Geomorphic Surface Maps of Northern Frenchman Flat, Nevada Test Site, Southern Nevada

Prepared by

Bechtel Nevada
Geotechnical Sciences
Las Vegas, Nevada

Prepared for

U.S. Department of Energy
National Nuclear Security Administration
Nevada Site Office
Las Vegas, Nevada

August 2005

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**Geomorphic Surface Maps of Northern Frenchman Flat,
Nevada Test Site, Southern Nevada**

DOE/NV/11718--1091

Preface

Raytheon Services Nevada (RSN), predecessor to Bechtel Nevada, was among the entities responsible for characterizing the subsurface hydrogeology of the Area 5 Radioactive Waste Management Site (RWMS) at the Nevada Test Site for the U.S. Department of Energy in the early 1990s. Some of this work was documented in a series of unpublished maps and data reports. As part of Bechtel Nevada's current scope for closure planning for the Area 5 RWMS, these maps and data reports are being updated to current editorial standards for approval for public release so they will be accessible for public review and for citation in future documents.

The maps in this document were prepared in 1995 by geoscientists of the RSN Environmental Restoration and Waste Management Division and the RSN subcontractor, Lockheed Environmental Systems and Technologies Company. The maps are reproduced here unchanged since the 1995 effort, but narrative information has been added to support the map data.

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**Geomorphic Surface Maps of Northern Frenchman Flat,
Nevada Test Site, Southern Nevada**

DOE/NV/11718--1091

Abstract

Large-scale (1:6000) surficial geology maps of northern Frenchman Flat were developed in 1995 as part of comprehensive site characterization required to operate a low-level radioactive waste disposal facility in that area. Seven surficial geology maps provide fundamental data on natural processes and are the platform needed to reconstruct the Quaternary history of northern Frenchman Flat. Reconstruction of the Quaternary history provides an understanding of the natural processes that act to develop the landscape, and the time-frames involved in landscape development.

The mapping was conducted using color and color-infrared aerial photographs and field verification of map unit composition and boundaries. Criteria for defining the map unit composition of geomorphic surface units are based on relative geomorphic position, landform morphology, and degree of preservation of surface morphology. Seven geomorphic surfaces (Units 1 through 7) are recognized, spanning from the early Quaternary to present time.

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List of Acronyms and Abbreviations

DOE	U.S. Department of Energy
NTS	Nevada Test Site
RSN	Raytheon Services Nevada
RWMS	Radioactive Waste Management Site

1.0 Introduction

1.1 Background Information

Raytheon Services Nevada (RSN), a predecessor to Bechtel Nevada, was among the entities responsible for characterizing the subsurface hydrogeology of the Area 5 Radioactive Waste Management Site (RWMS) at the Nevada Test Site (NTS). This work was conducted in 1995 for the U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office (formerly U.S. Department of Energy [DOE], Nevada Operations Office) Waste Management Division.

Some of this work was documented in a series of unpublished maps and data reports. As part of Bechtel Nevada's current scope for closure planning for the Area 5 RWMS, these maps and data reports are being updated to current editorial standards for approval for public release so they will be accessible for public review and for citation in future documents.

The maps in this document were prepared by geoscientists of the RSN Environmental Restoration and Waste Management Division and the RSN subcontractor, Lockheed Environmental Systems and Technologies Company.

1.2 Project Description

Seven large-scale (1:6000) surficial geology maps of northern Frenchman Flat were developed in 1995 as part of comprehensive site characterization required to operate a low-level radioactive waste disposal facility in that area. The region mapped is included within the area defined by the following latitude and longitude coordinates, and is shown in Figure 1-1:

Eastern Boundary:	115° 53' 58"
Western Boundary:	116° 00' 29"
Northern Boundary:	36° 57' 59"
Southern Boundary:	36° 50' 53"

These maps provide fundamental data on natural processes and are the platform needed to reconstruct the Quaternary history of northern Frenchman Flat. Reconstruction of the Quaternary history provides an understanding of the natural processes that act to develop the landscape, and the time-frames involved in landscape development.

Another objective of the surficial geology mapping project was to correlate the allostratigraphy of deposits (Section 2.2) exposed in the walls of disposal pits at the waste site and in other nearby trenches with the mapped surficial deposits.

Figure 1-1
Location of Surficial Geomorphic Maps in Frenchman Flat at the Nevada Test Site

1.3 *Site Description*

The Area 5 RWMS is located within the northeast part of Frenchman Flat, in the northern portion of the Mojave desert (DOE, 2004). Annual precipitation for Frenchman Flat is approximately 12 centimeters (5 inches) (DOE, 1998). Precipitation in the area is sporadic, typically falling as small amounts of rain or snow during isolated, short-duration winter and summer storms. Severe weather can occur in the region, usually in the form of summer thunderstorms with intense lightning, strong winds, and localized heavy rainfall.

Frenchman Flat is an intermontane basin located in the Basin and Range physiographic province. The sparsely vegetated valley floor slopes gently toward a central playa (dry lake bed). Ground level elevations range from 938 meters (3,078 feet) above sea level at the playa, to over 1,463 meters (4,800 feet) in the nearby surrounding highlands.

1.4 *Purpose and Scope of Report*

This report presents 7 surficial geologic maps, available on paper at a size of approximately 91 centimeters (36 inches) square and in electronic form. The maps are labeled in series, as Sheets 2 through 8. Also included is a brief narrative (this document) describing the rationale and methods for the mapping project.

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2.0 Methods

2.1 Methods

The mapping was conducted using color and color-infrared aerial photographs provided by EG&G Energy Measurements, Inc. Map unit composition and boundaries were verified in the field. Available pit and trench walls at the RWMS and nearby areas were also mapped and sampled to obtain detailed near-surface information about the Quaternary alluvium and to check for the presence of faults.

Unit contacts were plotted on orthophotographic base maps with topographic contour overlays. The orthophotograph base maps were prepared by The Orthoshop-Tucson from 1:24,000-scale aerial photographs taken in August 1991 EG&G Energy Measurements, Inc. The ground control for the topographic contours was provided by Reynolds Electrical and Engineering Company, Inc.

2.2 Mapping Units

The maps show the extent of the seven allostratigraphic units mapped in the study area. An allostratigraphic unit is a mappable unit of sedimentary rock defined and identified on the basis of bounding discontinuities, which may be either disconformities or buried soils. Criteria for defining the map unit composition of geomorphic surface units are based on relative geomorphic position, landform morphology, and degree of preservation of surface morphology.

Seven geomorphic surfaces are recognized, spanning the time from the early Quaternary to the present (Units 1 through 7). Each geomorphic surface exhibits a distinctive degree of six geologic characteristics: desert pavement, carbonate and/or silica platelets on the surface, varnished clasts, rubified clasts, preserved bar-and-swale morphology, and an eolian mantle (Table 2-1). The unit definitions were adapted from Gibson et al. (1992) who performed similar mapping work in the nearby Midway Valley at the NTS. Detailed descriptions of all the geomorphic surface mapping units are provided on each map.

Geomorphic surface mapping units 7 (youngest) through 3 are generally present on most of the seven maps. The oldest two surfaces (Units 2 and 1) are generally not extensive and are restricted to mountain front or upper alluvial fan locations. The maps also indicate the location and extent of disturbed areas (Unit d) and surfaces cut in bedrock units (Tertiary tuff [Tr] and Ordovician limestone [Oa]) where present.

