DRAFT REPORT

LA JARA MESA PROJECT

DRAFT Baseline Data Report

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Submitted To: Laramide Resources (USA) Inc.
The Exchange Tower
130 King Street West, Suite 3680
Box 99
Toronto, Ontario, Canada M5X 1B1

Submitted By: Golder Associates Inc.
5200 Pasadena Avenue N.E., Suite C
Albuquerque, NM 87113 USA

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Europe	+ 356 21 42 30 20
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solutions@golder.com
www.golder.com

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Golder Associates Inc.
5200 Pasadena Avenue N.E., Suite C
Albuquerque, NM 87113 USA
Tel: (505) 821-3043
Fax: (505) 821-5273

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1.0 INTRODUCTION

New Mexico Administrative Code (NMAC) 19.10.6.602 D.(13)

The level of detail required for environmental baseline information may vary depending on the location, size, scope and type of mining operation and site-specific characteristics. Baseline data shall describe the environment of the proposed permit area and, to the extent practicable, the affected area. Data gathered or available to the applicant for other purposes, such as a site assessment previously submitted, may be used in part to meet the requirements of this Part. Baseline data shall be collected over a period of at least 12 months for evaluation of water quality and quantity, wildlife and wildlife habitat and vegetation. The Director may require studies of longer duration than 12 months to address unique, site-specific factors.

In the United States, nuclear sources provide about 21 percent of our electrical energy supply compared to 70 percent for carbon-based (oil, coal, and natural gas) and 9 percent for renewable sources (wind, solar and hydropower). As concerns related to carbon emissions increase, greater emphasis is being given to nuclear and renewable sources. Laramide Resources (USA) Inc. (Laramide) proposes to develop an underground uranium mine in northwestern New Mexico.

The La Jara Mesa Project is located in the Ambrosia Lake Mining District approximately 10 miles northwest of Grants, NM (Figure 1-1). As part of the New Mexico Mining Act (NMMA) permit application process (Subsection D.13 of 19.10.6.602 NMAC), the New Mexico Mining and Minerals Division (MMD) requires preparation of an environmental baseline data report to support the mine permit application. Golder Associates Inc. (Golder) was retained by Laramide to prepare the Baseline Data Report (BDR) for the La Jara Mesa Project.

Laramide Resources (USA) Inc. (Laramide) has submitted a Plan of Operations for the La Jara Mesa Project to the United States Department of Agriculture (USDA) Forest Service (Forest Service) and the New Mexico Energy, Minerals and Natural Resources Department's MMD in support of the new mine permit application process. The Plan of Operations includes a detailed description of the proposed mine operations and reclamation plan (Laramide, 2008). The operational and reclamation plans are summarized below.

The proposed mine portal and surface facilities would be located on Forest Service land at the base of La Jara Mesa in Cibola County, New Mexico (Plate 1). Access to the proposed Permit Area from State Highway 605 is along an unpaved road across private, Bureau of Land Management (BLM), and Forest Service land.

The proposed mine portal and surface facilities (miner change house [dry], administration office, maintenance facility, fuel and explosives storage areas, etc.) would be located at about 7,300 feet (above

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mean sea level) in the northeast quarter (NE¼) of Section 15, Township (T) 12 North (N), Range (R) 9 West (W). An escape raise would be about 1 mile east of the portal on top of the mesa in Section 11, T12N, R9W (Plate 1). The ore zones are located about 600 feet below the surface of the mesa in portions of Sections 1, 2, 11, 12, 13 and 14, T12N, R9W.

Approximately 16.4 acres of surface disturbance is anticipated within the proposed Permit Area for the portal, surface facilities, and escape raise. The existing access road that crosses private, BLM, and Forest Service land would be upgraded to meet the Forest Service single-lane road standard with periodic turn-outs. Water and electric power utility lines would parallel the road in the proposed Permit Area on Forest Service land. Laramide intends to haul ore to a licensed mill; therefore, no ore processing (milling) or mill tailing disposal areas are associated with this project.

The proposed La Jara Mesa Project would develop two parallel, low-angle inclines for access to the ore while providing ventilation. These underground workings would be approximately 12 feet wide, 15 feet high and 5,000 feet long. The main incline would be for mining access and second incline would be used primarily for ventilation and as a contingency access for emergencies. Waste rock from the two inclines will be placed just west of the portal. Once the inclines are complete, the escape raise (an approximate 8-foot diameter borehole) would be constructed using a raise boring machine. A small diameter drill hole would be drilled from the surface of the La Jara Mesa to the underground mine. Then a drill raise bore would be “pulled” back to the surface to create escape raise. Waste rock from the escape raise boring would fall into the underground mine and would then be hauled out the main incline to the waste rock pile (Plate 2).

The underground mine would be developed using the room and pillar mining technique. The overburden and barren (un-mineralized) rock produced while constructing the inclines, escape raise, and underground mine would be placed just west of the portal (Plate 2). A flat pad area would be constructed from overburden and waste rock that would be used as a foundation for the mine’s surface facilities. Storm-water diversions and sediment ponds would be constructed to control and contain surface water. A compacted clay-lined area with internal drainage controls would be constructed for temporary ore storage.

During the first phase of mining, an estimated 40,000 to 50,000 tons of ore would be removed for bulk mill testing. Under full production, the mine is anticipated to yield an average of 500 tons per day. The ore would be transported to the surface in mine trucks and placed on the compacted clay-lined area to prevent mixing of the waste rock and ore. The ore would be periodically loaded and transported in 40-ton highway trucks to a licensed mill for processing.

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After the cessation of operations, Laramide would reclaim the site to meet the requirements of Section 19.10.6.603 NMAC. The major components of the reclamation involve permanently closing the inclines, underground mine and escape raise; demolishing and removing the buildings; reestablishing hydrologic balance of the surface-water system; and covering and revegetating the overburden and waste rock pile. The mine access road off the existing Forest Service road would be decommissioned and revegetated. The overall purpose of the reclamation is to return the disturbed surface to a stabilized and self-sustaining condition that is consistent with the post-mining land use and surrounding ecosystem.

1.1 Proposed Permit Area

The proposed Permit Area boundaries for the La Jara Mesa Project are shown on Plate 1. The proposed Permit Area covers approximately 107 acres composed of the underground mine section, the access road right-of-way and utility corridor, and escape raise. The underground mine would underlie approximately 77 acres of the total proposed Permit Area. The access road right-of-way and utility corridor would occupy approximately 30 acres of the total proposed Permit Area. The escape raise portion of the total proposed Permit Area would be 0.25 acres. Projected total disturbance of the surface within the proposed Permit Area is 22 acres. A projected surface disturbance of 16.4 acres is associated with the underground mine. The disturbed surface would include surface-water diversions and sedimentation controls, topsoil storage and waste rock pile, buildings, the portal, and roads (surface facilities). The access road right-of-way and utility corridor would occupy approximately 6 acres of surface disturbance associated with the upgrading the existing road. The escape raise portion of the proposed Permit Area would be approximately 0.10 acre. Thus, the proposed Permit Area for the La Jara Project is 107 acres with a projected disturbed surface of approximately 22 acres, including the existing access road and utility corridor.

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1.2 Baseline Data Collection

The objective for gathering the baseline data is to describe the proposed Permit Area and the potential affected area to the extent practicable. The requirements for the collecting baseline data are broadly defined under 19.10.6.602.D.13 NMAC, with the level of detail determined by the location, size, scope, and type of mining operation at the discretion of the MMD Director. The NMAC allows the use of existing data where appropriate, but requires a minimum of 12 months of site-specific data from the evaluation of water quality and quantity, wildlife and wildlife habitat, and vegetation.

This Baseline Data Report is a comprehensive description of the critical environmental factors considering the limited size and scope of the activities and surface disturbance associated with the La Jara Mesa Project. These data describe the current environmental conditions against which to quantify the effects of the proposed project activities, identify mitigation measures for construction and operation activities, and develop plans for reclamation and closeout. The report is structured in sections that

address the major baseline parameters required by the MMD in 19.10.6.602.D.13 NMAC and in their supporting guidance. These include: climate (Section 2), topography (Section 3), vegetation (Section 4), wildlife (Section 5), soils (Section 6), ore body and geology (Section 7), surface water (Section 8), groundwater (Section 9), prior mining operations (Section 10), historical and cultural properties (Section 11), land use (Section 12), and background radiation (Section 13).

Baseline evaluations of the proposed La Jara Mesa Project Permit Area were conducted using available existing data for the general Permit Area and site-specific data mostly collected in 2011. The methods of data collection were generally those detailed in the Sampling and Analysis Plan (SAP) submitted to and reviewed by MMD and other State regulatory agencies (Golder, 2009). The SAP was deemed administratively complete in December 2010.

1.3 References

Golder Associates Inc. 2009. Sampling and Analysis Plan for the La Jara Mesa Project. Prepared for Laramide Resources (USA) Inc. October 5, 2009.

Laramide Resources (USA), Inc. 2008. Plan of Operations Amendment (Updated October 2008). Prepared for the USDA Forest Service, Cibola National Forest, Mt. Taylor Ranger District. October 2008.

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FIGURES

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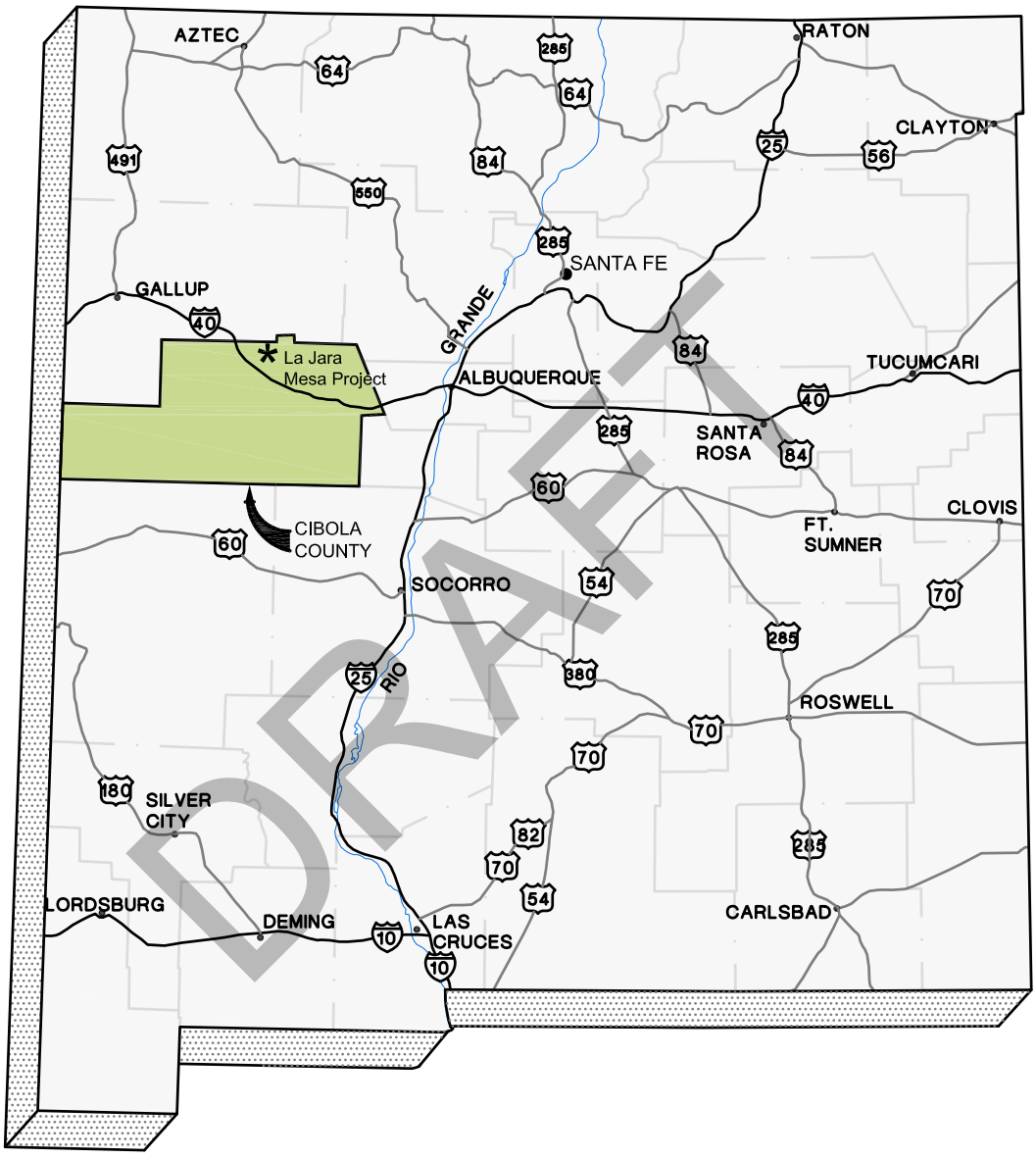
STATE OF NEW MEXICO

NOT TO SCALE



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PROJECT	LARAMIDE RESOURCES (USA) INC. LA JARA MESA PROJECT CIBOLA COUNTY, NEW MEXICO
TITLE	**SITE LOCATION MAP**

Golder Associates
Albuquerque, New Mexico

PROJECT No.		0839338SI	FILE No.	Figure1-1
DESIGN	CM	03/27/13	SCALE AS SHOWN	REV. 0
CADD	CM	03/27/13	**FIGURE 1-1**	
CHECK	EC	03/27/13		
REVIEW	BN	03/27/13		

Drawing file: Figure1-1.dwg Apr 04, 2013 - 11:45am

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2.0 CLIMATE

***New Mexico Administrative Code (NMAC) 19.10.6.602 D.(13)* (a)**

Baseline data shall include as applicable: A description of the climatological factors representative of the permit area including precipitation, prevailing winds and temperature.

2.1 Introduction

Climate is an important determinant of site ecological potential and a major consideration in operational and reclamation engineering designs. The climate in the La Jara Mesa region is broadly categorized as cool and semiarid. Mean annual temperature is approximately 50 degrees Fahrenheit (°F) and precipitation averages about 10 inches per year at the proposed Permit Area for the La Jara Mesa Project mine portal (the portal). Because of the higher elevation, the climate at the escape raise is likely somewhat cooler and wetter than the mine facilities at lower elevations.

2.2 Methods

Site-specific climate data for the baseline period (January 1, 2011, through December 31, 2011) was collected from the Homestake Mill weather station. This station was selected to represent the site-specific climate for the baseline period because it is an established station (installed in 1997) and is closest to the proposed Permit Area (within 4 miles; Figure 2-1). To better represent the long-term climate, data from regional weather stations were also summarized. The Grants Airport, San Mateo, and McGaffey 5SE (McGaffey) weather stations were selected to represent the regional climate (Figure 2-1) from a geographic and elevation perspective. Locally available data collected from the Homestake Mill station for the baseline period was compared to regional long-term data from the Grants Airport, San Mateo, and McGaffey stations.

2.3 Regional Climate

La Jara Mesa is about 10 miles from the Grants Airport and San Mateo stations and is at a similar elevation. The McGaffey station is approximately 40 miles northwest of La Jara Mesa, but is similar in elevation (8,000 feet) to the escape raise. Table 2-1 lists the weather stations with the distance from the proposed portal, elevation, period of record, average temperatures, and average annual precipitation. Monthly climate summaries were gathered from the Western Regional Climate Center (WRCC; 2012) and are provided for each weather station in Table 2-2.

Mean annual temperature for the Grants Airport and San Mateo stations ranges from approximately 33 to 68°F (Table 2-2). Maximum summer temperatures reach the upper 80s, with lows of about 50°F. Winter lows are below freezing, but temperatures approach 50°F during the day. The higher elevations of the

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proposed project area, represented by the McGaffey station, tend to be approximately 5°F cooler than the Grants Airport and San Mateo stations.

Precipitation in the proposed Permit Area averages about 10 inches per year. For the proposed portal, the Grants Airport station is the best comparison for precipitation. Grants Airport reported greater than 90 percent of possible observations for the period of record; whereas, San Mateo was less than 45 percent (Table 2-2). Variation in annual totals is characteristic of semiarid climates, as illustrated by annual extremes of 4.41 inches (1956) and 17.11 inches (1965) at Grants Airport during a period of 50 years. The majority of precipitation falls between June and October (Table 2-2). High intensity, short duration thunderstorms are common in the summer months. Snowfall may occur from October through April, but most likely between December and February (Grants Airport). At the higher elevations (McGaffey), heavier snowfall is expected and likely between October and April. Overall, the McGaffey station receives about 18.72 inches of mean annual precipitation, almost double the amount at Grants Airport.

Average monthly wind speed and direction data were collected from the Grants Airport station via the WRCC (2012; Table 2-3). Predominant wind direction is from the northwest. Winds in the summer months tend to be from the southeast. The average annual wind speed is approximately 8.7 miles per hour (mph). Wind speeds across the state of New Mexico are usually moderate, although relatively strong winds often accompany occasional storm fronts during the late winter and spring months and sometimes occur just before thunderstorms (WRCC, 2012). Although no hourly data were available from the weather stations, in general, frontal winds may exceed 30 mph for several hours and reach peak speeds of more than 50 mph in New Mexico. Highest sustained winds occur in March, April, May, and June (Table 2-3).

Evaporative demand in the region is high and annual evaporation far exceeds annual precipitation. Table 2-3 includes monthly pan evaporation for the nearby Laguna and the Gallup Ranger weather stations. The pan evaporation at the project area is generally similar, about 62 inches per year. The Laguna station is approximately 27 miles southeast of the proposed portal, at approximately 5,800 feet above mean sea level (amsl). The Gallup Ranger station is at approximately 7,100 feet amsl, approximately 47 miles northwest of the proposed portal.

2.4 Climate at the Proposed Permit Area

The Homestake Mill weather station was chosen to be most representative of the site-specific climate of the proposed Permit Area (Section 2-2). The station is a 10-meter-high meteorological tower located approximately 4 miles southwest of the proposed portal at approximately 6,600 feet amsl. Horizontal wind speed and direction are measured at 10 meters. Temperature, relative humidity, and solar radiation data are collected at 9.5 meters. Barometric pressure is measured at 8.8 meters and precipitation is collected at ground level. Average hourly relative humidity, air temperature, solar radiation, wind speed, wind

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direction, and total hourly precipitation measurements are recorded with a data logger. Data acquisition and quality assurance are performed by Meteorological Solutions, Inc. (MSI) and reported to Barrick/Homestake Mining Company. Quarterly data and two of the quarterly reports (covering April through September 2011) from MSI are included as Attachment 2A.

Data capture for the Homestake Mill station in 2011 was good. In most months data capture was 100 percent for all parameters. Months with less than 100-percent data capture include January, April, July, and October. Annually, the average data capture ranged from 93 to 98 percent. In April, a broken switch resulted in the loss of precipitation data. The precipitation gauge was down for about 20 days; however, there was no measurable precipitation recorded by the National Weather Service at Grants Airport during that time (Attachment 2A). There was also a power outage in July that resulted in a loss of data capture for about four days. The remaining data loss was attributed to routine maintenance, field performance audits, and data missed in recovery.

Monthly climate summaries from the Homestake Mill station for January 1, 2011, through December 31, 2011, are presented in Table 2-4. The precipitation, temperature and relative humidity, wind, and solar radiation are described below.

2.4.1 Precipitation

The Homestake Mill station is equipped with a Weathertronics Model 6011™ tipping bucket rain gauge. In 2011, annual precipitation was 7.5 inches, which is less than the long-term regional average (approximately 10 inches). The first half of 2011 was particularly dry with only 0.08 inch recorded through June (Table 2-4). The fall was more or less average as compared to the regional stations (Figure 2-2). December was uncharacteristically wet with precipitation (rain and snow) of more than four times the Grants Airport average falling at La Jara Mesa (Figure 2-2).

Intensity data were not available for the Homestake Mill station; however, precipitation frequency estimates for the semiarid southwestern United States are available via the Precipitation Frequency Data Server (PFDS) produced by the Hydrometeorological Design Studies Center within the Office of Hydrologic Development of the National Oceanic and Atmospheric Administration's National Weather Service (NOAA). Project area precipitation frequency estimates for 24-hour duration at recurrence intervals of 25, 50, and 100 years are presented in Table 2-5. Frequency estimates (estimated from measured station data) range from about 2 inches for the 25-year event to almost 3 inches for the 100-year event at the lower elevation, Grants Airport and San Mateo stations. Estimated precipitation events at the McGaffey station are about 1 inch more than the lower elevation stations. The PFDS has the capability to model user-defined locations from geographic coordinates (longitude and latitude). The proposed La Jara Mesa portal was modeled and estimated events are well correlated with the regional data (Table 2-5).

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2.4.2 Temperature and Relative Humidity

Temperature and relative humidity at the Homestake Mill station are measured with a HMP45AC™ probe manufactured by Vaisala Inc. The minimum, maximum, and average daily air temperatures for the baseline period are shown in Figure 2-3. Average monthly temperatures recorded at the Homestake Mill station during the baseline period correlate with the long-term regional averages at Grants Airport (Figure 2-4). No major temperature extremes occurred during the baseline period; although, March and April were slightly above normal temperatures and January and December dipped below the regional averages. The average daily relative humidity varied from about 10 to 90 percent (Attachment 2A) with an annual average near 45 percent (Table 2-4).

2.4.3 Wind Speed and Direction

Wind speed and direction at the Homestake Mill station are measured with a R.M. Young Model 05305™ wind monitor. The instrument is reliable for wind speeds up to 130 mph and wind directions over 360° (azimuth). The data logger records average hourly wind speed (mph), direction (degrees), and standard deviation.

Over the baseline period, the maximum average hourly wind speed recorded was 34 mph (Attachment 2A). The highest sustained intensities were recorded in March, April, May, and June (Table 2-4). The dominant wind direction associated with high intensity events (greater than 11 meters/second [m/s] or >25 mph) is typically from the west, northwest, and southwest (Figure 2-5). More than 40 percent of the winds at the Homestake Mill station were between 0.1 mph (0.5 m/s) and 5 mph (2.1 m/s). These winds tended to blow from the northeast. The frequency of calm winds was about 2 percent. Data measured during the baseline period is consistent with the long-term regional data (Table 2-3). The average wind speed for 2011 was 7.8 mph at the Homestake Mill station. The long-term mean annual wind speed measured at Grants Airport is 8.7 mph.

2.4.4 Solar Radiation

Solar radiation at the Homestake Mill station is measured with a silicon pyranometer (LiCor 200X™) designed to measure solar radiation flux density (in watts per square meter [W/m^2]) from a field of view of 180 degrees. The data logger records the average flux density hourly.

Daily total solar radiation data for the baseline period are shown in Figure 2-6. Excluding days with substantial cloud cover, daily total solar radiation ranged from a low of approximately 3,500 W/m^2 in December to maximum values near 9,300 W/m^2 in June.

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2.4.5 Barometric Pressure

Barometric pressure at the Homestake Mill station is measured with a Vaisala Inc. Model PTB110™ sensor over the range of 500 to 1,100 millibars (about 15 to 35 inches of mercury) at the Homestake Mill station. The sensor is located inside the data logger enclosure and is vented to the atmosphere.

In 2011, the average barometric pressure was about 24 inches of mercury (Table 2-4). Barometric pressure was relatively stable during the baseline period.

2.5 References

National Oceanic and Atmospheric Administration (NOAA) 2012. Hydrometeorological Design Studies Center. Precipitation Frequency Data Server http://hdsc.nws.noaa.gov/hdsc/pfds/index.html. Website accessed on September 1, 2012.

Western Regional Climate Center (WRCC) 2012. Desert Research Institute, Service on Demand (SOD) USA, New Mexico Climate Summaries. http://www.wrcc.dri.edu/summary/climsmnm.html. Website accessed on September 1, 2012.

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TABLES

Table 2-1: Regional Meteorological Stations Summary

Station	Distance and Direction from Portal (miles)	Elevation (feet)	Period of Record		Temperature		Precipitation
					Average Max (°F)	Average Min (°F)	Annual Average (inches)
Grants Airport	10 SW	6,530	5/1/1953	12/31/2005	67.7	33.0	10.34
San Mateo	10 NE	7,300	4/1/1918	2/29/1988	61.7	34.6	8.66
McGaffey 5SE	40 NW	8,000	1/1/1923	12/31/2005	59.8	26.4	18.72
Homestake Mill	4 SW	6,600	1/1/2011	12/31/2011	63.1	34.7	7.56

Note:
Homestake Mill station installed in 1997; baseline data collected for 2011

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Table 2-2: Regional Monthly Climate Summary

Month	Average Max. Temperature (F)	Average Min. Temperature (F)	Average Total Precipitation (inches)	Average Total Snowfall (inches)
Grants Airport				
Jan	46.5	14.6	0.51	2.5
Feb	51.5	18.6	0.43	2.2
Mar	58.3	23.9	0.55	1.7
Apr	67.4	30.2	0.47	0.4
May	76.4	38.9	0.53	0
Jun	86.3	47.5	0.56	0
Jul	88.4	55.0	1.69	0
Aug	85.1	53.0	1.99	0
Sep	79.8	44.7	1.32	0
Oct	69.4	32.8	1.09	0.4
Nov	56.3	22.1	0.58	0.9
Dec	47.3	14.5	0.62	4.0
Annual	**67.7**	**33.0**	**10.34**	**12.1**
San Mateo				
Jan	40.6	16	0.34	2.2
Feb	44.6	19.1	0.28	1.5
Mar	51.6	25.2	0.37	1.1
Apr	60.9	30.7	0.31	0
May	70.7	40.5	0.48	0.2
Jun	81.0	50.0	0.48	0
Jul	83.1	55.3	1.68	0
Aug	79.6	53.3	2.11	0
Sep	73.1	46.5	1.12	0
Oct	62.9	35.9	0.76	0.2
Nov	50.9	25.3	0.45	1.4
Dec	41.4	17.0	0.28	3.1
Annual	**61.7**	**34.6**	**8.66**	**9.7**
McGaffey				
Jan	40.1	8.8	1.7	10.6
Feb	42.3	11.6	1.46	9.0
Mar	47.7	17.7	1.81	10.5
Apr	56.4	24.3	1.12	3.1
May	66.4	31.3	0.74	0.3
Jun	77.7	38.9	0.66	0
Jul	81.0	46.3	2.39	0
Aug	77.8	45.5	2.85	0
Sep	72.9	38.1	1.59	0
Oct	63.5	27.8	1.51	1.7
Nov	50.2	17.2	1.46	5.6
Dec	41.7	9.7	1.42	11.0
Annual	**59.8**	**26.4**	**18.72**	**51.8**

Notes:

Source: Western Regional Climate Center

Percent of possible observations:

Grants- Max. Temp.: 96.2% Min. Temp.: 96.3% Precipitation: 96.1% Snowfall: 93.2% Snow Depth: 91.7%

San Mateo - Max. Temp.: 30.1% Min. Temp.: 31.1% Precipitation: 42.3% Snowfall: 27.1% Snow Depth: 26%

McGaffey - Max. Temp.: 64.3% Min. Temp.: 64.2% Precipitation: 65.3% Snowfall: 60.8% Snow Depth: 54.2%

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Table 2-3: Regional Wind Speed and Pan Evaporation

Station	Years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Average Wind Speed (mph)/Predominant Direction (Blowing From)														
Grants Airport	1997-2006	7.8	8.8	9.6	10.9	10.0	9.8	8.1	7.2	7.9	8.4	8.0	7.6	8.7
Grants Airport	1992-2002	NW	NW	NW	W	W	W	SE	SE	NW	NW	NW	NW	NW
Monthly Pan Evaporation (inches)														
Gallup Ranger	1966-1975	0.00	0.00	0.00	6.61	9.31	12.12	10.50	8.70	7.95	5.07	2.20	0.00	62.46
Laguna	1914-2005	0.00	0.00	0.00	8.47	9.33	11.98	10.76	8.88	6.83	5.00	1.98	0.00	63.23

Notes:
Gallup Ranger station elevation approximately 7,100 feet
Laguna station elevation approximately 5,800 feet
Source: Western Regional Climate Center

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Table 2-4: Homestake Mill Meteorological Station, 2011 Monthly Climate Summary

Month	Temperature (°F)			Relative Humidity (%)	Barometric Pressure (in of Hg)	Solar Radiation (W/m^2)	Precipitation (inches)	Wind Speed (mph)	
	Min	Max	Average	Average	Average	Total	Total	Average	Max
January[a]	13.1	42.7	26.7	58	23.63	83,842	0.03	5.9	13.7
February	15.0	44.4	30.1	49	23.57	131,287	0	8.1	16.9
March	26.9	59.3	44.4	31	23.59	191,835	0.02	8.9	18.6
April[a]	36.6	63.7	51.3	25	23.52	220,800	0	12.7	23.3
May	38.9	68.1	55.3	28	23.55	247,901	0	10.8	20.8
June	50.6	84.2	70.0	16	23.62	250,787	0.03	10.0	20.5
July[a]	58.6	84.2	71.9	44	23.69	178,261	0.58	7.1	15.7
August	58.1	84.4	71.2	48	23.72	193,750	1.95	5.8	13.0
September	48.6	74.1	61.2	52	23.74	161,606	0.75	6.4	14.5
October[a]	35.1	65.2	49.9	47	23.68	143,276	1.32	6.0	13.4
November	24.8	52.3	38.3	50	23.64	109,069	0.34	7.1	15.5
December	10.7	35.2	22.4	76	23.64	92,474	2.54	5.4	11.8
Annual	**34.7**	**63.1**	**49.4**	**44**	**23.63**	**2,004,888**	**7.56**	**7.8**	**16.5**

Notes:
a = Partial Data
Hg = Mercury
W/m^2 = watts per square meter
mph = miles per hour

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Table 2-5: 24-hour Duration Precipitation Frequency Estimates (inches)

Station	Average Recurrence Interval (years)		
	25	50	100
Grants Airport	2.19 (2.00 - 2.36)	2.45 (2.24 -2.64)	2.72 (2.47 -2.92)
San Mateo	2.02 (1.79 - 2.25)	2.26 (2.00 -2.50)	2.51 (2.2 - 2.77)
McGaffey 5SE	2.99 (2.71 - 3.23)	3.40 (3.06 - 3.67)	3.83 (3.44 - 4.14)
Proposed Portal[1]	2.13 (1.90 - 2.36)	2.40 (2.13 - 2.65)	2.66 (2.36 - 2.94)

Notes:

1 = Modeled using approximate location (35°16'29.61"N, 107°45'59.19"W)

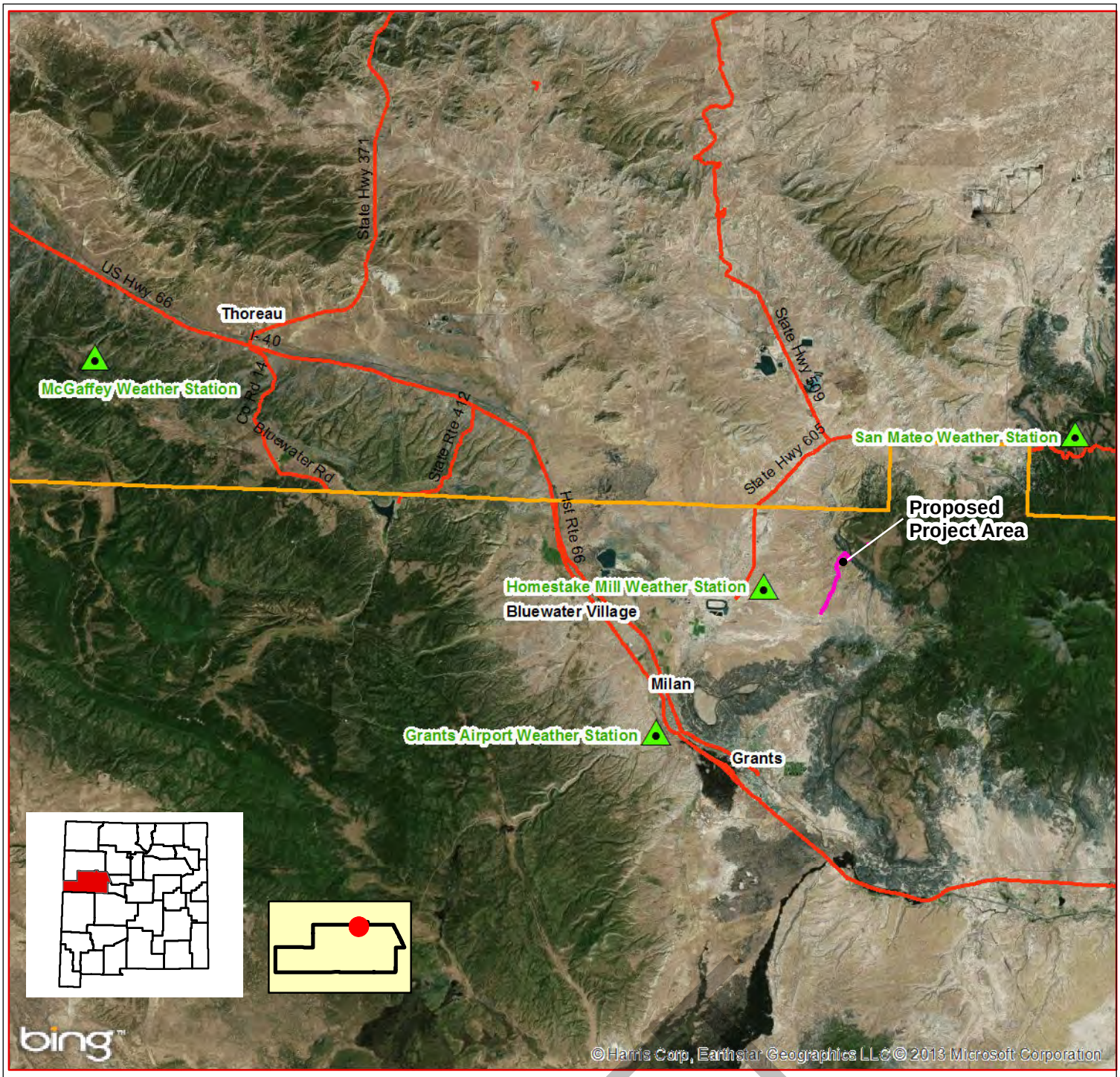
PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)

Source: NOAA Precipitation Frequency Data Server

http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=nm

DRAFT

FIGURES



LEGEND

- Weather Stations
- Cibola County
- NM Roads

N

32,500 16,250 0 32,500 Feet

SCALE 1:390,000 FEET

REFERENCES & NOTES

1. Projection: NAD 1983 UTM Zone 13N
2. Source Aerial: Bing Maps (c) 2010 Microsoft Corporation and its data suppliers
3. Figure is for illustration purposes only; NOT FOR CONSTRUCTION.

PROJECT/REPORT
LARAMIDE RESOURCES (USA) INC.
LA JARA MESA PROJECT
CIBOLA COUNTY, NEW MEXICO

TITLE
WEATHER STATION LOCATIONS

Golder Associates

PROJECT No. 083-9338SI

FIGURE 2-1

DRAFT

Map: W:\La Jara Mesa\Maps\Figure 2_1.mxd | Modified: 4/4/2013 10:43:54 AM | Plotted: 4/4/2013 10:57:33 AM by MPetersen

FIGURE 2-2: COMPARISON OF MONTHLY PRECIPITATION TOTALS LONG-TERM AVERAGE VS. BASELINE

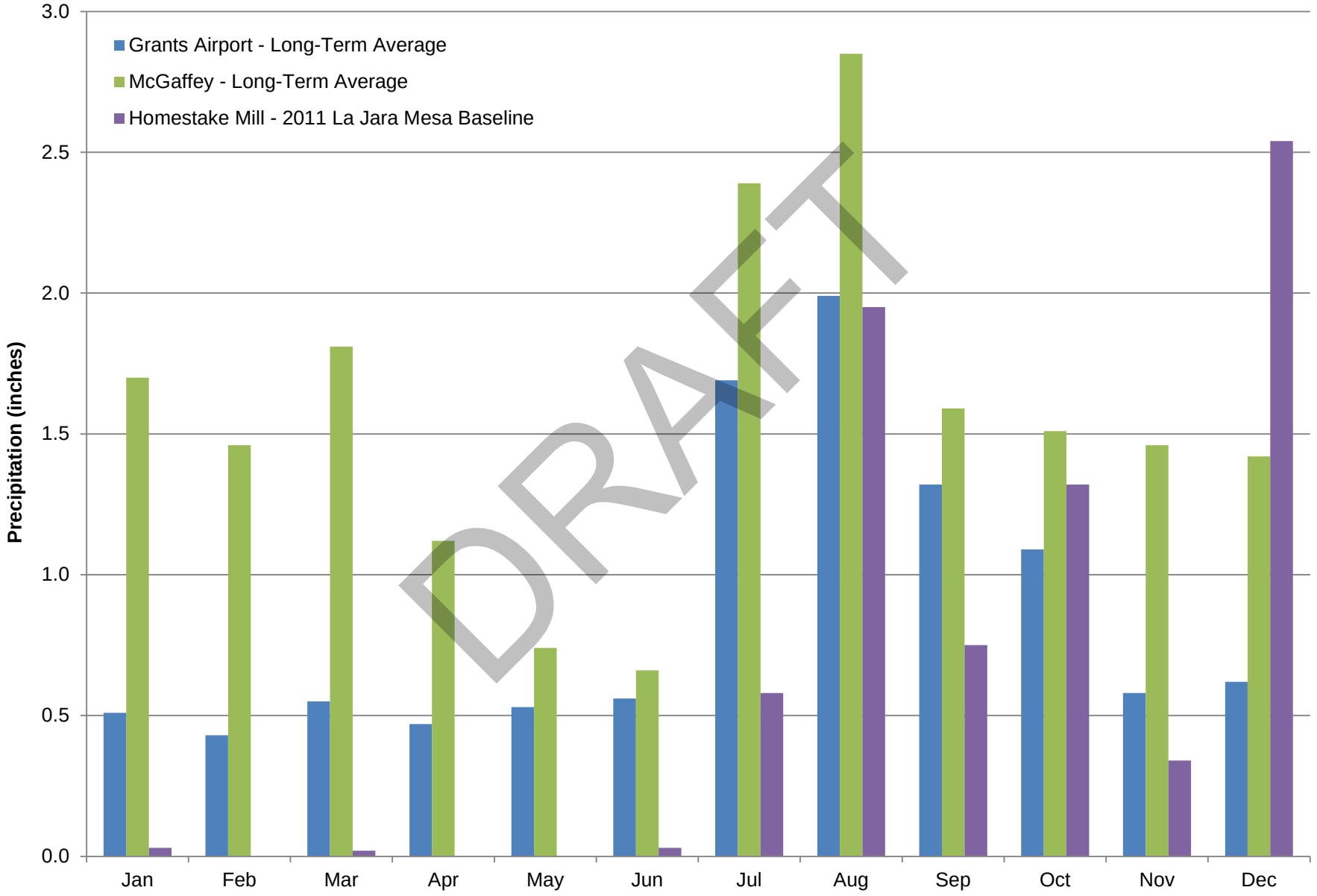


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FIGURE 2-3: HOMESTAKE MILL AVERAGE DAILY TEMPERATURES

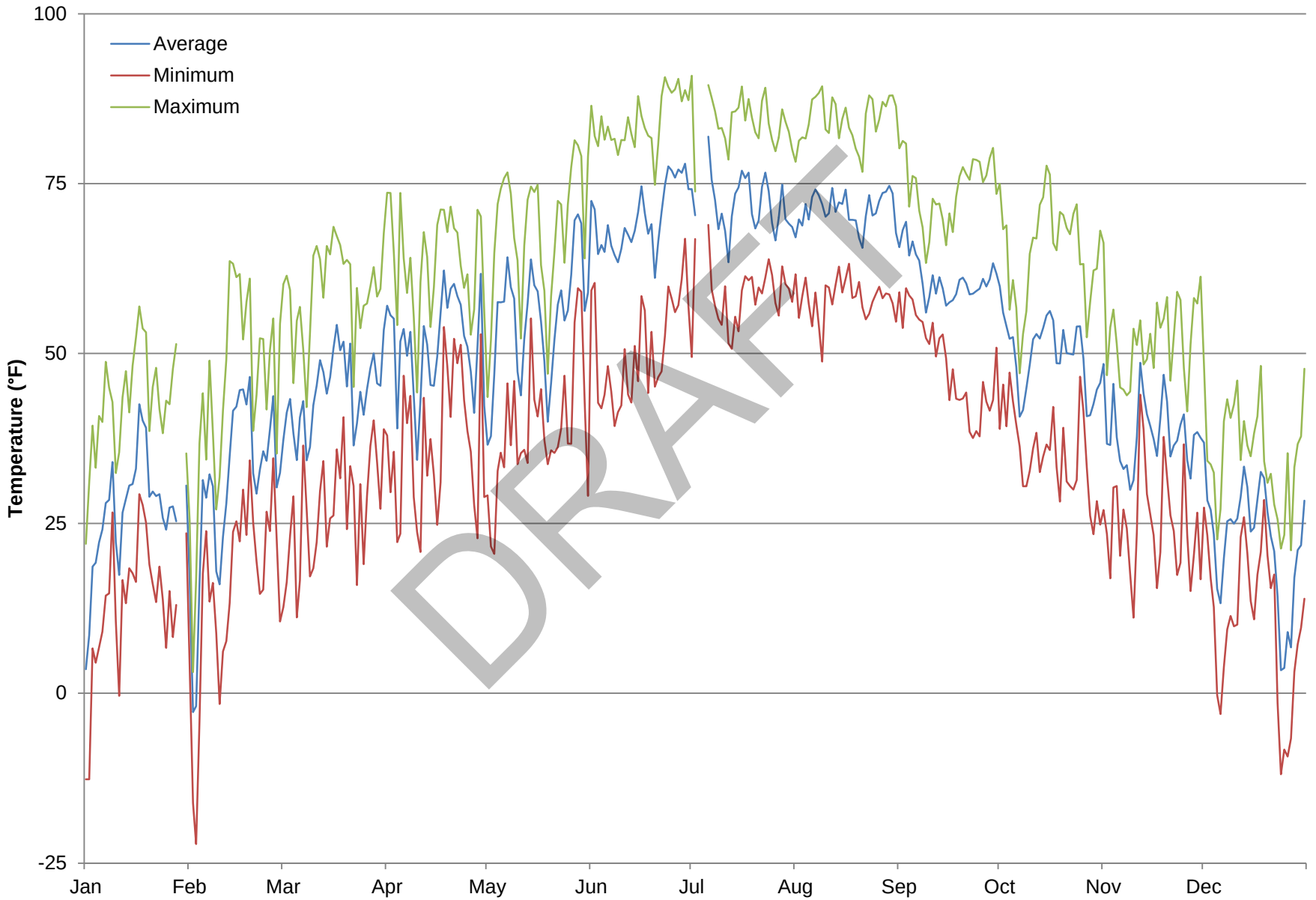

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FIGURE 2-4: COMPARISON OF MONTHLY AVERAGE TEMPERATURES LONG-TERM AVERAGE VS. BASELINE

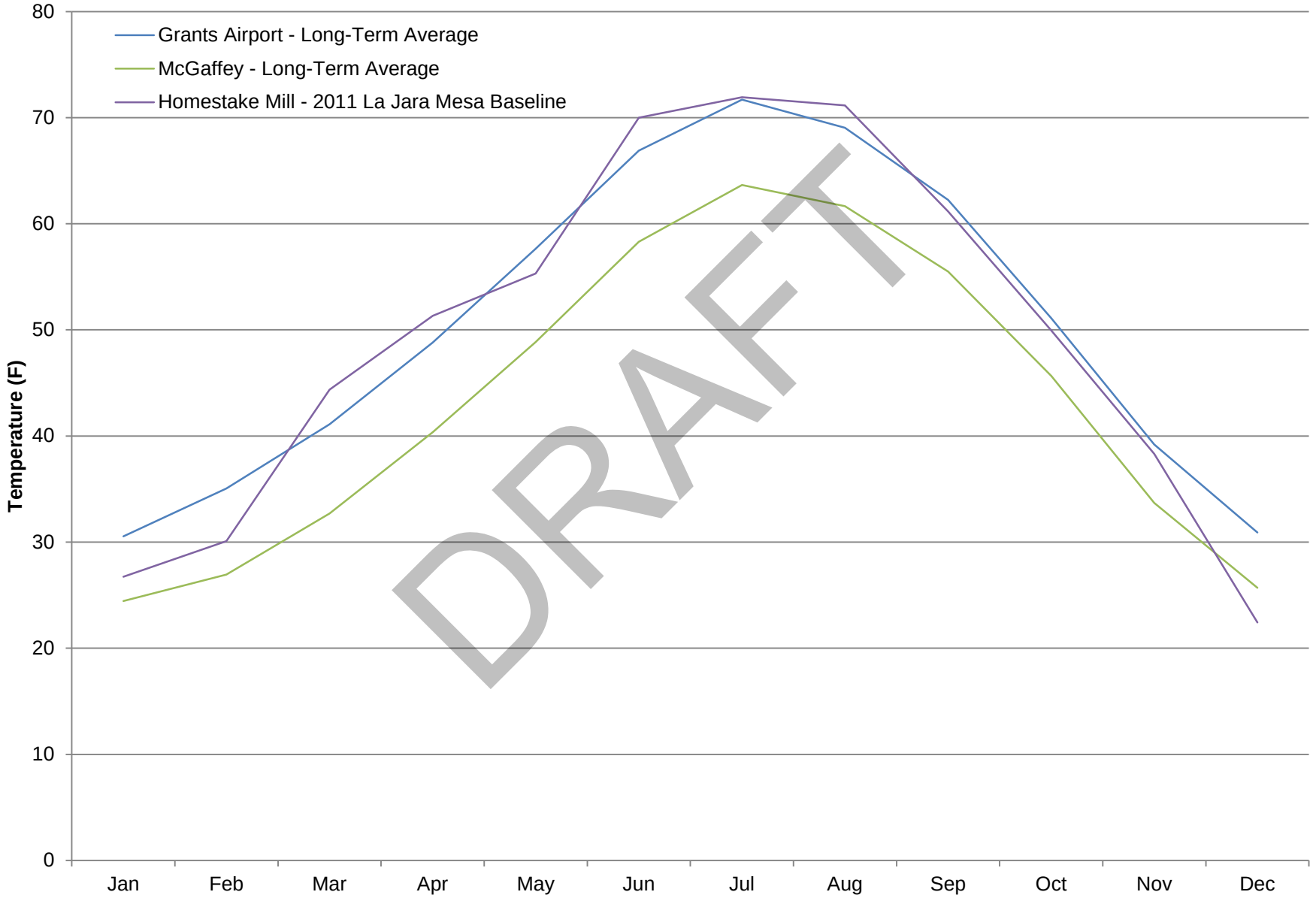

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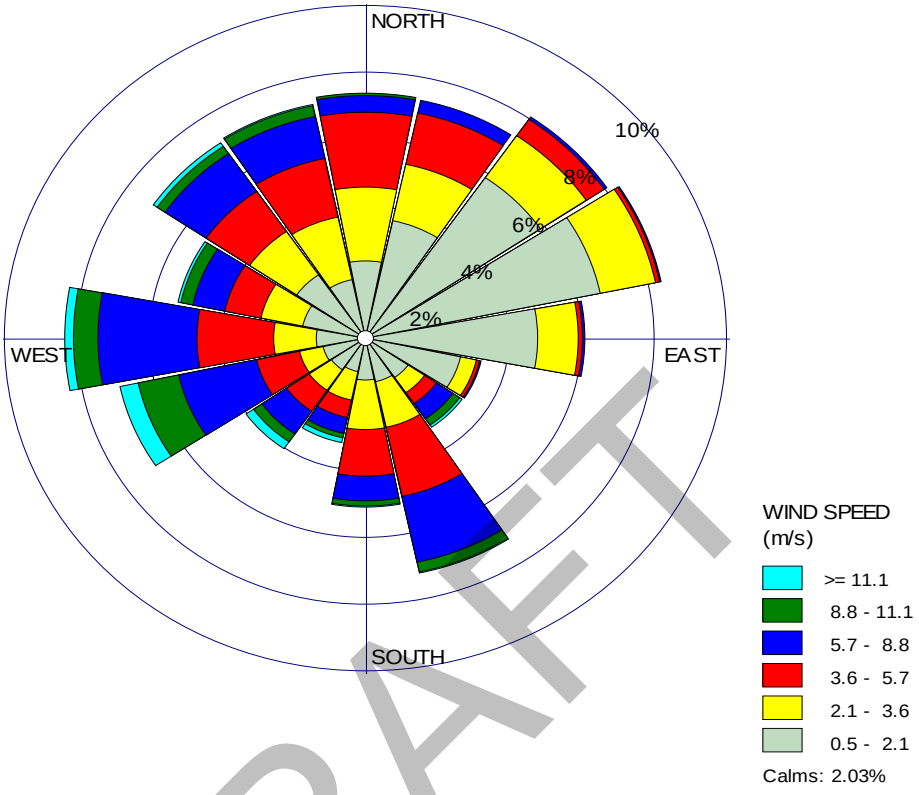
FIGURE 2-5: HOMESTAKE MILL
WIND ROSE AND FREQUENCY DISTRIBUTION
JANUARY 1, 2011 THROUGH DECEMBER 31, 2011



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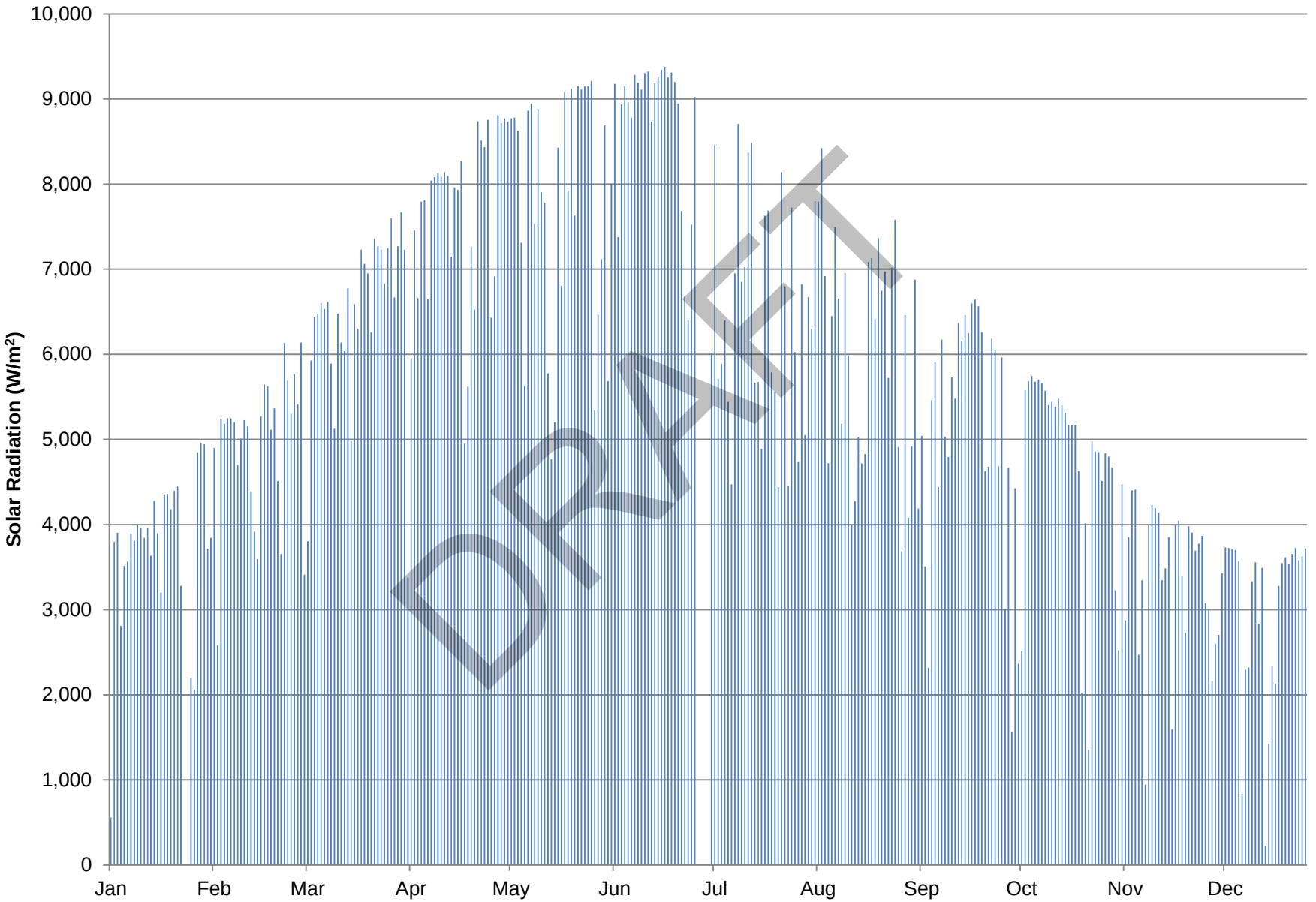
Average Wind Speed: 3.44 m/s

Direction (degrees)	Wind Speed (m/s) Percent						
	0.5 - 2.1	2.1 - 3.6	3.6 - 5.7	5.7 - 8.8	8.8 - 11.1	>= 11.1	Total
349-11	2.34	2.20	2.24	0.50	0.07	0.00	7.35
12-33	3.62	1.72	1.56	0.39	0.00	0.00	7.29
34-56	5.84	1.52	0.59	0.09	0.00	0.00	8.05
57-78	6.63	1.55	0.11	0.05	0.00	0.00	8.34
79-101	4.77	1.12	0.11	0.07	0.00	0.00	6.07
102-123	2.71	0.45	0.09	0.05	0.00	0.00	3.29
124-146	1.45	0.55	0.40	0.55	0.23	0.08	3.25
147-168	1.36	1.39	2.11	2.01	0.30	0.03	7.20
169-191	1.28	1.48	1.39	0.74	0.15	0.03	5.08
192-213	1.05	0.87	0.54	0.48	0.14	0.15	3.22
214-236	1.16	0.74	0.75	0.82	0.29	0.25	4.02
237-258	1.22	0.66	1.21	2.19	1.14	0.51	6.94
259-281	1.38	1.18	2.11	2.73	0.67	0.24	8.31
282-303	1.79	1.18	1.02	0.90	0.33	0.08	5.30
304-326	2.32	1.56	1.45	1.37	0.26	0.13	7.09
327-348	1.82	1.91	1.79	1.28	0.33	0.03	7.16

Note:
1.0 m/s = 2.34 mph

FIGURE 2-6: HOMESTAKE MILL DAILY TOTAL SOLAR RADIATION



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ATTACHMENT 2A
BASELINE METEOROLOGICAL QUARTERLY REPORTS

SUMMARY OF METEOROLOGICAL DATA
BARRICK/HOMESTAKE MINING COMPANY
GRANTS, NEW MEXICO
APRIL - JUNE 2011

Prepared for:

Homestake Mining Company
Grants Project
P.O. Box 98
Grants, New Mexico 87020-0011

By

Meteorological Solutions Inc.
Project No. 07111118

July 2011

Meteorological Solutions Inc.

