



U.S. Department of Energy/National Nuclear Security Administration and Sandia National Laboratories

- Semiannual public meeting
- Environmental restoration activities at Sandia National Laboratories
- Stormwater pollution control and monitoring activities at Sandia National Laboratories
- Information resources for environmental restoration activities at Sandia National Laboratories
 - New Mexico Environment Department Hazardous Waste Bureau
<https://www.env.nm.gov/hazardous-waste/sandia-national-laboratories/>
 - Sandia National Laboratories
<https://www.sandia.gov/about/environment/index.html>
https://www.sandia.gov/about/environment/environmental_management_system/index.html
- Questions? Send email to envinfo@sandia.gov

Environmental Restoration Activities at Sandia National Laboratories

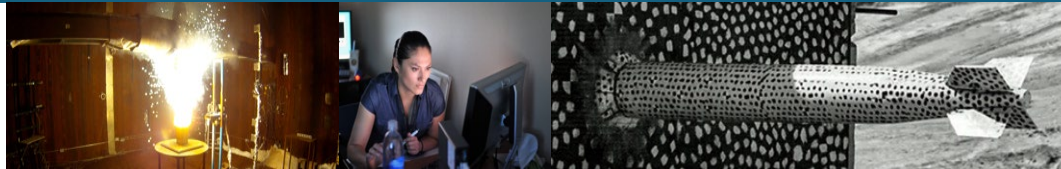


- Mission: Identify, characterize, and remediate sites where hazardous materials may have been released to the environment
- Current activities: Investigations at three groundwater areas of concern (AOCs)
 - Burn Site Groundwater AOC
 - Tijeras Arroyo Groundwater AOC
 - Technical Area-V Groundwater AOC
- The New Mexico Environment Department Hazardous Waste Bureau regulates the activities through the 2004 *Compliance Order on Consent*
- Drinking water standards serve as groundwater cleanup goals for human health and environmental protection
 - No drinking water wells are located in or near the contaminated groundwater
 - The contamination boundaries in each AOC are defined



Sandia National Laboratories

Middle Rio Grande (MRG) Municipal Separate Storm Sewer System (MS4) Permit



*Stormwater Quality Program
Environmental Compliance and Monitoring
October 27, 2023*



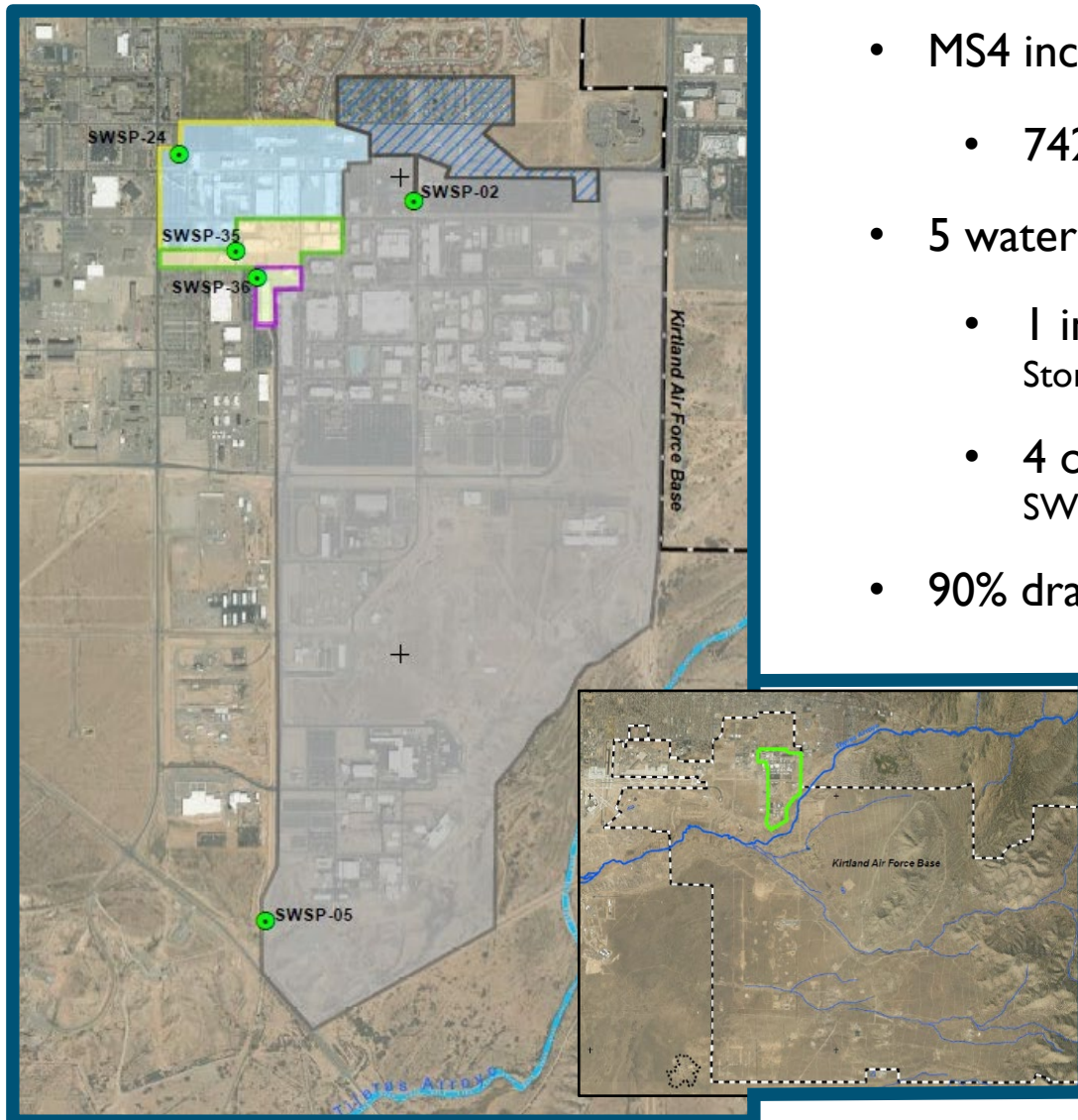
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SAND2023-10333PE



- Issued by the Environmental Protection Agency (EPA) in 2014
- Applies to all centralized storm drainage systems within the Albuquerque Urbanized Area
- Approximately 13 Permittees, including:
 - City of Albuquerque
 - Bernalillo County
 - Albuquerque Metropolitan Area Flood Control Authority (AMAFCA)
 - Kirtland Air Force Base
 - Sandia National Labs
- Permit requires development of Stormwater Management Program (SWMP), implementation of 7 control measure programs, water quality monitoring, and annual reporting
- All SNL submittals to EPA available to the public:
http://digitalrepository.unm.edu/snl_ms4/

SNL/NM MS4 Location and Water Quality Monitoring Stations



- MS4 includes all of TA-I, TA-II, and TA-IV
 - 742 acres (1.2 square miles)
- 5 water quality monitoring locations:
 - 1 inflow location
Stormwater Sampling Point (SWSP)-02
 - 4 outflow locations
SWSP-05, SWSP-24, SWSP-35, SWSP-36
- 90% drains south to Tijeras Arroyo
 - 10% drains west to KAFB



MS4 Stormwater Quality Monitoring to Date (2016-2022)

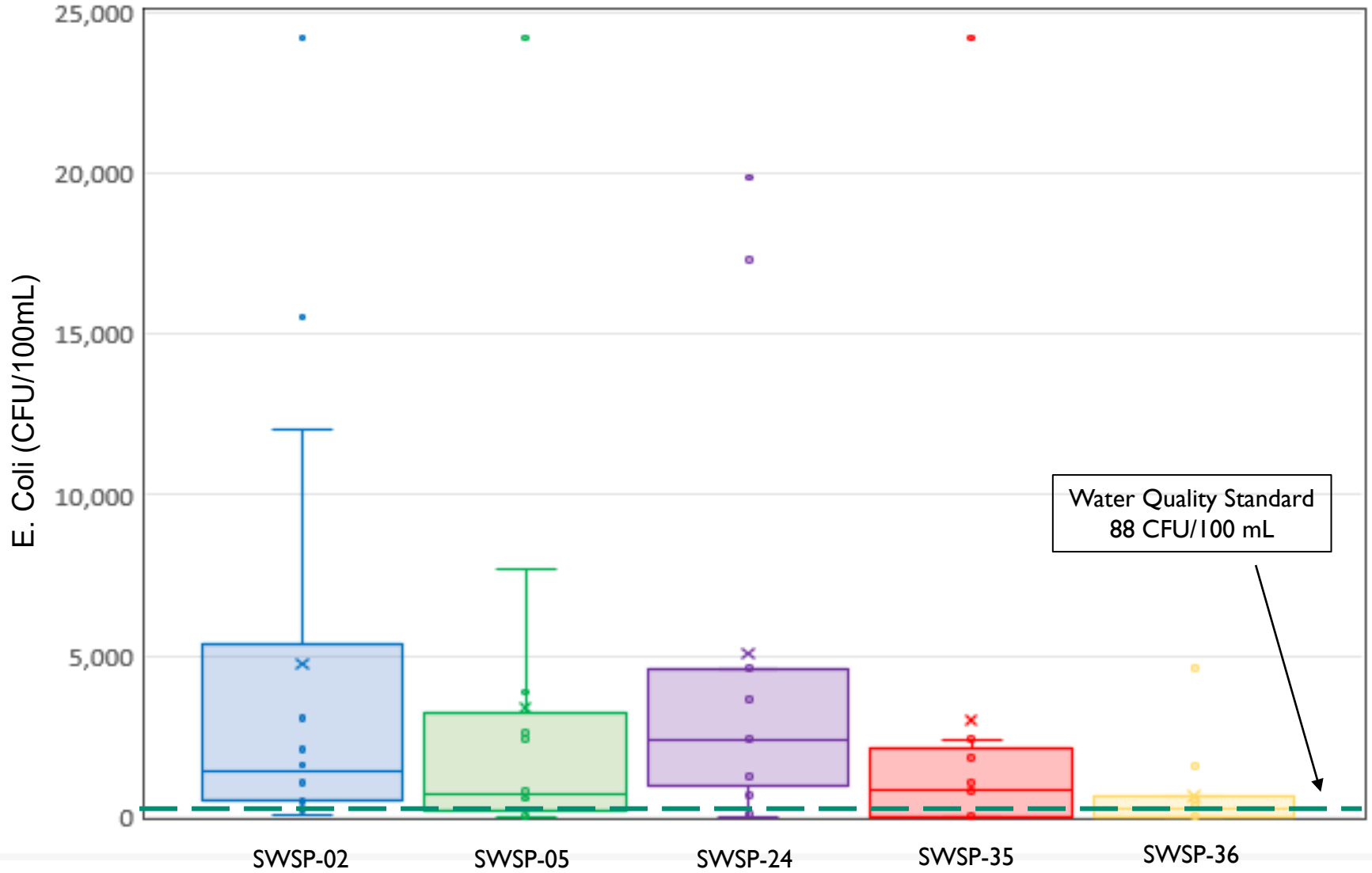


Constituent	# Samples	# Exceedances
pH	66	4
Temperature	66	0
Dissolved Oxygen	66	4
Specific Conductance	66	0
Gross Alpha	61	4
Biological Oxygen Demand	56	--
Chemical Oxygen Demand	58	--
Phosphorous (dissolved)	59	0
Phosphorous (total)	59	0
Oil and Grease	53	0
Total Kjeldahl Nitrogen	59	0
Nitrate plus Nitrite	55	0
Total Dissolved Solids	56	0
Total Suspended Solids	59	--
E. coli	68	46
PCBs	60	60

-- No Water Quality Standard established for this constituent.

