Quality Assurance/ Quality Control Documentation

San Juan Mine Remediation and Restoration Study

Prepared for

Mining and Minerals Division
New Mexico Energy, Minerals and
Natural Resources Department

Prepared by

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Table of Contents

List of Figures

List of Tables

List of Appendices

1. Introduction

Daniel B. Stephens & Associates, Inc. (DBS&A) has prepared this quality assurance/quality control (QA/QC) documentation report for the San Juan Mine remediation and restoration study on behalf of the New Mexico Energy, Minerals and Natural Resources Department (EMNRD). This report describes the types and quality of existing data available for the mine that will be used to describe environmental conditions. The New Mexico legislature enacted the San Juan Generating Station Facility and Mine Remediation and Restoration Study Act (Section 74-4H-1 to 74-4H-4, NMSA 1978) (the Act) on April 5, 2023. It became effective on July 1, 2023, and tasks EMNRD with characterizing environmental conditions at the San Juan Mine and then, if necessary, developing a remediation and restoration planning document to inform EMNRD decisions, in accordance with their jurisdiction, to prevent environmental contamination and impacts to groundwater. The San Juan Mine is located in San Juan County, approximately 10 miles west of Farmington, New Mexico (Figure 1). For approximately 50 years (1973 through 2022), the mine supplied coal to the adjacent San Juan Generating Station, which is now closed and is being demolished.

Section 74-4H-3 of the Act authorizes EMNRD to contract with environmental consultants to conduct the study of the San Juan Mine. This includes investigation to determine the extent of any environmental contamination and development of the restoration and remediation planning document if necessary. Addressing possible adverse effects to human health and community resilience, particularly resulting from groundwater contamination, is also required by Section 74-4H-3 of the Act. EMNRD contracted with DBS&A to perform these tasks.

Several groundwater monitor wells and surface water sampling sites exist at the San Juan Mine and have been monitored for years, providing a long history of water quality data. DBS&A intends to use these existing data, along with other publicly available information, to characterize environmental conditions, determine the extent of any mine impacts, and identify data gaps (if any). The purpose of the assessment presented herein is to document the quality and usefulness of existing data to characterize environmental condition in support of the potential preparation of the restoration and remediation planning document. DBS&A used U.S. Environmental Protection Agency (EPA) guidance (U.S. EPA, 2002 and 2003) when evaluating data quality and preparing this document.

DBS&A will also use publicly available information, such as those presented on Figures 2 through 4, and publications (e.g., Stewart, 2018; Thomson et al., 2012) to supplement the existing site data when describing and evaluating conditions at the mine.

2. Background

The following subsections describe the requirements of Section 74-4H-3 of the Act and summarize the mine's history and general site characteristics.

2.1 Sections 74-4H-1 to 74-4H-4, NMSA 1978

New Mexico House Bill 142 was passed by the 56th New Mexico State Legislature on April 5, 2023. Its passage created the Act. The Act requires the New Mexico Environment Department (NMED) and EMNRD to investigate, plan, oversee, monitor, and enforce remediation and restoration at the San Juan Generating Station and the San Juan Mine. EMNRD is responsible for activities at the San Juan Mine, while NMED is responsible for activities at the San Juan Generating Station facility.

Requirements of the Act include the following: (1) conduct a comprehensive study of the generating facility and mine to determine if there have been any environmental impacts to lands and waters on or adjacent to the generating facility and mine and (2) develop reclamation and restoration plans that provide environmental protection and prevent the migration of contaminants and off-site pollution. The purpose of these requirements is to make the generating facility and mine acceptable for post-mining purposes that protect natural resources and the aesthetic value of adjoining areas.

The Statute requires that EMNRD and NMED provide and present their remediation and restoration studies to the state legislature. The presentations will be given to the legislative interim committee that deals with water and natural resources. The presentations will provide results of the comprehensive studies and offer recommendations regarding protection of public health and welfare.

2.2 Site History

Mining began at the San Juan Mine in the early 1970s after over a decade of prospecting and exploration. The U.S. Office of Surface Mining Reclamation and Enforcement (OSMRE) approved an environmental impact assessment (EIA) for the site in 1973. At the start of mining, the mine

was owned by the Western Coal Company (formerly the New Mexico Public Service Coal Company) and was operated by Utah International, Inc. (UII). Coal was mined from a surface strip mine, which was expanded in 1976 after OSMRE approved another EIA. UII became the owner of the mine in 1980. Mining operations were continuous from the 1970s—through a shift to underground mining in October 2002—until operations were halted in September 2011 due to an underground fire. The mine began operations again in June 2012. UII was acquired by BHP Billiton in the early 1980s. BHP Billiton owned the mine and the San Juan Coal Company (New Mexico Coal) operated the mine through the early 2010s, until Westmoreland Coal Company became the owner and operator in February 2016 (Nickelson, 1988; Stewart, 2018; OSMRE, 2019).

2.3 Site Characteristics

The San Juan Mine is located in northern San Juan County, New Mexico (Figure 1). Kirtland, Fruitland, and Waterflow are the nearest town and unincorporated communities to the mine. They are all located south or southwest of the mine. The cities of Farmington, Aztec, and Bloomfield are also close to the mine and are located to the east. South of the mine, the San Juan River flows to the west and is fed by the Animas and La Plata Rivers upstream of the mine, as well as the Chaco River downstream. Appendix A is a map created using the New Mexico Oil Conservation Division (OCD) Oil and Gas Map Application that shows water bodies near the San Juan Mine. This application is accessible through the OCD website (http://www.emnrd.state.nm.us/OCD/ocdgis.html).

Figure 2 shows a U.S. Geological Survey (USGS) topography map of the mine and surrounding area. Elevations within the mine permit boundary range from about 5,160 feet above mean sea level (feet msl) to about 5,720 feet msl. The topography generally slopes toward the southwest, with a few areas sloping directly toward the south.

The climate for the region is characterized as arid to semiarid. A National Weather Service (NWS) reporting station located in Fruitland, New Mexico (5,220 feet msl) about 3 miles from the permit area reports an average annual precipitation of 8.26 inches. On-site weather stations report an average annual precipitation of 9.67 inches. In Farmington, New Mexico, average annual net evaporation is estimated to be 49 inches (Westmoreland, 2022). A USGS study on the San Juan Mine area reports an average annual precipitation rate of 9.66 inches, an estimated potential evapotranspiration range of 24 to 35 inches, and an annual average pan evaporation rate of 66.81 inches (Stewart, 2018). The majority of the mine area vegetation is considered to

be Great Basin Desert Scrub while the southernmost part of the mine property extends into urban or farmland cover (Thomson et al., 2012).

