SAND2014-15693PE

Site Characterization of the Burn Site Groundwater Area of Concern

Sandia National Laboratories, New Mexico (SNL)

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LOCKHEED MARTIN

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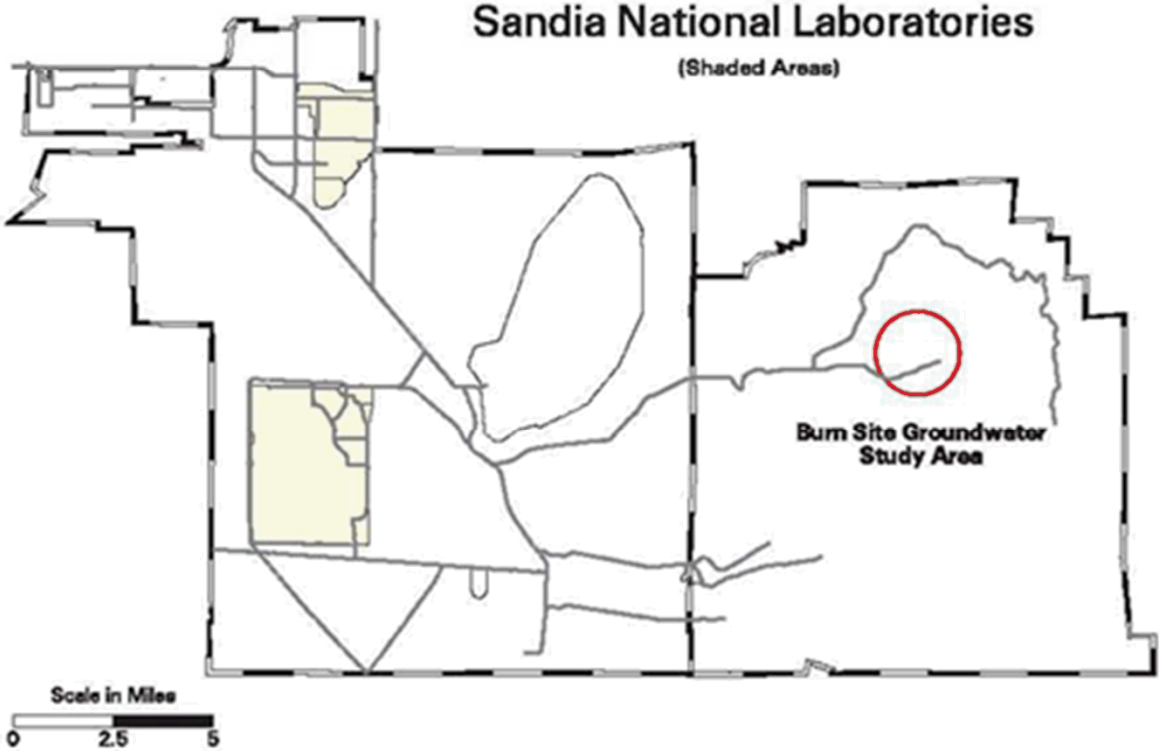
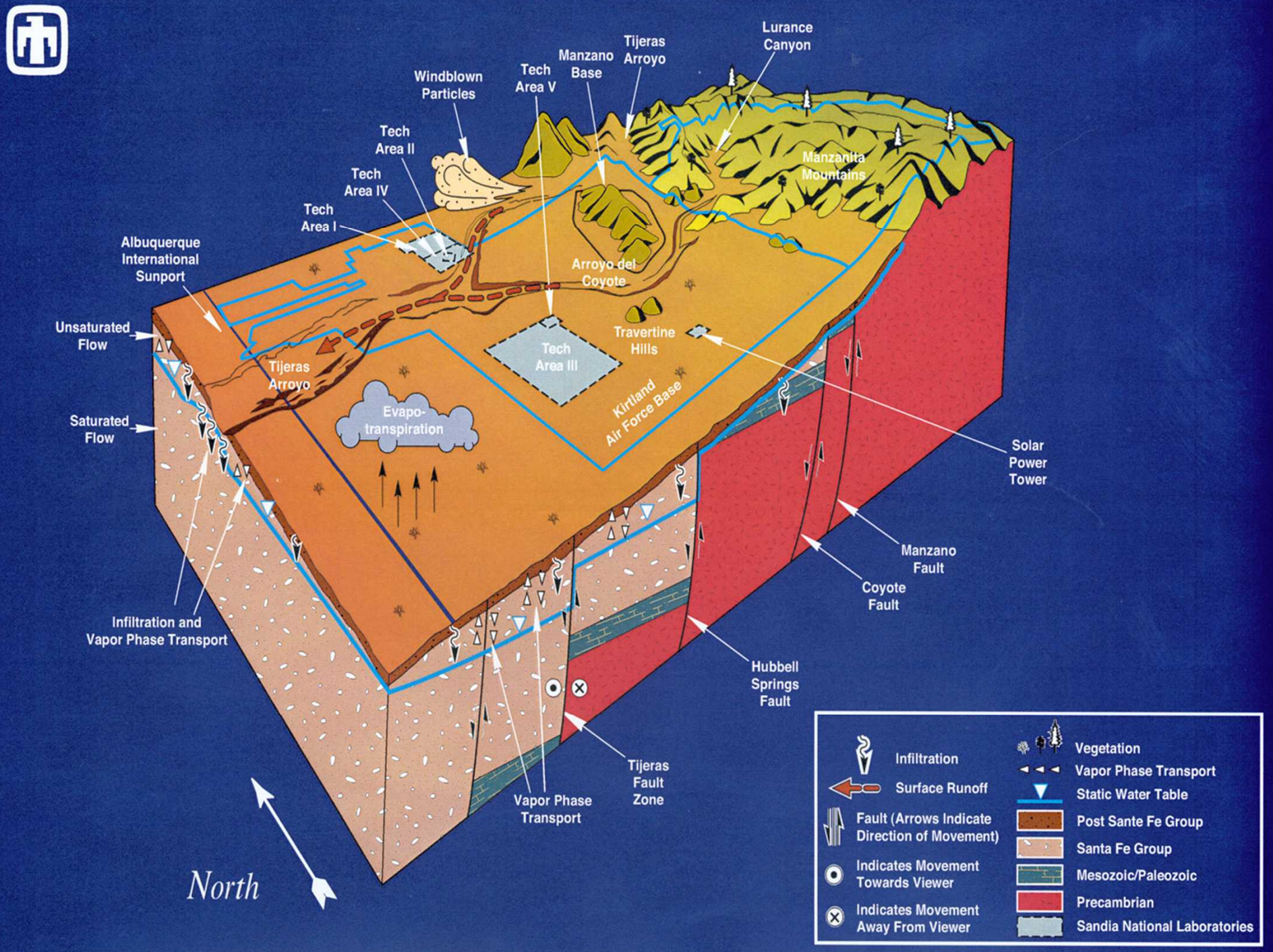
Bernalillo County, New Mexico
Albuquerque
Kirtland Air Force Base
Scale in Miles
0
6
12


Bernalillo County, New Mexico
Scale in Miles
0
70
140


Sandia National Laboratories
(Shaded Areas)
Burn Site Groundwater Study Area
Scale in Miles
0
2.5
5