MS4 E. Coli Samples by Location (2016-2023)

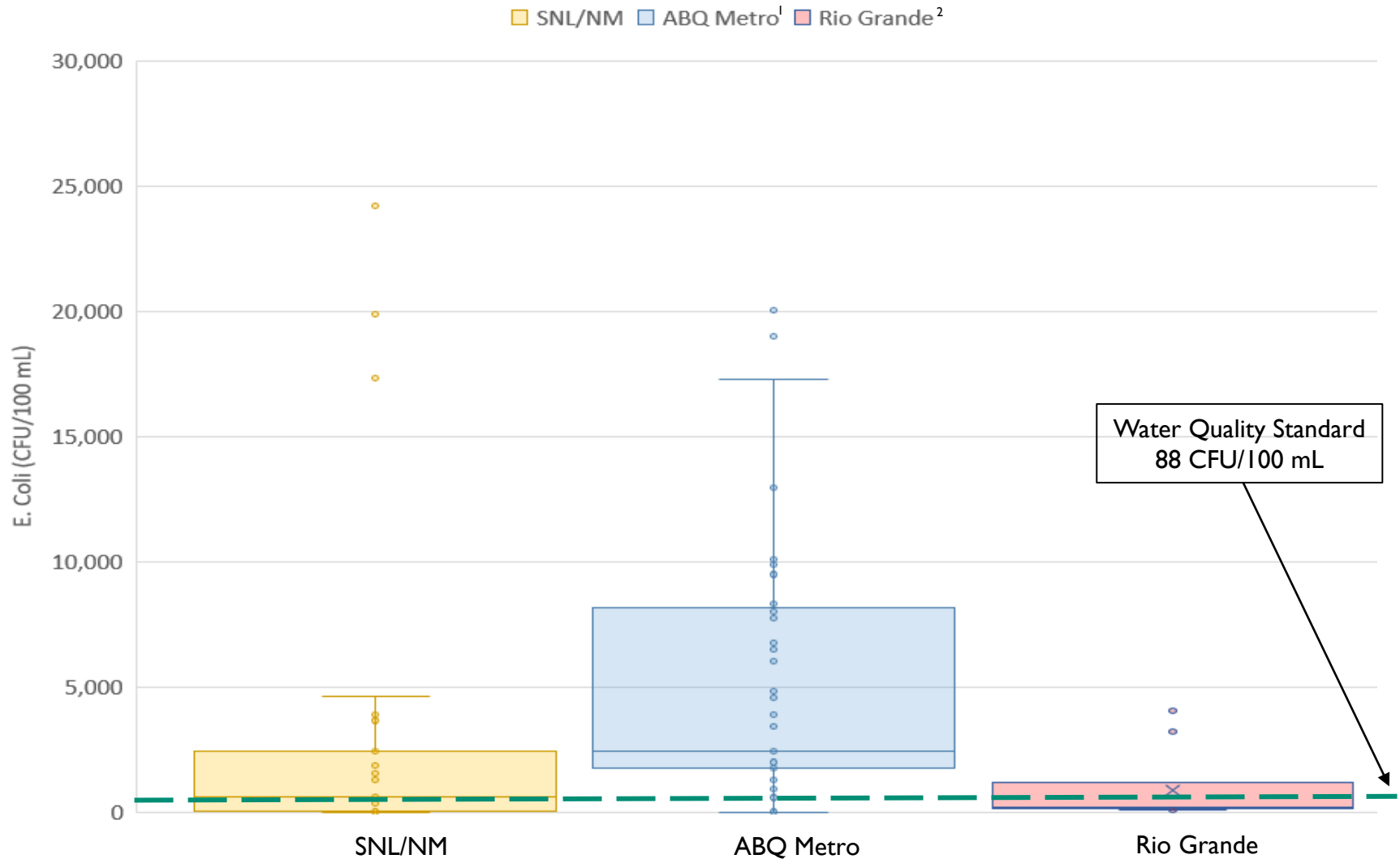
SWSP-02 SWSP-05 SWSP-24 SWSP-35 SWSP-36



Water Quality Standard
88 CFU/100 mL



E. Coli in the Albuquerque Metropolitan Area



- 1 U.S. Geological Survey, Scientific Investigations Report 2015-5006. Summary of Urban Stormwater Quality in Albuquerque, NM 2003-2012. 2015.
- 2 https://www.usgs.gov/centers/nm-water/science/microbial-source-tracking-and-escherichia-coli-monitoring-rio-grande-south?qt-science_center_objects=0#qt-science_center_objects.

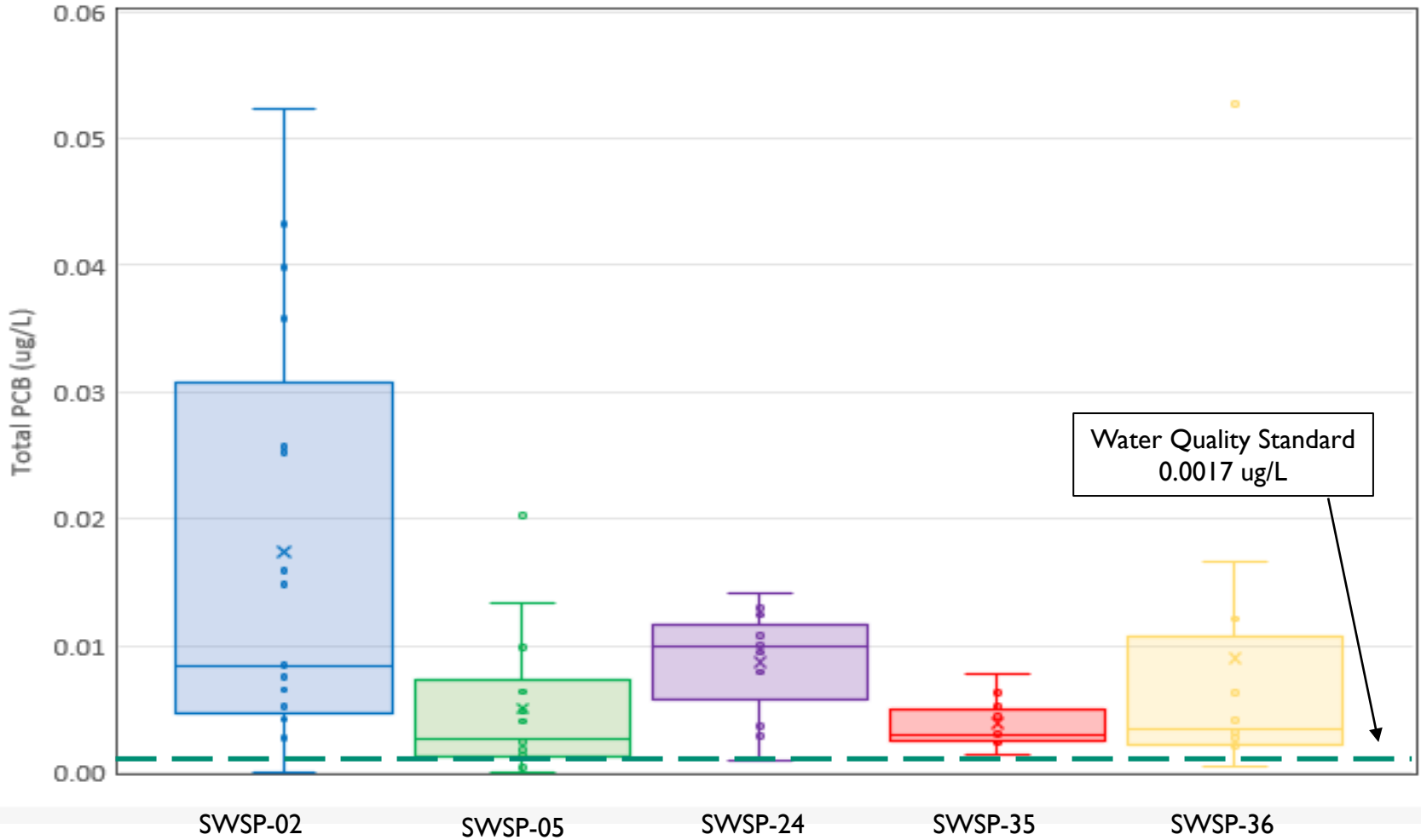


- Microbial Source Tracking Study (2020)
 - No E. coli from human sources
 - No E. coli from canine sources, low avian contribution
 - Suspect primary source is skunks, racoons, rodents
- Coordination with the Ecology Program reducing wildlife attractants and access to stormdrains
 - Wildlife proof trash cans
 - Barriers to stormdrains
- Coordination with Facilities group to reduce sediment load and standing water in stormdrains
 - Have seen significant improvements in the area of SWSP-02