Table 2-1
Relative Occurrence of Selected Characteristics of Geomorphic Surface Map
Units within Northern Frenchman Flat

Geologic Characteristic	Geomorphic Surface Map Unit						
	1	2	3	4	5	6	7
Desert pavement	••••	••••	••••	•• to ••••	• to ••	N.O.	N.O.
Carbonate/silica platelets on surface	••	••	••	•	N.O.	N.O.	N.O.
Varnished clasts	••••	••••	••••	•• to ••••	••	•	N.O.
Rubified clasts	••••	••••	••••	•• to ••••	••	•	N.O.
Bar-and-swale morphology preserved	•	•	•	••	•••	••••	••••
Eolian mantle	••••	••• to ••••	••• to ••••	•• to ••••	• to ••	•	N.P.

Notes:

Adapted from Gibson et al. (1992).

Dots (●) show the typical, relative development of selected geologic and geomorphic characteristics for the mapping units.

Geologic and Geomorphic Characteristics:

- = Very well developed
- = Well developed
- = Moderately well developed
- = Observed but poorly developed
- N.O. = Not observed

Dots (●) indicate relative thickness of eolian mantle:

- = Very thick
- = Thick
- = Thin
- = Very thin
- N.P. = Not present

3.0 References

DOE, see U.S. Department of Energy.

Gibson, J. D., J. R. Wesling, F. H. Swan, and T. F. Bullard, 1992. *Recent Characterization Activities of Midway Valley as a Potential Repository Surface Facility Site*. Sandia National Laboratories Report SAND92-0091C, Albuquerque, NM. 20 pp.

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GEOMORPHIC SURFACE MAP OF

December 1995

K. E. Snyder (2), H. E. Huckins-Gang (1),
S. E. Rawlinson (1), and D. L. Gustafson (1)

- (1) Raytheon Services Nevada, Environmental Restoration and Waste Management Division
(2) Lockheed Environmental Systems & Technologies Company

MAP UNIT DESCRIPTIONS

Unit d Historic--

Unit d represents areas where human activity such as cutting or filling for roads and drillpods has disturbed the natural surface; vegetation may be present; disturbances since August 1991 (date of basemap orthophotography) are not mapped.

Unit 7 Late Holocene--

Unit 7 occupies the bottom and side slopes of active drainageways. The land surface has the following characteristics: original unaltered bar-and-swale topography; no desert pavement; desert varnish on clasts is inherited; rubification on clasts is inherited; and shrubs are absent, but annuals may be sparse. Animal burrows are typically absent. In the erosional segment, many different truncated soils (paleosols) can underlie the surface. In the depositional segment, no pedogenic alteration of the substratum is apparent (including unaltered paleocarbonate coatings); occasionally a very thin, crust-like A horizon is present. Included in this map unit are narrow terrace, fan remnants, and side slopes of older surfaces (typically 6 and 5).

Unit 6 Late Holocene—

Unit 6 occupies terraces and bars along active drainageways that are typically less than 1 m above the 7 surface, broad fans on the piedmont, small colluvial fans on slopes adjoining older surfaces, and colluvium on bedrock. The land surface has the following characteristics: original bar-and-swale topography is unaltered; no desert pavement; desert varnish on clasts is inherited; rubification of clasts is inherited; and sparsely to partially vegetated with shrubs and annuals. Annual narrow terraces form. The erosional segment can have most different truncated soils. The pedogenic segment beneath the surface is in the depositional segment, pedogenesis is limited to the development of an AC profile, with thin A horizons and some accumulation of carbonate (stage 1) in the C horizon. Deposits may contain clasts with paleocarbonate coatings. Included in this map unit are narrow terraces, fan remnants, and side slopes of older surfaces (typically 5 and 4), and narrow 7 drainageways.

Unit 5 Middle to Early Holocene—

Unit 5 occupies broad fans on the piedmonts, terraces along active drainageways, abandoned drainageways cut into older surfaces, colluvial slopes adjoining older surfaces, and colluvial slopes on bedrock. Included in this map unit are narrow terraces, fan remnants, and side slopes of older surfaces (typically 4 and 3), and narrow 7 and 6 drainageways.

Where the landscape character allowed, the following criteria were used to map two subunits. Units designated as 5 have characteristics of either subunit.

Unit 5b Middle Holocene--

The land surface has the following characteristics: subdued bar-and-swale topography; small areas of incipient desert pavement; little to no incipient desert varnish on clasts; incipient rubification on bottom of clasts; paleocarbonate coatings on clasts; and vegetated with shrubs and annuals. Animal burrows are common. In the erosional segment, many different truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a Bw (cambic) or weakly expressed Bk (cambic) horizon. The accumulation of carbonate is stage I, with paleocarbonate coatings on clasts. The A horizon textures reflect the influence of eolian silt and very fine sand.

Unit 5a Early Holocene--

The land surface has the following characteristics: subdued bar-and-swale topography; large areas of moderately expressed pavement; moderately expressed varnish on clasts; incipient rubification on undersides of clasts; and vegetated with shrubs and annuals. Animal burrows are common. In the erosional segment many different truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a well expressed Bw (cambic) or Bk (cambic) horizon. The accumulation of carbonate is stage I to I+. The A horizon textures reflect the influence of eolian silt and very fine sand.

Unit 4 Late Pleistocene—

Unit 4 occupies broad floor on the piedmont, terraces along active drainageways, abandoned drainageways cut in older surfaces, colluvial slopes adjoining older surfaces, and colluvial slopes on bedrock. The land surface has the following characteristics: bar-and-swale topography is muted with clasts partially buried by an eolian mantle; large areas (greater than 50%) of well expressed (greater than 10 cm) to moderately expressed (5-10 cm) pedology; moderately expressed rubrication on bottom of clasts; and vegetated with shrubs and annuals. Animal burrows are common. In the erosional segment, many different truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a well expressed Bk (calic) or weakly expressed Btk (orgillic and calic) horizon. A vesicular A horizon is common. The erosional segment is typically 5 and 6 m wide, and the depositional segment is narrow terraces and fans of younger surfaces (typically 5 and 6), narrow 7 and 6 drainageways and side slopes of older units (typically 3).

Unit 3 Late Pleistocene—

Unit 3 occupies broad fans on the piedmonts, terraces along active drainageways, abandoned drainageways cut in older surfaces, colluvial slopes of older surfaces, colluvial slopes on bedrock, and pediments along the mountain fronts. The land surface has the following characteristics: smooth with bar-and-swale topography muted because clasts are nearly buried by an eolian mantle; large areas (>50%) of well expressed pavement; well varnished clasts; carbonate platelets are common; well expressed rubification on bottom of clasts; and vegetated with shrubs and grasses. The pedimental surface is commonly truncated by a sandstone, silty sandstone, or silty sandstone (unit 4) which underlies the surface. In the depositional segment, pedogenic development is typically an ABC profile with a well expressed Btk (argillic and calcic) horizon. The accumulation of carbonate is stage II to III. A vesicular A horizon is present. Included in this map unit are narrow terraces, inset fans, and side slopes of younger surfaces (typically 5 and 4).