Lurance Canyon
Tijeras Arroyo
Manzano Base
Tech Area V
Windblown Particles
Tech Area II
Tech Area IV
Tech Area I
Manzanita Mountains
Albuquerque International Sunport
Arroyo del Coyote
Unsaturated Flow
Travertine Hills
Tech Area III
Tijeras Arroyo
Kirtland Air Force Base
Evapo-transpiration
Saturated Flow
Solar Power Tower
Manzano Fault
Coyote Fault
Infiltration and Vapor Phase Transport
Hubbell Springs Fault
Tijeras Fault Zone
Vapor Phase Transport
North
Infiltration
Surface Runoff
Fault (Arrows Indicate Direction of Movement)
Indicates Movement Towards Viewer
Indicates Movement Away From Viewer
Vegetation
Vapor Phase Transport
Static Water Table
Post Sante Fe Group
Santa Fe Group
Mesozoic/Paleozoic
Precambrian
Sandia National Laboratories

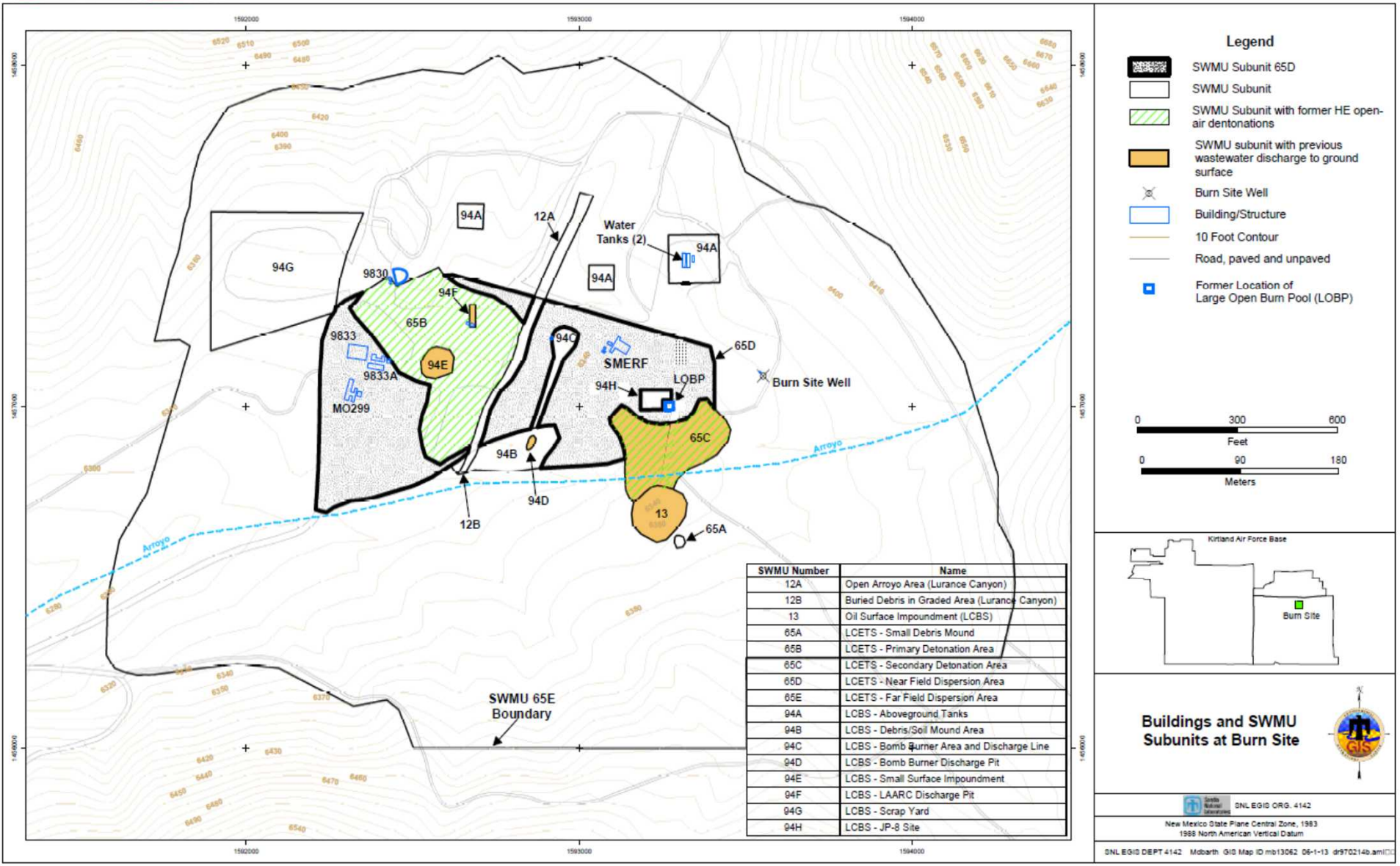
History of the Burn Site

- The Lurance Canyon Burn Site (SWMU 94) and Lurance Canyon Explosive Test Site (SWMU 65) have been used since 1967.
- Historical operations (1967 and 1975) included open detonation of HE compounds and the open burning of HE compounds, liquid propellants, and solid propellants.
- Burn testing began in the early 1970s and has continued to the present.
- Early burn testing was conducted in unlined pits excavated in native soil.

History of the Burn Site (continued)

- By 1975, portable, steel, burn pans were used for open burning, mostly using JP-4.
- The Light Air Transport Accident Resistant Container Unit was constructed in 1980, and other engineered burn units were constructed by 1983. These burn units used jet fuel, gasoline, and diesel for the burn tests.
- Most current research has involved testing the fire survivability of transportation containers, weapon components, simulated weapons, and satellite components.

