

Prepared in cooperation with the U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office, Office of Environmental Management under Interagency Agreement, DE-AI52-07NA28100

# Digitally Available Interval-Specific Rock-Sample Data Compiled from Historical Records, Nevada Test Site and Vicinity, Nye County, Nevada

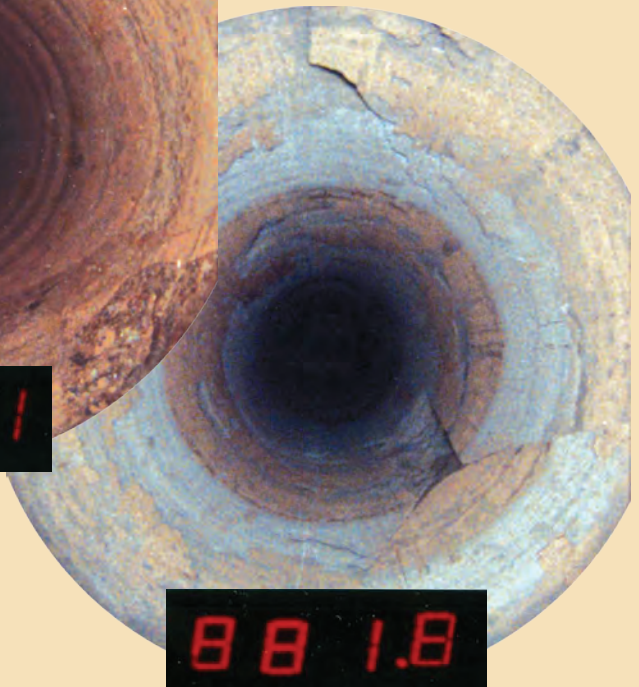
**Coarse alluvium**



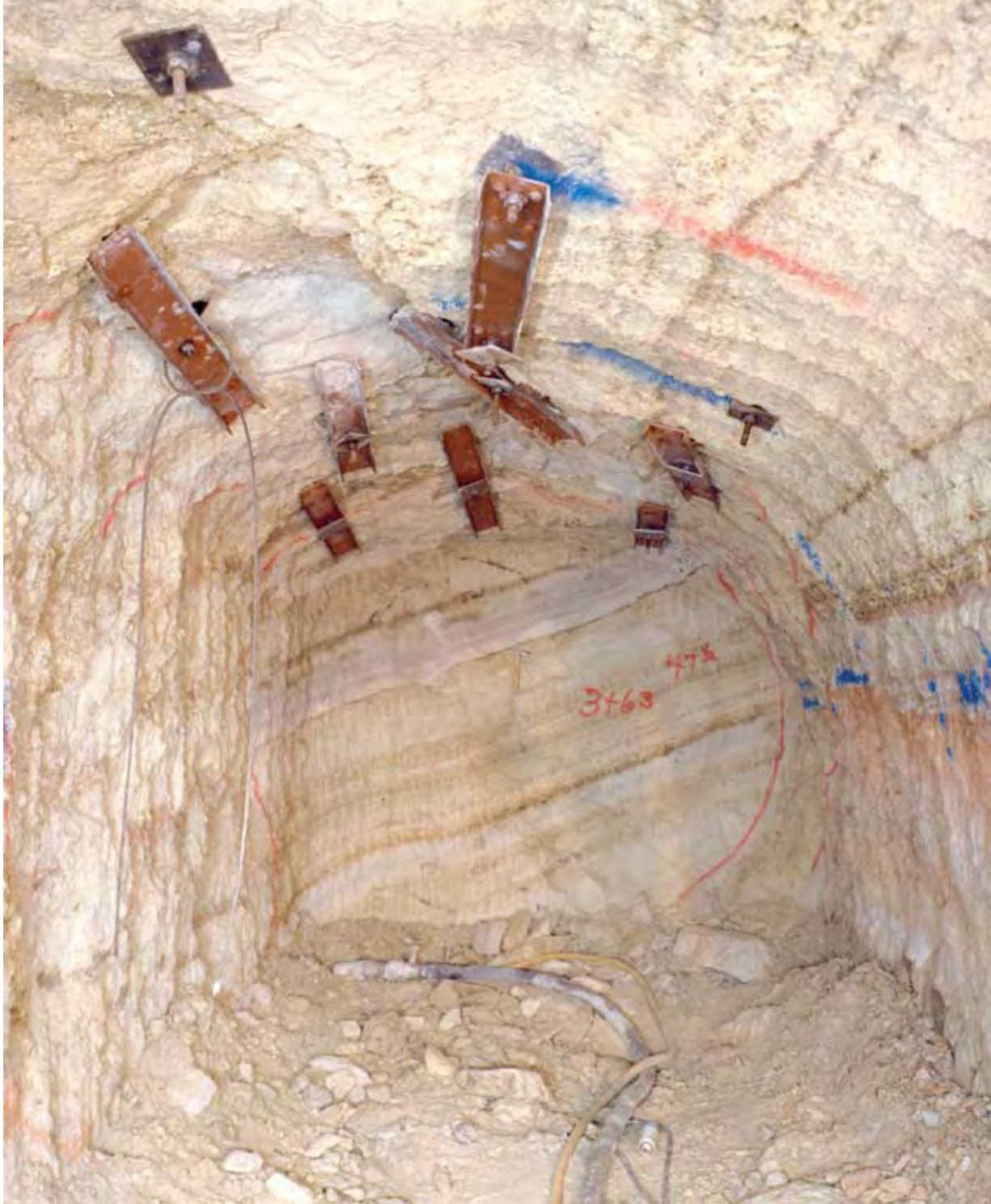
**Finer alluvium**



**Volcanic tuffs**



Data Series 297



View inside reentry drift U-12n.10 AB shows volcanic tuffs from the Tertiary Tunnel Formation, 4 Member, beds 4C and 4D (Dean R. Townsend, Fenix and Scisson, Inc., written commun., October 5, 1976). The number 3+63 painted on the face indicates 363 feet from the portal opening. Photograph courtesy of Defense Threat Reduction Information Analysis Center.

**Cover photograph**

Three downhole fish-eye camera views of emplacement hole U-2cs. View from 166.9 feet shows coarse alluvium. View from 634.1 feet shows coarse cobbly alluvium channels cut into finer alluvium. View from 881.8 feet shows a fault in the volcanic tuffs from the Tertiary Paintbrush Group. Photographs courtesy of Gayle A. Pawloski, Lawrence Livermore National Laboratory.

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By David B. Wood

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Data Series 297

**U.S. Department of the Interior  
U.S. Geological Survey**

**U.S. Department of the Interior**  
DIRK KEMPTHORNE, Secretary

**U.S. Geological Survey**  
Mark D. Myers, Director

U.S. Geological Survey, Reston, Virginia: 2007

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## Conversion Factors and Datums

Inch/Pound to SI

<b>Multiply</b>	<b>By</b>	<b>To obtain</b>
<b>Length</b>		
inch (in.)	2.54	centimeter (cm)
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
<b>Area</b>		
square mile (mi <sup>2</sup> )	2.590	square kilometer (km <sup>2</sup> )
<b>Volume</b>		
barrel (bbl), (petroleum, 1 barrel=42 gal)	0.1590	cubic meter (m <sup>3</sup> )
gallon (gal)	3.785	liter (L)
gallon (gal)	0.003785	cubic meter (m <sup>3</sup> )
cubic foot ft <sup>3</sup> )	0.02832	cubic meter (m <sup>3</sup> )
<b>Flow rate</b>		
foot per second (ft/s)	0.3048	meter per second (m/s)
gallon per minute (gal/min)	0.06309	liter per second (L/s)
gallon per day (gal/d)	0.003785	cubic meter per day (m <sup>3</sup> /d)
<b>Mass</b>		
ounce, avoirdupois (oz)	28.35	gram (g)
pound, avoirdupois (lb)	0.4536	kilogram (kg)
<b>Pressure</b>		
bar	100	kilopascal (kPa)
kilo bar (kb)	1,000	kilopascal (kPa)
pound per square inch (lb/in <sup>2</sup> )	6.895	kilopascal (kPa)
kilo pounds per square inch (kpsi)	6.894757	megapascal (MPa)
<b>Density</b>		
pound per cubic foot (lb/ft <sup>3</sup> )	16.02	kilogram per cubic meter (kg/m <sup>3</sup> )
pound per cubic foot (lb/ft <sup>3</sup> )	0.01602	gram per cubic centimeter (g/cm <sup>3</sup> )
pound per cubic foot (lb/ft <sup>3</sup> )	0.01602	megagram per cubic meter (Mg/m <sup>3</sup> )
<b>Specific capacity</b>		
gallon per minute per foot [(gal/min)/ft]	0.2070	liter per second per meter [(L/s)/m]
<b>Electrical conductivity</b>		
micromhos per centimeter (μmho/cm)	1	Microsiemens per centimeter (μS/cm)
<b>Velocity</b>		
foot per second (ft/s)	0.0003048	kilometer per second (km/s)

## Conversion Factors and Datums—Continued

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$^{\circ}\text{F}=(1.8\times^{\circ}\text{C})+32.$$

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:

$$^{\circ}\text{C}=(^{\circ}\text{F}-32)/1.8.$$

### Datums

Vertical coordinates are referenced to the North American Vertical Datum of 1929 (NGVD29); see altitude at portal opening, altitude of land surface, and reference point elevation in tables.

Horizontal coordinates are referenced to both the North American Datum of 1927 (NAD27) and 1983 (NAD83); see Nevada State Plane coordinates, latitude/longitude, decimal latitude/longitude, and UTM coordinates in tables.

Altitude, as used in this report, refers to distance above the vertical datum.



# Digitally Available Interval-Specific Rock-Sample Data Compiled from Historical Records, Nevada Test Site and Vicinity, Nye County, Nevada

By David B. Wood

## Abstract

Between 1951 and 1992, 828 underground tests were conducted on the Nevada Test Site, Nye County, Nevada. Prior to and following these nuclear tests, holes were drilled and mined to collect rock samples. These samples are organized and stored by depth of borehole or drift at the U.S. Geological Survey Core Library and Data Center at Mercury, Nevada, on the Nevada Test Site. From these rock samples, rock properties were analyzed and interpreted and compiled into project files and in published reports that are maintained at the Core Library and at the U.S. Geological Survey office in Henderson, Nevada. These rock-sample data include lithologic descriptions, physical and mechanical properties, and fracture characteristics. Hydraulic properties also were compiled from holes completed in the water table. Rock samples are irreplaceable because pre-test, in-place conditions cannot be recreated and samples cannot be recollected from the many holes destroyed by testing. Documenting these data in a published report will ensure availability for future investigators.

## Introduction

Rock-sample data are available from holes (boreholes, shafts, tunnels, and drifts) located on and around the Nevada Test Site (NTS), Nye County, Nevada. These data include rock-sample interval locations for nearly 2,600 holes; lithologic descriptions for nearly 1,300 holes; physical and mechanical rock properties for nearly 600 holes; fracture characteristics for nearly 500 holes; and hydraulic properties for nearly 100 holes. Acronyms and abbreviations in common usage at the NTS are described in the auxiliary 'nts\_acr\_abv' worksheets in the databases ([appendixes A-E](#)).

## Purpose and Scope

This report documents rock samples and data derived from these samples in digital spreadsheets. Specifically, this report presents five databases (rock samples, lithologic descriptions, rock properties, fracture characteristics, and hydraulic properties). Data presented in these databases were obtained from rock samples and compiled from paper records contained in the historical files and from published reports located at the U.S. Geological Survey (USGS) Core Library and Data Center at Mercury (on the NTS) and at the USGS office in Henderson, Nevada.

The many logs and samples presented in this report represent a large investment over many years and are unique, in that in many cases, they cannot be acquired again. Pre-test, in-place conditions, as well as conditions that existed prior and during nuclear testing cannot be recreated and rock samples (and associated analysis and interpretations) from the many holes destroyed by testing can not be recollected. Measurement techniques continuously evolve over time and the methods of interpretation are constantly being revised as new techniques become available. The application of these new methods often depends on the availability of the original subsurface data and the ability of individuals to understand both how these data were collected and how associated interpretations were developed. Documenting these data in a published report will ensure data availability for posterity. Furthermore, the condition of the original paper records is already poor and data are illegible for some records. The continuing deterioration of these records could preclude their availability to future investigators. All subsurface data, regardless of program or application, needs to be archived for future use at the NTS. Only through publication and archiving, can these data be fully developed and utilized in making sound decisions concerning future activities at the NTS and protection of human health and safety.

## Background

The NTS ([fig. 1](#)) was established by the United States during the 1950s as the primary continental proving ground for nuclear testing and peaceful applications of nuclear explosions (U.S. Congress, 1989). The site, which occupies about 1,375 mi<sup>2</sup> of south-central Nevada, was chosen by the Atomic Energy Commission (AEC, predecessor to the U.S. Department of Energy [DOE]) primarily because of its remoteness from population centers and because the land was under military control (Fehner and Gosling, 2000). Since 1951, 928 tests have been conducted at the NTS. Of these tests, 828 were detonated underground (U.S. Department of Energy, 2000). In addition to the holes used for underground emplacement of nuclear weapons, many auxiliary holes were drilled and mined adjacent to the emplacement holes for collecting supplemental data. The databases presented in this report represent an accumulation of data from each of these holes.

Geologists, geophysicists, hydrologists, and other specialists have worked in cooperation with the DOE, National Nuclear Security Administration, Nevada Site Office (and its predecessors) and the National Laboratories to provide Earth science data since 1956 (P.P. Orkild, U.S. Geological Survey, written commun., 1987). The USGS and AEC agreed to cooperate in geologic, geophysical, and hydrologic investigations at the NTS under a memorandum of understanding (No. AT (2902)474) dated June 1, 1957. A modification to the memorandum which incorporates the entire agreement (Modification No. 3, Schedule 1 to Appendix A, page 3, item 4), dated April 3, 1959 states:

*“Operation of a Field and Geological Data Repository and Core Library. Maintain field records at a central location at NTS which will have a recurring use for reference purposes. It is intended that the Geological Survey have on file representative logs of significant excavations, and establish and maintain core libraries (exclusive of radiochemical cores) in accordance with mutually agreed USGS-Commission rules and procedures.”*

The USGS Core Library and Data Center was established in temporary quarters during 1959 at Mercury, Nevada, and a permanent facility was built during the late 1960s (G.L. Dixon, U.S. Geological Survey, written commun., 1983). Because the USGS was designated as the caretaker of the rock samples, personnel from the National Laboratories as well as DOE and Department of Defense (DOD) contractors were continually accessing rock samples at the Core Library. This resulted in the USGS amassing paper copies of many of the preliminary results of the rock-sample analyses and interpretations as well as internal and published reports resulting from this work.

## Geohydrologic Setting

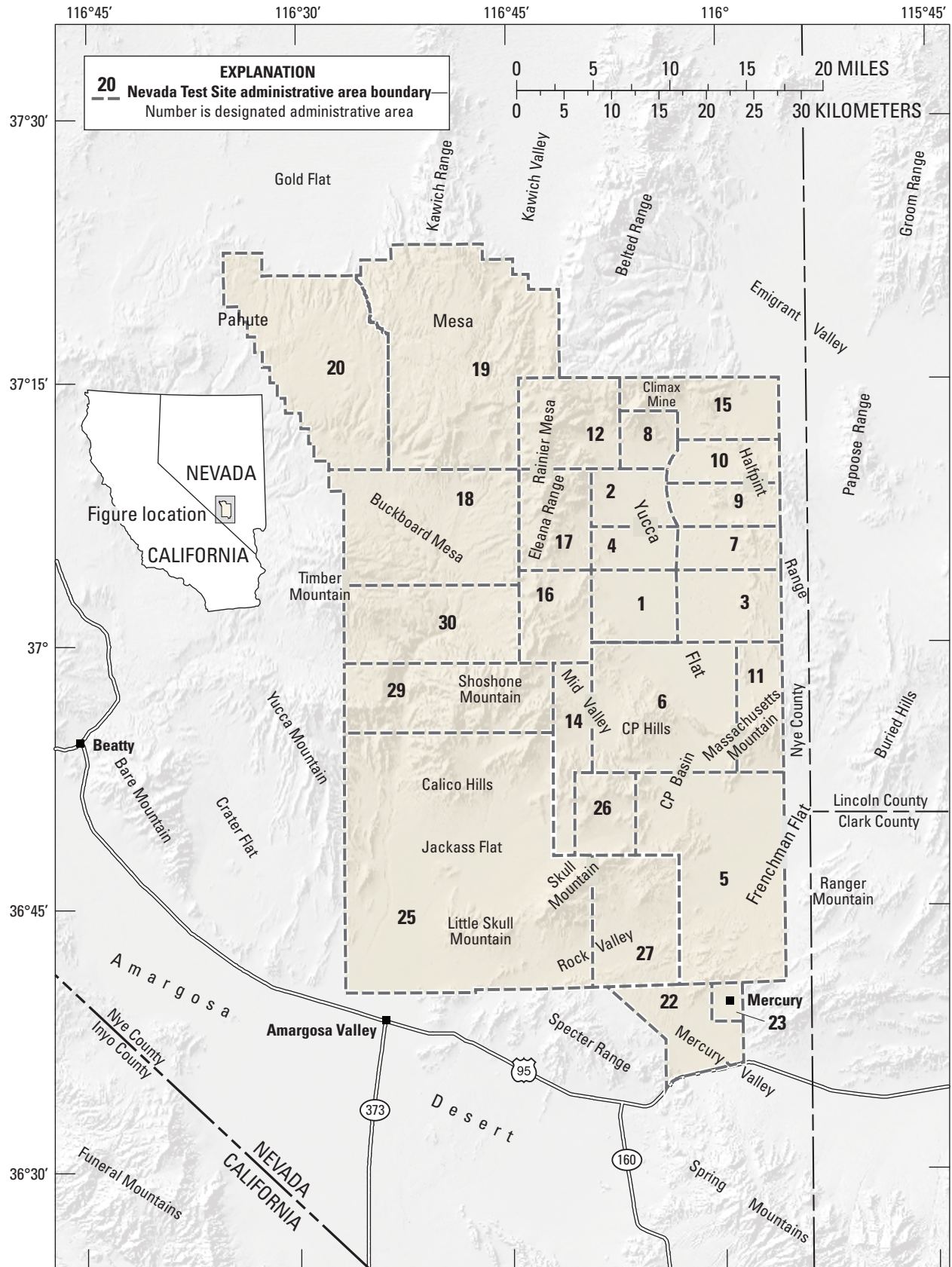
The NTS is entirely within the Great Basin region of the Basin and Range physiographic province. The region is characterized by mountain ranges with a general north-south orientation separated by basins (valleys) that are filled by accumulations of unconsolidated to partly consolidated sedimentary deposits and underlain by consolidated rocks that also form the surrounding ranges (Stewart, 1980). The unconsolidated rocks at the NTS consist of basin fill and volcanic and sedimentary rocks. Consolidated rocks consist of volcanic, metamorphic and intrusive, siliciclastic, and carbonate rocks. The generalized distribution of rock types in the vicinity of the NTS is shown in [figure 2](#).

The stratigraphic nomenclature at the NTS has evolved over time. The USGS conducted surface-mapping field work between 1958 and 1964 that resulted in the publication of thirty-four 7.5-minute geologic maps (Byers and others, 1989). The stratigraphy and lithology has been continually refined by investigators from various organizations (including DOE/DOD subcontractors, the National Laboratories, and USGS) by inspection of rock samples collected from holes drilled and mined at the NTS and vicinity. This has resulted in many informal units in common usage at the NTS. Volcanic rocks are summarized in Byers and others (1976) and Sawyer and others (1994). Carbonate rocks are summarized in Cole and Cashman (1999). Stratigraphic units are lumped into hydrogeologic units and discussed in IT Corporation (1996a, 1996b), Faunt and others (2004), and Sweetkind and others (2004).

The hydrologic setting of the NTS is similar to that of most of the Basin and Range province. It is characterized by localized aquifers within the alluvial deposits in the eastern, central, and southern parts. Regional aquifers are mostly within complexly folded and faulted limestones and dolomites that underlie the localized aquifers in the eastern and southern parts, but also are within fractured volcanic rocks in the western part of the NTS. Much of the ground-water flow is interbasin; that is, flow is not strictly controlled by the surface topography that defines surface-water drainage basins (Blankennagel and Weir, 1973; Winograd and Thordarson, 1975; Laczniaik and others, 1996; Slate and others, 2000; Potter and others, 2002; Workman and others, 2002).

## Site Designations

Rock-sample sites are identified primarily by the USGS NTS unique number and secondarily by the NTS area (the NTS is comprised of 26 administrative areas [[fig. 1](#)]), a Redbook hole number, and USGS National Water Information System (NWIS) site identification number (U.S. Geological Survey, 2005). A unique number is necessary because spatial (X-Y) coordinates are currently not available for some sites. Site designations are described in the tables listed in the appendixes of this report.



Base from U.S. Geological Survey digital data, 1:100,000, 1978-89; Universal Transverse Mercator Projection Zone 11. Shaded relief base from 1:250,000-scale Digital Elevation Model; sun illumination from northwest at 30 degrees above horizon.

Figure 1. Location of Nevada Test Site and pertinent physiographic features, Nye County, Nevada.

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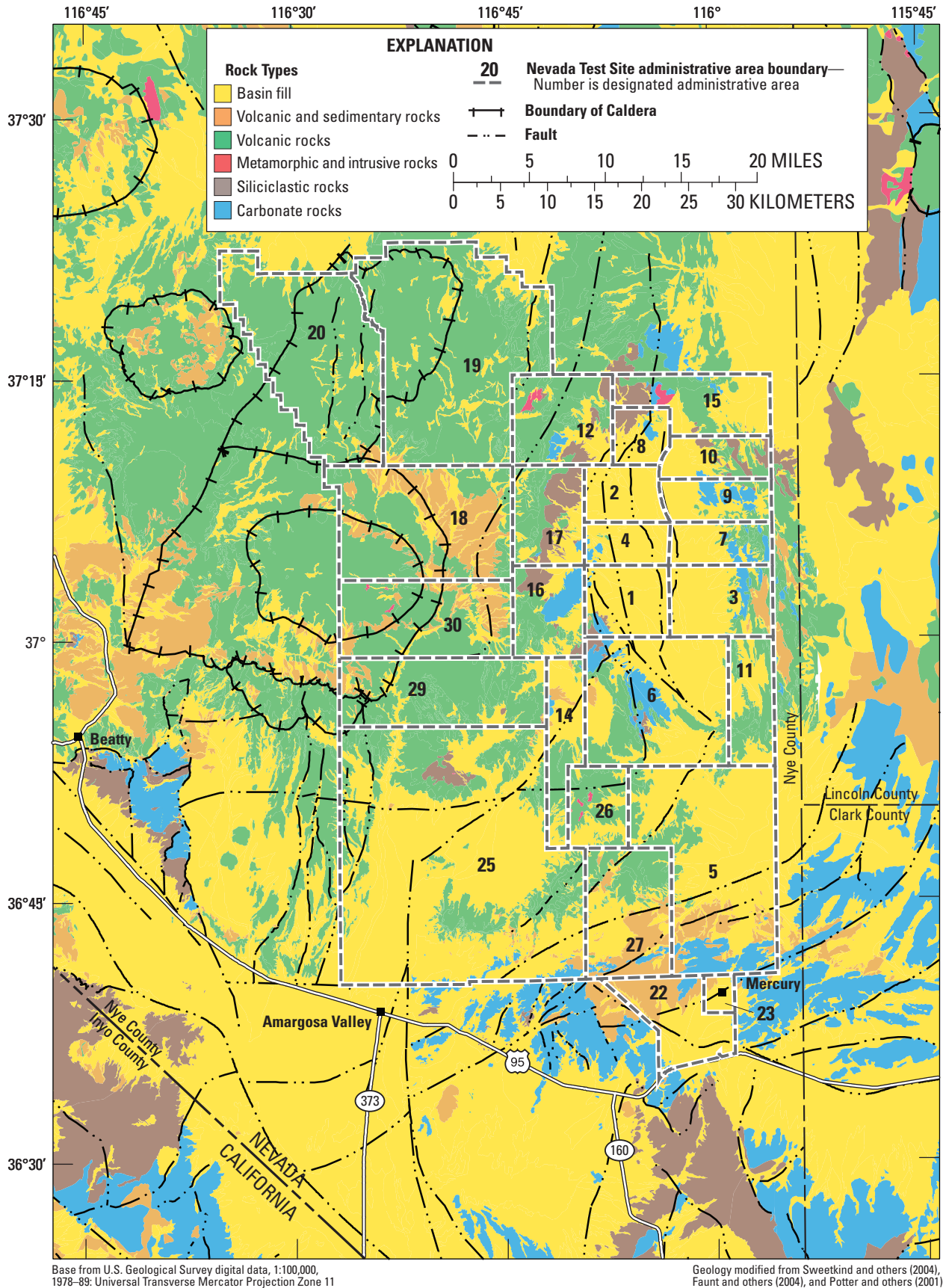


Figure 2. Generalized distribution of rock types in vicinity of Nevada Test Site, Nye County, Nevada.