Figure 3 shows a general geology map of the mine and nearby areas. The majority of the exposed geology on mine property is Cretaceous-age Kirtland Shale (Kk) and Fruitland Formation (Kf). Quaternary-age alluviums (Qcf and Qnt), eolian sand (Qes), terrace gravels (Q), and Pictured Cliffs Sandstone (Kpc) are also present. The Kirtland Shale is composed of three different members, all of which are present on site. The youngest and oldest members (the Upper Shale Member [Kku] and Lower Shale Member [Kkl], respectively) are green-gray shales with black carbonaceous beds and minor amounts of sandstone. The Farmington Sandstone Member (Kkm) is between the two shale members in age, and consists primarily of tan-colored sandstone. Below the Kirtland Shale is the Fruitland Formation, which consists of gray to black shale, light brown sandstone, and coal. The oldest unit exposed on site is the Pictured Cliff Sandstone, which is a tan, marine sandstone. Several older units that underlie below the units on site are exposed in a monocline hogback to the west of the mine (known only as "The Hogback"). These Cretaceous-age units include the Lewis Shale (Kl), Cliff House Sandstone (Kch), and Menefee Formation (Kmf), the latter two of which belong to the Mesaverde Group (Ward, 1990).

Figure 4 shows the soil coverage over the mine area. The majority of the mine area (from northwest to the central area) is covered by the gently sloping Blancot-Notal association and extremely steep Badland outcrops. In the southwest part of the mine, the primary soils are the very steep Haplargids-Blackston-Torriorthents complex and the less steep Avalon sandy loam. The eastern part of the mine has more extremely steep badlands as well as the moderately steep Farb-Persayo-Rock outcrop complex.

3. Existing Environmental Data

DBS&A is conducting a desktop evaluation to determine environmental conditions at the San Juan Mine. The evaluation will be presented in a subsequent report and based primarily on existing monitoring data collected at the mine by its operators. The purpose of this document and the assessment presented herein is to summarize the quality and usefulness of the existing data to characterize environmental condition at the San Juan Mine.

DBS&A conducted a site reconnaissance on May 9, 2024 with representatives from EMNRD and Westmoreland. The purpose of the site reconnaissance was to familiarize DBS&A with site

conditions, operations, and existing features of the mine's environmental monitoring program (e.g., stormwater samplers and wells).

3.1 Data Sources and Acquisition

The environmental data evaluated in this report were obtained from EMNRD, either directly through e-mail or downloaded from EMNRD's website for the San Juan Mine. The data are from various entities, including USGS, EMNRD, and Westmoreland. Westmoreland is the current owner/operator of the mine and has collected data while operating the mine. They also provided data collected by previous owners dating back to the 1970s.

3.2 Data Types

The following types of data are available for the San Juan Mine:

- *Climate data*. There are two meteorological stations listed in the current permit (Westmoreland, 2019): Met IB and Met IIB. Both stations are 10-meter tall towers with wind speed, wind direction, and temperature sensors. Met IB also has relative humidity and precipitation sensors. Each station has a datalogger to record parameter values (Westmoreland, 2019). The data made available to DBS&A for the mine include monthly precipitation values from 1974 to 1996 and monthly temperature values (mean, maximum, and minimum) from 1992 to 1996 (Westmoreland, 2019).
- *Borehole and well logs*. There are few lithologic logs and completion diagrams available for the on-site wells. Logs and diagrams are available for four deep wells (17CC, 26AA, 32CD, and 35DD) and a few older wells drilled into the No. 8 Coal Seam in the Fruitland Formation, such as G3 and G20 (Westmoreland, 2019). Appendix 804.B in the current permit document also contains completion diagrams for piezometers from an early 1980s study on the arroyos in and around the San Juan Mine, completed by Metric Corporation (Westmoreland, 2019). The locations given for these piezometers are vague and the included location map is unreadable. Because most borehole logs were unavailable, DBS&A relied on completion information summarized in report tables (e.g., Table 1 of Stewart, 2018) and well designations when developing geologic cross sections and developing maps specific to water-bearing geologic units. Some well designations are indicative of completion; for instance, KF-1 is completed in Fruitland (F) Formation and KPC-3 is completed in Pictured Cliffs (PC) Sandstone.

- *Survey data for monitoring locations.* Survey data (i.e., coordinates and top of casing elevations) are available for a total of 48 wells, including all of the wells on the current monitoring schedule (Westmoreland, Undated-a). Table 804.A-1 in the current permit document supplements this information with additional completion information on several bedrock monitor wells (Westmoreland, 2019).
- *Depth to groundwater measurements at site monitor wells.* A total of 10 years (2014 to 2024) of depth to groundwater measurements are available for the current schedule of groundwater monitor wells (Westmoreland, Undated-b). Measurements ranging in date from the 1980s to the late 1990s are also available for GA, GB, GD, GE, GL, G3, G10, G20 (Westmoreland, 2019). Multiple measurements from 1997 are available for G25 and G26, as well as 1998 for the deep wells (Westmoreland, 2019).
- *Groundwater quality data.* Groundwater is currently monitored at 31 wells at the San Juan Mine (Westmoreland, 2024). Data exist for other wells and piezometers that are not currently monitored. The groundwater quality data span over 50 years, from 1973 through the end of 2024. The parameters sampled include general chemistry (alkalinity, bromide, chloride, fluoride, hydroxide, nitrate, nitrite, pH, phosphate, phosphorus, specific conductance, sulfate, sulfide, sulfur, TDS, and total organic carbon [TOC]), dissolved and total metals (aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chromium, cobalt, copper, cyanide, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, potassium, radium-226/-228, selenium, silica, silicon, silver, sodium, strontium, thallium, uranium, vanadium, and zinc), and multiple organics. The organic parameters have only been sampled since 2022, with the exception of phenols.

  Only data provided from 2010 to 2023 include analytical methods and laboratory information (EMNRD, Undated-a, Undated-b, and Undated-c; Westmoreland, Undated-c, Undated-d, and Undated-e).
- *Surface water quality data.* Surface water is currently monitored from 13 automated samplers located in drainages on the San Juan Mine property. The sample dates for these data range from the late 1970s to 2024. Limited data are available from the National Pollutant Discharge Elimination System (NPDES) outfalls because they rarely discharge. Data from the early 2010s are available for two of the NPDES outfalls. Surface water quality parameters include a list similar to the groundwater quality parameters, plus organics and a few total parameters in addition to the dissolved ones. Only data provided since 2010 include analytical methods and laboratory information (Westmoreland, Undated-c and Undated-f).