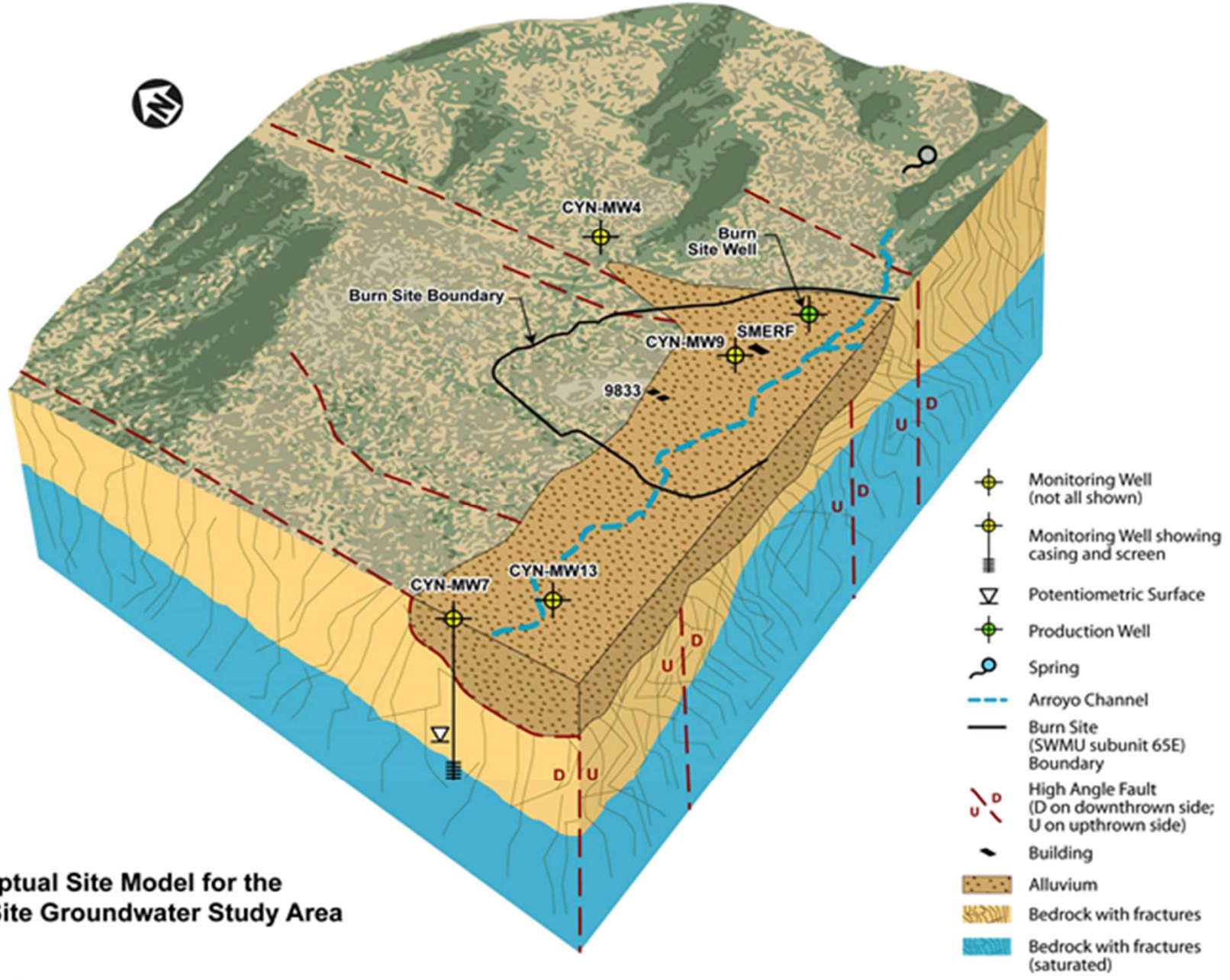
SWMUs



SWMU Number	Name
12A	Open Arroyo Area (Lurance Canyon)
12B	Buried Debris in Graded Area (Lurance Canyon)
13	Oil Surface Impoundment (LCBS)
65A	LCETS - Small Debris Mound
65B	LCETS - Primary Detonation Area
65C	LCETS - Secondary Detonation Area
65D	LCETS - Near Field Dispersion Area
65E	LCETS - Far Field Dispersion Area
94A	LCBS - Aboveground Tanks
94B	LCBS - Debris/Soil Mound Area
94C	LCBS - Bomb Burner Area and Discharge Line
94D	LCBS - Bomb Burner Discharge Pit
94E	LCBS - Small Surface Impoundment
94F	LCBS - LAARC Discharge Pit
94G	LCBS - Scrap Yard
94H	LCBS - JP-8 Site

Burn Site Groundwater AOC

- GW monitored since 1996
- GW occurs at ~125 to 380 ft deep in fractured bedrock
- Currently monitoring 10 wells
- Nitrates (6 wells) and perchlorate (1 well)
  - Nitrate: 0 to 37 ppm (std. = 10 ppm)
  - Perchlorate: 0 to 9 ppb (no std. established)
- Small plume 9 mi. away from drinking-water supplies
- Tentative source—suspected wide-spread non-point source from use of high explosives, with a possible contribution from natural nitrate sources



Conceptual Site Model for the Burn Site Groundwater Study Area

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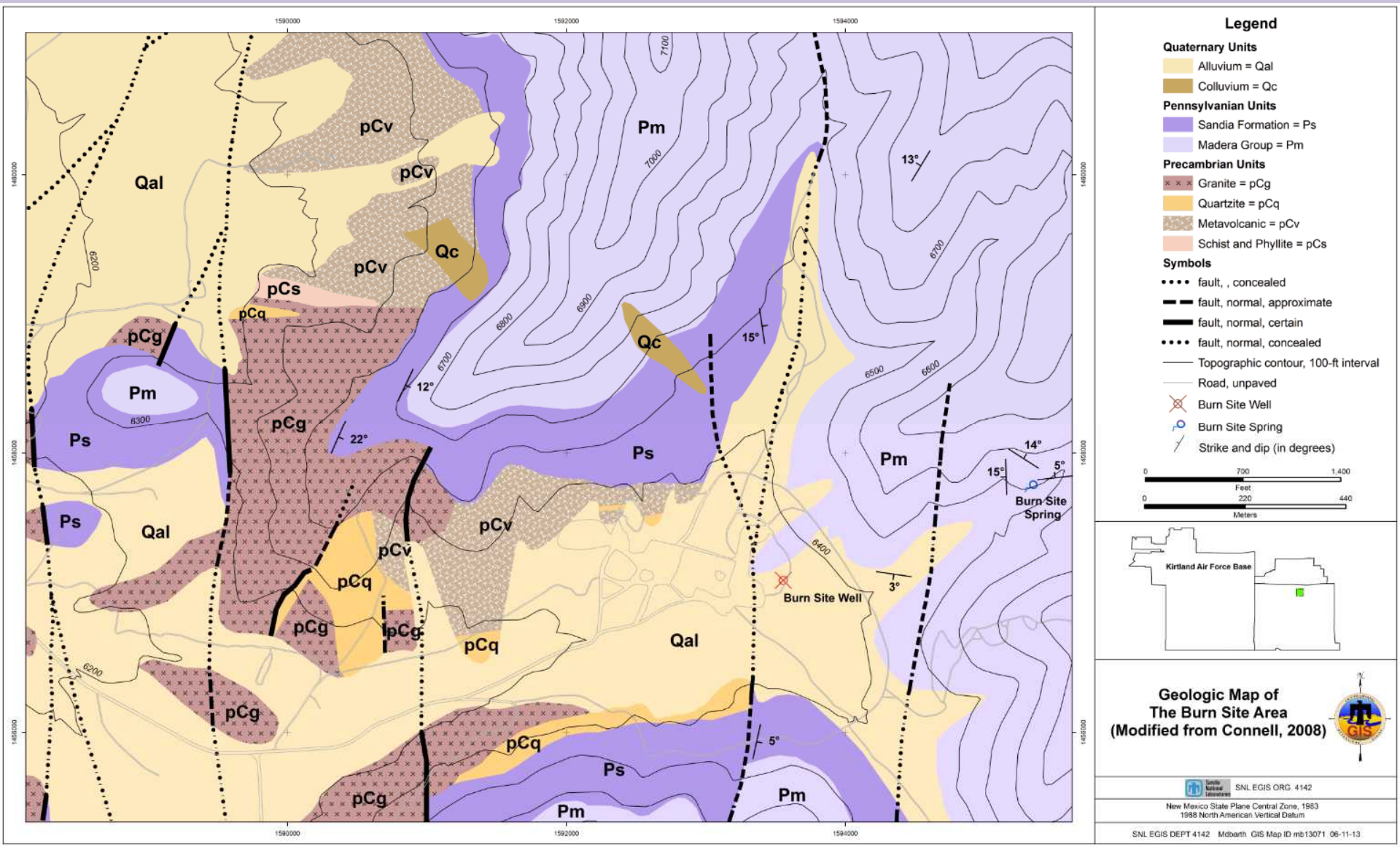
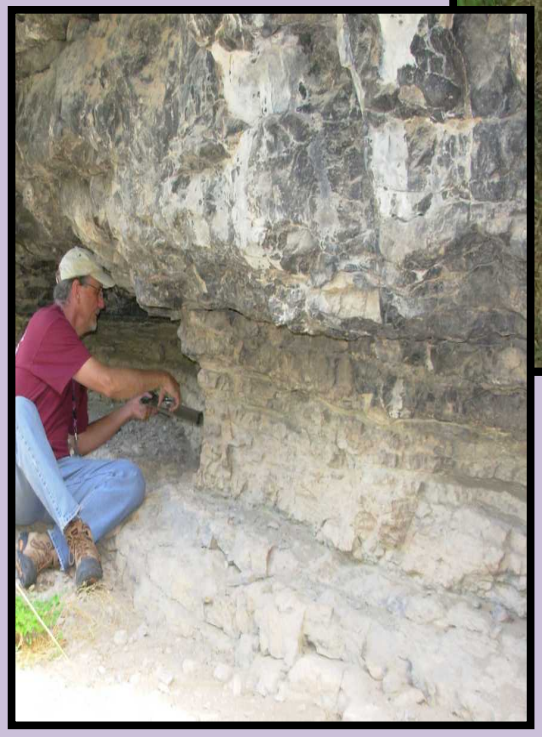
BSG AOC Geologic Map