## Digital Data

The USGS compiled digital spreadsheets, by depth interval, of available rock-sample data stored at the USGS Core Library and Data Center in Mercury and the USGS office in Henderson, Nevada. These digital spreadsheets are the Rock-Sample database, Lithologic-Description database, Rock-Property database, Fracture-Characteristic database, and Hydraulic-Property database. Records were compiled for vertical (boreholes and shafts) and horizontal (tunnels and drifts) holes. Rock-sample locations were inventoried by personnel stationed at the Mercury facility. Rock-sample records were compiled by personnel stationed at the Henderson office from paper copies of records contained in the historical files stored at the Mercury and Henderson locations and from paper copies of published reports. A small percentage of lithologic descriptions were provided in electronic format towards the end of the study.

### Rock-Sample Database

The USGS catalogued interval-specific locations for rock samples collected from nearly 2,600 holes drilled or mined on and around the NTS ([fig. 3](#)). The Rock-Sample database presents locations of rock samples collected by DOE/DOD contracting organizations, the National Laboratories, and USGS and stored at the USGS Core Library. The database is a digital spreadsheet ([appendix A](#)) and column contents are described in [table A1](#). Locations of all rock samples stored at the Mercury facility have been compiled. However, rock samples stored at the USGS Yucca Mountain Program (YMP) sample storage facility in NTS Area 25 ([fig. 1](#)) are part of another program and have not been included in this compilation.

A core sample collected from exploratory hole UE-20f and a cuttings sample collected from exploratory hole UE-14b are used to show examples of rock-sample data at the NTS. Hole UE-20f is the deepest hole drilled at the NTS and the core sample collected from the bottom (13,670–13,686 foot) interval of this hole shows an example of welded volcanic tuff. Wooden blocks indicate sections of core removed from the USGS Core Library ([fig. 4A](#)). The cuttings sample collected from the 1,120- to 2,160-ft interval of exploratory hole UE-14b shows an example of variations in welded volcanic tuffs ([fig. 4B](#)).

### Lithologic-Description Database

The USGS compiled interval-specific records for lithologic descriptions for nearly 1,300 holes drilled or mined on and around the NTS ([fig. 5](#)). The Lithologic-Description database presents lithologies interpreted and re-interpreted from rock samples and geophysical and video logs in boreholes and shafts and mapped inside tunnels and drifts by investigators from DOE/DOD contracting organizations, the National Laboratories, and USGS. The database is a digital spreadsheet ([appendix B](#)) and column contents are described in [table B1](#). Lithologic descriptions have been compiled for holes located in Frenchman and Yucca Flats and on Buckboard, Pahute, and Rainier Mesas and parts of the Amargosa Desert near the NTS ([fig. 1](#)). Lithologic descriptions are available but have not been compiled for holes located in Jackass Flat ([fig. 1](#)).

The lithologic-description data for borehole ER-6-1 is used to show a graphical example of generalized lithologic units at the NTS ([fig. 6](#)). The general units penetrated in this hole are alluvium, nonwelded to welded and bedded tuff, dolomite, and quartzite. The lithology was interpreted by Sigmund L. Drellack, Jr. and Lance B. Prothro from National Security Technologies, LLC and by Robert L. McCall from Stoller-Navarro Joint Venture.

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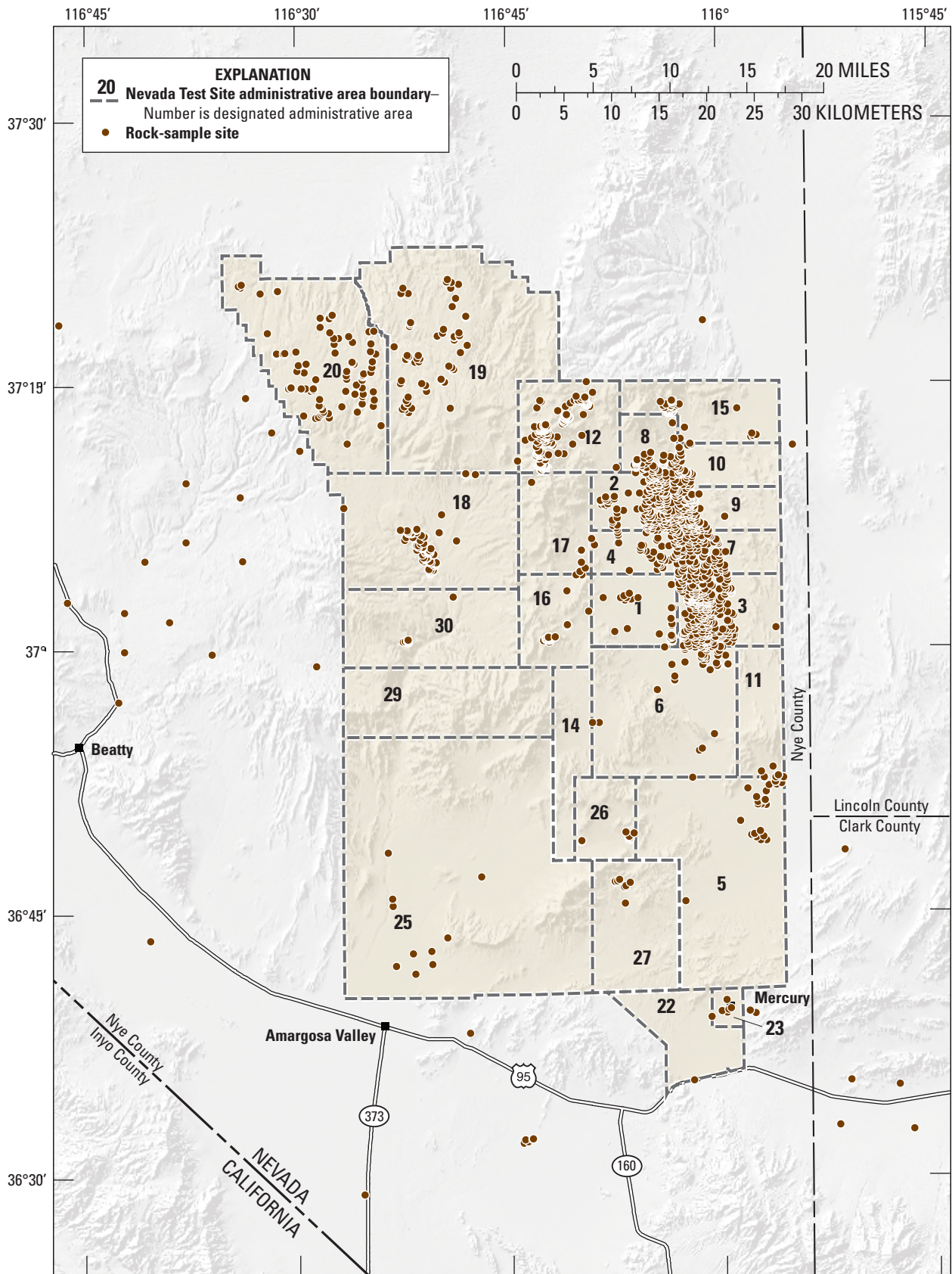
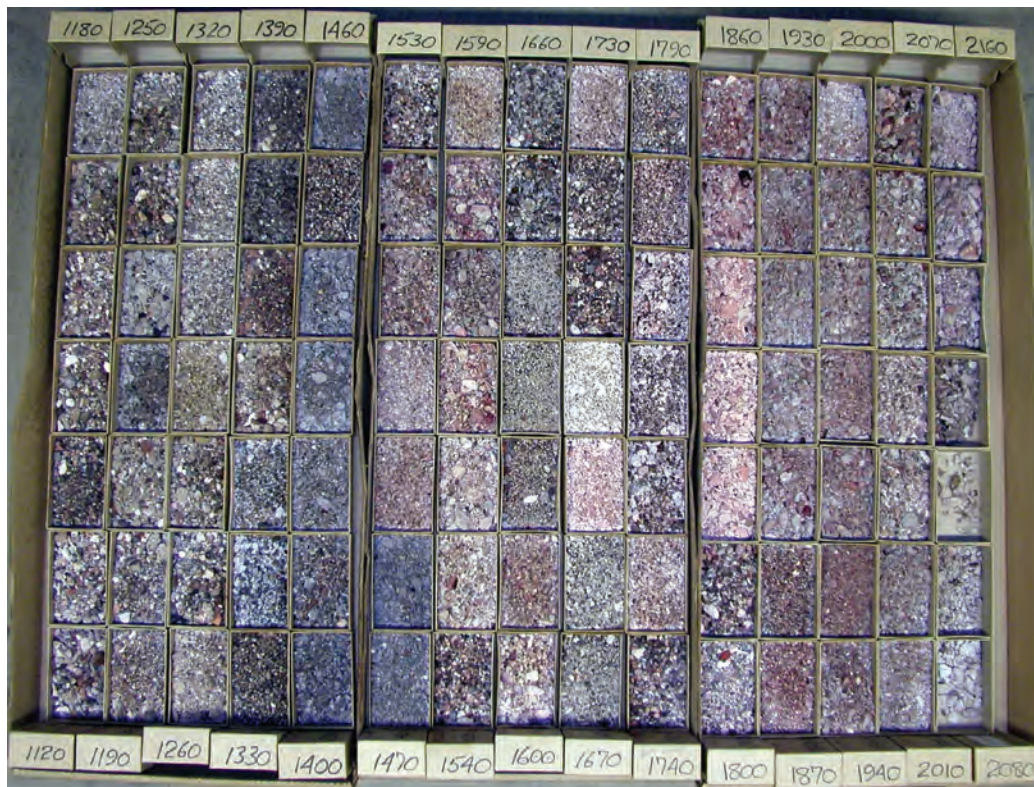


Figure 3. Areal distribution of rock-sample sites in vicinity of Nevada Test Site, Nye County, Nevada.



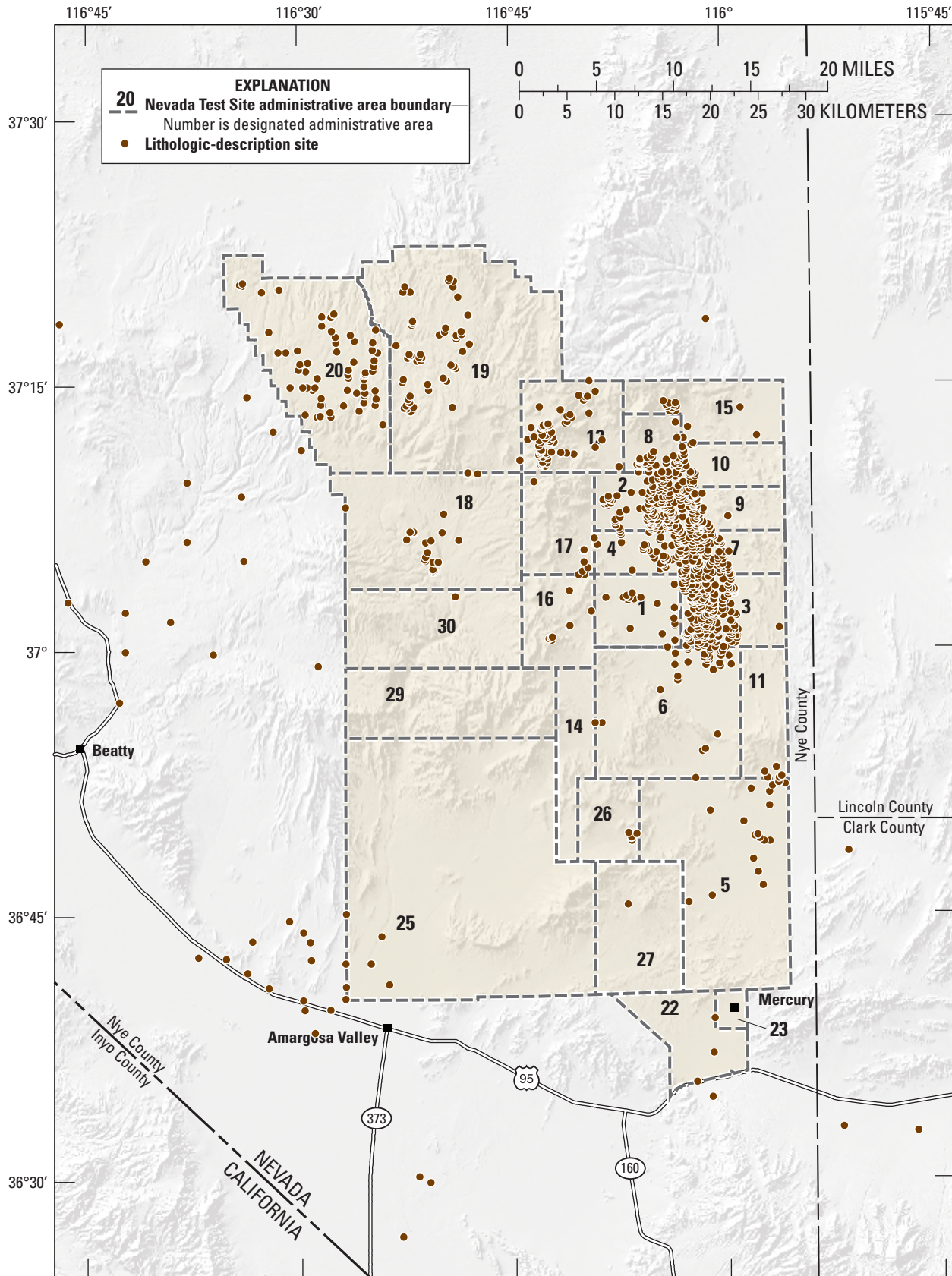
**A.** Subsurface core collected from bottom interval of exploratory hole UE-20f; deepest hole drilled at Nevada Test Site. Core sample shows welded volcanic tuff from 13,670- to 13,686-foot interval. Wooden blocks indicate sections of core removed from U.S. Geological Survey Core Library. Photograph taken by Jerry Magner, U.S. Geological Survey.



**B.** Subsurface cuttings collected from exploratory hole UE-14b. Cuttings sample shows variations in welded volcanic tuffs from 1,120- to 2,160-foot interval. Photograph taken by Jerry Magner, U.S. Geological Survey.

**Figure 4.** Examples of subsurface core and cuttings collected from exploratory holes at Nevada Test Site, Nye County, Nevada.

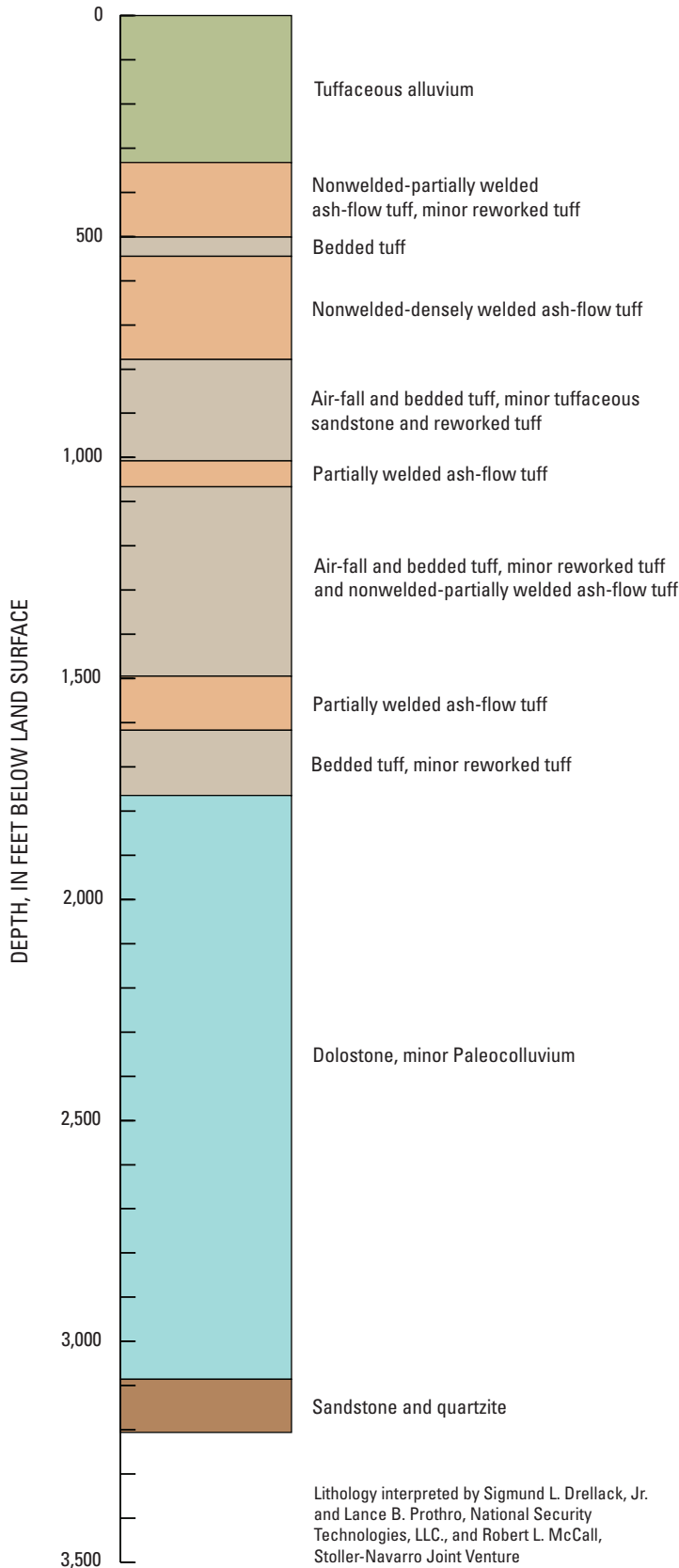
8 Interval-Specific Rock-Sample Data Compiled from Historical Records, Nevada Test Site, Nye County, Nevada



Base from U.S. Geological Survey digital data, 1:100,000, 1978-89; Universal Transverse Mercator Projection Zone 11. Shaded relief base from 1:250,000-scale Digital Elevation Model; sun illumination from northwest at 30 degrees above horizon.

Figure 5. Areal distribution of lithologic-description sites in vicinity of Nevada Test Site, Nye County, Nevada.





**Figure 6.** Example of generalized lithologic units in borehole ER-6-1, Nevada Test Site, Nye County, Nevada.

## Rock-Property Database

The USGS compiled interval-specific records for rock-property data for nearly 600 holes drilled or mined on and around the NTS (fig. 7). The Rock-Property database presents physical and mechanical properties analyzed from rock samples by investigators from DOE/DOD contracting organizations, the National Laboratories, and USGS. The database is a digital spreadsheet (appendix C) and column contents are described in table C1. Physical and mechanical rock properties have been compiled for holes located in Yucca Flat and on Rainier Mesa (fig. 1). Physical and mechanical rock properties are available but have not been compiled for holes located in Frenchman and Jackass Flats and on Buckboard and Pahute Mesas (fig. 1).

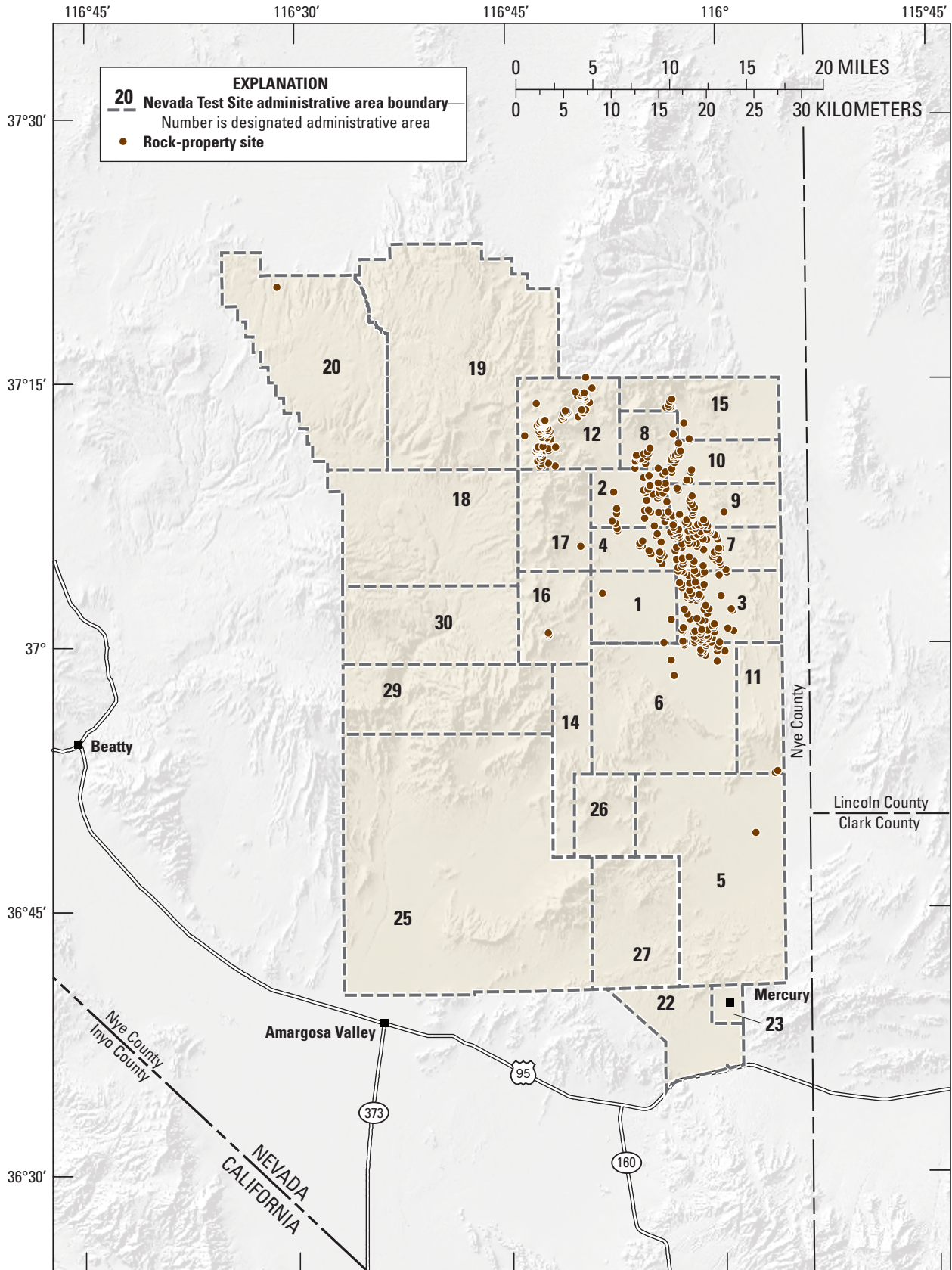
Samples collected from exploratory hole U-4d Ex. #1 and analyses contained in Lawrence Livermore National Laboratory project files are used to show examples of rock-property data at the NTS. Depth profiles are shown for grain density, wet (natural-state) bulk density, and wet water content by weight from exploratory hole U-4d Ex. #1 (fig. 8).