- *Mine facilities*. Water quality data from 2004 through 2011 are available for eight on-site ponds. Other samples (pre-2015) from mine facilities are available; however, specific locations for these samples are not known (Westmoreland, Undated-c).
- *Other data types*. The following types of data are also available:
  - Regraded spoil data (Westmoreland, 2024).
  - Annual coal combustion by-product (CCB) analytical results 2006-2024 (Assaigai, 2008; BHP, 2006, 2007, 2009, 2010, 2011, 2012, 2013, and 2015; San Juan Coal Company, 2016, 2017, 2018, and 2019; Westmoreland, 2020, 2021, 2022, and 2025).
  - Pumping and/or slug test data for nine on-site wells (Westmoreland, 2019).
  - Locations for nearby permitted and unpermitted wells in the vicinity of the San Juan Mine (Westmoreland, 2019 and Undated-g).
  - Stormwater flow event data for stations on the Shumway and Westwater Arroyos on September 14, 1979 (Westmoreland, 2019).
- *Online data*. A variety of site-specific and regional data are available from reputable online resources, such as well information from the New Mexico Office of the State Engineer (OSE) and soils data from the Soil Survey Geographic Database (SSURGO) of the Natural Resources Conservation Service.

3.3 Data File Formats

Data were provided to DBS&A in the following formats: Microsoft Excel spreadsheets (.xlsx and .xls), portable document format files (PDFs), ArcGIS shapefiles, and Microsoft Word documents (.docx and .doc).

4. Data Quality and Relevance

DBS&A evaluated the quality and usefulness of the existing data following EPA guidance (U.S. EPA, 2002 and 2003).

4.1 Assessment Approach

The data collected from the San Juan Mine were assessed to determine if they are of sufficient quality and relevance to be used to characterize site conditions and develop a remediation and

restoration planning document (if warranted) for the mine. The five general assessment factors described in U.S. EPA (2003) were considered. U.S. EPA (2003) developed these factors to help with the evaluation of the quality and relevance of data, obtained from various sources, to a new intended use, such as a new project or study. The five general assessment factors are as follows:

- *Soundness*. This factor assesses how the information was generated. In the case of this review, it applies to how data (i.e., climate, survey, water level, and chemistry data) were collected, including the instruments (probes, sensors, etc.) and methods used (field sampling, laboratory protocols, etc.). In general, the methods employed are reasonable and consistent with standard practices and the data's intended application for the San Juan Mine investigation. The last two evaluation steps in Chapter 3 of U.S. EPA (2002) help to characterize data for this factor. The third step is to evaluate the existing data regarding the data quality needed for the project. The final step is to document any quality issues with the existing data.
- *Applicability and utility*. This factor assesses the relevancy of the generated information for a study's intended purpose. The first two evaluation steps in Chapter 3 of U.S. EPA (2002) apply to this factor. First, determine the data needs for the project. Second, determine what data sources may fulfill the needs. All of the data described in Section 3.2 were generated primarily to characterize and monitor environmental conditions at the San Juan Mine, including groundwater and surface water quality; therefore, they are relevant to the San Juan Mine investigation.
- *Clarity and completeness*. This factor assesses how well the methods used to generate the data are explained or documented. In the case of this review, clarity and completeness applies primarily to the water level and water quality data. For the water level data, this includes a record of how the water levels were measured. For the water quality data, this includes a record of how the chemical samples were taken and analyzed (e.g., how the well was purged, how the samples were labeled and stored, chain-of-custody information, and documentation on laboratory procedures).
- *Uncertainty and variability*. This factor describes variability and uncertainty (quantitative and qualitative) in the existing data. The existing data were provided to DBS&A with little or no information regarding uncertainty or variability. These parameters are common in environmental data and will be evaluated using statistical techniques and documented in the subsequent investigation report.

- *Evaluation and Review*. This factor includes independent verification, validation, and peer review of the information or of the procedures, measures, methods, or models. The existing data were provided to DBS&A in typical data file formats (e.g., Excel spreadsheets) with no documentation or independent verification/validation.

4.2 Assessment Results

In general, the existing data are of sufficient quality and relevance to be used to characterize conditions at the San Juan Mine and develop the remediation and restoration planning document. Table 1 summarizes the assessment using the EPA's five general assessment factors (i.e., soundness, applicability and utility, clarity and completeness, uncertainty and variability, and evaluation and review [U.S. EPA, 2003]).

The number of currently available well and borehole logs is limited. The logs provided only include a few of the older wells, which are identified with the current well designation in handwriting. For the remaining well logs, it is unknown if these are wells currently used for monitoring, are existing and not used for monitoring, or are no longer existing. Location for each well is only provided as township, range, section, and quarter sections, which is too vague to identify precise locations. Only the driller (usually just the company) is identified on the logs, with no geologist named. Lithologic descriptions are often abbreviated and typically limited to the rock type (e.g., colluvium, shale, siltstone), the color, and the occasional other type of description (e.g., iron staining). Well completion information is detailed, and includes a completion diagram and initial depth to water information. The provided well logs are expected to be of limited use for the investigation report. Additional well logs will be considered if provided.

Survey data for monitoring locations have been obtained; therefore, the data quality for these sites is considered high.

The majority of the existing water quality data have been provided in a spreadsheet-type format, similar to that received directly from analytical laboratories. Laboratory names, analytical methods, and detection limits are provided with the results starting in 2010; therefore, the data quality from then on is considered high. The data have been provided electronically; therefore, there is little to no chance of introducing transcription errors during the construction of our Microsoft Access database (Section 5.2).

The Statute identifies 21 constituents of concern: antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chloride, chromium, cobalt, fluoride, lead, lithium, mercury, molybdenum, pH, radium-226, radium-228, selenium, sulfate, thallium, and TDS. The data provided for beryllium and lithium are limited. However, with these exceptions noted, sufficient data have been provided to evaluate the Statute's list of constituents.

5. Data Compilation

DBS&A compiled the site data into a geographic information system (GIS) to assist with the creation of future maps and an Access database to store the various data types and facilitate future analyses.