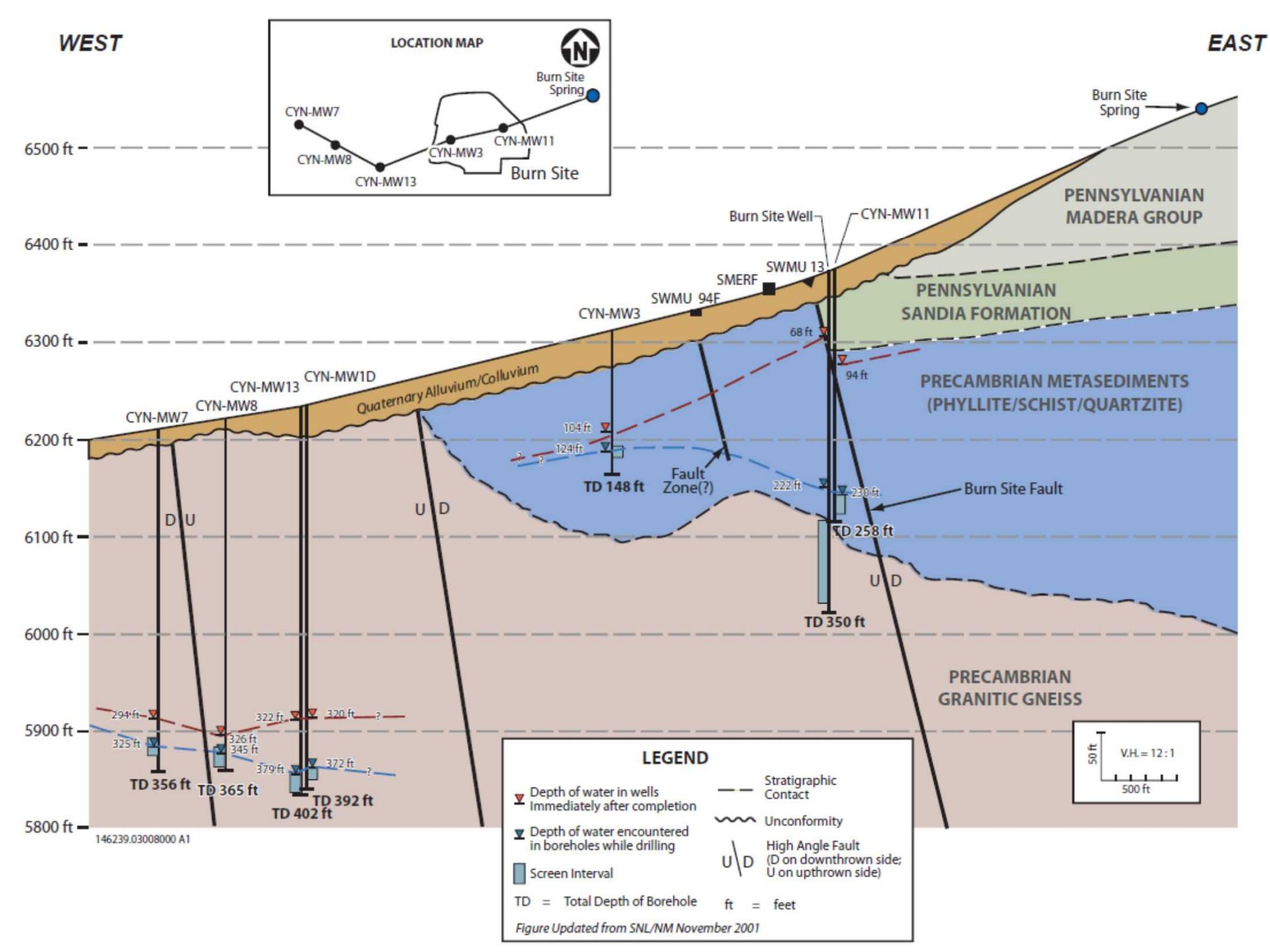


Pennsylvanian Sandia Formation

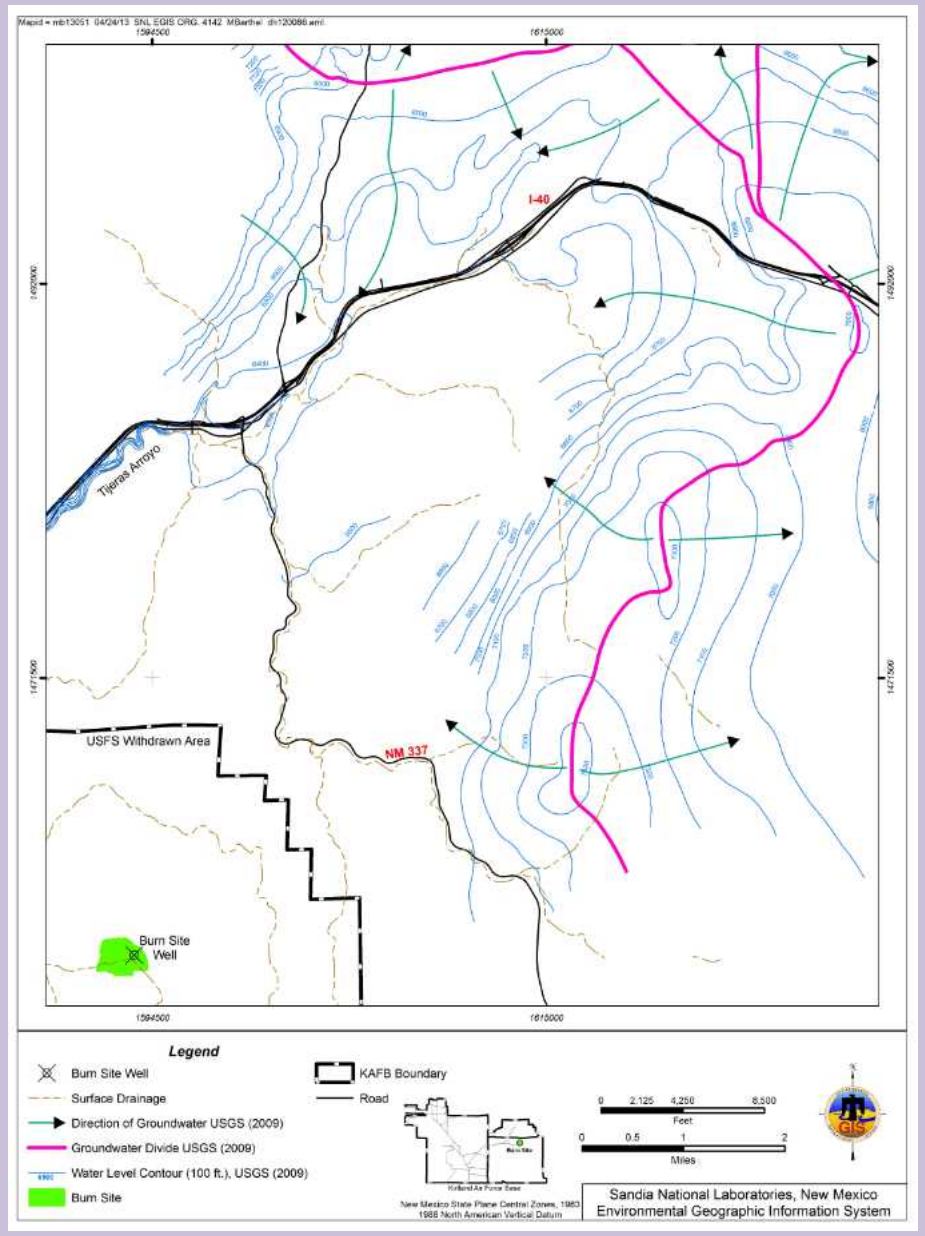
Pennsylvanian Madera Group

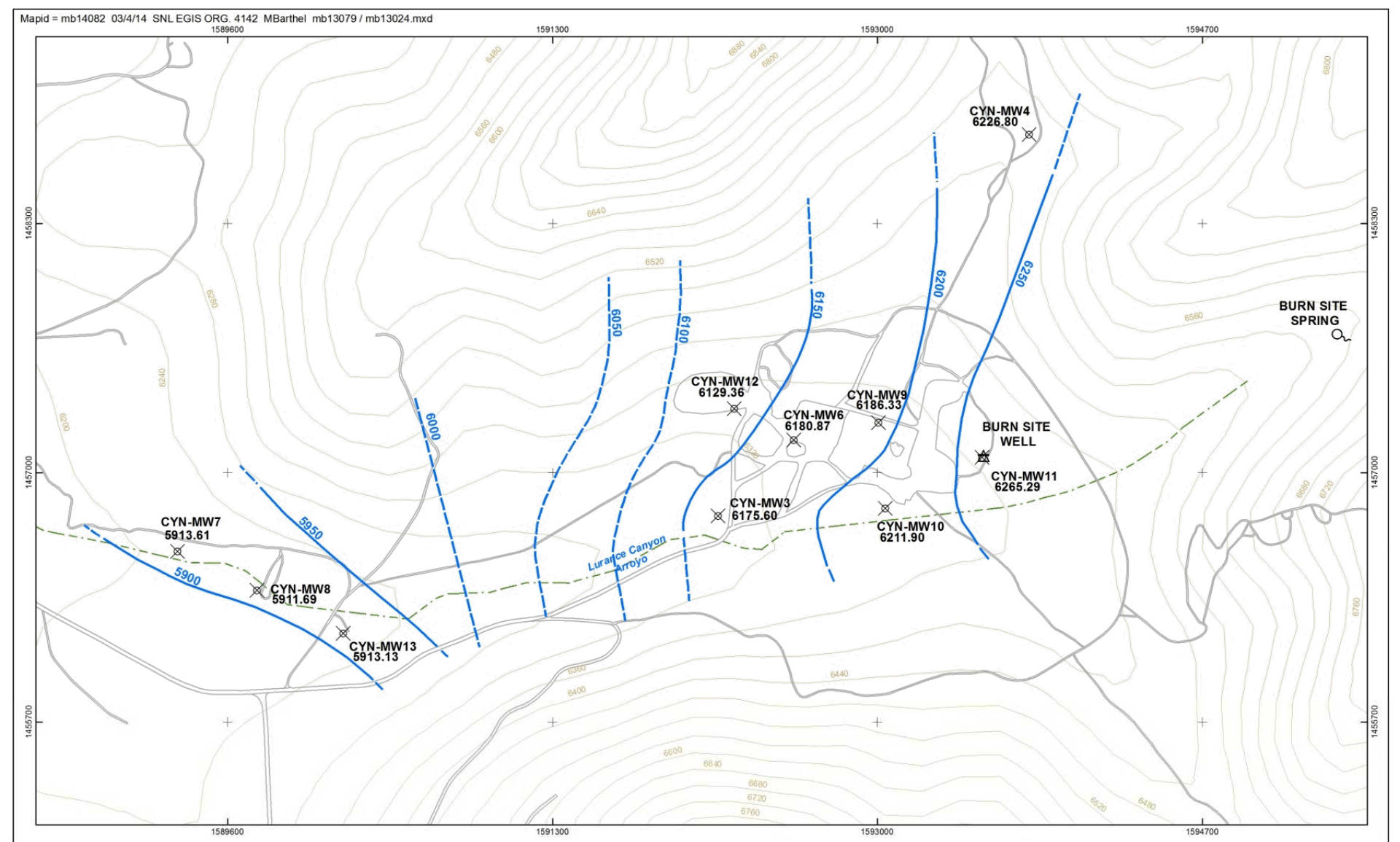


Burn Site
Spring


WEST
EAST
LOCATION MAP
N
Burn Site Spring
CYN-MW7
CYN-MW8
CYN-MW13
CYN-MW3
CYN-MW11
Burn Site
6500 ft
6400 ft
6300 ft
6200 ft
6100 ft
6000 ft
5900 ft
5800 ft
Burn Site Well
CYN-MW11
SWMU 13
SMERF
SWMU 94F
CYN-MW3
CYN-MW1D
CYN-MW13
CYN-MW8
CYN-MW7
Quaternary Alluvium/Colluvium
PENNSYLVANIAN MADERA GROUP
PENNSYLVANIAN SANDIA FORMATION
PRECAMBRIAN METASEDIMENTS (PHYLLITE/SCHIST/QUARTZITE)
PRECAMBRIAN GRANITIC GNEISS
68 ft
94 ft
104 ft
124 ft
TD 148 ft
Fault Zone(?)
222 ft
230 ft
Burn Site Fault
TD 258 ft
TD 350 ft
D U
U D
U D
294 ft
325 ft
326 ft
345 ft
322 ft
320 ft
379 ft
372 ft
TD 356 ft
TD 365 ft
TD 392 ft
TD 402 ft
LEGEND
Depth of water in wells Immediately after completion
Depth of water encountered in boreholes while drilling
Screen Interval
TD = Total Depth of Borehole
Stratigraphic Contact
Unconformity
U D High Angle Fault (D on downthrown side; U on upthrown side)
ft = feet
50 ft
V.H. = 12 : 1
500 ft
Figure Updated from SNL/NM November 2001
146239.03008000 A1

Regional Groundwater Potentiometric Surface





Legend

- Production well (non-potable)
- 6226.80 — Monitoring well, groundwater. (Groundwater elevation, feet amsl, October 2013, datum NAVD88).
- Potentiometric surface contour, feet amsl, dashed where inferred
- Road, unpaved Road
- Surface drainage, arroyo
- Ground surface contour, feet amsl