SUMMARY OF METEOROLOGICAL DATA
BARRICK/HOMESTAKE MINING COMPANY
GRANTS, NEW MEXICO
APRIL - JUNE 2011

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SUMMARY OF METEOROLOGICAL DATA
BARRICK/HOMESTAKE MINING COMPANY
GRANTS, NEW MEXICO
APRIL - JUNE 2011

1.0 INTRODUCTION

This report, prepared for Barrick/Homestake Mining Company by Meteorological Solutions, Inc. (MSI), summarizes the meteorological data collected at a 10-meter meteorological tower located at Barrick/Homestake Mining Company, Grants, New Mexico meteorological monitoring station for April 1 through June 30, 2011.

1.1 Background

The Barrick/Homestake Mining Company station is equipped to measure horizontal wind speed and wind direction at 10 meters, temperature at 9.5 meters, solar radiation at 9.5 meters, relative humidity at 9.5 meters, precipitation at 0.4 meters, and barometric pressure at 8.8 meters. Table 1-1 summarizes the parameters collected at the monitoring site and the units for each parameter. Figure 1.1 presents a photograph of the meteorological monitoring station.

Table 1-1

Measured Meteorological Parameters

Parameter	Units
Wind Speed	meters per second (mps)
Wind Direction	degrees from true north (°)
Temperature	degrees Celsius (°C)
Relative Humidity	Percent (%) RH
Solar Radiation	Watts per square meter (W/m^2)
Barometric Pressure	Inches of Mercury (in. Hg)
Precipitation	Inches (in.)
Time	Mountain Standard Time (MST)

Figure 1.1 Photograph of Barrick/Homestake Mining Company Meteorological Monitoring Station

Barrick/Homestake's meteorological station is located approximately at:

Latitude: 35º.23386 North

Longitude: 107°.86519 West

Figure 1.2 presents a map showing the location of the station.

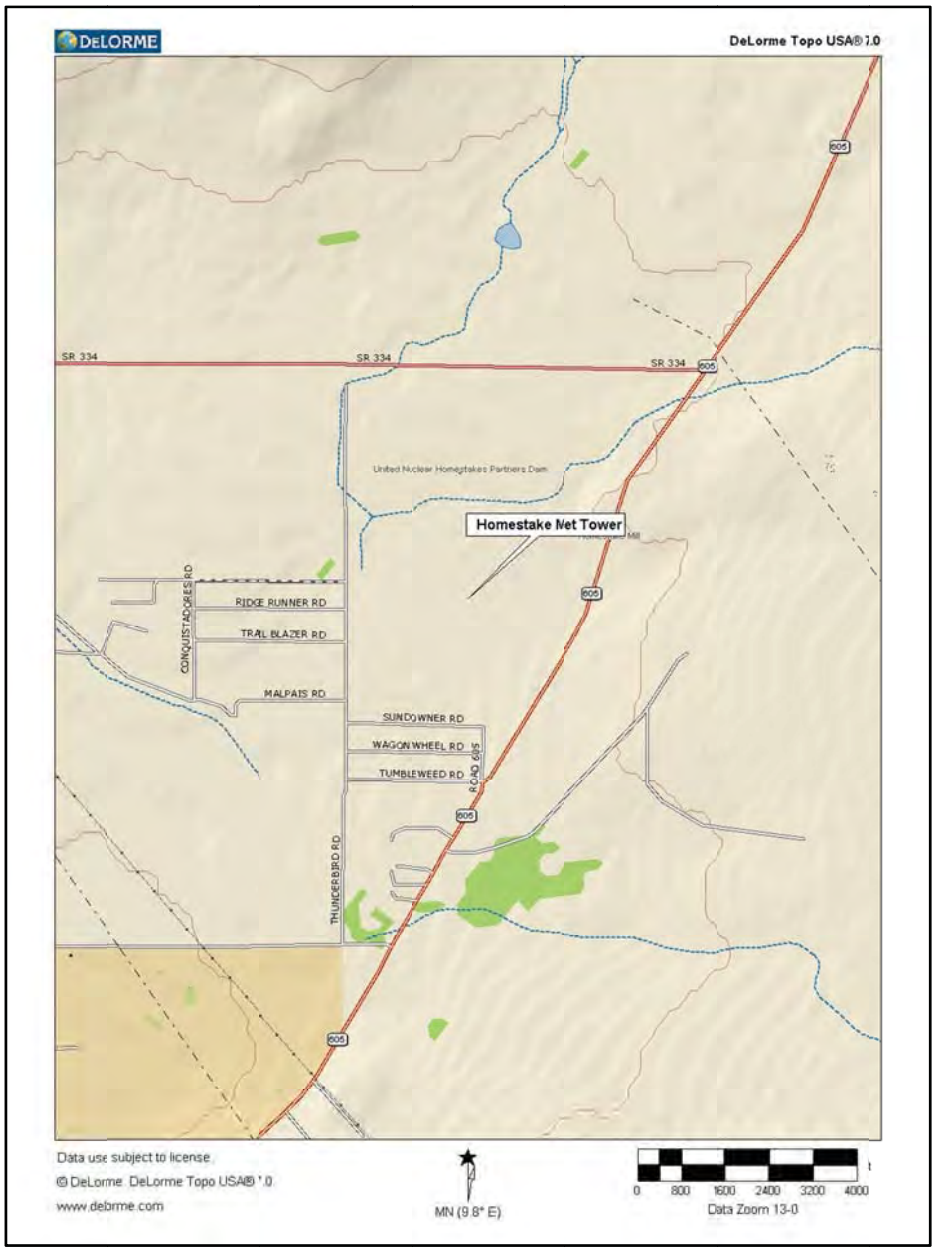


Figure 1.2 Map Showing Location of Barrick/Homestake Mining Company Meteorological Monitoring Station

1.2 Meteorological Instrumentation

The meteorological parameters measured provide information on the local meteorology in the immediate area. Table 1-2 provides a list of all meteorological equipment at the Barrick/Homestake Mining Company monitoring station.

Table 1-2
Instrumentation at Barrick/Homestake Mining Company Monitoring Station

Parameter	Meteorological Equipment	Serial Number
Wind Direction	RM Young Model 05305	88027
Wind Speed	RM Young Model 05305	88027
Temperature	Vaisala Model HMP45AC	C5110079
Precipitation	Weathertronics Model 6011	374
Relative Humidity	Vaisala Model HMP45AC	C5110079
Barometric Pressure	Vaisala Model PTB110	D2430004
Solar Radiation	LiCor 200X	PY69993

A water-proof and dust-proof enclosure is mounted at the top of the meteorological platform/tower. This enclosure houses the data acquisition system (DAS), battery backup equipment, and cellular phone modem. The precipitation gauge is installed near the base of the platform/tower.

1.3 Data Acquisition

At the meteorological tower, a Campbell Scientific Inc. (CSI) Model CR10X is used to store data from the sensors. The DAS uses secondly data values to compute and stores hourly averages of temperature, wind speed (scalar and vector), wind direction (unit vector), relative humidity, barometric pressure, solar radiation, and precipitation.

The data logger is interrogated by MSI daily via a static IP address and the data are copied to duplicate computer files. The data logger telecommunications software performs dynamic error checking during download to ensure that an exact duplicate file is created. Any failures in instrumentation or data acquisition are identified daily so that field personnel are able to correct problems in a timely manner in order to prevent excessive data loss.

The data collected during each interrogation are checked for consistency and the parameters are plotted for visual inspection. The quality assurance stacked parameter/time plots for the months of April through June 2011 are presented in Appendix A. Data presented in Appendix A represent the final, quality assured data set. Hourly values provided in this report are the hourly averages calculated by the data logger.

2.0 DATA SUMMARY

This section of the report summarizes the data results and data recovery for the second quarter 2011 (April 1 through June 30). Hourly data for the period are tabulated in the appendices. These appendix tables display the hourly average of measurements recorded in the hour "ending"; that is, the second hour of the day is labeled 01, meaning the hour beginning at 00:00:01 and ending at 01:00:00 a.m. The second hour is labeled 02, meaning the values collected from 01:00:01 a.m. to 02:00:00 a.m.

2.1 Meteorological Data

Meteorological data records from Barrick/Homestake's monitoring site include horizontal wind speed and wind direction at 10 meters, temperature at 9.5 meters, solar radiation at 9.5 meters, relative humidity at 9.5 meters, precipitation at 0.4 meters, and barometric pressure at 8.8 meters.

2.1.1 Wind Speed and Horizontal Wind Direction

Figures 2.1 through 2.3 provide diagrams of the joint frequency of occurrence distributions (wind rose) of wind speed and wind direction by month for April through June for the 10-meter level. A wind rose for the second quarter for the 10-meter level is presented in Figure 2.4. Summary tables of hourly average wind direction and wind speed for the 10-meter level for April through June 2011 are presented in Appendix B.

The most frequent (and predominant) winds during the second quarter 2011 at the 10-meter level were from the west followed by the west-southwest. Reported wind directions represent the directions from which the wind is blowing.

For April through June, there were 0.0 percent calm wind speeds at the 10-meter level. The percentage of wind speeds that were less than or equal to 10 mps (22 mph) was 91.4 percent. No winds were greater than 16 mps (35 mph). For the second quarter, the sector with the highest average wind speed was the west-southwest.

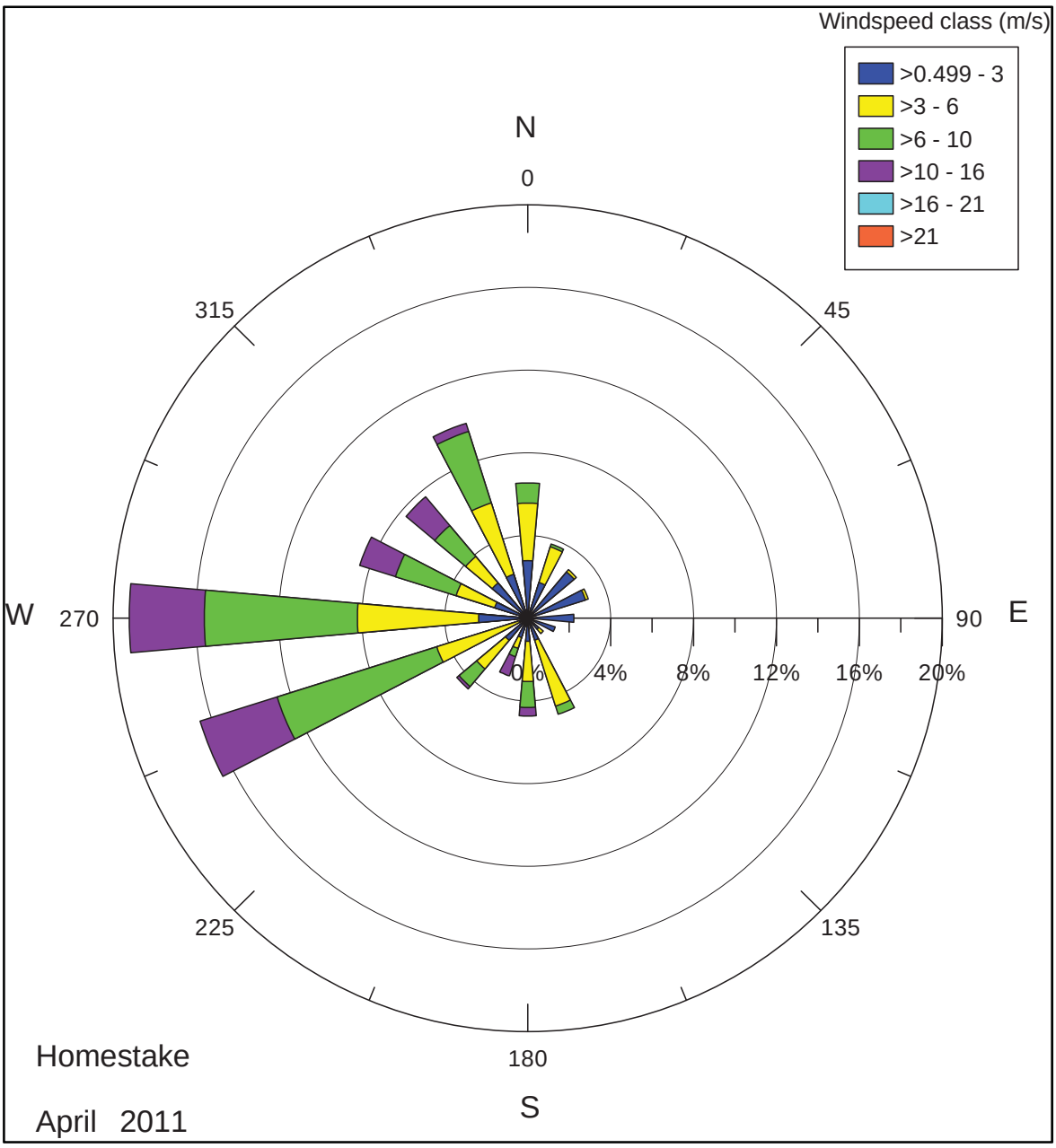


Figure 2.1 10-Meter Level Wind Rose, April 2011.

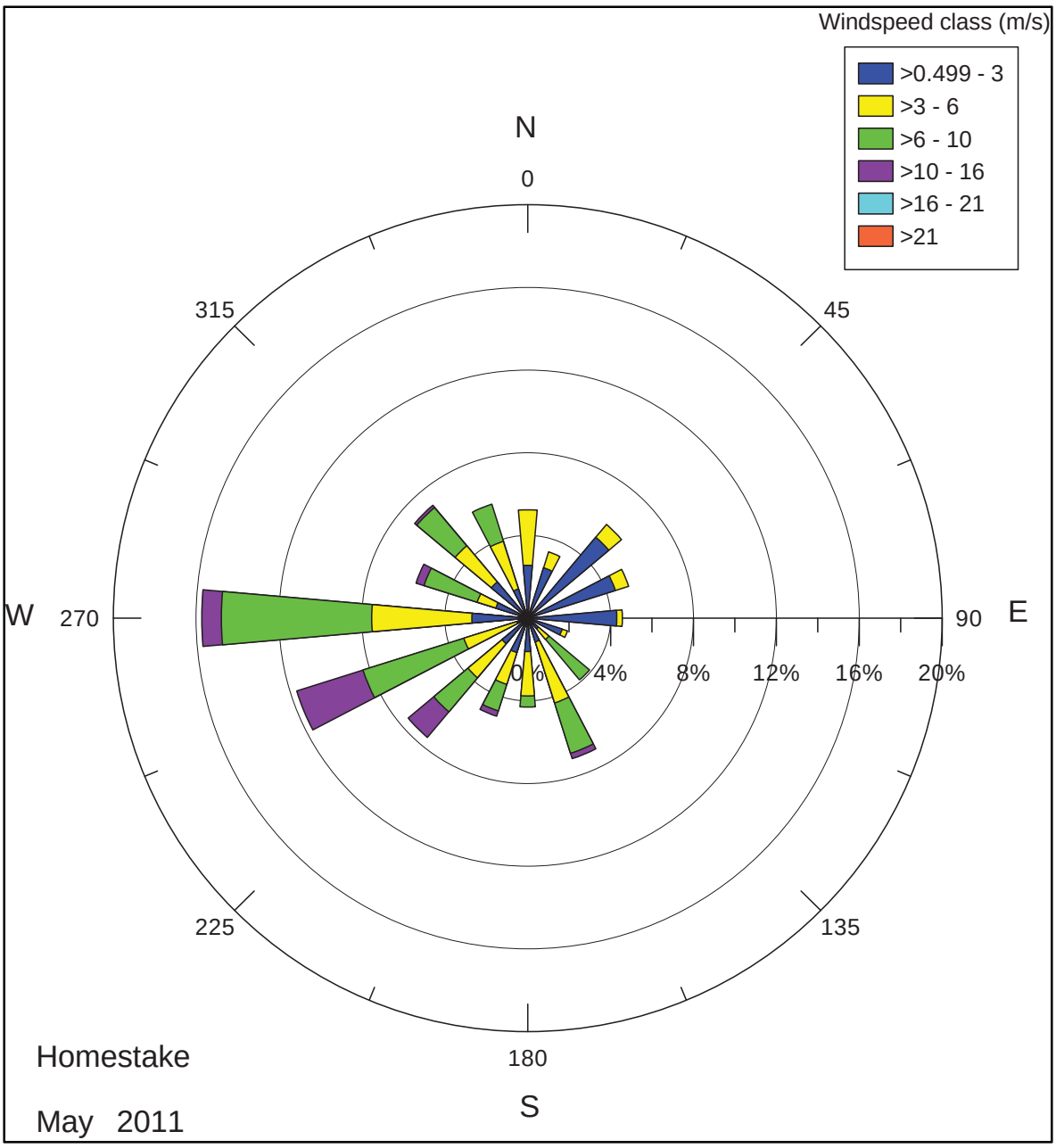


Figure 2.2 10-Meter Level Wind Rose, May 2011.

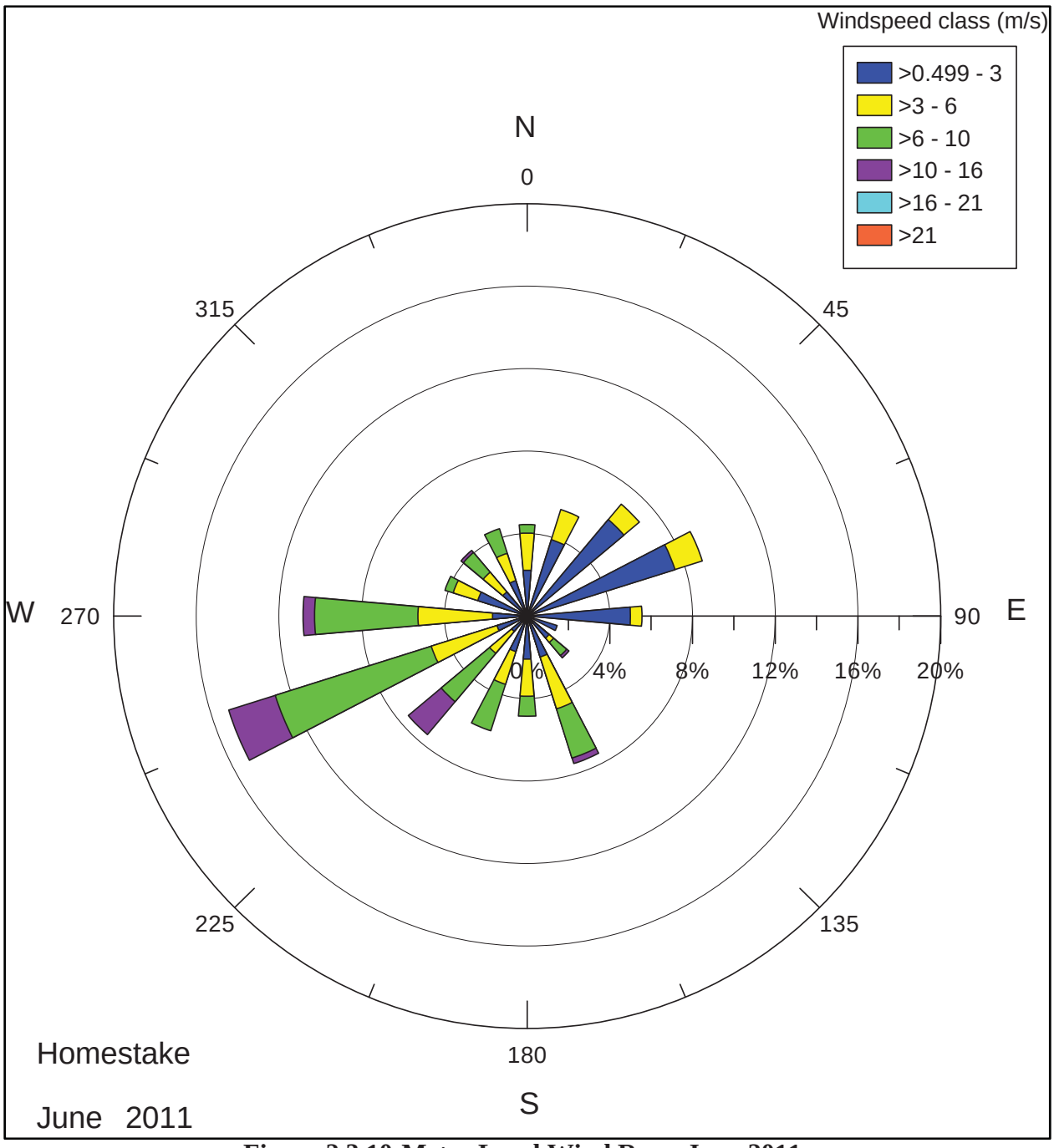


Figure 2.3 10-Meter Level Wind Rose, June 2011.

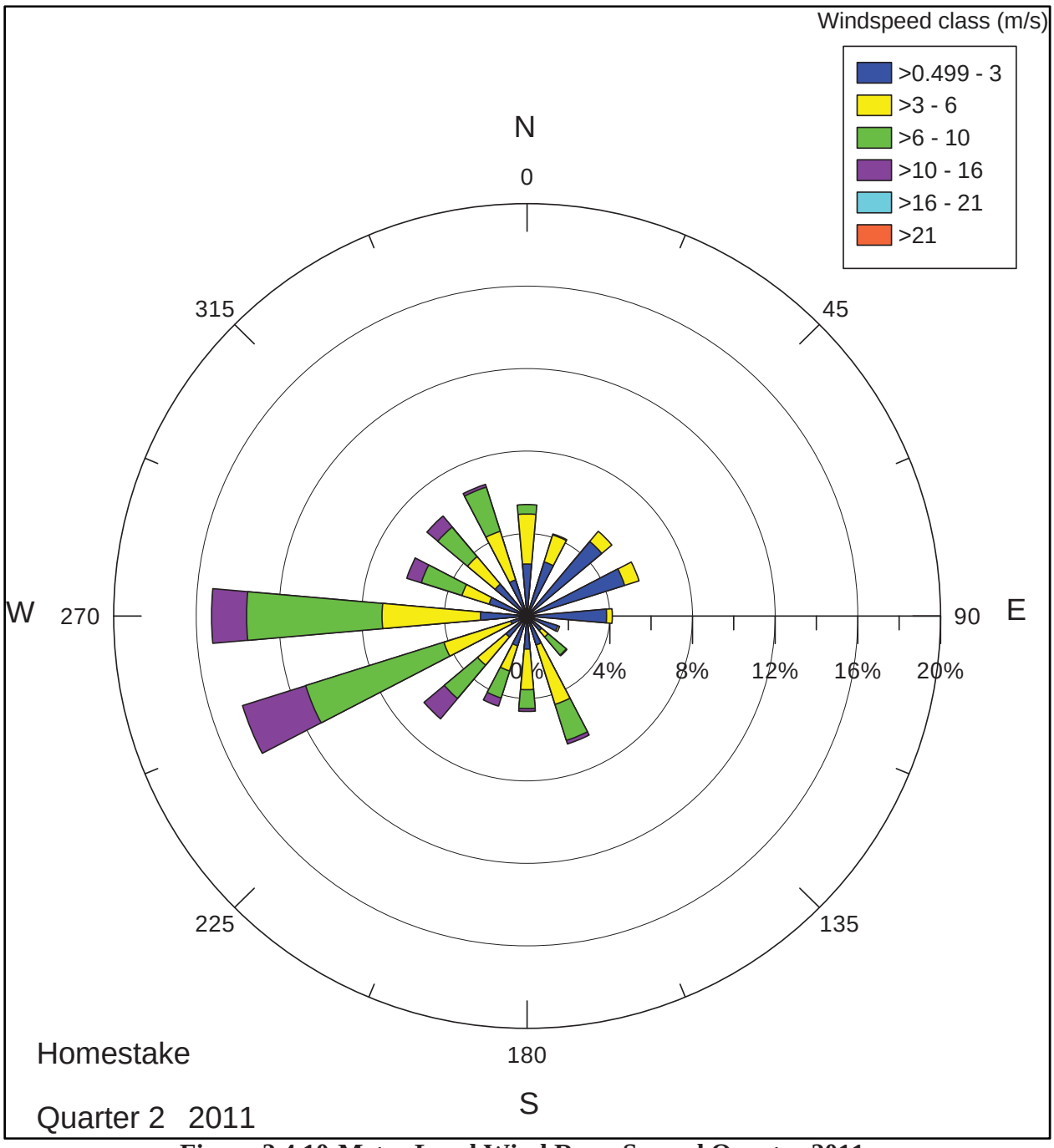


Figure 2.4 10-Meter Level Wind Rose, Second Quarter 2011.

2.1.2 Temperature

Temperature is measured at the 9.5-meter level. The ambient daily mean temperatures for April through June ranged from a low of 1.3 degrees Centigrade (°C) in April to a high of 25.5°C in June. The hourly minimum was -6.4°C in May and the hourly maximum temperature was 32.6°C in June. Temperature data for the period are summarized in Table 2-1. Hourly averages of the temperature data for the second quarter are presented in Appendix C.

Table 2-1

Summary of Temperature in Degrees Centigrade (°C) for Second Quarter 2011

Month	Monthly Mean	Maximum Daily Mean	Minimum Daily Mean	Maximum Hour	Minimum Hour
April	10.7	16.8	1.3	23.2	-6.2
May	13.0	21.4	2.5	27.4	-6.4
June	21.1	25.5	16.2	32.6	4.1

2.1.3 Relative Humidity

Table 2-2 presents the monthly means, maximum and minimum relative humidity information for the second quarter. Relative humidity data are presented in Appendix D.

Table 2-2

Summary of Relative Humidity in Percent for Second Quarter 2011

Month	Monthly Mean	Daily Mean Maximum	Daily Mean Minimum	Monthly Maximum	Monthly Minimum
April	25	47	13	88	5
May	28	71	12	93	5
June	16	32	10	59	4

2.1.4 Precipitation

For April through June, 0.03 inches of precipitation were measured at the site. The precipitation data are summarized in Table 2-3 and are presented in Appendix E.

Table 2-3

Summary of Precipitation in Inches for Second Quarter 2011

Month	Monthly Total	Maximum Daily Total	Maximum Hourly Total
April[1]	0.0	0.0	0.0
May	0.0	0.0	0.0
June	0.03	0.02	0.02

[1] Gauge inoperable through 4/19 10AM due to broken reed switch.

2.1.5 Solar Radiation

Solar radiation data for the second quarter are summarized in Table 2-4 and are presented in Appendix F. The statistics for the solar radiation data presented in Table 2-4 are based on daylight hours.

Table 2-4

Solar Radiation Data in Watts Per Meter Squared (W/m^2) for Second Quarter 2011

Month	Monthly Mean	Maximum Daily Total	Minimum Daily Total	Maximum Hour
April	307	8759	3382	1099
May	333	9216	4772	1080
June	348	9382	5345	1080

2.1.6 Barometric Pressure

Barometric pressure data for the second quarter are presented in Table 2-5 and in Appendix G.

Table 2-5

Barometric Pressure Data in Inches of Mercury (in. Hg) for Second Quarter 2011

Month	Monthly Mean	Maximum Daily Mean	Minimum Daily Mean	Maximum Hour	Minimum Hour
April	23.5	23.8	23.3	23.8	23.3
May	23.5	23.8	23.3	23.9	23.2
June	23.6	23.8	23.4	23.8	23.3

2.2 Data Recovery

Data recoveries for the meteorological parameters, in percent possible for April through June 2011 are provided in Table 2-6.

Table 2-6

Meteorological Measurement Data Recovery in Percent for Second Quarter 2011

Month	Wind Speed	Wind Direction	Temp.	Rel. Hum.	Prec.	Solar Rad.	Bar. Press.
April	99.7	99.7	99.0	99.0	38.8	100	100
May	100	100	100	100	100	100	100
June	100	100	100	100	100	100	100

3.0 QUALITY CONTROL

Meteorological data collected at the Barrick/Homestake Mining Company monitoring station have been subjected to a series of quality control procedures to document the validity of the data and increase the integrity of the data sets. The quality control performed for these data is described in this section.

3.1 Visual Inspection of Equipment

Visual inspection of the meteorological tower and sensors is performed at least every six months or more frequently when problems are indicated. Abnormal conditions are logged and reported immediately to the program manager for corrective action.

3.2 Remote Interrogation of the Monitoring Station

The data logger is interrogated daily to download and process the data. Abnormal data values or apparent problems are reported immediately to the program manager who initiates corrective action and determines if a special visit to the site is required.

3.3 Quality Control Data Inspections

During data acquisition, the data logger collects and saves hourly averages of each measured parameter. The values are stored in memory for subsequent retrieval via telephone, modem, and Internet. After the site data logger is interrogated, collecting all data since the last interrogation, the data are stored on MSI computers in Salt Lake City. These data are then subjected to a series of quality tests. The data files are input to a program which performs a series of quality control (QC) tests as listed in Table 3-1.

Table 3-1

Quality Control Checks Imposed by Data QC Program

Meteorological Data
Wind Speed > 25 m/s for one 1-hr period.
Ambient temperature > 40 ºC.
Ambient temperature < -20 ºC.
Relative Humidity > 100 %.
Relative Humidity < 5 %.
Barometric Pressure > 23.95 In. Hg.
Barometric Pressure < 23.20 In. Hg.
Precipitation total > 0.25 In. in one 1-hr period.
Solar Radiation > 1600 W/m2.
Battery Voltage < 11 V.
Wind Speed / Wind Direction / Sigma Theta unchanged for 3 or more hours.
Ambient temperature unchanged for 3 or more hours.
Relative Humidity unchanged for 4 or more hours.
Barometric Pressure unchanged for 3 or more hours.
Ambient temperature change > 5 ºC in one hour.
Relative Humidity change > 20 % in one hour.
Barometric Pressure change more than 0.04 In. Hg. in one hour.

The QC program produces a report that identifies each value in the data file that fails one or more of the listed tests. This report also provides means, maxima and minima for each variable. An example of this output is shown in Figure 3.1.

```
Quality Assurance
Data runs from 06/25/2010 at 600 to 06/26/2010 at 0600
Total number of hourly averages:  24
Calculated number of hourly averages  24
------------------------------------------------------------------------
MIN, MAX and MEAN VALUES (HOURLY AVERAGES)

Mean Wind Speed              4.3    (mps)
Max  Wind Speed              9.8    (mps) on  6/25/10 at  1400
Min  Wind Speed              0.6    (mps) on  6/25/10 at  2300

Mean Wind Direction          306    (deg)
Max  Wind Direction          356    (deg) on  6/25/10 at  2000
Min  Wind Direction          0      (deg) on  6/25/10 at  1000

Mean Sigma Theta             23     (deg)
Max  Sigma Theta             97     (deg) on  6/25/10 at  1100
Min  Sigma Theta             3      (deg) on  6/26/10 at  100

Mean Temperature             18.81  (deg C)
Max  Temperature             27.37  (deg C) on  6/25/10 at  1400
Min  Temperature             8.44   (deg C) on  6/26/10 at  400

Mean Relative Humidity       31     (%)
Max  Relative Humidity       59     (%) on  6/26/10 at  500
Min  Relative Humidity       12     (%) on  6/25/10 at  1400

Mean Solar Radiation         318    (w/m^2)
Max  Solar Radiation         1093   (w/m^2) on  6/25/10 at  1300
Min  Solar Radiation        -0.3    (w/m^2) on  6/25/10 at  2200

Mean Pressure                23.2   (in Hg)
Max  Pressure                23.29  (in Hg) on  6/25/10 at  600
Min  Pressure                23.14  (in Hg) on  6/25/10 at  1700

Total Precipitation          0      (inches)

Parameters that fell outside of normal bounds:
Temperature changed more than 4 on  6 / 25 / 2010  at  600
```

Figure 3.1 Example Quality Control Report

3.4 Data Validation

When the QC program identifies values that exceed the criteria set for that parameter, the data file is inspected visually. In most cases, a flagged value is not invalid; it merely fell outside of expected ranges or "normal" rates of change for that parameter. If, after investigation, a meteorologist determines that the value is reasonable, the value is not invalidated. If there is a reason to suspect the data point, the value is reset to "missing." (This is done on the data management file only, not on the raw data file collected from the data logger; the raw data file is never manipulated.) The conditions listed in Table 3-1 result in a flag in the data set.

In addition, MSI hosts a password-protected project web-site which is updated daily. The site contains 24-hour meteorological chart graphics, daily minimum, maximums, and averages, quality assurance reports and wind roses. Figures 3.2 and 3.3 present examples of these graphics. By using this approach, data collection percentages are greatly enhanced and MSI meteorologists can quickly note and resolve any potential instrumentation problems.

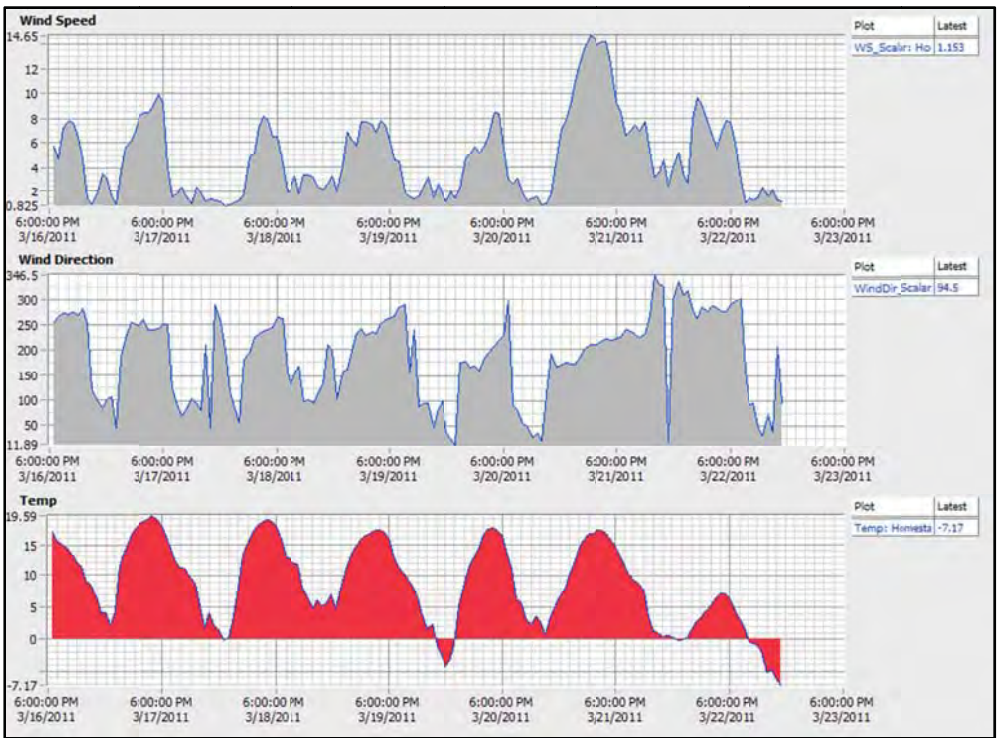


Figure 3.2 Real-Time Display

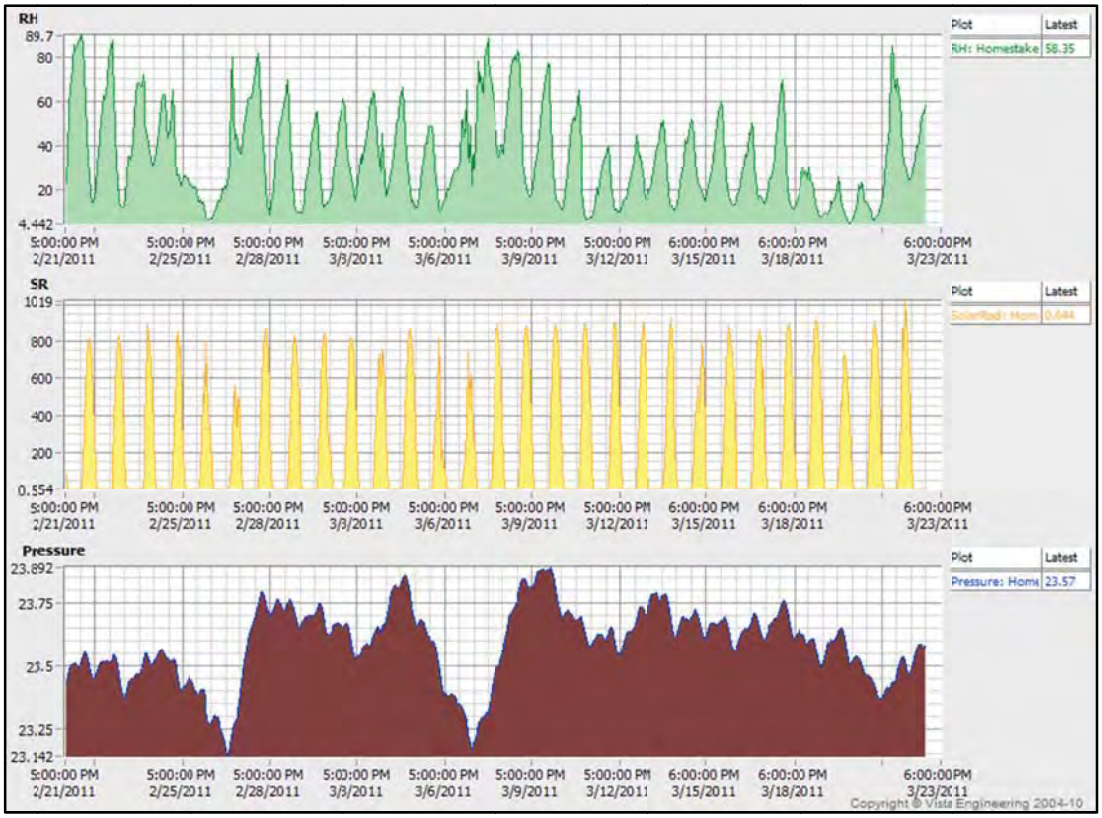


Figure 3.3 Strip-Chart of Real-Time Data

For the purposes of this data report, data failures or discrepancies that would invalidate an hourly average for the meteorological site are listed below:

- Visual evidence, on the stacked parameter/time plots for example, that the one-hour value is an outlier; and
- Audit, calibration or maintenance visit.

Invalid data periods for the second quarter 2011 are presented in Table 3-2.

Table 3-2

Invalid Data Periods Second Quarter 2011

Parameter	Beginning		Ending		Reason	Result
	Date	Time	Date	Time		
Precipitation	04/01/2011	01:00	04/19/2011	10:00	1	Set to missing
10M wind speed, wind dir.	04/19/2011	11:00	04/19/2011	12:00	2	Set to missing
Temp., rel. humidity	04/19/2011	10:00	04/19/2011	16:00	2	Set to missing

1. Reed switch broken.
2. Performance audit.

Precipitation amounts recorded by Homestake's gauge were compared against precipitation amounts measured by the National Weather Service (NWS) in Grants, New Mexico. From April 1-19, no precipitation was recorded by the NWS.

3.5 Equipment Calibration

Meteorological equipment calibrations are performed when audits indicate the need or when problems are identified. Sensors which do not meet US EPA PSD calibration specifications are repaired and re-calibrated. No calibrations were conducted during the second quarter 2011.

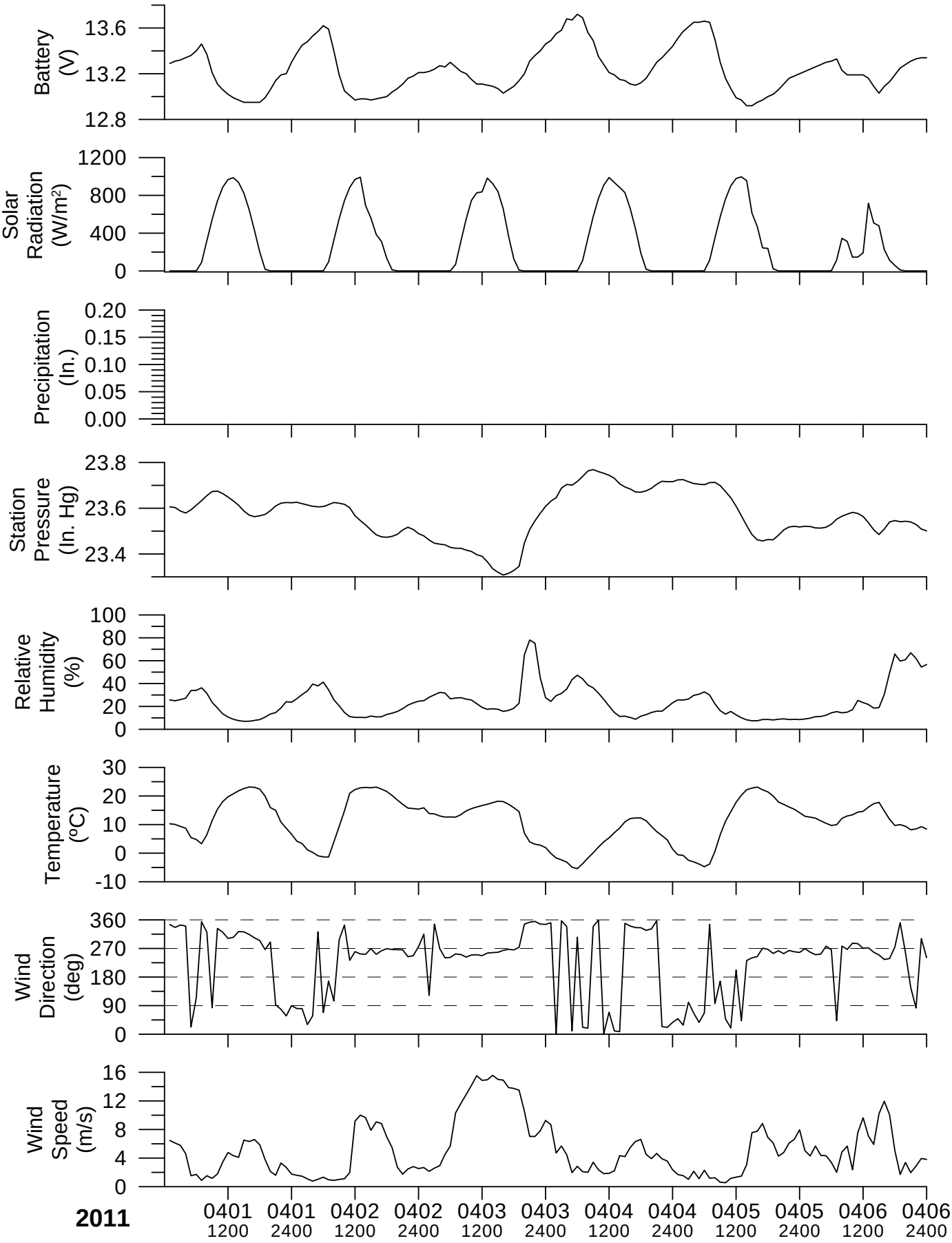
4.0 QUALITY ASSURANCE AUDITS

In order to comply with EPA requirements, a performance audit of meteorological instrumentation is conducted every six months. Audit reference standards are independent of those used for calibration checks.

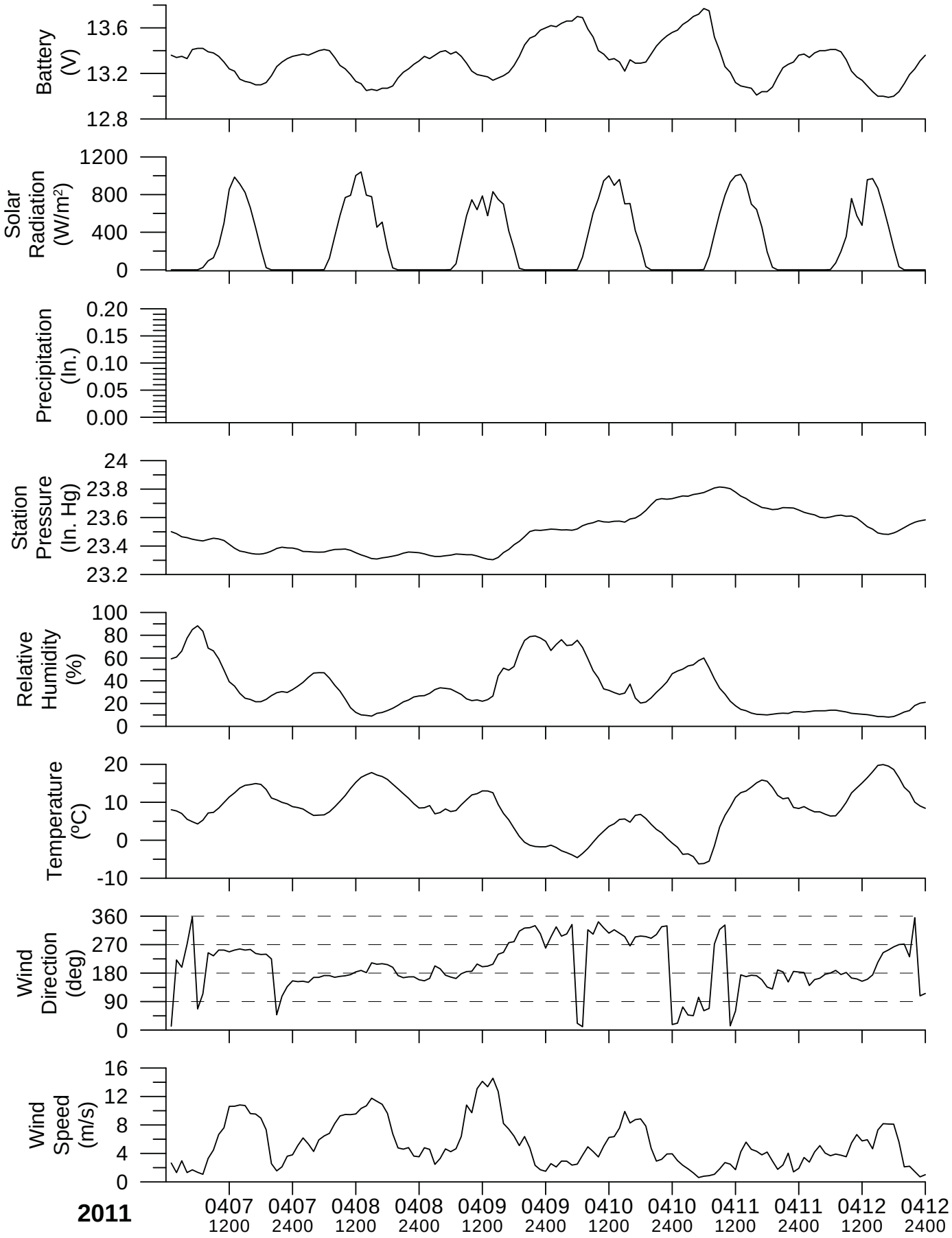
A quality assurance performance audit of the meteorological sensors was conducted on April 19, 2011. Results of this audit are presented in a separate report.