5.1 Establishment of a GIS

ArcGIS is a software program used to analyze and visually exhibit spatial data. A spatial dataset, or shapefile, needs to include coordinates and an assigned coordinate system to be used by the software. Westmoreland provided a shapefile for each type of on-site facility, such as for the monitor wells, surface water sample sites, roads, buried CCB locations, and ponds. For example, the monitor well shapefile includes x and y coordinates (assigned to the NAD 1927 New Mexico West State Plane coordinate system) and top of casing elevations (referenced to mean sea level) for each well. The spatial datasets can include additional information (i.e., attributes) regarding the facilities. For example, the monitor well shapefile also includes total well depths and geologies of the screened intervals.

In ArcGIS, spatial datasets can be combined or overlain to create maps and can be used to conduct analyses. For instance, the monitor wells (or other facilities) can be plotted in space alongside other spatially referenced data, such as aerial imagery (Figure 5). Additional data can then be applied to the well locations, such as chemistry and water level data, to show the spatial distribution of chemical constituents and construct potentiometric surface maps.

The site features provided by the Westmoreland include the following:

- Monitoring sites
  - Groundwater monitor wells and surface water monitoring sites
  - Surface water grab sample sites
  - NPDES Outfalls

  - Weather and air monitoring stations
  - Spoil sample locations
- Mine permit boundaries
- Mine facilities and features
  - Powerlines, roads, and structures (e.g., ponds, topsoil stockpiles [TSS], and excess spoil stockpiles [ESS])
  - Disturbed areas
  - Graded, seeded, and top-dressed areas
  - Top of stockpile areas
  - Former ash disposal areas
  - Gob vent boreholes
- Historical aerial imagery
- Historical topographic contours

DBS&A has placed files for these features into ArcGIS (Figures 1 through 5) to support future data analyses and interpretations. These analyses and interpretations will be presented in the investigation report.

5.2 Creation of an Access Database

Westmoreland provided tabulated water level elevation data and water quality data in Excel spreadsheets and PDFs. These data tables have been combined into an Access database. In addition, the location and measuring point data for wells and surface water monitoring sites have been included in the database. The location data help to attribute the data to a specific location. The measuring point data help to more quickly calculate groundwater elevation from depth to water measurements.

6. Conclusion

DBS&A has evaluated the data acquired concerning the San Juan Mine and surrounding areas for relevancy and quality for the San Juan Mine remediation and restoration study. The list includes data on climate, well construction and lithology from well and borehole logs, survey locations, groundwater elevation, water quality, mine facilities, and other environmental

concerns. DBS&A has concluded that the data are relevant to the mine and are of sufficient quality to characterize conditions at the mine for the study.

References

Assaigai Analytical Laboratories, Inc. (Assaigai). 2008. Laboratory report for ash and gypsum samples collected first quarter of 2008, PNM San Juan Generating Station. Samples received March 31, 2008.

BHP Billiton (BHP). 2006. Letter report from Brent Musslewhite to Jim O'Hara, New Mexico Mining and Minerals Division (MMD), regarding San Juan Mine Permit No. 05-01; Public Service Company of New Mexico's results from long-term leaching procedure. July 18, 2006.

BHP. 2007. Letter report from Cybil B. White to Jim O'Hara, MMD, regarding San Juan Mine Permit No. 05-01; San Juan Generating Station's 2007 ash analytical report. August 27, 2007.

BHP. 2009. Letter report from Cybil B. White to Jim O'Hara, MMD, regarding San Juan Mine Permit No. 05-01: Public Service Company of New Mexico's annual ash analytical report for calendar year 2009. August 25, 2009.

BHP. 2010. Letter report from Dennis R. Vaughn to Jim O'Hara, MMD, regarding San Juan Mine Permit No. 09-01 900.B(4): Public Service Company of New Mexico's annual ash analytical report for calendar year 2010. June 11, 2010.

BHP. 2011. Letter report from Dennis R. Vaughn to Jim O'Hara, MMD, regarding San Juan Mine Permit No. 09-01 900.B(4): Public Service Company of New Mexico's annual ash analytical report for calendar year 2011. August 9, 2011.

BHP. 2012. Letter report from Steven Perkins to Dave Clark, MMD, regarding San Juan Mine Permit No. 09-01 900.B(4): Public Service Company of New Mexico's annual ash analytical report for calendar year 2012. June 28, 2012.

BHP. 2013. Letter report from Steven Perkins to Dave Clark, MMD, regarding San Juan Mine Permit No. 09-01 900.B(4): Public Service Company of New Mexico's annual ash analytical report for calendar year 2013. July 9, 2013.

BHP. 2015. Letter report from Daphne Place-Hoskie to Dave Clark, MMD, regarding San Juan Mine Permit No. 09-01 900.B(4) Public Service Company of New Mexico's annual ash analytical report for calendar year 2014. June 29, 2015.

Energy, Minerals and Natural Resources Department (EMNRD), State of New Mexico. Undated-a. *All_SanJuan_GroundwaterData_EMNRD_SLD_20240711.xlsx*. Downloaded from EMNRD Sharepoint site on July 11, 2024.

EMNRD. Undated-b. *San Juan 2023_EMNRD_SLD.xlsx*. Downloaded from EMNRD Sharepoint site on July 11, 2024.

EMNRD. Undated-c. *San Juan Mine_EMNRD_2021.xlsx*. Downloaded from EMNRD Sharepoint site on July 11, 2024.

Nickelson, H.B. 1988. *One hundred years of coal mining in the San Juan Basin, New Mexico*. New Mexico Bureau of Mines and Mineral Resources Bulletin 111.

Office of Surface Mining Reclamation and Enforcement (OSMRE). 2019. *Final environmental impact statement, San Juan Mine deep lease extension mining plan modification*. U.S. Department of the Interior. March 2019.

San Juan Coal Company. 2016. Letter report from Daniel Mumm to James Smith, MMD, regarding San Juan Mine Permit 14-01 900.B(4) Public Service Company of New Mexico's annual ash analytical report for calendar year 2015. June 15, 2016.

San Juan Coal Company. 2017. Letter report from Daniel Mumm to James Smith, MMD, regarding San Juan Mine Permit 14-01 900.B(4) Public Service Company of New Mexico's annual ash analytical report for calendar year 2016. August 3, 2017.

San Juan Coal Company. 2018. Letter report from Daniel Mumm to James Smith, MMD, regarding San Juan Mine Permit 14-01 900.B(4) Public Service Company of New Mexico's annual ash analytical report for calendar year 2017. July 3, 2018.

San Juan Coal Company. 2019. Letter report from Daniel Mumm to James Smith, MMD, regarding San Juan Mine (MMD Permit 14-01); Public Service Company of New Mexico's annual ash analytical report for calendar year 2018. June 20, 2019.