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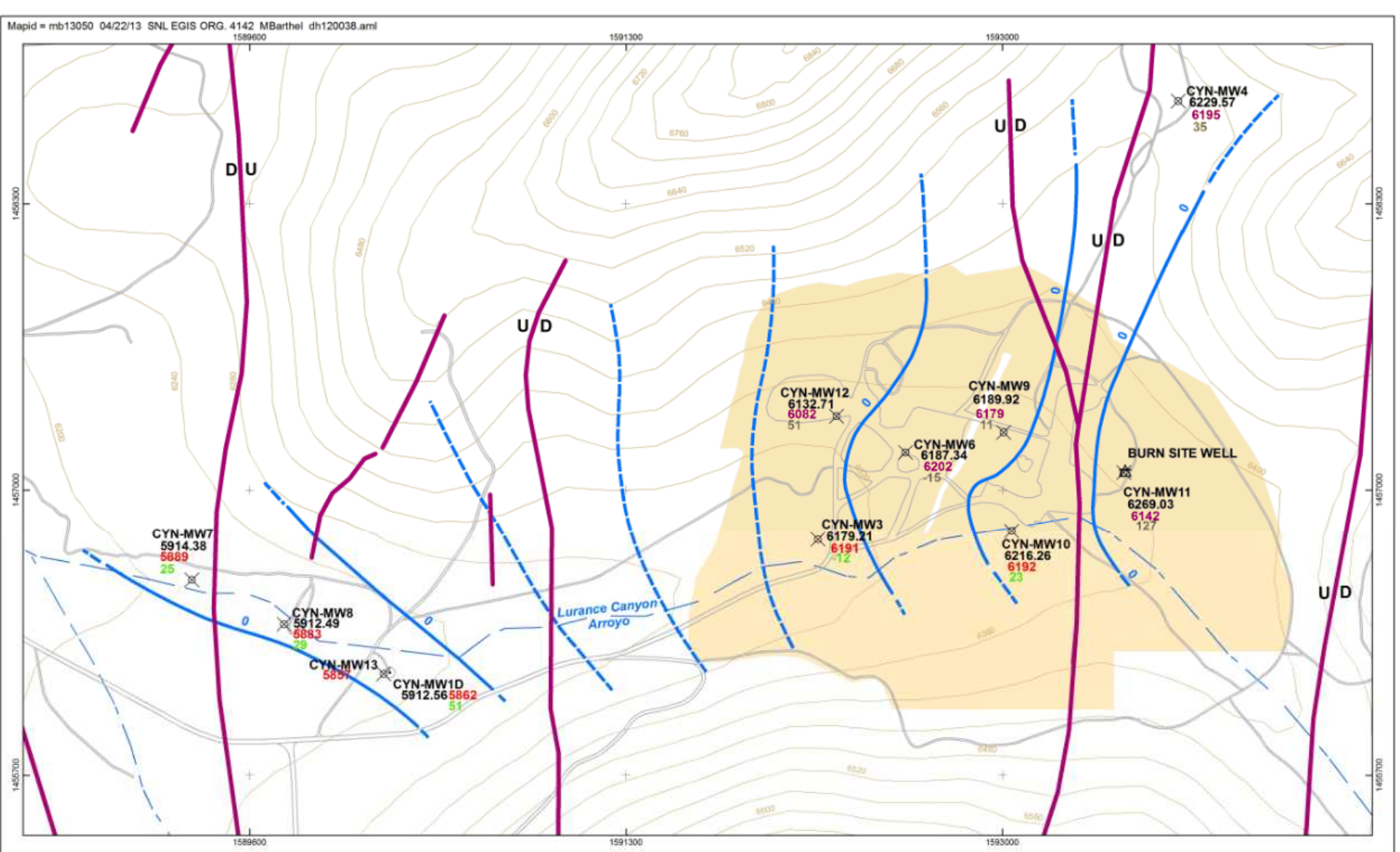
Environmental Geographic Information System

0 400 800 1,600
Feet

0 87.5 175 350
Meters

New Mexico State Plane Central Zone, 1983
1988 North American Vertical Datum



Legend

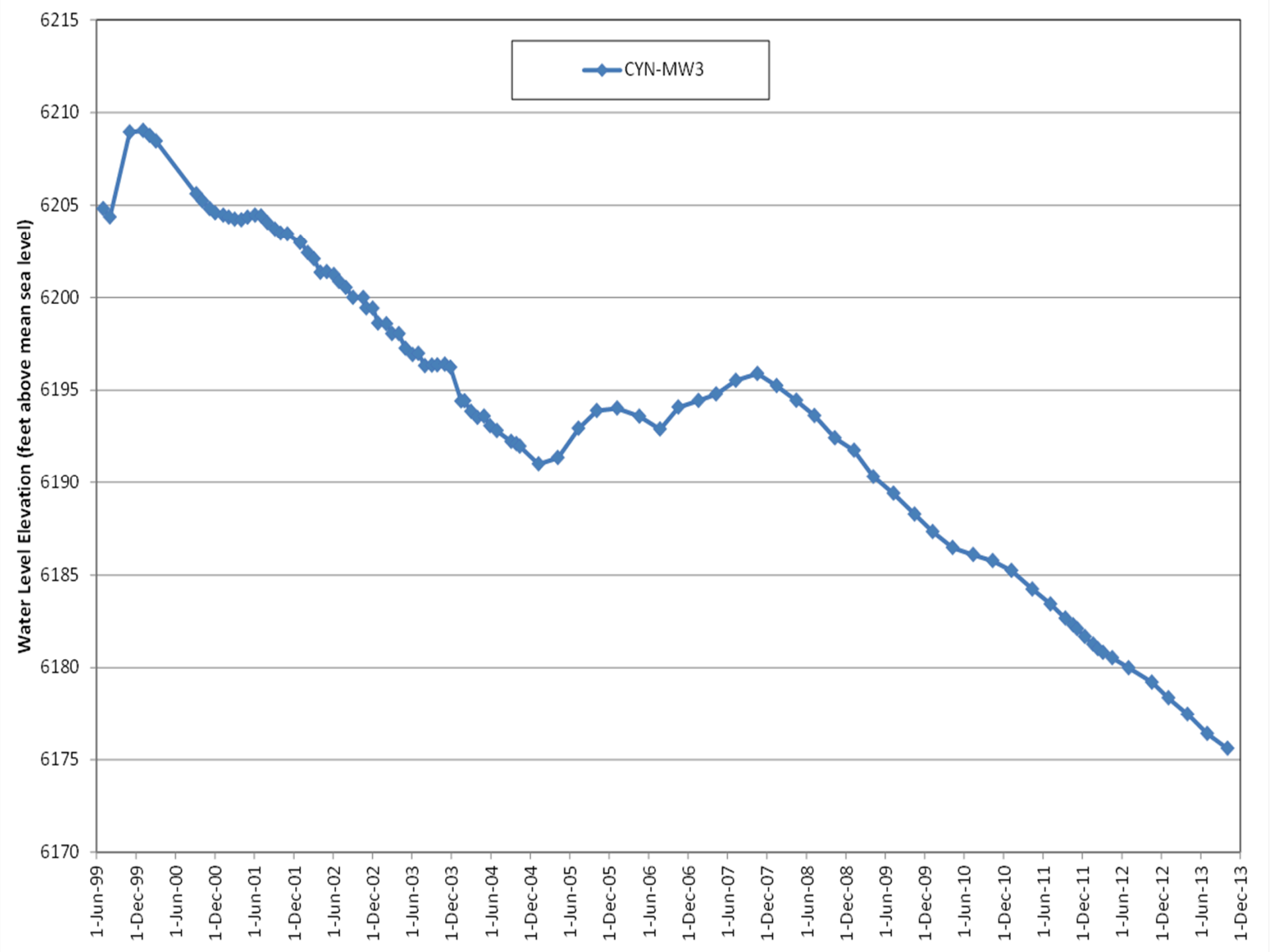
- Production well (non-potable)
- 6269.03 — Monitoring well, groundwater with groundwater elevation, feet amsl, October 2012 (datum NAVD88)
- CYN-MW1D, plugged and abandoned
- 6144 — Elevation (FT amsl) of first groundwater encountered while drilling.
- 51 — Pressure head, ft, October 2012
- U/D High-angle Normal fault (D on downthrown side, U on upthrown side). (Connell, 2008)
- Potentiometric surface contour, feet amsl, dashed where inferred
- Road, unpaved Road
- Surface drainage, arroyo
- Ground surface contour, feet amsl
- SWMU 65/94

