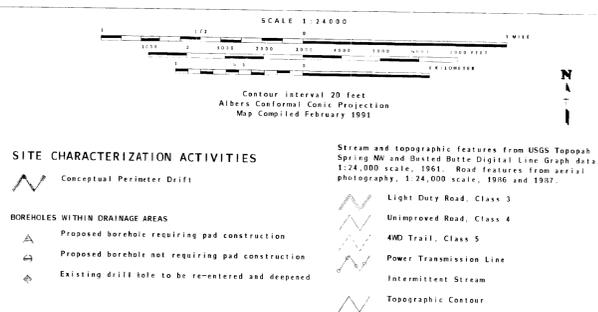
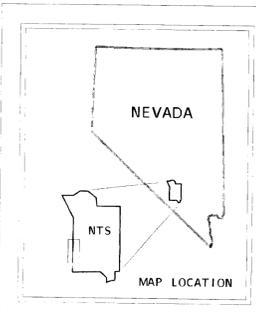
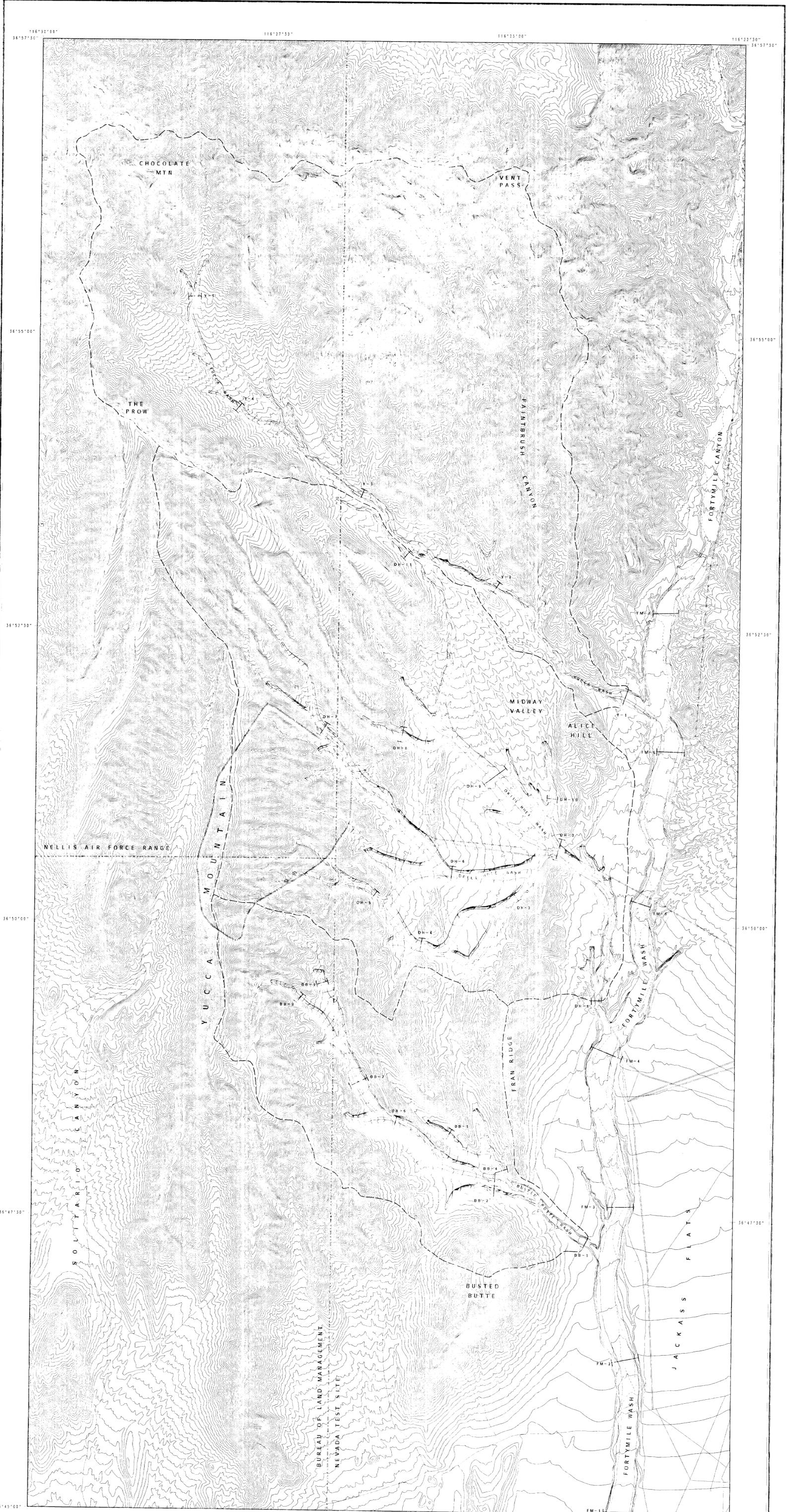
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12. Comments
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YUCCA MOUNTAIN PROJECT Flood Prone Areas

LIMITS OF INUNDATION

- 100 - year flood
- 500 - year flood
- Regional Maximum flood
- Drainage basin divide
- Cross Section and Number
 - BB - Busted Butte Wash; DH - Drill Hole Wash; FM - Fortymile Wash; Y - Yucca Wash

Flood prone areas, drainage basin divides, and cross sections from U.S. Geological Survey Water Resources Investigation Report 83-4001, Plate 1, "Map Showing Approximate Flood Prone Areas, Fortymile Wash and Its Principal Southwestern Tributaries, Nevada Test Site, Southern Nevada". Hydrology mapped by R.R. Squires and R.L. Young, 1982.

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