Stewart, A.M. 2018. *Hydrologic assessment and numerical simulation of groundwater flow, San Juan Mine, San Juan County, New Mexico, 2010–13*. U.S. Geological Survey Scientific Investigations Report 2017–5155.

Thomson, B., J. Stormont, M. Stone, R. Webb, C. Parker, and K. Bramlett. 2012. *Analysis of coal combustion by-products disposal practices at the San Juan Mine: Hydrologic & water quality issues*. Submitted to the Mining and Minerals Division, Energy, Minerals and Natural Resources Department, State of New Mexico. July 2012.

U.S. Environmental Protection Agency (U.S. EPA). 2002. *Guidance for quality assurance project plans, EPA QA/G-5*. EPA/240/R-02/009. December 2002.

U.S. EPA. 2003. *A summary of general assessment factors for evaluating the quality of scientific and technical information*. Assessment Factors Workgroup, Science Policy Council. EPA 100/B-03/001. June 2003.

Ward, A.W. 1990. *Geologic map emphasizing the surficial deposits of the Farmington 30' x 60' quadrangle, New Mexico and Colorado*. U.S. Geological Survey Miscellaneous Investigations Series Map I-1978.

Westmoreland Coal Company (Westmoreland). 2019. *SJM Permit 19-01*. Accessed April 15, 2024. <https://www.emnrd.nm.gov/mmd/public-notices/>.

Westmoreland. 2020. Letter report from Daniel Mumm to James Smith, MMD, regarding San Juan Mine (MMD Permit 19-01); Public Service Company of New Mexico's annual ash analytical report for calendar year 2019. June 29, 2020.

Westmoreland. 2021. Letter report from Daniel Mumm to James Smith, MMD, regarding San Juan Mine (MMD Permit 19-01); Public Service Company of New Mexico's annual ash analytical report for calendar year 2020. June 29, 2021.

Westmoreland. 2022. Letter report from Derek Rawson to James Smith, MMD, regarding San Juan Mine (MMD Permit 19-01); Public Service Company of New Mexico's annual ash analytical report for calendar year 2021. June 28, 2022.

Westmoreland. 2024. *San Juan Mine, 2023 annual report.* February 2024.

Westmoreland. 2025. Letter report from Derek Rawson to Erik Munroe, MMD, regarding San Juan Mine (MMD Permit 19-01); third and fourth quarter 2024 ash quantity report. January 29, 2025.

Westmoreland. Undated-a. *SJM GW Monitoring Wells.shp*. Received from EMNRD on April 9, 2024.

Westmoreland. Undated-b. *San Juan Mine - Ground Water Level Data.xlsx*. Received from EMNRD on August 1, 2024.

Westmoreland. Undated-c. *ALL-MINES-WQ-Site-Samples-and-Parameters-2015-07-06.xlsx*. Received from EMNRD on March 26, 2024.

Westmoreland. Undated-d. *SJCC Groundwater Analytical Results 2010 - 2022_20240513.xls*. Downloaded from EMNRD Sharepoint site on May 14, 2024.

Westmoreland. Undated-e. *Well GC Data 1970s.xlsx*. Downloaded from EMNRD Sharepoint site on April 8, 2024.

Westmoreland. Undated-f. *San Juan Mine - Surface Water Data.xlsx*. Downloaded from EMNRD Sharepoint site on July 16, 2024.

Westmoreland. Undated-g. *LMAP_WellsInVacinity.shp*. Accessed April 15, 2024. <https://www.emnrd.nm.gov/mmd/public-notices/>.

Figures

San Juan Mine
Shiprock
Waterflow
Fruitland
Kirtland
Farmington
Spencerville
Aztec
Flora Vista
Bloomfield
La Plata River
Animas River
San Juan River
Chaco River
64
491
170
516
550
Site Location
New Mexico
Source: Aerial imagery (NAIP, 2024)
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a Geo-Logic Company
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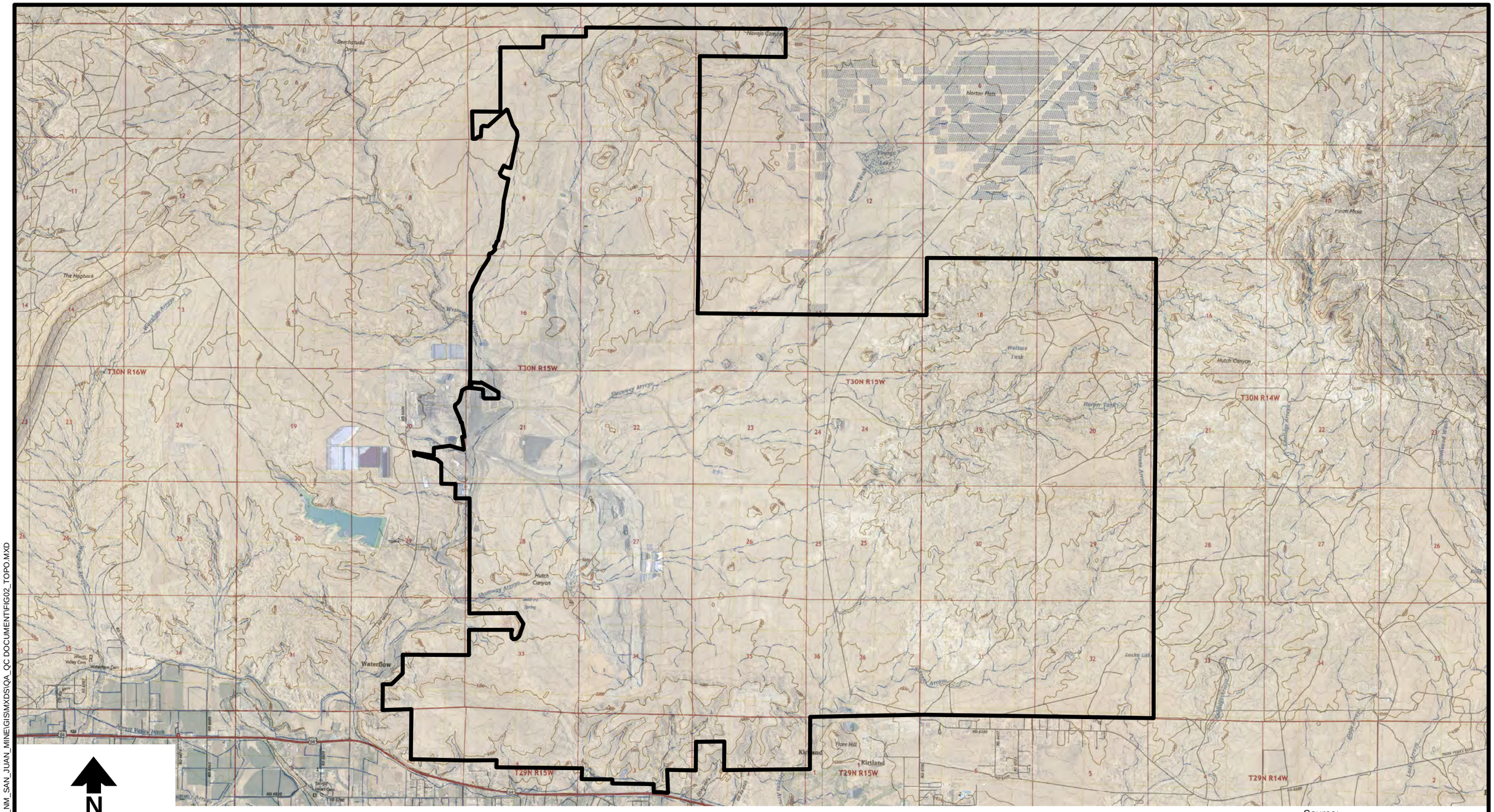
SAN JUAN MINE
Site Location
Figure 1