Appendix A
Stacked Parameter Plots for April through June 2011

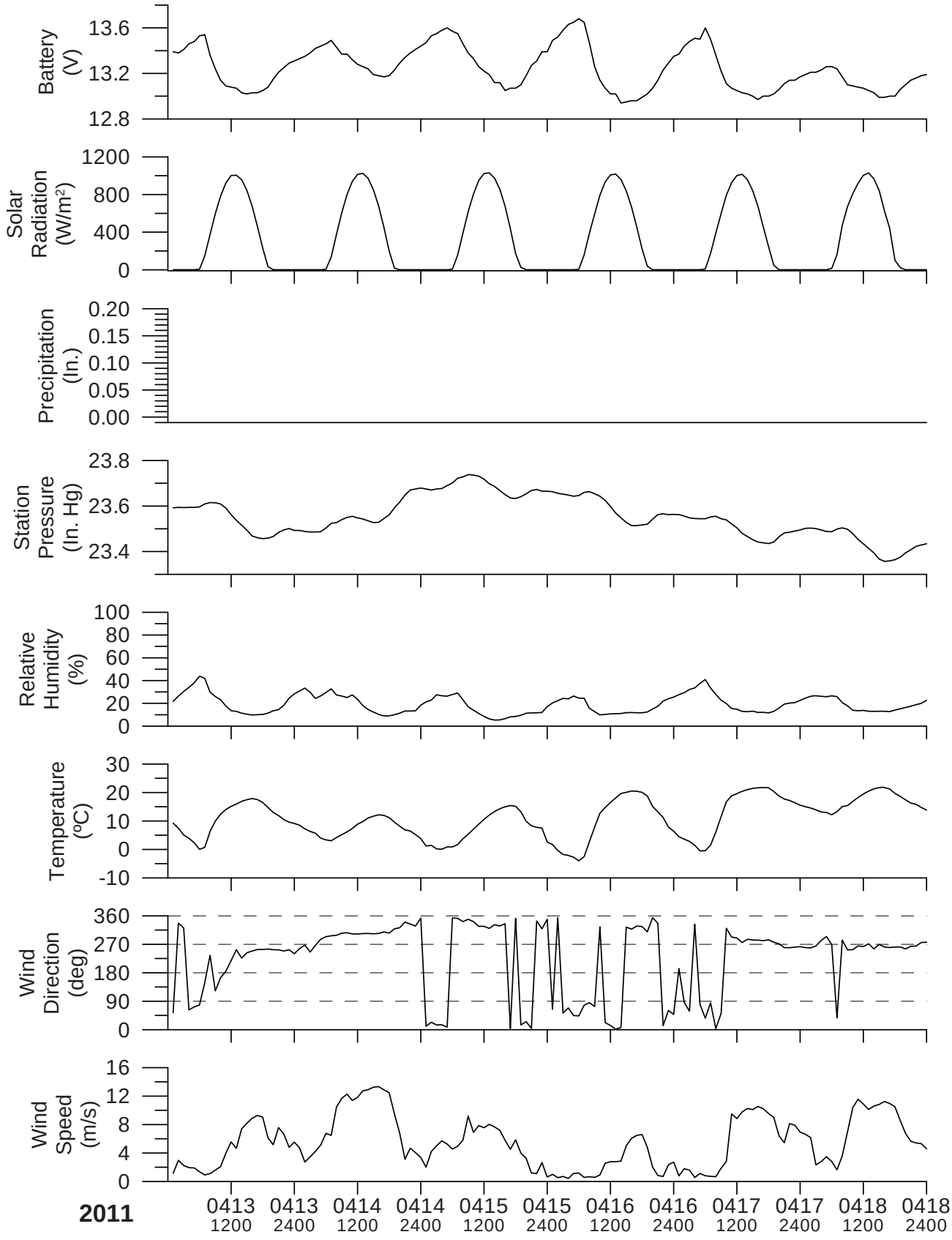
Homestake Stacked Plots



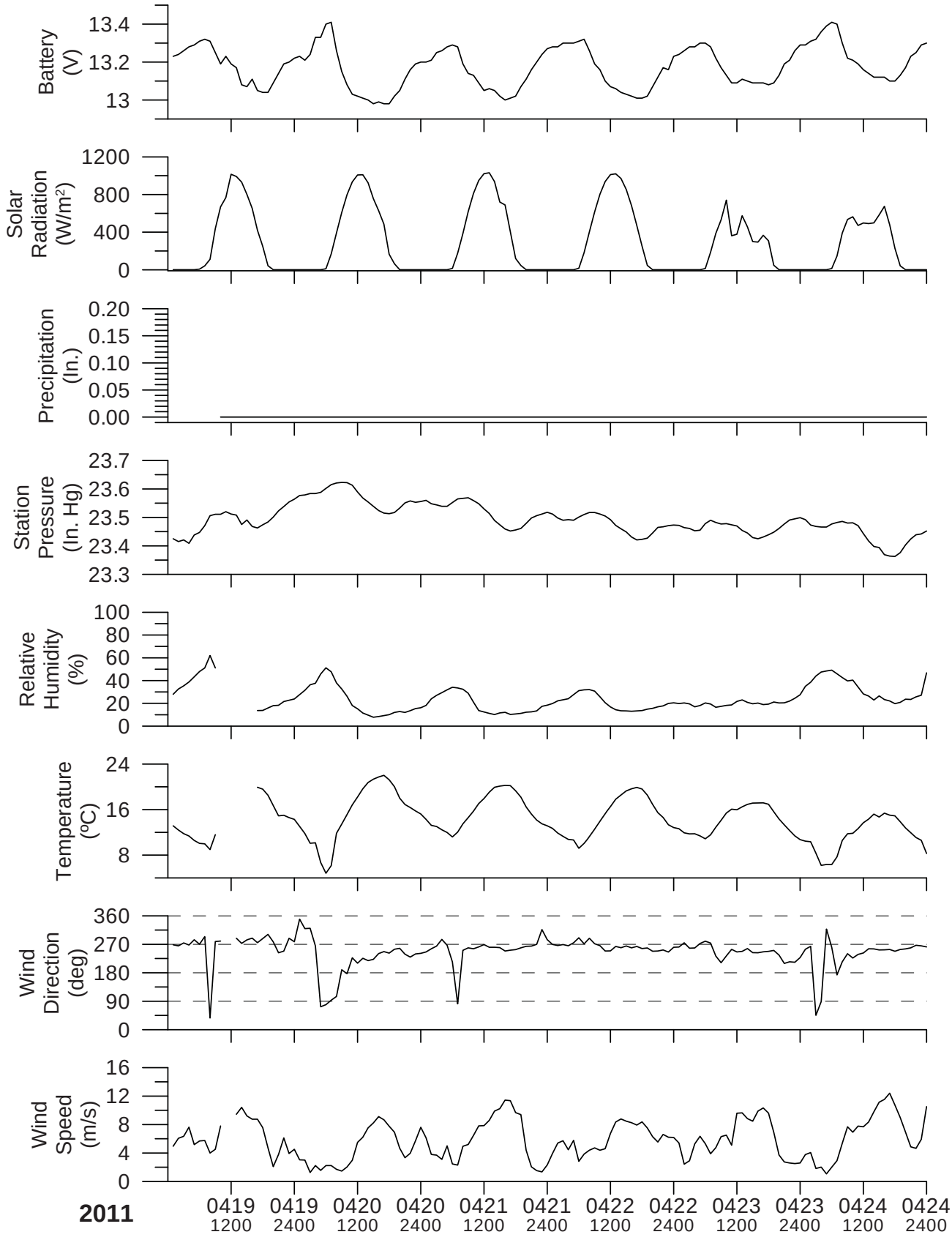
Homestake Stacked Plots



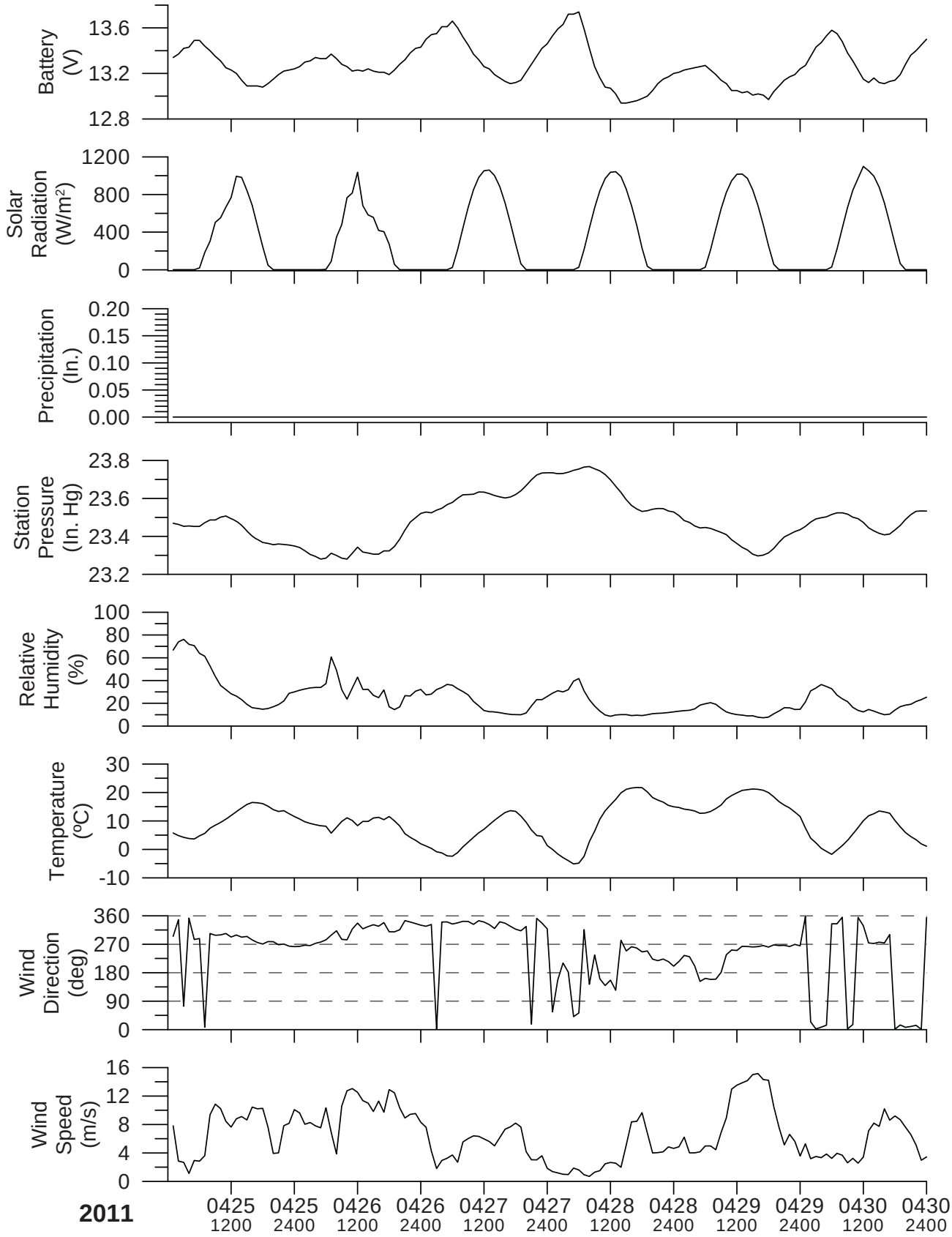
Homestake Stacked Plots



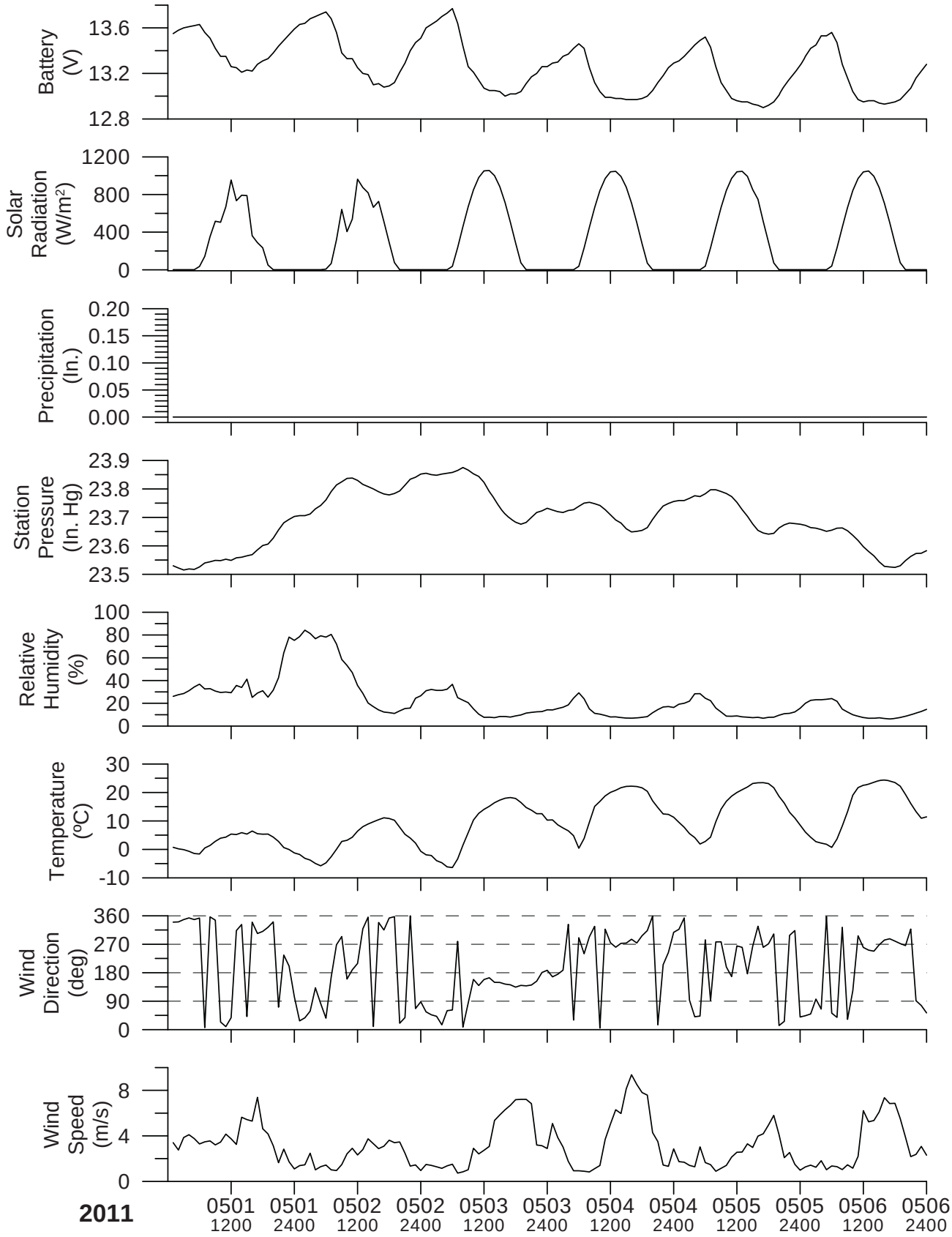
Homestake Stacked Plots



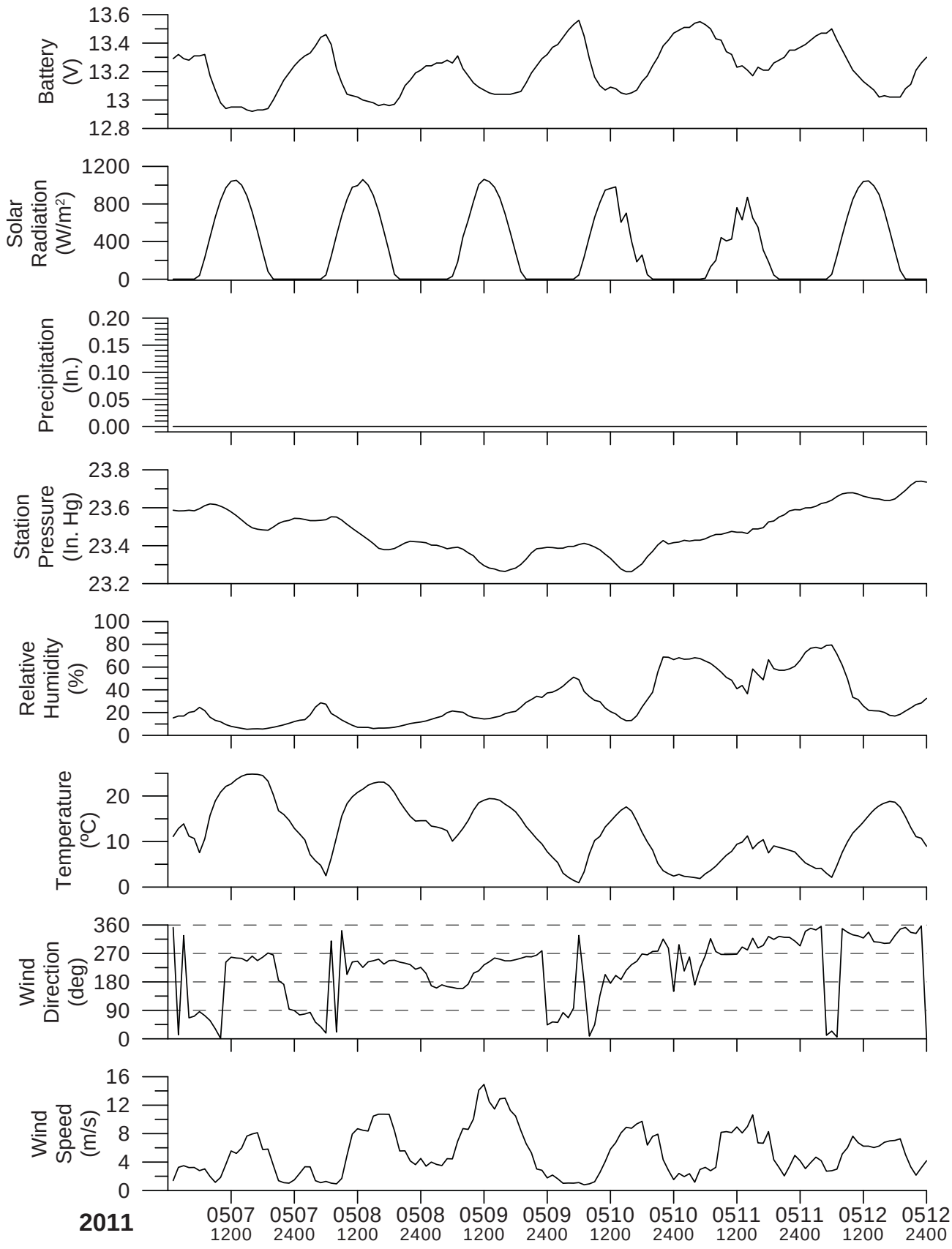
Homestake Stacked Plots



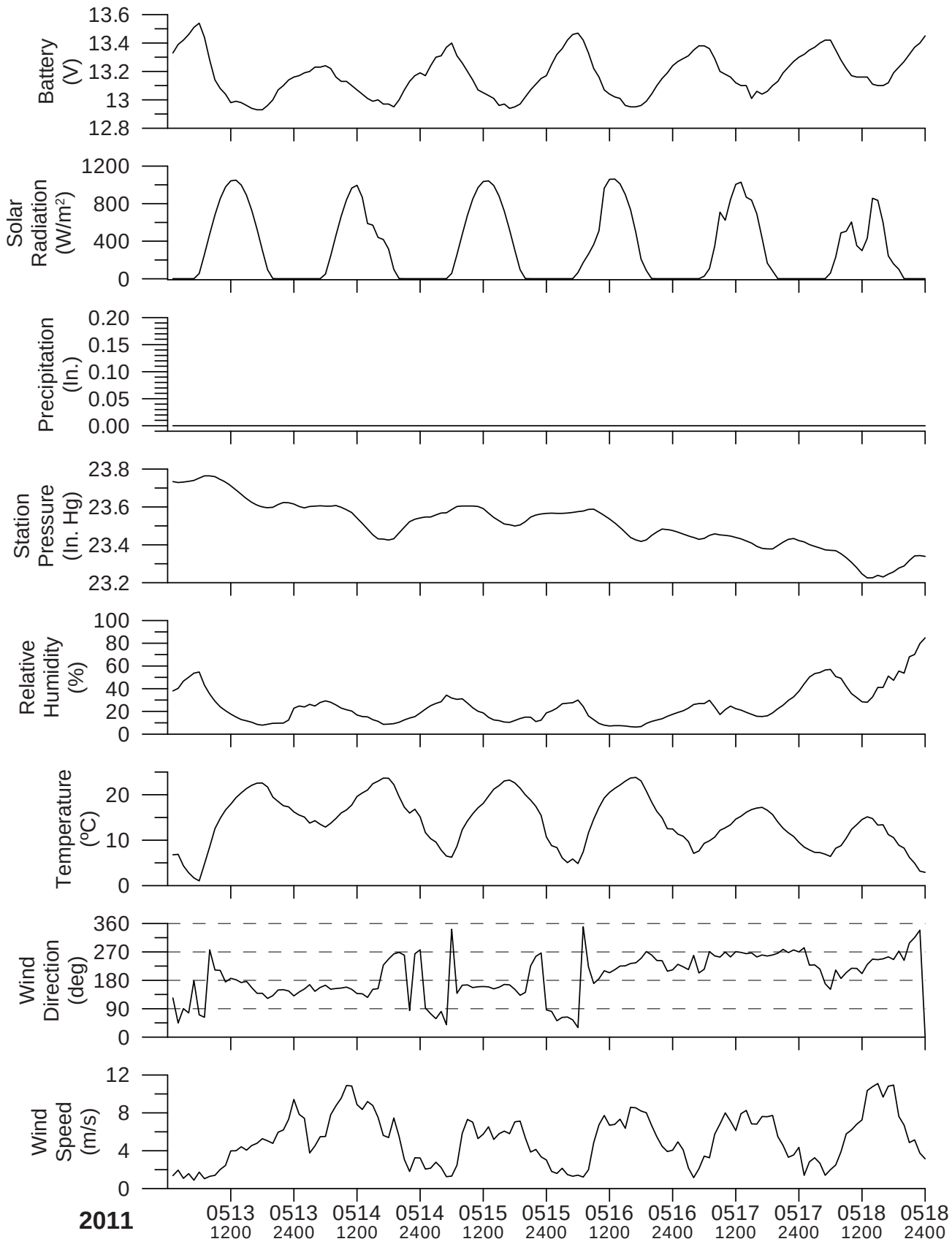
Homestake Stacked Plots



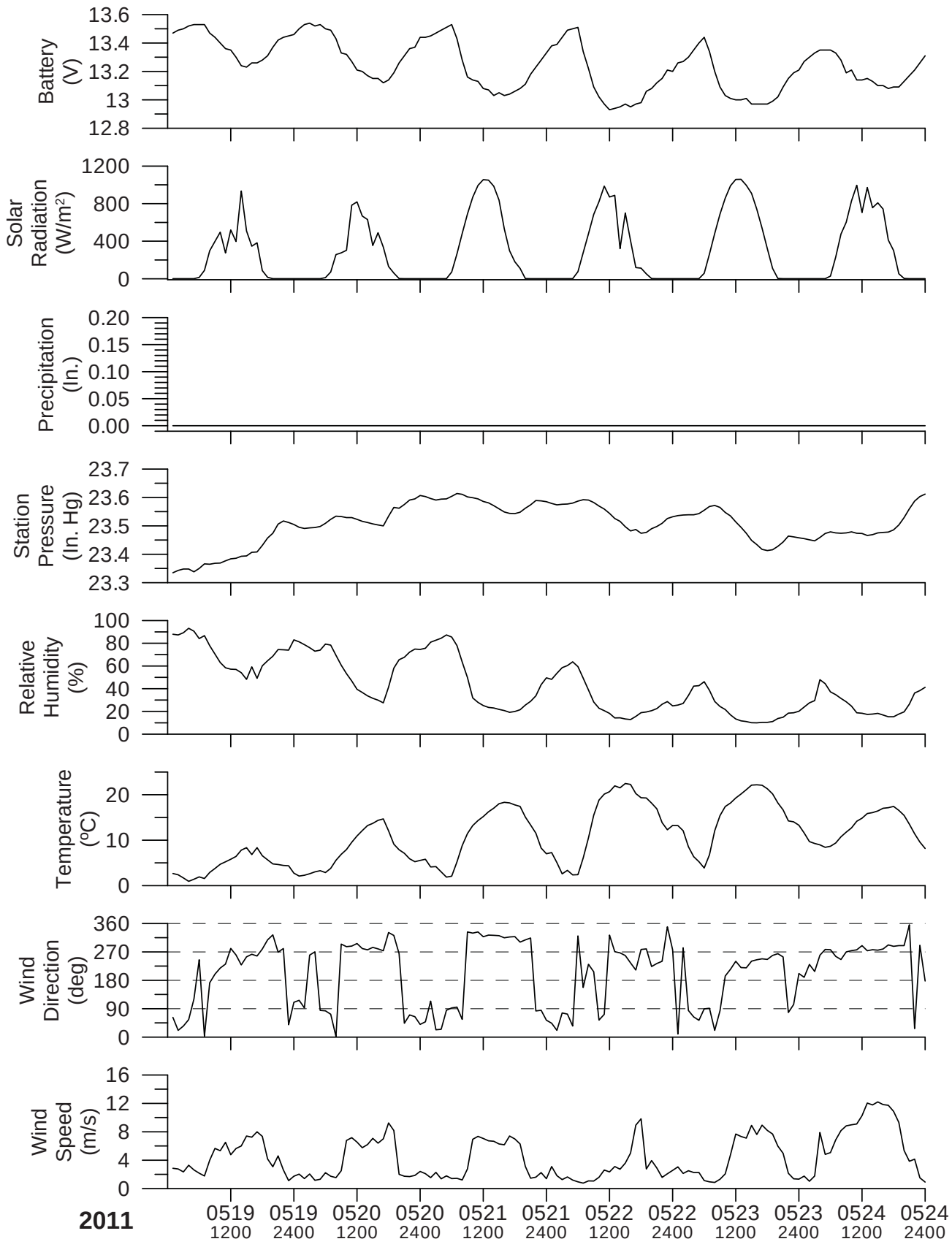
Homestake Stacked Plots



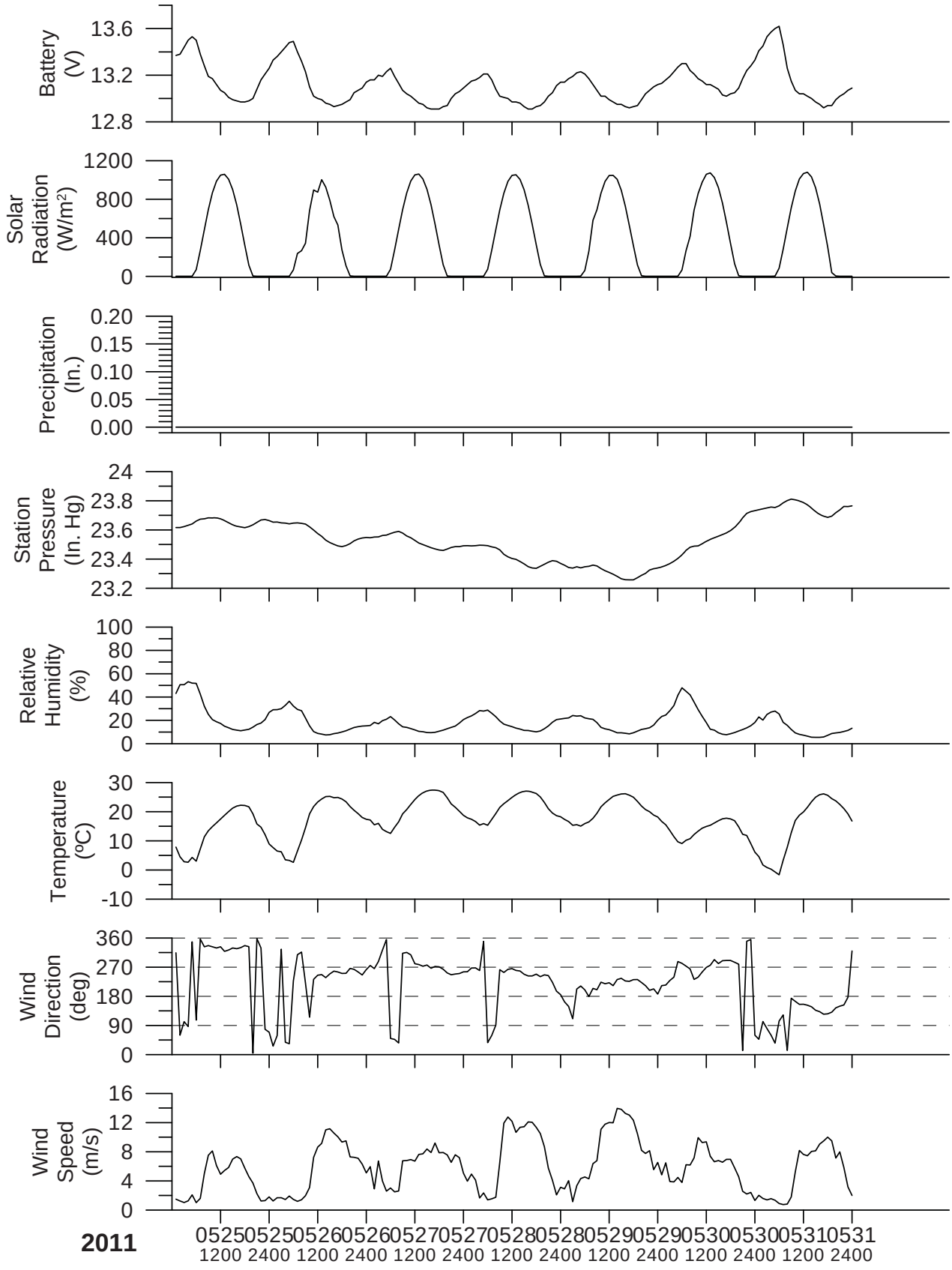
Homestake Stacked Plots



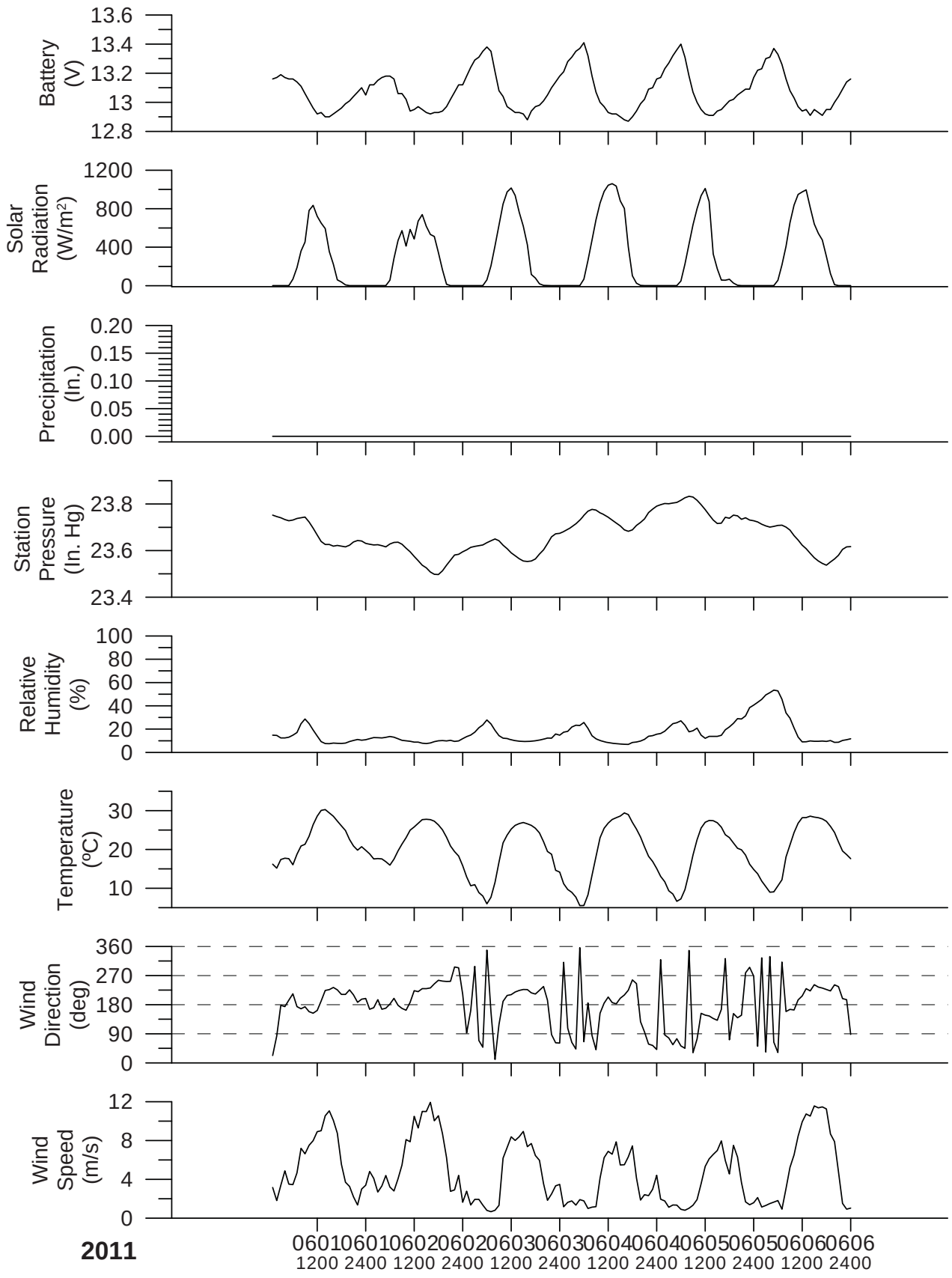
Homestake Stacked Plots



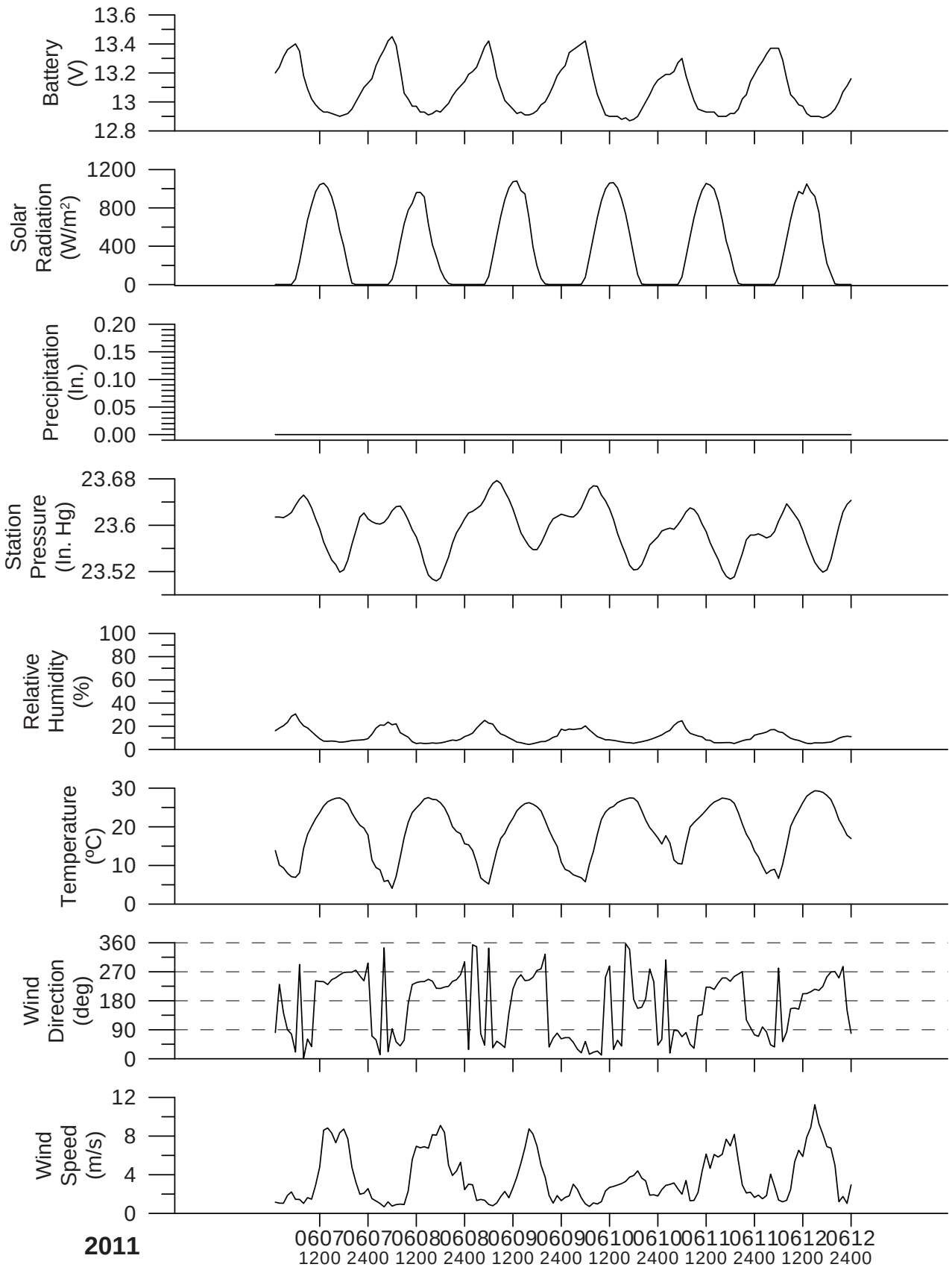
Homestake Stacked Plots



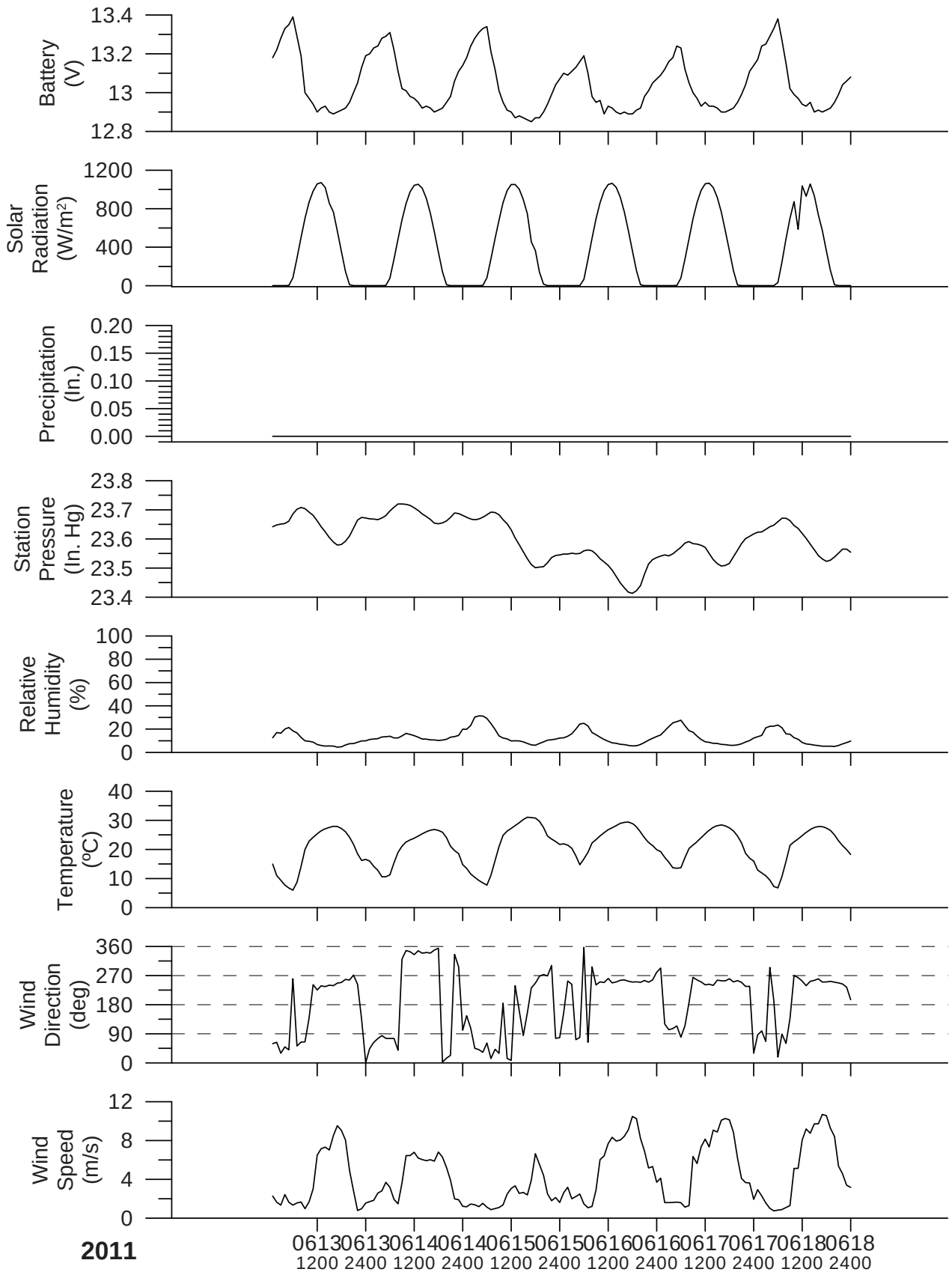
Homestake Stacked Plots



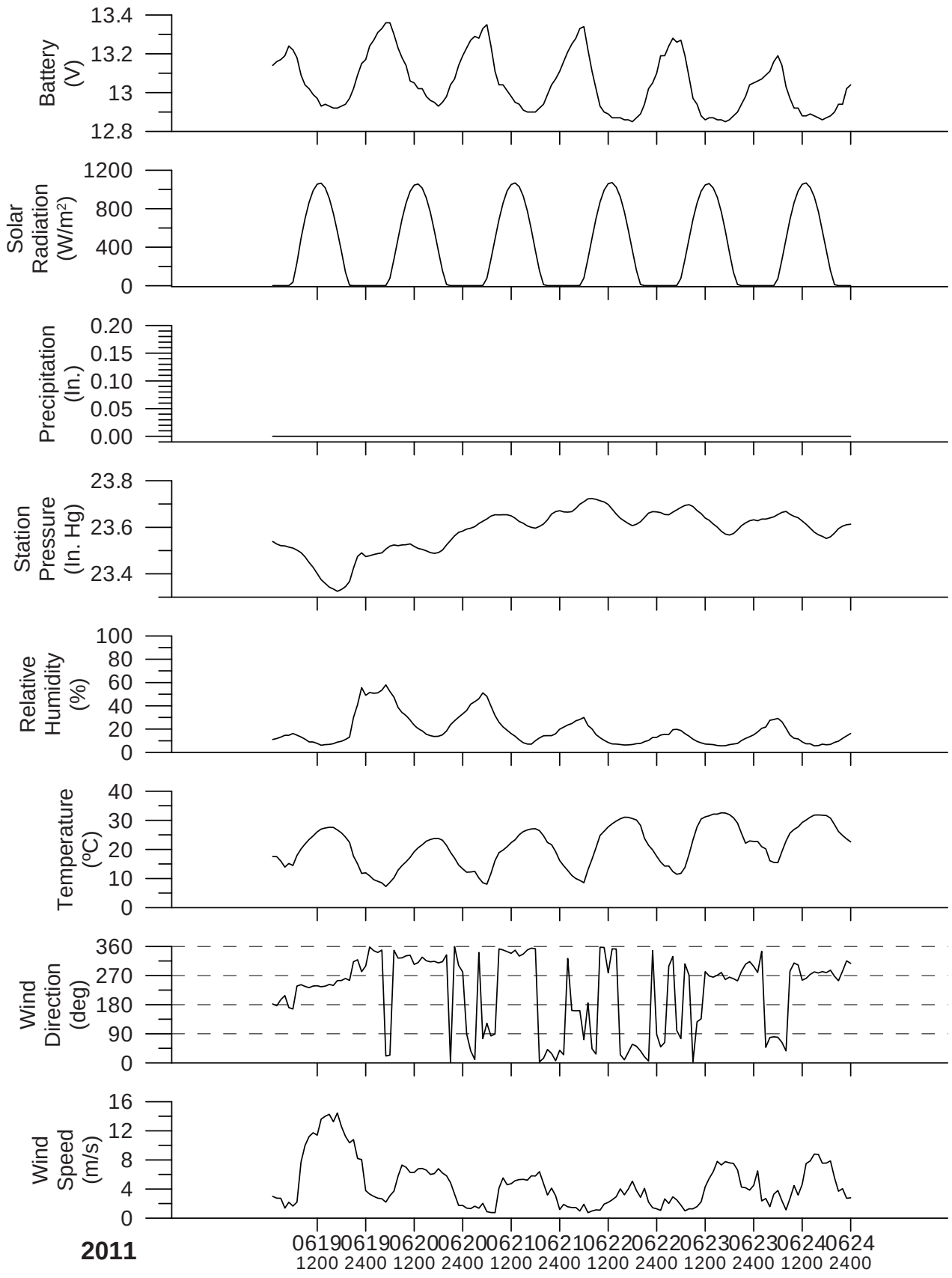
Homestake Stacked Plots



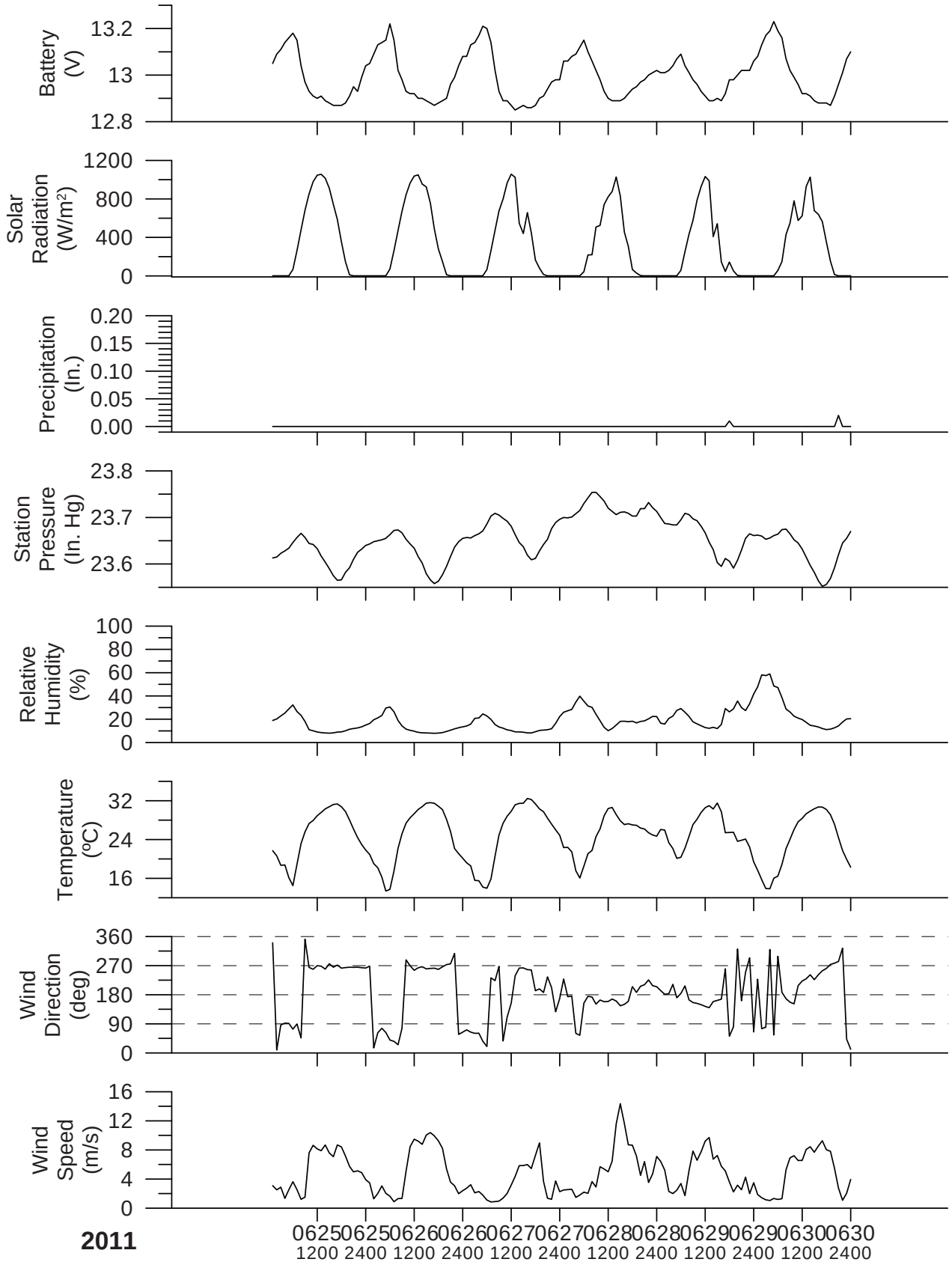
Homestake Stacked Plots



Homestake Stacked Plots



Homestake Stacked Plots



Appendix B
Wind Information for 10-Meter Levels for April through June 2011

B.1 Hourly Average Wind Speed/Direction

B.2 Joint Frequency of Occurrence Distributions of Wind Speeds and Directions

Appendix B.1
Hourly Average Wind Speed/Direction

Homestake

10M Wind Speed and Direction in m/s for APRIL, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13
01	345/06.5	336/06.1	344/05.8	341/04.6	023/01.5	114/01.7	354/00.9	322/01.5	083/01.2	333/01.8	321/03.4	302/04.8	305/04.3
02	081/01.6	081/01.5	030/01.1	058/00.8	322/01.0	068/01.3	168/01.0	105/00.9	297/01.0	344/01.1	233/02.0	260/09.2	253/10.0
03	315/02.7	122/02.1	347/02.6	270/02.9	241/04.5	242/05.7	253/10.3	251/11.7	243/12.9	250/14.2	250/15.5	247/14.9	256/15.0
04	351/08.7	360/04.7	357/05.7	339/04.5	010/02.0	306/02.8	022/02.1	019/02.0	339/03.4	359/02.4	002/01.8	069/01.9	010/02.2
05	049/01.7	029/01.5	101/01.0	066/02.2	037/01.1	067/02.3	346/01.2	096/01.2	167/00.6	048/00.6	020/01.2	202/01.3	042/01.5
06	270/05.0	258/04.3	250/05.7	252/04.4	277/04.3	266/03.4	042/02.0	277/04.9	267/05.7	287/02.4	285/07.6	271/09.6	272/07.1
07	012/02.6	222/01.3	199/03.0	271/01.3	358/01.7	067/01.3	115/01.1	244/03.3	235/04.5	253/06.7	253/07.6	247/10.6	253/10.6
08	153/05.1	154/06.2	151/05.3	166/04.3	167/05.9	172/06.5	172/06.8	167/08.2	170/09.3	172/09.5	175/09.5	184/09.6	189/10.3
09	156/04.8	163/04.6	203/02.5	194/03.3	173/04.6	168/04.2	163/04.7	178/06.4	185/10.8	186/09.7	209/13.1	200/14.1	202/13.4
10	294/02.6	326/02.1	297/02.9	304/02.9	334/02.4	021/02.5	011/03.8	317/04.9	303/04.3	342/03.5	323/05.0	306/06.2	317/06.4
11	022/03.0	073/02.3	048/01.8	046/01.3	104/00.6	061/00.8	068/00.9	272/01.1	318/01.8	332/02.7	013/02.5	060/01.7	175/04.2
12	182/03.4	141/02.8	160/04.2	164/05.1	176/04.0	180/03.7	189/03.9	176/03.8	182/03.5	165/05.5	162/06.7	154/05.8	161/05.9
13	053/01.1	337/03.0	322/02.2	063/01.9	072/01.9	078/01.4	149/00.9	235/01.1	123/01.6	164/02.1	185/04.0	219/05.6	253/04.6
14	257/04.7	268/02.7	245/03.5	267/04.2	286/05.1	294/06.8	297/06.5	299/10.4	305/11.7	306/12.3	303/11.4	302/11.8	304/12.7
15	011/02.0	023/04.2	015/05.0	015/05.7	008/05.3	353/04.6	352/04.9	342/05.8	349/09.2	342/06.9	327/07.9	327/07.6	320/08.0
16	064/01.0	354/00.5	052/00.7	069/00.4	045/01.1	044/01.2	077/00.6	085/00.7	073/00.6	325/00.9	022/02.6	013/02.8	002/02.8
17	193/00.8	086/01.8	059/01.6	334/00.6	080/01.1	036/00.8	085/00.7	003/00.7	051/01.9	321/02.8	293/09.5	290/08.8	276/09.8
18	260/06.6	258/06.2	265/02.3	282/02.8	295/03.5	269/02.8	037/01.6	283/03.6	252/07.0	253/10.4	265/11.6	263/10.9	272/10.1
19	268/04.9	265/06.1	274/06.3	268/07.6	284/05.2	270/05.7	294/05.8	037/04.0	279/04.5	280/07.8			289/09.5
20	349/03.0	320/03.0	321/01.3	265/02.2	073/01.6	079/02.2	093/02.2	105/01.7	190/01.5	177/02.0	227/03.0	210/05.5	226/06.2
21	246/06.1	256/03.8	264/03.7	285/03.1	267/05.0	214/02.5	082/02.3	251/05.0	259/05.2	256/06.5	262/07.8	269/07.9	261/08.6
22	270/03.9	266/05.4	269/05.7	266/04.5	275/05.8	291/02.8	271/03.9	289/04.4	272/04.7	266/04.4	249/04.6	249/06.7	263/08.4
23	261/05.4	275/02.4	258/02.9	259/05.3	272/06.3	280/05.3	274/03.9	233/04.8	212/06.3	233/06.5	254/05.1	246/09.6	248/09.6
24	254/03.8	264/04.1	046/01.8	089/02.0	318/01.1	261/02.0	173/02.9	215/05.4	240/07.7	227/06.9	238/07.8	243/07.7	256/08.4
25	295/07.8	348/02.8	074/02.7	352/01.1	285/02.9	288/02.8	008/03.6	304/09.4	298/10.9	300/10.2	304/08.5	293/07.6	299/08.8
26	263/09.6	267/08.0	266/08.3	273/07.8	277/07.5	284/10.3	299/06.9	312/03.9	286/10.6	284/12.7	318/13.1	337/12.5	319/11.4
27	327/07.6	333/04.3	002/01.8	340/02.9	341/03.3	334/03.7	338/02.7	343/05.5	342/06.0	333/06.4	344/06.3	340/06.0	332/05.6
28	056/01.4	157/01.2	211/01.0	182/01.0	041/01.9	052/01.6	316/00.9	143/00.7	236/01.3	160/01.5	140/02.5	157/02.7	125/02.6
29	216/04.9	235/06.2	231/04.0	201/04.0	153/04.2	162/05.0	159/05.0	159/04.4	181/06.9	237/08.9	252/13.0	250/13.5	264/13.9
30	357/05.3	024/03.2	002/03.5	008/03.3	014/03.8	335/03.2	335/03.9	356/03.7	003/02.6	016/03.2	355/02.6	328/03.4	274/07.1
MEAN	307/04.3	304/03.6	311/03.3	301/03.3	333/03.3	330/03.4	019/03.3	280/04.2	261/05.3	281/05.8	280/06.8	265/07.6	273/08.0
MX SPD	263/09.6	267/08.0	266/08.3	273/07.8	277/07.5	284/10.3	253/10.3	251/11.7	243/12.9	250/14.2	250/15.5	247/14.9	256/15.0
MN SPD	193/00.8	354/00.5	052/00.7	069/00.4	104/00.6	061/00.8	077/00.6	085/00.7	167/00.6	048/00.6	020/01.2	202/01.3	042/01.5

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Homestake

10M Wind Speed and Direction in m/s for APRIL, 2011 PAGE 2

HR END DAY	14	15	16	17	18	19	20	21	22	23	24	MEAN	MX SPD	MN SPD
01	323/04.1	322/06.5	314/06.3	303/06.6	295/05.9	267/03.8	290/02.1	093/01.6	079/03.3	058/02.7	090/01.8	342/03.7	303/06.6	354/00.9
02	252/09.7	269/07.9	252/09.1	263/08.8	269/07.0	267/05.5	266/02.7	266/01.8	244/02.5	247/02.8	276/02.5	272/03.9	253/10.0	058/00.8
03	257/15.6	258/15.0	264/14.9	267/13.9	265/13.8	274/13.5	346/10.6	353/07.0	355/07.0	347/07.8	346/09.3	277/10.1	257/15.6	122/02.1
04	008/04.3	349/04.2	341/05.5	336/06.3	335/06.6	327/04.5	332/03.9	357/04.6	024/03.9	022/03.6	037/02.4	358/03.9	351/08.7	002/01.8
05	232/03.1	241/07.6	245/07.8	271/08.8	267/06.9	254/06.1	263/04.3	254/04.8	264/06.1	260/06.6	258/08.0	294/03.6	271/08.8	167/00.6
06	258/05.9	250/10.2	235/12.0	238/10.1	275/05.0	351/01.7	257/03.4	147/02.0	083/02.9	301/03.9	241/03.8	267/05.3	235/12.0	351/01.7
07	256/10.8	253/10.7	255/09.6	242/09.5	239/09.0	240/07.3	225/02.6	048/01.6	107/02.1	137/03.6	156/03.8	235/05.3	256/10.8	115/01.1
08	182/10.7	213/11.8	208/11.3	210/10.9	207/09.6	198/06.8	172/04.8	166/04.6	168/04.8	168/03.6	159/03.5	177/07.5	213/11.8	159/03.5
09	208/14.6	240/12.7	246/08.2	276/07.4	279/06.4	313/05.1	322/06.4	324/04.8	330/02.3	304/01.7	259/01.5	221/07.0	208/14.6	259/01.5
10	306/07.6	295/09.9	266/08.3	294/08.8	297/08.9	295/07.8	290/04.8	302/02.9	327/03.2	329/03.9	017/03.9	315/05.0	295/09.9	326/02.1
11	169/05.6	173/04.6	172/04.3	159/03.8	136/04.2	130/02.9	190/01.8	184/02.4	152/04.0	185/01.4	183/01.9	124/02.6	169/05.6	104/00.6
12	174/04.7	215/07.3	245/08.2	253/08.1	263/08.1	270/05.6	272/02.1	232/02.2	355/01.5	108/00.7	116/01.0	187/04.5	245/08.2	108/00.7
13	227/07.4	243/08.2	249/08.9	254/09.3	254/09.0	255/06.1	253/05.2	252/07.6	249/06.7	253/04.8	240/05.5	235/04.6	254/09.3	149/00.9
14	305/12.9	303/13.3	305/13.3	309/12.9	305/12.5	319/09.5	323/06.8	340/03.1	334/04.7	328/04.0	353/03.4	303/08.3	303/13.3	268/02.7
15	332/07.7	328/07.2	335/05.8	003/04.5	352/05.9	015/04.0	026/03.3	004/01.2	344/01.1	319/02.7	349/00.6	351/05.0	349/09.2	349/00.6
16	007/02.9	325/05.0	318/06.1	328/06.5	326/06.6	310/04.8	354/02.0	336/00.8	013/00.7	061/02.3	048/02.7	017/02.3	326/06.6	069/00.4
17	286/10.3	284/10.1	283/10.6	281/10.2	284/09.6	277/09.0	271/06.4	260/05.4	259/08.1	261/07.9	262/06.9	299/05.6	283/10.6	334/00.6
18	255/10.6	269/10.8	261/11.2	260/11.0	261/10.5	261/08.6	256/06.8	264/05.7	265/05.4	276/05.3	277/04.6	268/07.1	265/11.6	037/01.6
19	273/10.4	284/09.2	290/08.8	275/08.8	288/07.6	301/04.7	278/02.1	243/03.8	249/06.1	289/03.9	278/04.5	280/06.2	273/10.4	278/02.1
20	218/07.5	222/08.2	241/09.1	247/08.7	242/07.8	255/06.9	257/04.7	239/03.3	230/04.0	240/05.7	241/07.6	234/04.5	241/09.1	321/01.3
21	261/09.9	259/10.2	249/11.4	251/11.4	253/09.7	259/09.4	264/04.4	264/02.1	270/01.5	316/01.3	285/02.3	262/05.9	249/11.4	316/01.3
22	259/08.8	265/08.5	259/08.3	263/07.9	257/08.4	258/07.5	248/06.3	249/05.5	252/06.6	246/06.2	261/06.2	263/06.1	259/08.8	291/02.8
23	257/08.8	244/08.5	243/09.9	246/10.3	248/09.6	251/06.9	236/03.7	210/02.7	215/02.6	213/02.5	228/02.6	246/05.9	246/10.3	275/02.4
24	255/09.8	252/11.1	252/11.5	254/12.4	248/10.7	254/09.0	255/06.9	259/04.9	267/04.7	265/05.9	262/10.5	251/06.6	254/12.4	318/01.1
25	292/09.1	295/08.6	284/10.4	275/10.2	271/10.3	278/07.6	278/03.9	268/04.0	271/07.8	264/08.2	263/10.1	295/07.1	298/10.9	352/01.1
26	326/11.0	332/09.8	327/11.3	339/09.7	310/12.9	309/12.5	316/10.3	345/08.9	340/09.4	336/09.6	330/08.3	308/09.8	318/13.1	312/03.9
27	320/05.0	341/06.2	337/07.3	327/07.7	318/08.2	312/07.7	326/04.2	017/03.0	352/03.0	337/03.6	319/01.8	336/05.0	318/08.2	002/01.8
28	282/02.0	249/05.1	262/08.4	258/08.4	246/09.7	249/06.8	223/04.0	218/04.0	223/04.2	215/04.9	201/04.6	208/03.4	246/09.7	143/00.7
29	263/14.2	261/15.0	262/15.2	266/14.3	261/14.2	268/10.5	266/07.6	267/05.1	263/06.6	270/05.6	265/03.6	238/08.6	262/15.2	265/03.6
30	273/08.2	276/07.7	274/10.2	301/08.6	002/09.2	015/08.7	007/07.6	010/06.6	014/05.1	001/03.0	355/03.4	347/05.3	274/10.2	003/02.6
MEAN	268/08.4	270/09.0	269/09.4	274/09.2	276/08.8	280/07.0	278/04.9	279/03.9	292/04.4	286/04.3	276/04.4	281/05.7		
MX SPD	257/15.6	258/15.0	262/15.2	266/14.3	261/14.2	274/13.5	346/10.6	345/08.9	340/09.4	336/09.6	262/10.5		257/15.6	
MN SPD	282/02.0	349/04.2	172/04.3	159/03.8	136/04.2	351/01.7	190/01.8	336/00.8	013/00.7	108/00.7	349/00.6			069/00.4