## Fracture-Characteristic Database

The USGS compiled interval-specific records for fracture-characteristic data for nearly 500 holes drilled or mined on and around the NTS (fig. 9). The Fracture-Characteristic database presents locations of fractures interpreted from rock samples and geophysical and video logs in boreholes and shafts and mapped inside tunnels and drifts by investigators from DOE/DOD contracting organizations, the National Laboratories, and USGS. The database is a digital spreadsheet (appendix D) and column contents are described in table D1. Fracture characteristics have been compiled for holes located in Yucca Flat and on Buckboard, Pahute, and Rainier Mesas (fig. 1). Fracture characteristics are available but have not been compiled for holes located in Frenchman and Jackass Flats (fig. 1).

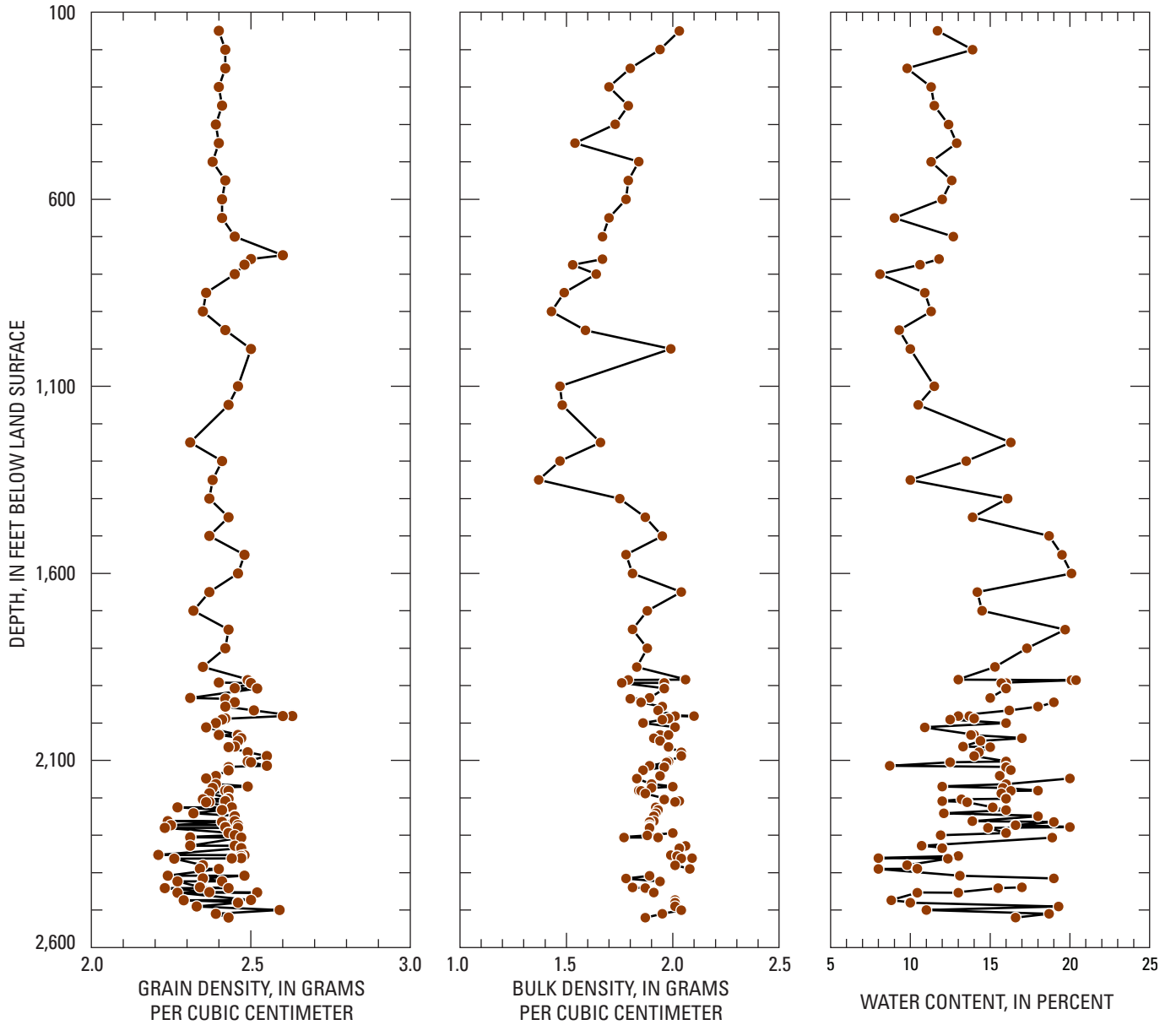
A core sample collected from the core hole MH-2, drilled vertically in the invert (floor) of emplacement drift U-12n.10 at 303.77 ft from the portal opening, is used to show an example of fracture-characteristic data at the NTS. Slickensides and black staining on fracture surfaces are indicated at 79 ft (fig. 10).

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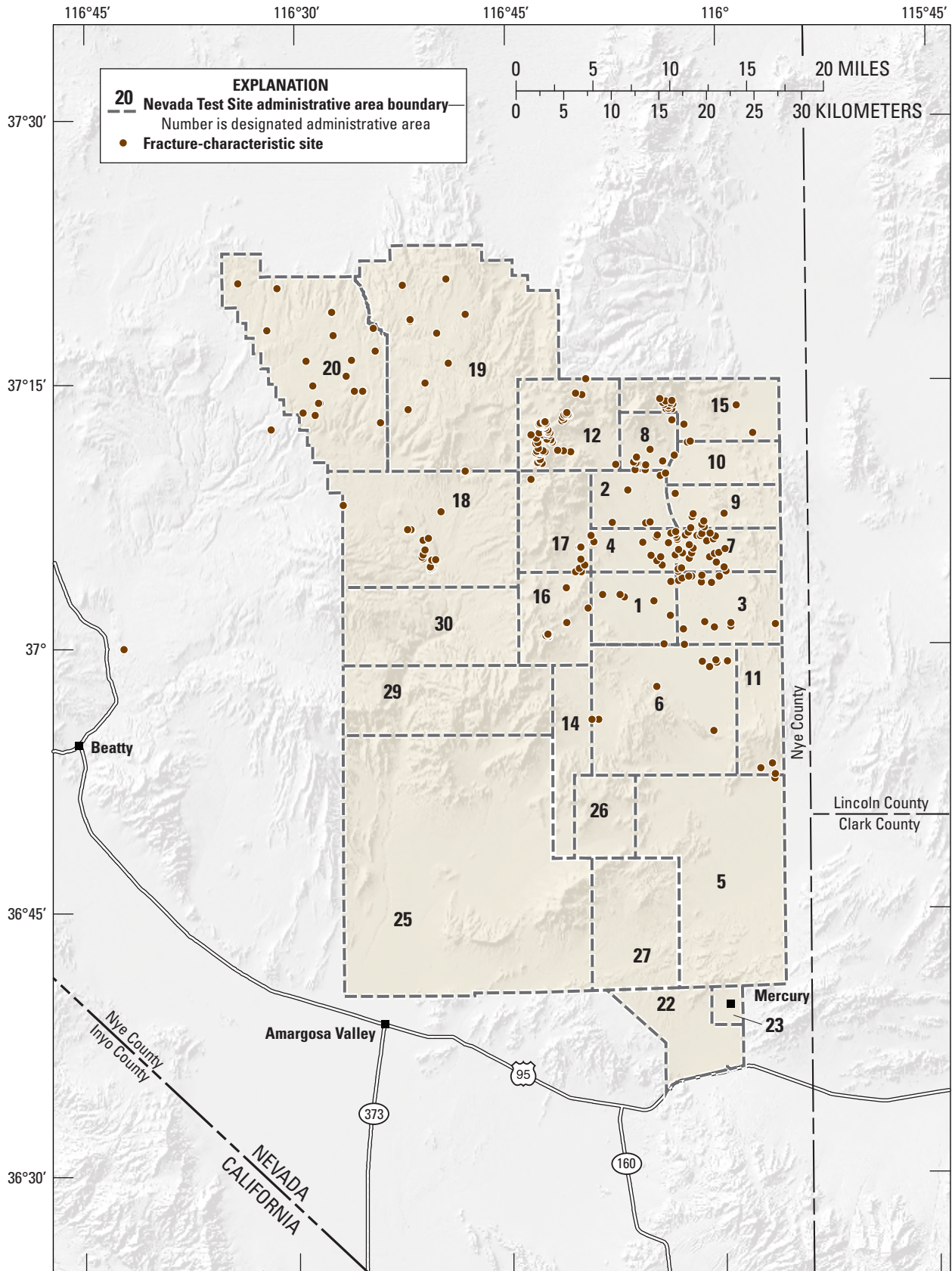
Base from U.S. Geological Survey digital data, 1:100,000, 1978-89; Universal Transverse Mercator Projection Zone 11. Shaded relief base from 1:250,000-scale Digital Elevation Model; sun illumination from northwest at 30 degrees above horizon.

Figure 7. Areal distribution of rock-property sites in vicinity of Nevada Test Site, Nye County, Nevada.



**Figure 8.** Examples of subsurface rock-property data collected at Nevada Test Site, Nye County, Nevada. Depth profiles of grain density, wet (natural-state) bulk density, and wet water content by weight are from exploratory hole U-4d Ex. #1. Anomalous values not shown.

12 Interval-Specific Rock-Sample Data Compiled from Historical Records, Nevada Test Site, Nye County, Nevada



Base from U.S. Geological Survey digital data, 1:100,000, 1978-89; Universal Transverse Mercator Projection Zone 11. Shaded relief base from 1:250,000-scale Digital Elevation Model; sun illumination from northwest at 30 degrees above horizon.

Figure 9. Areal distribution of fracture-characteristic sites in vicinity of Nevada Test Site, Nye County, Nevada.



**Figure 10.** Example of subsurface fracture characteristics in vertical core hole MH-2 in floor of emplacement drift U-12n.10 at 303.77 feet from portal opening, Nye County, Nevada. Core sample shows slickensides and black staining on fracture surfaces at 79 feet. Photograph taken by Jerry Magner, U.S. Geological Survey.

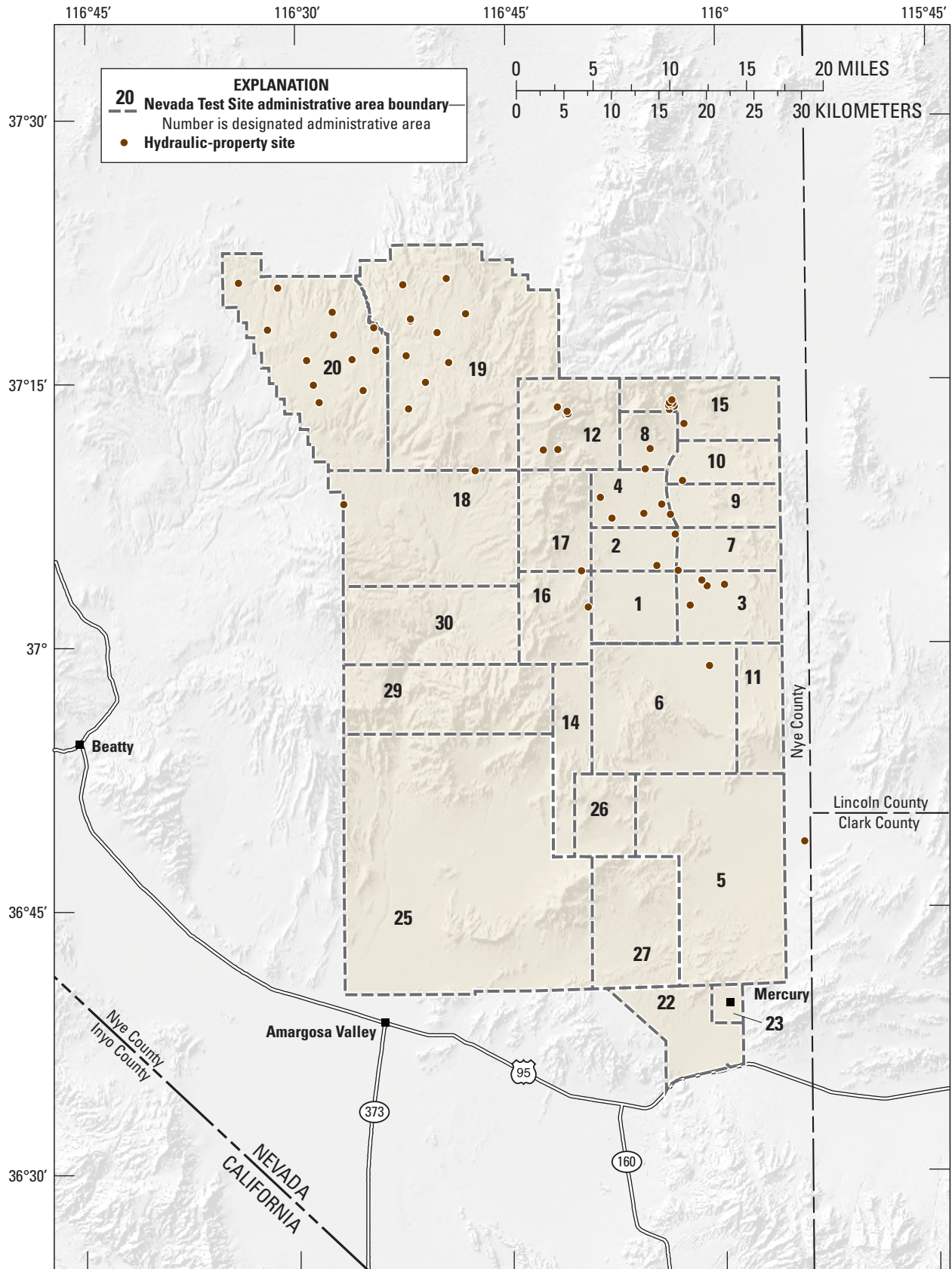
## Hydraulic-Property Database

The USGS compiled interval-specific records for hydraulic-property data for nearly 100 holes drilled or mined on and around the NTS (fig. 11). The Hydraulic-Property database presents water-level response from injection and withdrawal of water during aquifer tests conducted by investigators from DOE/DOD contracting organizations, the National Laboratories, and USGS. The database is a digital spreadsheet (appendix E) and column contents are described

in table E1. Hydraulic properties have been compiled for holes located in Yucca Flat and on Buckboard, Pahute, and Rainier Mesas (fig. 1). Hydraulic properties are available but have not been compiled for holes located in Frenchman and Jackass Flats (fig. 1).

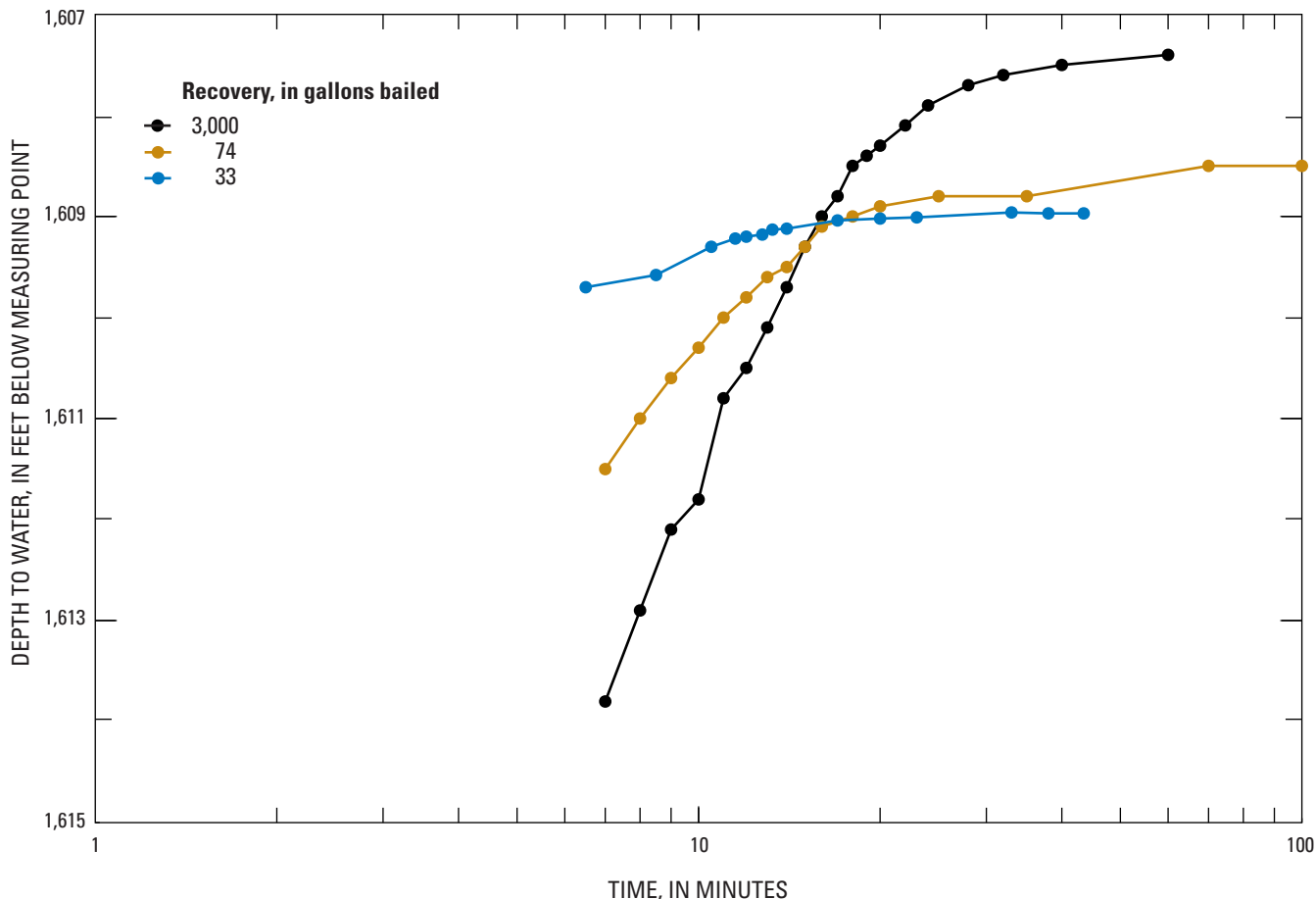
Aquifer testing conducted in water well WW-A and reported in Price and Thordarson (1961) are used to show examples of hydraulic-property data at the NTS. Water-level recovery is shown following bailing tests of 3,000, 74, and 33 gallons, respectively (fig. 12).

14 Interval-Specific Rock-Sample Data Compiled from Historical Records, Nevada Test Site, Nye County, Nevada



Base from U.S. Geological Survey digital data, 1:100,000, 1978-89; Universal Transverse Mercator Projection Zone 11  
Shaded relief base from 1:250,000-scale Digital Elevation Model;  
sun illumination from northwest at 30 degrees above horizon

Figure 11. Areal distribution of hydraulic-property sites in vicinity of Nevada Test Site, Nye County, Nevada.



**Figure 12.** Example of subsurface hydraulic-property data collected at Nevada Test Site, Nye County, Nevada. Recovery shown from three bailing tests conducted in water well WW-A.

## Summary

Between 1951 and 1992, 828 underground tests were conducted on the Nevada Test Site. Prior to and following these nuclear tests, holes (boreholes, shafts, tunnels, and drifts) were drilled and mined for the collection of rock samples. The U.S. Geological Survey has worked in cooperation with U.S. Department of Energy (and its predecessors) and the National Laboratories since 1956 and the USGS Core Library and Data Center was established at Mercury, Nevada, on the Nevada Test Site, through a modification to an existing memorandum of understanding dated April 3, 1959. Rock samples collected from these holes are stored in the Core Library and paper copies of records and reports derived from analyses and interpretation of rock samples are stored in the historical files at both the Mercury facility and the USGS office in Henderson, Nevada. The understanding of stratigraphy that underlies the NTS and vicinity continues to evolve, through interpretation of rock samples from new

holes that are drilled and mined, resulting in a multitude of formal and informal units in common use. Rock samples are irreplaceable because pre-test, in-place conditions cannot be recreated and samples cannot be recollected from the many holes destroyed by testing. The condition of the original paper records is rapidly deteriorating, which makes re-compilation unlikely. Documenting these data in a published report will ensure availability for future investigators.

Rock samples have been catalogued by depth interval for samples stored at the U.S. Geological Survey Core Library. Rock-sample data are compiled from paper records contained in file cabinets and from published reports located at the Mercury facility and at the U.S. Geological Survey Henderson office. Rock samples are available for nearly 2,600 holes drilled and mined at the Nevada Test Site and vicinity. Lithologic descriptions are available for nearly 1,300 holes located in Frenchman and Yucca Flats and on Buckboard, Pahute, and Rainier Mesas and parts of the Amargosa Desert near the Nevada Test Site. Physical and mechanical properties

are available for nearly 600 holes located in Yucca Flat and on Rainier Mesa. Fracture characteristics are available for nearly 500 holes located in Yucca Flat and on Buckboard, Pahute, and Rainier Mesas. Hydraulic-property data from aquifer testing is available for nearly 100 holes located in Yucca Flat and on Buckboard, Pahute, and Rainier Mesas. These data have been compiled into five digital spreadsheets.

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## Appendixes

The rock-sample, lithologic-description, rock-property, fracture-characteristic, and hydraulic-property databases distributed with this report are Microsoft® Excel spreadsheets and listed in the appendixes A–E. Column contents are described in tables A1–E1 and codes are explained in additional worksheets within each spreadsheet. Appendixes data are available at URL: <http://pubs.usgs.gov/ds/2007/297/>.

Appendix A. Rock-Sample Database.

Appendix B. Lithologic-Description Database.

Appendix C. Rock-Property Database

Appendix D. Fracture-Characteristic Database.

Appendix E. Hydraulic-Property Database.

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## Appendix A. Rock-Sample Database, Nevada Test Site and Vicinity, Nye County, Nevada

Rock-sample data were catalogued for nearly 2,600 holes drilled and mined at the NTS and vicinity. [Appendix A](#) data are available at URL: <http://pubs.usgs.gov/ds/2007/297/>.

**Table A1.** Description of Rock-Sample Database column contents.

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
USGS NTS sort order	–	Emplacement and exploratory holes typically are displayed together. Many sites also have multiple completion intervals within the same hole. Therefore, a sort order number is assigned to all USGS sites associated with DOE and/or DOD projects in Nevada. This field is modified as new sites are added.
USGS NTS unique number	–	Spatial (X-Y) coordinates are unavailable at some locations. Therefore, USGS site identification numbers cannot be established in the USGS NWIS database Sitefile for these sites. Because NWIS site identification numbers cannot be assigned to all sites, it is necessary to assign a unique site number to all USGS sites associated with USGS DOE/DOD projects in Nevada. Although the unique numbers were initially assigned in the same order as the USGS NTS sort order, new sites are assigned the next available sequential number.
NTS area	–	NTS Administrative Area number (see <a href="#">fig. 1</a> ). Entries are listed in <b>bold</b> type where sites are located in areas other than the hole name implies. For example, USGS hole name <b>U - 2bw</b> is actually located in NTS area <b>09</b> .
USGS hole name	–	USGS hole name designation. Entries are listed in <b>bold</b> type where sites are located in areas other than the hole name implies.
Sample interval number	–	Sequence of sample interval.
Sample interval top (ft)	–	Depth to top of sample interval; in feet below land surface for boreholes and shafts; in feet from portal opening for tunnels and drifts.
Sample interval bottom (ft)	–	Depth to bottom of sample interval; in feet below land surface for boreholes and shafts; in feet from portal opening for tunnels and drifts.
Sample interval sequence number	–	Sequence of samples, when multiple samples are reported within a sample interval.
Number of samples	–	Number of samples for rock-sample interval. Sample types (described below) have a direct bearing on number of samples reported. Auger, core, and cuttings samples are treated as continuous and the number of samples is reported as 1 unless auger or cuttings samples are split into separate boxes for various preservation and storage types or adjacent core samples are collected from the same depth interval within a hole. Drill cuttings are normally collected at regular 10-foot intervals throughout the drilling process. However, cuttings may be skipped or may be collected at other intervals. Also, core often is not fully recovered in the drilling process. These gaps in continuity are noted by investigators during sample interpretation and analysis. Normally missing core and cuttings intervals are minimal and not recorded in this table.
Sample type	–	Type of sample.
Sample type	Auger	Collected from a screw-like boring tool and normally collected from unconsolidated material. Accuracy is approximate.
Sample type	Core	A cylindrical piece of solid rock taken by a special hollow-type drill bit. Cores are usually about 3 inches in diameter and range from a few inches to several feet in length.
Sample type	Core, 12-inch	Core, 12-inch diameter sample.
Sample type	Core, 6-inch	Core, 6-inch diameter sample.
Sample type	Cuttings	Rock chips or fragments produced by drilling and brought to the surface.
Sample type	Cuttings, unwashed	Cuttings, unwashed sample. Stored as collected.