Unit 2 Middle Pleistocene—

Unit 2 occupies broad fans and small fan remnants, ballenas, colluvial-mantled hillslopes, and pediments along the mountain fronts. On the Scarp Canyon and Nye Canyon Piedmont two subunits were mapped based on relative topographic position and drainage patterns. Fan remnants are smooth because they lack silty cone facies burrows. The depositional sequence is massive to (greater than 5%) well-sorted, poorly to darkly varnished clasts; carbonate platelets are common; well expressed rubification on bottom of clasts; and sparsely vegetated with shrubs and annuals. Desert pavement and varnish may be poorly expressed on ballenas, where accordant summits define the surface. Animal burrows are uncommon. In the erosional segment many truncated soils (paleosols) may underlie the surface. In the depositional segment, pedogenic caliche is typically present. A thin, massive, yellowish-brown, micaceous, silty clay horizon. A thick vesicular caliche horizon is present. The accumulation of carbonate is stage II (IV, 4). Included in this map unit are narrow terraces, inset fans, and side slopes of younger surfaces (typically 4 and 3).

Unit Tr Tertiary to Quaternary—

This unit consists of surfaces cut in bedrock of gray, brown, red, and yellow bedded tuffs (both welded and non-welded) and a few areas of lava flows and tuffaceous sandstones, all of Tertiary age.

Unit 0a Ordovician to Quaternary—

This unit consists of surfaces cut in bedrock of gray, sparsely fossiliferous limestone of Ordovician age.

Map units with a dual designation (6/7, for example) is used where the map scale does not allow presentation of complex patterns; the older unit is written first. Most map units are dominated by geomorphic surfaces developed in alluvium, but units dominated by colluvium include the letter C in the designation (3C, for example), and units dominated by pediment include the letter P in the map unit designation (3P, for example).

Produced for the US Department of Energy
by Reynolds Electrical & Engineering Co., Inc.

Aerial photograph prepared from 1:24,000 scale aerial photographs taken August, 1991 by BG&G Energy Measurements, Inc.
Ground control provided by REECO-1991 survey.

Orthophotographs compiled using photogrammetric methods by the GTOshop function.
Polyconic Projection.
3500-foot grid ticks - Nevada coordinate system, central zone.

1927 North American datum

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AREA 5 RADIOACTIVE WASTE MANAGEMENT SITE

ORTHOPHOTO BASEMAP
SHEET 2
1991

GEOMORPHIC SURFACE MAP OF

December 1995

K. E. Snyder (2), S. E. Rawlinson (1),

- (1) Raytheon Services Nevada, Environmental Restoration and Waste Management Division

MAP UNIT DESCRIPTIONS

Unit d Historic--

Unit d represents areas where human activity such as cutting or filling for roads and drillpads has disturbed the natural surface; vegetation may be present; disturbances since August 1991 (date of basemap orthophotography) are not mapped.

Unit 7 Late Holocene—

Unit 7 occupies the bottom and side slopes of active drainageways. The land surface has the following characteristics: original unaltered bar-and-swale topography; no desert pavement; desert varnish on clasts is inherited; rubification on clasts is inherited; and shrubs are absent, but annuals may be sparse. Animal burrows are typically absent. In the erosional segment, many different truncated soils (paleosols) can underlie the surface. In the depositional segment, no pedogenic alteration of the substratum is apparent (including unaltered paleocarbonate coatings); occasionally a very thin, crust-like A horizon is present. Included in this map unit are narrow terrace, fan remnants, and side slopes of older surfaces (typically 6 and 5).

Unit 6 Late Holocene—

Unit 6 occupies terraces and bars along active drainageways that are typically less than 1 m above the 7 surface, broad fans on the piedmont, small colluvial fans on slopes adjoining older surfaces, and colluvium on bedrock. The land surface has the following characteristics: original bar-and-swale topography is unaltered; no desert pavement; desert varnish on clasts is inherited; rubification of clasts is inherited; and sparsely to partially vegetated with shrubs and annuals. Animal burrows are common. The erosional segment can have many different truncated soils (paleosols) beneath the surface. In the depositional segment, pedogenesis is limited to the surface and the C horizon. Deposits with some accumulation of carbonate (stage 1) are present in the C horizon. Deposits may contain clasts with paleocarbonate coatings. Included in this map unit are narrow terraces, fan remnants, and side slopes of older surfaces (typically 5 and 4), and narrow 7 drainageways.

Unit 5 Middle to Early Holocene--

Unit 5 occupies broad fans on the piedmonts, terraces along active drainageways, abandoned drainageways cut into older surfaces, colluvial slopes adjoining older surfaces, and colluvial slopes on bedrock. Included in this map unit are narrow terraces, fan remnants, and side slopes of older surfaces (typically 4 and 3), and narrow 7 and 6 drainageways.

Where the landscape character allowed, the following criteria were used to map two subunits. Units designated as 5 have characteristics of either subunit.

Unit 5b Middle Holocene--

The land surface has the following characteristics: subdued bar-and-swale topography; small areas of incipient desert pavement; little to no incipient desert varnish on clasts; incipient rubification on bottom of clasts; paleocarbonate coatings on clasts; and vegetated with shrubs and annuals. Animal burrows are common. In the erosional segment, many different truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a Bw (cambic) or weakly expressed Bk (cambic) horizon. The accumulation of carbonate is stage I, with paleocarbonate coatings on clasts. The A horizon textures reflect the influence of eolian silt and very fine sand.

Unit 5a Early Holocene—

The land surface has the following characteristics: subdued bar-and-swale topography; large areas of moderately expressed pavement; moderately expressed varnish on clasts; incipient rubification on undersides of clasts; and vegetated with shrubs and annuals. Animal burrows are common. In the erosional segment many different truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a well expressed Bw (cambic) or Bk (cambic) horizon. The accumulation of carbonate is stage I to I+. The A horizon textures reflect the influence of eolian silt and very fine sand.

Unit 4 Late Pleistocene--

Unit 4 occupies broad fans on the piedmont, terraces along active drainageways, abandoned drainageways cut in older surfaces, colluvial slopes adjoining older surfaces, and colluvial slopes on bedrock. The land surface has the following characteristics: bar-and-swale topography is muted; the surface is bare, with little or no vegetation; the surface is composed of a thin, well-sorted pavement; moderately to well varnished clasts depending on the lithology; moderately expressed rubification on bottom of clasts; and vegetated with shrubs and annuals. Animal burrows are common. In the erosional segment, many different truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a well expressed Bk (calic) or weakly expressed Bk (argillic and calic) horizon. A vesicular A horizon is common. The soil is typically a clayey to silty, calcareous, brown to gray, medium to fine grained, narrow terraces and fans of younger surfaces (typically 5 and 6), narrow 7 and 6 drainageways and side slopes of older units (typically 3).

Unit 3 Late Pleistocene--

Unit 3 occupies broad fans on the piedmonts, terraces along active drainageways, abandoned drainageways cut in older surfaces, colluvial slopes of older surfaces, colluvial slopes on bedrock outcrops, and some small-scale alluvial fans. The surface is smooth to very smooth, generally smooth with bar-and-saw topography muted because clasts are nearly buried by an eolian mantle; large areas (>50%) of well expressed pavement; well varnished clasts; carbonate platelets are common; well expressed rubification on bottom of clasts, and vegetated with shrubs and grasses. In the depositional segment, paleosols (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a well vesicular Bkz (argillic and calcic) horizon. The accumulation of carbonate is stage III to III_c. A vesicular Btkz is present. Included in this map unit are the lowermost (and largest) remnants of the "Hanging Rock" (Hanging Rock Formation).