POSSIBLE NUMBER OF OBSERVATIONS = 720 ACTUAL NUMBER OF OBSERVATIONS = 718 DATA RECOVERY RATE = 99.7 %

MONTHLY MEAN = 281/05.7 MAXIMUM WIND SPEED WAS 15.6 m/s AT 257 DEGREES ON 4/ 3 AT 1400

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Homestake

10M Wind Speed and Direction in m/s for MAY, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13
01	340/03.4	341/02.8	348/03.9	353/04.1	348/03.8	353/03.3	006/03.5	356/03.6	346/03.2	024/03.4	010/04.2	038/03.7	313/03.2
02	028/01.4	037/01.5	058/02.5	132/01.0	083/01.3	036/01.4	167/01.0	268/01.0	294/01.5	160/02.4	189/02.9	209/02.3	319/02.8
03	056/01.5	047/01.4	042/01.3	015/01.2	060/01.4	062/01.5	279/00.7	008/00.8	084/01.0	159/02.9	140/02.4	159/02.7	164/03.1
04	167/05.1	175/03.9	188/03.0	333/01.8	030/00.9	291/00.9	240/00.9	294/00.8	327/01.1	005/01.4	318/03.7	275/05.0	261/06.3
05	317/01.7	353/01.7	093/01.4	041/01.3	043/03.0	284/01.7	092/01.5	277/00.9	278/01.1	198/01.4	168/02.1	265/02.6	260/02.6
06	044/01.3	050/01.4	097/01.2	065/01.8	358/01.0	052/01.4	039/01.3	324/01.0	032/01.5	123/01.2	297/02.2	260/06.2	251/05.2
07	352/01.4	012/03.2	327/03.5	066/03.2	072/03.2	086/02.8	073/03.0	058/02.0	031/01.2	001/01.8	243/03.7	258/05.6	256/05.2
08	075/02.4	078/03.3	084/03.3	053/01.4	038/01.1	018/01.3	310/01.0	021/00.9	342/01.7	204/04.9	243/07.9	246/08.7	226/08.5
09	207/03.4	168/04.0	161/03.7	171/03.5	165/04.5	162/04.4	159/06.9	159/08.7	173/08.6	207/10.1	215/14.1	234/14.9	244/12.5
10	053/02.2	052/01.6	083/01.0	067/01.1	097/01.0	327/01.1	180/00.8	008/00.9	044/01.2	137/02.5	203/04.1	175/05.8	200/06.7
11	298/02.4	214/02.0	259/02.4	170/01.2	224/03.0	263/03.3	317/02.8	276/03.3	267/08.2	267/08.3	267/08.1	268/08.9	290/08.1
12	340/03.1	350/03.9	344/04.7	356/04.2	011/02.7	024/02.8	006/03.0	348/05.1	337/06.0	329/07.6	325/06.7	319/06.2	337/06.2
13	124/01.4	045/01.9	090/01.1	076/01.6	179/00.9	071/01.7	063/01.0	276/01.3	212/01.4	211/02.0	175/02.4	186/04.0	182/04.0
14	143/07.9	152/07.4	166/03.8	145/04.5	157/05.5	164/05.5	152/07.8	154/08.8	155/09.6	158/10.9	151/10.8	138/08.9	137/08.4
15	092/02.1	074/02.2	059/02.8	082/02.2	039/01.3	342/01.3	139/02.5	164/05.8	165/07.3	157/07.0	160/05.3	160/05.8	159/06.5
16	081/01.8	052/01.6	062/02.1	064/01.5	055/01.3	030/01.4	349/01.2	223/02.0	170/04.9	185/06.7	210/07.7	204/06.7	214/06.8
17	231/04.9	223/04.1	214/02.2	259/01.2	203/02.1	215/03.4	271/03.3	257/05.7	254/06.8	270/08.0	254/07.1	271/06.1	269/07.9
18	283/01.4	228/02.8	229/03.3	216/02.7	169/01.4	151/02.0	212/02.5	186/03.9	204/05.8	218/06.2	218/06.8	201/07.3	230/10.4
19	063/02.9	021/02.8	035/02.4	056/03.3	121/02.6	245/02.2	003/01.8	172/04.0	200/05.7	219/05.3	231/06.5	281/04.8	260/05.6
20	117/02.0	092/01.4	260/02.0	270/01.2	085/01.3	083/02.2	073/01.7	002/01.5	295/02.5	286/06.8	288/07.2	297/06.5	281/05.8
21	048/02.1	114/01.5	023/02.3	025/01.4	085/01.8	092/01.4	095/01.4	056/01.2	333/02.8	330/06.9	333/07.4	318/07.1	323/06.7
22	044/03.1	021/01.8	077/01.3	073/01.6	035/01.2	321/01.0	157/00.8	231/01.1	207/01.1	054/01.6	072/02.6	323/02.3	271/03.1
23	010/03.1	283/02.1	084/02.5	064/02.3	053/02.3	090/01.1	091/00.9	022/00.9	083/01.3	194/02.1	215/04.8	240/07.7	220/07.3
24	190/01.8	230/01.0	208/01.8	260/07.9	278/04.8	277/05.1	256/06.9	246/08.2	270/08.8	274/09.0	277/09.1	290/10.3	274/12.0
25	314/01.5	060/01.2	102/01.0	087/01.3	348/02.1	107/01.0	357/01.6	333/05.0	337/07.5	333/08.1	329/06.1	333/04.9	319/05.4
26	026/01.2	059/01.7	325/01.7	038/01.4	034/01.9	227/01.5	308/01.2	317/01.4	221/02.0	116/03.1	233/07.2	245/08.6	247/09.2
27	275/06.0	265/02.9	287/06.7	323/04.0	355/02.6	050/03.0	047/02.5	036/02.6	313/06.8	315/06.8	308/06.9	281/06.7	278/07.6
28	256/04.0	267/04.9	268/04.1	260/01.7	350/02.3	037/01.4	059/01.5	091/01.8	262/06.5	254/11.9	263/12.8	266/12.2	260/10.7
29	163/02.9	149/04.0	111/01.1	202/03.3	212/04.3	200/04.5	179/04.3	204/06.4	200/06.8	224/11.1	219/11.8	222/12.0	213/12.0
30	213/04.8	215/06.5	229/03.9	239/03.9	287/04.5	282/03.8	273/06.2	264/06.2	232/07.2	239/09.9	255/09.3	269/09.4	276/07.4
31	047/02.0	102/01.6	080/01.4	060/01.6	035/01.4	104/00.9	123/00.8	013/00.8	174/01.8	164/05.2	155/08.2	156/07.6	152/07.5
MEAN	039/02.8	062/02.7	076/02.6	055/02.4	052/02.3	038/02.3	067/02.5	310/03.1	261/04.3	219/05.7	238/06.5	250/06.8	251/06.9
MX SPD	143/07.9	152/07.4	287/06.7	260/07.9	157/05.5	164/05.5	152/07.8	154/08.8	155/09.6	254/11.9	215/14.1	234/14.9	244/12.5
MN SPD	026/01.2	230/01.0	083/01.0	132/01.0	030/00.9	291/00.9	279/00.7	008/00.8	084/01.0	123/01.2	168/02.1	209/02.3	260/02.6

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Homestake

10M Wind Speed and Direction in m/s for MAY, 2011 PAGE 2

HR END DAY	14	15	16	17	18	19	20	21	22	23	24	MEAN	MX SPD	MN SPD
01	333/05.6	042/05.4	340/05.3	304/07.4	311/04.6	324/04.2	341/03.1	071/01.6	236/02.8	201/01.7	104/01.1	350/03.7	304/07.4	104/01.1
02	356/03.7	010/03.3	339/02.9	315/03.1	353/03.6	357/03.4	020/03.5	038/02.5	360/01.3	067/01.5	088/00.9	021/02.2	356/03.7	088/00.9
03	149/05.4	149/05.8	144/06.3	142/06.7	134/07.2	140/07.2	138/07.2	141/06.8	153/03.2	181/03.1	188/02.9	124/03.5	134/07.2	279/00.7
04	273/06.0	274/08.1	286/09.4	274/08.5	297/07.8	313/07.6	359/04.3	015/03.5	205/01.4	244/01.3	308/02.9	289/04.0	286/09.4	294/00.8
05	177/03.3	264/03.0	327/04.0	260/04.2	272/05.0	302/05.8	013/04.1	026/02.1	298/02.5	313/01.5	040/01.0	307/02.5	302/05.8	277/00.9
06	248/05.3	268/06.1	283/07.4	287/06.8	280/06.9	272/05.5	266/03.9	318/02.2	091/02.4	076/03.1	053/02.3	344/03.3	283/07.4	358/01.0
07	254/06.0	246/07.7	262/07.9	247/08.1	258/05.8	271/05.8	265/03.6	184/01.4	172/01.1	094/01.0	089/01.5	303/03.7	247/08.1	094/01.0
08	243/08.4	247/10.5	252/10.7	236/10.7	247/10.7	248/08.4	243/05.6	239/05.6	234/04.2	220/03.6	226/04.5	253/05.4	252/10.7	021/00.9
09	255/11.5	252/12.9	246/13.0	246/11.3	250/10.5	255/08.4	260/06.6	259/05.3	265/03.0	278/02.8	044/01.8	218/07.8	234/14.9	044/01.8
10	188/08.1	217/08.9	234/08.8	245/09.4	268/09.7	266/06.4	276/07.6	277/07.9	316/04.3	287/02.8	150/01.5	223/04.4	268/09.7	180/00.8
11	281/09.0	318/10.6	287/06.7	296/06.6	324/08.3	314/04.3	324/03.2	321/02.0	321/03.4	309/04.9	294/04.2	285/05.2	318/10.6	170/01.2
12	307/06.0	306/06.2	302/06.8	303/07.0	327/07.0	347/07.3	352/05.0	337/03.3	333/02.2	357/03.2	003/04.2	339/05.0	329/07.6	333/02.2
13	173/04.4	177/04.1	156/04.6	139/04.8	139/05.3	123/05.0	131/04.8	149/05.9	150/06.2	146/07.3	131/09.4	146/03.6	131/09.4	179/00.9
14	126/09.2	151/08.8	154/07.5	228/05.6	247/05.4	264/07.5	268/05.5	260/03.1	084/01.8	264/03.3	277/03.2	172/06.7	158/10.9	084/01.8
15	153/05.2	158/05.8	167/06.1	165/05.8	151/07.1	132/07.1	142/05.4	225/03.9	256/04.1	267/03.4	086/03.0	143/04.5	165/07.3	039/01.3
16	225/07.3	226/06.4	233/08.6	236/08.5	250/08.2	271/08.0	260/06.7	243/05.5	242/04.5	209/03.9	213/04.1	222/04.9	233/08.6	349/01.2
17	264/08.3	267/06.8	254/06.8	260/07.6	257/07.6	260/07.7	266/05.5	278/04.5	268/03.3	276/03.6	270/04.4	255/05.4	264/08.3	259/01.2
18	247/10.8	245/11.1	248/09.7	255/10.8	246/10.9	273/07.6	243/06.7	298/04.9	316/05.1	339/03.8	001/03.1	238/05.9	245/11.1	283/01.4
19	229/06.0	254/07.4	262/07.2	257/08.0	279/07.4	308/04.2	324/03.1	269/04.6	281/02.6	039/01.1	110/01.7	273/04.3	257/08.0	039/01.1
20	277/06.2	284/07.1	280/06.4	274/07.0	331/09.3	322/08.2	264/02.0	044/01.7	070/01.7	065/01.9	040/02.4	326/04.0	331/09.3	270/01.2
21	323/06.7	321/06.3	315/06.2	317/07.4	318/07.0	301/06.3	308/03.1	314/01.5	083/01.6	085/02.2	053/01.4	003/03.9	333/07.4	056/01.2
22	267/02.7	258/03.6	235/05.0	212/08.9	278/09.8	279/02.8	224/03.9	233/02.9	240/01.6	350/02.1	277/02.6	278/02.9	278/09.8	157/00.8
23	220/07.1	241/08.9	245/07.6	248/08.9	246/08.2	259/07.7	264/06.0	254/05.0	078/02.1	103/01.4	201/01.3	216/04.3	241/08.9	091/00.9
24	277/11.8	275/12.2	279/11.8	292/11.7	288/10.9	290/09.3	290/05.4	356/03.8	027/04.1	291/01.5	178/00.9	272/07.1	275/12.2	178/00.9
25	323/05.8	329/07.0	327/07.3	330/07.0	336/05.8	333/04.6	004/03.7	358/02.3	329/01.3	078/01.3	069/01.8	354/03.9	333/08.1	102/01.0
26	238/11.0	249/11.2	258/10.6	255/10.1	251/09.3	251/09.5	266/07.3	263/07.2	255/07.1	246/06.3	262/05.1	265/05.7	249/11.2	026/01.2
27	273/07.7	277/08.4	267/07.9	272/09.2	271/07.9	264/07.9	252/07.6	247/06.5	249/07.6	250/07.2	255/05.1	287/06.2	272/09.2	047/02.5
28	258/11.4	248/11.4	243/12.1	243/12.1	249/11.4	241/10.5	246/08.7	244/05.8	223/04.1	196/02.1	185/03.1	252/07.0	263/12.8	037/01.4
29	232/14.0	235/13.8	227/13.3	226/13.0	232/12.3	232/10.5	222/08.2	213/07.8	199/08.1	203/05.5	187/06.5	206/08.2	232/14.0	111/01.1
30	293/06.6	281/06.8	290/06.6	291/07.0	291/07.0	285/05.8	279/04.6	013/02.6	350/02.2	355/02.4	060/01.3	276/05.7	239/09.9	060/01.3
31	148/08.0	137/08.1	133/09.1	125/09.5	126/10.0	131/09.5	144/07.1	149/08.0	153/05.8	177/03.2	320/02.0	126/05.0	126/10.0	123/00.8
MEAN	249/07.4	256/07.9	260/07.9	258/08.2	271/08.0	279/06.9	276/05.3	282/04.2	262/03.4	262/03.0	101/02.9	267/04.8		
MX SPD	232/14.0	235/13.8	227/13.3	226/13.0	232/12.3	241/10.5	246/08.7	149/08.0	199/08.1	146/07.3	131/09.4		234/14.9	
MN SPD	267/02.7	264/03.0	339/02.9	315/03.1	353/03.6	279/02.8	264/02.0	184/01.4	172/01.1	094/01.0	088/00.9			279/00.7

POSSIBLE NUMBER OF OBSERVATIONS = 744 ACTUAL NUMBER OF OBSERVATIONS = 744 DATA RECOVERY RATE = 100 %

MONTHLY MEAN = 267/04.8 MAXIMUM WIND SPEED WAS 14.9 m/s AT 234 DEGREES ON 5/ 9 AT 1200

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Homestake

10M Wind Speed and Direction in m/s for JUNE, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13
01	023/03.2	083/01.8	178/03.4	174/04.9	194/03.5	214/03.5	174/04.7	167/07.2	174/06.6	158/07.5	154/08.0	162/08.9	192/09.0
02	166/04.8	171/04.1	195/02.7	166/03.3	169/04.4	182/03.2	200/02.8	178/04.1	168/05.5	163/08.1	187/07.9	223/10.5	220/09.3
03	093/02.8	162/01.4	299/01.9	069/01.9	048/01.3	349/00.8	158/00.7	010/00.8	119/01.3	190/06.2	208/07.3	211/08.4	219/08.0
04	311/01.2	107/01.6	064/01.8	043/01.3	356/01.9	065/01.8	186/01.0	084/01.1	041/01.2	154/04.1	185/06.2	204/06.9	187/06.6
05	319/01.9	086/01.8	077/01.1	056/01.4	075/01.3	053/00.9	045/00.8	348/01.0	031/01.3	074/01.9	153/03.6	148/05.3	145/06.1
06	051/02.1	325/01.1	033/01.3	329/01.5	064/01.6	032/01.8	312/00.9	159/03.1	166/05.2	164/06.5	195/08.5	207/09.9	229/10.7
07	081/01.2	231/01.1	143/01.0	090/01.9	077/02.2	021/01.4	293/01.4	001/01.0	061/01.6	038/01.5	242/02.9	240/04.8	239/08.6
08	071/01.5	059/01.3	013/01.0	344/00.7	022/01.2	093/00.8	052/00.9	040/01.0	058/00.9	171/02.3	230/05.6	236/06.9	239/06.8
09	028/03.0	354/03.0	348/01.3	077/01.4	042/01.4	343/00.9	034/00.8	054/01.1	046/01.7	035/02.3	140/01.6	216/02.6	246/03.8
10	066/01.7	065/01.8	051/03.0	030/02.5	019/01.6	053/01.0	014/00.7	020/01.1	024/01.0	012/01.2	253/02.3	288/02.7	029/02.8
11	060/02.5	307/02.9	018/03.0	089/03.1	087/02.5	069/02.0	081/03.4	045/01.3	032/01.3	133/02.2	137/04.4	222/06.1	222/04.7
12	069/01.9	099/01.5	083/01.8	043/04.1	037/02.8	281/01.4	053/01.2	083/01.4	156/02.5	157/05.3	154/06.5	202/05.9	202/07.9
13	059/02.3	064/01.6	030/01.3	050/02.4	040/01.6	260/01.3	052/01.6	064/01.7	065/01.0	138/01.7	242/03.0	225/06.5	239/07.2
14	044/01.7	063/01.8	075/02.6	085/02.8	076/03.7	075/03.2	076/01.9	039/01.5	321/03.6	347/06.4	344/06.5	335/06.8	347/06.2
15	146/01.2	107/01.5	045/01.4	041/01.2	033/01.5	061/01.1	014/00.9	042/01.0	029/01.1	185/01.4	014/02.5	008/03.1	239/03.3
16	155/02.6	253/03.2	243/02.0	072/02.2	079/02.5	357/01.5	064/01.1	297/01.2	241/02.9	251/06.0	248/06.4	261/07.7	247/08.3
17	293/04.1	120/01.6	102/01.6	106/01.6	114/01.6	080/01.6	115/01.1	187/01.3	264/06.4	257/05.6	250/07.4	242/08.2	243/07.3
18	087/02.9	099/02.3	066/01.6	295/01.0	193/00.8	018/00.8	089/00.9	060/01.1	137/01.3	270/05.1	264/05.1	253/08.1	239/09.2
19	182/03.0	177/02.7	195/02.7	208/01.4	171/02.2	167/01.7	238/02.2	242/07.7	237/10.0	233/11.2	238/11.7	238/11.4	235/13.6
20	359/03.3	347/03.0	342/02.7	349/02.7	021/02.2	024/03.1	348/03.7	324/05.8	325/07.3	331/07.0	333/06.3	304/06.3	310/06.8
21	090/01.4	037/01.3	010/01.6	341/01.4	075/02.0	122/00.9	083/00.8	090/00.8	353/04.1	349/05.5	344/04.6	339/04.7	349/05.1
22	025/01.9	323/01.6	162/01.5	161/01.5	162/01.0	072/01.9	186/00.8	044/01.0	027/01.1	358/01.1	357/01.9	278/02.2	353/02.5
23	049/01.1	063/02.7	299/02.0	329/02.9	100/02.5	075/01.8	306/01.0	271/01.3	003/01.3	127/01.6	136/02.2	282/04.3	269/05.4
24	280/06.5	345/02.4	048/02.7	078/01.6	081/03.3	079/03.8	063/02.4	037/01.1	284/02.7	309/04.5	303/03.2	256/04.6	261/07.5
25	341/03.1	009/02.5	087/02.9	092/01.3	091/02.5	074/03.6	089/02.5	047/01.2	352/01.5	264/07.6	259/08.6	270/08.2	268/07.9
26	269/03.5	015/01.3	063/02.0	076/03.1	063/02.0	040/01.6	036/00.9	025/01.3	076/01.3	288/05.1	270/08.5	256/09.5	263/09.2
27	072/02.7	064/03.2	061/02.1	061/02.3	036/01.8	020/01.1	232/00.8	224/00.9	268/01.0	037/01.4	111/02.0	154/03.2	239/04.4
28	229/02.5	174/02.5	176/02.6	060/01.5	055/01.8	154/02.2	175/02.0	173/03.7	151/02.9	164/05.7	158/05.4	159/05.0	167/06.5
29	193/06.4	181/05.2	183/02.3	212/02.0	171/02.5	184/03.4	207/01.7	164/05.2	156/07.8	153/06.6	149/07.8	144/09.2	140/09.7
30	228/01.9	075/01.4	080/01.2	320/01.0	055/01.3	299/01.2	187/01.3	168/05.3	157/06.9	152/07.2	208/06.5	222/06.6	229/08.1
MEAN	056/02.7	070/02.2	066/02.0	058/02.1	074/02.1	056/01.8	083/01.6	058/02.2	056/03.1	173/04.7	216/05.5	235/06.5	239/07.1
MX SPD	280/06.5	181/05.2	178/03.4	174/04.9	169/04.4	079/03.8	174/04.7	242/07.7	237/10.0	233/11.2	238/11.7	238/11.4	235/13.6
MN SPD	049/01.1	325/01.1	143/01.0	344/00.7	193/00.8	349/00.8	158/00.7	010/00.8	058/00.9	358/01.1	140/01.6	278/02.2	353/02.5

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Homestake

10M Wind Speed and Direction in m/s for JUNE, 2011 PAGE 2

HR END DAY	14	15	16	17	18	19	20	21	22	23	24	MEAN	MX SPD	MN SPD
01	224/10.6	227/11.1	233/10.1	226/08.8	212/05.6	212/03.7	226/03.3	210/02.2	187/01.4	197/03.0	199/03.4	192/05.6	227/11.1	187/01.4
02	230/11.0	230/11.0	232/11.9	244/10.0	255/10.6	253/08.7	252/06.2	252/02.8	297/02.9	294/04.4	212/01.6	213/06.3	232/11.9	212/01.6
03	224/08.4	227/08.9	227/07.4	217/07.7	213/06.5	224/06.0	236/03.5	194/01.8	087/02.5	062/03.3	061/03.5	186/04.3	227/08.9	158/00.7
04	182/07.9	200/05.5	210/05.5	225/06.3	257/07.4	245/04.1	127/01.9	096/02.4	058/02.3	054/03.0	041/04.4	131/03.6	182/07.9	186/01.0
05	137/06.6	132/07.0	165/08.0	323/05.9	071/04.6	152/07.5	140/06.3	147/03.7	278/01.7	296/01.4	268/01.6	093/03.4	165/08.0	045/00.8
06	222/10.5	242/11.6	234/11.4	232/11.5	227/11.3	223/08.7	242/07.9	236/04.8	199/01.5	196/00.9	088/01.0	218/05.6	242/11.6	312/00.9
07	230/08.8	246/08.3	251/07.3	260/08.3	268/08.7	269/07.7	269/04.8	275/03.2	257/02.0	242/02.1	297/02.6	266/03.9	230/08.8	143/01.0
08	240/06.9	247/06.7	241/08.1	219/08.1	218/09.1	223/08.4	225/05.0	240/03.9	245/04.4	261/05.3	301/02.5	250/04.1	218/09.1	344/00.7
09	261/05.2	242/06.8	244/08.8	253/08.2	274/07.0	279/05.0	324/03.8	037/01.9	063/01.1	079/01.8	062/01.3	003/03.2	244/08.8	034/00.8
10	057/02.9	039/03.1	357/03.3	340/03.8	184/03.9	157/04.4	160/03.7	186/03.4	278/01.9	239/01.9	042/01.8	028/02.4	157/04.4	014/00.7
11	215/06.1	235/05.8	251/06.1	251/07.7	240/07.0	255/08.2	263/05.4	270/02.9	121/02.1	097/02.2	074/01.7	147/03.9	255/08.2	045/01.3
12	208/08.9	216/11.2	212/09.3	224/08.2	254/06.9	269/06.7	271/05.0	251/01.2	286/01.7	151/01.0	079/02.9	182/04.5	216/11.2	151/01.0
13	236/07.3	240/07.0	239/08.5	247/09.5	249/09.1	258/08.1	256/04.9	271/02.8	243/00.8	134/01.0	001/01.6	259/03.9	247/09.5	243/00.8
14	339/06.0	341/05.9	339/06.0	349/05.9	354/06.8	002/06.3	015/05.2	023/03.9	335/02.0	297/01.9	101/01.2	015/04.2	335/06.8	101/01.2
15	162/02.6	085/02.7	155/02.4	232/03.9	247/06.6	268/05.5	273/04.4	269/02.5	301/01.8	076/02.1	078/01.6	048/02.4	247/06.6	014/00.9
16	250/08.0	255/08.0	256/08.4	252/09.1	250/10.5	251/10.3	249/08.2	255/06.9	250/05.2	257/05.3	280/03.7	255/05.5	250/10.5	064/01.1
17	240/09.1	256/08.9	254/10.1	254/10.3	260/10.1	250/08.8	254/06.2	249/04.1	236/03.7	237/03.6	030/01.9	234/05.3	254/10.3	115/01.1
18	252/08.8	255/09.7	260/09.7	250/10.7	250/10.6	252/09.3	250/08.4	247/05.4	244/04.6	234/03.4	195/03.2	241/05.2	250/10.7	193/00.8
19	237/14.0	243/14.3	239/13.3	254/14.4	255/12.6	261/11.2	255/10.4	313/10.8	319/08.2	282/08.1	300/03.8	238/08.4	254/14.4	208/01.4
20	327/06.8	316/06.6	312/06.0	314/06.1	309/06.8	313/06.2	334/05.8	003/04.9	360/03.3	301/01.7	281/01.7	332/04.8	325/07.3	301/01.7
21	330/05.3	337/05.3	349/05.2	355/05.8	353/05.8	003/06.4	014/04.8	041/03.2	029/04.1	006/03.1	039/01.2	016/03.5	003/06.4	083/00.8
22	352/02.9	026/04.0	010/03.2	033/04.0	058/05.1	051/03.8	037/02.9	019/04.1	006/02.2	347/01.4	088/01.3	028/02.3	058/05.1	186/00.8
23	265/06.4	271/07.8	279/07.3	258/07.8	265/07.6	260/07.5	254/06.6	283/04.3	305/04.2	313/03.9	298/04.5	293/04.1	271/07.8	306/01.0
24	274/07.9	281/08.8	278/08.8	282/07.6	279/07.6	287/07.9	268/05.5	254/03.7	284/04.0	316/02.7	308/02.8	303/04.7	281/08.8	037/01.1
25	259/08.7	276/07.6	265/07.1	272/08.7	262/08.4	264/07.2	265/05.7	265/05.0	265/05.1	264/04.9	263/03.9	286/05.2	259/08.7	047/01.2
26	267/08.8	260/10.1	261/10.4	262/09.9	258/09.2	266/08.2	273/05.4	275/03.6	308/03.1	057/02.0	064/02.4	312/05.1	261/10.4	036/00.9
27	262/05.8	263/05.9	258/06.0	257/05.4	193/07.2	198/09.0	187/03.7	235/01.4	202/01.2	127/03.7	169/02.3	196/03.3	198/09.0	232/00.8
28	161/11.6	146/14.4	150/11.6	160/08.7	205/08.7	187/07.2	206/04.5	211/06.4	226/03.5	208/04.7	205/07.1	174/05.5	146/14.4	060/01.5
29	159/06.7	163/07.2	166/05.8	260/05.1	052/03.6	081/02.2	322/03.2	161/02.5	250/04.3	294/02.0	065/03.5	171/04.8	140/09.7	207/01.7
30	242/08.4	227/07.7	242/08.5	254/09.3	261/08.0	274/07.8	278/05.5	283/02.8	324/01.1	043/02.0	012/03.9	245/04.8	254/09.3	320/01.0
MEAN	239/07.6	247/08.0	248/07.9	259/07.9	253/07.8	253/07.1	259/05.3	256/03.8	280/02.9	278/02.9	025/02.7	254/04.5		
MX SPD	237/14.0	146/14.4	239/13.3	254/14.4	255/12.6	261/11.2	255/10.4	313/10.8	319/08.2	282/08.1	205/07.1		254/14.4	
MN SPD	162/02.6	085/02.7	155/02.4	340/03.8	052/03.6	081/02.2	127/01.9	251/01.2	243/00.8	196/00.9	088/01.0			158/00.7

POSSIBLE NUMBER OF OBSERVATIONS = 720 ACTUAL NUMBER OF OBSERVATIONS = 720 DATA RECOVERY RATE = 100 %

MONTHLY MEAN = 254/04.5 MAXIMUM WIND SPEED WAS 14.4 m/s AT 254 DEGREES ON 6/19 AT 1700

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Appendix B.2
Joint Frequency of Occurrence Distributions of Wind Speeds and Directions

Homestake

10M Joint Frequency Distribution April, 2011

PERCENTAGE FREQUENCY OF OCCURRENCE OF HOURLY WIND VELOCITIES FOR ALL STABILITIES

WIND SPEED (m/s)

WIND DIRECTION	0.5-3	3.1-6	6.1-10	10.1-16	16.1-21	OVER 21	TOTAL	AVG SPEED
N	2.8	2.8	1.0	.0	.0	.0	6.5	3.8
NNE	1.8	1.8	.1	.0	.0	.0	3.8	3.2
NE	2.9	.1	.0	.0	.0	.0	3.1	1.6
ENE	2.9	.1	.0	.0	.0	.0	3.1	1.7
E	2.2	.0	.0	.0	.0	.0	2.2	1.6
ESE	1.4	.0	.0	.0	.0	.0	1.4	1.4
SE	.7	.3	.0	.0	.0	.0	1.0	2.8
SSE	1.1	3.3	.4	.0	.0	.0	4.9	4.1
S	1.1	1.9	1.3	.4	.0	.0	4.7	5.3
SSW	1.0	.6	.4	1.0	.0	.0	2.9	6.8
SW	1.4	1.8	1.1	.1	.0	.0	4.5	4.6
WSW	.4	4.2	8.1	3.9	.0	.0	16.6	8.0
W	2.4	5.8	7.4	3.6	.0	.0	19.2	7.0
WNW	1.7	1.9	3.1	1.8	.0	.0	8.5	6.9
NW	2.2	1.7	1.9	1.8	.0	.0	7.7	6.3
NNW	2.2	3.6	3.6	.4	.0	.0	9.9	5.3
CALM							.1	
TOTAL	28.3	30.1	28.4	13.1	.0	.0	100.0	5.7

TOTAL NUMBER OF OBSERVATIONS 718
POSSIBLE NUMBER OF OBSERVATIONS 720
DATA RECOVERY 99.7%

Homestake

10M Joint Frequency Distribution May, 2011

PERCENTAGE FREQUENCY OF OCCURRENCE OF HOURLY WIND VELOCITIES FOR ALL STABILITIES

WIND SPEED (m/s)

WIND DIRECTION	0.5-3	3.1-6	6.1-10	10.1-16	16.1-21	OVER 21	TOTAL	AVG SPEED
N	2.6	2.7	.0	.0	.0	.0	5.2	2.8
NNE	2.6	.8	.0	.0	.0	.0	3.4	2.1
NE	5.1	.8	.0	.0	.0	.0	5.9	1.9
ENE	4.4	.7	.0	.0	.0	.0	5.1	2.0
E	4.3	.3	.0	.0	.0	.0	4.6	1.7
ESE	1.7	.3	.0	.0	.0	.0	2.0	1.7
SE	.7	.7	2.6	.0	.0	.0	3.9	6.5
SSE	1.2	3.1	2.6	.3	.0	.0	7.1	5.6
S	1.6	2.2	.5	.0	.0	.0	4.3	3.5
SSW	1.7	1.6	1.3	.3	.0	.0	5.0	4.7
SW	1.6	2.2	2.2	1.6	.0	.0	7.5	6.6
WSW	.5	2.7	5.1	3.4	.0	.0	11.7	8.0
W	2.7	4.8	7.3	.9	.0	.0	15.7	6.0
WNW	1.6	.9	2.7	.4	.0	.0	5.6	5.5
NW	2.3	2.3	2.4	.1	.0	.0	7.1	4.4
NNW	1.5	2.4	1.9	.0	.0	.0	5.8	4.6
CALM							.0	
TOTAL	36.2	28.4	28.5	7.0	.0	.0	100.0	4.8

TOTAL NUMBER OF OBSERVATIONS 744
POSSIBLE NUMBER OF OBSERVATIONS 744
DATA RECOVERY 100.0%

Homestake

10M Joint Frequency Distribution June, 2011

PERCENTAGE FREQUENCY OF OCCURRENCE OF HOURLY WIND VELOCITIES FOR ALL STABILITIES

WIND SPEED (m/s)

WIND DIRECTION	0.5-3	3.1-6	6.1-10	10.1-16	16.1-21	OVER 21	TOTAL	AVG SPEED
N	2.2	1.8	.4	.0	.0	.0	4.4	3.3
NNE	3.9	1.5	.0	.0	.0	.0	5.4	2.2
NE	6.1	1.0	.0	.0	.0	.0	7.1	1.8
ENE	7.5	1.4	.0	.0	.0	.0	8.9	2.1
E	5.0	.6	.0	.0	.0	.0	5.6	2.0
ESE	1.5	.0	.0	.0	.0	.0	1.5	1.5
SE	1.4	.3	.8	.1	.0	.0	2.6	4.4
SSE	2.1	2.6	2.5	.3	.0	.0	7.5	5.1
S	2.1	1.8	1.0	.0	.0	.0	4.9	3.7
SSW	1.8	1.7	2.4	.0	.0	.0	5.8	5.0
SW	1.0	1.4	3.1	2.1	.0	.0	7.5	7.3
WSW	1.5	3.3	7.9	2.4	.0	.0	15.1	7.1
W	1.7	3.6	5.0	.6	.0	.0	10.8	6.1
WNW	2.5	1.2	.4	.0	.0	.0	4.2	3.2
NW	1.5	1.2	1.2	.1	.0	.0	4.2	4.2
NNW	1.8	1.4	1.2	.0	.0	.0	4.4	4.0
CALM							.0	
TOTAL	43.6	24.9	26.0	5.6	.0	.0	100.0	4.5

TOTAL NUMBER OF OBSERVATIONS 720
POSSIBLE NUMBER OF OBSERVATIONS 720
DATA RECOVERY 100.0%

Homestake

10M Unit-Vector Wind Direction and Scalar Speed April - June 2011

PERCENTAGE FREQUENCY OF OCCURRENCE OF HOURLY WIND VELOCITIES FOR ALL STABILITIES

WIND SPEED (m/s)

WIND DIRECTION	0.5-3	3.1-6	6.1-10	10.1-16	16.1-21	OVER 21	TOTAL	AVG SPEED
N	2.5	2.4	.5	.0	.0	.0	5.4	3.3
NNE	2.7	1.4	.0	.0	.0	.0	4.2	2.5
NE	4.7	.6	.0	.0	.0	.0	5.4	1.8
ENE	4.9	.7	.0	.0	.0	.0	5.7	2.0
E	3.8	.3	.0	.0	.0	.0	4.1	1.8
ESE	1.6	.1	.0	.0	.0	.0	1.6	1.6
SE	.9	.4	1.1	.0	.0	.0	2.5	5.3
SSE	1.5	3.0	1.8	.2	.0	.0	6.5	5.0
S	1.6	2.0	.9	.1	.0	.0	4.6	4.2
SSW	1.5	1.3	1.4	.4	.0	.0	4.6	5.2
SW	1.3	1.8	2.1	1.3	.0	.0	6.5	6.4
WSW	.8	3.4	7.0	3.2	.0	.0	14.4	7.7
W	2.2	4.8	6.6	1.7	.0	.0	15.3	6.4
WNW	1.9	1.4	2.1	.7	.0	.0	6.1	5.6
NW	2.0	1.7	1.9	.7	.0	.0	6.3	5.1
NNW	1.8	2.5	2.2	.1	.0	.0	6.7	4.8
CALM							.0	
TOTAL	36.0	27.8	27.6	8.5	.0	.0	100.0	5.0

TOTAL NUMBER OF OBSERVATIONS 2182
POSSIBLE NUMBER OF OBSERVATIONS 2184
DATA RECOVERY 99.9%

Appendix C
Hourly Temperature Data for April through June 2011

Homestake

10M TEMPERATURE in Deg C for APRIL, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MN	MAX	MIN
01	10.3	10.1	9.4	8.7	5.5	4.8	3.3	6.5	11.4	15.4	18.1	19.7	20.8	21.8	22.6	23.2	23.0	22.4	20.0	15.9	15.0	10.9	8.7	6.6	13.9	23.2	3.3
02	4.2	3.4	1.2	.3	-.9	-1.3	-1.4	3.9	9.3	14.8	21.0	22.3	22.9	23.0	22.9	23.1	22.4	21.6	20.2	18.6	17.1	15.8	15.6	15.4	13.1	23.1	-1.4
03	15.9	13.9	13.7	13.0	12.6	12.7	12.6	13.5	14.8	15.6	16.1	16.7	17.1	17.7	18.2	18.1	17.1	15.9	14.5	7.0	3.9	3.1	2.8	2.0	12.9	18.2	2.0
04	-.1	-1.7	-2.4	-3.1	-4.9	-5.4	-3.7	-1.7	.1	2.1	4.0	5.4	7.2	8.8	11.0	12.1	12.3	12.3	11.4	9.4	7.6	6.1	4.6	1.4	3.9	12.3	-5.4
05	-.6	-.8	-2.5	-3.0	-3.8	-4.7	-3.8	.6	6.4	11.2	14.5	17.8	20.3	22.2	22.8	23.1	22.2	21.5	20.0	17.9	17.1	16.2	15.4	14.2	11.0	23.1	-4.7
06	12.9	12.6	12.3	11.3	10.4	9.7	10.0	12.2	13.0	13.4	14.4	14.6	16.1	17.3	17.8	14.8	11.9	9.7	10.0	9.4	8.2	8.5	9.3	8.5	12.0	17.8	8.2
07	8.0	7.7	7.0	5.5	4.9	4.3	5.3	7.2	7.3	8.5	9.9	11.4	12.5	13.8	14.5	14.7	14.9	14.7	13.4	11.1	10.6	10.0	9.6	8.9	9.8	14.9	4.3
08	8.6	8.2	7.3	6.5	6.6	6.7	7.5	8.8	10.3	11.8	13.7	15.3	16.6	17.3	17.8	17.2	16.8	16.0	14.8	13.6	12.3	11.1	9.6	8.5	11.8	17.8	6.5
09	8.6	9.1	7.0	7.3	8.2	7.6	7.8	9.3	10.7	11.9	12.3	13.0	13.0	12.5	9.4	7.1	5.4	3.2	1.0	-.5	-1.3	-1.6	-1.7	-1.7	6.6	13.0	-1.7
10	-1.3	-1.9	-2.8	-3.3	-3.9	-4.6	-3.5	-2.2	-.5	1.1	2.4	3.7	4.3	5.5	5.6	4.8	6.6	6.8	5.7	4.2	2.9	2.0	.5	-.8	1.3	6.8	-4.6
11	-1.8	-3.7	-3.6	-4.3	-6.2	-6.1	-5.5	-1.5	3.5	6.5	8.8	11.3	12.5	13.0	14.0	15.1	15.9	15.5	14.0	11.8	10.9	11.2	8.6	8.4	6.2	15.9	-6.2
12	8.9	8.1	7.5	7.5	6.9	6.4	6.4	8.0	10.0	12.5	13.8	15.1	16.5	18.0	19.7	19.9	19.5	18.6	16.5	14.0	12.7	10.0	9.0	8.4	12.2	19.9	6.4
13	9.2	7.5	5.1	3.9	2.4	.0	.7	6.3	10.0	12.4	14.0	15.1	16.0	16.9	17.5	17.9	17.5	16.5	14.7	13.0	11.9	10.5	9.6	9.1	10.7	17.9	.0
14	8.5	7.2	6.3	5.7	4.0	3.4	3.0	4.2	5.2	6.2	7.4	8.9	9.8	11.1	11.7	12.2	12.0	11.2	9.6	8.2	6.9	6.5	5.2	3.8	7.4	12.2	3.0
15	1.2	1.4	.2	.1	.9	.9	1.7	3.8	5.3	7.1	8.9	10.6	12.1	13.2	14.2	15.0	15.4	15.2	13.2	9.9	8.3	7.8	7.5	2.6	7.4	15.4	.1
16	1.7	-.4	-1.7	-2.1	-2.7	-4.0	-2.6	2.7	7.9	12.7	14.8	16.5	18.1	19.7	20.1	20.5	20.4	20.1	18.8	15.1	13.2	11.2	7.8	6.4	9.8	20.5	-4.0
17	4.5	3.6	2.8	1.5	-.5	-.5	1.5	6.1	11.5	16.8	18.8	19.6	20.4	21.1	21.4	21.7	21.8	21.7	20.4	18.8	17.7	17.2	16.4	15.5	13.3	21.8	-.5
18	15.0	14.5	13.9	13.2	13.0	12.2	13.3	15.1	15.4	16.9	18.2	19.5	20.5	21.2	21.8	21.7	21.2	19.7	18.6	17.4	16.3	15.8	14.8	13.8	16.8	21.8	12.2
19	13.2	12.4	11.8	11.4	10.6	10.1	10.0	9.0	11.6								19.9	19.6	18.5	16.7	14.9	15.0	14.6	14.3			
20	13.0	11.8	10.1	10.2	6.7	4.8	6.1	11.8	13.5	15.1	16.8	18.2	19.7	20.8	21.3	21.7	22.0	21.2	20.0	18.0	16.9	16.4	15.8	15.2	15.3	22.0	4.8
21	14.3	13.2	13.0	12.5	12.0	11.2	12.0	13.5	14.6	15.7	17.1	17.9	19.1	19.9	20.1	20.3	20.2	19.3	18.2	16.5	15.2	14.2	13.5	13.2	15.7	20.3	11.2
22	12.7	11.9	11.3	10.8	10.7	9.2	10.1	11.2	12.6	14.0	15.3	16.5	17.8	18.6	19.3	19.7	19.9	19.6	18.6	16.9	15.5	14.6	13.3	12.8	14.7	19.9	9.2
23	12.6	11.9	11.7	11.8	11.4	10.9	11.6	12.9	14.1	15.4	16.1	16.0	16.5	16.9	17.2	17.2	17.2	16.9	15.6	14.3	13.3	12.3	11.4	10.7	14.0	17.2	10.7
24	10.5	10.4	8.3	6.2	6.4	6.3	7.7	10.6	11.8	11.8	12.7	13.7	14.3	15.2	14.7	15.4	15.0	14.9	13.9	12.8	11.9	11.1	10.6	8.3	11.4	15.4	6.2
25	5.8	4.8	4.2	3.8	3.7	4.8	5.6	7.5	8.5	9.5	10.6	11.9	13.3	14.6	15.8	16.5	16.4	16.1	15.2	14.0	13.3	13.6	12.5	11.6	10.6	16.5	3.7
26	10.7	9.7	9.1	8.7	8.3	8.2	5.7	7.8	9.8	11.1	10.2	8.3	9.8	9.8	11.0	11.3	10.5	11.5	10.0	8.2	5.5	4.2	3.2	2.0	8.5	11.5	2.0
27	1.2	.3	-.8	-1.3	-2.3	-2.4	-1.1	.9	2.5	4.2	5.8	7.1	8.7	10.2	11.6	13.0	13.6	13.4	11.7	9.5	6.8	4.9	4.6	1.3	5.1	13.6	-2.4
28	.0	-1.6	-2.9	-3.9	-5.1	-4.8	-2.4	2.7	6.4	10.6	13.6	15.6	17.6	19.9	21.1	21.6	21.8	21.7	20.2	18.2	17.3	16.6	15.5	15.0	10.6	21.8	-5.1
29	14.7	14.2	13.9	13.5	12.7	12.8	13.3	14.4	15.6	17.7	18.9	19.9	20.7	21.0	21.2	21.1	20.8	20.0	18.5	16.8	15.6	14.5	13.1	11.6	16.5	21.2	11.6
30	7.5	3.9	2.3	.4	-.7	-1.7	-.2	1.4	3.1	5.3	7.7	10.1	11.8	12.5	13.5	13.2	12.7	10.2	7.9	5.9	4.5	3.4	1.9	1.1	5.7	13.5	-1.7
MEAN	7.7	6.7	5.8	5.1	4.2	3.7	4.4	6.9	9.2	11.3	12.9	14.2	15.4	16.3	16.9	17.0	16.9	16.2	14.8	12.8	11.4	10.4	9.4	8.3	10.7		
MAX	15.9	14.5	13.9	13.5	13.0	12.8	13.3	15.1	15.6	17.7	21.0	22.3	22.9	23.0	22.9	23.2	23.0	22.4	20.4	18.8	17.7	17.2	16.4	15.5		23.2	
MIN	-1.8	-3.7	-3.6	-4.3	-6.2	-6.1	-5.5	-2.2	-.5	1.1	2.4	3.7	4.3	5.5	5.6	4.8	5.4	3.2	1.0	-.5	-1.3	-1.6	-1.7	-1.7			-6.2

POSSIBLE NUMBER OF OBSERVATIONS = 720 ACTUAL NUMBER OF OBSERVATIONS = 713 DATA RECOVERY RATE = 99 %

MONTHLY MEAN = 10.7 Deg C

MAXIMUM 10M TEMPERATURE WAS 23.2 Deg C ON 4/ 1 AT 1600 MAXIMUM DAILY MEAN WAS 16.8 Deg C ON 4/18

MINIMUM 10M TEMPERATURE WAS -6.2 Deg C ON 4/11 AT 500 MINIMUM DAILY MEAN WAS 1.3 Deg C ON 4/10

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Homestake

10M TEMPERATURE in Deg C for MAY, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MN	MAX	MIN
01	.7	.2	-.1	-.7	-1.5	-1.6	.5	1.4	2.8	4.0	4.3	5.4	5.2	5.9	5.4	6.4	5.5	5.3	5.4	4.3	2.8	.6	-.1	-1.3	2.5	6.4	-1.6
02	-1.8	-3.2	-3.8	-4.9	-5.8	-4.7	-2.6	.0	2.8	3.2	4.3	6.4	8.0	8.9	9.7	10.4	11.1	10.8	10.2	7.8	5.3	4.0	2.2	-.7	3.2	11.1	-5.8
03	-1.9	-2.1	-4.0	-4.7	-6.1	-6.4	-3.3	1.5	5.9	10.3	12.7	14.1	15.1	16.4	17.3	18.0	18.2	17.9	16.5	14.7	13.8	12.6	12.5	10.3	8.3	18.2	-6.4
04	10.4	8.6	7.5	6.6	4.8	.4	3.8	9.6	15.1	16.9	18.8	20.0	20.8	21.7	22.1	22.2	22.1	21.6	20.4	17.1	14.7	12.5	12.3	11.3	14.2	22.2	.4
05	9.5	7.8	5.5	4.2	1.9	2.8	4.3	9.7	14.1	16.9	18.7	20.0	21.0	21.9	23.2	23.4	23.5	23.1	21.7	18.6	16.2	13.0	11.0	8.5	14.2	23.5	1.9
06	6.1	4.3	2.7	2.2	1.8	.7	3.7	8.2	13.3	19.0	21.7	22.6	22.9	23.6	24.1	24.3	24.0	23.5	22.2	19.3	16.1	13.3	10.9	11.4	14.2	24.3	.7
07	11.1	12.8	13.9	11.2	10.7	7.6	10.6	15.7	18.9	20.8	22.1	22.7	23.6	24.4	24.8	24.8	24.8	24.5	23.3	20.3	16.8	16.0	14.7	12.9	17.9	24.8	7.6
08	11.7	10.4	7.1	5.8	4.8	2.5	6.3	10.9	15.6	18.3	19.8	20.8	21.5	22.4	22.8	23.1	23.1	22.2	20.8	18.7	17.1	15.5	14.5	14.6	15.4	23.1	2.5
09	14.6	13.4	13.2	12.9	12.4	10.1	11.4	12.9	14.6	16.9	18.5	19.1	19.4	19.4	19.1	18.2	17.5	16.5	15.0	13.3	12.0	10.6	9.5	7.8	14.5	19.4	7.8
10	6.5	5.4	3.1	2.1	1.5	1.0	3.3	7.3	10.2	11.1	13.2	14.4	15.7	16.9	17.6	16.7	14.5	12.0	9.9	8.1	5.2	3.6	2.9	2.4	8.5	17.6	1.0
11	2.8	2.4	2.2	2.1	1.9	2.9	3.6	4.6	5.8	7.0	7.9	9.4	9.9	11.2	8.4	9.6	10.4	7.5	9.1	8.7	8.4	8.1	7.7	6.5	6.6	11.2	1.9
12	5.3	4.7	4.1	4.1	3.0	2.1	4.8	7.6	9.9	11.9	13.1	14.3	15.7	16.9	17.8	18.4	18.8	18.6	17.5	15.5	13.1	11.1	10.7	9.0	11.2	18.8	2.1
13	6.8	6.9	4.4	2.8	1.7	1.1	4.8	8.6	12.5	14.8	16.6	17.9	19.4	20.4	21.4	22.1	22.6	22.6	21.7	19.5	18.5	17.6	17.3	16.2	14.1	22.6	1.1
14	15.5	15.1	13.8	14.3	13.5	12.9	13.7	14.8	16.0	16.7	17.7	19.6	20.4	21.0	22.4	23.0	23.7	23.6	22.2	19.6	17.3	16.0	16.8	15.2	17.7	23.7	12.9
15	11.7	10.3	9.6	7.8	6.5	6.2	8.7	12.3	14.2	15.8	17.1	18.1	19.7	21.2	22.0	23.0	23.2	22.6	21.5	20.0	18.8	17.4	15.4	10.7	15.6	23.2	6.2
16	8.8	8.4	6.1	5.1	5.9	4.9	7.4	11.6	14.6	17.2	19.3	20.5	21.4	22.2	23.0	23.7	23.8	23.1	20.8	18.4	16.3	14.9	12.5	12.5	15.1	23.8	4.9
17	11.3	10.9	9.7	7.1	7.6	9.3	9.9	10.7	12.2	12.7	13.4	14.6	15.3	16.1	16.7	17.1	17.2	16.6	15.6	14.0	12.6	11.6	10.8	9.5	12.6	17.2	7.1
18	8.5	7.9	7.3	7.3	6.9	6.4	8.2	8.8	10.4	12.4	13.4	14.5	15.1	14.8	13.3	13.4	11.2	10.6	8.9	8.3	6.2	4.9	3.2	2.9	9.4	15.1	2.9
19	2.7	2.4	1.7	.9	1.4	1.9	1.6	2.9	3.8	4.7	5.2	5.8	6.4	7.8	8.3	6.8	8.3	6.6	5.7	4.8	4.6	4.5	4.4	2.7	4.4	8.3	.9
20	2.1	2.3	2.6	3.0	3.3	2.9	3.8	5.6	6.9	7.9	9.5	10.9	12.1	13.2	13.7	14.4	14.7	12.1	9.1	7.9	7.1	5.9	5.3	5.5	7.6	14.7	2.1
21	5.8	4.1	4.2	3.0	1.9	2.1	5.2	8.8	11.5	13.2	14.3	15.2	16.3	17.0	18.0	18.3	18.2	17.8	17.4	15.1	13.3	11.5	8.3	7.0	11.1	18.3	1.9
22	7.3	5.1	2.6	3.4	2.3	2.4	6.1	10.5	15.5	18.8	20.1	20.7	22.0	21.5	22.5	22.3	20.3	19.3	19.3	18.2	16.9	13.9	12.3	13.2	14.0	22.5	2.3
23	13.2	12.1	8.6	6.4	5.3	3.9	6.8	12.1	15.4	17.4	18.2	19.3	20.2	21.1	22.1	22.2	22.1	21.3	20.2	18.2	16.7	14.3	14.0	13.3	15.2	22.2	3.9
24	11.6	9.7	9.3	9.0	8.4	8.7	9.4	10.8	11.8	12.7	14.2	14.8	15.9	16.1	16.4	17.0	17.2	17.4	16.6	15.5	13.5	11.4	9.6	8.2	12.7	17.4	8.2
25	7.9	4.5	2.8	2.6	4.3	3.0	7.2	11.4	13.4	14.9	16.2	17.5	18.8	20.0	21.2	21.9	22.2	22.1	21.7	19.2	15.8	14.7	12.1	8.9	13.5	22.2	2.6
26	7.7	6.5	6.3	3.5	3.3	2.6	6.5	10.3	14.5	19.3	21.8	23.3	24.4	25.2	25.2	24.8	24.9	24.4	23.4	21.8	20.5	19.3	18.0	17.4	16.5	25.2	2.6
27	17.1	15.5	16.0	13.9	13.1	12.5	14.6	16.5	19.2	20.7	22.4	24.2	25.5	26.4	27.2	27.3	27.4	27.2	26.6	24.8	22.7	21.5	20.2	18.7	20.9	27.4	12.5
28	17.9	17.4	16.6	15.4	15.9	15.3	17.3	19.4	21.5	22.8	23.7	24.9	25.9	26.5	27.0	27.0	26.7	26.3	25.1	23.2	21.0	19.5	18.6	18.2	21.4	27.0	15.3
29	17.4	16.6	15.4	15.5	15.0	15.9	16.5	17.7	19.4	21.7	23.0	24.2	25.2	25.7	26.1	26.2	25.7	25.0	23.5	21.9	20.7	20.0	18.9	18.2	20.6	26.2	15.0
30	16.6	15.5	13.5	11.4	9.7	9.1	10.2	10.7	12.2	13.3	14.3	14.9	15.3	16.1	16.9	17.6	17.8	17.5	16.9	14.8	12.3	11.8	9.1	6.1	13.5	17.8	6.1
31	4.6	1.7	.8	.3	-.7	-1.6	3.4	7.8	12.8	17.0	18.8	19.9	21.5	23.4	25.0	25.9	26.1	25.6	24.5	23.7	22.5	21.0	19.2	16.8	15.0	26.1	-1.6
MEAN	8.7	7.7	6.5	5.6	5.0	4.4	6.7	9.7	12.5	14.5	15.9	17.1	18.0	18.9	19.4	19.7	19.6	18.9	17.8	16.0	14.1	12.7	11.4	10.1	13.0		
MAX	17.9	17.4	16.6	15.5	15.9	15.9	17.3	19.4	21.5	22.8	23.7	24.9	25.9	26.5	27.2	27.3	27.4	27.2	26.6	24.8	22.7	21.5	20.2	18.7		27.4	
MIN	-1.9	-3.2	-4.0	-4.9	-6.1	-6.4	-3.3	.0	2.8	3.2	4.3	5.4	5.2	5.9	5.4	6.4	5.5	5.3	5.4	4.3	2.8	.6	-.1	-1.3			-6.4