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**Table A1.** Description of Rock-Sample Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Sample type	Cuttings, washed	Cuttings, washed sample. Drill cuttings often contain various forms of debris, drilling mud, and other contaminants when collected. Samples are placed in a sieve and rinsed with clear running water in an attempt to remove foreign matter prior to permanent storage.
Sample type	Drill-bit	Drill-bit sample collected by gouging out rock chips or mud from the cutting parts of a drill bit while the bit is out of the hole.
Sample type	Grab	These fist-sized samples come from shafts and tunnels. Samples pried from walls are accurate to about a foot. Samples taken from debris piles are accurate to about 10 ft.
Sample type	None	No samples.
Sample type	Sidewall	These finger-sized samples are collected by shooting or drilling a plug of rock from the wall of an uncased hole. Accuracy is about a foot.
Sample type	Wax	Core samples are coated with wax in an attempt to preserve natural-state conditions. Samples are wrapped with heavy gage aluminum foil then dipped in melted bee's wax. Wax is usually built up in several layers to about 1/16 inch.
Sample owner	–	These organizations collected and have proprietary interest in the samples. <b>Each organization must be contacted for permission to view and/or analyze their samples.</b>
Sample owner	DOE	U.S. Department of Energy (DOE)
Sample owner	DOE/NSTec	DOE/National Security Technologies, LLC (NSTec; formerly owned by Bechtel, Nevada (BN); formerly owned by Reynolds Electrical and Engineering Co. (REECo)).
Sample owner	DOE/ER	DOE/Environmental Restoration Program (ER).
Sample owner	DTRA	DOD, Defense Threat Reduction Agency (DTRA).
Sample owner	LANL	Los Alamos National Laboratory (LANL).
Sample owner	LANL/JVE	LANL/Joint Verification Experiment (JVE).
Sample owner	LLNL	Lawrence Livermore National Laboratory (LLNL).
Sample owner	LLNL and DTRA	LLNL and Defense Threat Reduction Agency (DTRA).
Sample owner	LLNL/SNL	LLNL/Sandia National Laboratories (SNL).
Sample owner	PD	Public Display (PD).
Sample owner	USGS	U.S. Geological Survey (USGS).
Comments	–	Comments pertaining to rock-sample interval.
Comments	Bottom hole core	A rock chip or core sample taken from bottom of borehole. Used to confirm rock unit where hole bottomed.
Comments	Rubber sleeve core	A thick-walled rubber cylinder is used as a "core catcher" to collect unconsolidated material while using a core bit. The rubber sleeve confines the material keeping it in the order collected.
Comments	Paleo	Refers to drill cuttings collected for paleontological age dating studies.
Additional sample collection	–	Samples collected following initial drilling or excavation.
Sample range top (ft)	–	Depth to top of first sample interval; in feet below land surface for boreholes and shafts; in feet from portal opening for tunnels and drifts.
Sample range bottom (ft)	–	Depth to bottom of last sample interval; in feet below land surface for boreholes and shafts; in feet from portal opening for tunnels and drifts.
Number of boxes	–	Total number of standard sample boxes for hole. Standard sample box dimensions are 13 inches wide by 2 feet 6 inches deep. Height varies from 2 1/2 to 3 3/4 inches. Cardboard core-sample liners are 3 inches (4 per standard storage box), 3 1/2 inches (3 per standard storage box), and 5 1/4 inches (2 per standard storage box) in height. Therefore, standard storage box heights can increase to 5 1/2 inches. Most cuttings-sample boxes are 2 1/2 inches wide by 3 7/8 inches deep by 1 3/8 inches high. Standard storage boxes will accommodate 70 cuttings-sample boxes (5 rows by 7 rows, stacked 2 high). Because the majority of cuttings samples are collected every 10 feet, this represents 700 feet of hole. Cuttings-sample boxes used for Environmental Restoration Project (ER) holes are 4 1/4 inches wide by 4 1/4 inches deep by 2 inches high. Standard storage boxes will accommodate 42 ER cuttings-sample boxes (3 rows by 7 rows, stacked 2 high). Furthermore, oversized 6- and 12-inch cores are stored in wooden crates.

**Table A1.** Description of Rock-Sample Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Sample box name	–	Name written on sample box located at USGS Core Library in Mercury, Nevada. Entries are listed in <b>bold</b> type where sites are located in areas other than the hole name implies.
Sample rack-column-shelf number	–	Samples are stored in two types of storage racks. Rack number 1 was removed, so racks are numbered from 2-99. Open racks are 7 bays high and have bay openings that are 14 inches wide by 18 inches high by 2 feet 6 inches deep to accommodate standard storage boxes. Samples are ordered in bays from left to right as A-Z and AA-RR and from bottom to top as 1-7. Examples of open rack numbers are: 02-A-1 (bottom bay on left side of rack number 2) and 91-RR-6 (bay 6 on right side of rack 91). Most pallet racks are 3 bays high and have bay openings that are 46 inches wide and accommodate 1 pallet containing 3 standard storage boxes side by side. However some pallet racks are 4 bays high and newer pallet racks are 91 inches wide and accommodate 2 pallets containing 6 standard storage boxes side by side. Height varies from 36-54 inches high and depth is over 5 feet to accommodate 2 pallets (one behind the other). Samples are ordered on pallets in bays from left to right as 1-14 and from bottom to top as A-D. Examples of pallet rack numbers are: 89- 1-A-R (bottom rear bay in bay 1 on left side of rack 89) and 83- 8-D-F (top front bay in bay 8 of rack 83). Furthermore, a few odd sized samples are located on pallets or in wooden crates and stored on the floor at the end of the open or pallet racks. These locations are given an imaginary bay notation. For example rack 14 ends at bay K and rack 85 ends at bay 11. The space between the end of these racks and the building wall is denoted as an additional bay: 14- L-1 or 85-12-A-F.
Sample pallet number	–	Sample pallets are of sufficient width to accommodate 3 standard storage boxes and number of boxes varies by height of bay opening. Samples collected at the Nevada Test Site (NTS) are numbered by Administrative Area Number preceded by an “A” followed by the number of pallets for that area. However, samples collected from tunnels and drifts at Area 12 designate the letter of the particular tunnel following the Administrative Area Number. Samples collected in Nevada, but not at the NTS, are designated as “CNV” (Central Nevada) for samples associated with the Faultless project and by County (Clk, Clark; Nye) for other samples followed by the number of pallets. Samples collected outside Nevada are designated as “AMCH” for samples associated with the Amchitka project in Alaska and by State (Colo, Colorado; MISS, Mississippi; NMex, New Mexico) for other samples followed by the pallet number. Furthermore, a few samples from California, Montana, and New York are simply designated as “basket.”
Sample box number	–	Standard sample boxes are numbered as total per rack bay. The number of storage boxes is normally shown as the total number of standard storage boxes per sample type per hole, but in cases where the storage location is not continuous (usually broken by pallet capacity) the total is shown as the number of boxes on the given pallet or, in a very few cases, storage rack location.
Record location	–	Physical location of rock-sample record.
Hole type	–	Type of vertical or horizontal drilling or excavation.
Hole type	Borehole	Vertical surface location; includes wells and vertical test holes.
Hole type	Crater	Vertical surface location.
Hole type	Drift	Horizontal underground location; includes tunnels and horizontal test holes.
Hole type	Outcrop	Surface location.
Hole type	Shaft	Vertical surface location.
Hole type	Surface	Surface location.
Hole type	Trench	Horizontal surface location.
Hole type	Unknown	Hole type not known.
Tunnel or drift construction station	–	Construction station at collar location (portal opening), for tunnels and drifts (i.e. - 9+17 is 917 ft; 10+72,195’ is a 195 ft hole at the 1,072 ft station; etc.).
Construction station remarks	–	Remarks concerning the portal opening (collar location), for tunnels and drifts (i.e. - In U-12e.14 main drift; Alcove; Face; Invert; Lft Rib; Rt Rib; etc.).
Nevada SPCS Easting NAD27	–	Nevada State plane coordinates (SPCS), Easting, central zone, in feet; North American Datum of 1927 (NAD27).
Nevada SPCS Northing NAD27	–	Nevada State plane coordinates (SPCS), Northing, central zone, in feet; North American Datum of 1927 (NAD27).
Altitude at portal opening NGVD29 (ft)	–	Altitude at the collar location of the portal opening, for tunnels and drifts; in feet above mean sea level; National Geodetic Vertical Datum of 1929 (NGVD29).

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Table A1. Description of Rock-Sample Database column contents.—Continued

[Abbreviations: DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Bearing from portal opening (degrees)	–	Bearing from the portal opening, for tunnels and drifts; in degrees, minutes, and seconds or decimal degrees (i.e. - S0720958W is South, 72 degrees, 9 minutes, 58 seconds West; N0325529E is North, 32 degrees, 55 minutes, 29 seconds East; N052.75W is North 52 and three-quarter degrees West; etc.)
Inclination from portal opening (degrees)	–	Inclination from the portal opening, for tunnels and drifts; in degrees, minutes, and seconds or decimal degrees (i.e. - 0045825 is a hole 4 degrees, 58 minutes, 25 seconds above horizontal; 2700000 is a vertical hole below horizontal; 0900000 is a vertical hole above horizontal; 0000000 and 1800000 are horizontal holes; 0150000 and 1650000 are holes 15 degrees up (above horizontal); 3150000 and 2250000 are holes 45 degrees down (below horizontal); 356.5 is a hole 3 and one-half degrees below horizontal; 170.25 is 9 and three-quarter degrees above horizontal; etc.). Inclinations are linked to bearings, so values near horizontal for holes bearing north or east would be added to zero for holes inclined above horizontal and subtracted from 360 for holes below horizontal; conversely, values near horizontal for holes bearing south or west would be subtracted from 180 for holes inclined above horizontal and added to 180 for holes below horizontal.
Altitude of land surface NGVD29 (ft)	–	Altitude of land surface within a reasonable proximity of the site; in feet above mean sea level; National Geodetic Vertical Datum of 1929 (NGVD29). This is an average of the surrounding ground-surface elevation. If the original surface has been altered, estimate the altitude based on nearby unaltered terrain.
Altitude method	–	Method used to determine altitude of land surface.
Altitude method	A	Altimeter.
Altitude method	D	Differentially corrected Global Positioning System (DGPS).
Altitude method	G	Global Positioning System (GPS).
Altitude method	L	Level or other surveying method.
Altitude method	M	Interpolated from topographic map [report accuracy as ± one-half the contour interval (or supplementary contour interval) specified on the quadrangle].
Altitude method	N	Interpolated from digital elevation model (DEM).
Altitude method	R	Reported.
Altitude method	U	Unknown.
Altitude accuracy	–	Altitude accuracy; in feet (decimal values for accuracies less than 1 ft).
Altitude accuracy	U	Unknown.
Site completion date	–	Date hole construction completed.
Hole depth (ft)	–	Hole depth; in feet below land surface for boreholes and shafts; in feet from portal opening for tunnels and drifts.
Redbook hole number	–	Redbook hole numbers are currently assigned to new holes completed at the NTS by National Security Technologies, LLC (NSTec). Entries are listed in <b>bold</b> type where sites are located in areas other than the hole name implies.
Redbook hole number	–	Redbook hole numbers listed in the Raytheon Services Nevada (RSN) Nevada Test Site Drilling and Mining Summary (last updated 12-31-90) and previously in the Fenix and Scisson of Nevada NTS Drilling and Mining Summary (last updated 6-30-89; formerly Fenix and Scisson, Inc.) were assigned according to the type of hole drilled or mined, site location (NTS area), and sequence code for the consecutive order in which the hole was drilled, mined, or recompleted. Emplacement holes for nuclear weapons tests begin with the letter U, followed by a dash (-), NTS area number ( <a href="#">fig. 1</a> ), and sequence code (letters a-z, aa-az, ba-bz, ..., za-zz). Exploratory holes follow the same naming convention as emplacement holes, but begin with the letters UE. Holes that begin with the letter U but were drilled or mined specifically to provide data that could not be collected from an emplacement hole follow the emplacement hole naming convention, but are assigned incremental letters or numbers, or both following the sequence code. The suffix letters indicate: [#, satellite hole; CH, cable hole; Ex. or Expl., exploratory hole; HTH, hydrologic test hole; Inst., instrument hole; ITS, integrated test system; PPS, pre-postshot hole; PS, post-shot hole; RNM, radionuclide migration hole; RWMS, radioactive waste management site; and S, substitute hole]. There are numerous exceptions to the standard naming convention. The prefix letters indicate: [HTH, hydrologic test hole; J, Jackass Flat; and RNM radionuclide migration]. Numbers and letters following the dash in the exceptions represent sequence of site drilling or mining, not NTS location. Hole type also is commonly listed after the hole designation. For example: [Access Shaft; Cable Hole; Expl. Hole; Instrument; LOS (Line Of Sight) Drift; Sidetrack; Reentry Mining; Tunnel; Vent Hole; and Zero Station].



**Table A1.** Description of Rock-Sample Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Redbook hole number	–	USGS DOE project-related holes in Central Nevada follow a similar naming convention. However, emplacement holes begin with the letters UC and exploratory holes begin with the letters UCE.
Redbook hole number	–	USGS Yucca Mountain Project (YMP) holes at the NTS follow the exploratory hole naming convention. Offsite YMP holes begin with the letters USW to indicate underground southern Nevada waste. The suffix letters indicate: [G, geologic hole; GA, geologic angle hole; GU, geologic unsaturated zone hole; H, hydrologic hole; MX, missile-experimental hole (drilled for U.S. Air Force [USAF] MX Missile-Siting Investigation); N, neutron hole; p, Paleozoic or pre-Tertiary hole; RF, repository facility hole; UZ, unsaturated zone hole; V, volcanic hole; VSE, vertical shelter exploratory hole (drilled for USAF MX Missile-Siting Investigation); and WT, water table hole].
Redbook hole number	–	Environmental Restoration Program (ERP) holes at the NTS begin with the letters ER, followed by a dash, NTS area number (fig. 1), a dash, and an incremental sequence number. The NTS area number is replaced by suffix letters for ERP holes located offsite. The suffix letters indicate: [EC, area at the USAF Nellis Air Force Base Range (NAFBR) where the holes were drilled; and OV, Oasis Valley].
Redbook hole number	–	LLNL Containment Program Data Base hole names are 10 characters in length. The first character identifies the site location of the hole: [U, Nevada Test Site; C, Central Nevada Test Site; A, Amchitka Test Site; and O, offsite hole]. The second and third characters identify either the right-justified Area number for an NTS hole, or the two-letter State abbreviation (U.S. Postal Service abbreviation) for an offsite hole: [U 2, NTS hole in Area 2; U20, NTS hole in Area 20; and ONV, offsite hole in Nevada]. The fourth character is reserved for specially defined areas at the NTS: [U 9I, NTS hole in Area 9, in the ITS area]. Characters 5-10 identify the hole complex or group of holes (of different types) related to the emplacement hole. This may include letters or numbers. For an NTS hole, the fifth and sixth characters are alphabetical descriptors and usually complete the common hole name for an emplacement hole: [U 2 c, NTS hole in Area 2; U 2 ca, NTS hole in Area 2, drilled after U 2 c; and U 2 cb, NTS hole in Area 2, drilled after U 2 ca]. For offsite holes, these characters will indicate county name, on a limited space basis: [ONV NYE, offsite hole in Nevada, Nye County; and OCO RBL, offsite hole in Colorado, Rio Blanco County]. These characters also may indicate project identifiers: [U 1 RNM, NTS hole in Area 1, Radionuclide Migration Program; and U 12 ER, NTS hole in Area 12, Environmental Restoration Program]. LLNL Containment Program Data Base hole types are: [A, access; B, rad chem; C, core; D, Waterways experiment Station (WES); E, exploratory; F, tunnel; G, auger, crack investigation; H, emplacement (H A or H B is a centerpunch emplacement hole); I, instrument; J, PINEX or LOS; K, escape; L, cable; M, hydrologic test hole; N, tracer and sample, foil recovery; O, tunnel dynamics; P, post test; Q, seismic, high explosive; R, re-entry (R-S is a reentry shaft); S, shaft (W/S is a whipstock hole); T, test hole (many types); U, post-test hole, in crater; V, vent; W, water supply; X, pre-post test; Y, abandoned; Z, waste storage; 1, rack assembly; 2, dump; 3, oil well; 4, gas well; 5, geothermal well; and ?, unknown hole type]. Multiple uses of a hole are indicated by consecutively adding hole type abbreviations in this field. If the hole is closely associated with another hole, or if it also is known by another name, this is indicated by / _____. For example, the hole name: [U 2 bt HE/U2BU H] means that U 2 bt was initially an emplacement hole that became an exploratory hole. U 2 bt also is an exploratory hole for the nearby emplacement hole U 2 bu.
Former or other hole name	–	Former or other names utilized for holes.
NWIS agency code	USGS	USGS NWIS code to indicate the reporting agency. All sites currently populated in the rock-sample database are assigned as USGS.
NWIS site identification number	–	USGS NWIS site identification number.
NWIS site identification number	–	Downstream order numbers are assigned for surface-water, on-stream, sites. The first two digits of the station number indicate the part or major drainage system formerly used for USGS Water-Supply Papers entitled "Surface Water Supply of the United States" and the remaining digits indicate the downstream order within the part. This site number is left-justified. Although downstream identification numbers have been converted to a variable length format, with up to 14 digits available, 8 digits are normally assigned.

**Table A1.** Description of Rock-Sample Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
NWIS site identification number	–	Numbering system for sites on open water bodies, off-channel sites, wells, springs, etc., is based on the grid system of latitude and longitude. Although this number is initially determined from the best known latitude/longitude location, plus a 2-digit sequence number for the number of sites located at those coordinates, it retains no locational relevance once the site is created in the database. The overall designation consists of 15 digits. The values of latitude and longitude are updated as better coordinates become available, and should always be used for locating sites or plotting locations.
Latitude NAD27	–	Latitude; in degrees, minutes, and seconds [two digits are available for decimal seconds]; North American Datum of 1927 (NAD27).
Longitude NAD27	–	Longitude; in degrees, minutes, and seconds [two digits are available for decimal seconds]; North American Datum of 1927 (NAD27).
Location method	–	Method used to determine latitude and longitude coordinates.
Location method	C	Calculated from land net.
Location method	D	Differentially corrected Global Positioning System (DGPS).
Location method	G	Global positioning system (GPS), uncorrected [Standard Positioning Service (SPS) and Precise Positioning Service (PPS)].
Location method	L	Long-range navigation (Loran) system.
Location method	M	Interpolated from map.
Location method	N	Interpolated from digital map.
Location method	R	Reported.
Location method	S	Transit, theodolite, or other surveying method.
Location method	U	Unknown.
Location accuracy	–	Accuracy of latitude and longitude coordinates.
Location accuracy	H	Hundredth second.
Location accuracy	1	Tenth second.
Location accuracy	5	Half second.
Location accuracy	S	Second.
Location accuracy	R	Three seconds.
Location accuracy	F	Five seconds.
Location accuracy	T	Ten seconds.
Location accuracy	M	Minute.
Location accuracy	U	Unknown.
Decimal latitude NAD83	–	Latitude, in decimal degrees [automatically generated by the NWIS system software]; North American Datum of 1983 (NAD83).
Decimal longitude NAD83	–	Longitude, in decimal degrees [automatically generated by NWIS system software]; North American Datum of 1983 (NAD83).
UTM Easting NAD27 (meters)	–	Universal Transverse Mercator coordinates, Easting, zone 11, in meters; North American Datum of 1927 (NAD27).
UTM Northing NAD27 (meters)	–	Universal Transverse Mercator coordinates, Northing, zone 11, in meters; North American Datum of 1927 (NAD27).
Remarks	–	Pertinent remarks pertaining to the rock sample.
Date record last updated	–	Date of data entry (compiled into electronic format) is listed if a row of record has not been modified. The date of last (most recent) update is listed if a row of record has been modified. This date does not indicate which columns of data have been modified; only that records have been updated within a particular row. Dates are listed as yyyyymmdd (4-digit year; 2-digit month; 2-digit day).
URL address	–	Link to online website and database.

## Appendix B. Lithologic-Description Database, Nevada Test Site and Vicinity, Nye County, Nevada

Lithologic-description data were compiled for nearly 1,300 holes drilled and mined at the NTS and vicinity. [Appendix B](#) data are available at URL: <http://pubs.usgs.gov/ds/2007/297/>.

**Table B1.** Description of Lithologic-Description Database column contents.

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
USGS NTS sort order	–	Emplacement and exploratory holes typically are displayed together. Many sites also have multiple completion intervals within the same hole. Therefore, a sort order number is assigned to all USGS sites associated with DOE and/or DOD projects in Nevada. This field is modified as new sites are added.
USGS NTS unique number	–	Spatial (X-Y) coordinates are unavailable at some locations. Therefore, USGS site identification numbers cannot be established in the USGS NWIS database Sitefile for these sites. Because NWIS site identification numbers cannot be assigned to all sites, it is necessary to assign a unique site number to all USGS sites associated with USGS DOE/DOD projects in Nevada. Although the unique numbers were initially assigned in the same order as the USGS NTS sort order, new sites are assigned the next available sequential number.
NTS area	–	NTS Administrative Area number (see <a href="#">fig. 1</a> ). Entries are listed in <b>bold</b> type where sites are located in areas other than the hole name implies. For example, USGS hole name <b>UE-17c Eleana</b> is actually located in NTS area <b>04</b> .
USGS hole name	–	USGS hole name designation. Entries are listed in <b>bold</b> type where sites are located in areas other than the hole name implies.
Lithologic interval number	–	Sequence of lithologic interval.
Lithologic interval top (ft)	–	Depth to top of lithologic interval; in feet below land surface for boreholes and shafts; in feet from portal opening for tunnels and drifts.
Lithologic interval bottom (ft)	–	Depth to bottom of lithologic interval; in feet below land surface for boreholes and shafts; in feet from portal opening for tunnels and drifts.
Lithologic interval sequence number	–	Sequence of descriptions, when multiple descriptions are reported within a lithologic interval.
Sample or log type	–	Type of sample or log that lithologic description is based upon.
Sample or log type	Basket	–
Sample or log type	Bit	–
Sample or log type	Core	–
Sample or log type	Core and Cuttings	–
Sample or log type	Core and Geophysical log	–
Sample or log type	Core and Movie log	–
Sample or log type	Core and Sidewall	–
Sample or log type	Core, Sidewall, and Cuttings	–
Sample or log type	Cuttings	–
Sample or log type	Cuttings and Geophysical log	–

**Table B1.** Description of Lithologic-Description Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Sample or log type	Cuttings and Movie log	–
Sample or log type	Geophysical log	–
Sample or log type	Grab	–
Sample or log type	Movie log	–
Sample or log type	None	–
Sample or log type	Sidewall	–
Sample or log type	Sidewall & Cuttings	–
Sample or log type	Sidewall & Geophysical log	–
Sample or log type	Sidewall & Movie log	–
Sample or log type	Unknown	–
Lithologic description	–	Entire lithologic description verbatim. The intent is to offer the most comprehensive (usually the original) description available. Core and sidewall samples always take precedence over cuttings descriptions. Multiple descriptions exist for many holes. However, subsequent descriptions are abridged and important alteration and structural inferences are lost. Although stratigraphic units are frequently updated and lithologies are occasionally modified, original descriptions still take precedence because cuttings samples were interpreted with the aid of binocular microscopes and questionable core samples were interpreted from thin sections utilizing petrographic microscopes (and occasionally spectrographic analysis).
Photographic support	–	Merged columns (currently 10 assigned arbitrarily) contain photographs. Shaded column with red triangle in upper-right corner indicates photograph available. Hover cursor over shaded column and photograph is displayed.
USGS NWIS geologic unit	–	Geologic unit or aquifer name code stored in the Ground-Water Information System (GWIS) subsystem of the USGS NWIS Ingress database. For example: [110VLFL - Quaternary valley fill; 121AMTK - Tertiary Ammonia Tanks Member; 121RRMS - Tertiary Rainier Mesa Member; 122PBRS - Tertiary Paintbrush Tuff; 327ELEN - Pennsylvanian Eleana Formation; 331CNMN - Mississippian Chainman Shale; 344NEVD - Devonian Nevada Formation; 361EURK - Ordovician Eureka Quartzite; and 400SRLG - Precambrian Stirling Quartzite]. A complete list of codes is included in the <code>nv_geo_unit</code> worksheet in the <code>nts_lth_dsc</code> spreadsheet ( <a href="#">appendix B</a> ).
USGS NWIS lithologic unit	–	Lithologic unit code stored in the GWIS database. For example: [ALVM - alluvium; CLAY - clay; DLMT - dolomite; GRVL - gravel; LMSN - limestone; QRTZ - quartzite; SAND - sand; SHLE - shale; and TUFF - tuff]. A complete list of codes is included in the <code>lith_unit</code> worksheet in the <code>nts_lth_dsc</code> spreadsheet ( <a href="#">appendix B</a> ).
USGS NWIS contributing unit	–	Contributing unit code stored in the GWIS database.
USGS NWIS contributing unit	N	Contributes no water.
USGS NWIS contributing unit	P	Principal contributing aquifer (only one per site).
USGS NWIS contributing unit	Q	Aggregate of lithologic units.
USGS NWIS contributing unit	S	Secondary contributing aquifer.