N

0 2,150 4,300 ft

Explanation

San Juan Mine lease and permit boundary

DBS&A
a Geo-Logic Company

6/17/2025 DB24.1140

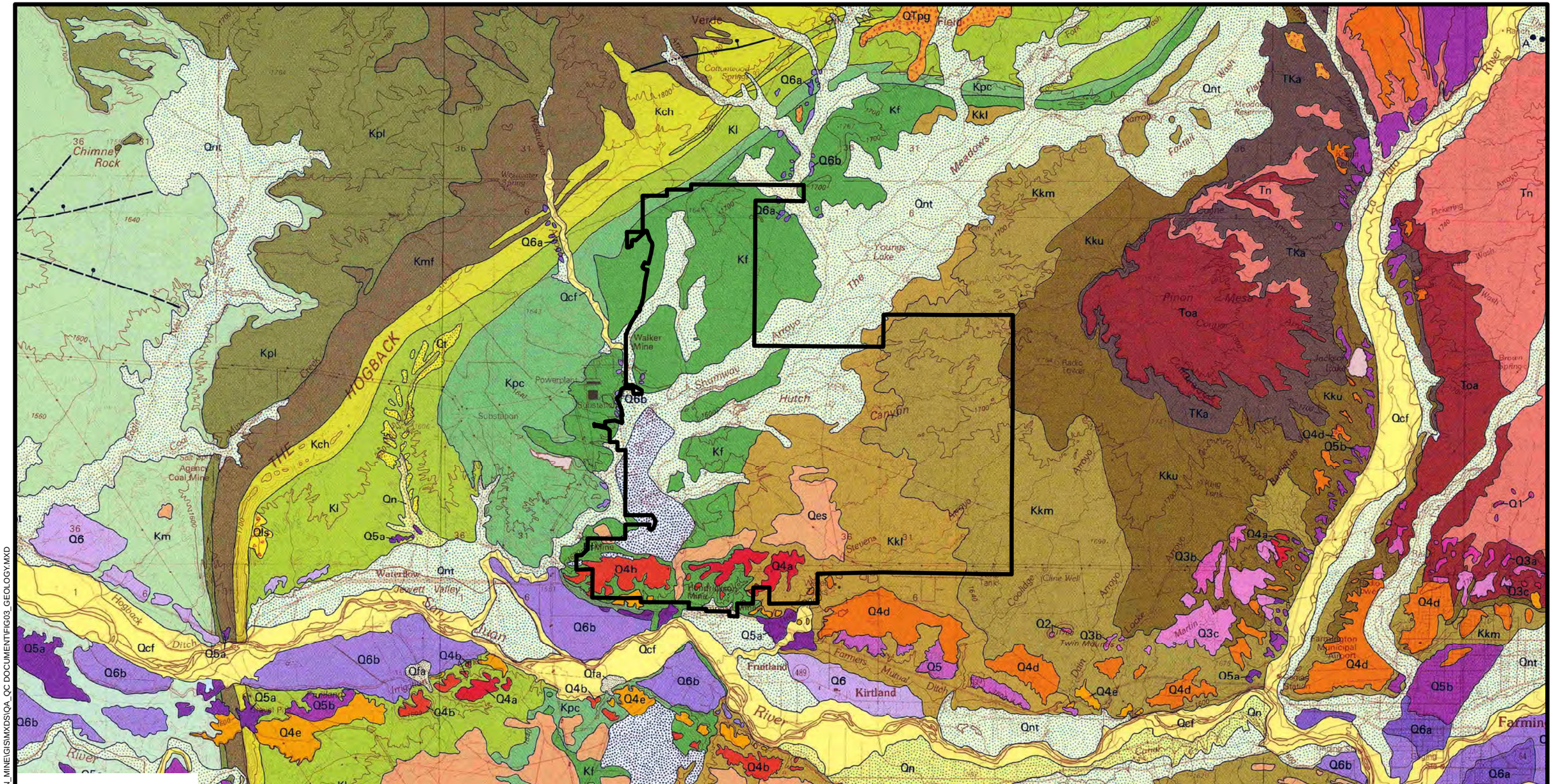
Source:
1. Surface topography (USGS, 2023)
   a. Chimney Rock Quadrangle
   b. Waterflow Quadrangle
   c. Youngs Lake Quadrangle
2. Aerial imagery (NAIP, 2024)

SAN JUAN MINE

Surface Topography

Figure 2

S:\PROJECTS\DB24.1140_EMNRD_NM_SAN_JUAN_MINE\GIS\MXDS\QA_QC DOCUMENT\FIG02_TOPO.MXD



Source: Surface geology (Ward, 1990).