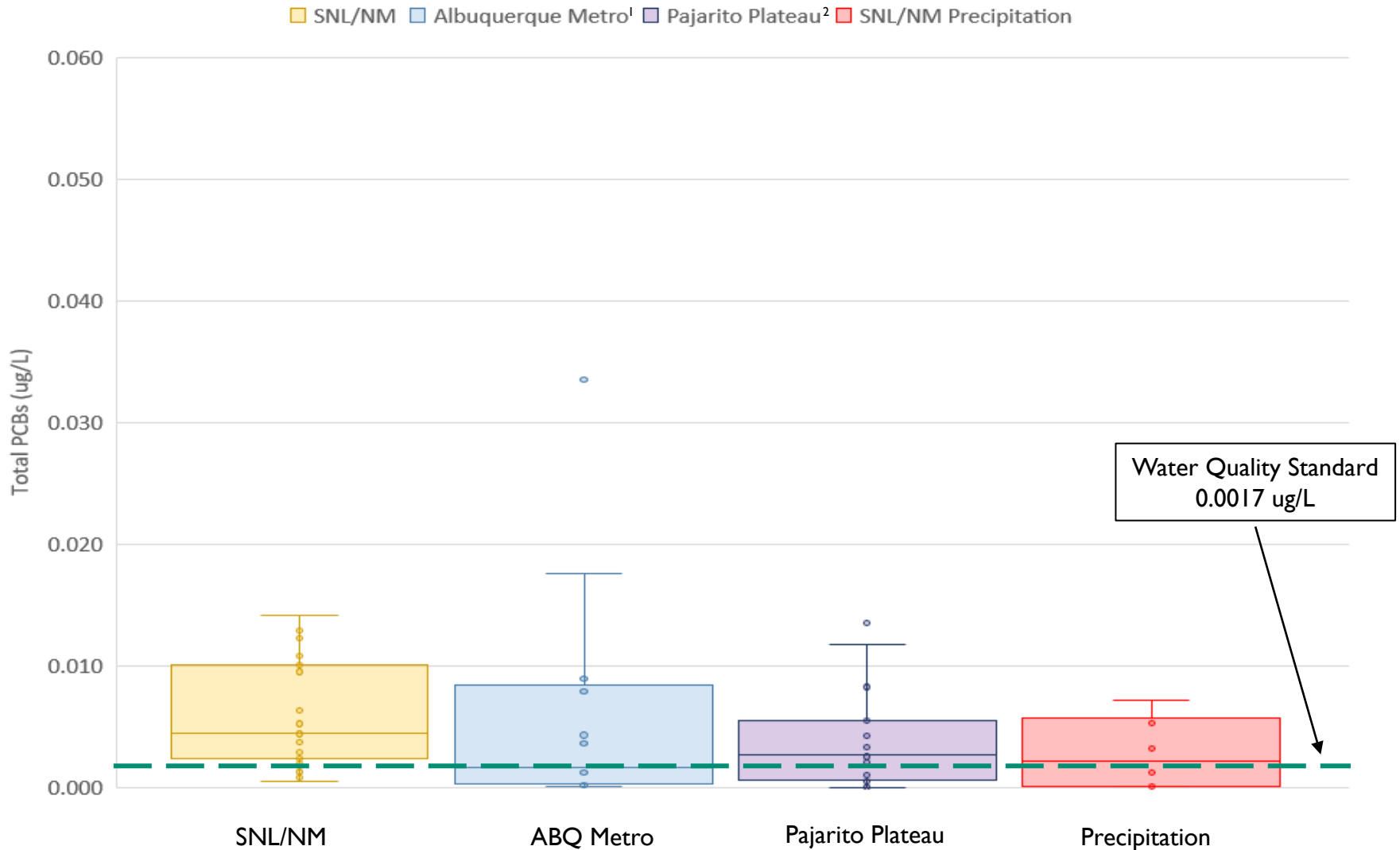


PCB Samples by Location (2016-2023)

SWSP-02 SWSP-05 SWSP-24 SWSP-35 SWSP-36



PCBs at Various NM Locations



1 U.S. Geological Survey, Scientific Investigations Report 2015-5006. Summary of Urban Stormwater Quality in Albuquerque, NM 2003-2012. 2015

2 Los Alamos National Laboratory. LA-UR-12-1081. PCBs in Precipitation and Stormwater Within the Upper Rio Grande Watershed. 2012

Activities to Improve Water Quality



- PCB source tracking and characterization (2017-ongoing)
 - Majority of PCBs entering MS4 at SWSP-02
 - PCBs strongly correlated to sediment load
 - Conducting further monitoring to identify potential source areas
 - Potential hot spot upgradient of SWSP-02
- Sediment Reduction Plan (2015-2020, ongoing)
 - Reduced sediment contribution to stormdrains by ~25%
 - New detention basins and conveyance channel configuration at SWSP-02
- More Information: http://digitalrepository.unm.edu/sn1_ms4/



II EPA Audit and Site Inspection

- Audit of SWMP and Records, June 2022
 - EPA requested specific information from all 7 control programs + monitoring program
 - SNL provided 550+ pages of records and proof of compliance to EPA
 - No deficiencies identified
- Site Visit and Inspections of MS4 Facilities, May 2023
 - Inspectors from Region 6 Compliance Assurance and Enforcement Division and NMED Surface Water Quality Bureau
 - Inspected all outfalls and numerous facilities
 - No violations identified, several recommendations were made:
 - Cover waste and recycling bins at reapplication yard, fix silt fence around a stormdrain inlet at fleet services, provide better containment of landscaping materials stored on ground surface

EPA Inspection Report issued August 2023: “...EPA inspectors found no deficiencies in staff understanding and application of permit requirements, or in the condition of the facilities. SNL has a comprehensive stormwater program and appears to do an excellent job of implementing their stormwater permit...”

Questions?



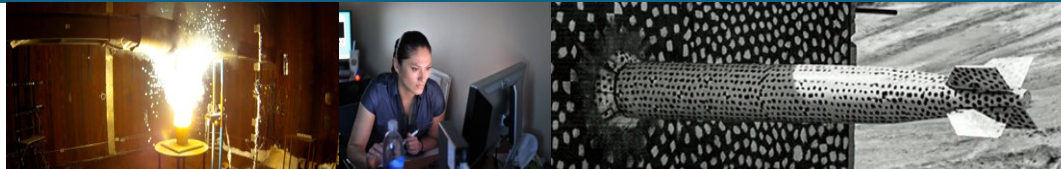
More Information at the UNM Digital Repository
http://digitalrepository.unm.edu/snl_ms4/





Sandia
National
Laboratories

Burn Site Groundwater (BSG) Investigation



Michael Skelly
Environmental Restoration Operations

October 2023



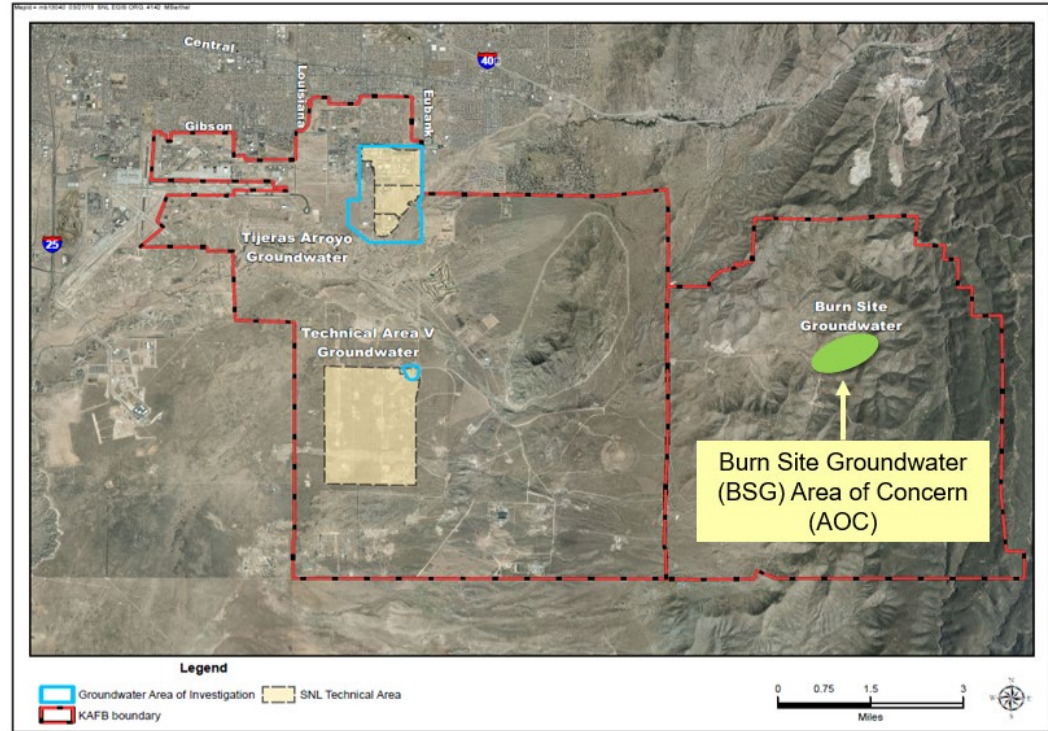
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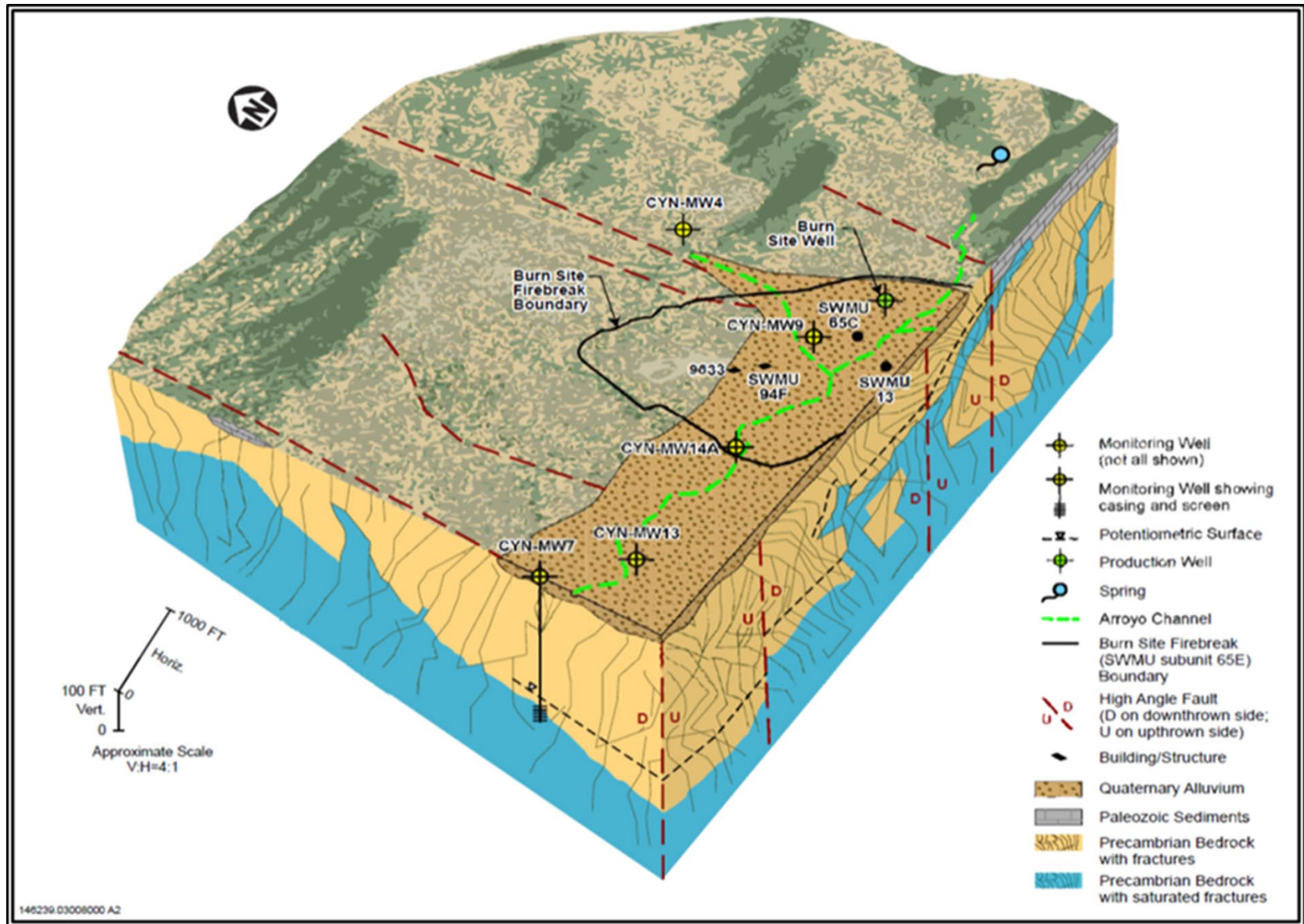
Site Description for the BSG AOC



- The BSG Area of Concern (AOC) is located in Lurance Canyon in a remote area of the Manzanita Mountains.
- Lurance Canyon is a west-flowing drainage deeply incised into Paleozoic and Precambrian bedrock in moderately to heavily wooded pinon-juniper forest.
- The groundwater occurs in fractured Precambrian bedrock that is recharged by infiltrating precipitation; flow is controlled by changes in rock type and faults/fractures.
- Sandia National Laboratories (SNL) activities in the Burn Site testing area began in 1967; early site test activities included explosives testing; current use is fire survivability studies (i.e., burn testing).
- Only the groundwater requires corrective action.