**Table B1.** Description of Lithologic-Description Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
USGS NWIS contributing unit	U	Unknown contribution.
Map unit symbol	–	A list of map unit symbols commonly used at the NTS and vicinity are provided. For example: [QTa - middle Pleistocene to late Tertiary alluvial deposits; Tac - Miocene Calico Hills Formation; Tbgr - Tertiary crystal-rich Grouse Canyon Tuff; Tcpk - Tertiary Rhyolite of Kearsarge; TnABCD - Tertiary Tunnel Formation, 4 Member, beds 4A, 4B, 4C, and 4D; Oaa - Ordovician Antelope Valley Limestone, Aysees Peak Member; and Dg - upper and middle Devonian Guilmette Formation]. A complete list of codes is included in the map_unt worksheet in the nts_lith_dsc spreadsheet ( <a href="#">appendix B</a> ).
Lithologic group	–	A list of one-three character codes is provided to specify general rock types. For example: [Iim - igneous, intrusive, mafic; Sc - sedimentary, consolidated; and M - Metamorphic]. A complete list of codes is included in the lith_grp worksheet in the nts_lith_dsc spreadsheet ( <a href="#">appendix B</a> ).
Lithologic description unit	–	A list of three-character codes and modifiers are provided to specify detailed descriptions or subdivisions of lithologic units. Codes are restricted to important features and added by significance (usually order listed). Modifier usage is also minimized because fields are parsed to construct graphical plots. One- to two-character codes are followed by one or two spaces to maintain the three-character length. For example: [air - air-fall/ash-fall tuff; ash - ash-flow tuff; bed - bedded tuff; dwt - densely welded tuff; fls - felsite; nwt - nonwelded tuff; lac - lacustrine deposits; pd - playa deposits; pum - pumice; and vtp - vitrophyre]. A complete list of codes is included in the lith_dsc worksheet in the nts_lth_dsc spreadsheet ( <a href="#">appendix B</a> ).
Lithologic characteristics unit	–	A list of three-character codes and modifiers are provided to specify diagnostic features of lithologic units. Codes are restricted to important features and added by significance (usually order listed). Modifier usage is also minimized because fields are parsed to construct graphical plots. One- to two-character codes are followed by one or two spaces to maintain the three-character length. For example: [arz - argillaceous; chl - chloritic; dvt - devitrified; fct - fractured; hxt - holocrystalline; ind - indurated; mrd - mordenite; Ol - Olivine; slc - silicic; vit - vitric; and zeo - zeolitic]. A complete list of codes is included in the lith_chr worksheet in the nts_lth_dsc spreadsheet ( <a href="#">appendix B</a> ).
Lithohydrologic unit	–	A list of codes is provided to specify general terms for aquifers or confining units. For example: [lcA - lower-carbonate aquifer; lclCU - lower-clastic confining unit; uclCU - upper-clastic confining unit; vA - volcanic aquifer; vCU - volcanic confining unit; and vfA - valley-fill aquifer]. A complete list of codes is included in the lith_hyd_unt worksheet in the nts_lth_dsc spreadsheet ( <a href="#">appendix B</a> ).
Lithologic remarks	–	Comments pertaining to lithologic-interval descriptions. Currently used mostly to house stratigraphic/lithologic references included with written descriptions; these data are utilized as an aid for populating the USGS NWIS geologic unit, USGS NWIS lithologic unit, USGS NWIS contributing unit, Map unit symbol, Lithologic description unit, Lithologic characteristics unit, and Lithohydrologic unit columns.
USGS Open-File Report 97-139 order	–	Numerical order site is listed in USGS Open-File Report 97-139.
USGS Open-File Report 97-139 Hole ID	–	Hole name listed in USGS Open-File Report 97-139. Entries are listed in <b>bold</b> type where sites are located in areas other than the hole name implies.
Data source	–	Agency that reported lithologic-description data.
Data source	BN	Bechtel Nevada (BN).
Data source	DTRA	DOD, Defense Threat Reduction Agency (DTRA).
Data source	F&S	Fenix and Scisson, Inc. (F&S).
Data source	FSN	Fenix and Scisson of Nevada (FSN).
Data source	IT Corp.	International Technology Corporation (IT Corp., purchased by Shaw Group, Inc.).
Data source	LANL	Los Alamos National Laboratory (LANL).
Data source	LLNL	Lawrence Livermore National Laboratory (LLNL).
Data source	NSTec	National Security Technologies, LLC (NSTec).

**Table B1.** Description of Lithologic-Description Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Data source	RSN	Raytheon Services Nevada (RSN).
Data source	SNJV	Stoller-Navarro Joint Venture (SNJV).
Data source	USGS	U.S. Geological Survey (USGS).
Record type or description		Record description and/or document type.
Record type or description	BN/PF	Bechtel Nevada (BN) Project Files (PF).
Record type or description	DTRA/PF	DOD, Defense Threat Reduction Agency (DTRA) Project Files (PF).
Record type or description	F&S/PF	Fenix and Scisson, Inc. (F&S) Project Files (PF).
Record type or description	FSN/PF	Fenix and Scisson of Nevada (FSN) Project Files (PF).
Record type or description	IT Corp./PF	International Technology Corporation (IT Corp.) Project Files (PF).
Record type or description	LANL/PF	Los Alamos National Laboratory (LANL) Project Files (PF); referred to as “Blue Folders.”
Record type or description	LLNL/PF	Lawrence Livermore National Laboratory (LLNL) Project Files (PF).
Record type or description	NSTec/PF	National Security Technologies, LLC. (NSTec) Project Files (PF).
Record type or description	RSN/PF	Raytheon Services Nevada (RSN) Project Files (PF).
Record type or description	SNJV/PF	Stoller-Navarro Joint Venture (SNJV) Project Files (PF).
Record type or description	USGS/PF	U.S. Geological Survey (USGS) Project Files (PF).
Report reference	–	Published report that contains lithologic-description data. A complete list of acronyms and abbreviations used in USGS and other reports is included in the usgs_rpt and nts_acr_abv worksheets in the nts_lth_dsc spreadsheet ( <a href="#">appendix B</a> ). NOTE: [USGS Technical Letters are considered internal correspondence and are not available for public release unless the report has been assigned a USGS Open-File Report number. Technical Letters prepared under the USGS Hydrologic Resource Management Program (HRMP, formerly Hydrology/Radionuclide Migration Program) and assigned “blanket open-file status” are designated “USGS-474-number.” Technical Letters prepared under the USGS Yucca Mountain Program (YMP) and assigned “blanket open-file status” are designated “USGS-1543-number.” Furthermore, some reports prepared by the National Laboratories and the various DOE and DOD subcontractors also may be considered internal correspondence and not available for public release. Users interested in these reports must check with the source agency to determine availability.]
Investigators	–	Authors and/or investigators.
Record location	–	Physical location of lithologic-description record.
Hole type	–	Type of vertical or horizontal drilling or excavation.
Hole type	Borehole	Vertical surface location; includes wells and vertical test holes.
Hole type	Crater	Vertical surface location.
Hole type	Drift	Horizontal underground location; includes tunnels and horizontal test holes.
Hole type	Outcrop	Surface location.

**Table B1.** Description of Lithologic-Description Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Hole type	Shaft	Vertical surface location.
Hole type	Surface	Surface location.
Hole type	Trench	Horizontal surface location.
Hole type	Unknown	Hole type not known.
Tunnel or drift construction station	–	Construction station at collar location (portal opening), for tunnels and drifts (i.e. - 9+17 is 917 ft; 10+72,195' is a 195 ft hole at the 1,072 ft station; etc.).
Construction station remarks	–	Remarks concerning the portal opening (collar location), for tunnels and drifts (i.e. - In U-12e.14 main drift; Alcove; Face; Invert; Lft Rib; Rt Rib; etc.).
Nevada SPCS Easting NAD27	–	Nevada state plane coordinates (SPCS), Easting, central zone, in feet; North American Datum of 1927 (NAD27).
Nevada SPCS Northing NAD27	–	Nevada state plane coordinates (SPCS), Northing, central zone, in feet; North American Datum of 1927 (NAD27).
Altitude at portal opening NGVD29 (ft)	–	Altitude at the collar location of the portal opening, for tunnels and drifts; in feet above mean sea level; National Geodetic Vertical Datum of 1929 (NGVD29).
Bearing from portal opening (degrees)	–	Bearing from the portal opening, for tunnels and drifts; in degrees, minutes, and seconds or decimal degrees (i.e. - S0720958W is South, 72 degrees, 9 minutes, 58 seconds West; N0325529E is North, 32 degrees, 55 minutes, 29 seconds East; N052.75W is North 52 and three-quarter degrees West; etc.)
Inclination from portal opening (degrees)	–	Inclination from the portal opening, for tunnels and drifts; in degrees, minutes, and seconds or decimal degrees (i.e. - 0045825 is a hole 4 degrees, 58 minutes, 25 seconds above horizontal; 2700000 is a vertical hole below horizontal; 0900000 is a vertical hole above horizontal; 0000000 and 1800000 are horizontal holes; 0150000 and 1650000 are holes 15 degrees up (above horizontal); 3150000 and 2250000 are holes 45 degrees down (below horizontal); 356.5 is a hole 3 and one-half degrees below horizontal; 170.25 is 9 and three-quarter degrees above horizontal; etc.). Inclinations are linked to bearings, so values near horizontal for holes bearing north or east would be added to zero for holes inclined above horizontal and subtracted from 360 for holes below horizontal; conversely, values near horizontal for holes bearing south or west would be subtracted from 180 for holes inclined above horizontal and added to 180 for holes below horizontal.
Altitude of land surface NGVD29 (ft)	–	Altitude of land surface within a reasonable proximity of the site; in feet above mean sea level; National Geodetic Vertical Datum of 1929 (NGVD29). This is an average of the surrounding ground-surface elevation. If the original surface has been altered, estimate the altitude based on nearby unaltered terrain.
Altitude method	–	Method used to determine altitude of land surface.
Altitude method	A	Altimeter.
Altitude method	D	Differentially-corrected Global Positioning System (DGPS).
Altitude method	G	Global Positioning System (GPS).
Altitude method	L	Level or other surveying method.
Altitude method	M	Interpolated from topographic map [report accuracy as $\pm$ one-half the contour interval (or supplementary contour interval) specified on the quadrangle].
Altitude method	N	Interpolated from digital elevation model (DEM).
Altitude method	R	Reported.
Altitude method	U	Unknown.
Altitude accuracy	–	Altitude accuracy; in feet (decimal values for accuracies less than 1 ft).
Altitude accuracy	U	Unknown.
Site completion date	–	Date hole construction completed.
Hole depth (ft)	–	Hole depth; in feet below land surface for boreholes and shafts; in feet from portal opening for tunnels and drifts.

**Table B1.** Description of Lithologic-Description Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Redbook hole number	–	Redbook hole numbers are currently assigned to new holes completed at the NTS by National Security Technologies, LLC (NSTec). Entries are listed in <b>bold</b> type where sites are located in areas other than the hole name implies.
Redbook hole number	–	Redbook hole numbers listed in the Raytheon Services Nevada (RSN) Nevada Test Site Drilling and Mining Summary (last updated 12-31-90) and previously in the Fenix and Scisson of Nevada NTS Drilling and Mining Summary (last updated 06-30-89; formerly Fenix and Scisson, Inc.) were assigned according to the type of hole drilled or mined, site location (NTS area), and sequence code for the consecutive order in which the hole was drilled, mined, or recompleted. Emplacement holes for nuclear weapons tests begin with the letter U, followed by a dash (-), NTS area number ( <a href="#">fig. 1</a> ), and sequence code (letters a-z, aa-az, ba-bz, ..., za-zz). Exploratory holes follow the same naming convention as emplacement holes, but begin with the letters UE. Holes that begin with the letter U but were drilled or mined specifically to provide data that could not be collected from an emplacement hole follow the emplacement hole naming convention, but are assigned incremental letters or numbers, or both following the sequence code. The suffix letters indicate: [#, satellite hole; CH, cable hole; Ex. or Expl., exploratory hole; HTH, hydrologic test hole; Inst., instrument hole; ITS, integrated test system; PPS, pre-postshot hole; PS, post-shot hole; RNM, radionuclide migration hole; RWMS, radioactive waste management site; and S, substitute hole]. There are numerous exceptions to the standard naming convention. The prefix letters indicate: [HTH, hydrologic test hole; J, Jackass Flat; and RNM, radionuclide migration]. Numbers and letters following the dash in the exceptions represent sequence of site drilling or mining, not NTS location. Hole type also is commonly listed after the hole designation. For example: [Access Shaft; Cable Hole; Expl. Hole; Instrument; LOS (Line Of Sight) Drift; Sidetrack; Reentry Mining; Tunnel; Vent Hole; and Zero Station].
Redbook hole number	–	USGS DOE project-related holes in Central Nevada follow a similar naming convention. However emplacement holes begin with the letters UC and exploratory holes begin with the letters UCE.
Redbook hole number	–	USGS Yucca Mountain Project (YMP) holes at the NTS follow the exploratory hole naming convention. Offsite YMP holes begin with the letters USW to indicate underground southern Nevada waste. The suffix letters indicate: [G, geologic hole; GA, geologic angle hole; GU, geologic unsaturated zone hole; H, hydrologic hole; MX, missile-experimental hole (drilled for U.S. Air Force [USAF] MX Missile-Siting Investigation); N, neutron hole; p, Paleozoic or pre-Tertiary hole; RF, repository facility hole; UZ, unsaturated zone hole; V, volcanic hole; VSE, vertical shelter exploratory hole (drilled for USAF MX Missile-Siting Investigation); and WT, water table hole].
Redbook hole number	–	Environmental Restoration Program (ERP) holes at the NTS begin with the letters ER, followed by a dash, NTS area number ( <a href="#">fig. 1</a> ), a dash, and an incremental sequence number. The NTS area number is replaced by suffix letters for ERP holes located offsite. The suffix letters indicate: [EC, area at the USAF Nellis Air Force Base Range (NAFBR) where the holes were drilled; and OV, Oasis Valley].



**Table B1.** Description of Lithologic-Description Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Redbook hole number	–	LLNL Containment Program Data Base hole names are 10 characters in length. The first character identifies the site location of the hole: [U, Nevada Test Site; C, Central Nevada Test Site; A, Amchitka Test Site; and O, offsite hole]. The second and third characters identify either the right-justified Area number for an NTS hole, or the two-letter state abbreviation (U.S. Postal Service abbreviation) for an offsite hole: [U 2, NTS hole in Area 2; U20, NTS hole in Area 20; and ONV, offsite hole in Nevada]. The fourth character is reserved for specially defined areas at the NTS: [U 9I, NTS hole in Area 9, in the ITS area]. Characters 5-10 identify the hole complex or group of holes (of different types) related to the emplacement hole. This may include letters or numbers. For an NTS hole, the fifth and sixth characters are alphabetical descriptors and usually complete the common hole name for an emplacement hole: [U 2 c, NTS hole in Area 2; U 2 ca, NTS hole in Area 2, drilled after U 2 c; and U 2 cb, NTS hole in Area 2, drilled after U 2 ca]. For offsite holes, these characters will indicate county name, on a limited space basis: [ONV NYE, offsite hole in Nevada, Nye County; and OCO RBL, offsite hole in Colorado, Rio Blanco County]. These characters also may indicate project identifiers: [U 1 RNM, NTS hole in Area 1, Radionuclide Migration Program; and U 12 ER, NTS hole in Area 12, Environmental Restoration Program]. LLNL Containment Program Data Base hole types are: [A, access; B, rad chem; C, core; D, Waterways experiment Station (WES); E, exploratory; F, tunnel; G, auger, crack investigation; H, emplacement (H A or H B is a centerpunch emplacement hole); I, instrument; J, PINEX or LOS; K, escape; L, cable; M, hydrologic test hole; N, tracer and sample, foil recovery; O, tunnel dynamics; P, post test; Q, seismic, high explosive; R, re-entry (R-S is a reentry shaft); S, shaft (W/S is a whipstock hole); T, test hole (many types); U, post-test hole, in crater; V, vent; W, water supply; X, pre-post test; Y, abandoned; Z, waste storage; 1, rack assembly; 2, dump; 3, oil well; 4, gas well; 5, geothermal well; and ?, unknown hole type]. Multiple uses of a hole are indicated by consecutively adding hole type abbreviations in this field. If the hole is closely associated with another hole, or if it also is known by another name, this is indicated by /____. For example, the hole name: [U 2 bt HE/U2BU H] means that U 2 bt was initially an emplacement hole that became an exploratory hole. U 2 bt also is an exploratory hole for the nearby emplacement hole U 2 bu.
Former or other hole name	–	Former or other names utilized for holes.
NWIS agency code	USGS	USGS NWIS code to indicate the reporting agency. All sites currently populated in the lithologic-description database are assigned as USGS.
NWIS site identification number	–	USGS NWIS site identification number.
NWIS site identification number	–	Downstream order numbers are assigned for surface-water, on-stream, sites. The first two digits of the station number indicate the part or major drainage system formerly used for USGS Water-Supply Papers entitled “Surface Water Supply of the United States” and the remaining digits indicate the downstream order within the part. This site number is left-justified. Although downstream identification numbers have been converted to a variable length format, with up to 14 digits available, 8 digits are normally assigned.
NWIS site identification number	–	Numbering system for sites on open water bodies, off-channel sites, wells, springs, etc., is based on the grid system of latitude and longitude. Although this number is initially determined from the best known latitude/longitude location, plus a 2-digit sequence number for the number of sites located at those coordinates, it retains no locational relevance once the site is created in the database. The overall designation consists of 15 digits. The values of latitude and longitude are updated as better coordinates become available, and should always be used for locating sites or plotting locations.

**Table B1.** Description of Lithologic-Description Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Latitude NAD27	–	Latitude; in degrees, minutes, and seconds [two digits are available for decimal seconds]; North American Datum of 1927 (NAD27).
Longitude NAD27	–	Longitude; in degrees, minutes, and seconds [two digits are available for decimal seconds]; North American Datum of 1927 (NAD27).
Location method	–	Method used to determine latitude and longitude coordinates.
Location method	C	Calculated from land net.
Location method	D	Differentially-corrected Global Positioning System (DGPS).
Location method	G	Global positioning system (GPS), uncorrected [Standard Positioning Service (SPS) and Precise Positioning Service (PPS)].
Location method	L	Long-range navigation (Loran) system.
Location method	M	Interpolated from map.
Location method	N	Interpolated from digital map.
Location method	R	Reported.
Location method	S	Transit, theodolite, or other surveying method.
Location method	U	Unknown.
Location accuracy	--	Accuracy of latitude and longitude coordinates.
Location accuracy	H	Hundredth second.
Location accuracy	1	Tenth second.
Location accuracy	5	Half second.
Location accuracy	S	Second.
Location accuracy	R	Three seconds.
Location accuracy	F	Five seconds.
Location accuracy	T	Ten seconds.
Location accuracy	M	Minute.
Location accuracy	U	Unknown.
Decimal latitude NAD83	–	Latitude, in decimal degrees [automatically generated by the NWIS system software]; North American Datum of 1983 (NAD83).
Decimal longitude NAD83	–	Longitude, in decimal degrees [automatically generated by NWIS system software]; North American Datum of 1983 (NAD83).
UTM Easting NAD27 (meters)	–	Universal Transverse Mercator coordinates, Easting, zone 11, in meters; North American Datum of 1927 (NAD27).
UTM Northing NAD27 (meters)	–	Universal Transverse Mercator coordinates, Northing, zone 11, in meters; North American Datum of 1927 (NAD27).
Remarks	–	Pertinent remarks pertaining to the lithologic description.
Date record last updated	–	Date of data entry (compiled into electronic format) is listed if a row of record has not been modified. The date of last (most recent) update is listed if a row of record has been modified. This date does not indicate which columns of data have been modified; only that records have been updated within a particular row. Dates are listed as yyyyymmdd (4-digit year; 2-digit month; 2-digit day).
URL address	–	Link to online website and database.

## Appendix C. Rock-Property Database, Nevada Test Site and Vicinity, Nye County, Nevada

Rock-property data were compiled for nearly 600 holes drilled and mined at the NTS and vicinity. [Appendix C](#) data are available at URL: <http://pubs.usgs.gov/ds/2007/297/>.

**Table C1.** Description of Rock-Property Database column contents.

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
USGS NTS sort order	–	Emplacement and exploratory holes typically are displayed together. Many sites also have multiple completion intervals within the same hole. Therefore, a sort order number is assigned to all USGS sites associated with DOE and/or DOD projects in Nevada. This field is modified as new sites are added.
USGS NTS unique number	–	Spatial (X-Y) coordinates are unavailable at some locations. Therefore, USGS site identification numbers cannot be established in the USGS NWIS database Sitefile for these sites. Because NWIS site identification numbers cannot be assigned to all sites, it is necessary to assign a unique site number to all USGS sites associated with USGS DOE/DOD projects in Nevada. Although the unique numbers were initially assigned in the same order as the USGS NTS sort order, new sites are assigned the next available sequential number.
NTS area	–	NTS Administrative Area number (see <a href="#">fig. 1</a> ). Entries are listed in <b>bold</b> type where sites are located in areas other than the hole name implies. For example, USGS hole name <b>U - 4t</b> is actually located in NTS area <b>07</b> .
USGS hole name	–	USGS hole name designation. Entries are listed in <b>bold</b> type where sites are located in areas other than the hole name implies.
Sample interval number	–	Sequence of sample interval.
Sample interval top	–	Depth to top of sample interval; below land surface for boreholes and shafts; from portal opening for tunnels and drifts.
Sample interval bottom	–	Depth to bottom of sample interval; below land surface for boreholes and shafts; from portal opening for tunnels and drifts.
Units	–	Sample depth reporting units.
Sample sequence number	–	Sequence of samples, when multiple analyses are reported within a sample interval.
Date	–	Date sample analyses reported (or analyzed; if known).
Grain density	–	Grain density.
Units	–	Grain density reporting units.
Dry bulk density	–	Dry bulk density. Bulk density is defined as dry bulk density.
Units	–	Bulk density reporting units.
Wet (natural-state) bulk density	–	Wet bulk density. Also reported as natural- or sample-state bulk density.
Units	–	Bulk density reporting units.
Wet H <sub>2</sub> O content by weight (percent)	–	Wet H <sub>2</sub> O content, by weight; as percentage. <b>Computed as: [% H<sub>2</sub>O volume / natural-state bulk density].</b>
Dry H <sub>2</sub> O content by weight (percent)	–	Dry H <sub>2</sub> O content, by weight; as percentage.
H <sub>2</sub> O content by volume (percent)	–	H <sub>2</sub> O content, by volume; as percentage. <b>Computed as: [(natural-state bulk density – dry bulk density) * 100].</b>
Dry CO <sub>2</sub> content by weight (percent)	–	Dry CO <sub>2</sub> content, by weight; as percentage.
Porosity (percent)	–	Porosity; as percentage.