N

0 0.75 1.5 mi

Explanation

San Juan Mine lease and permit boundary

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6/17/2025 DB24.1140

SAN JUAN MINE

Generalized Surface Geology

Figure 3

S:\PROJECTS\DB24.1140_EMNRD_NM_SAN_JUAN_MINE\GIS\MXDS\QA_QC DOCUMENT\FIG03_GEOLOGY.MXD

N

0 0.5 1 mi

Explanation

San Juan Mine lease and permit boundary

Soil type

- Av Avalon sandy loam, 2-5% slopes
- BA Badland
- BB Badland-Monierco-Rock outcrop complex, extremely steep
- BC Badland-Rock outcrop Persayo complex, extremely steep
- BT Blancot-Notal association, gently sloping
- DS Doak-Sheppard-Shiprock association, rolling
- FA Farb-Persayo-Rock outcrop compex, moderately steep
- Fs Fruitland sandy loam, wet, 2-5% slopes
- FX Fruitland-Persayo-Sheppard complex, hilly
- HA Haplargids-Blackston-Torriorthents complex, very steep
- Su Stumble loamy sand, 3-8% slopes
- Tt Turley clay loam, wet, 0-2% slopes
- W Lakes, rivers, reservoirs
- Wa Walrees loam

Source:
1. Aerial imagery (NAIP, 2022).
2. Soils (SSURGO, 2023).

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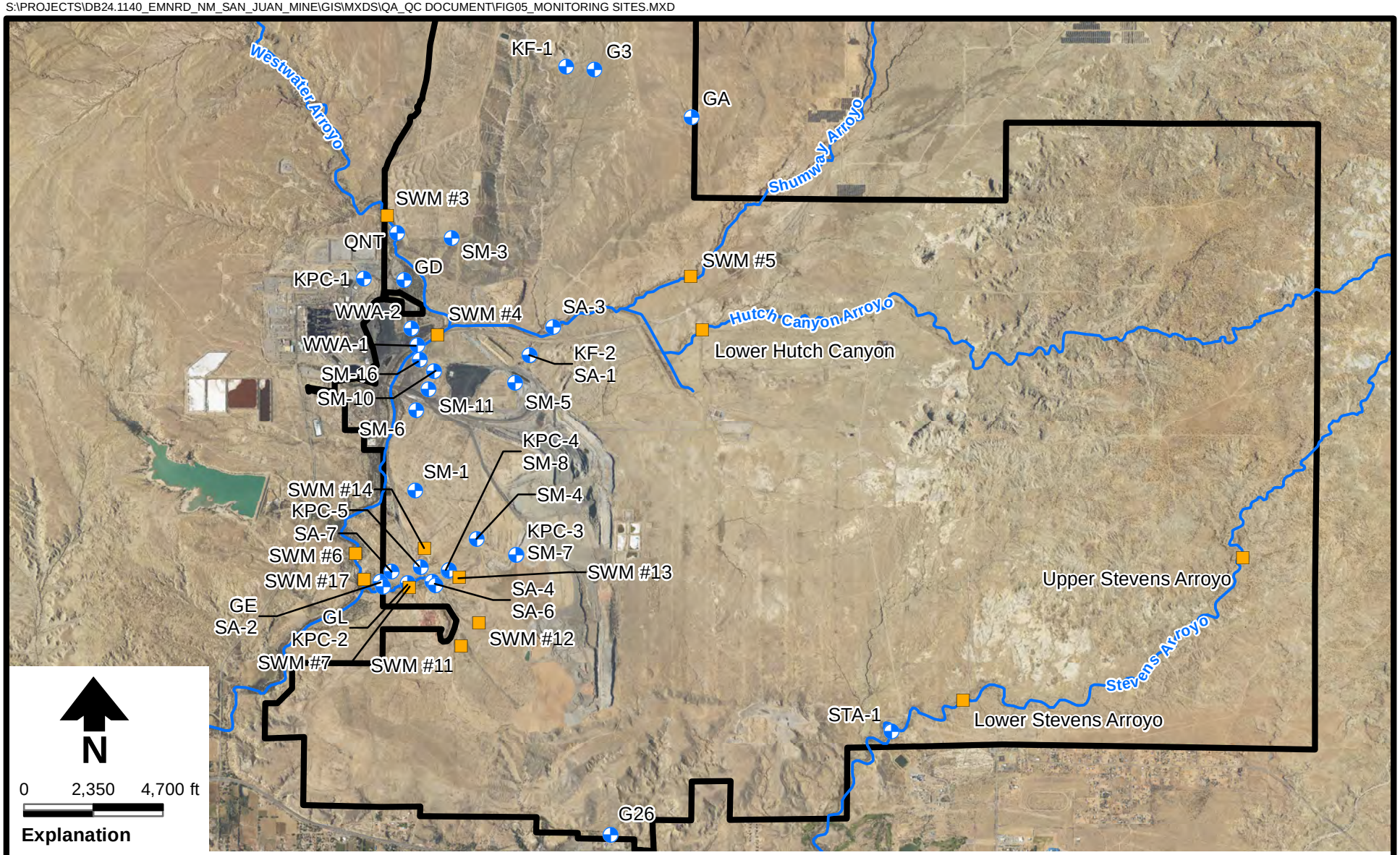
SAN JUAN MINE

Soil Map

Figure 4

S:\PROJECTS\DB24.1140_EMNRD_NM_SAN_JUAN_MINE\GIS\MXDS\QA_QC DOCUMENT\FIG04_SOILS.MXD

S:\PROJECTS\DB24.1140_EMNRD_NM_SAN_JUAN_MINE\GIS\MXDS\QA_QC DOCUMENT\FIG05_MONITORING SITES.MXD



Source: Aerial imagery (NAIP, 2024)