POSSIBLE NUMBER OF OBSERVATIONS = 744 ACTUAL NUMBER OF OBSERVATIONS = 744 DATA RECOVERY RATE = 100 %

MONTHLY MEAN = 13.0 Deg C

MAXIMUM 10M TEMPERATURE WAS 27.4 Deg C ON 5/27 AT 1700

MAXIMUM DAILY MEAN WAS 21.4 Deg C ON 5/28

MINIMUM 10M TEMPERATURE WAS -6.4 Deg C ON 5/ 3 AT 600

MINIMUM DAILY MEAN WAS 2.5 Deg C ON 5/ 1

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Homestake

10M TEMPERATURE in Deg C for JUNE, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MN	MAX	MIN
01	16.2	15.2	17.4	17.7	17.6	16.0	18.8	20.9	21.3	23.4	26.4	28.6	30.1	30.3	29.4	28.5	27.3	26.1	24.9	22.6	20.9	19.8	20.7	19.8	22.5	30.3	15.2
02	18.9	17.6	17.6	17.6	16.8	16.0	17.5	19.6	21.4	23.0	25.0	25.8	26.7	27.7	27.8	27.7	27.3	26.3	25.0	23.2	20.9	19.4	18.3	15.8	21.8	27.8	15.8
03	12.9	10.6	10.9	8.9	8.0	6.0	7.7	11.5	16.7	21.7	23.7	25.2	26.2	26.7	26.9	26.6	26.2	25.5	24.3	22.0	19.5	18.8	14.6	14.2	18.1	26.9	6.0
04	11.2	9.7	8.9	7.7	5.5	5.5	8.3	13.4	18.2	23.0	25.5	26.8	27.7	28.2	28.6	29.4	29.0	27.0	25.2	23.2	20.7	18.2	16.9	15.1	18.9	29.4	5.5
05	13.1	11.7	9.3	8.5	6.6	7.2	9.6	14.0	18.6	22.5	25.5	27.0	27.5	27.4	26.9	25.7	23.8	23.1	21.7	20.3	19.9	18.5	16.2	14.8	18.3	27.5	6.6
06	13.7	11.9	10.4	9.0	9.1	10.6	12.2	18.1	21.2	24.4	26.8	28.2	28.2	28.6	28.3	28.2	27.9	27.3	26.0	24.4	22.0	19.6	18.7	17.6	20.5	28.6	9.0
07	13.9	10.1	9.4	8.0	7.1	6.9	8.1	14.4	18.0	20.1	22.1	23.7	25.4	26.5	27.0	27.4	27.5	27.0	25.9	23.6	21.9	20.4	19.7	17.9	18.8	27.5	6.9
08	11.4	9.5	8.9	5.9	6.1	4.1	7.2	12.1	17.2	21.1	23.7	24.9	25.9	27.2	27.6	27.1	27.0	26.2	24.9	22.8	20.0	18.8	18.2	15.6	18.1	27.6	4.1
09	15.3	13.9	10.7	6.8	5.9	5.2	9.6	13.9	17.0	18.3	20.5	22.2	24.1	25.2	26.0	26.2	25.8	25.2	24.1	21.6	19.1	16.9	14.9	10.8	17.5	26.2	5.2
10	9.0	8.5	7.6	7.2	6.8	5.8	10.3	13.7	18.1	21.9	23.8	24.9	25.3	26.3	26.8	27.2	27.5	27.4	26.5	24.1	21.7	19.8	18.5	17.1	18.6	27.5	5.8
11	15.6	17.7	15.8	11.4	10.5	10.4	15.5	19.9	21.1	22.1	23.1	24.3	25.5	26.4	26.9	27.4	27.3	27.0	26.1	23.6	20.7	18.1	16.4	13.7	20.3	27.4	10.4
12	12.2	9.9	7.9	8.7	9.0	6.6	10.3	15.1	20.1	22.4	24.2	26.2	27.9	28.7	29.3	29.2	28.9	28.1	27.0	24.7	21.8	19.9	17.8	17.0	19.7	29.3	6.6
13	15.0	11.0	9.4	7.8	6.7	6.0	8.7	14.1	20.0	22.8	24.1	25.4	26.4	27.1	27.6	28.0	27.9	27.2	26.1	24.2	21.8	18.5	16.2	16.6	19.1	28.0	6.0
14	16.0	14.2	12.8	10.6	10.6	11.3	15.4	19.0	21.1	22.5	23.3	23.9	24.5	25.3	26.1	26.6	26.9	26.5	25.9	24.0	21.1	19.6	18.6	14.8	20.0	26.9	10.6
15	13.5	11.5	10.4	9.4	8.5	7.7	11.1	16.1	20.9	24.9	26.3	27.2	28.2	29.2	30.3	31.0	30.9	30.8	29.7	27.5	24.6	23.6	22.7	21.7	21.6	31.0	7.7
16	21.9	21.5	20.4	17.8	14.7	16.7	19.0	22.2	23.4	24.6	25.7	26.8	27.4	28.2	29.0	29.3	29.4	28.9	27.8	25.9	24.0	22.5	21.3	19.9	23.7	29.4	14.7
17	19.2	17.3	15.6	13.7	13.5	13.7	17.2	20.3	21.5	22.7	24.1	25.3	26.6	27.6	28.1	28.4	28.1	27.4	26.4	24.6	22.3	18.7	17.0	16.0	21.5	28.4	13.5
18	12.9	11.9	10.9	9.5	7.3	6.8	10.7	15.9	21.4	22.6	23.5	24.8	25.9	26.8	27.5	27.8	27.8	27.3	26.6	25.0	23.0	21.3	19.9	18.3	19.8	27.8	6.8
19	17.6	17.5	16.0	13.9	15.2	14.5	17.9	20.2	21.9	23.4	24.6	26.0	27.0	27.4	27.6	27.6	26.7	25.7	24.2	22.4	17.7	15.1	11.8	12.0	20.6	27.6	11.8
20	10.9	9.6	9.0	8.5	7.3	8.7	10.3	12.9	14.4	15.7	17.3	19.2	20.6	21.6	22.8	23.4	23.8	23.8	23.2	21.4	19.0	17.0	14.6	13.3	16.2	23.8	7.3
21	12.2	12.3	12.5	10.2	8.6	8.1	11.8	16.2	18.9	19.8	20.9	22.4	23.3	25.1	26.1	26.7	27.0	27.1	26.5	24.7	22.4	21.6	19.2	16.2	19.2	27.1	8.1
22	14.4	12.8	11.1	10.0	9.4	8.5	13.0	16.6	20.6	24.8	26.2	27.7	28.8	29.8	30.5	31.1	31.0	30.6	30.1	28.3	23.8	21.4	19.8	17.7	21.6	31.1	8.5
23	15.7	14.3	14.3	12.4	11.5	11.8	13.8	18.3	23.3	27.7	30.5	31.2	31.5	32.1	32.1	32.6	32.5	32.0	30.9	29.1	25.5	22.1	22.9	22.7	23.8	32.6	11.5
24	22.8	20.9	20.2	16.1	15.6	15.5	19.3	22.9	25.6	26.9	27.7	29.3	30.1	31.1	31.8	31.8	31.8	31.6	30.8	28.5	26.2	24.8	23.6	22.6	25.3	31.8	15.5
25	21.7	20.6	18.7	18.8	16.1	14.5	18.9	23.2	25.6	27.3	27.9	28.9	29.6	30.3	30.8	31.2	31.3	30.8	29.8	28.0	26.2	24.4	23.0	21.8	25.0	31.3	14.5
26	20.9	19.0	18.2	16.3	13.4	13.7	17.5	22.2	25.2	27.4	28.5	29.3	30.2	30.8	31.5	31.6	31.5	30.9	30.2	28.1	25.7	22.1	21.1	20.2	24.4	31.6	13.4
27	19.2	18.6	15.6	15.5	14.2	14.0	15.9	20.6	24.9	27.4	28.8	29.8	31.2	31.5	31.5	32.5	32.2	31.3	30.3	29.7	28.4	27.2	26.0	24.9	25.1	32.5	14.0
28	22.3	22.4	21.5	17.6	16.1	18.5	21.1	21.8	24.6	26.2	28.9	30.4	30.6	29.1	27.9	27.1	27.3	27.0	26.9	26.4	26.2	25.4	24.9	24.7	24.8	30.6	16.1
29	26.1	26.0	23.4	22.1	20.1	20.4	22.2	24.6	27.1	28.2	29.6	30.6	31.0	30.3	31.5	29.7	25.4	25.4	25.5	23.6	23.8	24.1	22.4	19.4	25.5	31.5	19.4
30	17.7	15.7	13.9	13.9	16.0	16.5	18.9	22.1	24.0	26.1	27.7	28.4	29.3	29.8	30.3	30.7	30.7	30.2	29.1	27.1	24.4	21.8	19.9	18.3	23.4	30.7	13.9
MEAN	16.1	14.8	13.6	12.0	11.1	10.9	13.9	17.9	21.1	23.5	25.2	26.5	27.4	28.1	28.5	28.6	28.3	27.7	26.7	24.8	22.5	20.6	19.2	17.7	21.1		
MAX	26.1	26.0	23.4	22.1	20.1	20.4	22.2	24.6	27.1	28.2	30.5	31.2	31.5	32.1	32.1	32.6	32.5	32.0	30.9	29.7	28.4	27.2	26.0	24.9		32.6	
MIN	9.0	8.5	7.6	5.9	5.5	4.1	7.2	11.5	14.4	15.7	17.3	19.2	20.6	21.6	22.8	23.4	23.8	23.1	21.7	20.3	17.7	15.1	11.8	10.8			4.1

POSSIBLE NUMBER OF OBSERVATIONS = 720 ACTUAL NUMBER OF OBSERVATIONS = 720 DATA RECOVERY RATE = 100 %

MONTHLY MEAN = 21.1 Deg C

MAXIMUM 10M TEMPERATURE WAS 32.6 Deg C ON 6/23 AT 1600 MAXIMUM DAILY MEAN WAS 25.5 Deg C ON 6/29

MINIMUM 10M TEMPERATURE WAS 4.1 Deg C ON 6/ 8 AT 600 MINIMUM DAILY MEAN WAS 16.2 Deg C ON 6/20

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Appendix D
Relative Humidity Data for April through June 2011

Homestake

RELATIVE HUMIDITY in % for APRIL, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MN	MAX	MIN
01	26	25	26	27	34	34	36	32	24	19	13	11	9	8	7	7	8	8	11	13	15	19	24	24	19	36	7
02	27	30	34	40	38	41	35	26	21	15	11	10	10	10	12	11	11	13	14	16	18	21	23	25	21	41	10
03	25	28	30	32	32	27	27	28	26	26	22	19	17	18	18	16	17	18	23	65	78	75	45	28	31	78	16
04	24	29	31	35	43	47	44	39	36	32	26	20	15	11	11	10	9	11	13	15	16	16	19	23	24	47	9
05	26	26	26	30	31	33	30	22	16	13	16	13	10	8	7	7	9	9	8	9	9	9	9	9	16	33	7
06	9	10	11	11	12	14	15	14	15	17	25	23	22	19	19	30	49	66	60	61	67	62	54	57	31	67	9
07	59	61	66	78	85	88	84	69	66	59	49	39	35	29	25	24	22	22	24	27	30	31	30	32	47	88	22
08	35	39	43	47	47	47	42	36	31	24	16	12	10	10	9	11	12	14	16	18	21	23	26	27	26	47	9
09	27	29	32	34	33	33	30	28	24	23	23	22	23	27	44	51	49	53	66	75	79	79	78	75	43	79	22
10	67	72	76	71	72	76	69	59	49	42	33	32	30	28	29	37	25	20	21	25	30	34	39	46	45	76	20
11	49	50	53	54	58	60	51	42	33	28	22	18	15	14	12	11	10	10	11	11	12	11	13	13	28	60	10
12	13	13	14	14	14	14	14	13	13	11	11	11	10	10	9	9	8	9	10	13	14	18	20	21	13	21	8
13	22	26	30	34	38	44	42	30	26	23	18	14	13	11	10	10	10	10	11	13	14	18	24	28	22	44	10
14	31	33	30	24	27	30	33	27	26	25	27	24	18	15	12	10	9	9	10	11	13	13	13	18	20	33	9
15	21	23	28	27	26	28	29	23	17	14	11	9	6	5	5	7	8	9	10	11	12	12	12	17	15	29	5
16	20	22	24	24	26	25	24	16	13	10	10	11	11	11	12	12	12	12	12	15	17	22	24	25	17	26	10
17	28	29	32	34	38	41	34	28	23	20	16	15	13	13	13	12	12	12	13	16	19	20	21	23	22	41	12
18	25	26	27	26	26	27	26	21	18	14	14	14	13	13	13	13	13	14	15	16	18	19	20	23	19	27	13
19	28	33	35	39	43	48	51	62	51								14	14	16	18	18	22	23	24			
20	28	31	36	38	46	51	48	38	33	26	18	15	11	10	8	8	9	10	12	13	12	14	15	16	23	51	8
21	18	24	27	29	32	34	33	32	29	21	14	12	11	10	12	12	10	11	11	12	13	13	17	18	19	34	10
22	20	22	23	24	28	31	32	32	31	26	21	17	14	13	13	13	13	14	15	16	17	18	20	20	21	32	13
23	20	20	20	17	18	20	19	17	17	18	19	22	23	21	20	20	19	19	21	20	20	22	24	28	20	28	17
24	35	39	44	47	48	49	46	43	40	40	34	28	26	23	26	23	22	20	21	24	23	26	27	47	33	49	20
25	67	74	76	72	71	64	61	53	44	36	32	28	26	23	19	16	16	15	15	17	19	22	29	30	39	76	15
26	31	33	34	34	34	37	61	49	32	24	33	43	32	32	27	25	32	17	14	17	27	26	31	32	32	61	14
27	27	28	32	34	37	36	33	30	27	22	18	14	13	12	12	11	10	10	10	12	18	23	23	26	22	37	10
28	29	31	30	32	39	42	31	23	18	13	10	9	10	10	10	9	10	9	10	11	11	12	12	13	18	42	9
29	13	14	14	15	18	20	21	19	16	12	11	10	10	9	9	8	7	8	11	13	16	16	15	15	13	21	7
30	21	31	33	37	35	33	27	24	22	16	14	12	15	13	11	10	10	14	17	18	19	22	23	25	21	37	10
MEAN	29	32	34	35	38	39	38	32	28	23	20	18	16	15	15	15	15	16	17	21	23	25	25	27	25		
MAX	67	74	76	78	85	88	84	69	66	59	49	43	35	32	44	51	49	66	66	75	79	79	78	75		88	
MIN	9	10	11	11	12	14	14	13	13	10	10	9	6	5	5	7	7	8	8	9	9	9	9	9			5

POSSIBLE NUMBER OF OBSERVATIONS = 720 ACTUAL NUMBER OF OBSERVATIONS = 713 DATA RECOVERY RATE = 99 %

MONTHLY MEAN = 25 %

MAXIMUM RELATIVE HUMIDITY WAS 88 % ON 4/ 7 AT 600

MINIMUM RELATIVE HUMIDITY WAS 5 % ON 4/15 AT 1400

MAXIMUM DAILY MEAN WAS 47 % ON 4/ 7

MINIMUM DAILY MEAN WAS 13 % ON 4/12

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Homestake

RELATIVE HUMIDITY in % for MAY, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MN	MAX	MIN
01	26	28	29	31	34	37	33	33	31	29	30	29	36	34	41	25	29	31	25	32	42	64	78	75	37	78	25
02	79	84	81	77	79	78	81	72	59	53	47	36	29	20	17	14	12	12	11	13	15	16	24	27	43	84	11
03	31	32	31	31	32	37	25	23	21	15	10	8	8	7	8	8	8	9	10	11	12	13	13	14	17	37	7
04	14	15	16	19	25	29	24	15	11	10	9	8	8	8	7	7	7	8	8	12	15	17	17	16	14	29	7
05	19	20	22	28	29	24	22	16	12	9	9	9	8	8	7	8	7	8	8	10	11	11	12	16	14	29	7
06	20	23	23	23	24	24	22	15	12	10	9	7	7	7	7	7	6	7	8	8	10	11	13	15	13	24	6
07	15	17	17	20	21	25	22	16	13	12	9	8	7	6	5	6	6	6	6	7	8	9	11	12	12	25	5
08	13	14	18	25	29	27	19	17	13	11	9	7	7	7	6	6	6	7	7	8	9	10	11	12	12	29	6
09	13	14	15	17	20	21	21	20	17	16	15	14	15	16	17	19	20	21	25	29	31	34	33	37	21	37	13
10	38	40	43	47	51	49	39	34	31	30	24	21	19	15	13	13	17	25	31	38	56	69	69	67	37	69	13
11	68	67	67	68	68	65	63	60	56	51	48	41	44	37	58	53	49	66	59	57	57	58	61	66	58	68	37
12	73	77	77	76	79	79	71	62	49	33	31	26	22	22	21	20	18	17	19	21	24	27	28	32	42	79	17
13	38	40	47	50	54	55	43	35	29	24	21	18	15	13	12	11	9	8	9	10	10	10	12	23	25	55	8
14	25	24	26	25	28	29	28	26	23	22	20	17	16	15	13	11	9	9	9	11	12	14	15	19	19	29	9
15	22	25	27	29	34	32	31	31	27	23	20	19	15	13	12	11	10	12	14	15	15	11	12	19	20	34	10
16	20	23	27	27	28	30	24	16	13	9	8	7	7	8	7	7	6	7	9	11	12	14	16	17	15	30	6
17	19	21	23	26	27	27	30	24	17	22	25	22	21	19	17	16	15	16	19	22	26	30	33	38	23	38	15
18	44	50	53	54	56	57	51	49	42	36	32	29	28	33	41	41	51	47	55	54	68	70	80	85	50	85	28
19	88	87	89	93	91	84	87	78	70	63	58	57	57	54	48	59	49	60	65	69	75	74	74	83	71	93	48
20	81	79	76	73	74	79	78	69	61	53	47	39	37	34	32	30	28	41	58	65	68	72	75	75	59	81	28
21	76	81	83	84	87	86	78	63	50	32	28	25	23	23	22	21	19	20	21	26	29	34	44	50	46	87	19
22	48	54	59	60	64	59	49	39	28	23	21	18	14	14	13	13	16	19	20	21	23	26	29	25	31	64	13
23	26	27	34	42	43	46	39	29	24	22	17	13	12	11	10	10	10	10	11	14	15	19	19	20	22	46	10
24	24	28	29	48	44	37	35	31	28	25	19	18	17	18	18	17	15	15	18	20	26	36	38	41	27	48	15
25	43	51	51	53	52	52	42	32	25	21	19	17	15	14	12	12	11	12	12	14	16	18	21	27	27	53	11
26	29	29	30	33	36	32	29	28	22	15	10	9	8	8	8	9	9	10	11	13	14	15	15	15	18	36	8
27	16	18	17	20	21	23	20	17	14	14	13	12	11	10	9	9	10	11	12	13	14	15	18	21	15	23	9
28	22	24	26	28	28	29	26	23	20	17	16	15	13	13	11	11	11	10	11	13	15	18	21	21	18	29	10
29	22	22	24	24	24	22	21	21	18	14	13	12	11	9	9	9	8	9	11	12	13	14	16	20	16	24	8
30	23	25	28	33	42	48	45	42	36	29	23	18	12	12	9	8	8	9	10	11	12	14	15	18	22	48	8
31	23	20	25	27	28	25	18	16	12	9	8	7	6	6	5	5	6	7	9	9	10	10	11	13	13	28	5
MEAN	35	37	39	42	44	44	39	34	29	24	22	19	18	16	17	16	16	18	19	22	25	28	30	33	28		
MAX	88	87	89	93	91	86	87	78	70	63	58	57	57	54	58	59	51	66	65	69	75	74	80	85		93	
MIN	13	14	15	17	20	21	18	15	11	9	8	7	6	6	5	5	6	6	6	7	8	9	11	12			5

POSSIBLE NUMBER OF OBSERVATIONS = 744 ACTUAL NUMBER OF OBSERVATIONS = 744 DATA RECOVERY RATE = 100 %

MONTHLY MEAN = 28 %

MAXIMUM RELATIVE HUMIDITY WAS 93 % ON 5/19 AT 400

MAXIMUM DAILY MEAN WAS 71 % ON 5/19

MINIMUM RELATIVE HUMIDITY WAS 5 % ON 5/ 7 AT 1500

MINIMUM DAILY MEAN WAS 12 % ON 5/ 7

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Homestake

RELATIVE HUMIDITY in % for JUNE, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MN	MAX	MIN
01	15	15	12	12	13	15	17	25	29	25	19	14	9	8	8	8	8	8	8	9	10	11	10	11	13	29	8
02	12	13	13	12	13	14	13	12	10	10	10	9	9	8	8	8	9	10	10	10	10	9	10	12	11	14	8
03	14	15	17	21	24	28	24	19	14	12	12	11	10	10	10	9	10	10	11	12	12	12	16	15	15	28	9
04	17	18	22	23	23	26	21	14	12	10	9	8	8	7	7	7	7	9	9	10	11	14	14	16	13	26	7
05	16	18	21	25	25	27	23	18	19	21	15	12	14	14	14	15	19	22	25	29	29	31	38	41	22	41	12
06	43	46	49	51	54	53	46	34	29	21	13	9	9	10	10	9	10	9	10	9	9	10	11	12	24	54	9
07	16	18	20	23	29	31	24	20	19	15	12	9	7	7	7	7	6	6	7	8	8	8	8	9	14	31	6
08	13	18	21	21	24	21	22	14	13	11	7	5	5	5	5	6	5	6	6	7	8	8	9	11	11	24	5
09	12	14	18	22	25	23	22	17	13	12	10	8	6	6	5	4	5	6	7	7	8	10	11	17	12	25	4
10	16	18	17	18	18	20	17	14	11	10	8	8	8	7	6	6	6	5	6	7	8	8	10	11	11	20	5
11	13	15	16	21	24	25	18	14	13	12	11	8	8	6	6	6	6	6	5	6	7	8	9	12	11	25	5
12	13	14	15	17	17	15	15	12	10	8	8	6	5	5	6	6	6	6	6	8	10	11	11	11	10	17	5
13	13	17	16	20	21	19	17	13	10	10	9	7	6	5	6	5	4	5	6	7	8	9	10	10	11	21	4
14	11	12	12	13	13	14	12	12	14	16	15	14	13	12	11	11	11	10	11	11	13	14	15	20	13	20	10
15	20	23	30	31	31	29	25	20	14	12	12	10	10	10	9	8	6	6	8	9	10	11	11	12	15	31	6
16	13	14	16	20	24	25	23	17	15	13	11	10	8	8	7	7	6	6	6	7	9	10	12	14	13	25	6
17	15	19	22	25	26	28	23	19	17	14	11	9	9	8	8	7	7	6	6	6	7	9	10	12	13	28	6
18	13	15	21	22	23	23	21	16	16	13	11	8	7	7	6	6	5	5	5	5	6	7	8	10	12	23	5
19	11	12	13	15	15	16	15	13	11	9	9	8	6	7	7	7	9	10	11	13	30	41	56	49	16	56	6
20	51	51	51	53	58	52	47	39	34	31	28	23	21	18	16	14	14	14	15	18	24	27	30	33	32	58	14
21	36	41	44	46	51	48	40	32	26	22	19	16	14	11	8	7	7	10	12	14	14	14	16	20	24	51	7
22	22	24	25	27	28	30	23	20	15	13	10	8	7	7	7	6	6	7	7	8	9	10	13	13	14	30	6
23	15	15	15	19	20	19	16	14	11	9	8	7	7	7	6	6	6	7	7	8	10	12	13	15	11	20	6
24	18	21	22	28	28	29	26	21	15	12	12	9	7	7	6	6	7	7	7	9	10	12	14	16	15	29	6
25	19	20	23	25	29	32	27	23	18	11	10	9	8	8	8	8	9	9	10	11	12	12	13	15	15	32	8
26	16	19	21	23	30	31	26	19	14	11	10	10	9	8	8	8	8	8	9	9	11	12	13	13	14	31	8
27	14	16	21	21	25	23	20	15	13	12	11	10	9	9	9	8	8	9	10	11	11	12	16	22	14	25	8
28	26	27	29	35	40	35	31	30	24	19	13	10	12	15	18	18	18	18	17	18	19	20	22	22	22	40	10
29	17	16	21	23	28	29	26	22	18	16	14	13	12	13	12	15	29	26	29	36	30	27	33	42	23	42	12
30	48	58	57	59	48	47	39	29	26	23	21	20	17	15	14	13	12	11	12	13	14	18	20	20	27	59	11
MEAN	19	21	23	26	28	28	24	20	17	14	12	10	9	9	9	8	9	9	10	11	13	14	16	18	16		
MAX	51	58	57	59	58	53	47	39	34	31	28	23	21	18	18	18	29	26	29	36	30	41	56	49		59	
MIN	11	12	12	12	13	14	12	12	10	8	7	5	5	5	5	4	4	5	5	5	6	7	8	9			4

POSSIBLE NUMBER OF OBSERVATIONS = 720 ACTUAL NUMBER OF OBSERVATIONS = 720 DATA RECOVERY RATE = 100 %

MONTHLY MEAN = 16 %

MAXIMUM RELATIVE HUMIDITY WAS 59 % ON 6/30 AT 400 MAXIMUM DAILY MEAN WAS 32 % ON 6/20

MINIMUM RELATIVE HUMIDITY WAS 4 % ON 6/ 9 AT 1600 MINIMUM DAILY MEAN WAS 10 % ON 6/12

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Appendix E
Precipitation Data for April through June 2011

Homestake

PRECIPITATION in Inches for APRIL, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOT	MAX HR
01	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
02	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
03	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
04	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
05	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
07	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
08	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
09	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
10	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
11	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
12	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
13	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
14	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
15	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
18	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
19	---	---	---	---	---	---	---	---	---																---	---
20																									.00	.00
21																									.00	.00
22																									.00	.00
23																									.00	.00
24																									.00	.00
25																									.00	.00
26																									.00	.00
27																									.00	.00
28																									.00	.00
29																									.00	.00
30																									.00	.00

POSSIBLE NUMBER OF OBSERVATIONS = 720 ACTUAL NUMBER OF OBSERVATIONS = 279 DATA RECOVERY RATE = 38.8 %

TOTAL PRECIPITATION for the MONTH = .00 Inches

MISSING DATA IS INDICATED BY ---
BLANKS INDICATE ZERO PRECIPITATION

Homestake

PRECIPITATION in Inches for MAY, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOT	MAX HR
01																									.00	.00
02																									.00	.00
03																									.00	.00
04																									.00	.00
05																									.00	.00
06																									.00	.00
07																									.00	.00
08																									.00	.00
09																									.00	.00
10																									.00	.00
11																									.00	.00
12																									.00	.00
13																									.00	.00
14																									.00	.00
15																									.00	.00
16																									.00	.00
17																									.00	.00
18																									.00	.00
19																									.00	.00
20																									.00	.00
21																									.00	.00
22																									.00	.00
23																									.00	.00
24																									.00	.00
25																									.00	.00
26																									.00	.00
27																									.00	.00
28																									.00	.00
29																									.00	.00
30																									.00	.00
31																									.00	.00

POSSIBLE NUMBER OF OBSERVATIONS = 744 ACTUAL NUMBER OF OBSERVATIONS = 744 DATA RECOVERY RATE = 100 %

TOTAL PRECIPITATION for the MONTH = .00 Inches

MISSING DATA IS INDICATED BY ---
BLANKS INDICATE ZERO PRECIPITATION

Homestake

PRECIPITATION in Inches for JUNE, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOT	MAX HR
01																									.00	.00
02																									.00	.00
03																									.00	.00
04																									.00	.00
05																									.00	.00
06																									.00	.00
07																									.00	.00
08																									.00	.00
09																									.00	.00
10																									.00	.00
11																									.00	.00
12																									.00	.00
13																									.00	.00
14																									.00	.00
15																									.00	.00
16																									.00	.00
17																									.00	.00
18																									.00	.00
19																									.00	.00
20																									.00	.00
21																									.00	.00
22																									.00	.00
23																									.00	.00
24																									.00	.00
25																									.00	.00
26																									.00	.00
27																									.00	.00
28																									.00	.00
29																		.01							.01	.01
30																					.02				.02	.02

POSSIBLE NUMBER OF OBSERVATIONS = 720 ACTUAL NUMBER OF OBSERVATIONS = 720 DATA RECOVERY RATE = 100 %

TOTAL PRECIPITATION for the MONTH = .03 Inches

MAXIMUM DAILY PRECIPITATION WAS .02 Inches on 6/30

MAXIMUM HOURLY PRECIPITATION WAS .02 Inches on 6/30 at 2100

MISSING DATA IS INDICATED BY ---
BLANKS INDICATE ZERO PRECIPITATION

Appendix F
Solar Radiation Data for April through June 2011

Homestake

SOLAR RADIATION in W/M^2 for APRIL, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL	MAX
01	1	1	1	1	1	1	90	319	545	741	886	968	987	937	823	647	430	200	18	1	1	1	1	1	7602	987
02	1	1	1	1	1	2	95	326	553	745	884	970	992	691	560	386	312	133	13	1	1	1	1	1	6672	992
03	1	1	1	1	1	2	69	314	550	748	827	837	983	925	841	658	372	128	9	1	1	1	1	1	7273	983
04	1	1	1	1	1	2	110	346	575	768	909	989	935	885	829	660	445	189	18	1	1	1	1	1	7670	989
05	1	1	1	1	1	2	115	349	572	762	901	979	996	956	612	471	245	238	24	1	1	1	1	1	7232	996
06	1	1	1	1	1	2	115	345	313	146	147	192	716	508	478	226	114	59	11	1	1	1	1	1	3382	716
07	1	1	1	1	1	1	25	97	129	264	497	856	986	913	823	659	449	224	24	1	1	1	1	1	5957	986
08	1	1	1	1	1	3	125	355	578	769	792	1003	1041	794	778	454	508	228	22	1	1	1	1	1	7460	1041
09	1	1	1	1	1	3	65	324	576	745	640	786	576	831	749	698	415	227	17	1	1	1	1	1	6662	831
10	1	1	1	1	1	3	137	370	605	757	946	1000	898	961	702	705	417	251	35	1	1	1	1	1	7797	1000
11	1	1	1	1	1	4	145	378	602	792	932	1000	1015	915	699	642	456	193	28	1	1	1	1	1	7811	1015
12	1	1	1	1	1	3	73	196	355	758	577	473	958	970	867	675	463	237	34	1	1	1	1	1	6649	970
13	1	1	1	1	1	6	147	375	596	783	922	1002	1006	957	844	674	460	231	33	1	1	1	1	1	8046	1006
14	1	1	1	1	1	6	136	376	606	800	940	1014	1025	972	852	678	453	200	18	1	1	1	1	1	8086	1025
15	1	1	1	1	1	8	156	391	618	805	950	1023	1030	974	857	675	438	173	26	1	1	1	1	1	8134	1030
16	1	1	1	1	1	6	158	388	594	792	934	1008	1018	960	839	669	455	222	38	1	1	1	1	1	8091	1018
17	1	1	1	1	1	9	174	389	597	793	927	1002	1015	958	841	674	457	249	48	1	1	1	1	1	8143	1015
18	1	1	1	1	1	14	162	473	673	810	919	1004	1030	967	844	629	440	101	23	1	1	1	1	1	8099	1030
19	1	1	1	1	1	7	42	112	438	669	768	1015	992	932	801	653	420	250	43	1	1	1	1	1	7152	1015
20	1	1	1	1	1	11	168	391	610	797	934	1008	1010	924	757	629	485	166	64	1	1	1	1	1	7964	1010
21	1	1	1	1	1	14	176	387	619	811	949	1022	1032	937	720	689	404	120	45	1	1	1	1	1	7935	1032
22	1	1	1	1	1	16	182	403	615	802	938	1012	1021	970	853	682	472	251	46	1	1	1	1	1	8273	1021
23	1	1	1	1	1	13	187	386	531	740	362	378	574	456	300	295	366	308	48	1	1	1	1	1	4954	740
24	1	1	1	1	1	13	147	391	536	563	471	498	491	499	583	674	479	227	42	1	1	1	1	1	5624	674
25	1	1	1	1	1	19	184	304	505	552	665	768	994	982	843	685	463	247	50	1	1	1	1	1	7271	994
26	1	1	1	1	1	5	90	347	480	766	816	1037	681	584	558	418	406	272	58	1	1	1	1	1	6528	1037
27	1	1	1	1	1	25	216	444	665	850	982	1053	1060	1002	884	711	500	276	64	1	1	1	1	1	8742	1060
28	1	1	1	1	1	27	217	442	660	842	971	1037	1043	990	857	682	471	230	37	1	1	1	1	1	8516	1043
29	1	1	1	1	1	27	213	434	648	823	947	1016	1018	972	850	684	480	256	58	1	1	1	1	1	8436	1018
30	1	1	1	1	1	29	220	443	662	845	973	1099	1053	995	879	711	498	275	67	1	1	1	1	1	8759	1099
MEAN	1	1	1	1	1	9	138	353	553	728	810	902	939	877	757	613	426	212	35	1	1	1	1	1	7364	
MAX	1	1	1	1	1	29	220	473	673	850	982	1099	1060	1002	884	711	508	308	67	1	1	1	1	1		1099
MIN	1	1	1	1	1	1	25	97	129	146	147	192	491	456	300	226	114	59	9	1	1	1	1	1		

POSSIBLE NUMBER OF OBSERVATIONS = 720 ACTUAL NUMBER OF OBSERVATIONS = 720 DATA RECOVERY RATE = 100 %

MONTHLY MEAN OF DATA > 0 = 307 W/M^2

MAXIMUM DAILY TOTAL WAS 8759 W/M^2 ON 4/30

MAXIMUM SOLAR RADIATION WAS 1099 W/M^2 ON 4/30 AT 1200

MINIMUM DAILY TOTAL WAS 3382 W/M^2 ON 4/ 6

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY ---

Homestake

SOLAR RADIATION in W/M^2 for MAY, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL	MAX
01	1	1	1	1	1	35	143	352	517	505	670	954	734	793	789	362	289	234	50	1	1	1	1	1	6437	954
02	1	1	1	1	1	7	67	320	642	405	539	963	875	819	665	727	512	291	77	1	1	1	1	1	6919	963
03	1	1	1	1	1	37	236	459	670	850	981	1051	1055	1001	884	714	506	285	74	1	1	1	1	1	8813	1055
04	1	1	1	1	1	37	232	452	661	842	970	1042	1046	992	878	709	501	278	71	1	1	1	1	1	8721	1046
05	1	1	1	1	1	38	233	453	663	844	972	1041	1047	993	852	749	513	293	73	1	1	1	1	1	8774	1047
06	1	1	1	1	1	40	232	451	662	842	970	1040	1050	994	875	707	504	282	76	1	1	1	1	1	8735	1050
07	1	1	1	1	1	39	228	447	661	840	972	1042	1051	1000	887	717	510	290	82	1	1	1	1	1	8776	1051
08	1	1	1	1	1	44	244	466	674	849	978	995	1059	1002	891	721	509	290	52	1	1	1	1	1	8784	1059
09	1	1	1	1	1	31	182	449	626	826	1007	1062	1038	978	865	696	496	283	80	1	1	1	1	1	8629	1062
10	1	1	1	1	1	45	235	452	658	816	947	966	982	606	703	405	185	257	48	1	1	1	1	1	7315	982
11	1	1	1	1	1	9	131	200	442	406	426	761	630	871	652	554	309	185	45	1	1	1	1	1	5631	871
12	1	1	1	1	1	51	250	465	669	848	967	1039	1045	993	900	721	515	300	92	2	1	1	1	1	8866	1045
13	1	1	1	1	1	56	260	476	680	853	977	1043	1050	998	888	727	528	306	96	2	1	1	1	1	8949	1050
14	1	1	1	1	1	49	245	462	668	840	966	996	868	588	570	441	418	317	99	2	1	1	1	1	7538	996
15	1	1	1	1	1	56	257	472	677	848	971	1035	1043	993	881	720	521	304	97	2	1	1	1	1	8886	1043
16	1	1	1	1	1	66	172	263	366	511	964	1059	1062	1010	897	735	494	208	89	2	1	1	1	1	7907	1062
17	1	1	1	1	1	27	108	348	709	624	844	1005	1029	868	838	691	434	166	83	1	1	1	1	1	7784	1029
18	1	1	1	1	1	60	232	489	506	605	354	300	432	857	835	598	244	157	101	1	1	1	1	1	5780	857
19	1	1	1	1	1	15	89	298	398	496	274	520	397	935	509	347	383	86	15	1	1	1	1	1	4772	935
20	1	1	1	1	1	12	71	258	275	303	784	819	669	631	354	490	336	131	60	2	1	1	1	1	5204	819
21	1	1	1	1	1	72	265	482	690	868	994	1055	1050	985	838	532	298	181	111	2	1	1	1	1	8432	1055
22	1	1	1	1	1	76	278	479	685	821	987	871	888	321	701	405	119	113	52	2	1	1	1	1	6807	987
23	1	1	1	1	1	58	263	483	689	859	991	1058	1059	995	910	740	538	320	110	3	1	1	1	1	9085	1059
24	1	1	1	1	1	29	231	476	602	829	995	706	972	757	809	743	411	301	53	3	1	1	1	1	7926	995
25	1	1	1	1	1	69	268	486	692	867	988	1050	1059	1008	900	740	541	323	115	4	1	1	1	1	9119	1059
26	1	1	1	1	1	66	238	267	344	682	896	874	1003	926	789	620	532	275	109	5	1	1	1	1	7635	1003
27	1	1	1	1	1	73	273	489	692	865	989	1053	1061	1011	903	742	543	326	120	4	1	1	1	1	9153	1061
28	1	1	1	1	1	73	270	485	689	862	986	1048	1054	1005	898	737	542	328	123	4	1	1	1	1	9113	1054
29	1	1	1	1	2	61	262	582	690	864	986	1047	1048	1007	894	727	529	320	118	6	1	1	1	1	9151	1048
30	1	1	1	1	1	65	265	415	686	860	978	1059	1074	1025	921	759	560	341	131	5	1	1	1	1	9153	1074
31	1	1	1	1	1	84	283	502	711	886	1010	1066	1080	1032	919	750	536	306	39	3	1	1	1	1	9216	1080
MEAN	1	1	1	1	1	48	218	425	613	749	882	955	952	903	809	646	447	261	82	2	1	1	1	1	8000	
MAX	1	1	1	1	2	84	283	582	711	886	1010	1066	1080	1032	921	759	560	341	131	6	1	1	1	1		1080
MIN	1	1	1	1	1	7	67	200	275	303	274	300	397	321	354	347	119	86	15	1	1	1	1	1		

POSSIBLE NUMBER OF OBSERVATIONS = 744 ACTUAL NUMBER OF OBSERVATIONS = 744 DATA RECOVERY RATE = 100 %

MONTHLY MEAN OF DATA > 0 = 333 W/M^2 MAXIMUM DAILY TOTAL WAS 9216 W/M^2 ON 5/31

MAXIMUM SOLAR RADIATION WAS 1080 W/M^2 ON 5/31 AT 1300 MINIMUM DAILY TOTAL WAS 4772 W/M^2 ON 5/19

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY ---

Homestake

SOLAR RADIATION in W/M^2 for JUNE, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL	MAX
01	1	1	1	1	1	68	187	361	452	781	835	722	651	593	354	223	61	38	9	1	1	1	1	1	5345	835
02	1	1	1	1	1	57	283	470	573	411	585	485	671	739	617	533	512	344	166	14	1	1	1	1	6469	739
03	1	1	1	1	1	61	206	416	629	849	974	1015	938	763	618	425	116	79	19	4	1	1	1	1	7121	1015
04	1	1	1	1	1	68	262	475	684	858	979	1044	1060	1035	881	802	402	103	26	3	1	1	1	1	8691	1060
05	1	1	1	1	1	48	225	432	632	800	936	1011	873	329	176	58	57	67	27	5	1	1	1	1	5685	1011
06	1	1	1	1	1	56	216	409	655	837	948	974	996	812	641	543	475	305	125	11	1	1	1	1	8012	996
07	1	1	1	1	1	57	236	458	675	831	969	1042	1058	1010	913	762	558	400	191	14	1	1	1	1	9183	1058
08	1	1	1	1	1	55	213	435	634	775	849	960	962	915	634	416	292	154	66	12	1	1	1	1	7381	962
09	1	1	1	1	2	85	293	511	713	886	1008	1073	1080	981	946	695	394	194	63	7	1	1	1	1	8939	1080
10	1	1	1	1	1	76	283	499	702	876	997	1059	1063	1008	892	735	535	311	102	5	1	1	1	1	9152	1063
11	1	1	1	1	1	80	287	501	698	862	984	1055	1038	995	866	674	455	315	134	12	1	1	1	1	8965	1055
12	1	1	1	1	2	80	275	480	681	853	972	946	1050	971	921	755	446	222	113	7	1	1	1	1	8782	1050
13	1	1	1	1	2	82	286	502	700	869	983	1058	1071	1020	857	767	569	356	148	10	1	1	1	1	9288	1071
14	1	1	1	1	2	78	274	485	684	853	977	1043	1054	1013	908	752	560	350	145	10	1	1	1	1	9196	1054
15	1	1	1	1	2	81	279	489	679	864	988	1051	1051	1003	895	747	456	365	141	16	1	1	1	1	9115	1051
16	1	1	1	1	1	65	273	493	693	862	987	1051	1064	1022	919	765	575	364	156	10	1	1	1	1	9308	1064
17	1	1	1	1	2	79	276	488	694	865	991	1059	1065	1021	917	763	571	364	155	7	1	1	1	1	9325	1065
18	1	1	1	1	1	32	245	488	701	874	586	1038	930	1056	936	735	575	362	157	10	1	1	1	1	8734	1056
19	1	1	1	1	1	36	240	493	694	866	988	1055	1065	1017	907	750	563	358	141	5	1	1	1	1	9187	1065
20	1	1	1	1	1	77	276	488	690	859	980	1045	1056	1014	912	761	571	361	156	12	1	1	1	1	9267	1056
21	1	1	1	1	1	77	274	485	687	859	985	1052	1068	1029	929	777	584	364	157	11	1	1	1	1	9347	1068
22	1	1	1	1	1	80	280	494	697	870	993	1060	1071	1024	923	768	577	366	158	12	1	1	1	1	9382	1071
23	1	1	1	1	1	77	274	486	689	859	982	1047	1062	1015	919	765	571	348	139	12	1	1	1	1	9254	1062
24	1	1	1	1	1	73	271	484	690	862	984	1054	1068	1020	925	772	573	363	157	11	1	1	1	1	9316	1068
25	1	1	1	1	1	67	262	477	681	852	979	1047	1057	1015	911	743	587	355	147	11	1	1	1	1	9200	1057
26	1	1	1	1	1	71	263	472	672	843	966	1038	1050	955	925	757	489	280	148	12	1	1	1	1	8950	1050
27	1	1	1	1	1	65	262	474	676	799	966	1058	1024	547	440	657	448	165	81	15	1	1	1	1	7686	1058
28	1	1	1	1	1	43	217	220	507	525	742	822	877	1028	830	455	307	67	29	4	1	1	1	1	6682	1028
29	1	1	1	1	1	58	251	434	577	787	929	1033	988	408	542	144	46	144	51	4	1	1	1	1	6405	1033
30	1	1	1	1	1	57	149	430	548	780	576	625	927	1026	678	640	565	353	153	13	1	1	1	1	7529	1026
MEAN	1	1	1	1	1	66	254	461	656	819	921	987	1000	913	791	638	450	274	115	9	1	1	1	1	8363	
MAX	1	1	1	1	2	85	293	511	713	886	1008	1073	1080	1056	946	802	587	400	191	16	1	1	1	1		1080
MIN	1	1	1	1	1	32	149	220	452	411	576	485	651	329	176	58	46	38	9	1	1	1	1	1		

POSSIBLE NUMBER OF OBSERVATIONS = 720 ACTUAL NUMBER OF OBSERVATIONS = 720 DATA RECOVERY RATE = 100 %

MONTHLY MEAN OF DATA > 0 = 348 W/M^2

MAXIMUM DAILY TOTAL WAS 9382 W/M^2 ON 6/22

MAXIMUM SOLAR RADIATION WAS 1080 W/M^2 ON 6/ 9 AT 1300

MINIMUM DAILY TOTAL WAS 5345 W/M^2 ON 6/ 1

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY ---

Appendix G
Barometric Pressure Data for April through June 2011

Homestake

STATION PRESSURE in Inches of Mercury for APRIL, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MN	MAX	MIN
01	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.6
02	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.5
03	23.5	23.5	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.3	23.3	23.3	23.3	23.3	23.4	23.5	23.5	23.6	23.6	23.4	23.6	23.3
04	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.6
05	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.7	23.5
06	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.5
07	23.5	23.5	23.5	23.5	23.4	23.4	23.4	23.4	23.5	23.5	23.4	23.4	23.4	23.4	23.4	23.3	23.3	23.3	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.5	23.3
08	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.4	23.4	23.4	23.4	23.4	23.4	23.3
09	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.4	23.4	23.4	23.4	23.5	23.5	23.5	23.5	23.4	23.5	23.3
10	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.7	23.5
11	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.7
12	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.6	23.6	23.5
13	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.5
14	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.7	23.7	23.6	23.7	23.5
15	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6
16	23.7	23.7	23.7	23.6	23.6	23.6	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.6	23.7	23.5
17	23.6	23.6	23.5	23.5	23.5	23.5	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.4	23.4	23.4	23.4	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.4
18	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.5	23.4
19	23.4	23.4	23.4	23.4	23.4	23.4	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.5	23.6	23.4
20	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.6	23.6	23.5
21	23.6	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.5
22	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.4	23.4	23.4	23.4	23.4	23.4	23.5	23.5	23.5	23.5	23.5	23.5	23.4
23	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.4	23.4	23.4	23.4	23.4	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.4
24	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.5	23.4	23.5	23.4
25	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.3	23.5	23.5	23.3
26	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.4	23.4	23.5	23.5	23.5	23.3	23.5	23.3
27	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.6	23.7	23.5
28	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.8	23.5
29	23.5	23.5	23.5	23.5	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.4	23.4	23.4	23.4	23.4	23.4	23.5	23.3
30	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.4	23.4	23.4	23.4	23.4	23.4	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.4
MEAN	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5		
MAX	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7		23.8	
MIN	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.4	23.4	23.4	23.3			23.3

POSSIBLE NUMBER OF OBSERVATIONS = 720 ACTUAL NUMBER OF OBSERVATIONS = 720 DATA RECOVERY RATE = 100 %

MONTHLY MEAN = 23.5 Inches of Mercury

MAXIMUM STATION PRESSURE WAS 23.8 Inches of Mercury ON 4/11 AT 900 MAXIMUM DAILY MEAN WAS 23.8 Inches of Mercury ON 4/11

MINIMUM STATION PRESSURE WAS 23.3 Inches of Mercury ON 4/26 AT 500 MINIMUM DAILY MEAN WAS 23.3 Inches of Mercury ON 4/26

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Homestake

STATION PRESSURE in Inches of Mercury for MAY, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MN	MAX	MIN
01	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.5	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.6	23.7	23.5
02	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.9	23.8	23.9	23.7
03	23.9	23.9	23.8	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.9	23.7
04	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.7	23.8	23.6
05	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.6
06	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.6	23.7	23.5
07	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.5
08	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.5	23.6	23.4
09	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.4	23.4	23.4	23.4	23.4	23.3
10	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.3
11	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.6	23.5	23.6	23.4
12	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6
13	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.8	23.6
14	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.4	23.4	23.4	23.4	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.4
15	23.5	23.5	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.5
16	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.4	23.4	23.4	23.4	23.4	23.5	23.5	23.5	23.5	23.5	23.6	23.4
17	23.5	23.5	23.4	23.4	23.4	23.4	23.5	23.5	23.5	23.5	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.5	23.4
18	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.3	23.3	23.3	23.2	23.2	23.2	23.2	23.2	23.2	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.4	23.2
19	23.3	23.3	23.3	23.3	23.3	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.5	23.5	23.5	23.5	23.5	23.5	23.4	23.5	23.3
20	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.6	23.5
21	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.5
22	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.5
23	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.5	23.5	23.5	23.5	23.6	23.4
24	23.5	23.5	23.4	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.5	23.6	23.4
25	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.6
26	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.7	23.5
27	23.5	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.5
28	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.3	23.3	23.3	23.4	23.4	23.4	23.4	23.4	23.4	23.5	23.3
29	23.4	23.3	23.3	23.3	23.3	23.3	23.4	23.4	23.4	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.4	23.3
30	23.3	23.4	23.4	23.4	23.4	23.4	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.5	23.7	23.3
31	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.7
MEAN	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.5		
MAX	23.9	23.9	23.8	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.9		23.9	
MIN	23.3	23.3	23.3	23.3	23.3	23.3	23.4	23.4	23.3	23.3	23.3	23.2	23.2	23.2	23.2	23.2	23.2	23.3	23.3	23.3	23.3	23.3	23.3	23.3			23.2

POSSIBLE NUMBER OF OBSERVATIONS = 744 ACTUAL NUMBER OF OBSERVATIONS = 744 DATA RECOVERY RATE = 100 %

MONTHLY MEAN = 23.5 Inches of Mercury

MAXIMUM STATION PRESSURE WAS 23.9 Inches of Mercury ON 5/ 3 AT 800 MAXIMUM DAILY MEAN WAS 23.8 Inches of Mercury ON 5/ 3

MINIMUM STATION PRESSURE WAS 23.2 Inches of Mercury ON 5/18 AT 1300 MINIMUM DAILY MEAN WAS 23.3 Inches of Mercury ON 5/18

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

SUMMARY OF METEOROLOGICAL DATA
BARRICK/HOMESTAKE MINING COMPANY
GRANTS, NEW MEXICO
JULY - SEPTEMBER 2011

Prepared for:

Homestake Mining Company
Grants Project
P.O. Box 98
Grants, New Mexico 87020-0011

By

Meteorological Solutions Inc.
Project No. 10111118

October 2011

SUMMARY OF METEOROLOGICAL DATA
BARRICK/HOMESTAKE MINING COMPANY
GRANTS, NEW MEXICO
JULY - SEPTEMBER 2011

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SUMMARY OF METEOROLOGICAL DATA
BARRICK/HOMESTAKE MINING COMPANY
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1.0 INTRODUCTION

This report, prepared for Barrick/Homestake Mining Company by Meteorological Solutions, Inc. (MSI), summarizes the meteorological data collected at a 10-meter meteorological tower located at Barrick/Homestake Mining Company, Grants, New Mexico meteorological monitoring station for July 1 through September 30, 2011.

1.1 Background

The Barrick/Homestake Mining Company station is equipped to measure horizontal wind speed and wind direction at 10 meters, temperature at 9.5 meters, solar radiation at 9.5 meters, relative humidity at 9.5 meters, precipitation at 0.4 meters, and barometric pressure at 8.8 meters. Table 1-1 summarizes the parameters collected at the monitoring site and the units for each parameter. Figure 1.1 presents a photograph of the meteorological monitoring station.

Table 1-1

Measured Meteorological Parameters

Parameter	Units
Wind Speed	meters per second (mps)
Wind Direction	degrees from true north (E)
Temperature	degrees Celsius (EC)
Relative Humidity	Percent (%) RH
Solar Radiation	Watts per square meter (W/m^2)
Barometric Pressure	Inches of Mercury (in. Hg)
Precipitation	Inches (in.)
Time	Mountain Standard Time (MST)

Figure 1.1 Photograph of Barrick/Homestake Mining Company Meteorological Monitoring Station

Barrick/Homestake's meteorological station is located approximately at:

Latitude: 35º.23386 North

Longitude: 107°.86519 West

Figure 1.2 presents a map showing the location of the station.

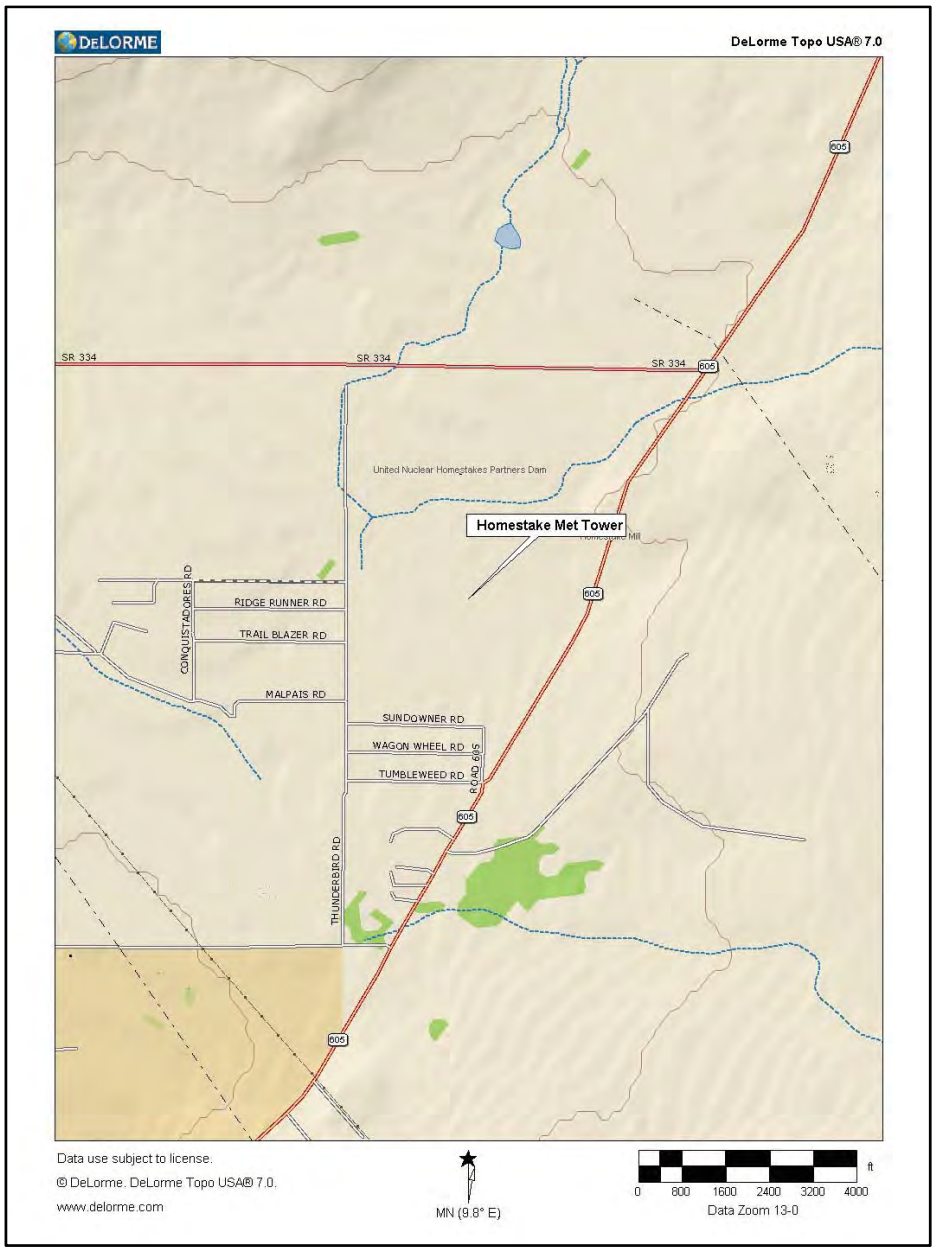


Figure 1.2 Map Showing Location of Barrick/Homestake Mining Company Meteorological Monitoring Station

1.2 Meteorological Instrumentation

The meteorological parameters measured provide information on the local meteorology in the immediate area. Table 1-2 provides a list of all meteorological equipment at the Barrick/Homestake Mining Company monitoring station.