**Table C1.** Description of Rock-Property Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Remarks	–	Remarks concerning sample analyses. <b>Note:</b> [the <b>Copy EQ</b> (hot) button contained in this column ( <b>V</b> ) automatically recomputes the following five values ( <b>blue-shaded columns</b> W-Z and AB) for the entire <b>rck_pty</b> worksheet utilizing the equations contained in row 2 (the hidden row)].
Computed porosity (percent)	–	Computed porosity; as percentage. <b>Computed, using dry bulk density, as:</b> $\{[1 - (\text{dry bulk density} / \text{grain density})] * 100\}$ . <b>Computed, using natural-state bulk density, as:</b> $\{[1 - ((\text{natural-state bulk density} / \text{grain density}) * (1 - \% \text{ wet H}_2\text{O weight} / 100))] * 100\}$ . <b>Note:</b> [Data generated in this column represent raw, interval-specific, values that have not been corrected, averaged, or weighted to a proposed working point and therefore may not agree with referenced data].
Computed gas-filled porosity (percent)	–	Computed gas-filled porosity; as percentage. <b>Computed as:</b> $[\text{porosity} - (\% \text{ wet H}_2\text{O weight} * \text{natural-state bulk density})]$ . <b>Note:</b> [Data generated in this column represent raw, interval-specific, values that have not been corrected, averaged, or weighted to a proposed working point and therefore may not agree with referenced data].
Computed saturation (percent)	–	Computed saturation; as percentage. <b>Computed as:</b> $\{[(\% \text{ wet H}_2\text{O weight} * \text{natural-state bulk density}) / \text{porosity}] * 100\}$ . <b>Note:</b> [Data generated in this column represent raw, interval-specific, values that have not been corrected, averaged, or weighted to a proposed working point and therefore may not agree with referenced data].
Computed dry bulk density	–	Computed dry bulk density. <b>Computed as:</b> $[\text{natural-state bulk density} * \{1 - (\% \text{ wet H}_2\text{O weight} / 100)\}]$ . <b>Note:</b> [Data generated in this column represent raw, interval-specific, values that have not been corrected, averaged, or weighted to a proposed working point and therefore may not agree with referenced data].
Units	–	Bulk density reporting units.
Computed saturated bulk density	–	Computed saturated bulk density. <b>Computed, using analyzed dry bulk density, as:</b> $[\text{analyzed dry bulk density} + (\text{porosity} / 100)]$ . <b>Computed, computed dry bulk density, as:</b> $[\text{computed dry bulk density} + (\text{porosity} / 100)]$ . <b>Note:</b> [Data generated in this column represent raw, interval-specific, values that have not been corrected, averaged, or weighted to a proposed working point and therefore may not agree with referenced data].
Units	–	Bulk density reporting units.
Young's modulus	–	Young's modulus (or modulus of elasticity or tensile modulus).
Bulk modulus	–	Bulk modulus (or compression modulus).
Shear modulus	–	Shear modulus (or modulus of rigidity or 2nd Lamé' constant).
Moduli units	–	Moduli reporting units.
Poisson's ratio	–	Poisson's ratio; a dimensionless value.
Compressional velocity	–	Compressional velocity (or longitudinal velocity; P waves).
Shear velocity	–	Shear velocity (or transverse velocity; S waves).
Velocity units	–	Velocity reporting units.
Sample properties state	–	Moduli (Young's, bulk, and shear) and velocity (compressional and shear) properties as well as Poisson's ratio are reported for both static and dynamic states. Mechanical rock property states are: [D - dynamic; S - static; U (or blank) - undefined].
Remarks	–	Remarks concerning sample analyses.
Unconfined compressive strength	–	Unconfined compressive strength.
Units	–	Unconfined compressive strength reporting units.
Secant Young's modulus	–	Secant Young's modulus.
Units	–	Secant Young's modulus reporting units.
Secant range	–	Secant range.
Units	–	Secant range reporting units.
Magnetic susceptibility	–	Magnetic susceptibility.
Units	–	Magnetic susceptibility reporting units.
End parallelism of core	–	End parallelism of core.

**Table C1.** Description of Rock-Property Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Units	–	End parallelism of core reporting units.
Shore hardness	–	Shore hardness.
Units	–	Shore hardness reporting units.
Analyzing agency	–	Agency that performed the sample analyses.
Analyzing agency	Birdwell	Birdwell Division of Seismograph Service Corporation (SSC).
Analyzing agency	BN	Bechtel Nevada (BN).
Analyzing agency	CL	Core Laboratories, Inc. (CL), Bakersfield, California; Dallas, Texas.
Analyzing agency	DTRA	DOD, Defense Threat Reduction Agency (DTRA).
Analyzing agency	DRI	Desert Research Institute (DRI).
Analyzing agency	F&S	Fenix and Scisson, Inc. (F&S).
Analyzing agency	FSN	Fenix and Scisson of Nevada (FSN).
Analyzing agency	H&N	Holmes & Narver, Inc. (H&N).
Analyzing agency	LANL	Los Alamos National Laboratory (LANL).
Analyzing agency	LLNL	Lawrence Livermore National Laboratory (LLNL).
Analyzing agency	NSTec	National Security Technologies, LLC (NSTec).
Analyzing agency	NTL	Nevada Testing Laboratories, LTD. (NTL).
Analyzing agency	PTL	Pittsburgh Testing Laboratory (PTL), Salt Lake City, Utah.
Analyzing agency	REECo	Reynolds Electrical & Engineering Company (REECo).
Analyzing agency	RSN	Raytheon Services Nevada (RSN).
Analyzing agency	SNL	Sandia National Laboratories (SNL).
Analyzing agency	TT	Terra Tek, Inc. (TT), Salt Lake City, Utah, a Schlumberger company; sometimes referred to as TerraTek Research.
Analyzing agency	UI	University of Illinois (UI).
Analyzing agency	USACE	U.S. Army Corps of Engineers (USACE).
Analyzing agency	USGS	U.S. Geological Survey (USGS).
Data source	–	Agency that reported rock-property data.
Data source	Birdwell	Birdwell Division of Seismograph Service Corporation (SSC).
Data source	BN	Bechtel Nevada (BN).
Data source	CL	Core Laboratories, Inc. (CL), Bakersfield, California; Dallas, Texas.
Data source	DTRA	DOD, Defense Threat Reduction Agency (DTRA).
Data source	DRI	Desert Research Institute (DRI).
Data source	F&S	Fenix and Scisson, Inc. (F&S).
Data source	FSN	Fenix and Scisson of Nevada (FSN).
Data source	H&N	Holmes & Narver, Inc. (H&N).
Data source	LANL	Los Alamos National Laboratory (LANL).
Data source	LLNL	Lawrence Livermore National Laboratory (LLNL).
Data source	NSTec	National Security Technologies, LLC (NSTec).
Data source	NTL	Nevada Testing Laboratories, LTD. (NTL).
Data source	PTL	Pittsburgh Testing Laboratory (PTL), Salt Lake City, Utah.
Data source	REECo	Reynolds Electrical & Engineering Company (REECo).
Data source	RSN	Raytheon Services Nevada (RSN).
Data source	SNL	Sandia National Laboratories (SNL).
Data source	TT	Terra Tek, Inc. (TT), Salt Lake City, Utah, a Schlumberger company; sometimes referred to as TerraTek Research.
Data source	UI	University of Illinois (UI).
Data source	USACE	U.S. Army Corps of Engineers (USACE).
Data source	USGS	U.S. Geological Survey (USGS).

**Table C1.** Description of Rock-Property Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Record type or description	–	Record description and/or document type.
Record type or description	BN/PF	Bechtel Nevada (BN) Project Files (PF).
Record type or description	DTRA/PF	DOD, Defense Threat Reduction Agency (DTRA) Project Files (PF).
Record type or description	DRI/PF	Desert Research Institute (DRI) Project Files (PF).
Record type or description	F&S/PF	Fenix and Scisson, Inc. (F&S) Project Files (PF).
Record type or description	FSN/PF	Fenix and Scisson of Nevada (FSN) Project Files (PF).
Record type or description	H&N/MTL	Holmes & Narver, Inc. (H&N) Materials Testing Laboratory (MTL).
Record type or description	LANL/PF	Los Alamos National Laboratory (LANL) Project Files (PF); referred to as “Blue Folders.”
Record type or description	LLNL/PF	Lawrence Livermore National Laboratory (LLNL) Project Files (PF).
Record type or description	NSTec/PF	National Security Technologies, LLC. (NSTec) Project Files (PF).
Record type or description	REECO/ES	Reynolds Electrical & Engineering Company (REECO) Environmental Sciences (ES).
Record type or description	REECO/ML	Reynolds Electrical & Engineering Company (REECO) Medical Laboratory (ML).
Record type or description	REECO/PF	Reynolds Electrical & Engineering Company (REECO) Project Files (PF).
Record type or description	RSN/MTL	Raytheon Services Nevada (RSN) Materials Testing Laboratory (MTL).
Record type or description	RSN/PF	Raytheon Services Nevada (RSN) Project Files (PF).
Record type or description	SNL/PF	Sandia National Laboratories (SNL) Project Files (PF).
Record type or description	UI/TL	University of Illinois (UI) Talbot Laboratory (TL).
Record type or description	USACE/WES	U.S. Army Corps of Engineers (USACE) Waterways Experiment Station (WES), Vicksburg, Mississippi.
Record type or description	USGS/EGBL/PPR	U.S. Geological Survey (USGS) Engineering Geology Branch Laboratory (EGBL) Physical Properties Results (PPR).
Record type or description	USGS/PF	U.S. Geological Survey (USGS) Project Files (PF).
Report reference	–	Published report that contains rock-property data. A complete list of acronyms and abbreviations used in USGS and other reports is included in the usgs_rpt and nts_acr_abv worksheets in the nts_rck_pty spreadsheet ( <a href="#">appendix C</a> ). NOTE: [USGS Technical Letters are considered internal correspondence and are not available for public release unless the report has been assigned a USGS Open-File Report number. Technical Letters prepared under the USGS Hydrologic Resource Management Program (HRMP, formerly Hydrology/Radionuclide Migration Program) and assigned “blanket open-file status” are designated “USGS-474-number.” Technical Letters prepared under the USGS Yucca Mountain Program (YMP) and assigned “blanket open-file status” are designated “USGS-1543-number.” Furthermore, some reports prepared by the National Laboratories and the various DOE and DOD subcontractors also may be considered internal correspondence and not available for public release. Users interested in these reports must check with the source agency to determine availability].

**Table C1.** Description of Rock-Property Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Investigators	–	Authors and/or investigators.
Record location	–	Physical location of rock-property record.
Hole type	–	Type of vertical or horizontal drilling or excavation.
Hole type	Borehole	Vertical surface location; includes wells and vertical test holes.
Hole type	Crater	Vertical surface location.
Hole type	Drift	Horizontal underground location; includes tunnels and horizontal test holes.
Hole type	Outcrop	Surface location.
Hole type	Shaft	Vertical surface location.
Hole type	Surface	Surface location.
Hole type	Trench	Horizontal surface location.
Hole type	Unknown	Hole type not known.
Tunnel or drift construction station	–	Construction station at collar location (portal opening), for tunnels and drifts (i.e. - 9+17 is 917 ft; 10+72,195' is a 195 ft hole at the 1,072 ft station; etc.).
Construction station remarks	–	Remarks concerning the portal opening (collar location), for tunnels and drifts (i.e. - In U-12e.14 main drift; Alcove; Face; Invert; Lft Rib; Rt Rib; etc.).
Nevada SPCS Easting NAD27	–	Nevada state plane coordinates (SPCS), Easting, central zone, in feet; North American Datum of 1927 (NAD27).
Nevada SPCS Northing NAD27	–	Nevada state plane coordinates (SPCS), Northing, central zone, in feet; North American Datum of 1927 (NAD27).
Altitude at portal opening NGVD29 (ft)	–	Altitude at the collar location of the portal opening, for tunnels and drifts; in feet above mean sea level; National Geodetic Vertical Datum of 1929 (NGVD29).
Bearing from portal opening (degrees)	–	Bearing from the portal opening, for tunnels and drifts; in degrees, minutes, and seconds or decimal degrees (i.e. - S0720958W is South, 72 degrees, 9 minutes, 58 seconds West; N0325529E is North, 32 degrees, 55 minutes, 29 seconds East; N052.75W is North 52 and three-quarter degrees West; etc.)
Inclination from portal opening (degrees)	–	Inclination from the portal opening, for tunnels and drifts; in degrees, minutes, and seconds or decimal degrees (i.e. - 0045825 is a hole 4 degrees, 58 minutes, 25 seconds above horizontal; 2700000 is a vertical hole below horizontal; 0900000 is a vertical hole above horizontal; 0000000 and 1800000 are horizontal holes; 0150000 and 1650000 are holes 15 degrees up (above horizontal); 3150000 and 2250000 are holes 45 degrees down (below horizontal); 356.5 is a hole 3 and one-half degrees below horizontal; 170.25 is 9 and three-quarter degrees above horizontal; etc.). Inclinations are linked to bearings, so values near horizontal for holes bearing north or east would be added to zero for holes inclined above horizontal and subtracted from 360 for holes below horizontal; conversely, values near horizontal for holes bearing south or west would be subtracted from 180 for holes inclined above horizontal and added to 180 for holes below horizontal.
Altitude of land surface NGVD29 (ft)	–	Altitude of land surface within a reasonable proximity of the site; in feet above mean sea level; National Geodetic Vertical Datum of 1929 (NGVD29). This is an average of the surrounding ground-surface elevation. If the original surface has been altered, estimate the altitude based on nearby unaltered terrain.
Altitude method	–	Method used to determine altitude of land surface.
Altitude method	A	Altimeter.
Altitude method	D	Differentially-corrected Global Positioning System (DGPS).
Altitude method	G	Global Positioning System (GPS).
Altitude method	L	Level or other surveying method.
Altitude method	M	Interpolated from topographic map [report accuracy as $\pm$ one-half the contour interval (or supplementary contour interval) specified on the quadrangle].
Altitude method	N	Interpolated from digital elevation model (DEM).
Altitude method	R	Reported.

**Table C1.** Description of Rock-Property Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Altitude method	U	Unknown.
Altitude accuracy	–	Altitude accuracy; in feet (decimal values for accuracies less than 1 ft).
Altitude accuracy	U	Unknown.
Site completion date	–	Date hole construction completed.
Hole depth (ft)	–	Hole depth; in feet below land surface for boreholes and shafts; in feet from portal opening for tunnels and drifts.
Redbook hole number	–	Redbook hole numbers are currently assigned to new holes completed at the NTS by National Security Technologies, LLC (NSTec). Entries are listed in <b>bold</b> type where sites are located in areas other than the hole name implies.
Redbook hole number	–	Redbook hole numbers listed in the Raytheon Services Nevada (RSN) Nevada Test Site Drilling and Mining Summary (last updated 12-31-90) and previously in the Fenix and Scisson of Nevada NTS Drilling and Mining Summary (last updated 06-30-89; formerly Fenix and Scisson, Inc.) were assigned according to the type of hole drilled or mined, site location (NTS area), and sequence code for the consecutive order in which the hole was drilled, mined, or recompleted. Emplacement holes for nuclear weapons tests begin with the letter U, followed by a dash (-), NTS area number ( <a href="#">fig. 1</a> ), and sequence code (letters a-z, aa-az, ba-bz, ..., za-zz). Exploratory holes follow the same naming convention as emplacement holes, but begin with the letters UE. Holes that begin with the letter U but were drilled or mined specifically to provide data that could not be collected from an emplacement hole follow the emplacement hole naming convention, but are assigned incremental letters or numbers, or both following the sequence code. The suffix letters indicate: [#, satellite hole; CH, cable hole; Ex. or Expl., exploratory hole; HTH, hydrologic test hole; Inst., instrument hole; ITS, integrated test system; PPS, pre-postshot hole; PS, post-shot hole; RNM, radionuclide migration hole; RWMS, radioactive waste management site; and S, substitute hole]. There are numerous exceptions to the standard naming convention. The prefix letters indicate: [HTH, hydrologic test hole; J, Jackass Flat; and RNM, radionuclide migration]. Numbers and letters following the dash in the exceptions represent sequence of site drilling or mining, not NTS location. Hole type also is commonly listed after the hole designation. For example: [Access Shaft; Cable Hole; Expl. Hole; Instrument; LOS (Line Of Sight) Drift; Sidetrack; Reentry Mining; Tunnel; Vent Hole; and Zero Station].
Redbook hole number	–	USGS DOE project-related holes in Central Nevada follow a similar naming convention. However emplacement holes begin with the letters UC and exploratory holes begin with the letters UCE.
Redbook hole number	–	USGS Yucca Mountain Project (YMP) holes at the NTS follow the exploratory hole naming convention. Offsite YMP holes begin with the letters USW to indicate underground southern Nevada waste. The suffix letters indicate: [G, geologic hole; GA, geologic angle hole; GU, geologic unsaturated zone hole; H, hydrologic hole; MX, missile-experimental hole (drilled for U.S. Air Force [USAF] MX Missile-Siting Investigation); N, neutron hole; p, Paleozoic or pre-Tertiary hole; RF, repository facility hole; UZ, unsaturated zone hole; V, volcanic hole; VSE, vertical shelter exploratory hole (drilled for USAF MX Missile-Siting Investigation); and WT water table hole].
Redbook hole number	–	Environmental Restoration Program (ERP) holes at the NTS begin with the letters ER, followed by a dash, NTS area number ( <a href="#">fig. 1</a> ), a dash, and an incremental sequence number. The NTS area number is replaced by suffix letters for ERP holes located offsite. The suffix letters indicate: [EC, area at the USAF Nellis Air Force Base Range (NAFBR) where the holes were drilled; and OV, Oasis Valley].



**Table C1.** Description of Rock-Property Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Redbook hole number	–	LLNL Containment Program Data Base hole names are 10 characters in length. The first character identifies the site location of the hole: [U, Nevada Test Site; C, Central Nevada Test Site; A, Amchitka Test Site; and O, offsite hole]. The second and third characters identify either the right-justified Area number for an NTS hole, or the two-letter state abbreviation (U.S. Postal Service abbreviation) for an offsite hole: [U 2, NTS hole in Area 2; U20, NTS hole in Area 20; and ONV, offsite hole in Nevada]. The fourth character is reserved for specially defined areas at the NTS: [U 9I, NTS hole in Area 9, in the ITS area]. Characters 5-10 identify the hole complex or group of holes (of different types) related to the emplacement hole. This may include letters or numbers. For an NTS hole, the fifth and sixth characters are alphabetical descriptors and usually complete the common hole name for an emplacement hole: [U 2 c, NTS hole in Area 2; U 2 ca, NTS hole in Area 2, drilled after U 2 c; and U 2 cb, NTS hole in Area 2, drilled after U 2 ca]. For offsite holes, these characters will indicate county name, on a limited space basis: [ONV NYE, offsite hole in Nevada, Nye County; and OCO RBL, offsite hole in Colorado, Rio Blanco County]. These characters also may indicate project identifiers: [U 1 RNM, NTS hole in Area 1, Radionuclide Migration Program; and U 12 ER, NTS hole in Area 12, Environmental Restoration Program]. LLNL Containment Program Data Base hole types are: [A, access; B, rad chem; C, core; D, Waterways experiment Station (WES); E, exploratory; F, tunnel; G, auger, crack investigation; H, emplacement (H A or H B is a centerpunch emplacement hole); I, instrument; J, PINEX or LOS; K, escape; L, cable; M, hydrologic test hole; N, tracer and sample, foil recovery; O, tunnel dynamics; P, post test; Q, seismic, high explosive; R, re-entry (R-S is a reentry shaft); S, shaft (W/S is a whipstock hole); T, test hole (many types); U, post-test hole, in crater; V, vent; W, water supply; X, pre-post test; Y, abandoned; Z, waste storage; 1, rack assembly; 2, dump; 3, oil well; 4, gas well; 5, geothermal well; and ?, unknown hole type]. Multiple uses of a hole are indicated by consecutively adding hole type abbreviations in this field. If the hole is closely associated with another hole, or if it also is known by another name, this is indicated by /____. For example, the hole name: [U 2 bt HE/U2BU H] means that U 2 bt was initially an emplacement hole that became an exploratory hole. U 2 bt also is an exploratory hole for the nearby emplacement hole U 2 bu.
Former or other hole name	–	Former or other names utilized for holes.
NWIS agency code	USGS	USGS NWIS code to indicate the reporting agency. All sites currently populated in the rock-property database are assigned as USGS.
NWIS site identification number	–	USGS NWIS site identification number.
NWIS site identification number	–	Downstream order numbers are assigned for surface-water, on-stream, sites. The first two digits of the station number indicate the part or major drainage system formerly used for USGS Water-Supply Papers entitled “Surface Water Supply of the United States” and the remaining digits indicate the downstream order within the part. This site number is left-justified. Although downstream identification numbers have been converted to a variable length format, with up to 14 digits available, 8 digits are normally assigned.
NWIS site identification number	–	Numbering system for sites on open water bodies, off-channel sites, wells, springs, etc., is based on the grid system of latitude and longitude. Although this number is initially determined from the best known latitude/longitude location, plus a 2-digit sequence number for the number of sites located at those coordinates, it retains no locational relevance once the site is created in the database. The overall designation consists of 15 digits. The values of latitude and longitude are updated as better coordinates become available, and should always be used for locating sites or plotting locations.
Latitude NAD27	–	Latitude; in degrees, minutes, and seconds [two digits are available for decimal seconds]; North American Datum of 1927 (NAD27).
Longitude NAD27	–	Longitude; in degrees, minutes, and seconds [two digits are available for decimal seconds]; North American Datum of 1927 (NAD27).
Location method	–	Method used to determine latitude and longitude coordinates.
Location method	C	Calculated from land net.