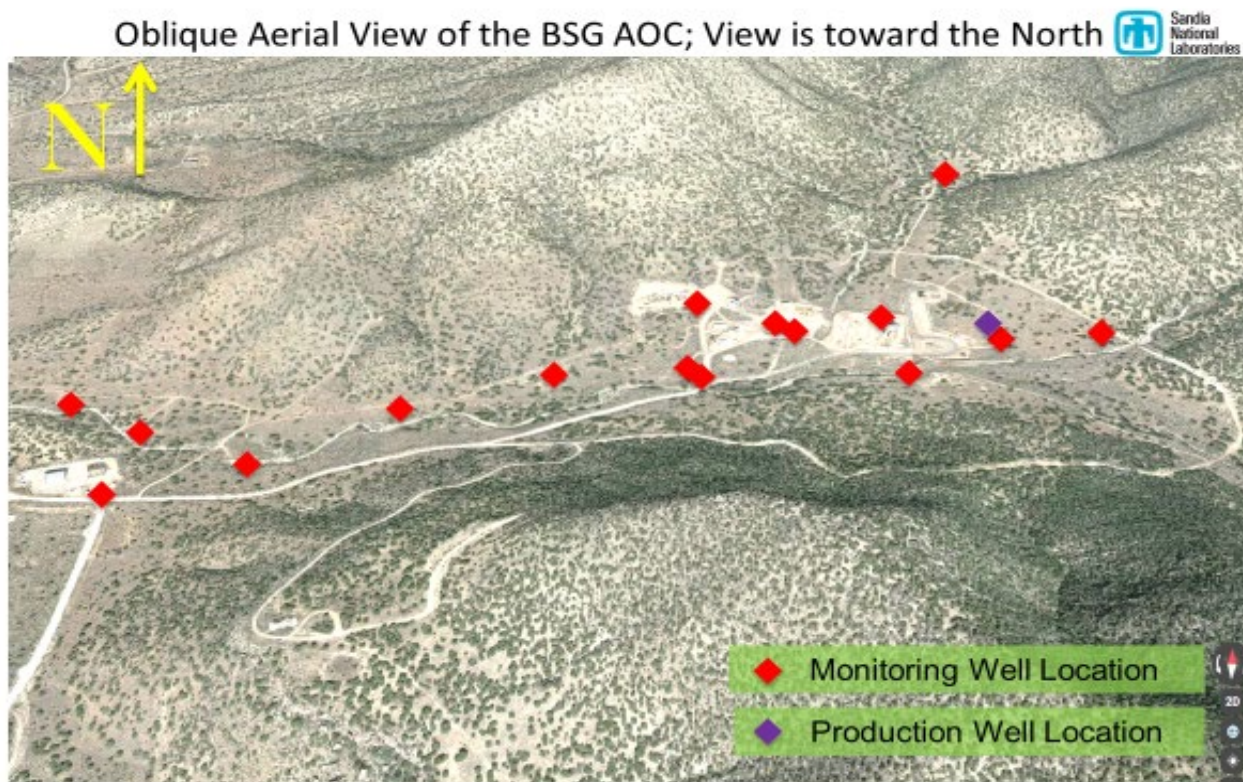
Conceptual Site Model for the BSG AOC



BSG AOC Groundwater Monitoring



- Groundwater monitoring began in 1996.
- Depth to groundwater ranges from 46 to 361 feet below ground surface, and the groundwater flows to the west.
- The monitoring well network consists of 16 active monitoring wells and 1 inactive production well, with the 4 newest wells installed in October/November 2019.

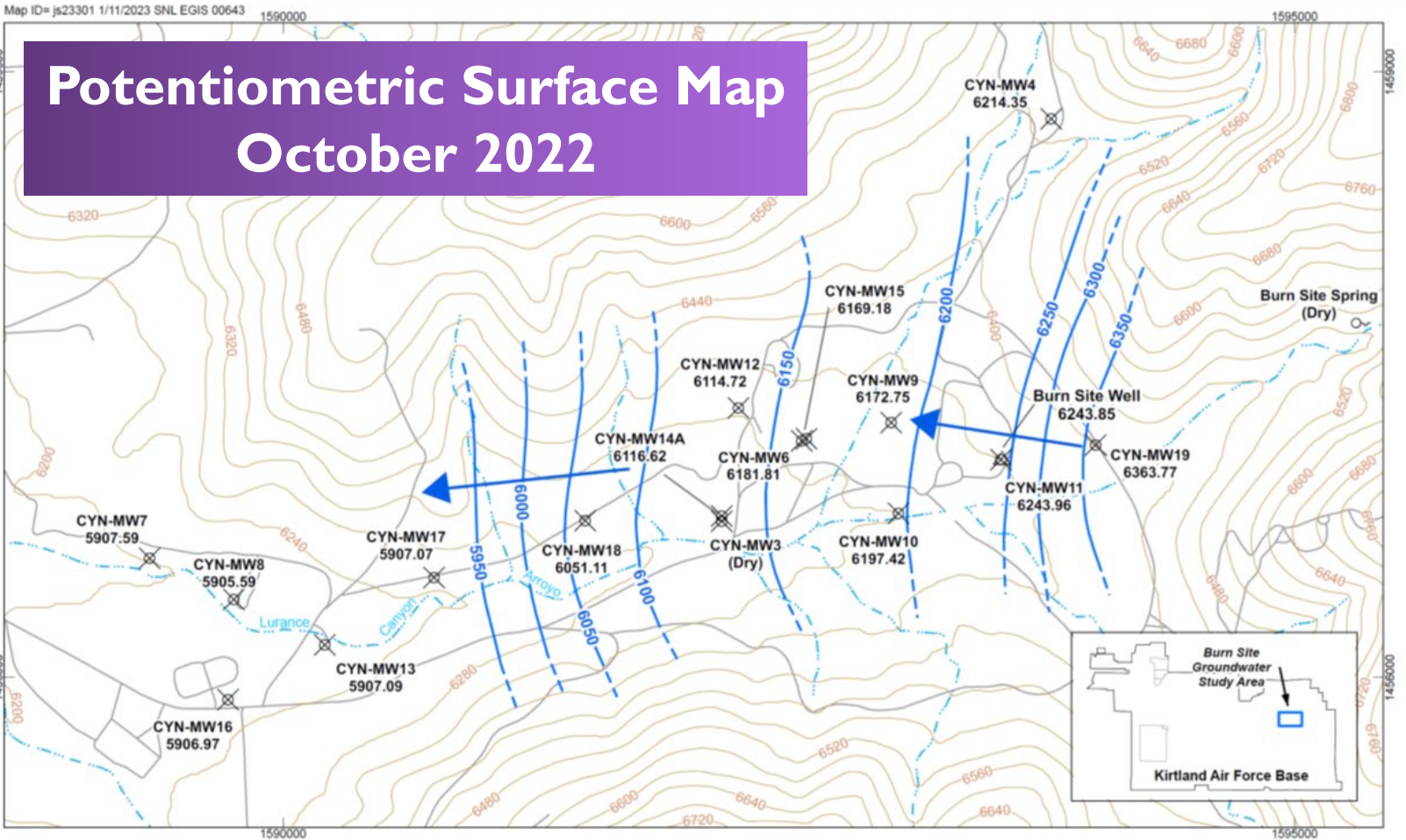


BSG AOC Groundwater Monitoring (continued)



- The groundwater is contaminated with nitrate (the constituent of concern) at concentrations above the U.S. Environmental Protection Agency maximum contaminant level (MCL).
- Nitrate has been detected above the MCL in about half of the monitoring wells.
- The two combined plumes are approximately 41 acres.
- The groundwater is not used for any purpose; no one is drinking contaminated groundwater.
- The nearest downgradient drinking water supply well (KAFB-4) is 8.4 miles to the west.
- Nitrate is derived from both manmade and natural sources, including ammonium nitrate slurry, wastewater discharges, and degraded explosive compounds.
- No other constituents in the groundwater exceed the MCLs.

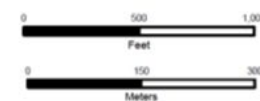
Constituent of Concern	Maximum Concentration in 2022	MCL
Nitrate	38.1 milligrams per liter (well CYN-MW9; April)	10.0 milligrams per liter