Unit 2 Middle Pleistocene--

Unit 2 occupies fan remnants, ballenas, colluvial-mantled hillslopes, and pediments along the mountain fronts. The land surface has the following characteristics: fan remnants are smooth because a thick, silty, eolian mantle buries the depositional bar-and-swale topography; extensive pedimentation (more than 75%) covers the surface; desert shrubs and forbs are common; clay-rich platelets; well expressed rubification on bottom of clasts; and sparsely vegetated with shrubs and annuals. Desert pavement and varnish may be poorly expressed on ballenas, where accretion summits define the surface. Animal burrows are uncommon. In the erosional segment many truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a well expressed Btkm (argillic and petrocalcic) horizon. Thick vesicular horizons are present. The accumulation of carbonates in stage 2 is not included in this map unit but terraces, inset fans, and side slopes of younger surfaces (typically 4 and 3).

Unit Tr Tertiary to Quaternary--

This unit consists of surfaces cut in bedrock of gray, brown, red, and yellow bedded tuffs (both welded and non-welded) and a few areas of lava flows and tuffaceous sandstones, all of Tertiary age.

Map units with a dual designation (6/7, for example) is used where the map scale does not allow presentation of complex patterns; the older unit is written first. Most map units are dominated by geomorphic surfaces developed in alluvium, but units dominated by colluvium include the letter C in the designation (3C, for example), and units dominated by pediment include the letter P in the map unit designation (3P, for example).

Drawn by R. A. Diaz, RSN
12\29\95 Sheet 1

UNITED STATES
DEPARTMENT OF ENERGY

AREA 5 RADIOACTIVE
WASTE MANAGEMENT SITE

Produced for the U.S. Department of Energy
by Raytheon Electrical & Engineering Co., Inc.

Orthophotograph prepared from 1:24,000
scale aerial photograph (aero) August 1950 by
SG & G Energy Measurements, Inc.

Ground control provided by REEDCO
001 survey

Orthophotographs compiled using photogrammetric
methods by this Orthophoto Unit.

Pyrozone Projection
23M foot grid scale - *Natural* coordinate system
central line

0527 North American datum

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AREA 5 RADIOACTIVE WASTE MANAGEMENT SITE

ORTHOPHOTO BASEMAP
SHEET 3
1991

GEOMORPHIC SURFACE MAP
OF
NORTHERN FRENCHMAN FLAT, SOUTHERN NEVADA

December 1995

H. E. Huckins—Gang (1), K. E. Snyder (2),
S. E. Rawlinson (1), and D. L. Gustafson (1)

- (1) Raytheon Services Nevada, Environmental Restoration and Waste Management Division
(2) Lockheed Environmental Systems & Technologies Company

MAP UNIT DESCRIPTIONS

Unit d Historic—

Unit d represents areas where human activity such as cutting or filling for roads and drillpads has disturbed the natural surface; vegetation may be present; disturbances since August 1991 (date of basemap orthophotography) are not mapped.

Unit 7 Late Holocene—

Unit 7 occupies the bottom and side slopes of active drainageways. The land surface has the following characteristics: original unaltered bar-and-swale topography; no desert pavement; desert varnish on clasts is inherited; rubification on clasts is inherited; and shrubs are absent, but annuals may be sparse. Animal burrows are typically absent. In the erosional segment, many different truncated soils (paleosols) can underlie the surface. In the depositional segment, no pedogenic alteration of the substratum is apparent (including unaltered paleocarbonate coatings); occasionally a very thin, crust-like A horizon is present. Included in this map unit are narrow terrace, fan remnants, and side slopes of older surfaces (typically 6 and 5).

Unit 6 Late Holocene—

Unit 6 occupies terraces and bars along active drainageways that are typically less than 1 m above the 7 surface, broad fans on the piedmont, small colluvial fans on slopes adjoining older surfaces, and colluvium on bedrock. The land surface has the following characteristics: original bar-and-swale topography is unaltered; no desert pavement; desert varnish on clasts is inherited; rubification of clasts is inherited; and sparsely to partially vegetated with shrubs and annuals. Animal burrows are common. The erosional segment can have many different truncated soils (paleosols) beneath the surface. In the depositional segment, pedogenesis is limited to the development of an AC profile, with thin A horizons and some accumulation of carbonate (stage I) in the C horizon. Deposits may contain clasts with paleocarbonate coatings. Included in this map unit are narrow terraces, fan remnants, and side slopes of older surfaces (typically 5 and 4), and narrow 7 drainageways.

Unit 5 Middle to Early Holocene—

Unit 5 occupies broad fans on the piedmonts, terraces along active drainageways, abandoned drainageways cut into older surfaces, colluvial slopes adjoining older surfaces, and colluvial slopes on bedrock. Included in this map unit are narrow terraces, fan remnants, and side slopes of older surfaces (typically 4 and 3), and narrow 7 and 6 drainageways.

Where the landscape character allowed, the following criteria were used to map two subunits. Units designated as 5 have characteristics of either subunit.

Unit 5b Middle Holocene—

The land surface has the following characteristics: subdued bar-and-swale topography; small areas of incipient desert pavement; little to no incipient desert varnish on clasts; incipient rubification on bottom of clasts; paleocarbonate coatings on clasts; and vegetated with shrubs and annuals. Animal burrows are common. In the erosional segment, many different truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a Bw (cambic) or weakly expressed Bk (cambic) horizon. The accumulation of carbonate is stage I, with paleocarbonate coatings on clasts. The A horizon textures reflect the influence of eolian silt and very fine sand.

Unit 5a Early Holocene—

The land surface has the following characteristics: subdued bar-and-swale topography; large areas of moderately expressed pavement; moderately expressed varnish on clasts; incipient rubification on undersides of clasts; and vegetated with shrubs and annuals. Animal burrows are common. In the erosional segment many different truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a well expressed Bw (cambic) or Bk (cambic) horizon. The accumulation of carbonate is stage I to II. The A horizon textures reflect the influence of eolian silt and very fine sand.

Unit 4 Late Pleistocene—

Unit 4 occupies broad fans on the piedmont, terraces along active drainageways, abandoned drainageways cut in older surfaces, colluvial slopes adjoining older surfaces, and colluvial slopes on bedrock. The land surface has the following characteristics: bar-and-swale topography is muted with clasts partially buried by an eolian mantle; large areas (greater than 50%) of well expressed pavement; moderately to well varnished clasts depending on the lithology; moderately expressed rubification on bottom of clasts; and vegetated with shrubs and annuals. Animal burrows are common. In the erosional segment, many different truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a well expressed Bk (calcic) or weakly expressed Btk (argillic and calcic) horizon. A vesicular A horizon is present. The accumulation of carbonate is stage I+ to II. Included in this map unit are narrow terraces and fans of younger surfaces (typically 5 and 6), narrow 7 and 6 drainageways, and side slopes of older units (typically 3).

Unit 3 Late Pleistocene—

Unit 3 occupies broad fans on the piedmonts, terraces along active drainageways, abandoned drainageways cut in older surfaces, colluvial slopes of older surfaces, colluvial slopes on bedrock, and pediments along the mountain fronts. The land surface has the following characteristics: smooth with bar-and-swale topography muted because clasts are nearly buried by an eolian mantle; large areas (>50%) of well expressed pavement; well varnished clasts; carbonate platelets are common; well expressed rubification on bottom of clasts; and vegetated with shrubs and annuals. Animal burrows are uncommon. In the erosional segment, many different truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a well expressed Btk (argillic and calcic) horizon. The accumulation of carbonate is stage II to III. A vesicular A horizon is present. Included in this map unit are narrow terraces, inset fans, and side slopes of younger surfaces (typically 5 and 4).