**Table C1.** Description of Rock-Property Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Location method	D	Differentially-corrected Global Positioning System (DGPS).
Location method	G	Global positioning system (GPS), uncorrected [Standard Positioning Service (SPS) and Precise Positioning Service (PPS)].
Location method	L	Long-range navigation (Loran) system.
Location method	M	Interpolated from map.
Location method	N	Interpolated from digital map.
Location method	R	Reported.
Location method	S	Transit, theodolite, or other surveying method.
Location method	U	Unknown.
Location accuracy	–	Accuracy of latitude and longitude coordinates.
Location accuracy	H	Hundredth second.
Location accuracy	1	Tenth second.
Location accuracy	5	Half second.
Location accuracy	S	Second.
Location accuracy	R	Three seconds.
Location accuracy	F	Five seconds.
Location accuracy	T	Ten seconds.
Location accuracy	M	Minute.
Location accuracy	U	Unknown.
Decimal latitude NAD83	–	Latitude, in decimal degrees [automatically generated by the NWIS system software]; North American Datum of 1983 (NAD83).
Decimal longitude NAD83	–	Longitude, in decimal degrees [automatically generated by NWIS system software]; North American Datum of 1983 (NAD83).
UTM Easting NAD27 (meters)	–	Universal Transverse Mercator coordinates, Easting, zone 11, in meters; North American Datum of 1927 (NAD27).
UTM Northing NAD27 (meters)	–	Universal Transverse Mercator coordinates, Northing, zone 11, in meters; North American Datum of 1927 (NAD27).
Remarks	–	Pertinent remarks pertaining to the rock properties.
Date record last updated	–	Date of data entry (compiled into electronic format) is listed if a row of record has not been modified. The date of last (most recent) update is listed if a row of record has been modified. This date does not indicate which columns of data have been modified; only that records have been updated within a particular row. Dates are listed as yyyyymmdd (4-digit year; 2-digit month; 2-digit day).
URL address	–	Link to online website and database.

## Appendix D. Fracture-Characteristic Database, Nevada Test Site and Vicinity, Nye County, Nevada.

Fracture-characteristic data were compiled for nearly 500 holes drilled and mined at the NTS and vicinity. [Appendix D](#) data are available at URL: <http://pubs.usgs.gov/ds/2007/297/>.

**Table D1.** Description of Fracture-Characteristic Database column contents.

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
USGS NTS sort order	–	Emplacement and exploratory holes typically are displayed together. Many sites also have multiple completion intervals within the same hole. Therefore, a sort order number is assigned to all USGS sites associated with DOE and/or DOD projects in Nevada. This field is modified as new sites are added.
USGS NTS unique number	–	Spatial ( <i>X-Y</i> ) coordinates are unavailable at some locations. Therefore, USGS site identification numbers cannot be established in the USGS NWIS database Sitefile for these sites. Because NWIS site identification numbers cannot be assigned to all sites, it is necessary to assign a unique site number to all USGS sites associated with USGS DOE/DOD projects in Nevada. Although the unique numbers were initially assigned in the same order as the USGS NTS sort order, new sites are assigned the next available sequential number.
NTS area	–	NTS Administrative Area number (see <a href="#">fig. 1</a> ). Entries are listed in <b>bold</b> type where sites are located in areas other than the hole name implies. For example, USGS hole name <b>UE-14b</b> is actually located in NTS area <b>06</b> .
USGS hole name	–	USGS hole name designation. Entries are listed in <b>bold</b> type where sites are located in areas other than the hole name implies.
Fracture interval number	–	Sequence of fracture interval.
Fracture interval top (ft)	–	Top of fracture interval; in feet below land surface for boreholes and shafts; in feet from portal opening for tunnels and drifts.
Fracture interval bottom (ft)	–	Bottom of fracture interval; in feet below land surface for boreholes and shafts; in feet from portal opening for tunnels and drifts.
Fracture interval sequence number	–	Sequence of descriptions, when multiple descriptions are reported within a fracture interval.
Fracture description	–	Description of fracture characteristics.
Fracture frequency (fractures/ft)	–	Frequency of fractures; as fractures per foot.
Fracture orientation (degrees)	–	Orientation of fractures; as degrees from horizontal to vertical.
Fracture remarks	–	Pertinent comments concerning fracture descriptions.
Lithologic interval number	–	Sequence of lithologic interval adjacent to fracture interval.
Lithologic interval top (ft)	–	Top of lithologic unit adjacent to fracture interval; in feet below land surface for boreholes and shafts; in feet from portal opening for tunnels and drifts.
Lithologic interval bottom (ft)	–	Bottom of lithologic unit adjacent to fracture interval; in feet below land surface for boreholes and shafts; in feet from portal opening for tunnels and drifts.
Lithologic interval sequence number	–	Sequence of descriptions, when multiple descriptions are reported within a lithologic interval.
Sample or log type	–	Type of sample or log that lithologic description is based upon.
Sample or log type	Basket	–
Sample or log type	Bit	–
Sample or log type	Core	–

**Table D1.** Description of Fracture-Characteristic Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Sample or log type	Core and Cuttings	–
Sample or log type	Core and Geophysical log	–
Sample or log type	Core and Movie log	–
Sample or log type	Core and Sidewall	–
Sample or log type	Core, Sidewall, and Cuttings	–
Sample or log type	Cuttings	–
Sample or log type	Cuttings and Geophysical log	–
Sample or log type	Cuttings and Movie log	–
Sample or log type	Geophysical log	–
Sample or log type	Grab	–
Sample or log type	Movie log	–
Sample or log type	None	–
Sample or log type	Sidewall	–
Sample or log type	Sidewall and Cuttings	–
Sample or log type	Sidewall and Geophysical log	–
Sample or log type	Sidewall and Movie log	–
Sample or log type	Unknown	–
Lithologic description	–	Entire lithologic description verbatim. The intent is to offer the most comprehensive (usually the original) description available. Core and sidewall samples always take precedence over cuttings descriptions. Multiple descriptions exist for many holes. However, subsequent descriptions are abridged and important alteration and structural inferences are lost. Although stratigraphic units are frequently updated and lithologies are occasionally modified, original descriptions still take precedence because cuttings samples were interpreted with the aid of binocular microscopes and questionable core samples were interpreted from thin sections utilizing petrographic microscopes (and occasionally spectrographic analysis).
USGS NWIS geologic unit	–	Geologic unit or aquifer name code stored in the Ground-Water Information System (GWSI) subsystem of the USGS NWIS Ingress database. For example: [110VLFL - Quaternary valley fill; 121AMTK - Tertiary Ammonia Tanks Member; 121RRMS - Tertiary Rainier Mesa Member; 122PBR5 - Tertiary Paintbrush Tuff; 327ELEN - Pennsylvanian Eleana Formation; 331CNMN - Mississippian Chainman Shale; 344NEVD - Devonian Nevada Formation; 361EURK - Ordovician Eureka Quartzite; and 400SRLG - Precambrian Stirling Quartzite]. A complete list of codes is included in the nv_geo_unt worksheet in the nts_fct_chr spreadsheet ( <a href="#">appendix D</a> ).
USGS NWIS lithologic unit	–	Lithologic unit code stored in the GWSI database. For example: [ALVM - alluvium; CLAY - clay; DLMT - dolomite; GRVL - gravel; LMSN - limestone; QRTZ - quartzite; SAND - sand; SHLE - shale; and TUFF - tuff]. A complete list of codes is included in the lith_unt worksheet in the nts_fct_chr spreadsheet ( <a href="#">appendix D</a> ).

**Table D1.** Description of Fracture-Characteristic Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Lithologic remarks	–	Comments pertaining to lithologic-interval descriptions. Currently used mostly to house stratigraphic/lithologic references included with written descriptions; these data are utilized as an aid for populating the USGS NWIS geologic unit and USGS NWIS lithologic unit columns.
Data source	–	Agency that reported fracture-characteristic data.
Data source	AML	Analytical Materials Laboratory, 3463 State Street, #349, Santa Barbara, California.
Data source	BN	Bechtel Nevada (BN).
Data source	DTRA	DOD, Defense Threat Reduction Agency (DTRA).
Data source	F&S	Fenix and Scisson, Inc. (F&S).
Data source	FSN	Fenix and Scisson of Nevada (FSN).
Data source	IT Corp.	International Technology Corporation (IT Corp., purchased by Shaw Group, Inc.).
Data source	LANL	Los Alamos National Laboratory (LANL).
Data source	LLNL	Lawrence Livermore National Laboratory (LLNL).
Data source	NSTec	National Security Technologies, LLC (NSTec).
Data source	RSN	Raytheon Services Nevada (RSN).
Data source	SNJV	Stoller-Navarro Joint Venture (SNJV).
Data source	USGS	U.S. Geological Survey (USGS).
Record type or description	–	Record description and/or document type.
Record type or description	BN/PF	Bechtel Nevada (BN) Project Files (PF).
Record type or description	DTRA/PF	DOD, Defense Threat Reduction Agency (DTRA) Project Files (PF).
Record type or description	F&S/PF	Fenix and Scisson, Inc. (F&S) Project Files (PF).
Record type or description	FSN/PF	Fenix and Scisson of Nevada (FSN) Project Files (PF).
Record type or description	IT Corp./PF	International Technology Corporation (IT Corp.) Project Files (PF).
Record type or description	LANL/PF	Los Alamos National Laboratory (LANL) Project Files (PF); referred to as “Blue Folders.”
Record type or description	LLNL/PF	Lawrence Livermore National Laboratory (LLNL) Project Files (PF).
Record type or description	NSTec/PF	National Security Technologies, LLC. (NSTec) Project Files (PF).
Record type or description	RSN/PF	Raytheon Services Nevada (RSN) Project Files (PF).
Record type or description	SNJV/PF	Stoller-Navarro Joint Venture (SNJV) Project Files (PF).
Record type or description	USGS/PF	U.S. Geological Survey (USGS) Project Files (PF).
Report reference	–	Published report that contains fracture-characteristic data. A complete list of acronyms and abbreviations used in USGS and other reports is included in the usgs_rpt and nts_acr_abv worksheets in the nts_fct_chr spreadsheet ( <a href="#">appendix D</a> ). NOTE: [USGS Technical Letters are considered internal correspondence and are not available for public release unless the report has been assigned a USGS Open-File Report number. Technical Letters prepared under the USGS Hydrologic Resource Management Program (HRMP, formerly Hydrology/Radionuclide Migration Program) and assigned “blanket open-file status” are designated “USGS-474-number.” Technical Letters prepared under the USGS Yucca Mountain Program (YMP) and assigned “blanket open-file status” are designated “USGS-1543-number.” Furthermore, some reports prepared by the National Laboratories and the various DOE and DOD subcontractors also may be considered internal correspondence and not available for public release. Users interested in these reports must check with the source agency to determine availability].

**Table D1.** Description of Fracture-Characteristic Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Investigators	–	Authors and/or investigators.
Record location	–	Physical location of fracture-characteristic record.
Hole type	–	Type of vertical or horizontal drilling or excavation.
Hole type	Borehole	Vertical surface location; includes wells and vertical test holes.
Hole type	Crater	Vertical surface location.
Hole type	Drift	Horizontal underground location; includes tunnels and horizontal test holes.
Hole type	Outcrop	Surface location.
Hole type	Shaft	Vertical surface location.
Hole type	Surface	Surface location.
Hole type	Trench	Horizontal surface location.
Hole type	Unknown	Hole type not known.
Tunnel or drift construction station	–	Construction station at collar location (portal opening), for tunnels and drifts (i.e. - 9+17 is 917 ft; 10+72,195' is a 195 ft hole at the 1,072 ft station; etc.).
Construction station remarks	–	Remarks concerning the portal opening (collar location), for tunnels and drifts (i.e. - In U-12e.14 main drift; Alcove; Face; Invert; Lft Rib; Rt Rib; etc.).
Nevada SPCS Easting NAD27	–	Nevada state plane coordinates (SPCS), Easting, central zone, in feet; North American Datum of 1927 (NAD27).
Nevada SPCS Northing NAD27	–	Nevada state plane coordinates (SPCS), Northing, central zone, in feet; North American Datum of 1927 (NAD27).
Altitude at portal opening NGVD29 (ft)	–	Altitude at the collar location of the portal opening, for tunnels and drifts; in feet above mean sea level; National Geodetic Vertical Datum of 1929 (NGVD29).
Bearing from portal opening (degrees)	–	Bearing from the portal opening, for tunnels and drifts; in degrees, minutes, and seconds or decimal degrees (i.e. - S0720958W is South, 72 degrees, 9 minutes, 58 seconds West; N0325529E is North, 32 degrees, 55 minutes, 29 seconds East; N052.75W is North 52 and three-quarter degrees West; etc.)
Inclination from portal opening (degrees)	–	Inclination from the portal opening, for tunnels and drifts; in degrees, minutes, and seconds or decimal degrees (i.e. - 0045825 is a hole 4 degrees, 58 minutes, 25 seconds above horizontal; 2700000 is a vertical hole below horizontal; 0900000 is a vertical hole above horizontal; 0000000 and 1800000 are horizontal holes; 0150000 and 1650000 are holes 15 degrees up (above horizontal); 3150000 and 2250000 are holes 45 degrees down (below horizontal); 356.5 is a hole 3 and one-half degrees below horizontal; 170.25 is 9 and three-quarter degrees above horizontal; etc.). Inclinations are linked to bearings, so values near horizontal for holes bearing north or east would be added to zero for holes inclined above horizontal and subtracted from 360 for holes below horizontal; conversely, values near horizontal for holes bearing south or west would be subtracted from 180 for holes inclined above horizontal and added to 180 for holes below horizontal.
Altitude of land surface NGVD29 (ft)	–	Altitude of land surface within a reasonable proximity of the site; in feet above mean sea level; National Geodetic Vertical Datum of 1929 (NGVD29). This is an average of the surrounding ground-surface elevation. If the original surface has been altered, estimate the altitude based on nearby unaltered terrain.
Altitude method	–	Method used to determine altitude of land surface.
Altitude method	A	Altimeter.
Altitude method	D	Differentially corrected Global Positioning System (DGPS).
Altitude method	G	Global Positioning System (GPS).
Altitude method	L	Level or other surveying method.
Altitude method	M	Interpolated from topographic map [report accuracy as $\pm$ one-half the contour interval (or supplementary contour interval) specified on the quadrangle].
Altitude method	N	Interpolated from digital elevation model (DEM).
Altitude method	R	Reported.

**Table D1.** Description of Fracture-Characteristic Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Altitude method	U	Unknown.
Altitude accuracy	–	Altitude accuracy; in feet (decimal values for accuracies less than 1 ft).
Altitude accuracy	U	Unknown.
Site completion date	–	Date hole construction completed.
Hole depth (ft)	–	Hole depth; in feet below land surface for boreholes and shafts; in feet from portal opening for tunnels and drifts.
Redbook hole number	–	Redbook hole numbers are currently assigned to new holes completed at the NTS by National Security Technologies, LLC (NSTec). Entries are listed in <b>bold</b> type where sites are located in areas other than the hole name implies.
Redbook hole number	–	Redbook hole numbers listed in the Raytheon Services Nevada (RSN) Nevada Test Site Drilling and Mining Summary (last updated 12-31-90) and previously in the Fenix and Scisson of Nevada NTS Drilling and Mining Summary (last updated 06-30-89; formerly Fenix and Scisson, Inc.) were assigned according to the type of hole drilled or mined, site location (NTS area), and sequence code for the consecutive order in which the hole was drilled, mined, or recompleted. Emplacement holes for nuclear weapons tests begin with the letter U, followed by a dash (-), NTS area number ( <a href="#">fig. 1</a> ), and sequence code (letters a-z, aa-az, ba-bz, ..., za-zz). Exploratory holes follow the same naming convention as emplacement holes, but begin with the letters UE. Holes that begin with the letter U but were drilled or mined specifically to provide data that could not be collected from an emplacement hole follow the emplacement hole naming convention, but are assigned incremental letters or numbers, or both following the sequence code. The suffix letters indicate: [#, satellite hole; CH, cable hole; Ex. or Expl., exploratory hole; HTH, hydrologic test hole; Inst., instrument hole; ITS, integrated test system; PPS, pre-postshot hole; PS, post-shot hole; RNM, radionuclide migration hole; RWMS, radioactive waste management site; and S, substitute hole]. There are numerous exceptions to the standard naming convention. The prefix letters indicate: [HTH, hydrologic test hole; J, Jackass Flat; and RNM, radionuclide migration]. Numbers and letters following the dash in the exceptions represent sequence of site drilling or mining, not NTS location. Hole type also is commonly listed after the hole designation. For example: [Access Shaft; Cable Hole; Expl. Hole; Instrument; LOS (Line Of Sight) Drift; Sidetrack; Reentry Mining; Tunnel; Vent Hole; and Zero Station].
Redbook hole number	–	USGS DOE project-related holes in Central Nevada follow a similar naming convention. However, emplacement holes begin with the letters UC and exploratory holes begin with the letters UCE.
Redbook hole number	–	USGS Yucca Mountain Project (YMP) holes at the NTS follow the exploratory hole naming convention. Offsite YMP holes begin with the letters USW to indicate underground southern Nevada waste. The suffix letters indicate: [G, geologic hole; GA, geologic angle hole; GU, geologic unsaturated zone hole; H, hydrologic hole; MX, missile-experimental hole (drilled for U.S. Air Force [USAF] MX Missile-Siting Investigation); N, neutron hole; p, Paleozoic or pre-Tertiary hole; RF, repository facility hole; UZ, unsaturated zone hole; V, volcanic hole; VSE, vertical shelter exploratory hole (drilled for USAF MX Missile-Siting Investigation); and WT, water table hole].
Redbook hole number	–	Environmental Restoration Program (ERP) holes at the NTS begin with the letters ER, followed by a dash, NTS area number ( <a href="#">fig. 1</a> ), a dash, and an incremental sequence number. The NTS area number is replaced by suffix letters for ERP holes located offsite. The suffix letters indicate: [EC, area at the USAF Nellis Air Force Base Range (NAFBR) where the holes were drilled; and OV, Oasis Valley].

**Table D1.** Description of Fracture-Characteristic Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Redbook hole number	–	LLNL Containment Program Data Base hole names are 10 characters in length. The first character identifies the site location of the hole: [U, Nevada Test Site; C, Central Nevada Test Site; A, Amchitka Test Site; and O, offsite hole]. The second and third characters identify either the right-justified Area number for an NTS hole, or the two-letter state abbreviation (U.S. Postal Service abbreviation) for an offsite hole: [U 2, NTS hole in Area 2; U20, NTS hole in Area 20; and ONV, offsite hole in Nevada]. The fourth character is reserved for specially defined areas at the NTS: [U 9I, NTS hole in Area 9, in the ITS area]. Characters 5-10 identify the hole complex or group of holes (of different types) related to the emplacement hole. This may include letters or numbers. For an NTS hole, the fifth and sixth characters are alphabetical descriptors and usually complete the common hole name for an emplacement hole: [U 2 c, NTS hole in Area 2; U 2 ca, NTS hole in Area 2, drilled after U 2 c; and U 2 cb, NTS hole in Area 2, drilled after U 2 ca]. For offsite holes, these characters will indicate county name, on a limited space basis: [ONV NYE, offsite hole in Nevada, Nye County; and OCO RBL, offsite hole in Colorado, Rio Blanco County]. These characters also may indicate project identifiers: [U 1 RNM, NTS hole in Area 1, Radionuclide Migration Program; and U 12 ER, NTS hole in Area 12, Environmental Restoration Program]. LLNL Containment Program Data Base hole types are: [A, access; B, rad chem; C, core; D, Waterways experiment Station (WES); E, exploratory; F, tunnel; G, auger, crack investigation; H, emplacement (H A or H B is a centerpunch emplacement hole); I, instrument; J, PINEX or LOS; K, escape; L, cable; M, hydrologic test hole; N, tracer and sample, foil recovery; O, tunnel dynamics; P, post test; Q, seismic, high explosive; R, re-entry (R-S is a reentry shaft); S, shaft (W/S is a whipstock hole); T, test hole (many types); U, post-test hole, in crater; V, vent; W, water supply; X, pre-post test; Y, abandoned; Z, waste storage; 1, rack assembly; 2, dump; 3, oil well; 4, gas well; 5, geothermal well; and ?, unknown hole type]. Multiple uses of a hole are indicated by consecutively adding hole type abbreviations in this field. If the hole is closely associated with another hole, or if it also is known by another name, this is indicated by /____. For example, the hole name: [U 2 bt HE/U2BU H] means that U 2 bt was initially an emplacement hole that became an exploratory hole. U 2 bt also is an exploratory hole for the nearby emplacement hole U 2 bu.
Former or other hole name	–	Former or other names utilized for holes.
NWIS agency code	USGS	USGS NWIS code to indicate the reporting agency. All sites currently populated in the fracture-characteristic database are assigned as USGS.
NWIS site identification number	–	USGS NWIS site identification number.
NWIS site identification number	–	Downstream order numbers are assigned for surface-water, on-stream, sites. The first two digits of the station number indicate the part or major drainage system formerly used for USGS Water-Supply Papers entitled “Surface Water Supply of the United States” and the remaining digits indicate the downstream order within the part. This site number is left-justified. Although downstream identification numbers have been converted to a variable length format, with up to 14 digits available, 8 digits are normally assigned.
NWIS site identification number	–	Numbering system for sites on open water bodies, off-channel sites, wells, springs, etc., is based on the grid system of latitude and longitude. Although this number is initially determined from the best known latitude/longitude location, plus a 2-digit sequence number for the number of sites located at those coordinates, it retains no locational relevance once the site is created in the database. The overall designation consists of 15 digits. The values of latitude and longitude are updated as better coordinates become available, and should always be used for locating sites or plotting locations.
Latitude NAD27	–	Latitude; in degrees, minutes, and seconds [two digits are available for decimal seconds]; North American Datum of 1927 (NAD27).
Longitude NAD27	–	Longitude; in degrees, minutes, and seconds [two digits are available for decimal seconds]; North American Datum of 1927 (NAD27).



**Table D1.** Description of Fracture-Characteristic Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Location method	–	Method used to determine latitude and longitude coordinates.
Location method	C	Calculated from land net.
Location method	D	Differentially corrected Global Positioning System (DGPS).
Location method	G	Global positioning system (GPS), uncorrected [Standard Positioning Service (SPS) and Precise Positioning Service (PPS)].
Location method	L	Long-range navigation (Loran) system.
Location method	M	Interpolated from map.
Location method	N	Interpolated from digital map.
Location method	R	Reported.
Location method	S	Transit, theodolite, or other surveying method.
Location method	U	Unknown.
Location accuracy	--	Accuracy of latitude and longitude coordinates.
Location accuracy	H	Hundredth second.
Location accuracy	1	Tenth second.
Location accuracy	5	Half second.
Location accuracy	S	Second.
Location accuracy	R	Three seconds.
Location accuracy	F	Five seconds.
Location accuracy	T	Ten seconds.
Location accuracy	M	Minute.
Location accuracy	U	Unknown.
Decimal latitude NAD83	–	Latitude, in decimal degrees [automatically generated by the NWIS system software]; North American Datum of 1983 (NAD83).
Decimal longitude NAD83	–	Longitude, in decimal degrees [automatically generated by NWIS system software]; North American Datum of 1983 (NAD83).
UTM Easting NAD27 (meters)	–	Universal Transverse Mercator coordinates, Easting, zone 11, in meters; North American Datum of 1927 (NAD27).
UTM Northing NAD27 (meters)	–	Universal Transverse Mercator coordinates, Northing, zone 11, in meters; North American Datum of 1927 (NAD27).
Remarks	–	Pertinent remarks pertaining to the fracture characteristics.
Date record last updated	–	Date of data entry (compiled into electronic format) is listed if a row of record has not been modified. The date of last (most recent) update is listed if a row of record has been modified. This date does not indicate which columns of data have been modified; only that records have been updated within a particular row. Dates are listed as yyyyymmdd (4-digit year; 2-digit month; 2-digit day).
URL address	–	Link to online website and database.

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## Appendix E. Hydraulic-Property Database, Nevada Test Site and Vicinity, Nye County, Nevada

Hydraulic-property data were compiled for nearly 100 holes drilled and mined at the NTS and vicinity. [Appendix E](#) data are available at URL: <http://pubs.usgs.gov/ds/2007/297/>.