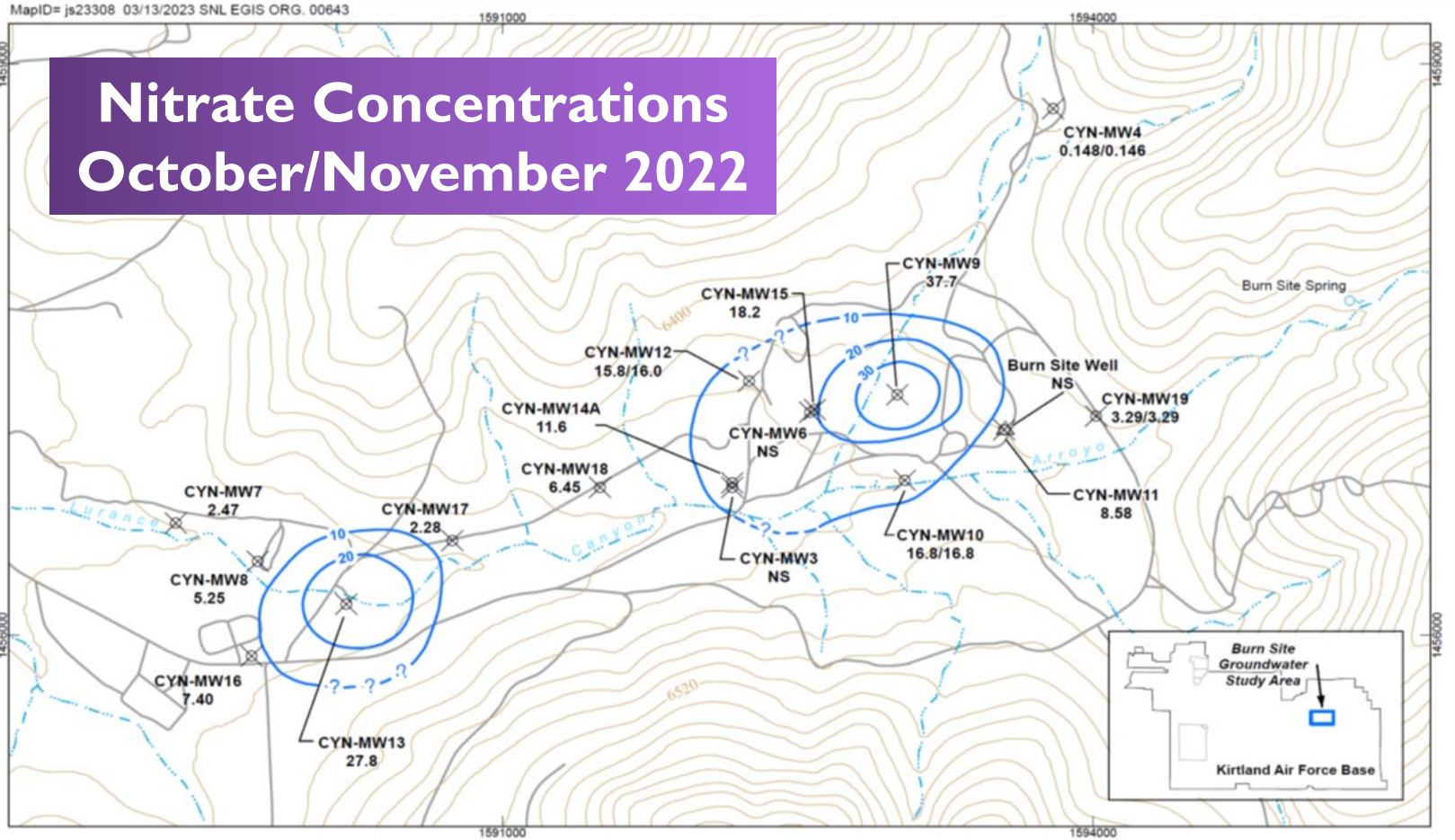
Legend

- ⊗ Monitoring well, groundwater
- 6221.95 Groundwater elevation (ft amsl)
October 2022, datum (NAVD 88)
- △ Water supply well (non-potable)
- Spring
- Potentiometric surface contour
(ft amsl), dashed where uncertain
- Surface drainage, arroyo
- Road, unpaved
- Ground surface contour (40 ft)
- ← Inferred direction of groundwater flow

Sandia National Laboratories, New Mexico
Environmental Geographic Information System



New Mexico State Plane, Central Zone 3002
1983 North American Datum



Legend

- Monitoring Well, groundwater
- 15.8** October/November 2022 Nitrate plus Nitrite concentration, mg/L
- NS** Not sampled
- Water Supply Well (non-potable)
- Spring
- Concentration contour (mg/L), dashed where inferred, queried where uncertain
- Road, unpaved
- Ground surface contour (40 ft)
- Surface drainage, arroyo

Sandia National Laboratories, New Mexico
Environmental Geographic Information System



New Mexico State Plane, Central Zone 3002
1983 North American Datum



- The BSG AOC is currently in the corrective action process.
- SNL submitted a monitoring well network evaluation to the New Mexico Environment Department (NMED) Hazardous Waste Bureau (HWB) in November 2022 (approved by the NMED HWB in December 2022).
- SNL personnel performed quarterly water level measurements and semiannual groundwater sampling and presented the results in the *Annual Groundwater Monitoring Report* submitted to the NMED HWB in July 2023.
- SNL submitted a *Current Conceptual Model and Corrective Measures Evaluation Report* to the NMED HWB in January 2023.
- NMED HWB is currently reviewing the proposed remedial alternatives.



Sandia National Laboratories

Tijeras Arroyo Groundwater (TAG) Investigation



John R. Copland
TAG Task Leader
Environmental Restoration Operations

October 2023



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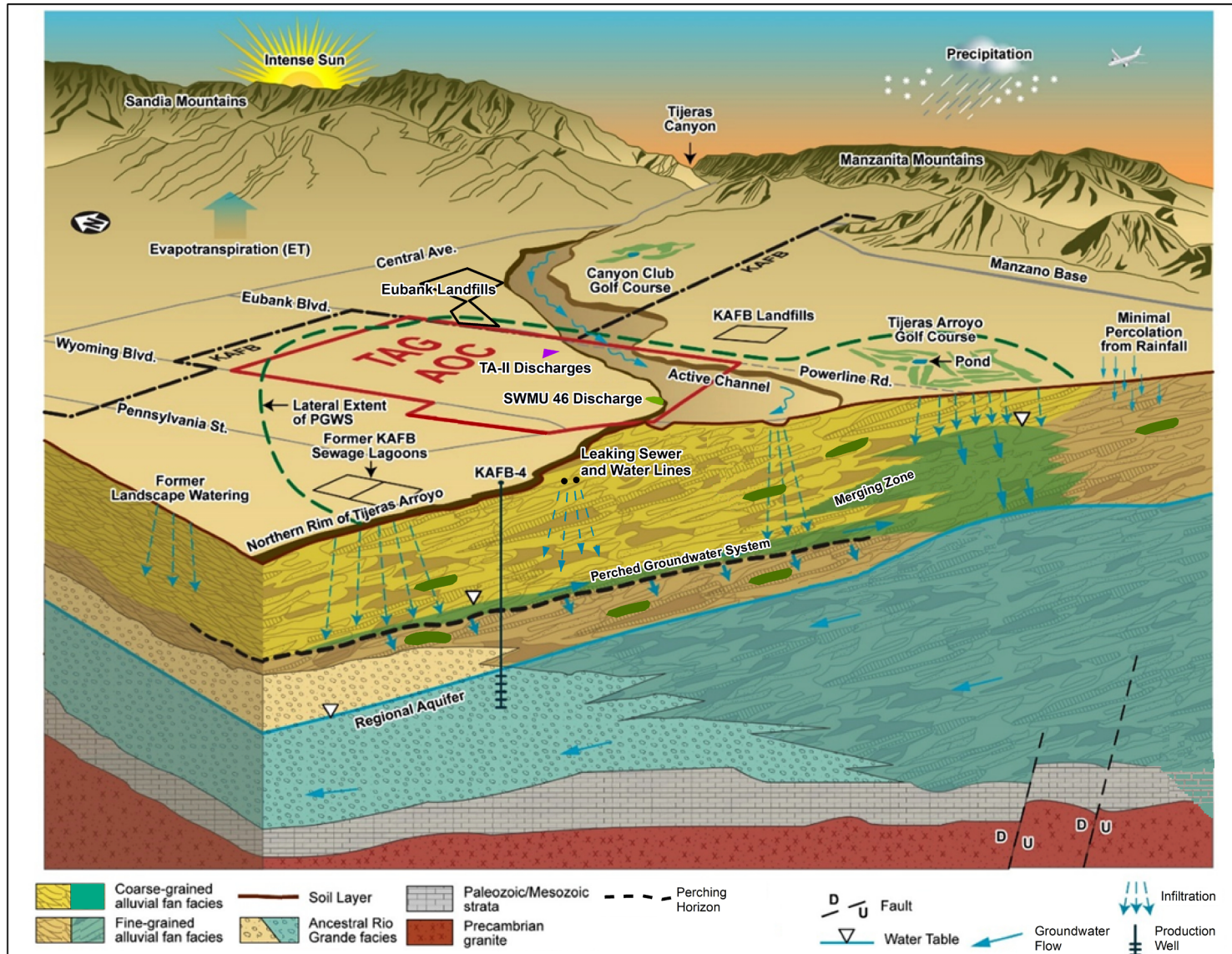
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Site Description for the TAG AOC

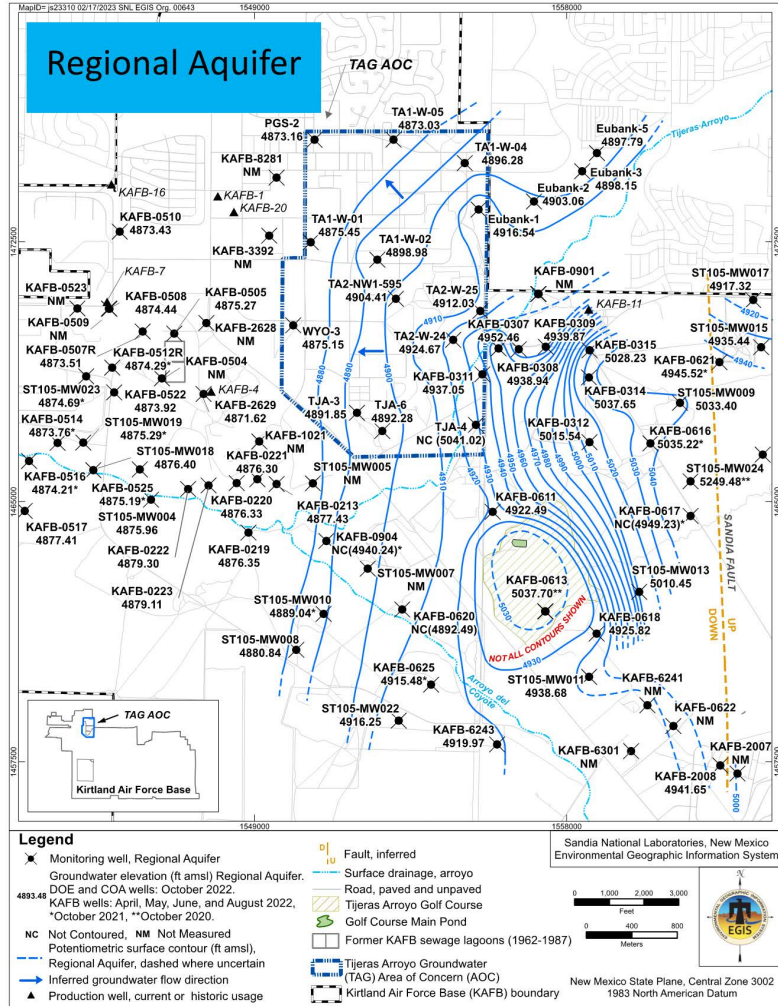
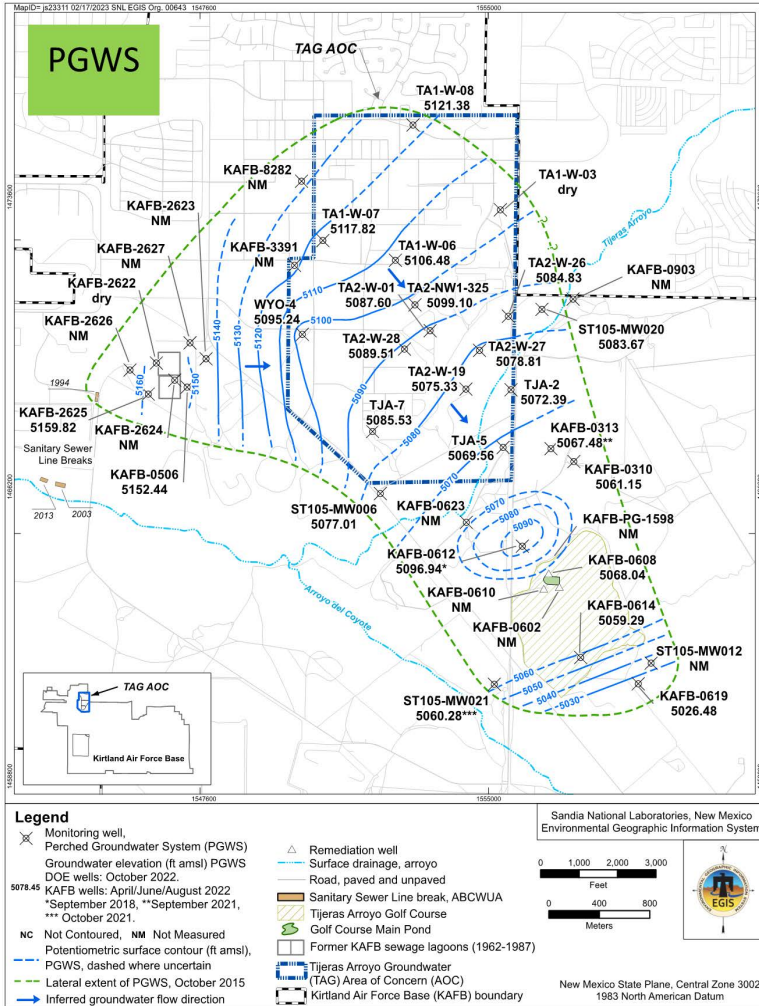