Table 1-2
Instrumentation at Barrick/Homestake Mining Company Monitoring Station

Parameter	Meteorological Equipment	Serial Number
Wind Direction	RM Young Model 05305	88027
Wind Speed	RM Young Model 05305	88027
Temperature	Vaisala Model HMP45AC	C5110079
Precipitation	Weathertronics Model 6011	374
Relative Humidity	Vaisala Model HMP45AC	C5110079
Barometric Pressure	Vaisala Model PTB110	D2430004
Solar Radiation	LiCor 200X	PY69993

A water-proof and dust-proof enclosure is mounted at the top of the meteorological platform/tower. This enclosure houses the data acquisition system (DAS), battery backup equipment, and cellular phone modem. The precipitation gauge is installed near the base of the platform/tower.

1.3 Data Acquisition

At the meteorological tower, a Campbell Scientific Inc. (CSI) Model CR10X is used to store data from the sensors. The DAS uses secondly data values to compute and stores hourly averages of temperature, wind speed (scalar and vector), wind direction (unit vector), relative humidity, barometric pressure, solar radiation, and precipitation.

The data logger is interrogated by MSI daily via a static IP address and the data are copied to duplicate computer files. The data logger telecommunications software performs dynamic error checking during download to ensure that an exact duplicate file is created. Any failures in instrumentation or data acquisition are identified daily so that field personnel are able to correct problems in a timely manner in order to prevent excessive data loss.

The data collected during each interrogation are checked for consistency and the parameters are plotted for visual inspection. The quality assurance stacked parameter/time plots for the months of July through September 2011 are presented in Appendix A. Data presented in Appendix A represent the final, quality assured data set. Hourly values provided in this report are the hourly averages calculated by the data logger.

2.0 DATA SUMMARY

This section of the report summarizes the data results and data recovery for the third quarter 2011 (July 1 through September 30). Hourly data for the period are tabulated in the appendices. These appendix tables display the hourly average of measurements recorded in the hour "ending"; that is, the second hour of the day is labeled 01, meaning the hour beginning at 00:00:01 and ending at 01:00:00 a.m. The second hour is labeled 02, meaning the values collected from 01:00:01 a.m. to 02:00:00 a.m.

2.1 Meteorological Data

Meteorological data records from Barrick/Homestake's monitoring site include horizontal wind speed and wind direction at 10 meters, temperature at 9.5 meters, solar radiation at 9.5 meters, relative humidity at 9.5 meters, precipitation at 0.4 meters, and barometric pressure at 8.8 meters.

2.1.1 Wind Speed and Horizontal Wind Direction

Figures 2.1 through 2.3 provide diagrams of the joint frequency of occurrence distributions (wind rose) of wind speed and wind direction by month for July through September for the 10-meter level. A wind rose for the third quarter for the 10-meter level is presented in Figure 2.4. Summary tables of hourly average wind direction and wind speed for the 10-meter level for July through September 2011 are presented in Appendix B.

The most frequent (and predominant) winds during the third quarter 2011 at the 10-meter level were from the south-southeast followed by the northwest. Reported wind directions represent the directions from which the wind is blowing.

For July through September, there were 0.0 percent calm wind speeds at the 10-meter level. The percentage of wind speeds that were less than or equal to 10 mps (22 mph) was 100 percent. No winds were greater than 16 mps (35 mph). For the third quarter, the sector with the highest average wind speed was the south-southeast.

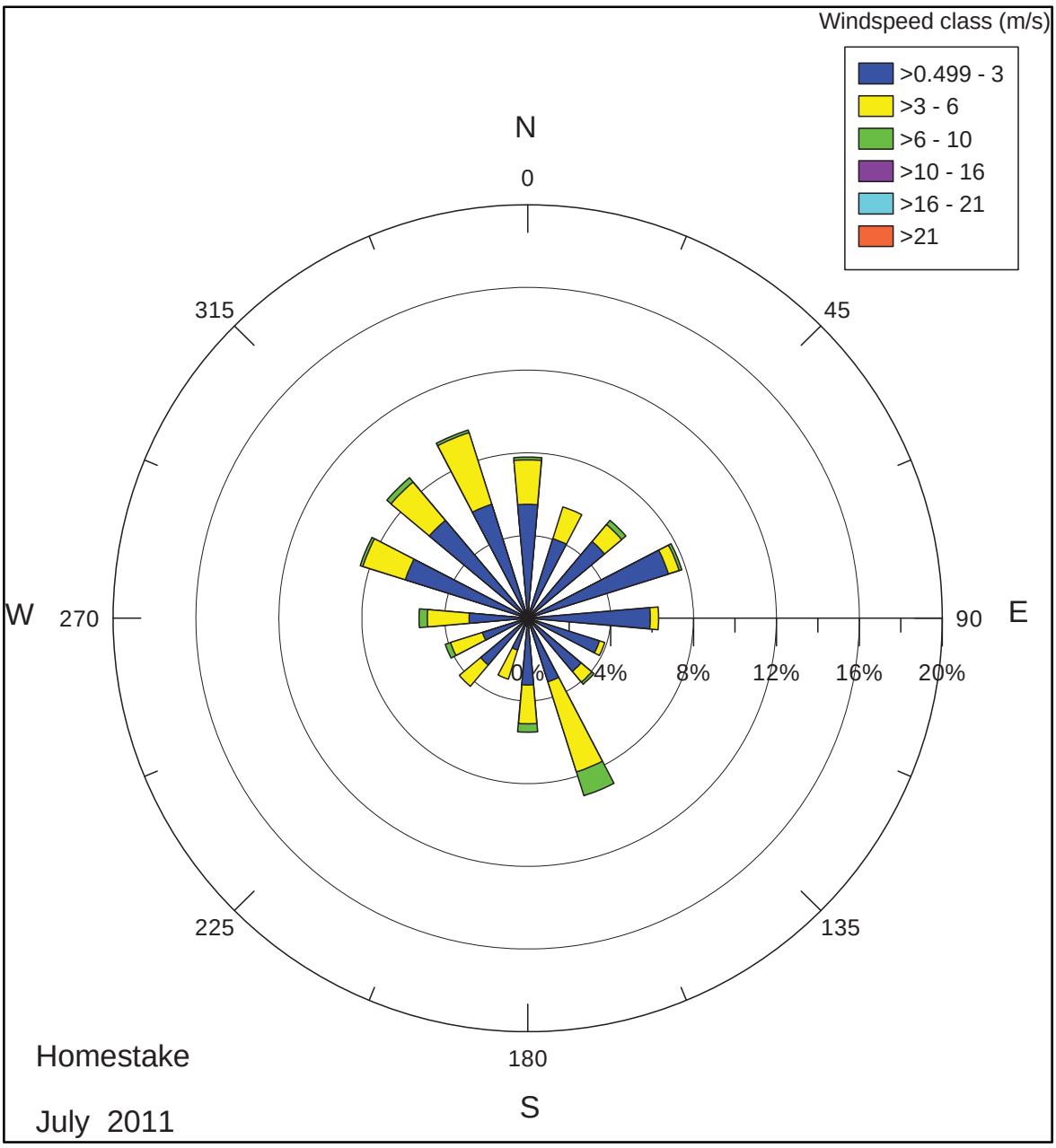


Figure 2.1 10-Meter Level Wind Rose, July 2011.

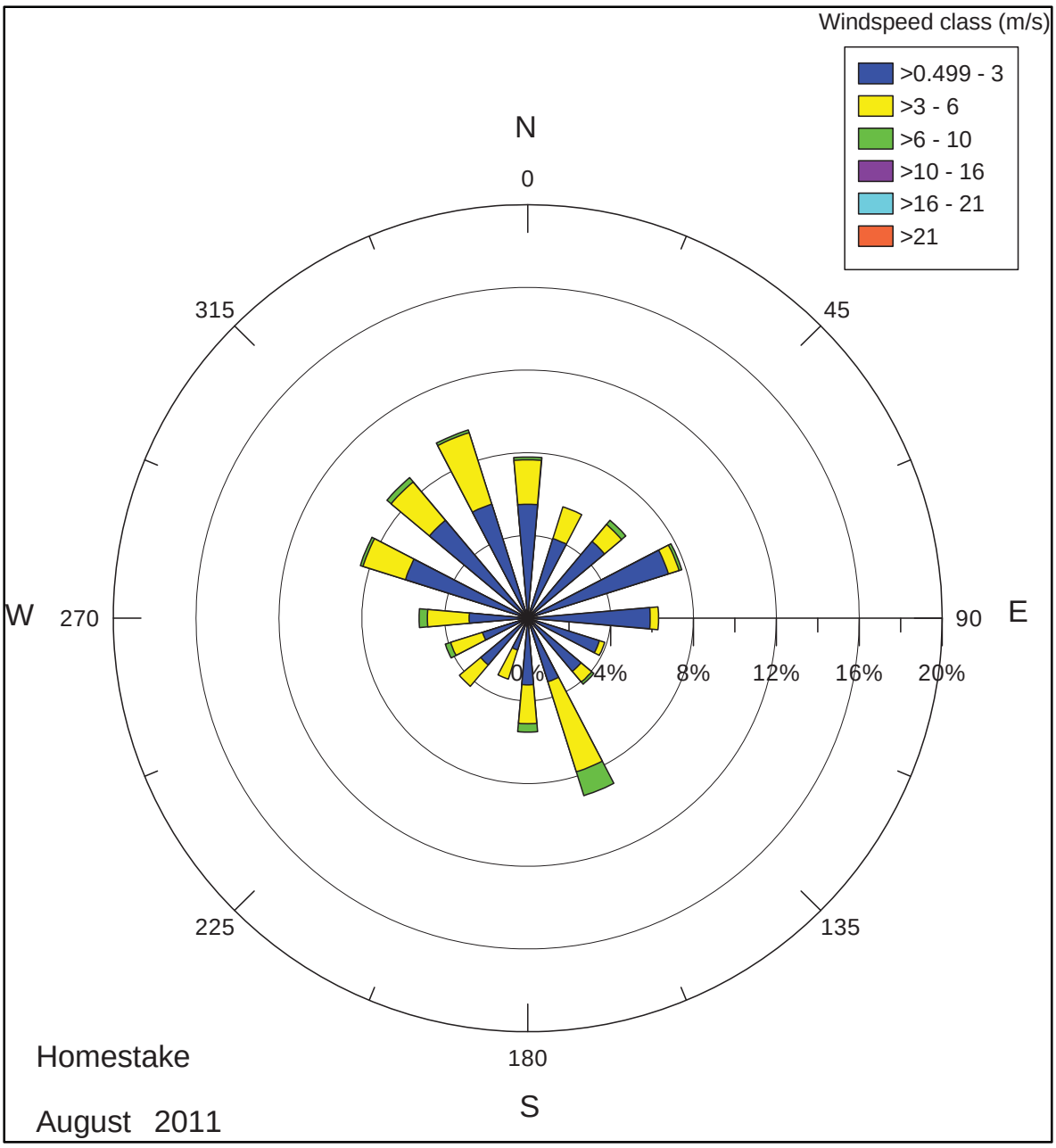


Figure 2.2 10-Meter Level Wind Rose, August 2011.

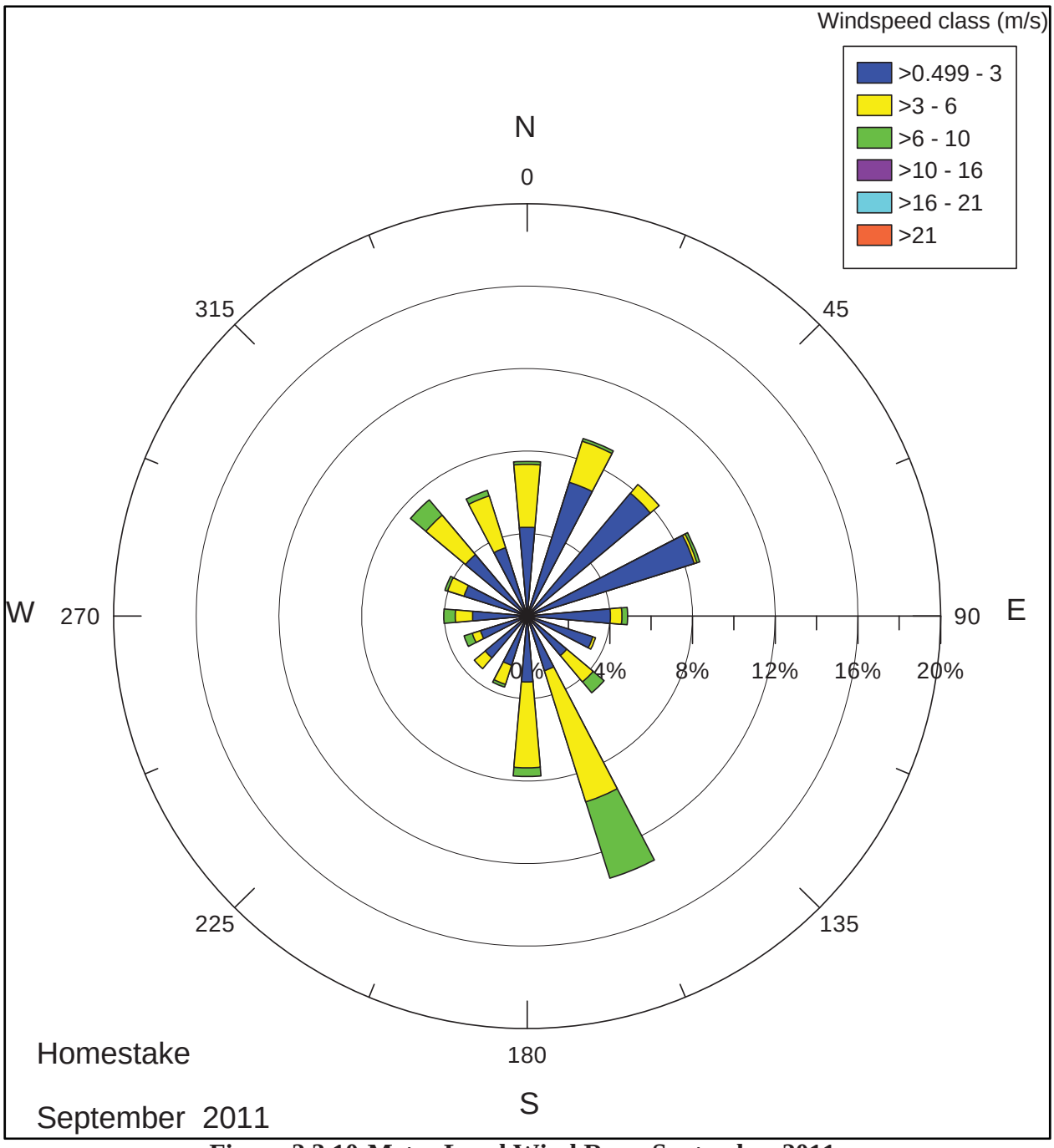


Figure 2.3 10-Meter Level Wind Rose, September 2011.

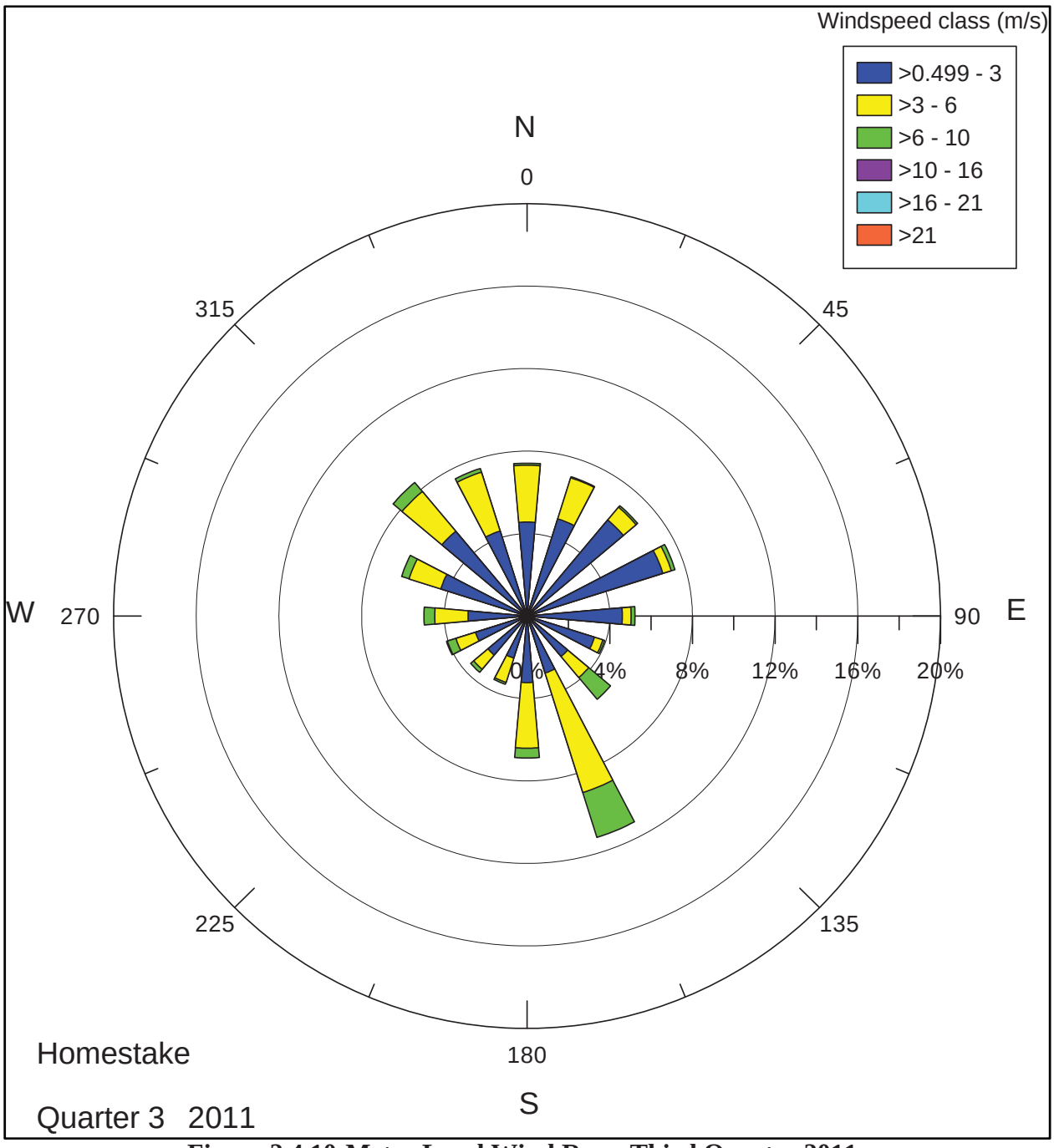


Figure 2.4 10-Meter Level Wind Rose, Third Quarter 2011.

2.1.2 Temperature

Temperature is measured at the 9.5-meter level. The ambient daily mean temperatures for July through September ranged from a low of 13.4 degrees Centigrade (°C) in September to a high of 25.0°C in July. The hourly minimum was 3.1°C in September and the hourly maximum temperature was 32.7°C in July. Temperature data for the period are summarized in Table 2-1. Hourly averages of the temperature data for the third quarter are presented in Appendix C.

Table 2-1

Summary of Temperature in Degrees Centigrade (°C) for Third Quarter 2011

Month	Monthly Mean	Maximum Daily Mean	Minimum Daily Mean	Maximum Hour	Minimum Hour
July	22.1	25.0	17.5	32.7	9.7
August	21.8	23.7	18.6	31.9	9.3
September	16.2	20.8	13.4	27.4	3.1

2.1.3 Relative Humidity

Table 2-2 presents the monthly means, maximum and minimum relative humidity information for the third quarter. Relative humidity data are presented in Appendix D.

Table 2-2

Summary of Relative Humidity in Percent for Third Quarter 2011

Month	Monthly Mean	Daily Mean Maximum	Daily Mean Minimum	Monthly Maximum	Monthly Minimum
July	44	67	17	92	8
August	48	73	22	94	7
September	52	74	27	94	7

2.1.4 Precipitation

For July through September, 3.28 inches of precipitation were measured at the site. The precipitation data are summarized in Table 2-3 and are presented in Appendix E.

Table 2-3

Summary of Precipitation in Inches for Third Quarter 2011

Month	Monthly Total	Maximum Daily Total	Maximum Hourly Total
July	0.58	0.37	0.12
August	1.95	0.57	0.54
September	0.75	0.23	0.13

2.1.5 Solar Radiation

Solar radiation data for the third quarter are summarized in Table 2-4 and are presented in Appendix F. The statistics for the solar radiation data presented in Table 2-4 are based on daylight hours.

Table 2-4

Solar Radiation Data in Watts Per Meter Squared (W/m^2) for Third Quarter 2011

Month	Monthly Mean	Maximum Daily Total	Minimum Daily Total	Maximum Hour
July	281	9023	4446	1121
August	263	8428	4002	1026
September	225	6882	2322	935

2.1.6 Barometric Pressure

Barometric pressure data for the third quarter are presented in Table 2-5 and in Appendix G.

Table 2-5

Barometric Pressure Data in Inches of Mercury (in. Hg) for Third Quarter 2011

Month	Monthly Mean	Maximum Daily Mean	Minimum Daily Mean	Maximum Hour	Minimum Hour
July	23.7	23.8	23.6	23.8	23.5
August	23.7	23.8	23.6	23.8	23.6
September	23.7	23.9	23.7	23.9	23.6

2.2 Data Recovery

Data recoveries for the meteorological parameters, in percent possible for July through September 2011 are provided in Table 2-6.

Table 2-6

Meteorological Measurement Data Recovery in Percent for Third Quarter 2011

Month	Wind Speed	Wind Direction	Temp.	Rel. Hum.	Prec.	Solar Rad.	Bar. Press.
July	86.2	86.2	86.2	86.2	86.2	86.2	86.2
August	100	100	100	100	100	100	100
September	100	100	100	100	100	100	100

3.0 QUALITY CONTROL

Meteorological data collected at the Barrick/Homestake Mining Company monitoring station have been subjected to a series of quality control procedures to document the validity of the data and increase the integrity of the data sets. The quality control performed for these data is described in this section.

3.1 Visual Inspection of Equipment

Visual inspection of the meteorological tower and sensors is performed at least every six months or more frequently when problems are indicated. Abnormal conditions are logged and reported immediately to the program manager for corrective action.

3.2 Remote Interrogation of the Monitoring Station

The data logger is interrogated daily to download and process the data. Abnormal data values or apparent problems are reported immediately to the program manager who initiates corrective action and determines if a special visit to the site is required.

3.3 Quality Control Data Inspections

During data acquisition, the data logger collects and saves hourly averages of each measured parameter. The values are stored in memory for subsequent retrieval via telephone, modem, and Internet. After the site data logger is interrogated, collecting all data since the last interrogation, the data are stored on MSI computers in Salt Lake City. These data are then subjected to a series of quality tests. The data files are input to a program which performs a series of quality control (QC) tests as listed in Table 3-1.

Table 3-1

Quality Control Checks Imposed by Data QC Program

Meteorological Data
Wind Speed > 25 m/s for one 1-hr period.
Ambient temperature > 40 ºC.
Ambient temperature < -20 ºC.
Relative Humidity > 100 %.
Relative Humidity < 5 %.
Barometric Pressure > 23.95 In. Hg.
Barometric Pressure < 23.20 In. Hg.
Precipitation total > 0.25 In. in one 1-hr period.
Solar Radiation > 1600 W/m2.
Battery Voltage < 11 V.
Wind Speed / Wind Direction / Sigma Theta unchanged for 3 or more hours.
Ambient temperature unchanged for 3 or more hours.
Relative Humidity unchanged for 4 or more hours.
Barometric Pressure unchanged for 3 or more hours.
Ambient temperature change > 5 ºC in one hour.
Relative Humidity change > 20 % in one hour.
Barometric Pressure change more than 0.04 In. Hg. in one hour.

The QC program produces a report that identifies each value in the data file that fails one or more of the listed tests. This report also provides means, maxima and minima for each variable. An example of this output is shown in Figure 3.1.

```
Quality Assurance
Data runs from 06/25/2010 at 600 to 06/26/2010 at 0600
Total number of hourly averages:  24
Calculated number of hourly averages  24
------------------------------------------------------------------------
MIN, MAX and MEAN VALUES (HOURLY AVERAGES)

Mean Wind Speed              4.3    (mps)
Max  Wind Speed              9.8    (mps) on  6/25/10 at  1400
Min  Wind Speed              0.6    (mps) on  6/25/10 at  2300

Mean Wind Direction          306    (deg)
Max  Wind Direction          356    (deg) on  6/25/10 at  2000
Min  Wind Direction          0      (deg) on  6/25/10 at  1000

Mean Sigma Theta             23     (deg)
Max  Sigma Theta             97     (deg) on  6/25/10 at  1100
Min  Sigma Theta             3      (deg) on  6/26/10 at  100

Mean Temperature             18.81  (deg C)
Max  Temperature             27.37  (deg C) on  6/25/10 at  1400
Min  Temperature             8.44   (deg C) on  6/26/10 at  400

Mean Relative Humidity       31     (%)
Max  Relative Humidity       59     (%) on  6/26/10 at  500
Min  Relative Humidity       12     (%) on  6/25/10 at  1400

Mean Solar Radiation         318    (w/m^2)
Max  Solar Radiation         1093   (w/m^2) on  6/25/10 at  1300
Min  Solar Radiation        -0.3    (w/m^2) on  6/25/10 at  2200

Mean Pressure                23.2   (in Hg)
Max  Pressure                23.29  (in Hg) on  6/25/10 at  600
Min  Pressure                23.14  (in Hg) on  6/25/10 at  1700

Total Precipitation          0      (inches)

Parameters that fell outside of normal bounds:
Temperature changed more than 4 on  6 / 25 / 2010  at  600
```

Figure 3.1 Example Quality Control Report

3.4 Data Validation

When the QC program identifies values that exceed the criteria set for that parameter, the data file is inspected visually. In most cases, a flagged value is not invalid; it merely fell outside of expected ranges or "normal" rates of change for that parameter. If, after investigation, a meteorologist determines that the value is reasonable, the value is not invalidated. If there is a reason to suspect the data point, the value is reset to "missing." (This is done on the data management file only, not on the raw data file collected from the data logger; the raw data file is never manipulated.) The conditions listed in Table 3-1 result in a flag in the data set.

In addition, MSI hosts a password-protected project web-site which is updated daily. The site contains 24-hour meteorological chart graphics, daily minimum, maximums, and averages, quality assurance reports and wind roses. Figures 3.2 and 3.3 present examples of these graphics. By using this approach, data collection percentages are greatly enhanced and MSI meteorologists can quickly note and resolve any potential instrumentation problems.

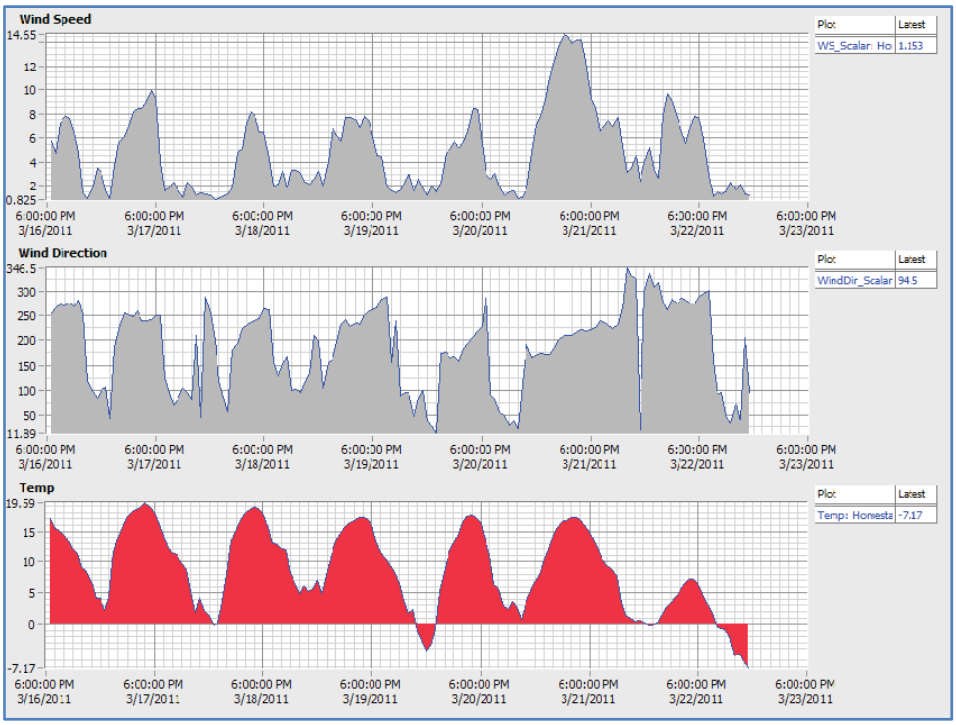


Figure 3.2 Real-Time Display

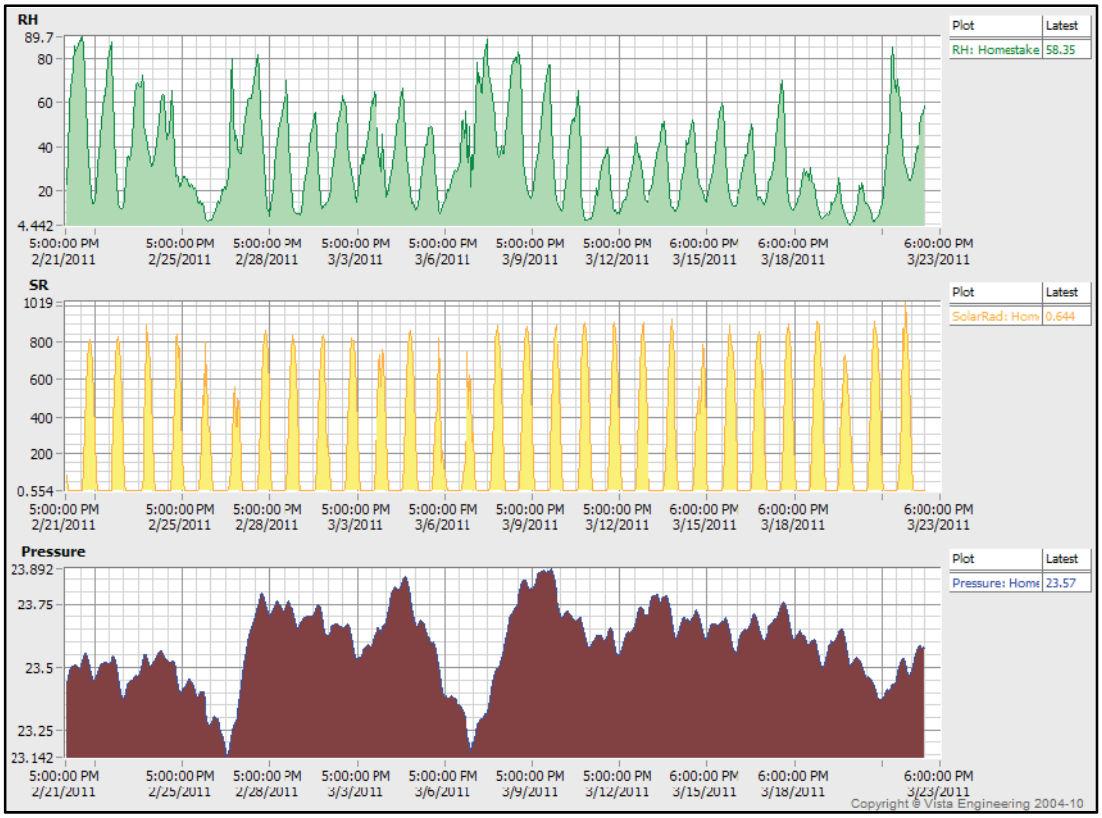


Figure 3.3 Strip-Chart of Real-Time Data

For the purposes of this data report, data failures or discrepancies that would invalidate an hourly average for the meteorological site are listed below:

- Visual evidence, on the stacked parameter/time plots for example, that the one-hour value is an outlier; and
- Audit, calibration or maintenance visit.

Invalid data periods for the third quarter 2011 are presented in Table 3-2.

Table 3-2

Invalid Data Periods Third Quarter 2011

Parameter	Beginning		Ending		Reason	Result
	Date	Time	Date	Time		
All parameters	07/02/2011	04:00	07/06/2011	10:00	1	Set to missing

1. Power outage.

3.5 Equipment Calibration

Meteorological equipment calibrations are performed when audits indicate the need or when problems are identified. Sensors which do not meet US EPA PSD calibration specifications are repaired and re-calibrated. No calibrations were conducted during the third quarter 2011.

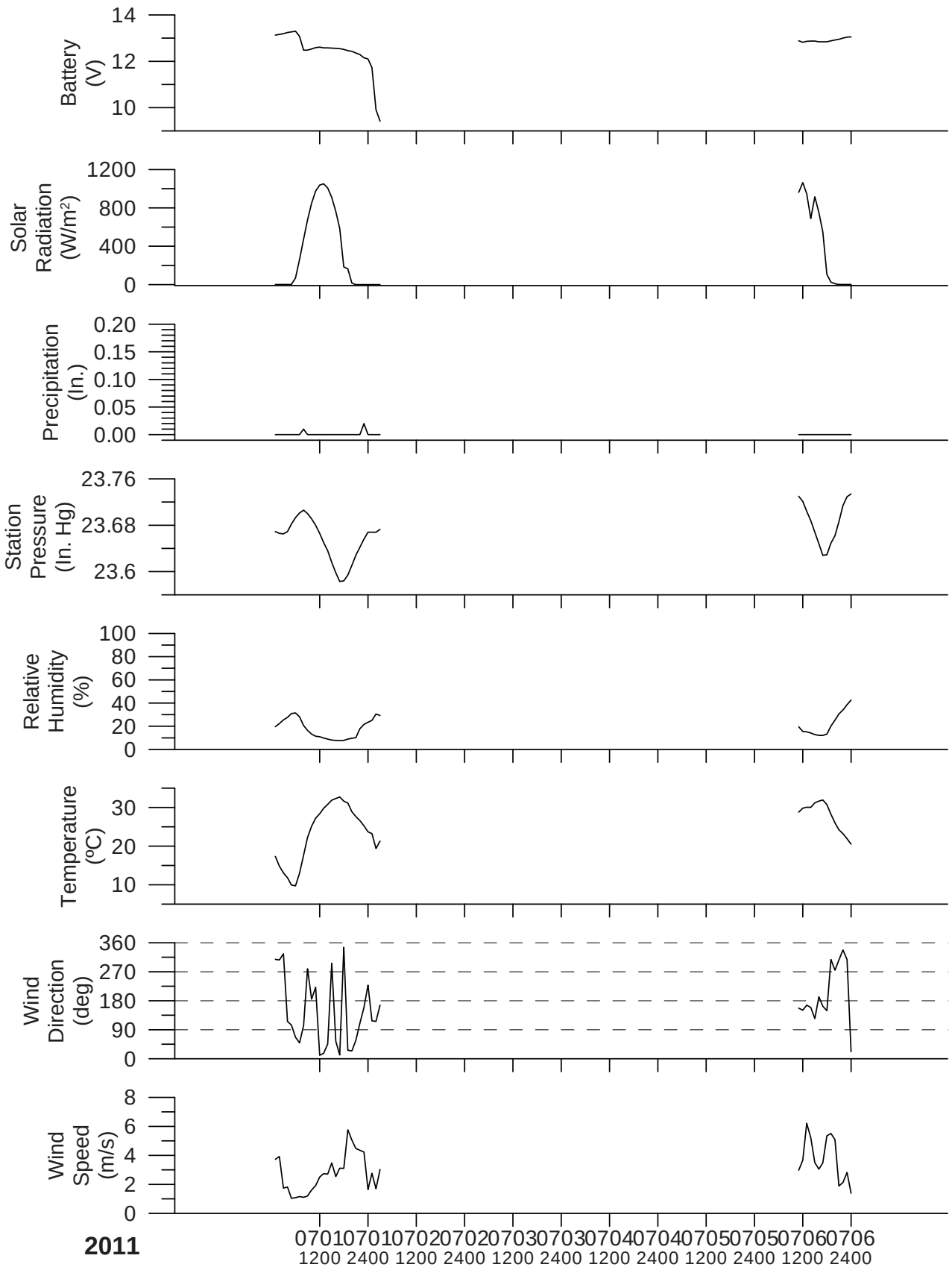
4.0 QUALITY ASSURANCE AUDITS

In order to comply with EPA requirements, a performance audit of meteorological instrumentation is conducted every six months. Audit reference standards are independent of those used for calibration checks.

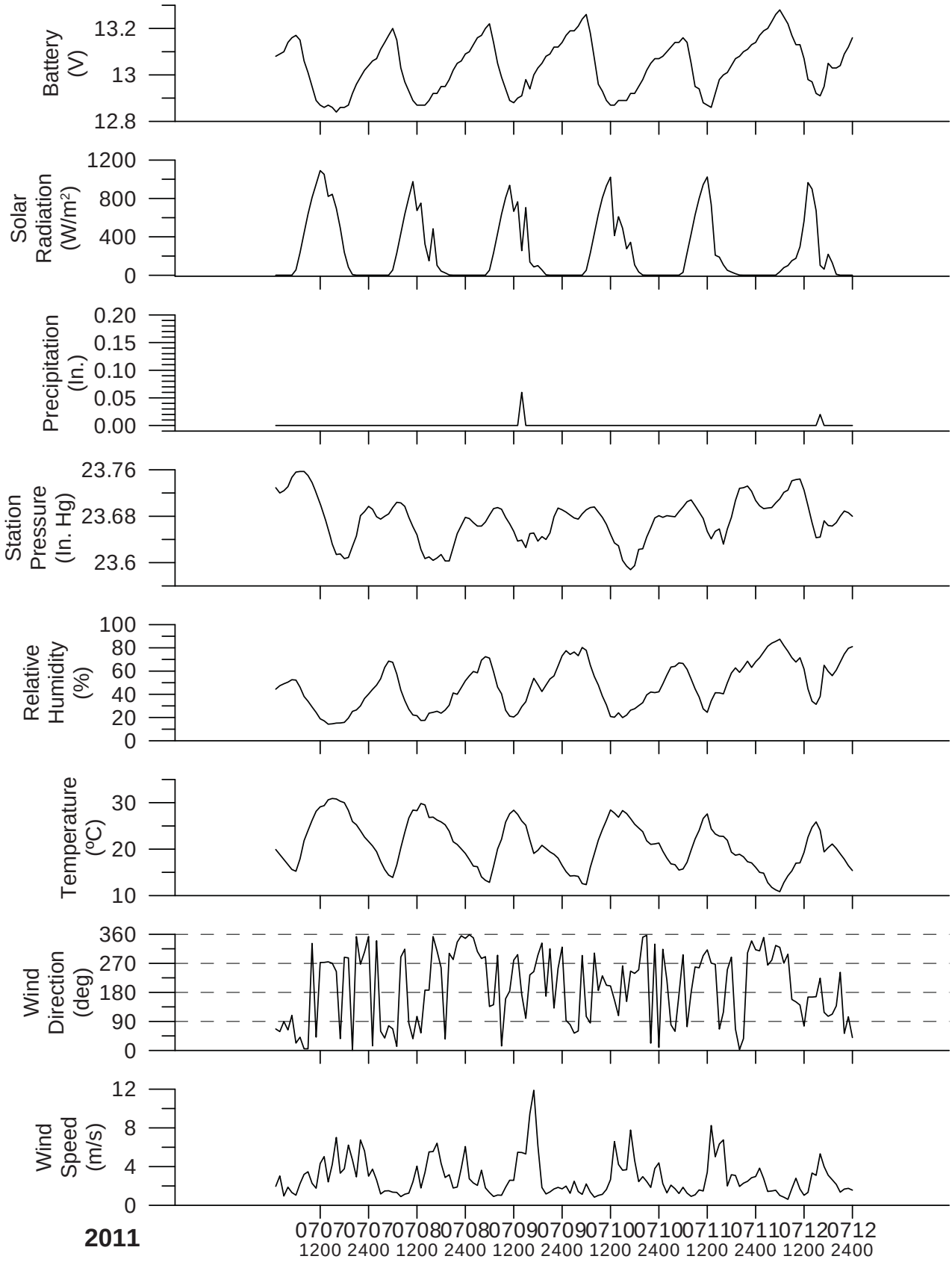
A quality assurance performance audit of the meteorological sensors was conducted on April 19, 2011. Results of this audit are presented in a separate report.

Appendix A
Stacked Parameter Plots for July through September 2011

Homestake Stacked Plots



Homestake Stacked Plots



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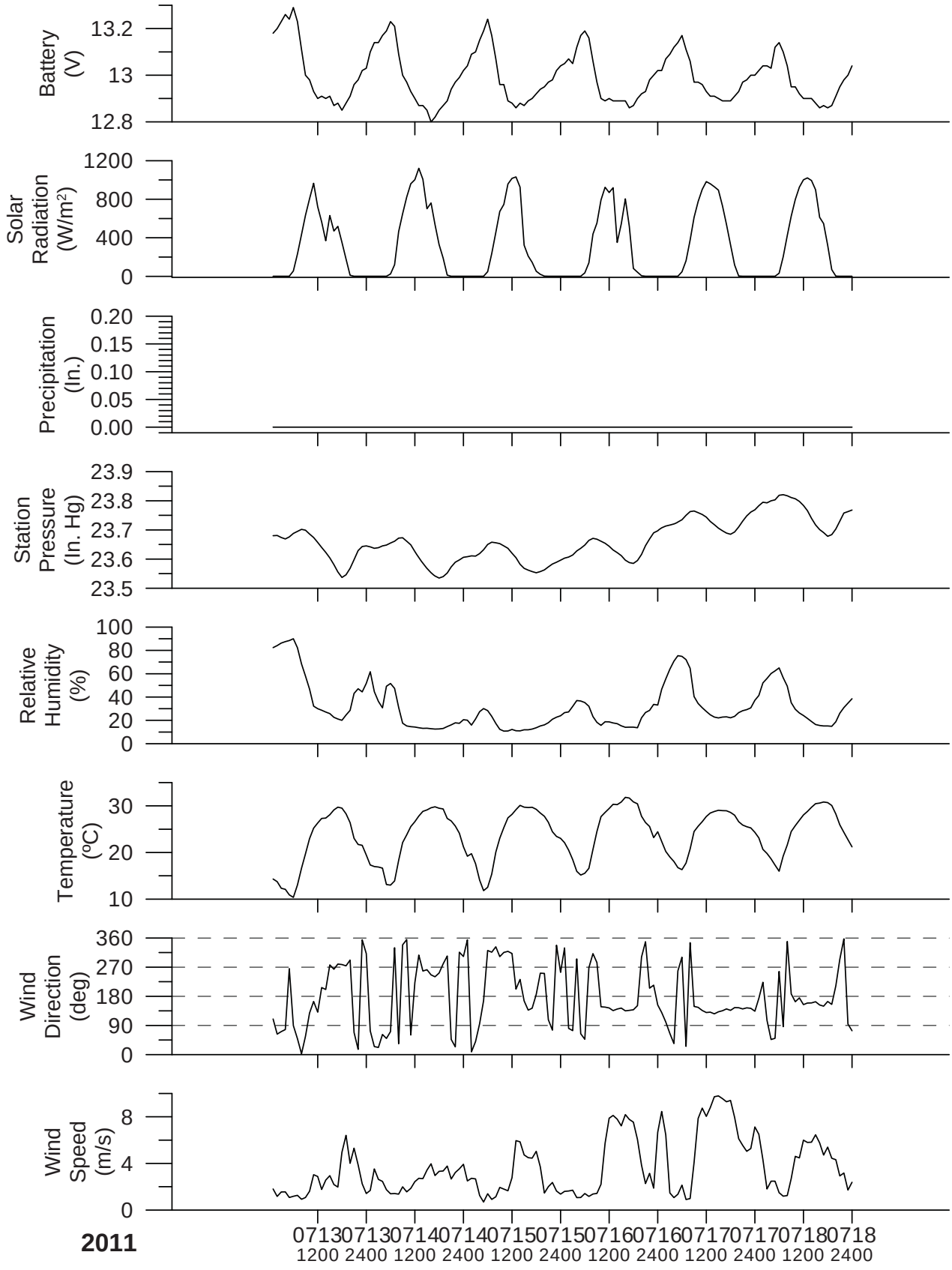

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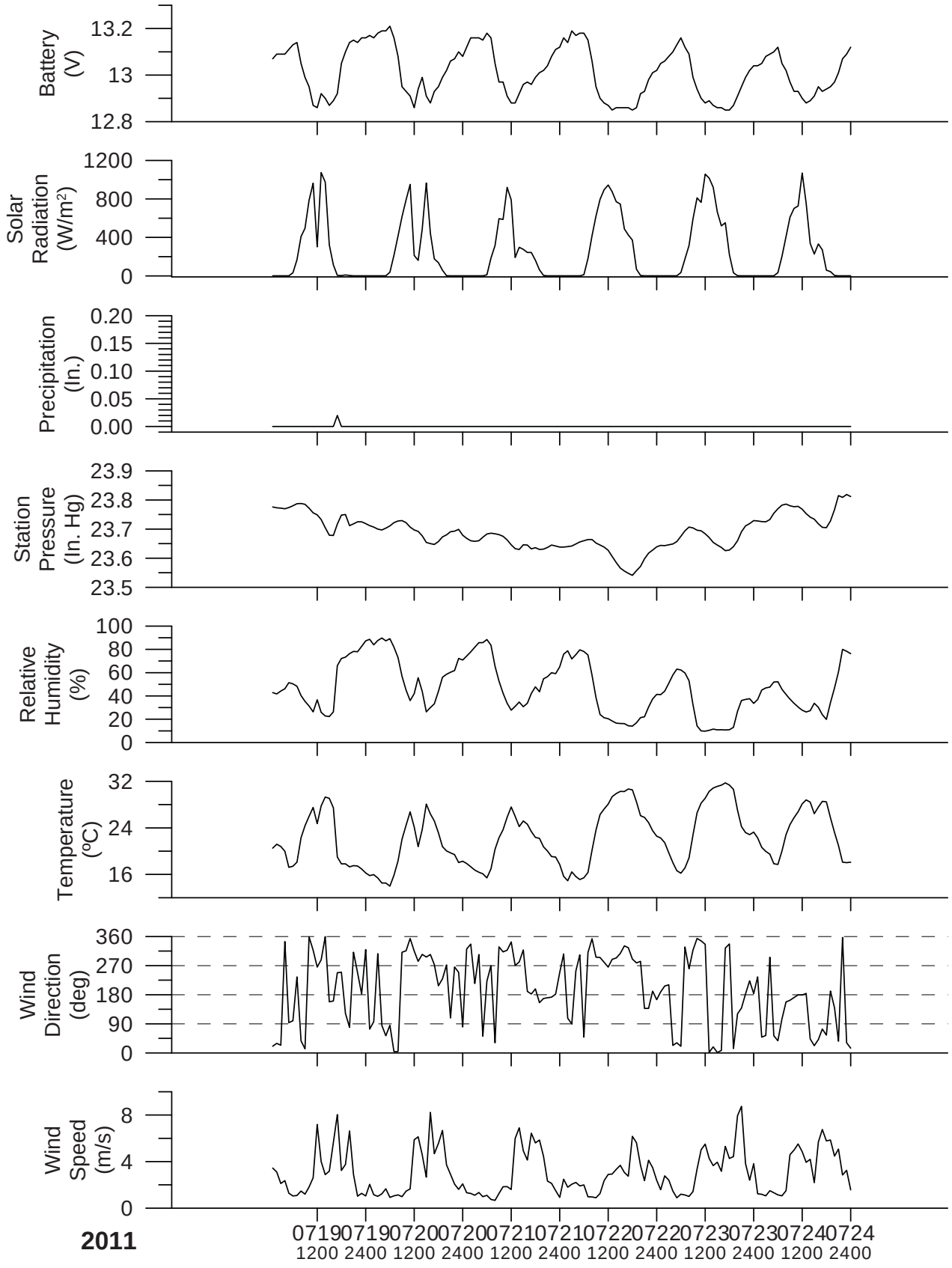
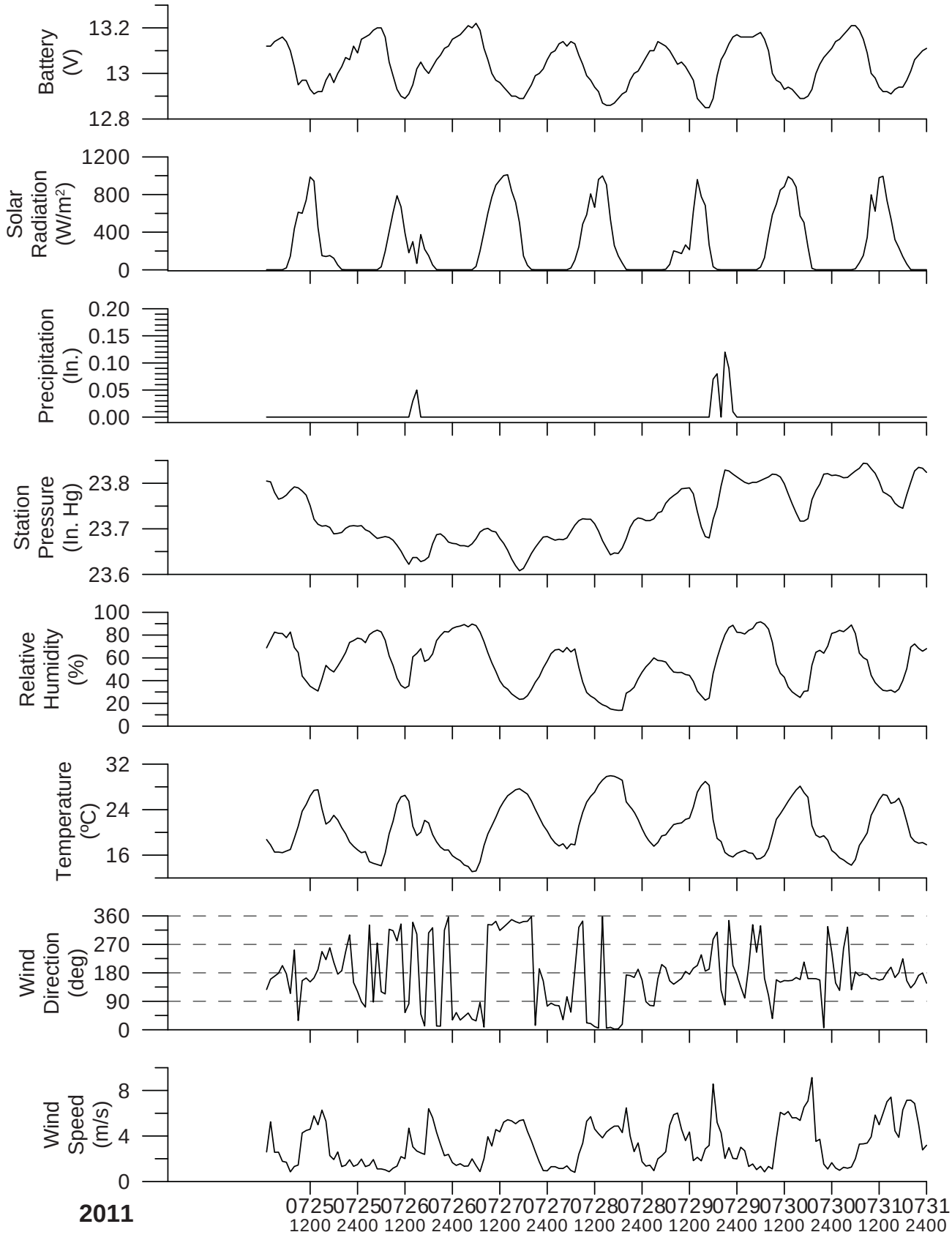