Figure 5

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SAN JUAN MINE

Groundwater and Surface Water Monitoring Locations

Tables

Table 1. Evaluation of Existing Data Using EPA's Five General Assessment Factors

Data Type	Source	U.S. EPA (2003) General Assessment Factors				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
Climate data	Monthly summaries have been provided (e.g., monthly precipitation values for 1974-1996).	Sound. Data are being recorded at two weather stations. Data include humidity, precipitation, temperature, wind speed, and wind direction.	Applicable. Data can be used to generally describe site-specific climatic conditions.	Data appear to be clear and complete. Daily (instead of monthly) values would be better when estimating stormwater flow and groundwater recharge.	▪ Uncertainty is likely described in manuals for the two weather stations and is expected to be low. ▪ Temporal and spatial variability are expected and common for these types of data.	▪ DBS&A is unaware of any existing third party data review or evaluation. ▪ DBS&A will perform data review as data are used for evaluation, including preparation of time-series plots and statistical calculations. This will help to identify any erroneous data or periods with data gaps.
Borehole and well logs	Provided as an appendix in the Mine's 2019 permit. Downloaded from EMNRD website.	Somewhat sound. Logs generally consist of lithologic descriptions and field notes recorded by drillers as boreholes were advanced and wells constructed.	Applicable. Data can be used to characterize subsurface conditions, prepare geologic cross sections, and identify water-bearing rocks.	▪ Limited clarity and completeness. Lithologic descriptions are generally limited to major rock types (e.g., colluvium, shale, siltstone). Well completion information is detailed and includes completion diagrams. ▪ Missing well identities and precise locations on some of the logs.	▪ Lithologic descriptions are interpretative and so some uncertainty exists in the descriptions provided on the logs. ▪ Well completion information is likely accurate and representative of the wells. ▪ Uncertainty regarding well identities and precise locations on some of the logs	
Survey data for monitoring locations	Provided as a shapefile and obtained by EMNRD from the Mine. Provided in an appendix in the Mine's 2019 permit and downloaded from EMNRD website.	Sound. Locations were surveyed. Data of survey provided in attribute table for the monitor wells.	Applicable. Data can be used to accurately show locations of monitoring sites. This will help when evaluating water level and quality data and showing the spatial distribution of constituent concentrations.	Clear and somewhat complete. Name of surveyor not provided but other information is (e.g. x, y, and z coordinates).	▪ Monitor well survey coordinates given to the ±0.01 foot. ▪ Survey coordinates for surface water site monitoring sites given to the ±0.1 foot.	
Depth to groundwater measurements	Provided as an excel file obtained by EMNRD from the Mine. Provided as an appendix in the Mine's 2019 permit and downloaded from EMNRD website.	Sound. Data recorded routinely and apparently with a standard depth to water meter.	Applicable. Data can be used to prepare hydrographs and potentiometric surface maps to determine groundwater flow directions.	Clear and complete. Records consist of dates, depth to groundwater measurements, locations, and initials of field technicians.	Depth to groundwater measurements given to the ±0.01 foot.	
Groundwater, surface water, and mine water quality data	Provided as spreadsheets from EMNRD. Some data collected by the Mine and some by EMNRD.	Sound. Water quality samples collected and submitted to analytical laboratories for analysis.	Applicable. Data can be used to characterize water quality and determine if groundwater or surface water have been impacted by mining activities.	Clear and complete. Records consist of constituent concentrations and associated units and analytical methods. They also include sample dates and locations.	Reporting limits provided.	

Appendix A

Water Features near the San Juan Mine

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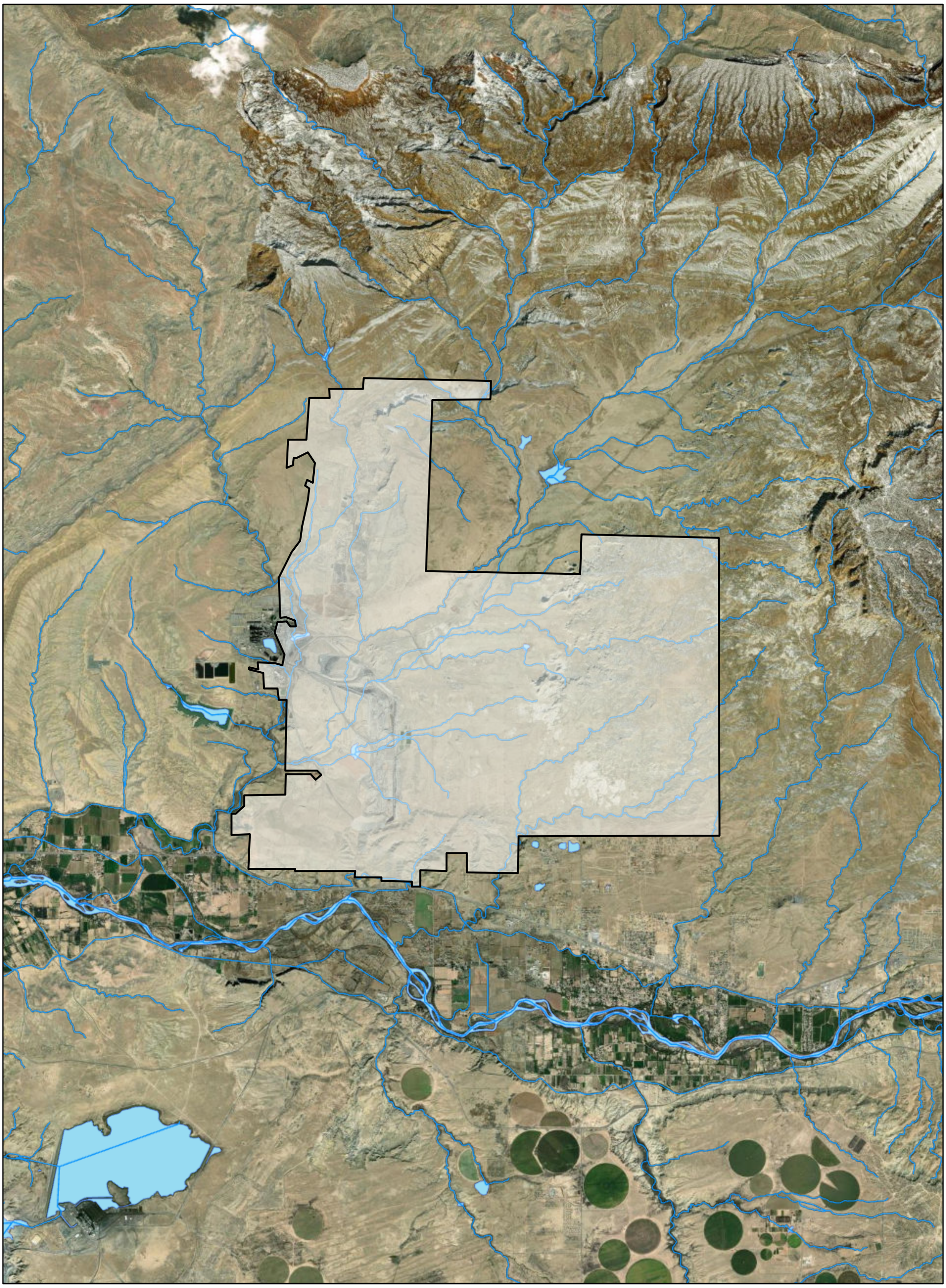
Water Features near the San Juan Mine



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Override 1

OSW Water Bodys

OSE Streams

1:100,000

0 0.75 1.5 3 mi

0 1.25 2.5 5 km

Earthstar Geographics
NM OSE

New Mexico Oil Conservation Division