- The TAG Area of Concern (AOC) covers approximately 1.82 square miles in the north-central portion of Kirtland Air Force Base (KAFB) and includes Technical Areas (TAs) I, II, and IV at Sandia National Laboratories (SNL).
- The Santa Fe Group underlying the TAG AOC contains two water-bearing zones: the Perched Groundwater System (PGWS) and the Regional Aquifer. The PGWS depth to water ranges from approximately 270 to 320 feet (ft) below ground surface (bgs). The Regional Aquifer depth to water ranges from approximately 410 to 560 ft bgs. The PGWS and the Regional Aquifer are separated by a Perching Horizon and an approximately 200-ft-thick sequence of unsaturated sediments. A localized Merging Zone that partially extends under the TAG AOC's southeast corner hydraulically connects the PGWS and the Regional Aquifer.
- Solid Waste Management Unit (SWMU) 46 and TA-II Discharges, two SNL sites located in the TAG AOC, released significant volumes of wastewater and septic water before 1992. SWMU 46 released approximately 1.3 billion gallons from 1948 to 1974. TA-II Discharges released approximately 100 million gallons from 1948 to 1992.
- Only the groundwater requires corrective action.

Conceptual Site Model for the TAG AOC and Vicinity



Potentiometric Surface Maps, PGWS and Regional Aquifer, October 2022



TAG AOC Groundwater Monitoring

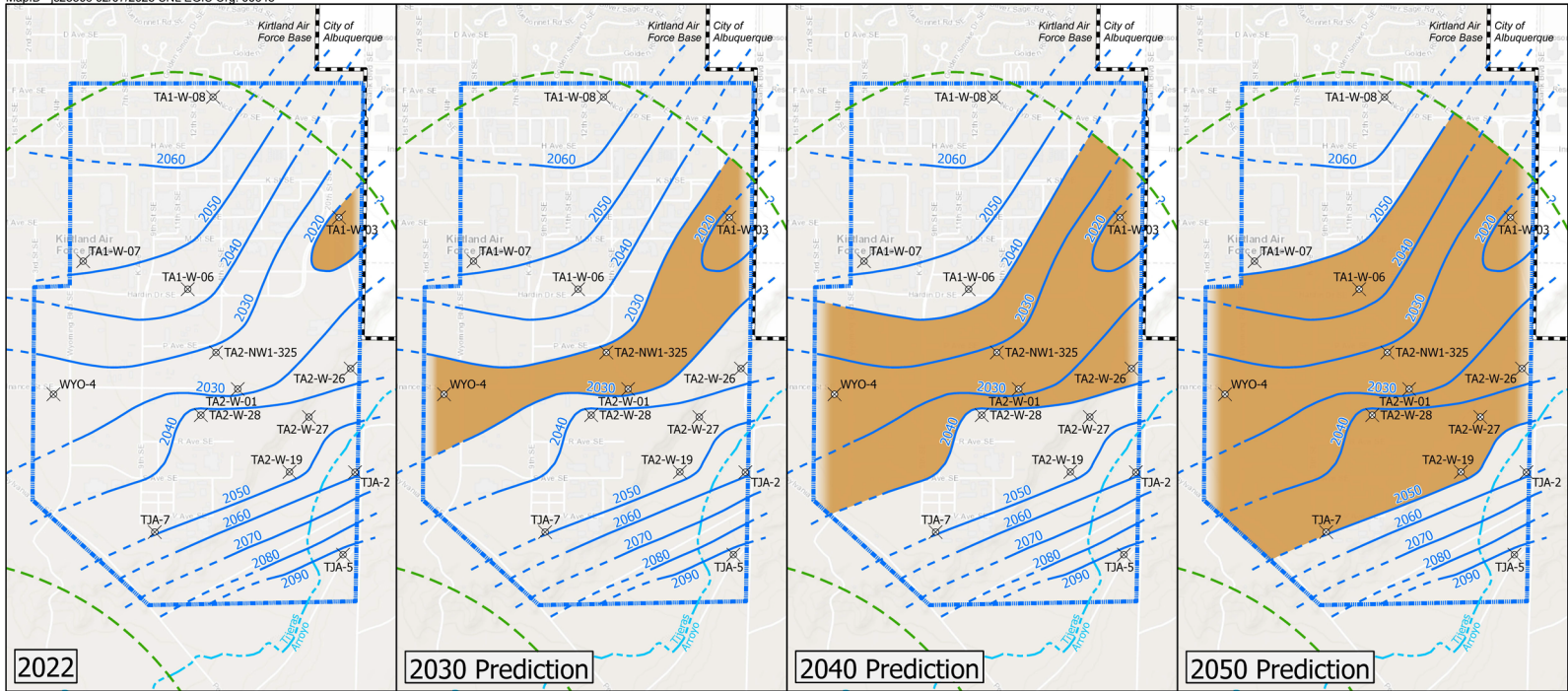


- Groundwater monitoring began in 1992.
- 31 groundwater and 14 soil-vapor monitoring wells have been installed.
- SNL personnel currently sample 21 groundwater monitoring wells for nitrate, volatile organic compounds, metals, and radionuclides on a quarterly, semiannual, or annual basis. The other wells do not require sampling.
- Monitoring wells in the surrounding area include 84 KAFB wells and 4 city wells. Data sharing enhances our understanding of the hydrogeologic setting.
- The monitoring wells screened in the PGWS yield small volumes of water, typically less than 1 gallon per minute. The PGWS is not used for any purpose at SNL.
- KAFB, Veterans Affairs, and Albuquerque Bernalillo County Water Utility Authority (ABCWUA) production wells are screened in the Regional Aquifer.
- The nearest production well is KAFB-20; it is located approximately 1 mile west of the elevated nitrate concentrations in the PGWS.
- The nearest ABCWUA production well is Ridgcrest 1; it is located approximately 2 miles north of the elevated nitrate concentrations in the PGWS.

PGWS Lateral Extent in 2022 and Predicted Dewatering



MapID= js23306 02/07/2023 SNL EGIS Org. 00643



Legend

- ⊗ Monitoring Well, Perched Groundwater System (PGWS)
- 2030 Predicted year when water level declines below well screen. Prediction based upon water-level data measured from October 2015 through October 2022
- - - Predicted year contour, dashed where uncertain
- - - Lateral extent of PGWS, October 2015
- - - Surface drainage, arroyo
- ⬜ Tijeras Arroyo Groundwater (TAG) Area of Concern (AOC)
- Water below screen in SNL/NM well
- ⬜ Kirtland Air Force Base (KAFB) boundary

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

TAG AOC
Kirtland Air Force Base

0 2,000 4,000
Feet

0 500 1,000
Meters

New Mexico State Plane, Central Zone 3002
1983 North American Datum

TAG AOC Groundwater Monitoring Results



Constituent of Concern	Maximum Concentration in PGWS, 2022	Maximum Concentration in Merging Zone, 2022	Maximum Concentration in Regional Aquifer, 2022	U.S. Environmental Protection Agency Maximum Contaminant Level (MCL)
Nitrate	22.2 mg/L	34.4 mg/L	3.92	10 mg/L

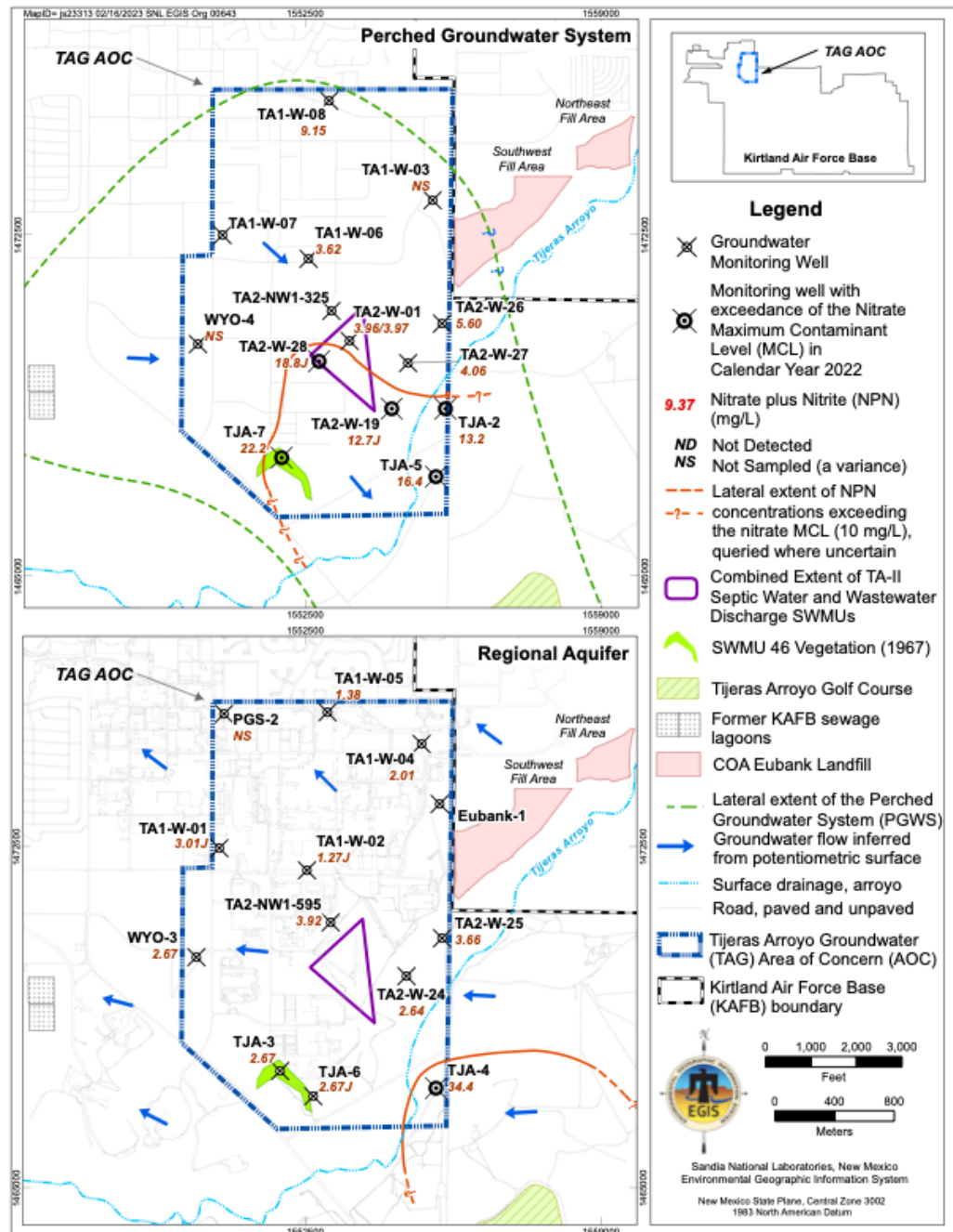
- The elevated nitrate concentrations in the PGWS do not pose a threat to the Regional Aquifer. SNL operations have not contaminated the Regional Aquifer. Computer modeling and ongoing groundwater sampling continue to demonstrate that the Regional Aquifer will not be impacted.
- Over much of the TAG AOC, monitoring wells screened in the PGWS are predicted to go dry by 2050 because the manmade recharge sources, such as the septic water leach fields and wastewater outfalls, have been eliminated. Landscape watering at KAFB has also been reduced.