**Table E1.** Description of Hydraulic-Property Database column contents.

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
USGS NTS sort order	–	Emplacement and exploratory holes typically are displayed together. Many sites also have multiple completion intervals within the same hole. Therefore, a sort order number is assigned to all USGS sites associated with DOE and/or DOD projects in Nevada. This field is modified as new sites are added.
USGS NTS unique number	–	Spatial (X-Y) coordinates are unavailable at some locations. Therefore, USGS site identification numbers cannot be established in the USGS NWIS database Sitefile for these sites. Because NWIS site identification numbers cannot be assigned to all sites, it is necessary to assign a unique site number to all USGS sites associated with USGS DOE/DOD projects in Nevada. Although the unique numbers were initially assigned in the same order as the USGS NTS sort order, new sites are assigned the next available sequential number.
NTS area	–	NTS Administrative Area number (see <a href="#">fig. 1</a> ). Entries are listed in <b>bold</b> type where sites are located in areas other than the hole name implies. For example, USGS hole name <b>UE-10j</b> is actually located in NTS area <b>08</b> .
USGS hole name	–	USGS hole name designation. Entries are listed in <b>bold</b> type where sites are located in areas other than the hole name implies.
Test interval number	–	Sequence of tested interval.
Test interval top (ft)	–	Depth to top of tested interval; in feet below land surface for boreholes and shafts; in feet from portal opening for tunnels and drifts.
Test interval bottom (ft)	–	Depth to bottom of tested interval; in feet below land surface for boreholes and shafts; in feet from portal opening for tunnels and drifts.
Test interval sequence number	–	Sequence of tests, when multiple tests are reported within a test interval.
Hole test sequence number	–	Sequence of testing conducted at each specific borehole or drift, listed in ascending order by date and time.
Test number	–	Number or zone of test, as recorded on field sheets.
Test type	–	Typical testing types are: bailing, injection, pumping, and swabbing.
Test phase	–	Phases of testing are: initializing, injection, pumping, recovery, suspended, and swabbing.
Test run number	–	Cumulative number of swabbing runs or trips in the borehole.
Test duration	–	Length of test; as hours, minutes, and seconds.
Test remarks	–	Pertinent comments concerning test data.
Test rate or yield	–	Yield or rate of injection.
Test rate or yield units	–	The conversion factor [448.83117] is used to convert between gallons per minute (gpm) and cubic feet per second (cfs).
Test rate or yield remarks	–	Pertinent comments concerning rate or yield data.
Flowmeter reading	–	Totalizing flowmeter readings.
Flowmeter units	–	Normally gallons [(325,851 gallons = 1 acre-foot) and (gallons * 3.78533 = liters)].
Flowmeter remarks	–	Pertinent comments concerning flowmeter data.
Staff gauge reading	–	Depth to water in storage tank used for injection of water.
Staff gauge units	–	Normally feet [feet * 0.3048 = meters].

**Table E1.** Description of Hydraulic-Property Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Staff gauge remarks	–	Pertinent comments concerning staff gage data.
Test quantity	–	Total quantity withdrawn from or injected into the borehole.
Test quantity units	–	Normally gallons [(325,851 gallons = 1 acre-foot) and (gallons * 3.78533 = liters)].
Test quantity remarks	–	Pertinent comments concerning quantity data.
Calculated date/time	–	Calculated from data contained in the following Date, Time, and Elapsed or cumulative time fields.
Date	–	Calendar date, as century, year, month, and day.
Time	–	Clock time (24-hour -or- military), as hour and minute.
Elapsed or cumulative time	–	Elapsed or cumulative time, in minutes, since testing or recovery commenced.
Depth to water below measuring point	–	Depth-to-water measurement, in feet or meters below the measuring point [“-----” indicates time listed but no water level recorded or other activity performed].
Depth to water units	–	Normally meters [meters / 0.3048 = feet].
Depth to water remarks	–	Pertinent comments concerning depth-to-water data.
Airline gauge reading	–	Normally pounds per square inch.
Airline gauge units	–	Multiply psi * 2.31 to convert to feet of water.
Airline gauge remarks	–	Pertinent comments concerning airline data.
Static water level below measuring point	–	Static (undisturbed) water level.
Testing water level below measuring point	–	Maximum water level during testing.
Water level units	–	Normally feet [feet * 0.3048 = meters].
Water level remarks	–	Pertinent comments concerning water-level data.
Drawdown	–	Change in depth to water during testing.
Drawdown units	–	Normally meters [meters / 0.3048 = feet].
Drawdown remarks	–	Pertinent comments concerning drawdown data.
Packer type	–	Manufacturer or model name of straddle-packer tool.
Packer diameter	–	Uninflated diameter of packer unit.
Packer spacing	–	Distance between bottom of upper and top of lower packer.
Packer units	–	Normally inches and feet [feet * 0.3048 = meters].
Packer remarks	–	Pertinent comments concerning straddle-packer data.
Pump type	–	Manufacturer or model name of pump.
Pump intake depth	–	Depth to pump intake.
Pump units	–	Normally feet [feet * 0.3048 = meters].
Pump remarks	–	Pertinent comments concerning pump data.
Storage tank size	–	Dimensions of storage tank, as width × length × height.
Storage tank size units	–	Normally feet [feet * 0.3048 = meters].
Storage tank capacity	–	Volume of water storage tank will hold.
Storage tank capacity units	–	Normally gallons [(325,851 gallons = 1 acre-foot) and (gallons * 3.78533 = liters)].
Storage tank remarks	–	Pertinent comments concerning storage tank data.
Discharge line depth	–	Depth to bottom of discharge line.
Discharge line depth units	–	Normally feet [feet * 0.3048 = meters].
Discharge line size	–	Inside diameter (if available) of discharge line.
Discharge line size units	–	Normally inches [Divide by 12 and multiply by 0.3048 to obtain meters].
Discharge line reference	–	Note whether diameter is expressed as inside or outside dimensions.

**Table E1.** Description of Hydraulic-Property Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Discharge line capacity	–	Volume of water discharge line will transmit.
Discharge line capacity units	–	Normally listed as gallons per foot.
Discharge line remarks	–	Pertinent comments concerning discharge line data.
Specific capacity	–	Yield per unit of drawdown.
Specific capacity units	–	Normally expressed as gallons per minute per foot of drawdown.
Specific capacity remarks	–	Pertinent comments concerning specific capacity data.
Temperature water	–	Water temperature, as degrees.
Temperature initial water	–	Initial (pre-testing) water temperature, as degrees.
Temperature maximum water	–	Maximum water temperature, as degrees.
Temperature units	–	Normally Celsius [(Celsius * 1.8) + 32 = Fahrenheit].
Temperature remarks	–	Pertinent comments concerning temperature data.
Conductivity water	–	Specific conductance (reciprocal of resistivity) of the water.
Conductivity units	–	Reporting units are micromhos per centimeter [micromhos have been renamed to the numerically equivalent microsiemens].
Conductivity remarks	–	Pertinent comments concerning specific conductance data.
pH water	–	Hydrogen ion activity (concentration); expressed as the negative base-10 log of the hydrogen-ion activity, in moles per liter.
pH remarks	–	Pertinent comments concerning pH data.
Major producing zone(s)	–	Depth(s) to top and bottom of major a major producing zone(s).
Major producing zone lithology	–	Lithologic description or stratigraphic unit adjacent to major producing zone(s).
Major producing zone units	–	Normally feet [feet * 0.3048 = meters].
Major producing zone remarks	–	Pertinent comments concerning major producing zone data.
Reference point elevation NGVD29 (ft)	–	Elevation of reference (measuring) point, in feet above mean sea level; National Geodetic Vertical Datum of 1929 (NGVD29).
Reference point height	–	Height of reference (measuring) point, in feet above land surface.
Reference point description	–	Description of the reference (measuring) point.
Reference point units	–	Normally feet [feet * 0.3048 = meters].
Reference point remarks	–	Pertinent comments concerning measuring point data.
Data source	–	Agency that reported hydraulic-property data.
Data source	BN	Bechtel Nevada (BN).
Data source	DTRA	DOD, Defense Threat Reduction Agency (DTRA).
Data source	DRI	Desert Research Institute (DRI).
Data source	F&S	Fenix and Scisson, Inc. (F&S).
Data source	FSN	Fenix and Scisson of Nevada (FSN).
Data source	IT Corp.	International Technology Corporation (IT Corp., purchased by Shaw Group, Inc.).
Data source	LANL	Los Alamos National Laboratory (LANL).
Data source	LLNL	Lawrence Livermore National Laboratory (LLNL).
Data source	NSTec	National Security Technologies, LLC (NSTec).

**Table E1.** Description of Hydraulic-Property Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Data source	RSN	Raytheon Services Nevada (RSN).
Data source	SNJV	Stoller-Navarro Joint Venture (SNJV).
Data source	USGS	U.S. Geological Survey (USGS).
Record type or description	–	Record description and/or document type.
Record type or description	BN/PF	Bechtel Nevada (BN) Project Files (PF).
Record type or description	DTRA/PF	DOD, Defense Threat Reduction Agency (DTRA) Project Files (PF).
Record type or description	DRI/PF	Desert Research Institute (DRI) Project Files (PF).
Record type or description	F&S/PF	Fenix and Scisson, Inc. (F&S) Project Files (PF).
Record type or description	FSN/PF	Fenix and Scisson of Nevada (FSN) Project Files (PF).
Record type or description	IT Corp./PF	International Technology Corporation (IT Corp.) Project Files (PF).
Record type or description	LANL/PF	Los Alamos National Laboratory (LANL) Project Files (PF); referred to as “Blue Folders.”
Record type or description	LLNL/PF	Lawrence Livermore National Laboratory (LLNL) Project Files (PF).
Record type or description	NSTec/PF	National Security Technologies, LLC. (NSTec) Project Files (PF).
Record type or description	RSN/PF	Raytheon Services Nevada (RSN) Project Files (PF).
Record type or description	SNJV/PF	Stoller-Navarro Joint Venture (SNJV) Project Files (PF).
Record type or description	USGS/PF	U.S. Geological Survey (USGS) Project Files (PF).
Report reference	–	Published report that contains hydraulic-property data. A complete list of acronyms and abbreviations used in USGS and other reports is included in the usgs_rpt and nts_acr_abv worksheets in the nts_hyd_pty spreadsheet ( <a href="#">appendix E</a> ). NOTE: [USGS Technical Letters are considered internal correspondence and are not available for public release unless the report has been assigned a USGS Open-File Report number. Technical Letters prepared under the USGS Hydrologic Resource Management Program (HRMP, formerly Hydrology/Radionuclide Migration Program) and assigned “blanket open-file status” are designated “USGS-474-number.” Technical Letters prepared under the USGS Yucca Mountain Program (YMP) and assigned “blanket open-file status” are designated “USGS-1543-number.” Furthermore, some reports prepared by the National Laboratories and the various DOE and DOD subcontractors may also be considered internal correspondence and not available for public release. Users interested in these reports must check with the source agency to determine availability].
Investigators	–	Authors and/or investigators.
Record location	–	Physical location of hydraulic-property record.
Hole type	–	Type of vertical or horizontal drilling or excavation.
Hole type	Borehole	Vertical surface location; includes wells and vertical test holes.
Hole type	Crater	Vertical surface location.
Hole type	Drift	Horizontal underground location; includes tunnels and horizontal test holes.
Hole type	Outcrop	Surface location.
Hole type	Shaft	Vertical surface location.
Hole type	Surface	Surface location.

**Table E1.** Description of Hydraulic-Property Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Hole type	Trench	Horizontal surface location.
Hole type	Unknown	Hole type not known.
Tunnel or drift construction station	–	Construction station at collar location (portal opening), for tunnels and drifts (i.e. - 9+17 is 917 ft; 10+72,195' is a 195 ft hole at the 1,072 ft station; etc.).
Construction station remarks	–	Remarks concerning the portal opening (collar location), for tunnels and drifts (i.e. - In U-12e.14 main drift; Alcove; Face; Invert; Lft Rib; Rt Rib; etc.).
Nevada SPCS Easting NAD27	–	Nevada state plane coordinates (SPCS), Easting, central zone, in feet; North American Datum of 1927 (NAD27).
Nevada SPCS Northing NAD27	–	Nevada state plane coordinates (SPCS), Northing, central zone, in feet; North American Datum of 1927 (NAD27).
Altitude at portal opening NGVD29 (ft)	–	Altitude at the collar location of the portal opening, for tunnels and drifts; in feet above mean sea level; National Geodetic Vertical Datum of 1929 (NGVD29).
Bearing from portal opening (degrees)	–	Bearing from the portal opening, for tunnels and drifts; in degrees, minutes, and seconds or decimal degrees (i.e. - S0720958W is South, 72 degrees, 9 minutes, 58 seconds West; N0325529E is North, 32 degrees, 55 minutes, 29 seconds East; N052.75W is North 52 and three-quarter degrees West; etc.)
Inclination from portal opening (degrees)	–	Inclination from the portal opening, for tunnels and drifts; in degrees, minutes, and seconds or decimal degrees (i.e. - 0045825 is a hole 4 degrees, 58 minutes, 25 seconds above horizontal; 2700000 is a vertical hole below horizontal; 0900000 is a vertical hole above horizontal; 0000000 and 1800000 are horizontal holes; 0150000 and 1650000 are holes 15 degrees up (above horizontal); 3150000 and 2250000 are holes 45 degrees down (below horizontal); 356.5 is a hole 3 and one-half degrees below horizontal; 170.25 is 9 and three-quarter degrees above horizontal; etc.). Inclinations are linked to bearings, so values near horizontal for holes bearing north or east would be added to zero for holes inclined above horizontal and subtracted from 360 for holes below horizontal; conversely, values near horizontal for holes bearing south or west would be subtracted from 180 for holes inclined above horizontal and added to 180 for holes below horizontal.
Altitude of land surface NGVD29 (ft)	–	Altitude of land surface within a reasonable proximity of the site; in feet above mean sea level; National Geodetic Vertical Datum of 1929 (NGVD29). This is an average of the surrounding ground-surface elevation. If the original surface has been altered, estimate the altitude based on nearby unaltered terrain.
Altitude method	–	Method used to determine altitude of land surface.
Altitude method	A	Altimeter.
Altitude method	D	Differentially corrected Global Positioning System (DGPS).
Altitude method	G	Global Positioning System (GPS).
Altitude method	L	Level or other surveying method.
Altitude method	M	Interpolated from topographic map [report accuracy as $\pm$ one-half the contour interval (or supplementary contour interval) specified on the quadrangle].
Altitude method	N	Interpolated from digital elevation model (DEM).
Altitude method	R	Reported.
Altitude method	U	Unknown.
Altitude accuracy	–	Altitude accuracy; in feet (decimal values for accuracies less than 1 ft).
Altitude accuracy	U	Unknown.
Site completion date	–	Date hole construction completed.
Hole depth (ft)	–	Hole depth; in feet below land surface for boreholes and shafts; in feet from portal opening for tunnels and drifts.
Redbook hole number	–	Redbook hole numbers are currently assigned to new holes completed at the NTS by National Security Technologies, LLC (NSTec). Entries are listed in <b>bold</b> type where sites are located in areas other than the hole name implies.

**Table E1.** Description of Hydraulic-Property Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Redbook hole number	–	Redbook hole numbers listed in the Raytheon Services Nevada (RSN) Nevada Test Site Drilling and Mining Summary (last updated 12-31-90) and previously in the Fenix and Scisson of Nevada NTS Drilling and Mining Summary (last updated 06-30-89; formerly Fenix and Scisson, Inc.) were assigned according to the type of hole drilled or mined, site location (NTS area), and sequence code for the consecutive order in which the hole was drilled, mined, or recompleted. Emplacement holes for nuclear weapons tests begin with the letter U, followed by a dash (-), NTS area number ( <a href="#">fig. 1</a> ), and sequence code (letters a-z, aa-az, ba-bz, ..., za-zz). Exploratory holes follow the same naming convention as emplacement holes, but begin with the letters UE. Holes that begin with the letter U but were drilled or mined specifically to provide data that could not be collected from an emplacement hole follow the emplacement hole naming convention, but are assigned incremental letters or numbers, or both following the sequence code. The suffix letters indicate: [#, satellite hole; CH, cable hole; Ex. or Expl., exploratory hole; HTH, hydrologic test hole; Inst., instrument hole; ITS, integrated test system; PPS, pre-postshot hole; PS, post-shot hole; RNM, radionuclide migration hole; RWMS, radioactive waste management site; and S, substitute hole]. There are numerous exceptions to the standard naming convention. The prefix letters indicate: [HTH, hydrologic test hole; J, Jackass Flat; and RNM, radionuclide migration]. Numbers and letters following the dash in the exceptions represent sequence of site drilling or mining, not NTS location. Hole type also is commonly listed after the hole designation. For example: [Access Shaft; Cable Hole; Expl. Hole; Instrument; LOS (Line Of Sight) Drift; Sidetrack; Reentry Mining; Tunnel; Vent Hole; and Zero Station].
Redbook hole number	–	USGS DOE project-related holes in Central Nevada follow a similar naming convention. However emplacement holes begin with the letters UC and exploratory holes begin with the letters UCE.
Redbook hole number	–	USGS Yucca Mountain Project (YMP) holes at the NTS follow the exploratory hole naming convention. Offsite YMP holes begin with the letters USW to indicate underground southern Nevada waste. The suffix letters indicate: [G, geologic hole; GA, geologic angle hole; GU, geologic unsaturated zone hole; H, hydrologic hole; MX, missile-experimental hole (drilled for U.S. Air Force [USAF] MX Missile-Siting Investigation); N, neutron hole; p, Paleozoic or pre-Tertiary hole; RF, repository facility hole; UZ, unsaturated zone hole; V, volcanic hole; VSE, vertical shelter exploratory hole (drilled for USAF MX Missile-Siting Investigation); and WT, water table hole].
Redbook hole number	–	Environmental Restoration Program (ERP) holes at the NTS begin with the letters ER, followed by a dash, NTS area number ( <a href="#">fig. 1</a> ), a dash, and an incremental sequence number. The NTS area number is replaced by suffix letters for ERP holes located offsite. The suffix letters indicate: [EC, area at the USAF Nellis Air Force Base Range (NAFBR) where the holes were drilled; and OV, Oasis Valley].



**Table E1.** Description of Hydraulic-Property Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Redbook hole number	–	LLNL Containment Program Data Base hole names are 10 characters in length. The first character identifies the site location of the hole: [U, Nevada Test Site; C, Central Nevada Test Site; A, Amchitka Test Site; and O, offsite hole]. The second and third characters identify either the right-justified Area number for an NTS hole, or the two-letter state abbreviation (U.S. Postal Service abbreviation) for an offsite hole: [U 2, NTS hole in Area 2; U20, NTS hole in Area 20; and ONV, offsite hole in Nevada]. The fourth character is reserved for specially defined areas at the NTS: [U 9I, NTS hole in Area 9, in the ITS area]. Characters 5-10 identify the hole complex or group of holes (of different types) related to the emplacement hole. This may include letters or numbers. For an NTS hole, the fifth and sixth characters are alphabetical descriptors and usually complete the common hole name for an emplacement hole: [U 2 c, NTS hole in Area 2; U 2 ca, NTS hole in Area 2, drilled after U 2 c; and U 2 cb, NTS hole in Area 2, drilled after U 2 ca]. For offsite holes, these characters will indicate county name, on a limited space basis: [ONV NYE, offsite hole in Nevada, Nye County; and OCO RBL, offsite hole in Colorado, Rio Blanco County]. These characters may also indicate project identifiers: [U 1 RNM, NTS hole in Area 1, Radionuclide Migration Program; and U 12 ER, NTS hole in Area 12, Environmental Restoration Program]. LLNL Containment Program Data Base hole types are: [A, access; B, rad chem; C, core; D, Waterways experiment Station (WES); E, exploratory; F, tunnel; G, auger, crack investigation; H, emplacement (H A or H B is a centerpunch emplacement hole); I, instrument; J, PINEX or LOS; K, escape; L, cable; M, hydrologic test hole; N, tracer and sample, foil recovery; O, tunnel dynamics; P, post test; Q, seismic, high explosive; R, re-entry (R-S is a reentry shaft); S, shaft (W/S is a whipstock hole); T, test hole (many types); U, post-test hole, in crater; V, vent; W, water supply; X, pre-post test; Y, abandoned; Z, waste storage; 1, rack assembly; 2, dump; 3, oil well; 4, gas well; 5, geothermal well; and ?, unknown hole type]. Multiple uses of a hole are indicated by consecutively adding hole type abbreviations in this field. If the hole is closely associated with another hole, or if it also is known by another name, this is indicated by / _____. For example, the hole name: [U 2 bt HE/U2BU H] means that U 2 bt was initially an emplacement hole that became an exploratory hole. U 2 bt also is an exploratory hole for the nearby emplacement hole U 2 bu.
Former or other hole name	–	Former or other names utilized for holes.
NWIS agency code	USGS	USGS NWIS code to indicate the reporting agency. All sites currently populated in the hydraulic-property database are assigned as USGS.
NWIS site identification number	–	USGS NWIS site identification number.
NWIS site identification number	–	Downstream order numbers are assigned for surface-water, on-stream, sites. The first two digits of the station number indicate the part or major drainage system formerly used for USGS Water-Supply Papers entitled "Surface Water Supply of the United States" and the remaining digits indicate the downstream order within the part. This site number is left-justified. Although downstream identification numbers have been converted to a variable length format, with up to 14 digits available, 8 digits are normally assigned.
NWIS site identification number	–	Numbering system for sites on open water bodies, off-channel sites, wells, springs, etc., is based on the grid system of latitude and longitude. Although this number is initially determined from the best known latitude/longitude location, plus a 2-digit sequence number for the number of sites located at those coordinates, it retains no locational relevance once the site is created in the database. The overall designation consists of 15 digits. The values of latitude and longitude are updated as better coordinates become available, and should always be used for locating sites or plotting locations.
Latitude NAD27	–	Latitude; in degrees, minutes, and seconds [two digits are available for decimal seconds]; North American Datum of 1927 (NAD27).
Longitude NAD27	–	Longitude; in degrees, minutes, and seconds [two digits are available for decimal seconds]; North American Datum of 1927 (NAD27).
Location method	–	Method used to determine latitude and longitude coordinates.
Location method	C	Calculated from land net.

**Table E1.** Description of Hydraulic-Property Database column contents.—Continued

[**Abbreviations:** DOD, U.S. Department of Defense; DOE, U.S. Department of Energy; NTS, Nevada Test Site; NWIS, National Water Information System; USGS, U.S. Geological Survey; ft, foot; –, not applicable]

Column heading	Column code	Column explanation
Location method	D	Differentially corrected Global Positioning System (DGPS).
Location method	G	Global positioning system (GPS), uncorrected [Standard Positioning Service (SPS) and Precise Positioning Service (PPS)].
Location method	L	Long-range navigation (Loran) system.
Location method	M	Interpolated from map.
Location method	N	Interpolated from digital map.
Location method	R	Reported.
Location method	S	Transit, theodolite, or other surveying method.
Location method	U	Unknown.
Location accuracy	–	Accuracy of latitude and longitude coordinates.
Location accuracy	H	Hundredth second.
Location accuracy	1	Tenth second.
Location accuracy	5	Half second.
Location accuracy	S	Second.
Location accuracy	R	Three seconds.
Location accuracy	F	Five seconds.
Location accuracy	T	Ten seconds.
Location accuracy	M	Minute.
Location accuracy	U	Unknown.
Decimal latitude NAD83	–	Latitude, in decimal degrees [automatically generated by the NWIS system software]; North American Datum of 1983 (NAD83).
Decimal longitude NAD83	–	Longitude, in decimal degrees [automatically generated by NWIS system software]; North American Datum of 1983 (NAD83).
UTM Easting NAD27 (meters)	–	Universal Transverse Mercator coordinates, Easting, zone 11, in meters; North American Datum of 1927 (NAD27).
UTM Northing NAD27 (meters)	–	Universal Transverse Mercator coordinates, Northing, zone 11, in meters; North American Datum of 1927 (NAD27).
Remarks	–	Pertinent remarks pertaining to the hydraulic properties.
Date record last updated	–	Date of data entry (compiled into electronic format) is listed if a row of record has not been modified. The date of last (most recent) update is listed if a row of record has been modified. This date does not indicate which columns of data have been modified; only that records have been updated within a particular row. Dates are listed as yyymmdd (4-digit year; 2-digit month; 2-digit day).
URL address	–	Link to online website and database.

For more information contact:  
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