Unit 2 Middle Pleistocene—

Unit 2 occupies fan remnants, ballenas, colluvial-mantled hillslopes, and pediments along the mountain fronts. The land surface has the following characteristics: fan remnants are smooth because a thick, silty, eolian mantle buries the depositional bar-and-swale topography; extensive areas (greater than 75%) of well expressed pavement; darkly varnished clasts; common carbonate platelets; well expressed rubification on bottom of clasts; and sparsely vegetated with shrubs and annuals. Desert pavement and varnish may be poorly expressed on ballenas, where accordant summits define the surface. Animal burrows are uncommon. In the erosional segment many truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a well expressed Btkm (argillic and petrocalcic) horizon. A thick vesicular A horizon is present. The accumulation of carbonate is stage III to IV. Included in this map unit are narrow terraces, inset fans, and side slopes of younger surfaces (typically 4 and 3).

Unit Tr Tertiary to Quaternary—

This unit consists of surfaces cut in bedrock of gray, brown, red, and yellow bedded tuffs (both welded and non-welded) and a few areas of lava flows and tuffaceous sandstones, all of Tertiary age.

Map units with a dual designation (6/7, for example) is used where the map scale does not allow presentation of complex patterns; the older unit is written first. Most map units are dominated by geomorphic surfaces developed in alluvium, but units dominated by colluvium include the letter C in the designation (3C, for example), and units dominated by pediment include the letter P in the map unit designation (3P, for example).

UNITED STATES
DEPARTMENT OF ENERGY

AREA 5 RADIOACTIVE
WASTE MANAGEMENT SITE

Prepared for the U.S. Department of Energy
by Raytheon Services Nevada, Environmental Restoration and Waste Management Division
(1) Raytheon Services Nevada, Environmental Restoration and Waste Management Division
(2) Lockheed Environmental Systems & Technologies Company

SCALE 1:6000
1 INCH = 500 FEET
10 FT. CONTOUR INTERVAL

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AREA 5 RADIOACTIVE
WASTE MANAGEMENT SITE

ORTHOPHOTO BASEMAP
SHEET 4
1991

GEOMORPHIC SURFACE MAP OF

December 1995

K. E. Snyder (2), H. E. Huckins-Gang (1),
S. E. Rawlinson (1), and D. L. Gustafson (1)

(1) Raytheon Services Nevada, Environmental Restoration and Waste Management Division
(2) Lockheed Environmental Systems & Technologies Company

MAP UNIT DESCRIPTIONS

Unit d Historic—

Unit d represents areas where human activity such as cutting or filling for roads and drillpads has disturbed the natural surface; vegetation may be present; disturbances since August 1991 (date of basemap orthophotography) are not mapped.

Unit 7 Late Holocene—

Unit 7 occupies the bottom and side slopes of active drainageways. The land surface has the following characteristics: original unaltered bar-and-swale topography; no desert pavement; desert varnish on clasts is inherited; rubification on clasts is inherited; and shrubs are absent, but annuals may be sparse. Animal burrows are typically absent. In the erosional segment, many different truncated soils (paleosols) can underlie the surface. In the depositional segment, no pedogenic alteration of the substratum is apparent (including unaltered paleocarbonate coatings); occasionally a very thin, crust-like A horizon is present. Included in this map unit are narrow terrace, fan remnants, and side slopes of older surfaces (typically 6 and 5).

Unit 6 Late Holocene—

Unit 6 occupies terraces and bars along active drainageways that are typically less than 1 m above the 7 surface, broad fans on the piedmont, small colluvial fans on slopes adjoining older surfaces, and colluvium on bedrock. The land surface has the following characteristics: original bar-and-swale topography is unaltered; no desert pavement; desert varnish on clasts is inherited; rubification of clasts is inherited; and sparsely to partially vegetated with shrubs and annuals. Animal burrows are common. The erosional segment can have many different truncated soils (pediments) with the surface. In the depositional segment, pedogenesis to the surface is the development of an AC profile, with thin A horizons and some accumulation of carbonate (stage 1) in the C horizon. Deposits may contain clasts with paleocarbonate coatings. Included in this map unit are narrow terraces, fan remnants, and side slopes of older surfaces (typically 5 and 4), and narrow 7 drainageways.

Unit 5 Middle to Early Holocene—

Unit 5 occupies broad fans on the piedmonts, terraces along active drainageways, abandoned drainageways cut into older surfaces, colluvial slopes adjoining older surfaces, and colluvial slopes on bedrock. Included in this map unit are narrow terraces, fan remnants, and side slopes of older surfaces (typically 4 and 3), and narrow 7 and 6 drainageways.

Where the landscape character allowed, the following criteria were used to map two subunits. Units designated as 5 have characteristics of either subunit.

Unit 5b Middle Holocene--

The land surface has the following characteristics: subdued bar-and-swale topography; small areas of incipient desert pavement; little to no incipient desert varnish on clasts; incipient rubification on bottom of clasts; paleocalcareous coatings on clasts; and vegetated with shrubs and annuals. Animal burrows are common. In the erosional segment, many different truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a Bw (cambic) or weakly expressed Bk (cambic) horizon. The accumulation of carbonate is stage I, with paleocalcareous coatings on clasts. The A horizon textures reflect the influence of eolian silt and very fine sand.

Unit 5a Early Holocene--

The land surface has the following characteristics: subdued bar-and-swale topography; large areas of moderately expressed pavement; moderately expressed varnish on clasts; incipient rubification on undersides of clasts; and vegetated with shrubs and annuals. Animal burrows are common. In the erosional segment many different truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a well expressed Bw (cambic) or Bk (cambic) horizon. The accumulation of carbonate is stage I to I+. The A horizon textures reflect the influence of eolian silt and very fine sand.

Unit 4 Late Pleistocene—

Unit 4 occupies broad fans on the piedmont, terraces along active drainageways, abandoned drainageways cut in older surfaces, colluvial slopes adjoining older surfaces, and colluvial slopes on bedrock. The land surface has the following characteristics: bar- and swale topography is muted (bar-and-swale topography is well expressed in the bar-and-swale topography of the surface); the surface is expressed as a pavement; moderately to well varnished clasts, depending on the lithology, moderately expressed rubrication on bottom of clasts; and vegetated with shrubs and annuals. Animal burrows are common. In the erosional segment, many different truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a well expressed Bk (calic) or weakly expressed Btk (argillic and calic) horizon. A vesicular A horizon is present in the accumulation of carbonates (type 4 to 11, included in this map unit are narrow terraces and fans of younger surfaces (types 5 and 6), narrow 7 and 6 drainageways and wide slopes of older units (types 1, 3).

Unit 3 Late Pleistocene—

Unit 3 occupies broad fans on the piedmonts, terraces along active drainageways, abandoned drainageways cut in older surfaces, colluvial slopes of older surfaces, colluvial slopes on bedrock, and pediments along the mountain fronts. The land surface has the following characteristics: smooth with bar-and-swale topography muted because clasts are nearly buried by an eolian mantle; large areas (>50%) of well expressed pavement; well varnished clasts; carbonate platelets are common; well expressed rubification on bottom of clasts; and vegetated with shrubs and grasses. The older terraces are common in the middle of the erosional segment, many different truncated soils (paleosols) can under the surface. In the depositional segment, the Btk horizon is developed typically an ABC profile with a well expressed Btk (argillic and calcic) horizon. The accumulation of carbonate is stage II to III. A vesicular A horizon is present. Included in this map unit are narrow terraces, inset fans, and side slopes of younger surfaces (typically 5 and 4).