Nitrate Results

The upper panel shows the nitrate release sites and 2022 maximum nitrate concentrations for the PGWS. The lower panel shows the nitrate results for the Regional Aquifer.

For the PGWS, 5 monitoring wells in the TAG AOC's southeast corner exceeded the nitrate MCL.

For the Regional Aquifer, 1 monitoring well in the TAG AOC's far southeast corner exceeded the nitrate MCL. However, the groundwater sampled at that well (TJA-4) is likely from an upgradient source and/or has natural origins.





- In January 2023, the New Mexico Environment Department (NMED) Hazardous Waste Bureau (HWB) approved the *Revised Tijeras Arroyo Groundwater Current Conceptual Model and Corrective Measures Evaluation Report* submitted in February 2018. The approved remedial action is Monitored Natural Attenuation.
- SNL submitted the *Tijeras Arroyo Groundwater Corrective Measures Implementation Plan* to the NMED HWB in June 2023. The plan specifies a simpler sampling schedule. Per that schedule, SNL personnel will sample 10 monitoring wells screened in the PGWS semiannually and 8 monitoring wells screened in the Regional Aquifer annually.
- SNL personnel will follow the existing sampling schedule until the *Tijeras Arroyo Groundwater Corrective Measures Implementation Plan* is approved.
- SNL personnel will present the analytical results in the *Annual Groundwater Monitoring Reports* submitted to the NMED HWB each summer.



Sandia
National
Laboratories

Technical Area-V Groundwater (TAVG) Investigation



Jun Li
Environmental Restoration Operations

October 2023

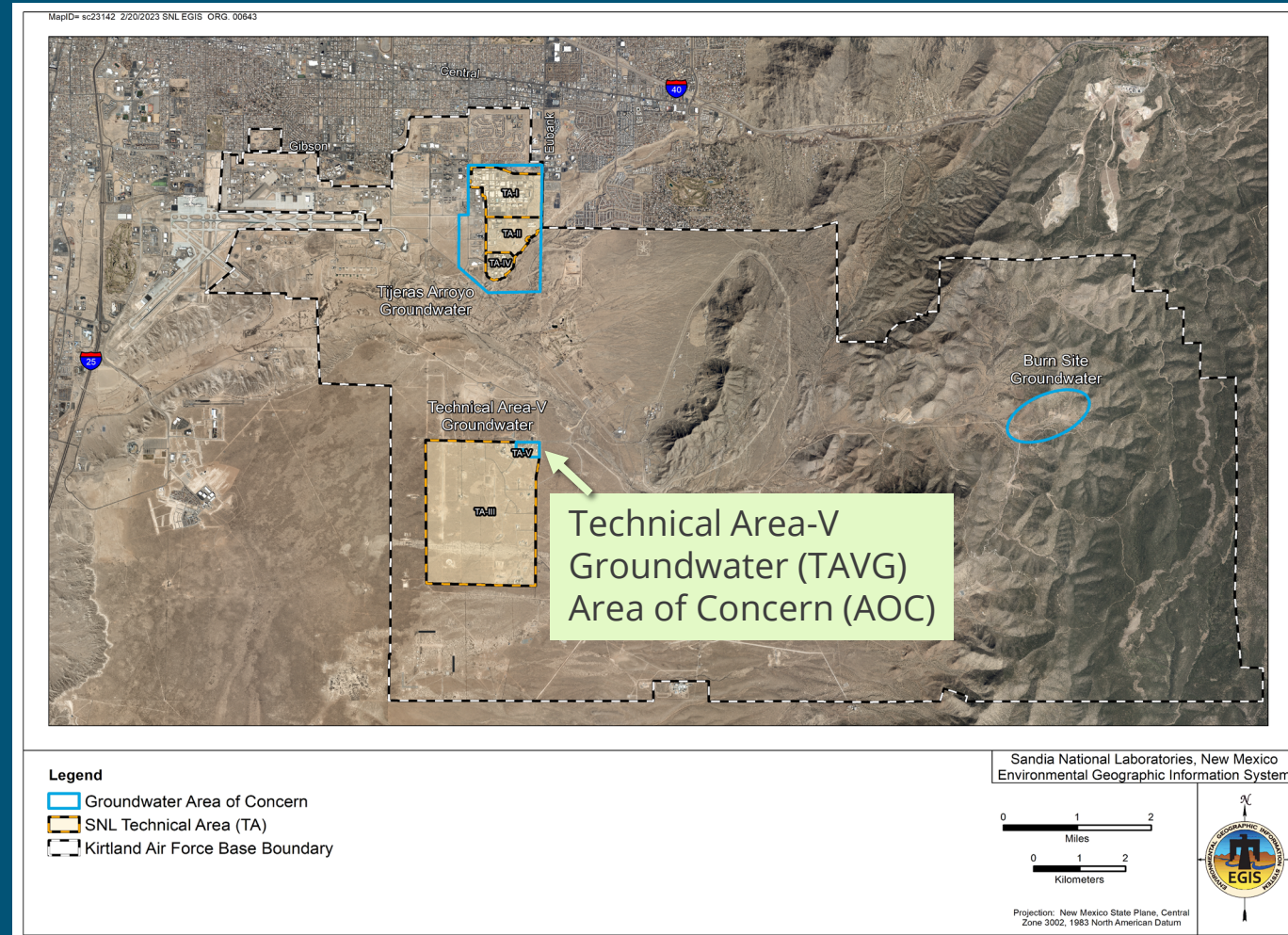


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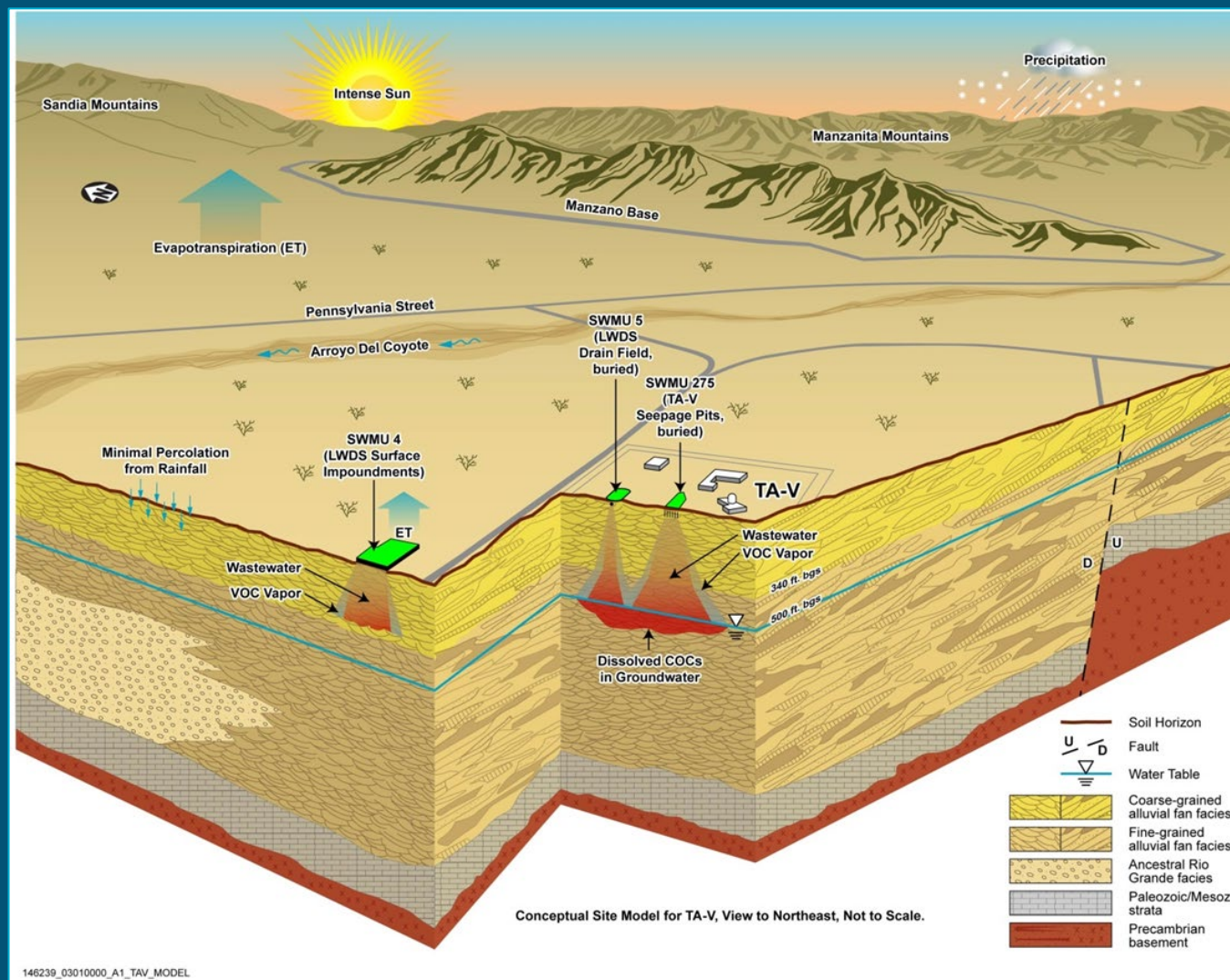
- Technical Area-V (TA-V) covers approximately 35 acres in the west-central portion of Kirtland Air Force Base (KAFB).
- Sandia National Laboratories (SNL) activities in TA-V began in 1961.
- The groundwater in TA-V is designated an Area of Concern (AOC) in the 2004 *Compliance Order on Consent*.
- The New Mexico Environment Department (NMED) Hazardous Waste Bureau (HWB) regulates the site under the 2004 *Compliance Order on Consent*.