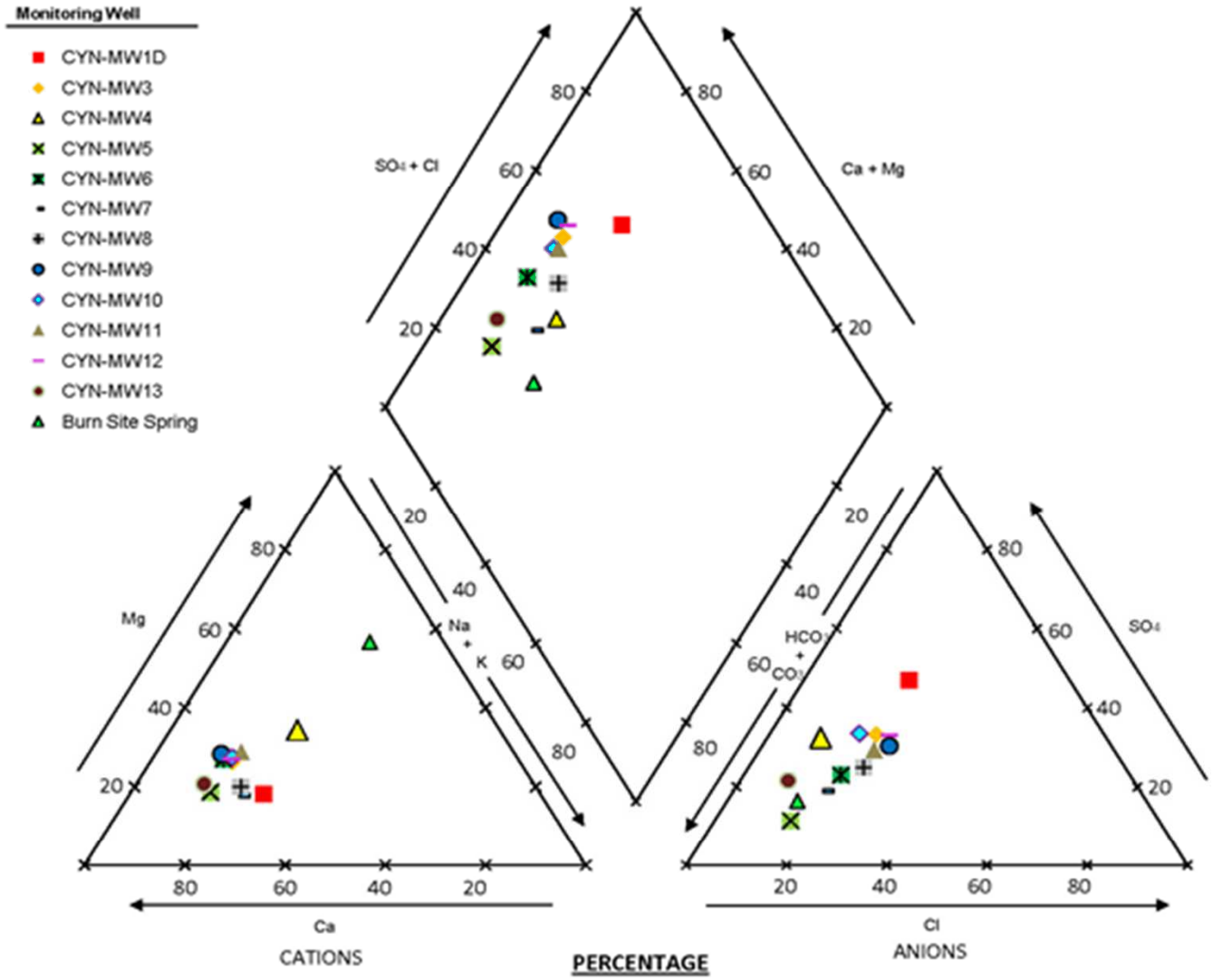
Sandia National Laboratories, New Mexico
Environmental Geographic Information System

0 250 500 1,000
Feet

0 75 150 300
Meters

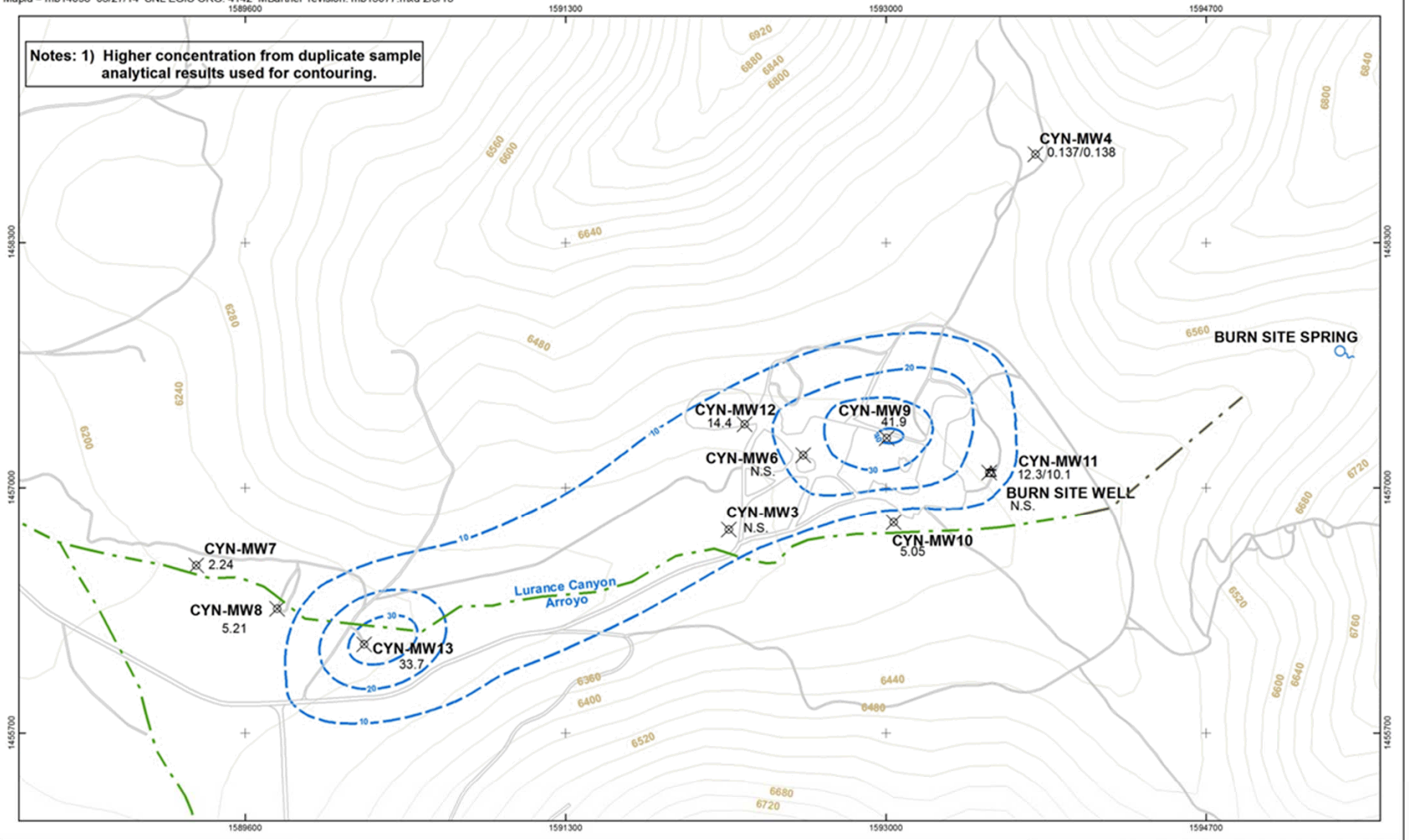
New Mexico State Plane Central Zone, 1983
1988 North American Vertical Datum