Homestake Stacked Plots



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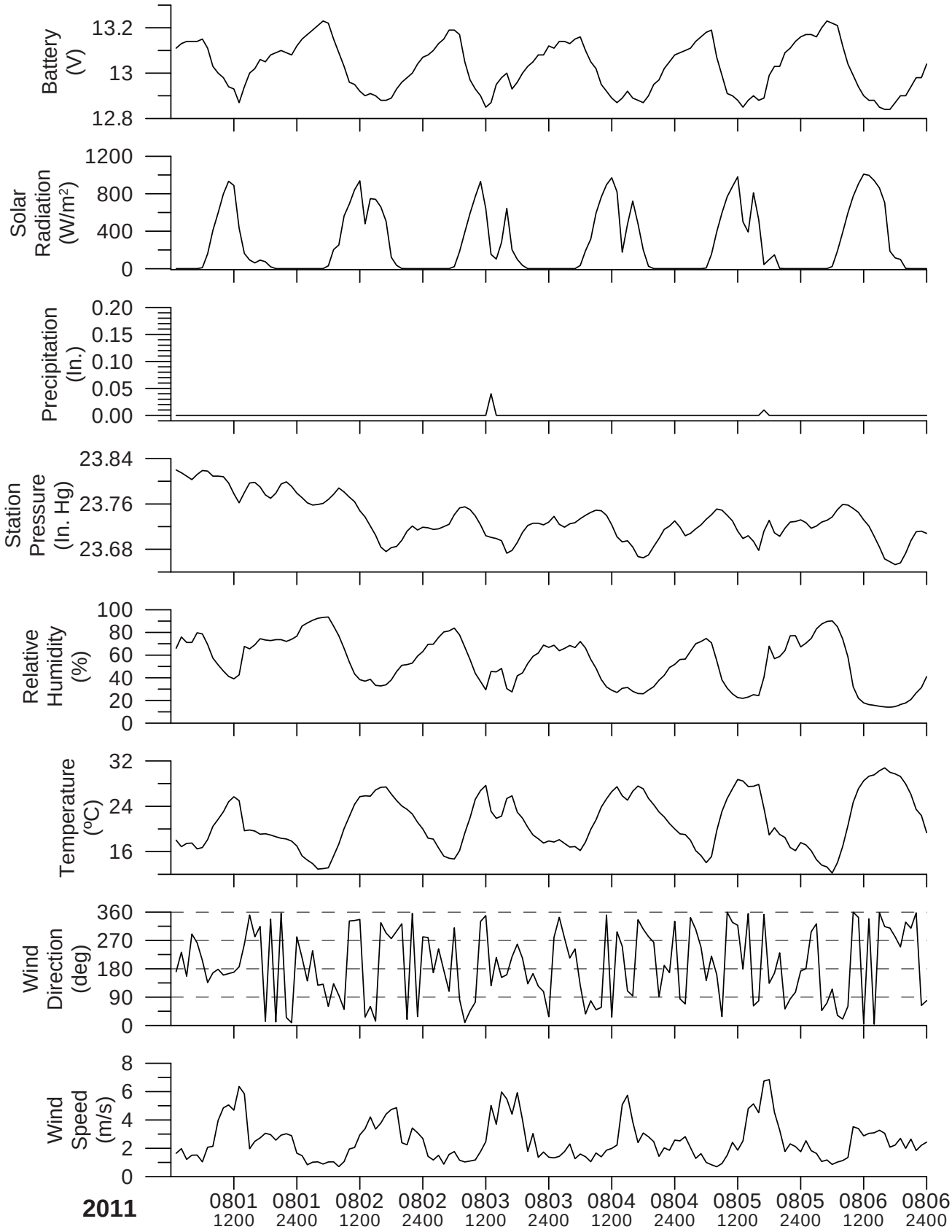

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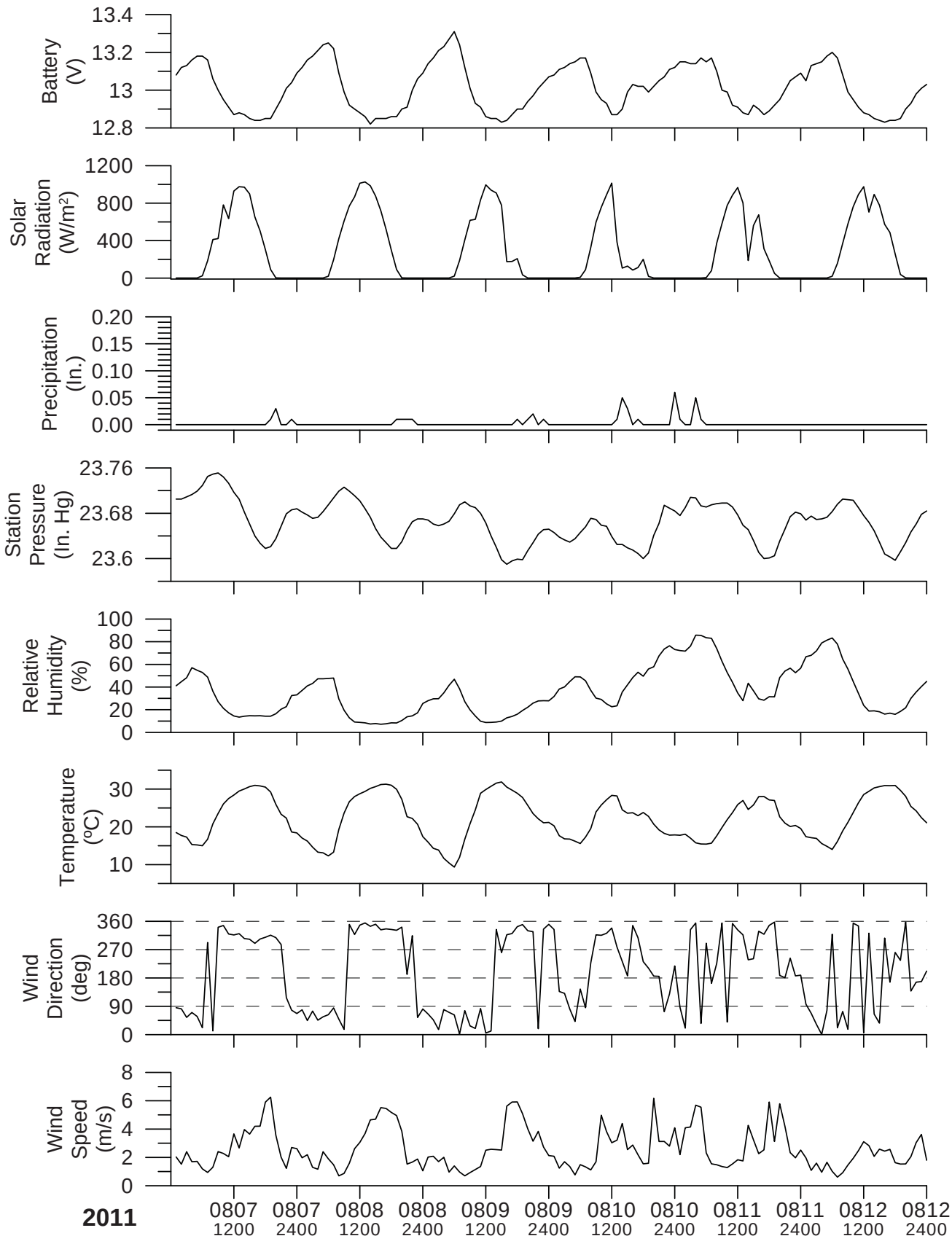

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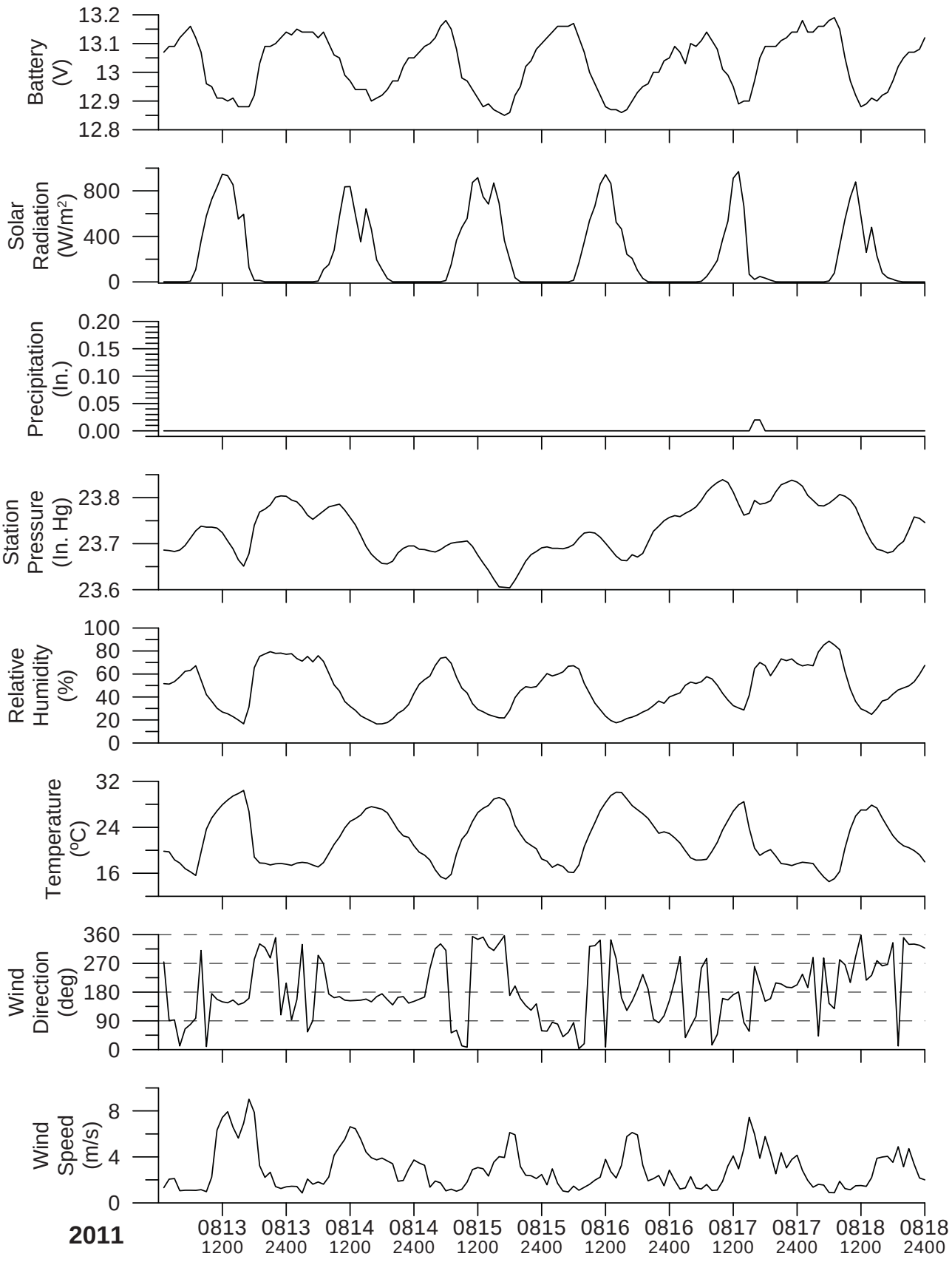

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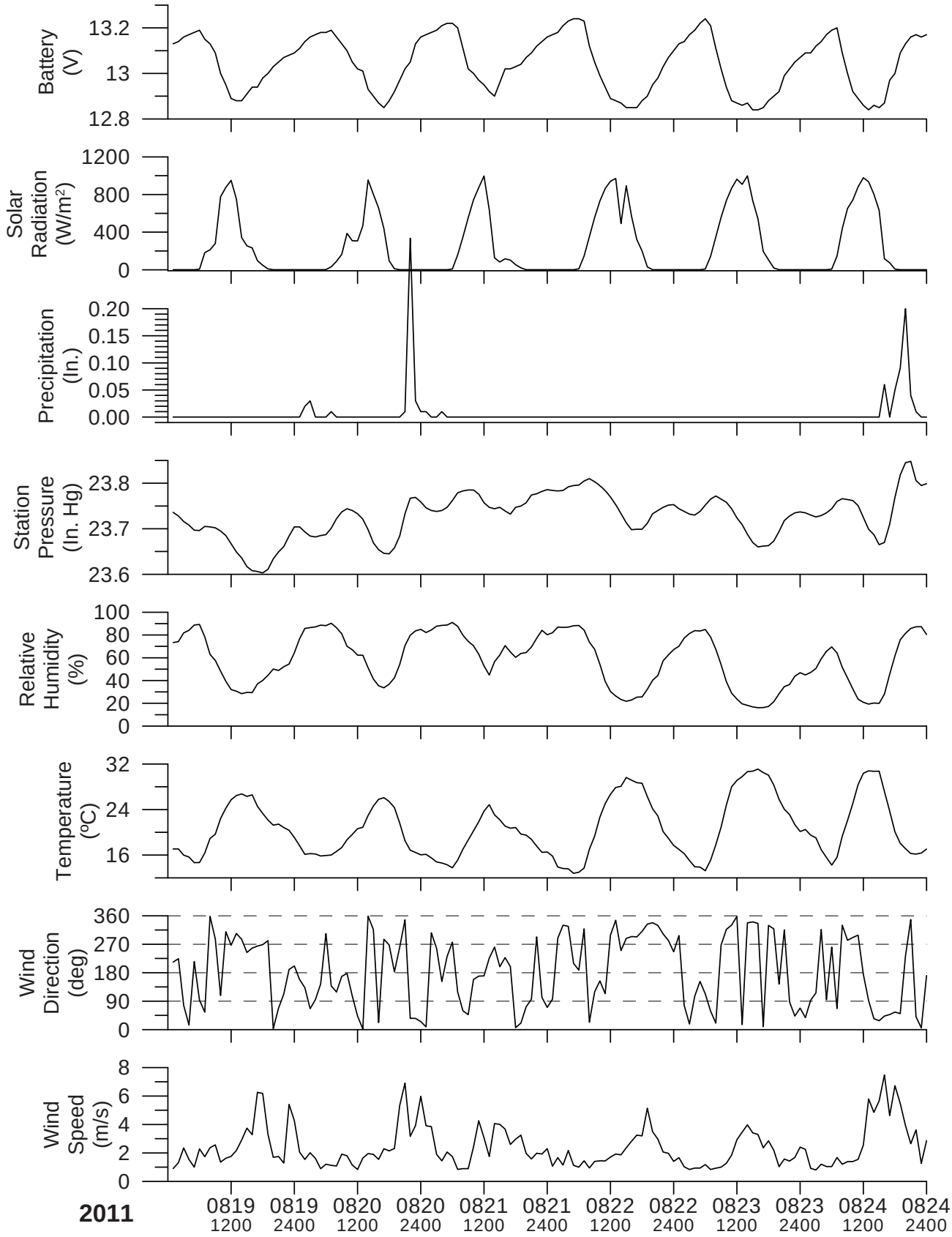

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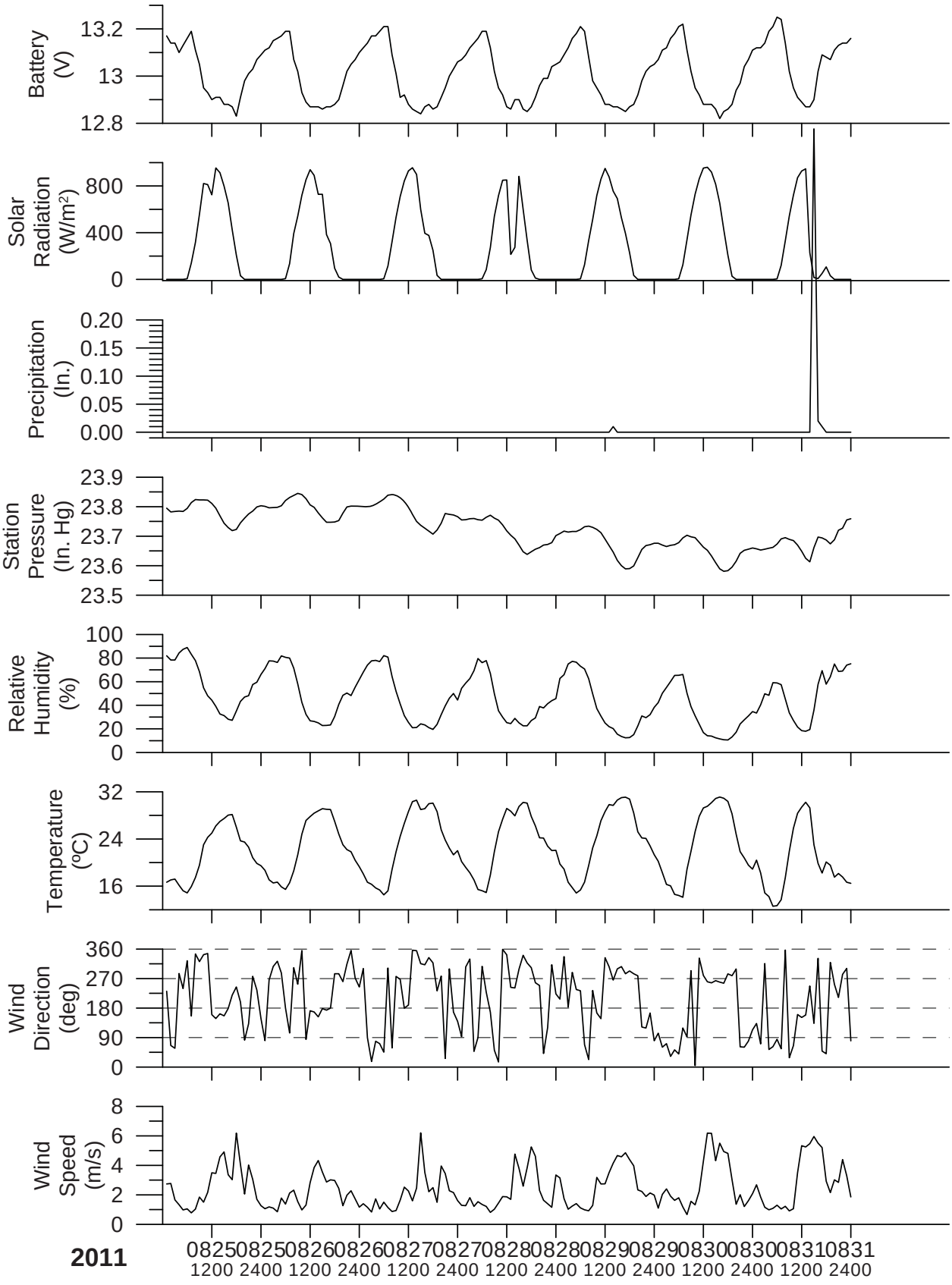

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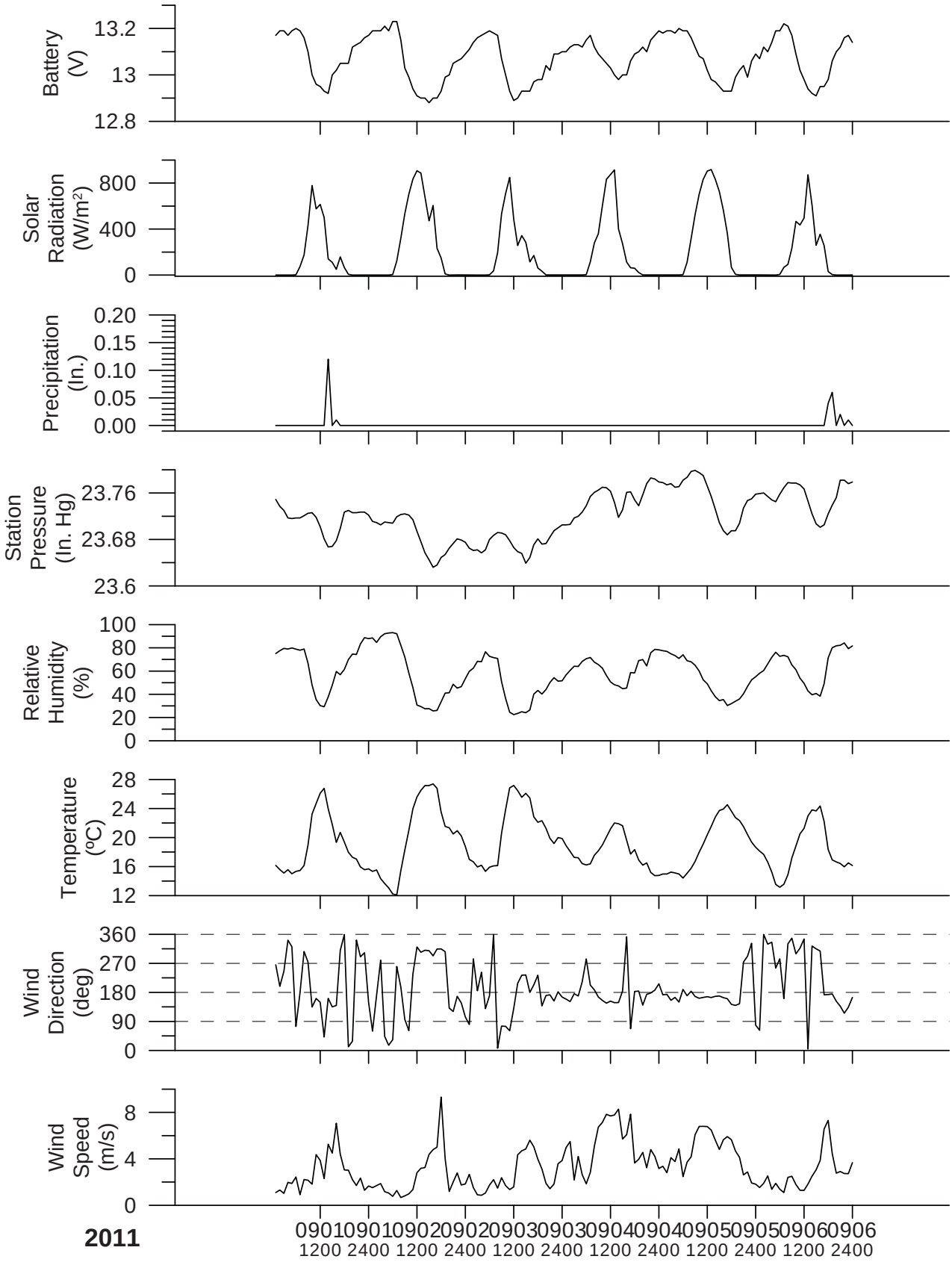

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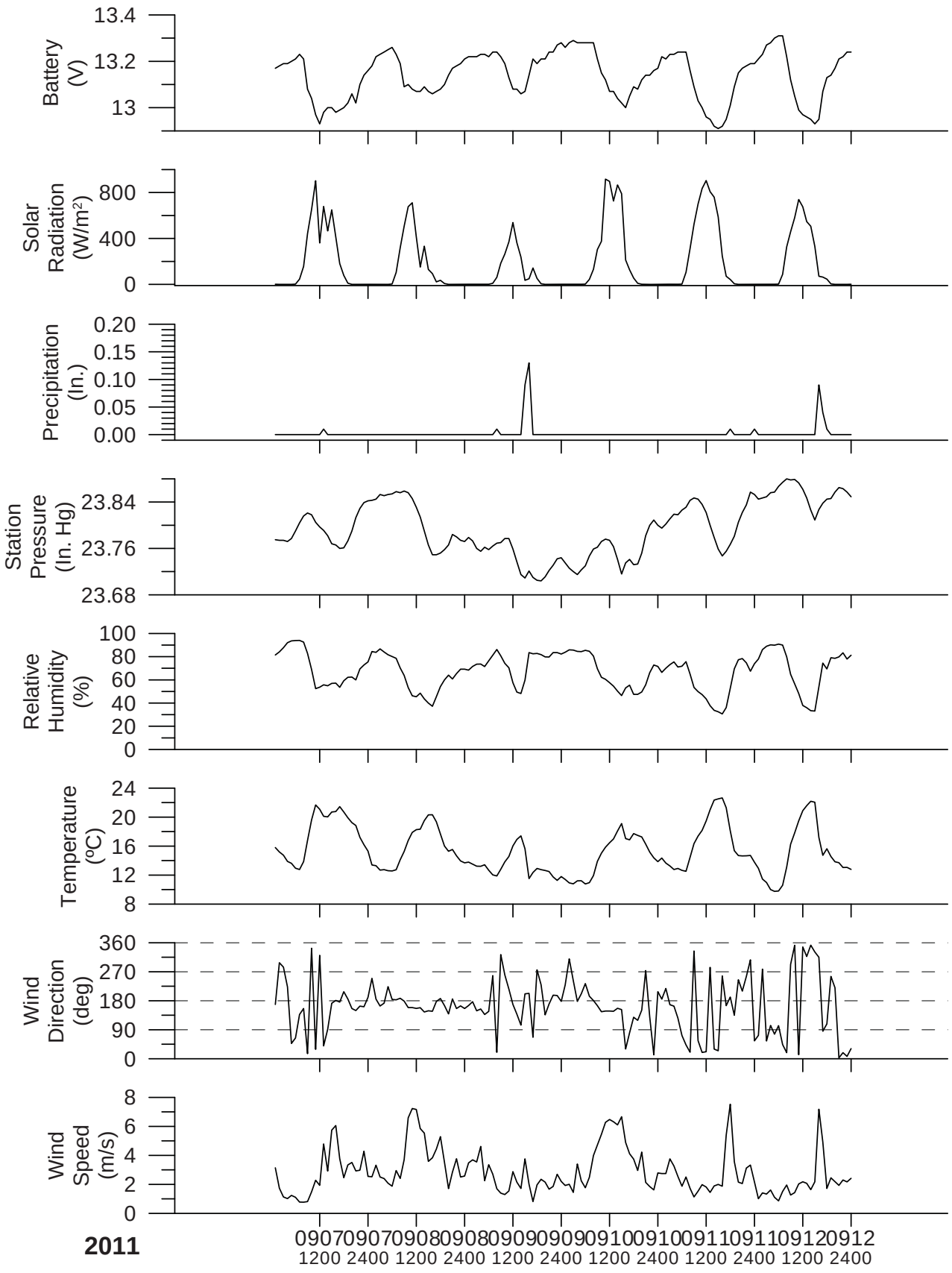

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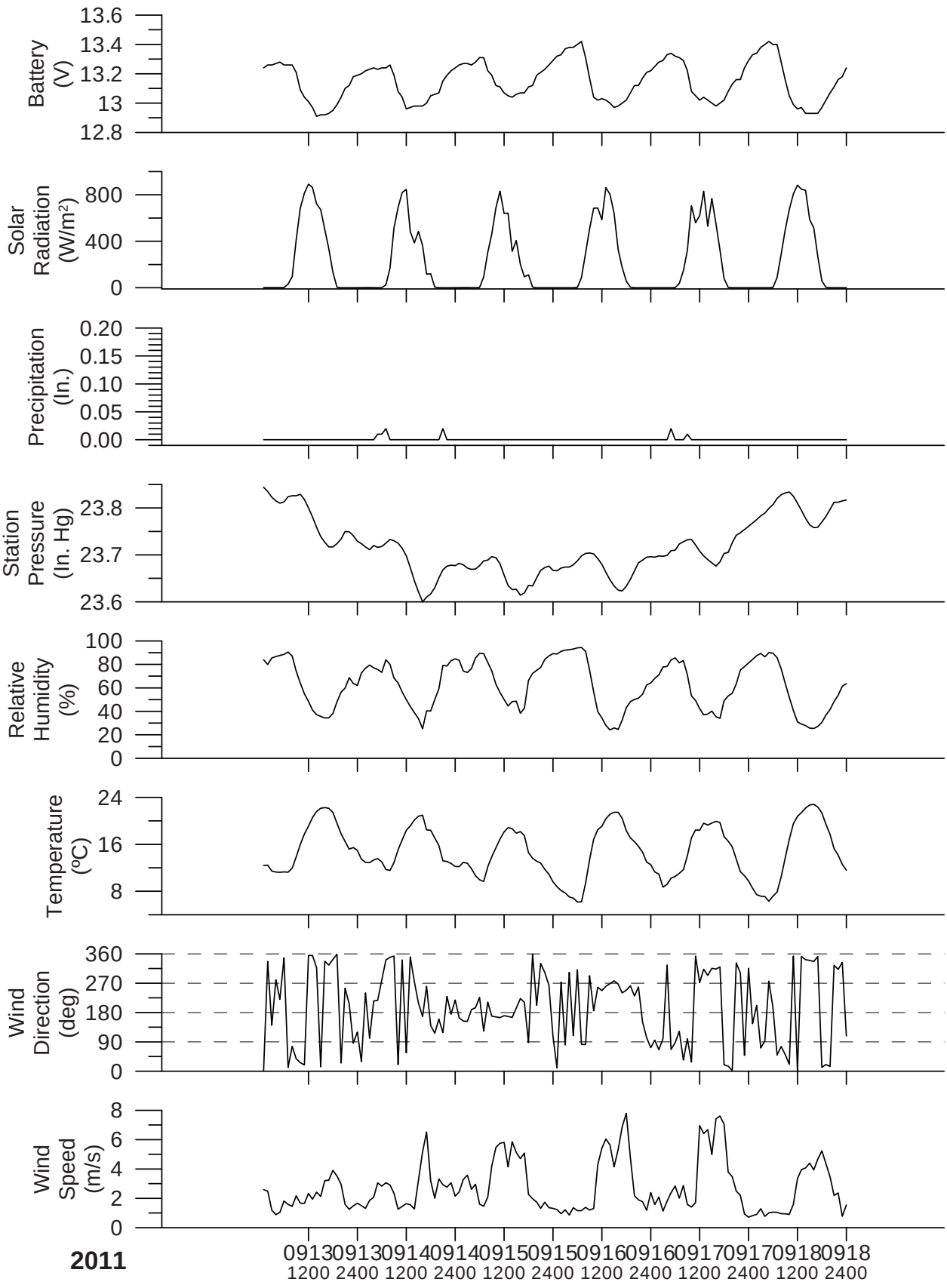

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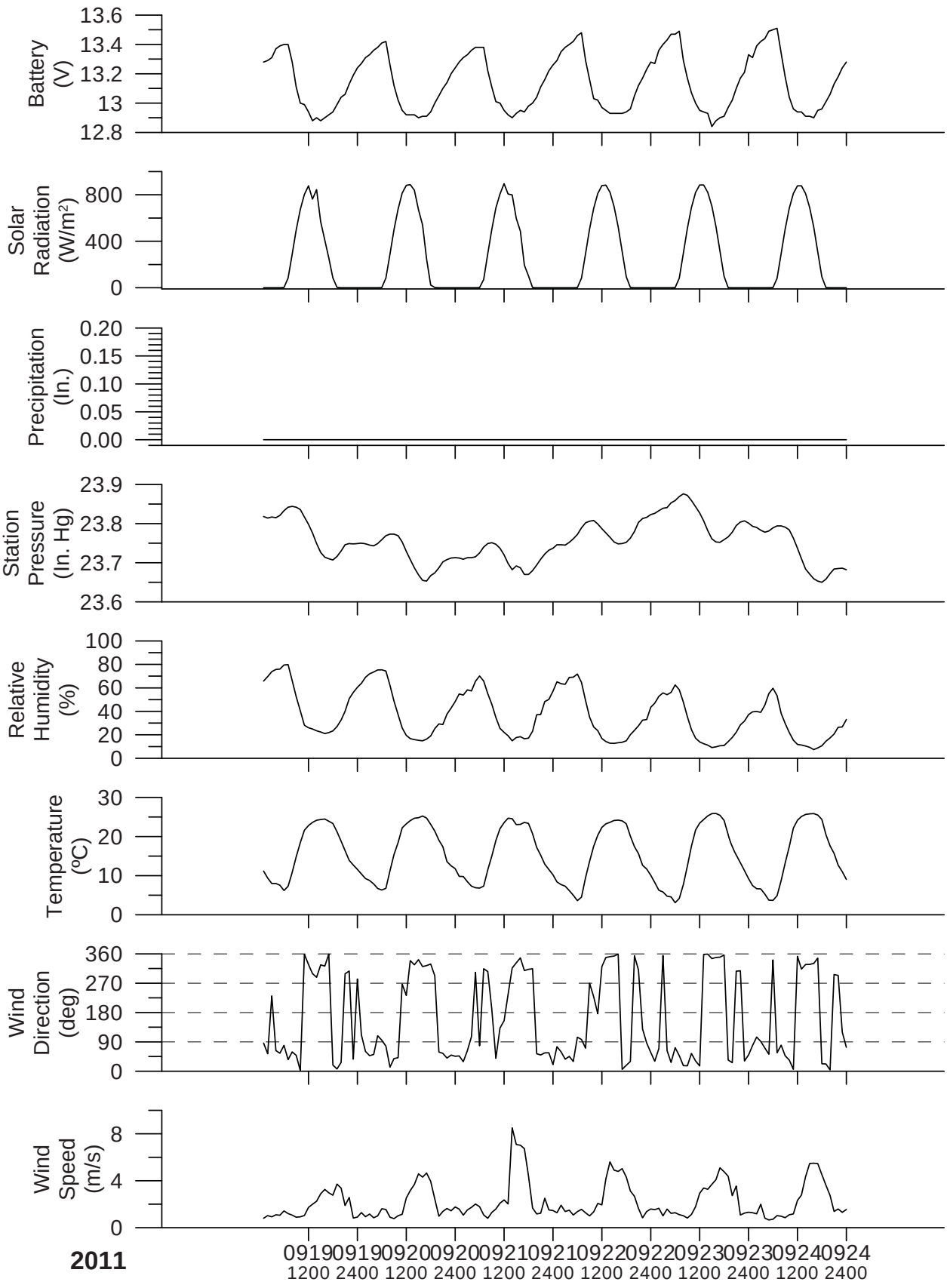
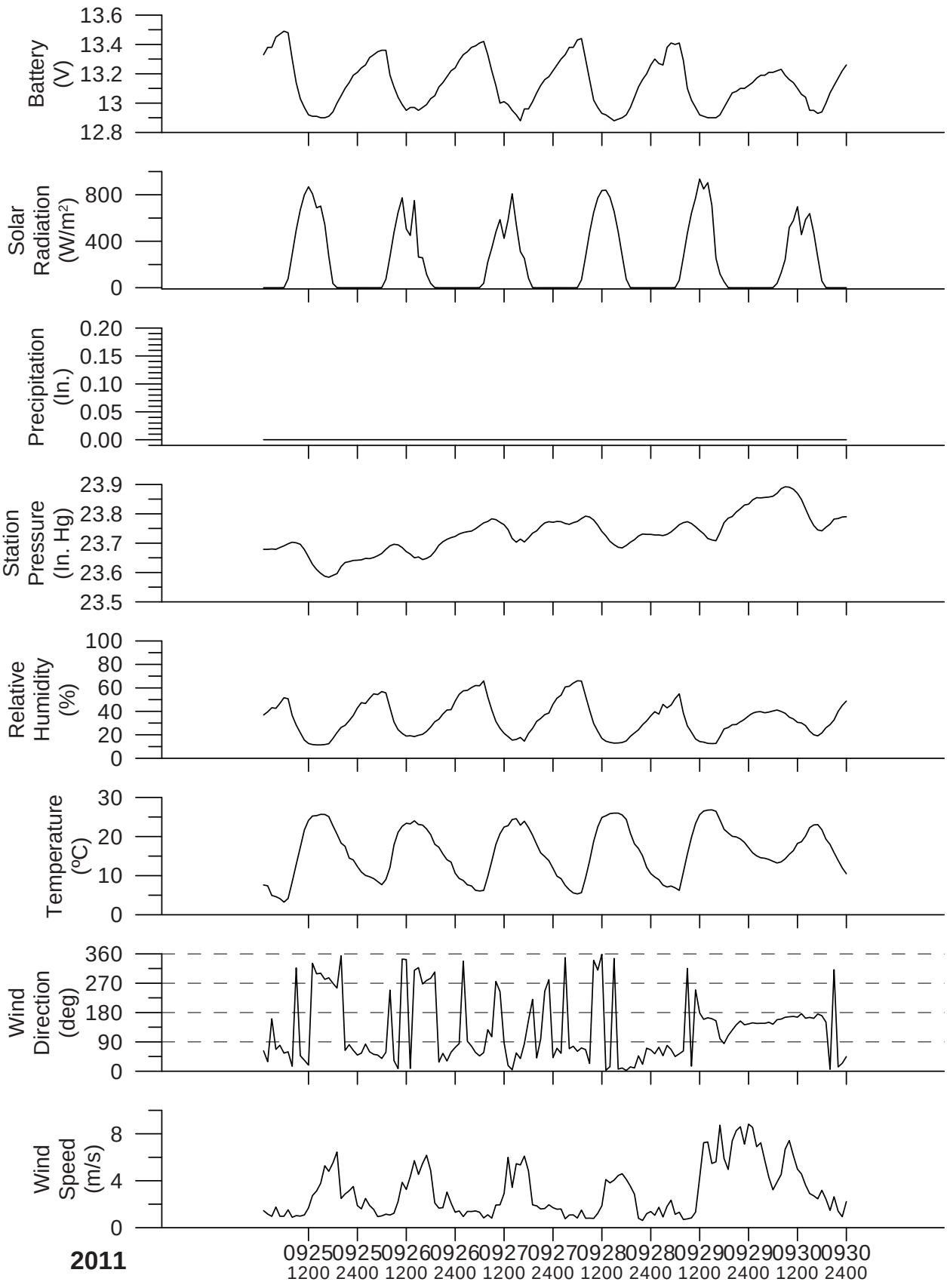


Homestake Stacked Plots



Appendix B
Wind Information for 10-Meter Levels for July through September 2011

B.1 Hourly Average Wind Speed/Direction

B.2 Joint Frequency of Occurrence Distributions of Wind Speeds and Directions

Appendix B.1
Hourly Average Wind Speed/Direction

Homestake

10M Wind Speed and Direction in m/s for JULY, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13
01	308/03.7	307/03.9	326/01.7	116/01.8	105/01.0	067/01.1	049/01.2	103/01.1	279/01.2	185/01.6	222/01.9	011/02.5	017/02.7
02	118/02.8	116/01.7	167/03.0										
03													
04													
05													
06											157/03.0	151/03.7	166/06.2
07	067/02.0	059/03.0	090/01.0	064/01.9	109/01.3	023/01.0	041/02.2	005/03.2	005/03.5	332/02.3	042/01.8	272/04.3	273/05.0
08	014/03.7	340/02.6	060/01.2	038/01.5	077/01.5	067/01.4	013/01.3	290/00.9	314/01.2	085/01.3	036/02.4	105/04.1	054/01.8
09	359/02.7	349/02.3	307/02.1	285/03.6	291/01.8	136/01.3	142/00.9	295/01.1	014/01.0	160/01.9	184/02.6	280/02.6	297/05.5
10	093/02.0	080/01.2	054/02.5	060/01.4	294/01.1	106/02.2	085/01.4	302/00.8	186/01.0	232/01.1	202/01.6	200/02.7	157/06.6
11	314/02.2	218/01.3	079/02.1	059/01.7	173/01.2	297/01.9	074/01.3	180/00.9	259/01.1	256/01.6	294/01.5	312/03.4	271/08.2
12	309/03.8	350/02.8	264/01.4	280/01.5	325/01.6	320/01.0	271/00.8	298/00.6	158/01.7	151/02.8	141/01.7	076/01.0	166/01.3
13	110/01.8	063/01.2	071/01.5	077/01.6	265/01.1	090/01.2	049/01.3	002/00.9	057/01.1	128/01.6	164/03.0	131/02.9	207/01.8
14	073/01.7	025/03.5	022/02.6	062/02.5	050/01.7	071/01.4	330/01.4	034/01.4	339/02.0	355/01.6	060/01.9	222/02.4	307/02.7
15	354/02.5	008/02.7	040/02.7	096/01.3	167/00.7	321/01.4	316/00.9	333/01.1	303/01.9	316/01.8	319/01.7	312/02.8	202/06.0
16	329/01.6	081/01.6	074/01.7	296/01.1	064/01.1	047/01.4	268/01.2	312/01.4	284/01.4	148/02.2	146/05.7	144/07.9	136/08.1
17	130/08.5	101/06.4	065/01.5	034/01.1	258/01.4	301/02.1	026/00.9	345/01.0	149/04.1	146/07.9	136/08.7	130/08.0	131/08.8
18	174/06.5	223/04.3	106/01.8	046/02.5	050/02.5	257/01.5	086/01.2	349/01.2	187/02.7	163/04.6	175/04.5	155/06.0	159/05.8
19	021/03.4	030/03.1	024/02.1	345/02.4	094/01.3	100/01.0	235/01.1	037/01.5	013/01.2	359/01.8	318/02.6	266/07.2	288/04.0
20	074/02.0	096/01.2	307/01.0	085/01.2	053/01.7	085/00.9	004/01.1	004/01.1	311/01.0	316/01.5	354/01.7	315/05.9	283/06.1
21	321/01.3	336/01.3	215/01.1	304/01.3	052/01.0	222/01.1	270/00.7	031/00.7	328/01.3	312/01.8	318/01.8	343/01.6	271/06.0
22	306/02.5	107/01.8	089/02.1	254/02.2	303/01.9	049/02.0	310/01.0	353/01.0	296/00.9	295/01.3	280/02.4	266/02.9	290/02.9
23	189/01.6	207/02.8	211/02.4	023/01.5	031/00.9	021/01.2	328/01.1	260/01.0	318/01.4	354/03.3	346/05.0	336/05.5	002/04.3
24	235/01.2	049/01.2	054/01.1	296/01.5	053/01.3	038/01.1	105/01.1	158/01.5	163/04.6	171/05.0	180/05.5	179/04.9	184/03.9
25	127/02.6	160/05.2	169/02.6	179/02.6	203/01.8	177/01.7	115/00.9	252/01.3	029/01.4	155/04.3	164/04.5	151/04.6	164/05.8
26	089/02.0	072/01.3	331/01.4	088/01.9	274/01.1	120/01.1	113/01.0	318/00.9	313/01.2	281/01.4	334/02.2	054/02.0	082/04.7
27	055/01.4	031/01.6	042/01.3	053/01.4	034/02.0	028/01.4	086/00.9	009/02.0	332/03.9	331/03.1	343/04.6	314/04.4	325/05.2
28	084/01.3	077/01.3	076/01.2	032/01.2	104/01.4	056/01.0	189/00.8	324/02.4	344/03.4	022/05.3	020/05.7	010/04.6	005/04.2
29	089/01.4	077/01.4	075/01.0	161/02.0	206/02.3	196/02.6	155/04.9	144/05.9	153/06.0	162/04.6	184/03.6	175/04.4	194/01.8
30	135/03.0	100/02.7	200/01.3	332/01.5	245/01.0	329/01.3	162/00.9	109/01.3	036/01.1	158/03.8	150/06.1	156/05.9	155/06.1
31	148/01.2	124/01.0	257/01.3	324/01.2	127/01.3	183/02.0	171/03.3	177/03.3	174/03.4	161/03.9	163/05.8	157/05.0	160/06.0
MEAN	065/02.6	063/02.4	060/01.7	032/01.7	067/01.4	058/01.4	065/01.3	339/01.5	320/02.1	199/02.8	180/03.5	200/04.2	212/04.9
MX SPD	130/08.5	101/06.4	167/03.0	285/03.6	050/02.5	196/02.6	155/04.9	144/05.9	153/06.0	146/07.9	136/08.7	130/08.0	131/08.8
MN SPD	235/01.2	124/01.0	090/01.0	296/01.1	167/00.7	085/00.9	270/00.7	298/00.6	296/00.9	232/01.1	294/01.5	076/01.0	166/01.3

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Homestake

10M Wind Speed and Direction in m/s for JULY, 2011 PAGE 2

HR END DAY	14	15	16	17	18	19	20	21	22	23	24	MEAN	MX SPD	MN SPD
01	045/02.7	296/03.5	054/02.5	012/03.1	346/03.1	026/05.8	024/05.0	057/04.5	110/04.4	159/04.2	229/01.6	031/02.7	026/05.8	105/01.0
02													167/03.0	116/01.7
03														
04														
05														
06	159/05.2	125/03.5	192/03.1	163/03.5	149/05.3	308/05.5	275/05.1	306/01.9	338/02.1	308/02.8	022/01.4		166/06.2	022/01.4
07	275/02.4	270/04.2	245/07.0	037/03.3	289/03.8	287/06.2	360/04.7	353/02.9	267/06.8	305/05.6	353/03.0	349/03.4	245/07.0	090/01.0
08	187/03.4	187/05.5	353/05.6	308/06.4	257/04.3	035/02.9	301/03.2	282/01.8	336/01.9	356/03.8	347/06.1	006/02.9	308/06.4	290/00.9
09	173/05.5	099/05.3	234/09.5	245/11.9	295/06.2	333/01.8	168/01.2	315/01.4	131/01.7	254/01.8	320/01.7	274/03.2	245/11.9	142/00.9
10	108/04.2	262/03.6	152/03.7	246/07.8	239/04.6	250/02.4	351/03.0	357/02.5	023/01.8	329/03.8	009/04.4	148/02.8	246/07.8	302/00.8
11	267/05.0	066/06.3	119/06.8	250/02.0	289/03.2	066/03.1	003/01.9	037/02.3	302/02.5	339/02.9	312/03.0	308/02.8	271/08.2	180/00.9
12	165/03.3	167/03.1	224/05.3	118/04.0	106/03.1	112/02.6	138/02.2	242/01.4	053/01.7	104/01.8	040/01.6	157/02.2	224/05.3	298/00.6
13	201/02.6	277/03.0	264/02.2	280/02.0	278/05.0	274/06.4	292/04.0	068/05.3	016/03.9	355/02.3	312/01.4	019/02.5	274/06.4	002/00.9
14	258/02.7	262/03.4	246/04.0	240/03.0	252/03.3	280/03.4	304/03.8	047/02.7	024/03.2	316/03.5	303/03.9	340/02.7	246/04.0	071/01.4
15	232/05.9	166/04.7	137/04.5	143/04.5	186/05.0	251/03.7	251/01.5	108/02.0	076/02.4	338/01.6	254/01.4	293/02.7	202/06.0	167/00.7
16	141/07.8	144/07.2	135/08.2	137/07.8	139/07.5	151/06.1	301/03.8	348/02.3	205/03.1	214/01.9	153/06.7	143/04.1	135/08.2	296/01.1
17	126/09.7	132/09.8	136/09.6	141/09.3	137/09.4	145/08.0	145/06.1	141/05.6	145/05.0	143/05.3	134/07.1	128/06.1	132/09.8	026/00.9
18	160/05.8	163/06.5	153/05.8	150/04.7	164/05.4	155/04.4	213/04.3	294/02.9	357/03.2	094/01.7	074/02.4	150/03.8	174/06.5	086/01.2
19	360/02.9	158/03.2	161/05.6	248/08.0	250/03.2	122/03.8	079/06.6	311/02.9	248/01.0	182/01.3	320/01.0	344/03.0	248/08.0	100/01.0
20	305/04.6	297/02.7	304/08.2	273/04.7	208/05.6	229/06.7	272/03.7	108/02.9	266/02.1	249/01.6	080/02.1	323/03.0	304/08.2	085/00.9
21	281/06.9	319/04.9	190/04.1	182/06.4	198/05.6	155/05.9	168/04.4	171/02.3	173/02.1	182/01.5	249/00.9	258/02.8	281/06.9	270/00.7
22	294/03.3	308/03.7	331/03.1	325/02.7	290/06.2	278/05.6	283/03.7	138/02.4	138/04.1	191/03.5	165/02.4	293/02.7	290/06.2	296/00.9
23	019/03.7	001/03.9	008/03.2	324/05.3	337/04.3	013/04.4	121/07.9	139/08.7	183/03.8	223/02.4	184/03.8	341/03.5	139/08.7	031/00.9
24	043/04.2	022/02.2	041/05.7	074/06.8	055/05.8	191/05.8	140/04.5	036/05.1	357/02.8	031/03.2	015/01.6	080/03.4	074/06.8	054/01.1
25	191/05.0	247/06.3	222/05.3	259/02.3	213/01.9	176/02.6	187/01.3	246/01.4	300/01.9	149/01.3	121/01.5	183/02.9	247/06.3	115/00.9
26	340/03.1	302/02.7	050/02.5	012/02.4	306/06.4	323/05.6	012/04.3	011/03.3	315/02.3	356/02.4	031/01.7	003/02.5	306/06.4	318/00.9
27	336/05.4	348/05.3	342/05.1	337/05.3	342/05.4	343/04.4	358/03.6	014/02.6	193/01.7	154/01.0	075/00.9	007/03.1	336/05.4	086/00.9
28	357/03.8	005/04.3	008/04.6	002/04.9	003/04.9	017/04.3	173/06.5	171/04.0	166/02.6	192/03.4	157/01.7	041/03.3	173/06.5	189/00.8
29	203/02.1	237/01.8	185/02.9	192/03.2	286/08.6	309/05.2	125/04.3	079/02.0	346/03.0	203/02.0	174/02.0	171/03.3	286/08.6	075/01.0
30	156/05.6	165/05.6	159/05.4	214/06.5	162/07.1	162/09.1	161/03.5	157/03.7	006/01.5	326/01.1	246/01.6	162/03.6	162/09.1	162/00.9
31	182/07.0	198/07.4	165/04.5	180/03.9	225/06.3	155/07.1	132/07.2	146/06.9	172/05.0	180/02.8	147/03.2	169/04.2	198/07.4	124/01.0
MEAN	211/04.6	237/04.6	179/05.1	238/05.0	249/05.2	251/04.9	219/04.1	049/03.2	341/02.9	237/02.6	016/02.6	028/03.2		
MX SPD	126/09.7	132/09.8	136/09.6	245/11.9	137/09.4	162/09.1	121/07.9	139/08.7	267/06.8	305/05.6	134/07.1		245/11.9	
MN SPD	203/02.1	237/01.8	264/02.2	250/02.0	213/01.9	333/01.8	168/01.2	315/01.4	248/01.0	154/01.0	249/00.9			298/00.6

POSSIBLE NUMBER OF OBSERVATIONS = 744 ACTUAL NUMBER OF OBSERVATIONS = 641 DATA RECOVERY RATE = 86.2 %

MONTHLY MEAN = 028/03.2 MAXIMUM WIND SPEED WAS 11.9 m/s AT 245 DEGREES ON 7/ 9 AT 1700

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Homestake

10M Wind Speed and Direction in m/s for AUGUST, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13
01	171/01.6	233/02.0	156/01.2	290/01.5	262/01.5	206/01.0	136/02.1	167/02.1	179/04.0	160/04.9	165/05.1	169/04.7	186/06.4
02	215/01.5	141/00.8	238/01.0	128/01.0	131/00.9	060/01.0	132/01.0	096/00.7	051/01.1	332/02.0	333/02.1	336/02.9	027/03.4
03	279/01.4	168/01.2	243/01.5	175/00.9	108/01.6	310/01.8	083/01.2	010/01.0	046/01.1	074/01.2	330/01.8	349/02.5	127/05.0
04	280/01.3	343/01.4	277/01.8	214/02.3	243/01.3	127/01.6	037/01.4	079/01.1	050/01.7	057/01.4	351/01.9	026/02.0	297/02.2
05	084/02.5	068/02.8	343/02.0	305/01.3	249/01.6	142/01.0	220/00.8	162/00.7	028/00.9	360/01.5	327/02.4	318/01.9	179/02.5
06	180/02.5	298/01.8	323/01.6	047/01.1	072/01.2	115/00.9	032/01.0	020/01.1	061/01.3	359/03.5	343/03.4	004/02.9	339/03.0
07	086/02.0	082/01.5	055/02.4	070/01.7	058/01.7	022/01.2	293/00.9	012/01.3	341/02.4	346/02.3	320/02.0	317/03.7	321/02.7
08	079/02.0	045/02.2	075/01.3	046/01.2	056/02.4	063/01.9	085/01.5	049/00.7	017/00.9	350/01.6	318/02.6	348/03.1	355/03.7
09	065/02.0	047/02.1	016/01.7	080/02.0	071/01.0	062/01.4	002/01.0	076/00.7	028/00.9	020/01.1	083/01.4	005/02.5	011/02.6
10	334/02.1	137/01.2	131/01.7	081/01.4	042/00.8	145/01.5	085/01.3	228/01.1	317/01.7	316/05.0	322/03.8	338/03.0	278/03.2
11	087/02.2	020/04.1	334/04.1	354/05.7	036/05.5	290/02.3	163/01.5	226/01.5	355/01.4	040/01.3	353/01.5	333/01.8	317/01.8
12	097/02.0	068/01.1	032/01.6	001/01.0	077/01.7	319/01.0	022/00.6	074/00.9	017/01.5	354/01.9	345/02.5	006/03.1	322/02.8
13	274/01.3	091/02.1	093/02.1	011/01.1	065/01.1	079/01.1	098/01.1	310/01.2	010/01.0	175/02.2	157/06.3	150/07.4	147/07.9
14	093/01.4	157/01.4	329/00.9	056/02.1	091/01.6	295/01.8	269/01.6	174/02.3	163/04.1	166/04.9	155/05.5	153/06.6	154/06.4
15	158/03.5	165/03.3	254/01.4	316/01.9	331/01.7	311/01.1	052/01.2	061/01.0	012/01.2	007/01.8	354/02.9	345/03.1	352/03.0
16	058/01.6	085/03.0	080/01.7	040/01.0	054/01.0	084/01.5	003/01.1	018/01.4	323/01.6	326/02.0	343/02.2	008/03.8	344/02.7
17	215/02.0	291/01.2	038/01.3	072/02.3	104/01.3	255/01.2	286/01.6	015/01.1	047/01.1	160/01.9	155/03.2	172/04.1	181/03.0
18	236/02.8	194/02.0	288/01.4	042/01.6	287/01.6	145/00.9	128/00.9	281/01.9	266/01.2	210/01.1	291/01.5	358/01.5	217/01.4
19	214/00.9	224/01.3	077/02.4	015/01.5	215/01.0	093/02.3	055/01.7	358/02.4	286/02.6	108/01.4	310/01.6	267/01.8	304/02.2
20	158/02.1	132/01.5	066/02.0	095/01.6	145/00.9	304/01.2	138/01.1	119/01.1	168/01.9	178/01.8	106/01.2	043/00.8	002/01.6
21	009/03.9	306/03.8	257/01.9	152/01.4	232/02.1	277/01.7	119/00.8	060/00.9	047/00.9	158/02.4	169/04.3	170/03.1	226/01.8
22	096/01.1	289/01.7	330/01.1	327/02.2	210/01.1	188/01.0	319/01.4	024/00.9	119/01.4	154/01.4	114/01.4	299/01.7	346/01.9
23	297/01.7	076/01.0	018/00.8	106/00.9	153/00.9	113/01.2	059/00.8	021/00.9	267/01.0	317/01.3	331/01.9	358/02.9	016/03.5
24	038/02.3	093/00.9	116/00.8	317/01.2	095/01.0	261/01.0	067/01.7	330/01.2	283/01.4	292/01.4	299/01.5	175/02.5	092/05.8
25	232/02.7	066/02.8	057/01.7	285/01.3	240/01.0	324/01.0	156/00.8	345/01.0	322/01.8	343/01.5	347/02.2	160/03.5	148/03.5
26	081/01.1	266/01.2	307/01.1	323/00.9	287/01.8	180/01.4	104/02.1	303/02.3	253/01.5	355/01.0	085/01.3	172/02.8	168/03.9
27	301/01.4	090/01.2	017/00.8	079/01.7	071/01.0	045/01.5	302/01.1	058/00.9	276/00.9	268/01.6	180/02.5	189/02.3	357/01.6
28	093/01.3	305/01.3	330/01.8	048/01.2	090/01.5	307/01.3	228/01.2	167/00.8	051/01.0	015/01.4	359/01.9	343/01.9	243/01.7
29	207/03.1	337/01.7	183/01.0	289/01.2	236/01.4	233/01.1	068/01.0	023/00.9	234/01.3	165/03.2	148/02.7	334/02.7	306/03.5
30	103/01.1	061/02.0	071/02.4	032/01.9	053/01.6	040/01.8	119/01.2	092/00.7	294/01.6	004/01.3	333/02.2	279/04.3	260/06.2
31	133/02.7	071/01.9	316/01.2	054/01.0	062/01.1	085/01.3	056/01.0	357/01.2	028/00.9	065/01.1	160/03.5	151/05.3	159/05.3
MEAN	128/02.0	079/01.9	009/01.6	033/01.6	090/01.5	059/01.4	078/01.2	038/01.2	356/01.5	011/02.0	346/02.6	338/03.1	304/03.4
MX SPD	009/03.9	020/04.1	334/04.1	354/05.7	036/05.5	290/02.3	136/02.1	358/02.4	163/04.1	316/05.0	157/06.3	150/07.4	147/07.9
MN SPD	214/00.9	141/00.8	018/00.8	175/00.9	042/00.8	115/00.9	022/00.6	096/00.7	028/00.9	355/01.0	106/01.2	043/00.8	217/01.4