Unit 2 Middle Pleistocene—

Unit 2 occupies broad fans and small fan remnants, ballenas, colluvial-mantled hillslopes, and pediments along the mountain fronts. On the Scarp Canyon and Nye Canyon Piedmont two subunits were mapped based on relative topographic position and drainage patterns. Fan remnants are common in the Scarp Canyon area, but they are rare in the Nye Canyon area. The Scarp Canyon extensive areas (greater than 75%) of well expressed pavement; darkly varnished clasts; carbonate platelets are common; well expressed rubification on bottom of clasts; and sparsely vegetated with shrubs and annuals. Desert pavement and varnish may be poorly expressed on ballenas, where accordant summits define the surface. Animal burrows are uncommon. In the erosional segment many truncated soils (paleosols) may underlie the surface. In the depositional segment, pedogenic soils are common. A typical A horizon is present. The Nye Canyon area is composed of a thick vesicular A horizon is present. The accumulation of carbonate is stage III to IV, included in this map unit are narrow terraces, inset fans, and side slopes of younger surfaces (typically 4 and 3).

Unit 1 Early Pleistocene to Tertiary (?)—

Unit 1 occupies small pediments. The pediments are smooth with extensive areas (greater than 50%) of well expressed pavement; darkly varnished clasts; well expressed rubification on bottom of clasts; and sparsely vegetated with shrubs and annuals. Animal burrows are uncommon. Pedogenic development is typically an AR profile, with a vesicular A horizon over bedrock, but a thin weakly expressed Bw (cambic) horizon may be present. The accumulation of carbonate is limited, typically stage I.

Unit Tr Tertiary to Quaternary--

This unit consists of surfaces cut in bedrock of gray, brown, red, and yellow bedded tuffs (both welded and non-welded) and a few areas of lava flows and tuffaceous sandstones, all of Tertiary age.

Unit 0a Ordovician to Quaternary—

This unit consists of surfaces cut in bedrock of gray, sparsely fossiliferous limestone of Ordovician age.

Map units with a dual designation (6/7, for example) is used where the map scale does not allow presentation of complex patterns; the older unit is written first. Most map units are dominated by geomorphic surfaces developed in alluvium, but units dominated by colluvium include the letter C in the designation (3C, for example), and units dominated by pediment include the letter P in the map unit designation (3P, for example).

GEOMORPHIC SURFACE MAP
OF
NORTHERN FRENCHMAN FLAT, SOUTHERN NEVADA

December 1995

H. E. Huckins—Gang (1), S. E. Rawlinson (1),
K. E. Snyder (2), and D. L. Gustafson (1)

- (1) Raytheon Services Nevada, Environmental Restoration and Waste Management Division
(2) Lockheed Environmental Systems & Technologies Company

MAP UNIT DESCRIPTIONS

Unit d Historic—

Unit d represents areas where human activity such as cutting or filling for roads and drillpads has disturbed the natural surface; vegetation may be present; disturbances since August 1991 (date of basemap orthophotography) are not mapped.

Unit 7 Late Holocene—

Unit 7 occupies the bottom and side slopes of active drainageways. The land surface has the following characteristics: original unaltered bar-and-swale topography; no desert pavement; desert varnish on clasts is inherited; rubification on clasts is inherited; and shrubs are absent, but annuals may be sparse. Animal burrows are typically absent. In the erosional segment, many different truncated soils (paleosols) can underlie the surface. In the depositional segment, no pedogenic alteration of the substratum is apparent (including unaltered paleocarbonate coatings); occasionally a very thin, crust-like A horizon is present. Included in this map unit are narrow terrace, fan remnants, and side slopes of older surfaces (typically 6 and 5).

Unit 6 Late Holocene—

Unit 6 occupies terraces and bars along active drainageways that are typically less than 1 m above the 7 surface, broad fans on the piedmont, small colluvial fans on slopes adjoining older surfaces, and colluvium on bedrock. The land surface has the following characteristics: original bar-and-swale topography is unaltered; no desert pavement; desert varnish on clasts is inherited; rubification of clasts is inherited; and sparsely to partially vegetated with shrubs and annuals. Animal burrows are common. The erosional segment can have many different truncated soils (paleosols) beneath the surface. In the depositional segment, pedogenesis is limited to the development of an AC profile, with thin A horizons and some accumulation of carbonate (stage I) in the C horizon. Deposits may contain clasts with paleocarbonate coatings. Included in this map unit are narrow terraces, fan remnants, and side slopes of older surfaces (typically 5 and 4), and narrow 7 drainageways.

Unit 5 Middle to Early Holocene—

Unit 5 occupies broad fans on the piedmonts, terraces along active drainageways, abandoned drainageways cut into older surfaces, colluvial slopes adjoining older surfaces, and colluvial slopes on bedrock. Included in this map unit are narrow terraces, fan remnants, and side slopes of older surfaces (typically 4 and 3), and narrow 7 and 6 drainageways.

Where the landscape character allowed, the following criteria were used to map two subunits. Units designated as 5 have characteristics of either subunit.

Unit 5b Middle Holocene—

The land surface has the following characteristics: subdued bar-and-swale topography; small areas of incipient desert pavement; little to no incipient desert varnish on clasts; incipient rubification on bottom of clasts; paleocarbonate coatings on clasts; and vegetated with shrubs and annuals. Animal burrows are common. In the erosional segment, many different truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a Bw (cambic) or weakly expressed Bk (cambic) horizon. The accumulation of carbonate is stage I, with paleocarbonate coatings on clasts. The A horizon textures reflect the influence of eolian silt and very fine sand.

Unit 5a Early Holocene—

The land surface has the following characteristics: subdued bar-and-swale topography; large areas of moderately expressed pavement; moderately expressed varnish on clasts; incipient rubification on undersides of clasts; and vegetated with shrubs and annuals. Animal burrows are common. In the erosional segment, many different truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a well expressed Bw (cambic) or Bk (cambic) horizon. The accumulation of carbonate is stage I to II. The A horizon textures reflect the influence of eolian silt and very fine sand.

Unit 4 Late Pleistocene—

Unit 4 occupies broad fans on the piedmont, terraces along active drainageways, abandoned drainageways cut in older surfaces, colluvial slopes of older surfaces, and colluvial slopes on bedrock. The land surface has the following characteristics: bar-and-swale topography is muted with clasts partially buried by an eolian mantle; large areas (greater than 50%) of well expressed pavement; moderately to well varnished clasts depending on the lithology; moderately expressed rubification on bottom of clasts; and vegetated with shrubs and annuals. Animal burrows are common. In the erosional segment, many different truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a well expressed Bk (caliche) or weakly expressed Bk (argillic and calcic) horizon. A vesicular A horizon is present. The accumulation of carbonate is stage I+ to II. Included in this map unit are narrow terraces and fans of younger surfaces (typically 5 and 6), narrow 7 and 6 drainageways and side slopes of older units (typically 3).

Unit 3 Late Pleistocene—

Unit 3 occupies broad fans on the piedmonts, terraces along active drainageways, abandoned drainageways cut in older surfaces, colluvial slopes of older surfaces, and pediments along the mountain fronts. The land surface has the following characteristics: smooth with bar-and-swale topography muted because clasts are nearly buried by an eolian mantle; large areas (>50%) of well expressed pavement; well varnished clasts; carbonate platelets are common; well expressed rubification on bottom of clasts; and vegetated with shrubs and annuals. Animal burrows are common. In the erosional segment, many different truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a well expressed Btkm (argillic and petrocalcic) horizon. A thick vesicular A horizon is present. The accumulation of carbonate is stage III to IV. Included in this map unit are narrow terraces, inset fans, and side slopes of younger surfaces (typically 5 and 4).