CYN-MW3
Water Level Elevation (feet above mean sea level)
6215
6210
6205
6200
6195
6190
6185
6180
6175
6170
1-Jun-99
1-Dec-99
1-Jun-00
1-Dec-00
1-Jun-01
1-Dec-01
1-Jun-02
1-Dec-02
1-Jun-03
1-Dec-03
1-Jun-04
1-Dec-04
1-Jun-05
1-Dec-05
1-Jun-06
1-Dec-06
1-Jun-07
1-Dec-07
1-Jun-08
1-Dec-08
1-Jun-09
1-Dec-09
1-Jun-10
1-Dec-10
1-Jun-11
1-Dec-11
1-Jun-12
1-Dec-12
1-Jun-13
1-Dec-13


Monitoring Well
CYN-MW1D
CYN-MW3
CYN-MW4
CYN-MW5
CYN-MW6
CYN-MW7
CYN-MW8
CYN-MW9
CYN-MW10
CYN-MW11
CYN-MW12
CYN-MW13
Burn Site Spring
SO4 + Cl
Ca + Mg
Mg
Na + K
HCO3 + CO3
SO4
Ca
Cl
CATIONS
ANIONS
PERCENTAGE

Mapid = mb14096 03/27/14 SNL EGIS ORG. 4142 MBarthel revision: mb13077.mxd 2/3/13

Notes: 1) Higher concentration from duplicate sample analytical results used for contouring.



Legend

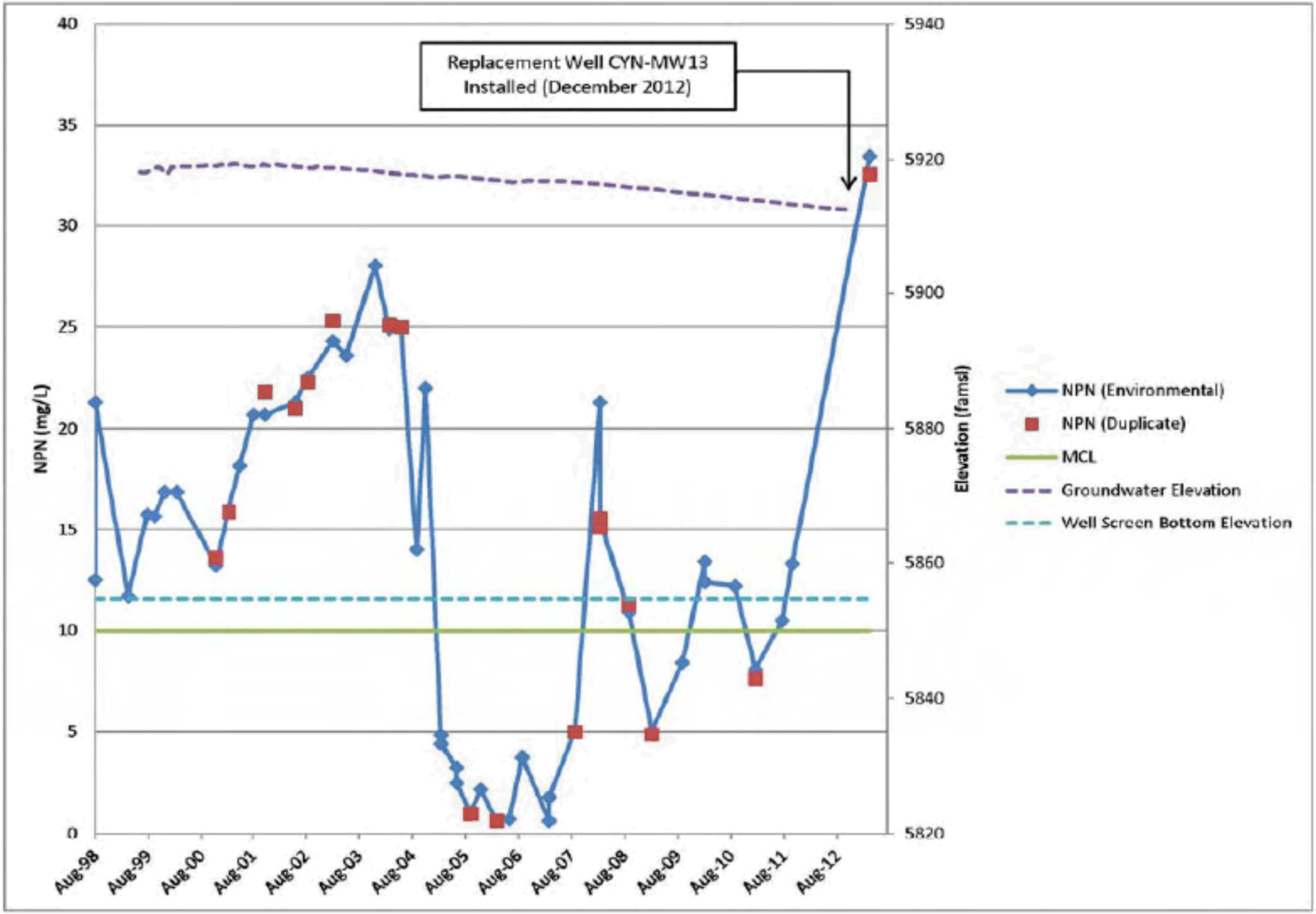
- Groundwater Monitoring Well, with December 2013 Nitrate plus Nitrite Concentrations (mg/L). N.S. denotes not sampled.
- Production Well (non-potable)
- Concentration Contour (mg/L) (dashed where inferred)
- Spring
- Unpaved Road
- Arroyo
- 40-ft. Contour

0 250 500 1,000
Feet

0 112.5 225 450
Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

New Mexico State Plane Central Zone, 1983
1988 North American Vertical Datum



Nitrate plus Nitrite Concentrations, CYN-MW1D and Replacement Well CYN-MW13

Summary

- BSG located in eastern/mountainous portion of KAFB
- Early 1960's -1992, liquid effluent released to vadose zone
- Regional aquifer in fractured bedrock at 125 to 380 ft bgs
- Regional aquifer contaminated with Nitrate at 3 to 4 times MCL
- Nearest drinking wells 9 miles away
- BSG permitted to DOE; on Air Force Base with strong institutional controls
- Updated CCM and CME Report due to NMED March 31, 2016