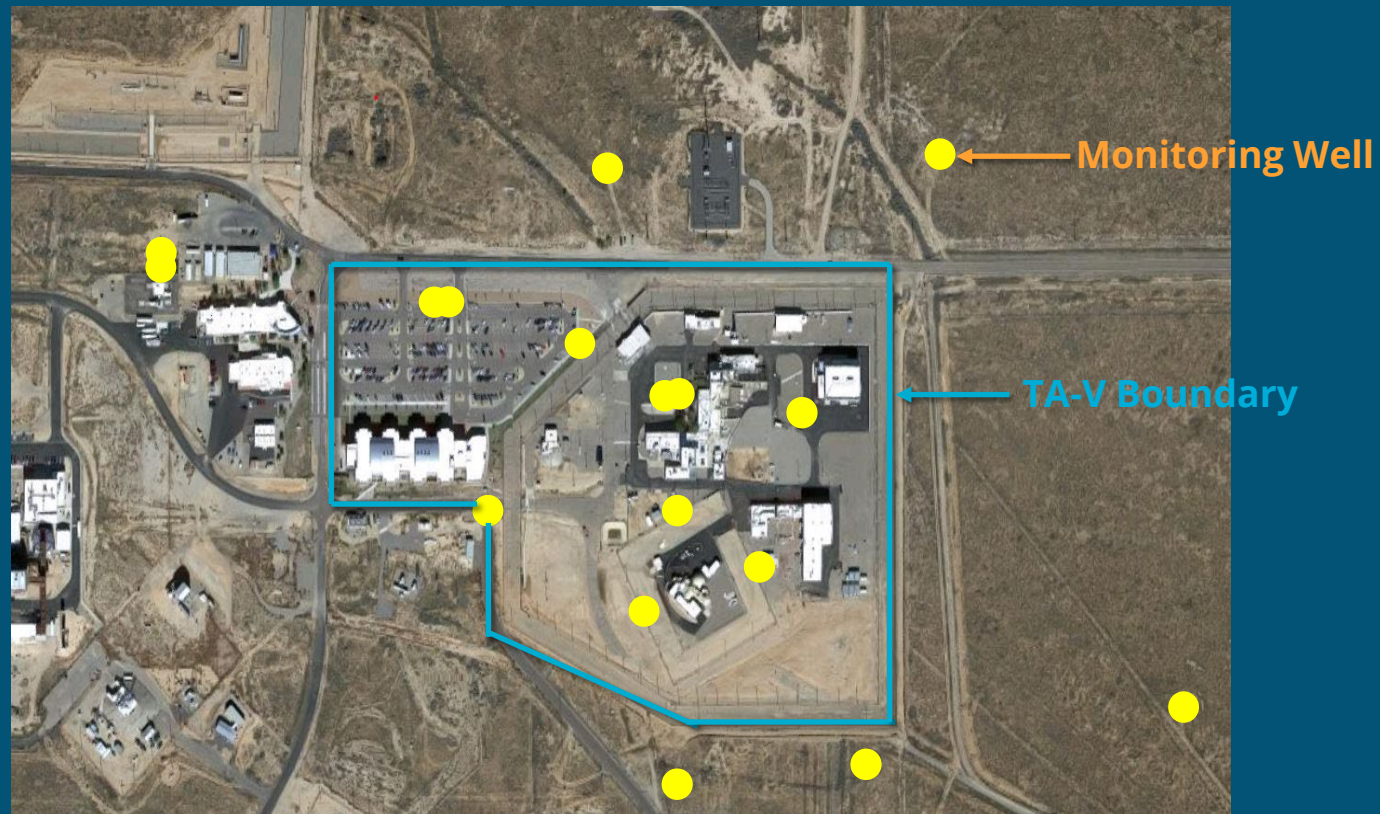
Conceptual Site Model for the TAVG AOC



- The groundwater in TA-V is the Regional Aquifer that resides in fine-grained, clay-rich, alluvial-fan sediments.
- The groundwater in the Regional Aquifer generally flows to the west, then turns northward toward the production wells located near KAFB's northern boundary.
- The water table is approximately 500 – 520 feet below ground surface at TA-V.
- All the surface and shallow subsurface soil contamination has been addressed and corrective action is complete.
- Only the groundwater requires corrective action.



- SNL personnel have installed 21 monitoring wells to date. The current monitoring well network consists of 17 active wells.
- The groundwater is not used for any purpose. The nearest drinking water supply well (KAFB-4) is 2.8 miles to the north-northwest of TA-V.

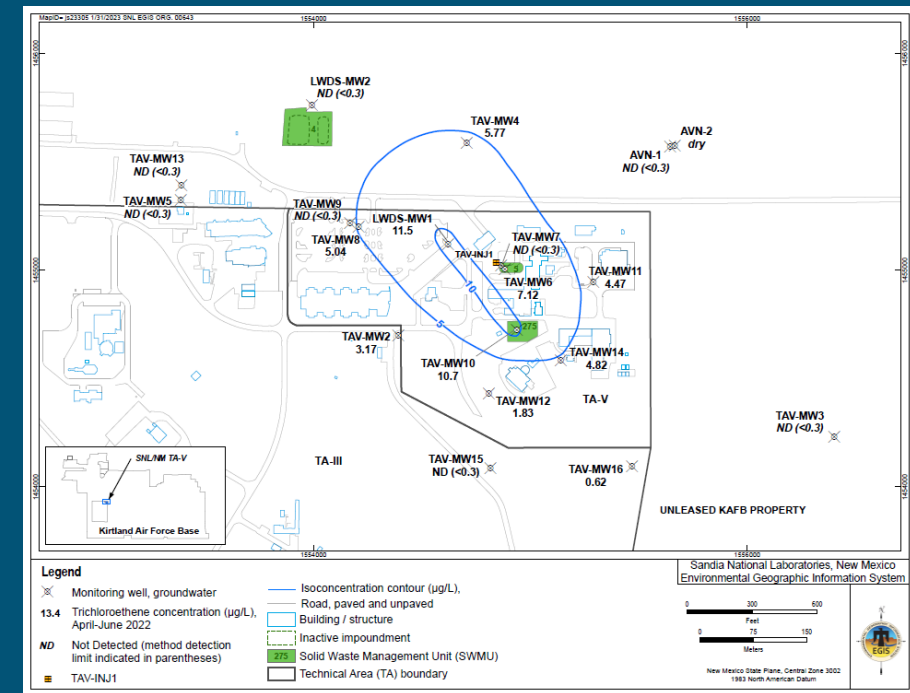
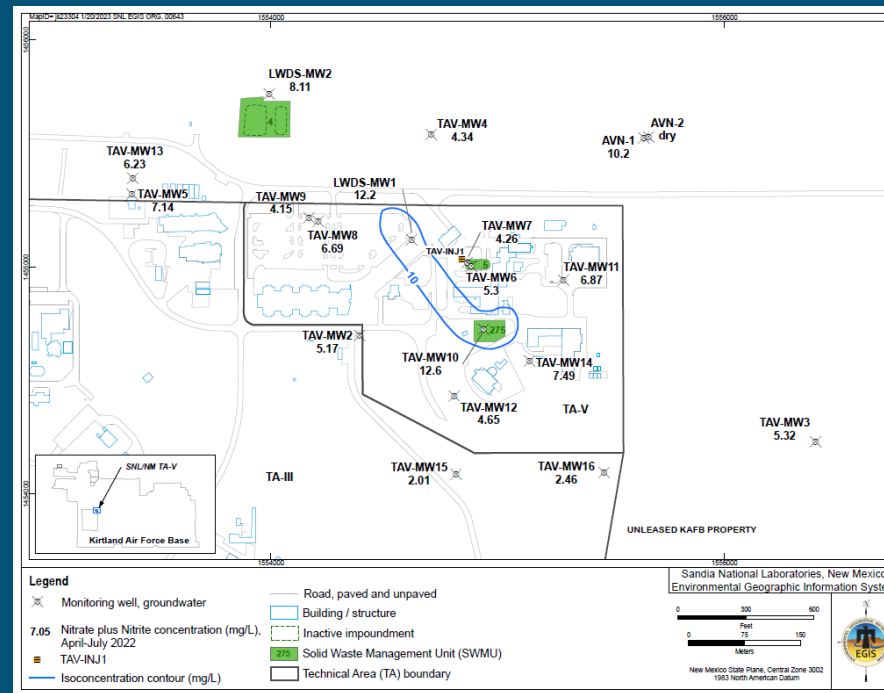


TAVG AOC Groundwater Monitoring (continued)



- The groundwater is contaminated with nitrate and trichloroethene (TCE) at concentrations above the U. S. Environmental Protection Agency maximum contaminant levels (MCLs) for drinking water.
- The nitrate plume covers approximately 1.4 acres. The TCE plume covers approximately 13 acres.
- Both plumes are stable. They are not adversely impacting human health or the environment.
- No other constituents in the groundwater exceed the MCLs.

- Maximum nitrate concentration in 2022 was 13.5 mg/L (MCL is 10 mg/L).
- Maximum TCE concentration in 2022 was 12.4 µg/L (MCL is 5 µg/L).





Monitoring Well Network

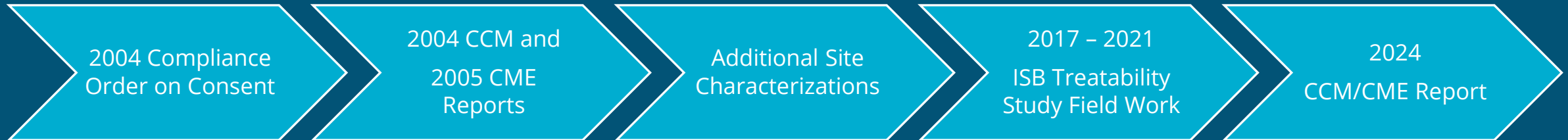
- The current 17-well network is in place, with newest monitoring well TAV-MW17 added in April 2023.
- Per the 2004 *Compliance Order on Consent*, SNL personnel will sample monitoring well TAV-MW17 for perchlorate for at least four quarters.
- The annual *Comprehensive Site-Wide Groundwater Monitoring Plan* approved by the NMED HWB in July 2023 will govern the groundwater monitoring activities.

Activities

- The NMED HWB approved the work plan to decommission injection well TAV-INJ1 in March 2023.
- SNL submitted the *Monitoring Well TAV-MW17 Installation and Monitoring Well AVN-1, AVN-2, and LWDS-MW2 Decommissioning Report* to the NMED HWB in August 2023.
- SNL personnel will document the quarterly activities for the TAVG AOC in the *Environmental Restoration Consolidated Quarterly Reports* submitted to the NMED HWB.
- SNL personnel will document all groundwater monitoring activities and analytical data in the *Annual Groundwater Monitoring Reports* submitted to the NMED HWB each summer.



- The TAVG AOC is in the corrective measures evaluation process.



- CCM = current conceptual model
- CME = corrective measures evaluation
- ISB = in-situ bioremediation



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