Unit 2 Middle Pleistocene—

Unit 2 occupies broad fans and small fan remnants, ballenas, colluvial-mantled hillslopes, and pediments along the mountain fronts. The land surface has the following characteristics: fan remnants are smooth because a thick, silty, eolian mantle buries the depositional bar-and-swale topography; extensive areas (greater than 75%) of well expressed pavement; darkly varnished clasts; common carbonate platelets; well expressed rubification on bottom of clasts; and sparsely vegetated with shrubs and annuals. Desert pavement and varnish may be poorly expressed on ballenas, where accordant summits define the surface. Animal burrows are uncommon. In the erosional segment many truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a well expressed Btkm (argillic and petrocalcic) horizon. A thick vesicular A horizon is present. The accumulation of carbonate is stage III to IV. Included in this map unit are narrow terraces, inset fans, and side slopes of younger surfaces (typically 4 and 3).

Unit 1 Early Pleistocene to Tertiary (?) --

Unit 1 occupies colluvial-mantled hillslopes along the mountain fronts. The land surface has the following characteristics: surfaces are smooth because a thick, silty, eolian mantle buries the depositional bar-and-swale topography; extensive areas (greater than 75%) of well expressed pavement; darkly varnished clasts; common carbonate platelets; well expressed rubification on bottom of clasts; and sparsely vegetated with shrubs and annuals. Animal burrows are uncommon. In the erosional segment many truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a well expressed Btkm (argillic and petrocalcic) horizon. A thick vesicular A horizon is present. The accumulation of carbonate is stage IV. Included in this map unit are inset fans and side slopes of younger surfaces (typically 3 and 2).

Unit Tr Tertiary to Quaternary—

This unit consists of surfaces cut in bedrock of gray, brown, red, and yellow bedded tuffs (both welded and non-welded) and a few areas of lava flows and tuffaceous sandstones, all of Tertiary age.

Map units with a dual designation (6/7, for example) is used where the map scale does not allow presentation of complex patterns; the older unit is written first. Most map units are dominated by geomorphic surfaces developed in alluvium, but units dominated by colluvium include the letter C in the designation (3C, for example), and units dominated by pediment include the letter P in the map unit designation (3P, for example).

UNITED STATES
DEPARTMENT OF ENERGY

AREA 5 RADIOACTIVE
WASTE MANAGEMENT SITE

GEOMORPHIC SURFACE MAP
OF
NORTHERN FRENCHMAN FLAT, SOUTHERN NEVADA

December 1995

H. E. Huckins—Gang (1), K. E. Snyder (2),
S. E. Rawlinson (1), and D. L. Gustafson (1)

- (1) Raytheon Services Nevada, Environmental Restoration and Waste Management Division
(2) Lockheed Environmental Systems & Technologies Company

MAP UNIT DESCRIPTIONS

Unit d Historic—

Unit d represents areas where human activity such as cutting or filling for roads and drillpads has disturbed the natural surface; vegetation may be present; disturbances since August 1991 (date of base map orthophotography) are not mapped.

Unit 7 Late Holocene—

Unit 7 occupies the bottom and side slopes of active drainageways. The land surface has the following characteristics: original unaltered bar-and-swale topography; no desert pavement; desert varnish on clasts is inherited; rubification on clasts is inherited; and shrubs are absent, but annuals may be sparse. Animal burrows are typically absent. In the erosional segment, many different truncated soils (paleosols) can underlie the surface. In the depositional segment, no pedogenic alteration of the substratum is apparent (including unaltered paleocarbonate coatings); occasionally a very thin, crust-like A horizon is present. Included in this map unit are narrow terraces, fan remnants, and side slopes of older surfaces (typically 6 and 5).

Unit 6 Late Holocene—

Unit 6 occupies terraces and bars along active drainageways that are typically less than 1 m above the 7 surface, broad fans on the piedmont, small colluvial fans on slopes adjoining older surfaces, and colluvium on bedrock. The land surface has the following characteristics: original bar-and-swale topography is unaltered; no desert pavement; desert varnish on clasts is inherited; rubification of clasts is inherited; and sparsely to partially vegetated with shrubs and annuals. Animal burrows are common. The erosional segment can have many different truncated soils (paleosols) beneath the surface. In the depositional segment, pedogenesis is limited to the development of an AC profile, with thin A horizons and some accumulation of carbonate (stage I) in the C horizon. Deposits may contain clasts with paleocarbonate coatings. Included in this map unit are narrow terraces, fan remnants, and side slopes of older surfaces (typically 5 and 4), and narrow 7 drainageways.

Unit 5 Middle to Early Holocene—

Unit 5 occupies broad fans on the piedmonts, terraces along active drainageways, abandoned drainageways cut into older surfaces, colluvial slopes adjoining older surfaces, and colluvial slopes on bedrock. Included in this map unit are narrow terraces, fan remnants, and side slopes of older surfaces (typically 4 and 3), and narrow 7 and 6 drainageways.

Where the landscape character allowed, the following criteria were used to map two subunits. Units designated as 5 have characteristics of either subunit.

Unit 5b Middle Holocene—

The land surface has the following characteristics: subdued bar-and-swale topography; small areas of incipient desert pavement; little to no incipient desert varnish on clasts; incipient rubification on bottom of clasts; paleocarbonate coatings on clasts; and vegetated with shrubs and annuals. Animal burrows are common. In the erosional segment, many different truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a Bw (calcic) or weakly expressed Bk (calcic) horizon. The accumulation of carbonate is stage I, with paleocarbonate coatings on clasts. The A horizon textures reflect the influence of eolian silt and very fine sand.

Unit 5a Early Holocene—

The land surface has the following characteristics: subdued bar-and-swale topography; large areas of moderately expressed pavement; moderately expressed varnish on clasts; incipient rubification on undersides of clasts; and vegetated with shrubs and annuals. Animal burrows are common. In the erosional segment, many different truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a well expressed Bw (calcic) or weakly expressed Btk (argillic and calcic) horizon. A vesicular A horizon is present. The accumulation of carbonate is stage II to III. The A horizon textures reflect the influence of eolian silt and very fine sand.

Unit 4 Late Pleistocene—

Unit 4 occupies broad fans on the piedmont, terraces along active drainageways, abandoned drainageways cut in older surfaces, colluvial slopes adjoining older surfaces, and colluvial slopes on bedrock. The land surface has the following characteristics: bar-and-swale topography is muted with clasts partially buried by an eolian mantle; large areas (greater than 50%) of well expressed pavement; moderately to well varnished clasts depending on the lithology; moderately expressed rubification on bottom of clasts; and vegetated with shrubs and annuals. Animal burrows are common. In the erosional segment, many different truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a well expressed Bk (calcic) or weakly expressed Btk (argillic and calcic) horizon. A vesicular A horizon is present. The accumulation of carbonate is stage II to III. Included in this map unit are narrow terraces and fans of younger surfaces (typically 5 and 6), narrow 7 and 6 drainageways and side slopes of older units (typically 3).

Unit 3 Late Pleistocene—

Unit 3 occupies broad fans on the piedmonts, terraces along active drainageways, abandoned drainageways cut in older surfaces, colluvial slopes of older surfaces, colluvial slopes on bedrock, and pediments along the mountain fronts. The land surface has the following characteristics: smooth with bar-and-swale topography muted because clasts are nearly buried by an eolian mantle; large areas (>50%) of well expressed pavement; well varnished clasts; carbonate platelets are common; well expressed rubification on bottom of clasts; and vegetated with shrubs and annuals. Animal burrows are uncommon. In the erosional segment, many different truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a well expressed Btk (argillic and calcic) horizon. The accumulation of carbonate is stage II to III. A vesicular A horizon is present. Included in this map unit are narrow terraces, inset fans, and side slopes of younger surfaces (typically 5 and 4).

Unit Tr Tertiary to Quaternary—

This unit consists of surfaces cut in bedrock of gray, brown, red, and yellow bedded tuffs (both welded and non-welded) and a few areas of lava flows and tuffaceous sandstones, all of Tertiary age.

Map units with a dual designation (6/7, for example) is used where the map scale does not allow presentation of complex patterns; the older unit is written first. Most map units are dominated by geomorphic surfaces developed in alluvium, but units dominated by colluvium include the letter C in the designation (3C, for example), and units dominated by pediment include the letter P in the map unit designation (3P, for example).

UNITED STATES
DEPARTMENT OF ENERGY

Produced for the U.S. Department of Energy
by Raytheon Lockheed & Engineering Co., Inc.
Orthophotograph prepared from 3 (24000)
Scale aerial photograph taken August 1991 by
EG & G Energy Measurements, Inc.
Ground control provided by REICo
1991 survey
Orthophotographic compiled using photogrammetric
methods by the Orthophotographic
Raytheon, Projection
2500 foot grid and base Nevada coordinate system
Digital zone
1997 North American datum

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AREA 5 RADIOACTIVE
WASTE MANAGEMENT SITE

ORTHOPHOTO BASEMAP
SHEET 7
1991

GEOMORPHIC SURFACE MAP OF

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MAP UNIT DESCRIPTIONS

Unit d Historic--

Unit d represents areas where human activity such as cutting or filling for roads and drillpads has disturbed the natural surface; vegetation may be present; disturbances since August 1991 (date of basemap orthophotography) are not mapped.

Unit 7 Late Holocene—

Unit 7 occupies the bottom and side slopes of active drainageways. The land surface has the following characteristics: original unaltered bar-and-swale topography; no desert pavement; desert varnish on clasts is inherited; rubification on clasts is inherited; and shrubs are absent, but annuals may be sparse. Animal burrows are typically absent. In the erosional segment, many different truncated soils (paleosols) can underlie the surface. In the depositional segment, no pedogenic truncation of the substratum is apparent (including unaltered paleocarbonate coatings); occasionally a very thin, crust-like A horizon is present. Included in this map unit are narrow terrace, fan remnants, and side slopes of older surfaces (types 6 and 5).

Unit 6 Late Holocene—

Unit 6 occupies terraces and bars along active drainageways that are typically less than 1 m above the 7 surface, broad fans on the piedmont, small colluvial fans on slopes adjoining older surfaces, and colluvium on bedrock. The land surface has the following characteristics: original bar-and-swale topography is unaltered; no desert pavement; desert varnish on clasts is inherited; rubification of clasts is inherited; and sparsely to partially vegetated with shrubs and annuals. Animal burrows are common. The erosional segment can have many different truncated soils (Fig. 10). The surface, in the depositional segment, is limited to the development of an AC profile, with thin A horizons and some accumulation of carbonate (stage 1) in the C horizon. Deposits may contain clasts with paleocarbonate coatings. Included in this map unit are narrow terraces, fan remnants, and side slopes of older surfaces (typically 5 and 4), and narrow 7 drainageways.

Unit 5 Middle to Early Holocene—

Unit 5 occupies broad fans on the piedmonts, terraces along active drainageways, abandoned drainageways cut into older surfaces, colluvial slopes adjoining older surfaces, and colluvial slopes on bedrock. Included in this map unit are narrow terraces, fan remnants, and side slopes of older surfaces (typically 4 and 3), and narrow 7 and 6 drainageways.

Where the landscape character allowed, the following criteria were used to map two subunits. Units designated as 5 have characteristics of either subunit.

Unit 5b Middle Holocene--

The land surface has the following characteristics: subdued bar-and-swale topography; small areas of incipient desert pavement; little to no incipient desert varnish on clasts; incipient rubification on bottom of clasts; paleocarbonate coatings on clasts; and vegetated with shrubs and annuals. Animal burrows are common. In the erosional segment, many different truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a Bw (cambic) or weakly expressed Bk (cambic) horizon. The accumulation of carbonate is stage I, with paleocarbonate coatings on clasts. The A horizon textures reflect the influence of eolian silt and very fine sand.

Unit 5a Early Holocene—

The land surface has the following characteristics: subdued bar-and-swale topography; large areas of moderately expressed pavement; moderately expressed varnish on clasts; incipient rubification on undersides of clasts; and vegetation with shrubs and annuals. Animal burrows are common. In the erosional segment many different truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a well expressed Bw (cambic) or Bk (Cambic) horizon. The accumulation of carbonate is stage I to IV. The A horizon textures reflect the influence of eolian silt and very fine sand.

Unit 4 Late Pleistocene—

Unit 4 occupies broad fans on the piedmont, terraces along active drainageways, abandoned drainageways cut in older surfaces, colluvial slopes adjoining older surfaces, and colluvial slopes on bedrock. The land surface has the following characteristics: bar-and-swale topography is muted with clasts partially buried by an eolian mantle; large areas (greater than 50%) are well expressed and the surface is relatively smooth; clasts standing on the surface are moderately expressed; rubification on bottom of clasts; and vegetated with shrubs and annuals. Animal burrows are common. In the erosional segment, many different truncated soils (paleosols) can underlie the surface. In the depositional segment, pedogenic development is typically an ABC profile with a well expressed Bk (calic) or weakly expressed Btk (argillic and calic) horizon. A vesicular A horizon is common. The usual sequence of soil types standing on the surface is: 6 drainageways, narrow terraces and fans of younger surfaces (typically 5 and 6), narrow 7 and 6 drainageways and side slopes of older units (typically 3).

Unit 3 Late Pleistocene—

Unit 3 occupies broad fans on the piedmonts, terraces along active drainageways, abandoned drainageways cut in older surfaces, colluvial slopes of older surfaces, colluvial slopes on bedrock, and pediments along the mountain fronts. The land surface has the following characteristics: smooth with bar-and-swale topography muted because clasts are nearly buried by an eolian mantle; large areas (>50%) of well expressed pavement; well varnished clasts; carbonate platelets are common; well expressed rubification on bottom of clasts; and vegetated with shrubs and grasses. The mineral composition is dominantly calcareous. The soil is a well sorted, unconsolidated (paleosols) cast under the surface. In the depositional segment, pedogenic development is typically an ABC profile with a well expressed Bk (argillic and calcic) horizon. The accumulation of carbonate is stage II to III. A vesicular A horizon is present. Included in this map unit are narrow terraces, inset fans, and side slopes of younger surfaces (typically 5 and 4).

Map units with a dual designation (6/7, for example) is used where the map scale does not allow presentation of complex patterns; the older unit is written first. Most map units are dominated by geomorphic surfaces developed in alluvium, but units dominated by colluvium include the letter C in the designation (3C, for example), and units dominated by pediment include the letter P in the map unit designation (3P, for example).

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Orthophotograph prepared from 1:24,000
scale aerial photographs taken August 1991.

EG & G Energy Measurement, Inc.

1991 survey.

orthophotographs compiled using photogrammetric methods by The Orthostap-Tuosit.

Polycyclic Projection:

Central zone

1997). The authors also found that the effect of the

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