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Homestake

10M Wind Speed and Direction in m/s for AUGUST, 2011 PAGE 2

HR END DAY	14	15	16	17	18	19	20	21	22	23	24	MEAN	MX SPD	MN SPD
01	258/05.8	351/02.0	282/02.5	314/02.7	013/03.1	338/03.0	011/02.6	356/02.9	025/03.0	009/02.9	281/01.7	243/02.9	186/06.4	206/01.0
02	060/04.2	014/03.4	326/03.8	294/04.4	276/04.7	299/04.9	323/02.4	019/02.2	356/03.4	028/03.1	282/02.7	001/02.4	299/04.9	096/00.7
03	216/03.7	153/06.0	161/05.5	218/04.4	258/05.9	213/04.0	132/01.8	165/03.0	125/01.4	108/01.7	028/01.4	149/02.5	153/06.0	175/00.9
04	251/05.1	109/05.7	094/03.9	336/02.4	306/03.1	282/02.8	264/02.5	091/01.4	191/02.0	168/01.9	331/02.6	331/02.3	109/05.7	079/01.1
05	355/04.8	062/05.1	078/04.5	353/06.7	134/06.8	166/04.5	231/03.3	053/01.8	084/02.3	106/02.1	173/01.8	071/02.7	134/06.8	162/00.7
06	004/03.1	358/03.3	314/03.1	309/02.1	282/02.2	249/02.7	328/02.0	309/02.6	358/01.8	064/02.2	079/02.4	357/02.2	359/03.5	115/00.9
07	305/04.0	303/03.6	290/04.2	304/04.2	309/05.9	316/06.3	308/03.6	286/02.0	117/01.2	078/02.7	067/02.6	350/02.8	316/06.3	293/00.9
08	344/04.6	351/04.7	333/05.5	336/05.5	334/05.2	332/05.0	341/03.8	191/01.5	314/01.7	054/01.9	082/01.1	016/02.7	333/05.5	049/00.7
09	334/02.5	260/02.5	317/05.6	321/05.9	343/05.9	350/05.1	330/04.0	327/03.1	019/03.8	335/02.7	350/02.1	011/02.6	321/05.9	076/00.7
10	233/04.4	187/02.6	347/02.9	308/02.2	232/01.5	211/01.6	186/06.2	185/03.1	073/03.1	129/02.8	218/04.1	224/02.6	186/06.2	042/00.8
11	238/04.3	241/03.2	328/02.3	319/02.5	347/05.9	357/03.1	188/05.8	181/04.2	243/02.3	187/02.0	189/02.5	313/03.0	347/05.9	040/01.3
12	065/02.1	036/02.6	307/02.4	167/02.6	261/01.6	236/01.5	357/01.5	138/02.1	166/03.0	169/03.6	202/01.8	027/01.9	169/03.6	022/00.6
13	155/06.6	141/05.6	147/06.9	161/09.0	282/07.9	331/03.2	320/02.2	287/02.7	350/01.4	109/01.2	208/01.4	117/03.5	161/09.0	010/01.0
14	155/05.5	158/04.4	150/03.9	166/03.7	175/03.9	157/03.6	140/03.4	164/01.9	166/01.9	145/02.9	151/03.7	155/03.3	153/06.6	329/00.9
15	322/02.3	310/03.5	333/04.0	357/03.9	170/06.1	199/05.9	160/03.2	138/02.4	123/02.4	143/02.1	059/02.5	006/02.7	170/06.1	061/01.0
16	284/02.2	163/03.3	122/05.8	152/06.1	190/05.9	235/03.3	189/01.9	095/02.1	084/02.4	106/01.5	153/02.8	067/02.6	152/06.1	040/01.0
17	085/04.7	057/07.4	260/06.0	205/03.9	152/05.8	160/04.3	209/02.5	205/04.4	195/03.0	194/03.8	203/04.1	177/03.1	057/07.4	015/01.1
18	232/02.2	279/03.9	262/04.0	267/04.0	335/03.5	011/04.9	350/03.1	330/04.7	330/03.4	327/02.2	318/02.0	288/02.4	011/04.9	145/00.9
19	286/02.9	244/03.7	258/03.3	264/06.3	269/06.2	281/03.3	003/01.7	068/01.8	113/01.3	190/05.4	202/04.3	272/02.6	264/06.3	214/00.9
20	359/02.0	316/01.9	022/01.5	286/02.3	268/02.1	183/02.3	261/05.3	347/06.9	036/03.2	036/03.9	026/06.0	066/02.3	347/06.9	043/00.8
21	261/04.1	199/04.0	228/03.7	200/02.6	006/03.0	021/03.3	072/02.0	096/01.6	293/02.0	102/01.9	070/02.3	169/02.5	169/04.3	119/00.8
22	250/01.9	288/02.4	294/02.8	293/03.2	311/03.2	334/05.1	338/03.5	329/03.0	302/02.1	282/02.0	246/01.4	302/02.0	334/05.1	024/00.9
23	338/04.0	341/03.4	336/03.3	009/02.4	330/02.9	319/02.2	144/01.0	316/01.6	087/01.4	043/01.7	068/02.4	012/01.9	338/04.0	018/00.8
24	035/04.9	028/05.7	043/07.5	048/04.6	055/06.7	051/05.5	233/03.9	348/02.6	041/03.6	005/01.3	171/02.9	031/03.0	043/07.5	116/00.8
25	162/04.6	156/04.9	179/03.4	219/03.0	244/06.2	199/04.1	082/02.1	132/04.0	277/03.1	235/01.7	148/01.3	204/02.6	244/06.2	156/00.8
26	153/04.3	179/03.5	174/02.9	180/03.0	285/03.0	285/02.4	261/01.3	314/02.0	356/02.3	272/01.7	245/01.2	252/02.1	153/04.3	323/00.9
27	355/02.5	315/06.2	312/03.5	334/02.2	318/02.5	233/01.5	278/04.0	026/03.4	299/02.3	168/02.2	140/01.6	332/02.1	315/06.2	017/00.8
28	241/04.8	299/03.8	341/02.6	318/03.8	303/05.2	257/04.6	249/02.3	041/01.6	121/01.4	312/01.2	223/03.4	317/02.2	303/05.2	167/00.8
29	265/04.1	300/04.7	307/04.6	285/04.9	293/04.4	285/04.0	278/02.3	122/02.2	119/01.9	165/02.1	080/02.0	260/02.6	285/04.9	023/00.9
30	257/06.2	264/04.3	259/05.5	256/04.9	284/04.8	279/03.0	299/01.4	062/02.0	061/01.2	079/01.6	114/02.1	003/02.7	260/06.2	092/00.7
31	247/05.5	133/06.0	332/05.5	049/05.2	041/02.9	319/02.2	252/03.0	212/02.8	283/04.4	301/03.3	080/01.9	055/02.9	133/06.0	028/00.9
MEAN	281/04.0	294/04.1	306/04.1	290/04.0	295/04.5	279/03.7	279/02.9	050/02.7	048/02.4	106/02.4	147/02.5	352/02.6		
MX SPD	155/06.6	057/07.4	043/07.5	161/09.0	282/07.9	316/06.3	186/06.2	347/06.9	283/04.4	190/05.4	026/06.0		161/09.0	
MN SPD	250/01.9	316/01.9	022/01.5	309/02.1	232/01.5	236/01.5	144/01.0	091/01.4	117/01.2	109/01.2	082/01.1			022/00.6

POSSIBLE NUMBER OF OBSERVATIONS = 744 ACTUAL NUMBER OF OBSERVATIONS = 744 DATA RECOVERY RATE = 100 %

MONTHLY MEAN = 352/02.6 MAXIMUM WIND SPEED WAS 9 m/s AT 161 DEGREES ON 8/13 AT 1700

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Homestake

10M Wind Speed and Direction in m/s for SEPTEMBER, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13
01	266/01.1	199/01.3	245/01.0	342/02.0	321/01.9	074/02.4	179/00.9	306/02.2	274/02.2	135/01.8	161/04.4	149/03.9	042/02.3
02	060/01.5	171/01.7	280/01.9	043/01.2	016/01.1	033/00.8	260/01.3	196/00.7	097/00.8	061/01.0	237/01.4	321/02.8	304/03.2
03	081/02.7	284/01.5	185/00.9	243/00.9	129/01.1	169/01.7	359/02.2	007/01.5	075/02.4	075/01.7	061/01.4	130/01.6	208/04.3
04	159/05.0	151/05.5	176/02.2	169/04.2	213/02.6	284/01.9	203/02.8	188/05.1	166/06.7	155/07.1	146/07.8	153/07.7	148/07.8
05	172/03.4	174/02.8	155/04.1	164/03.8	150/04.9	189/02.5	170/03.7	184/04.2	167/06.1	162/06.8	164/06.8	167/06.8	164/06.5
06	063/01.5	360/01.9	330/02.5	335/01.4	255/01.9	284/01.4	161/01.1	330/02.4	348/02.5	300/01.8	317/01.3	346/01.3	004/01.8
07	168/03.1	298/01.7	284/01.1	223/01.0	047/01.2	064/01.1	137/00.8	156/00.8	016/00.8	343/01.5	029/02.3	321/01.9	040/04.8
08	249/02.5	185/03.3	164/02.5	173/02.4	224/02.1	184/01.9	183/03.0	188/02.4	179/03.7	159/06.6	159/07.2	156/07.2	158/05.9
09	165/03.5	177/03.7	149/03.5	154/04.6	137/02.3	147/03.4	258/02.7	020/01.7	323/01.4	260/01.3	216/01.5	168/02.9	138/02.2
10	229/01.9	310/02.0	243/01.4	178/03.4	201/02.2	233/01.8	194/02.5	181/04.0	165/04.7	146/05.5	148/06.3	148/06.5	147/06.3
11	185/02.7	218/02.7	168/03.8	163/03.3	126/02.6	072/01.9	043/02.5	020/01.7	334/01.1	056/01.5	019/02.0	022/01.8	284/01.5
12	072/01.0	278/01.4	055/01.3	103/01.6	076/01.1	102/00.9	044/01.5	019/02.0	293/01.3	352/01.4	012/02.0	347/02.2	317/02.1
13	001/02.6	337/02.5	141/01.2	280/00.9	221/01.0	348/01.8	012/01.6	076/01.5	038/02.2	026/01.7	019/01.7	355/02.3	355/01.9
14	029/01.5	240/01.3	101/01.9	216/02.1	217/03.1	280/02.8	341/03.1	350/02.9	353/02.3	020/01.3	342/01.5	056/01.6	350/01.6
15	164/02.4	154/03.3	153/03.6	189/02.6	195/03.0	226/01.6	123/01.5	212/02.1	169/04.2	167/05.5	164/05.7	170/05.8	168/04.1
16	010/01.2	273/01.0	081/01.2	303/00.9	109/01.4	311/01.2	082/01.2	082/01.4	293/01.2	186/01.3	258/04.3	247/05.4	261/06.0
17	095/01.6	066/02.1	100/01.1	325/01.8	067/02.4	088/02.8	122/02.0	034/02.9	100/01.6	028/01.4	353/01.7	272/07.0	313/06.4
18	146/00.8	202/00.9	071/01.3	093/00.8	276/01.0	195/01.1	049/01.0	076/01.0	051/00.9	021/00.9	353/01.6	003/03.3	352/04.0
19	086/00.8	054/01.0	231/00.9	063/01.1	055/01.1	079/01.4	035/01.2	059/01.1	049/00.9	002/00.9	359/01.0	327/01.7	299/02.0
20	111/01.3	061/00.9	048/01.2	052/00.8	109/01.0	095/01.6	077/01.6	012/00.9	039/00.8	041/01.0	267/01.1	233/02.5	339/03.2
21	047/01.6	029/01.1	063/01.5	106/01.7	303/02.0	078/01.8	314/01.1	306/00.8	191/01.3	039/01.6	132/02.1	155/02.4	235/02.0
22	075/01.3	060/01.9	037/01.4	045/01.5	030/01.1	104/01.4	097/01.6	071/01.3	270/01.0	228/01.3	176/02.1	321/01.9	349/04.2
23	031/01.5	069/01.7	355/01.0	063/01.6	027/01.2	072/01.3	048/01.1	017/01.0	017/00.8	054/01.1	031/01.8	016/02.9	359/03.4
24	079/01.3	105/01.2	091/02.0	071/00.8	052/00.7	341/00.7	056/01.0	080/01.0	047/00.8	034/01.1	006/01.2	353/02.3	313/02.8
25	063/01.5	029/01.2	161/01.0	067/01.8	080/01.0	055/01.0	060/01.5	015/00.9	317/01.0	048/01.0	034/01.1	019/01.7	331/02.7
26	055/01.6	083/02.5	060/01.9	052/01.6	050/00.9	039/01.0	058/01.1	249/01.1	033/01.2	008/02.2	344/03.9	342/03.3	008/04.4
27	085/01.4	338/00.9	092/01.4	077/01.4	058/01.4	047/01.3	057/00.8	127/01.1	106/00.8	275/01.9	245/01.9	087/02.9	018/06.0
28	070/01.6	055/01.6	348/00.8	069/01.1	077/01.1	061/00.8	071/01.5	066/00.8	024/00.8	340/00.8	310/01.2	359/01.9	003/04.1
29	053/01.1	074/01.7	048/00.9	079/01.8	067/02.3	045/01.1	053/01.3	062/00.7	315/00.8	015/00.8	250/01.3	179/04.3	159/07.2
30	148/08.6	147/06.9	147/07.2	147/05.7	150/04.3	144/03.2	158/03.9	160/04.5	166/06.7	167/07.4	168/06.2	166/05.0	177/04.6
MEAN	093/02.1	100/02.1	113/01.9	101/02.0	097/01.8	080/01.7	082/01.8	058/01.9	029/02.1	043/02.4	343/02.9	014/03.5	332/04.0
MX SPD	148/08.6	147/06.9	147/07.2	147/05.7	150/04.9	147/03.4	158/03.9	188/05.1	166/06.7	167/07.4	146/07.8	153/07.7	148/07.8
MN SPD	146/00.8	202/00.9	348/00.8	093/00.8	052/00.7	341/00.7	137/00.8	196/00.7	097/00.8	340/00.8	359/01.0	346/01.3	284/01.5

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Homestake

10M Wind Speed and Direction in m/s for SEPTEMBER, 2011 PAGE 2

HR END DAY	14	15	16	17	18	19	20	21	22	23	24	MEAN	MX SPD	MN SPD
01	161/05.3	135/04.5	140/07.1	310/04.4	359/03.0	011/03.0	029/02.2	342/01.7	290/02.3	303/01.3	149/01.7	286/02.7	140/07.1	179/00.9
02	311/03.2	309/04.4	293/04.8	314/05.0	315/09.3	306/04.0	131/01.2	121/02.0	168/02.8	147/01.8	104/01.8	331/02.5	315/09.3	196/00.7
03	233/04.7	234/04.8	180/05.6	203/05.0	233/04.0	138/03.1	170/01.9	172/01.4	153/01.8	182/03.6	166/03.9	169/02.7	180/05.6	185/00.9
04	148/08.3	184/05.7	352/06.1	067/07.9	183/03.6	184/04.0	140/04.6	174/03.2	178/04.8	187/04.2	207/03.2	172/05.1	148/08.3	284/01.9
05	168/05.6	169/04.8	164/05.6	160/05.9	143/05.6	140/04.7	145/04.1	274/02.6	292/02.9	332/01.9	078/01.8	167/04.5	162/06.8	078/01.8
06	324/02.5	315/03.0	308/03.9	173/06.6	173/07.3	175/04.5	153/02.8	137/02.9	115/02.7	134/02.7	164/03.7	315/02.7	173/07.3	161/01.1
07	092/02.9	172/05.7	181/06.1	176/03.8	208/02.5	185/03.3	156/03.5	149/02.9	163/03.0	162/04.3	191/02.5	157/02.6	181/06.1	137/00.8
08	145/05.5	149/03.6	147/03.8	178/04.4	187/05.3	165/03.5	139/01.7	185/02.8	156/03.8	164/02.5	156/02.6	171/03.8	159/07.2	139/01.7
09	104/01.7	202/03.8	203/02.0	066/00.8	276/02.0	230/02.4	136/02.2	170/01.7	197/01.9	196/02.7	178/02.2	179/02.4	154/04.6	066/00.8
10	157/06.1	152/06.7	030/04.9	081/04.1	129/03.7	119/03.0	151/04.2	274/02.1	129/01.9	012/01.6	208/02.8	168/03.7	152/06.7	243/01.4
11	030/01.9	025/02.0	257/01.9	165/05.4	192/07.5	135/03.6	245/02.2	210/02.1	256/03.1	307/03.3	056/02.2	102/02.7	192/07.5	334/01.1
12	353/01.6	332/02.2	315/07.2	085/04.9	108/01.7	255/02.5	220/02.2	003/01.9	019/02.3	007/02.2	031/02.4	014/02.1	315/07.2	102/00.9
13	317/02.4	013/02.1	337/03.2	326/03.2	343/03.9	359/03.5	025/03.0	254/01.6	207/01.2	086/01.5	120/01.7	360/02.1	343/03.9	280/00.9
14	274/01.3	209/03.3	168/05.2	260/06.5	140/03.2	117/02.0	160/03.3	119/02.9	230/02.8	175/03.1	218/02.1	230/02.6	260/06.5	240/01.3
15	165/05.9	194/05.1	223/04.7	211/05.1	088/02.3	359/02.0	202/01.7	331/01.3	303/01.7	264/01.4	107/01.3	182/03.2	165/05.9	331/01.3
16	268/05.6	277/04.1	267/05.3	240/06.9	248/07.8	262/04.8	231/02.2	258/01.9	151/01.8	103/01.2	072/02.4	258/03.0	248/07.8	303/00.9
17	294/06.7	316/05.0	313/07.4	320/07.6	020/07.1	015/03.8	002/03.5	332/02.5	301/02.2	049/00.9	316/00.7	008/03.4	320/07.6	316/00.7
18	342/04.1	340/04.4	336/03.9	352/04.7	012/05.2	021/04.4	014/03.5	325/02.2	313/02.4	334/00.8	108/01.5	011/02.3	012/05.2	146/00.8
19	288/02.2	326/02.9	323/03.3	359/03.0	019/02.8	007/03.7	027/03.4	299/01.9	307/02.6	037/00.8	283/00.9	005/01.8	007/03.7	086/00.8
20	327/03.7	342/04.6	321/04.3	324/04.7	329/04.0	293/02.4	059/01.0	055/01.4	040/01.6	049/01.4	046/01.8	026/02.0	324/04.7	052/00.8
21	317/08.5	332/07.1	348/07.0	309/06.7	313/04.4	315/01.7	054/01.2	050/01.2	056/02.5	057/01.5	020/01.5	015/02.7	317/08.5	306/00.8
22	352/05.6	353/04.9	359/04.8	006/05.0	018/04.3	030/03.1	354/02.7	311/01.6	130/00.8	087/01.4	057/01.6	031/02.4	352/05.6	130/00.8
23	359/03.3	345/03.7	349/04.1	350/05.1	357/04.8	034/04.4	026/02.7	307/03.5	308/01.1	031/01.2	050/01.3	019/02.3	350/05.1	017/00.8
24	327/04.3	328/05.5	331/05.5	347/05.5	023/04.5	022/03.6	004/02.7	297/01.4	294/01.6	120/01.3	073/01.6	023/02.3	328/05.5	052/00.7
25	299/03.1	301/03.8	282/05.3	287/04.8	270/05.5	255/06.4	354/02.5	064/02.9	081/03.1	064/03.5	050/01.9	019/02.5	255/06.4	015/00.9
26	310/05.7	318/04.5	268/05.5	279/06.2	285/04.9	304/02.1	028/01.7	055/01.7	031/03.0	059/02.1	073/01.3	014/02.7	279/06.2	050/00.9
27	004/03.4	056/05.4	039/05.3	084/06.1	156/04.8	220/01.9	040/01.9	098/01.6	246/01.6	281/02.0	042/01.7	062/02.5	084/06.1	057/00.8
28	014/03.8	346/04.1	006/04.4	010/04.6	002/04.1	013/03.5	010/02.8	047/00.8	021/00.6	071/01.2	065/01.4	028/02.1	010/04.6	021/00.6
29	164/07.3	161/05.5	155/05.6	100/08.7	085/05.9	109/05.0	126/07.4	142/08.3	154/08.6	143/07.1	145/08.8	107/04.3	145/08.8	062/00.7
30	163/03.6	165/02.9	162/02.7	176/02.5	170/03.2	151/02.4	006/01.5	311/02.6	013/01.4	024/00.9	045/02.2	151/04.2	148/08.6	024/00.9
MEAN	315/04.3	300/04.3	298/04.9	325/05.2	334/04.6	015/03.4	079/02.7	319/02.3	217/02.5	077/02.2	097/02.2	062/02.9		
MX SPD	317/08.5	332/07.1	313/07.4	100/08.7	315/09.3	255/06.4	126/07.4	142/08.3	154/08.6	143/07.1	145/08.8		315/09.3	
MN SPD	274/01.3	025/02.0	257/01.9	066/00.8	108/01.7	315/01.7	059/01.0	047/00.8	021/00.6	334/00.8	316/00.7			021/00.6

POSSIBLE NUMBER OF OBSERVATIONS = 720 ACTUAL NUMBER OF OBSERVATIONS = 720 DATA RECOVERY RATE = 100 %

MONTHLY MEAN = 062/02.9 MAXIMUM WIND SPEED WAS 9.3 m/s AT 315 DEGREES ON 9/ 2 AT 1800

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Appendix B.2
Joint Frequency of Occurrence Distributions of Wind Speeds and Directions

Homestake

10M Joint Frequency Distribution July, 2011

PERCENTAGE FREQUENCY OF OCCURRENCE OF HOURLY WIND VELOCITIES FOR ALL STABILITIES

WIND SPEED (m/s)

WIND DIRECTION	0.5-3	3.1-6	6.1-10	10.1-16	16.1-21	OVER 21	TOTAL	AVG SPEED
N	3.7	3.1	.0	.0	.0	.0	6.9	3.0
NNE	3.9	2.7	.0	.0	.0	.0	6.6	2.6
NE	5.6	.8	.0	.0	.0	.0	6.4	2.2
ENE	4.8	.6	.3	.0	.0	.0	5.8	2.1
E	3.7	.3	.3	.0	.0	.0	4.4	2.1
ESE	3.3	.9	.3	.0	.0	.0	4.5	2.5
SE	1.7	1.7	3.6	.0	.0	.0	7.0	5.7
SSE	2.7	7.2	1.7	.0	.0	.0	11.5	4.3
S	3.3	3.6	.6	.0	.0	.0	7.5	3.5
SSW	2.3	1.2	.2	.0	.0	.0	3.7	3.0
SW	1.7	.6	.6	.0	.0	.0	3.0	3.5
WSW	3.3	.9	.6	.2	.0	.0	5.0	3.1
W	3.1	2.0	.6	.0	.0	.0	5.8	3.3
WNW	3.6	1.9	.9	.0	.0	.0	6.4	3.0
NW	6.1	2.7	.5	.0	.0	.0	9.2	2.8
NNW	3.6	2.7	.2	.0	.0	.0	6.4	3.0
CALM							.0	
TOTAL	56.5	32.9	10.5	.2	.0	.0	100.0	3.2

TOTAL NUMBER OF OBSERVATIONS 641
POSSIBLE NUMBER OF OBSERVATIONS 744
DATA RECOVERY 86.2%

Homestake

10M Joint Frequency Distribution August, 2011

PERCENTAGE FREQUENCY OF OCCURRENCE OF HOURLY WIND VELOCITIES FOR ALL STABILITIES

WIND SPEED (m/s)

WIND DIRECTION	0.5-3	3.1-6	6.1-10	10.1-16	16.1-21	OVER 21	TOTAL	AVG SPEED
N	5.5	2.2	.1	.0	.0	.0	7.8	2.5
NNE	4.0	1.6	.0	.0	.0	.0	5.6	2.0
NE	4.8	1.1	.3	.0	.0	.0	6.2	2.3
ENE	7.1	.5	.1	.0	.0	.0	7.8	1.9
E	5.9	.4	.0	.0	.0	.0	6.3	1.8
ESE	3.6	.3	.0	.0	.0	.0	3.9	1.8
SE	3.4	.7	.1	.0	.0	.0	4.2	2.3
SSE	3.2	4.6	1.2	.0	.0	.0	9.0	3.7
S	3.2	1.9	.4	.0	.0	.0	5.5	3.1
SSW	1.6	1.5	.0	.0	.0	.0	3.1	2.8
SW	3.0	1.3	.0	.0	.0	.0	4.3	2.3
WSW	2.3	1.6	.3	.0	.0	.0	4.2	3.0
W	2.8	2.0	.4	.0	.0	.0	5.2	3.0
WNW	6.2	2.2	.1	.0	.0	.0	8.5	2.6
NW	6.2	2.4	.3	.0	.0	.0	8.9	2.6
NNW	5.8	3.6	.1	.0	.0	.0	9.5	3.0
CALM							.0	
TOTAL	68.7	27.8	3.5	.0	.0	.0	100.0	2.6

TOTAL NUMBER OF OBSERVATIONS 744
POSSIBLE NUMBER OF OBSERVATIONS 744
DATA RECOVERY 100.0%

Homestake

10M Joint Frequency Distribution September, 2011

PERCENTAGE FREQUENCY OF OCCURRENCE OF HOURLY WIND VELOCITIES FOR ALL STABILITIES

WIND SPEED (m/s)

WIND DIRECTION	0.5-3	3.1-6	6.1-10	10.1-16	16.1-21	OVER 21	TOTAL	AVG SPEED
N	4.3	3.1	.1	.0	.0	.0	7.5	2.9
NNE	6.8	2.1	.1	.0	.0	.0	9.0	2.2
NE	7.8	.6	.0	.0	.0	.0	8.3	1.6
ENE	8.5	.1	.1	.0	.0	.0	8.8	1.6
E	4.0	.6	.3	.0	.0	.0	4.9	2.3
ESE	3.3	.1	.0	.0	.0	.0	3.5	1.8
SE	2.5	1.7	.7	.0	.0	.0	4.9	3.5
SSE	2.8	6.7	3.9	.0	.0	.0	13.3	4.7
S	3.2	4.2	.4	.0	.0	.0	7.8	3.5
SSW	2.5	1.0	.1	.0	.0	.0	3.6	2.8
SW	2.6	.7	.0	.0	.0	.0	3.3	2.4
WSW	2.4	.4	.4	.0	.0	.0	3.2	2.7
W	2.6	.8	.6	.0	.0	.0	4.0	3.0
WNW	3.2	.8	.1	.0	.0	.0	4.2	2.4
NW	3.9	2.5	1.0	.0	.0	.0	7.4	3.3
NNW	3.5	2.6	.3	.0	.0	.0	6.4	2.9
CALM							.0	
TOTAL	63.9	27.9	8.2	.0	.0	.0	100.0	2.9

TOTAL NUMBER OF OBSERVATIONS 720
POSSIBLE NUMBER OF OBSERVATIONS 720
DATA RECOVERY 100.0%

Homestake

10M Unit-Vector Wind Direction and Scalar Speed — July - September 2011

PERCENTAGE FREQUENCY OF OCCURRENCE OF HOURLY WIND VELOCITIES FOR ALL STABILITIES

WIND SPEED (m/s)

WIND DIRECTION	0.5-3	3.1-6	6.1-10	10.1-16	16.1-21	OVER 21	TOTAL	AVG SPEED
N	4.6	2.8	.1	.0	.0	.0	7.4	2.8
NNE	4.9	2.1	.0	.0	.0	.0	7.1	2.3
NE	6.1	.8	.1	.0	.0	.0	7.0	2.0
ENE	6.9	.4	.2	.0	.0	.0	7.5	1.8
E	4.6	.4	.2	.0	.0	.0	5.2	2.0
ESE	3.4	.4	.1	.0	.0	.0	3.9	2.0
SE	2.6	1.3	1.4	.0	.0	.0	5.3	4.0
SSE	2.9	6.1	2.3	.0	.0	.0	11.3	4.3
S	3.2	3.2	.5	.0	.0	.0	6.9	3.4
SSW	2.1	1.2	.1	.0	.0	.0	3.5	2.9
SW	2.5	.9	.2	.0	.0	.0	3.6	2.6
WSW	2.6	1.0	.4	.0	.0	.0	4.1	3.0
W	2.9	1.6	.5	.0	.0	.0	5.0	3.1
WNW	4.4	1.6	.4	.0	.0	.0	6.4	2.7
NW	5.4	2.5	.6	.0	.0	.0	8.5	2.9
NNW	4.3	3.0	.2	.0	.0	.0	7.5	3.0
CALM							.0	
TOTAL	63.3	29.4	7.2	.0	.0	.0	100.0	2.9

TOTAL NUMBER OF OBSERVATIONS 2105
POSSIBLE NUMBER OF OBSERVATIONS 2208
DATA RECOVERY 95.3%

Appendix C
Hourly Temperature Data for July through September 2011

Homestake

10M TEMPERATURE in Deg C for JULY, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MN	MAX	MIN
01	17.3	14.8	13.1	11.8	9.9	9.7	13.0	17.6	22.2	25.2	27.2	28.3	29.8	30.8	31.9	32.3	32.7	31.6	31.1	28.9	27.6	26.6	25.2	23.7	23.4	32.7	9.7
02	23.2	19.4	21.3																								
03																											
04																											
05																											
06											28.8	29.8	30.1	30.0	31.2	31.6	31.9	30.7	28.2	26.0	24.2	23.2	21.9	20.5			
07	19.9	18.8	17.8	16.7	15.6	15.2	17.9	21.8	24.0	26.2	28.2	29.1	29.4	30.6	30.9	30.8	30.3	30.0	28.3	25.9	25.2	24.0	22.6	21.6	24.2	30.9	15.2
08	20.7	19.5	17.4	15.6	14.4	13.9	16.6	20.3	23.6	26.7	28.4	28.3	29.8	29.5	26.8	26.9	26.3	25.9	25.2	23.9	21.6	21.0	20.1	19.1	22.6	29.8	13.9
09	17.8	16.4	16.2	14.0	13.3	12.8	16.3	20.1	22.1	25.8	27.6	28.4	27.5	26.1	25.1	22.0	19.1	19.8	20.8	20.1	19.4	18.9	18.1	16.5	20.2	28.4	12.8
10	15.2	14.2	14.3	14.1	12.6	12.4	16.1	19.0	21.9	24.2	26.2	28.4	27.8	26.9	28.3	27.7	26.6	25.4	24.6	23.7	21.8	21.0	21.1	21.3	21.5	28.4	12.4
11	19.6	18.1	16.8	16.7	15.5	15.7	17.2	19.8	22.2	24.0	26.6	27.6	24.4	23.3	22.8	22.8	21.9	19.4	18.7	18.9	18.4	17.3	17.1	16.1	20.0	27.6	15.5
12	15.0	14.8	12.8	11.8	11.2	10.8	12.8	14.3	15.3	17.0	17.1	19.3	22.6	24.7	25.9	24.1	19.4	20.3	21.1	20.2	19.0	17.9	16.4	15.4	17.5	25.9	10.8
13	14.3	13.8	12.3	12.1	10.9	10.4	13.0	16.6	19.7	23.0	25.2	26.3	27.3	27.4	28.1	29.1	29.7	29.5	28.3	26.4	23.0	21.7	21.5	19.5	21.2	29.7	10.4
14	17.3	17.0	16.9	16.7	13.1	13.0	13.9	18.3	22.1	23.8	25.6	26.6	27.8	28.8	29.1	29.6	29.8	29.5	29.3	27.3	26.8	25.7	24.2	21.2	23.1	29.8	13.0
15	19.2	19.7	17.6	14.1	11.8	12.5	15.4	20.1	23.1	25.4	27.4	28.2	29.2	30.1	29.7	29.7	29.7	29.3	28.5	27.8	26.5	24.5	23.5	23.0	23.6	30.1	11.8
16	22.1	20.5	18.5	16.0	15.2	15.5	16.6	20.7	24.5	27.7	28.6	29.4	30.3	30.3	30.8	31.8	31.7	30.9	30.4	27.8	26.4	25.6	23.2	24.5	25.0	31.8	15.2
17	22.4	20.2	19.1	18.1	16.8	16.3	17.7	20.7	24.5	25.6	26.6	27.7	28.5	28.8	29.1	29.0	29.0	28.6	28.0	26.6	25.9	25.5	25.3	24.3	24.3	29.1	16.3
18	23.1	20.7	19.8	18.6	17.3	16.0	19.2	21.6	24.5	25.8	26.9	28.1	28.8	29.7	30.5	30.6	30.8	30.7	30.1	28.3	25.9	24.3	22.8	21.2	24.8	30.8	16.0
19	20.5	21.2	20.8	20.0	17.2	17.4	18.1	22.3	24.4	26.0	27.5	24.7	27.8	29.3	29.1	27.5	19.0	17.8	17.8	17.3	17.5	17.4	16.9	16.3	21.4	29.3	16.3
20	15.8	16.0	15.4	14.5	14.5	14.0	15.9	18.3	22.0	24.4	26.8	24.2	20.8	23.7	28.1	26.4	25.2	23.2	20.8	20.0	19.7	19.4	18.0	18.3	20.2	28.1	14.0
21	17.9	17.3	16.8	16.4	16.1	15.4	17.0	20.3	22.3	23.7	25.8	27.6	26.0	24.2	25.2	24.6	23.4	22.4	22.2	20.7	20.0	19.1	19.0	17.7	20.9	27.6	15.4
22	15.7	14.9	16.4	15.6	15.1	15.4	16.3	20.2	23.6	26.3	27.3	28.1	29.4	29.9	30.3	30.2	30.7	30.5	28.5	26.1	25.8	24.9	23.5	22.6	23.6	30.7	14.9
23	22.3	21.5	19.7	18.0	16.6	16.2	17.1	18.8	22.8	26.6	28.3	29.1	30.3	30.8	31.1	31.3	31.7	31.4	30.6	27.0	24.2	23.2	22.8	23.3	24.8	31.7	16.2
24	22.3	20.7	20.0	19.5	17.8	17.7	20.0	22.8	24.6	25.8	26.8	28.1	28.8	28.4	26.4	27.6	28.6	28.5	25.7	23.2	21.0	18.1	18.0	18.1	23.3	28.8	17.7
25	18.7	17.8	16.5	16.6	16.4	16.7	17.0	19.0	21.1	23.7	24.9	26.4	27.4	27.5	24.1	21.5	22.0	23.0	22.2	20.8	19.8	18.3	17.5	16.9	20.7	27.5	16.4
26	16.4	16.6	14.9	14.6	14.4	14.1	16.4	19.8	21.9	24.9	26.2	26.5	25.5	21.1	19.5	20.0	22.1	21.7	19.6	18.3	17.4	16.9	16.9	15.9	19.2	26.5	14.1
27	15.4	15.0	14.3	14.0	13.1	13.2	14.8	17.7	19.7	21.2	22.7	24.3	25.4	26.4	27.0	27.5	27.7	27.2	26.7	25.5	24.1	22.7	21.3	20.2	21.1	27.7	13.1
28	19.0	18.1	17.6	18.0	17.1	18.0	17.8	21.2	23.5	25.3	26.3	27.1	28.3	29.2	29.8	30.0	29.9	29.6	29.2	25.4	24.5	23.6	22.3	20.6	23.8	30.0	17.1
29	19.4	18.3	17.6	18.2	19.4	19.6	20.5	21.4	21.6	21.7	22.3	22.5	24.5	27.1	28.2	28.9	28.3	22.2	19.0	18.4	16.5	16.0	15.7	16.3	21.0	28.9	15.7
30	16.6	16.8	16.4	16.3	15.3	15.4	15.9	17.2	19.6	22.3	23.3	24.4	25.5	26.5	27.4	28.1	27.0	26.2	21.2	19.5	19.1	19.4	18.7	16.8	20.6	28.1	15.3
31	16.3	15.5	15.2	14.6	14.2	15.2	17.7	18.8	19.9	23.0	24.3	25.7	26.7	26.5	25.1	25.4	26.0	24.4	21.9	19.2	18.4	18.1	18.2	17.8	20.3	26.7	14.2
MEAN	18.6	17.7	16.9	15.9	14.8	14.7	16.5	19.6	22.2	24.4	26.0	26.8	27.4	27.7	27.8	27.7	27.0	26.3	25.1	23.5	22.2	21.3	20.4	19.6	22.1		
MAX	23.2	21.5	21.3	20.0	19.4	19.6	20.5	22.8	24.6	27.7	28.8	29.8	30.3	30.8	31.9	32.3	32.7	31.6	31.1	28.9	27.6	26.6	25.3	24.5		32.7	
MIN	14.3	13.8	12.3	11.8	9.9	9.7	12.8	14.3	15.3	17.0	17.1	19.3	20.8	21.1	19.5	20.0	19.0	17.8	17.8	17.3	16.5	16.0	15.7	15.4			9.7

POSSIBLE NUMBER OF OBSERVATIONS = 744 ACTUAL NUMBER OF OBSERVATIONS = 641 DATA RECOVERY RATE = 86.2 %

MONTHLY MEAN = 22.1 Deg C

MAXIMUM 10M TEMPERATURE WAS 32.7 Deg C ON 7/ 1 AT 1700 MAXIMUM DAILY MEAN WAS 25.0 Deg C ON 7/16

MINIMUM 10M TEMPERATURE WAS 9.7 Deg C ON 7/ 1 AT 600 MINIMUM DAILY MEAN WAS 17.5 Deg C ON 7/12

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Homestake

10M TEMPERATURE in Deg C for AUGUST, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MN	MAX	MIN
01	18.0	16.9	17.5	17.5	16.5	16.7	18.1	20.5	21.7	23.0	24.8	25.7	25.0	19.7	19.8	19.6	19.1	19.2	18.9	18.6	18.4	18.2	17.9	17.0	19.5	25.7	16.5
02	15.2	14.5	13.9	12.9	13.0	13.1	15.2	17.4	20.1	22.2	24.3	25.7	25.9	25.8	26.9	27.3	27.4	26.2	25.0	24.1	23.5	22.6	21.2	20.0	21.0	27.4	12.9
03	18.4	18.2	16.7	15.2	14.8	14.7	16.2	19.3	22.0	25.2	26.8	27.7	23.1	21.9	22.3	25.4	25.9	23.0	21.9	20.3	18.9	18.3	17.5	17.9	20.5	27.7	14.7
04	17.7	18.1	17.5	16.8	16.9	16.2	17.7	19.9	21.6	23.9	25.3	26.6	27.4	25.8	25.1	26.7	27.6	27.1	25.4	24.3	23.0	22.1	20.9	20.0	22.2	27.6	16.2
05	19.1	19.0	18.0	16.2	15.3	14.1	15.1	19.7	23.1	25.4	27.1	28.7	28.5	27.5	27.5	27.9	23.6	18.9	20.2	19.0	18.5	16.7	16.2	17.6	21.0	28.7	14.1
06	17.2	16.2	14.6	13.6	13.3	12.2	14.1	16.9	20.6	24.7	27.1	28.5	29.3	29.6	30.3	30.8	30.0	29.7	29.3	28.0	26.1	23.5	22.4	19.3	22.8	30.8	12.2
07	18.5	17.7	17.3	15.3	15.2	15.0	16.7	20.8	23.6	26.0	27.5	28.4	29.5	30.0	30.6	31.0	30.8	30.5	29.2	26.0	23.3	22.3	18.6	18.4	23.4	31.0	15.0
08	17.0	16.2	14.6	13.3	13.1	12.3	13.3	19.3	23.6	26.7	28.0	28.8	29.4	30.2	30.6	31.2	31.3	31.0	29.9	27.3	22.7	22.2	20.7	17.4	22.9	31.3	12.3
09	15.9	14.3	13.9	11.7	10.4	9.3	11.9	16.7	20.8	24.5	28.9	29.9	30.7	31.6	31.9	30.5	29.7	28.9	27.8	25.7	23.5	22.1	21.1	21.2	22.2	31.9	9.3
10	20.3	17.7	16.8	16.8	16.2	15.6	17.3	19.5	23.9	25.8	27.1	28.3	28.2	24.5	23.6	23.7	22.9	23.8	22.8	20.7	19.2	18.3	17.8	17.9	21.2	28.3	15.6
11	17.8	18.0	17.0	15.8	15.4	15.4	15.7	17.6	19.8	21.9	23.8	25.9	27.0	24.6	25.8	28.0	28.0	27.1	27.0	22.6	21.0	20.1	20.4	19.6	21.5	28.0	15.4
12	17.4	17.1	16.9	15.6	14.9	14.0	16.1	18.9	21.2	23.8	26.3	28.5	29.4	30.3	30.6	30.9	30.9	31.0	29.7	28.1	25.4	24.2	22.4	21.1	23.5	31.0	14.0
13	19.8	19.7	18.4	17.8	16.8	16.3	15.6	19.7	23.7	25.6	26.8	27.9	28.8	29.5	29.9	30.4	26.8	18.8	17.8	17.7	17.5	17.7	17.7	17.6	21.6	30.4	15.6
14	17.4	17.8	17.9	17.8	17.4	17.1	17.9	19.4	21.0	22.3	23.9	25.0	25.5	26.1	27.2	27.6	27.4	27.1	26.5	25.1	23.5	22.5	22.3	20.8	22.4	27.6	17.1
15	19.7	19.2	18.3	16.6	15.4	15.0	15.8	19.4	21.9	23.0	25.0	26.6	27.3	27.8	28.9	29.2	28.8	27.3	24.3	22.8	21.5	20.9	20.3	18.5	22.2	29.2	15.0
16	18.1	17.0	17.6	17.2	16.2	16.1	17.5	20.6	22.8	24.8	26.9	28.3	29.5	30.1	30.1	28.9	27.8	27.1	26.4	25.5	24.3	23.0	23.2	22.9	23.4	30.1	16.1
17	22.2	21.3	19.9	18.7	18.3	18.3	18.4	19.8	21.4	23.5	25.2	26.8	27.9	28.5	23.8	20.4	19.1	19.7	20.1	19.0	17.7	17.6	17.3	17.7	20.9	28.5	17.3
18	17.9	17.8	17.7	16.5	15.4	14.5	15.1	16.3	20.4	23.7	26.0	27.0	27.0	27.9	27.4	25.6	24.1	22.6	21.5	20.8	20.5	19.9	19.2	18.0	21.0	27.9	14.5
19	17.1	17.1	16.0	15.7	14.7	14.7	16.4	18.9	19.7	22.4	24.2	25.7	26.5	26.8	26.3	26.6	24.6	23.3	22.2	21.3	21.4	20.8	20.4	19.1	20.9	26.8	14.7
20	17.7	16.1	16.3	16.2	15.9	15.9	16.0	16.6	17.3	18.7	19.6	20.6	20.9	23.0	24.6	25.8	26.1	25.4	24.3	21.6	18.5	16.9	16.5	16.1	19.4	26.1	15.9
21	16.1	15.5	14.8	14.6	14.3	13.8	15.1	17.0	18.6	20.3	21.9	23.7	24.9	23.1	22.2	21.1	20.7	20.9	19.7	19.5	18.8	17.6	16.5	16.6	18.6	24.9	13.8
22	15.8	13.9	13.6	13.6	12.8	13.0	13.7	17.0	19.3	22.7	25.0	26.7	27.9	28.1	29.6	29.2	28.7	28.6	26.3	24.1	22.9	20.1	19.0	17.7	21.2	29.6	12.8
23	17.0	16.3	15.0	13.9	13.9	13.2	15.1	17.8	20.9	24.8	28.0	29.1	29.8	30.7	30.7	31.1	30.5	30.0	28.3	25.8	24.1	23.1	21.4	20.2	22.9	31.1	13.2
24	20.5	19.5	19.0	17.0	15.6	14.2	15.6	19.3	22.1	25.1	28.4	30.4	30.8	30.7	30.7	27.2	23.7	20.1	18.1	17.1	16.3	16.2	16.4	17.1	21.3	30.8	14.2
25	16.7	17.1	17.2	16.2	15.2	14.9	15.9	17.5	19.5	23.0	24.3	25.0	26.2	27.0	27.5	28.0	28.2	26.0	23.7	23.5	22.6	20.8	19.9	19.5	21.5	28.2	14.9
26	18.7	17.1	16.5	16.7	15.9	15.5	16.6	18.6	21.3	24.8	27.1	27.8	28.4	28.8	29.1	29.0	29.0	27.0	24.8	23.0	22.2	21.8	20.4	19.3	22.5	29.1	15.5
27	18.1	16.7	16.3	15.7	15.4	14.5	15.2	18.8	21.8	24.4	26.7	28.6	30.3	30.6	29.0	29.1	30.0	30.1	28.6	25.6	23.8	22.4	21.3	22.0	23.1	30.6	14.5
28	20.2	19.2	18.3	17.1	15.4	15.2	14.9	17.9	21.8	25.2	27.3	29.2	28.7	27.9	29.5	30.2	30.1	27.8	26.2	24.2	24.2	22.8	22.0	22.1	23.2	30.2	14.9
29	19.8	18.9	16.7	15.7	14.8	15.4	16.7	19.5	22.5	24.5	27.1	28.7	29.8	29.7	30.6	31.0	31.1	30.8	28.4	25.2	24.2	24.1	22.8	21.3	23.7	31.1	14.8
30	20.2	18.3	16.3	16.0	14.6	14.4	14.1	18.9	21.9	25.3	27.9	29.3	29.6	30.2	30.9	31.1	30.9	30.4	28.3	24.8	21.8	20.8	19.6	18.9	23.1	31.1	14.1
31	20.4	18.2	14.9	14.2	12.6	12.7	13.7	17.5	21.9	25.8	28.4	29.4	30.2	29.3	23.0	19.9	18.2	20.1	19.6	17.5	18.1	17.5	16.7	16.5	19.8	30.2	12.6
MEAN	18.3	17.4	16.6	15.7	15.0	14.6	15.7	18.6	21.4	24.0	26.0	27.4	27.8	27.6	27.6	27.6	26.9	25.8	24.6	22.9	21.5	20.6	19.7	19.0	21.8		
MAX	22.2	21.3	19.9	18.7	18.3	18.3	18.4	20.8	23.9	26.7	28.9	30.4	30.8	31.6	31.9	31.2	31.3	31.0	29.9	28.1	26.1	24.2	23.2	22.9		31.9	
MIN	15.2	13.9	13.6	11.7	10.4	9.3	11.9	16.3	17.3	18.7	19.6	20.6	20.9	19.7	19.8	19.6	18.2	18.8	17.8	17.1	16.3	16.2	16.2	16.1			9.3

POSSIBLE NUMBER OF OBSERVATIONS = 744 ACTUAL NUMBER OF OBSERVATIONS = 744 DATA RECOVERY RATE = 100 %

MONTHLY MEAN = 21.8 Deg C

MAXIMUM 10M TEMPERATURE WAS 31.9 Deg C ON 8/ 9 AT 1500 MAXIMUM DAILY MEAN WAS 23.7 Deg C ON 8/29

MINIMUM 10M TEMPERATURE WAS 9.3 Deg C ON 8/ 9 AT 600 MINIMUM DAILY MEAN WAS 18.6 Deg C ON 8/21

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Homestake

10M TEMPERATURE in Deg C for SEPTEMBER, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MN	MAX	MIN
01	16.2	15.6	15.1	15.6	15.0	15.3	15.5	16.1	19.0	23.2	24.7	26.1	26.8	24.0	21.8	19.3	20.7	19.4	18.0	17.3	17.0	16.0	15.6	15.7	18.7	26.8	15.0
02	15.3	15.5	14.3	13.7	13.1	12.2	12.1	15.4	18.3	21.0	24.0	25.6	26.5	27.2	27.2	27.4	26.8	23.5	21.5	21.3	20.5	20.9	20.2	18.8	20.1	27.4	12.1
03	17.0	16.7	16.0	16.2	15.3	15.9	16.1	16.1	20.6	23.9	26.9	27.2	26.5	25.5	26.1	25.4	22.8	22.1	22.3	21.3	19.9	19.2	20.0	19.9	20.8	27.2	15.3
04	18.9	18.1	17.3	17.2	16.4	16.2	16.4	17.6	18.2	19.0	20.1	21.2	22.0	21.9	21.6	19.6	17.7	18.3	16.9	16.2	16.5	15.2	14.8	14.8	18.0	22.0	14.8
05	15.0	15.0	15.2	15.1	15.0	14.4	15.1	15.8	16.7	18.0	19.1	20.4	21.5	22.8	23.7	23.9	24.5	23.6	22.7	22.3	21.5	20.4	19.4	18.7	19.2	24.5	14.4
06	18.1	17.7	16.6	15.2	13.6	13.1	13.6	14.9	17.2	18.8	20.5	21.3	23.0	23.8	23.7	24.3	22.2	18.4	16.9	16.6	16.4	16.0	16.5	16.1	18.1	24.3	13.1
07	15.8	15.2	14.8	13.9	13.6	13.0	12.8	13.9	16.8	19.6	21.7	21.1	20.1	20.0	20.7	20.8	21.5	20.7	19.9	19.2	18.8	17.2	16.2	15.3	17.6	21.7	12.8
08	13.4	13.3	12.7	12.8	12.6	12.6	12.7	14.1	15.3	16.8	17.9	18.3	18.3	19.5	20.3	20.3	19.4	17.7	16.0	15.3	15.5	14.7	14.0	13.7	15.7	20.3	12.6
09	13.8	13.5	13.2	13.2	13.4	12.7	12.0	11.9	12.8	13.8	14.6	16.0	16.9	17.4	15.6	11.5	12.4	12.9	12.8	12.6	12.5	11.8	11.3	11.8	13.4	17.4	11.3
10	11.4	10.9	10.8	11.2	11.2	10.8	11.0	11.9	13.9	15.0	15.8	16.5	17.0	18.1	19.1	17.0	16.9	17.7	17.5	17.3	16.3	15.2	14.4	13.9	14.6	19.1	10.8
11	14.4	13.7	13.3	12.8	12.9	12.7	12.5	14.5	16.3	17.4	18.2	19.5	21.0	22.4	22.5	22.7	21.3	18.1	15.4	14.7	14.7	14.7	14.7	13.8	16.4	22.7	12.5
12	12.9	11.5	11.0	10.0	9.8	9.8	10.6	13.1	16.3	17.8	19.5	20.9	21.6	22.2	22.1	17.2	14.7	15.6	14.6	13.8	13.7	13.1	13.1	12.8	14.9	22.2	9.8
13	12.4	12.5	11.5	11.3	11.2	11.3	11.3	11.9	13.8	16.0	17.8	19.1	20.6	21.6	22.2	22.3	22.2	21.5	19.6	17.8	16.5	15.2	15.5	15.0	16.3	22.3	11.2
14	13.5	12.9	12.9	13.3	13.6	13.0	11.7	11.6	12.9	15.1	16.8	18.4	19.1	20.1	20.8	21.0	18.5	18.4	17.1	15.8	13.2	13.1	12.7	12.2	15.3	21.0	11.6
15	12.2	12.9	12.8	11.8	10.7	10.0	9.7	12.2	13.9	15.4	16.9	18.1	18.9	18.7	17.9	18.2	17.5	14.6	13.6	13.1	12.8	11.8	10.9	9.6	13.9	18.9	9.6
16	8.8	8.1	7.7	7.0	6.8	6.2	6.2	9.4	13.4	16.9	18.5	19.1	20.4	21.1	21.5	21.5	20.4	18.3	17.1	16.5	15.7	14.7	13.0	12.5	14.2	21.5	6.2
17	11.3	10.9	8.7	9.2	10.2	10.5	11.1	11.7	14.0	17.1	18.5	18.4	19.6	19.3	19.6	19.9	19.7	17.3	16.5	15.6	13.5	11.3	10.6	9.8	14.3	19.9	8.7
18	8.5	7.4	7.2	7.1	6.3	7.2	7.9	10.5	13.7	16.8	19.5	20.8	21.4	22.2	22.7	22.8	22.4	21.4	19.4	17.7	15.3	14.2	12.6	11.6	14.9	22.8	6.3
19	11.2	9.4	8.0	8.0	7.6	6.2	7.3	10.8	14.8	18.4	21.6	22.8	23.6	24.2	24.3	24.5	23.9	23.3	21.2	18.8	16.4	13.9	12.7	11.6	16.0	24.5	6.2
20	10.4	9.2	8.8	7.9	6.7	6.3	6.8	11.3	15.4	18.4	22.2	23.2	24.1	24.7	24.8	25.3	24.7	23.1	21.4	19.1	17.4	13.6	12.5	11.8	16.2	25.3	6.3
21	9.8	9.8	8.4	7.3	6.9	6.8	7.3	11.5	15.0	19.0	22.0	23.5	24.7	24.6	23.1	23.1	23.6	23.4	20.7	17.2	15.2	12.9	11.6	10.2	15.7	24.7	6.8
22	8.4	7.7	7.3	6.2	5.0	3.6	4.5	9.5	13.6	17.5	20.3	22.4	23.2	23.6	24.1	24.2	24.0	23.3	20.1	17.4	15.7	12.7	11.7	10.1	14.8	24.2	3.6
23	8.2	6.3	5.8	4.7	4.6	3.1	4.2	7.7	12.4	17.6	21.7	23.4	24.3	25.3	25.9	25.9	25.4	24.1	20.5	17.4	15.3	13.1	11.4	9.2	14.9	25.9	3.1
24	7.5	6.7	6.6	5.3	3.7	3.7	4.9	8.8	13.2	17.4	22.1	24.2	25.1	25.6	25.8	25.8	25.5	24.4	20.5	17.6	15.7	12.7	11.0	9.0	15.1	25.8	3.7
25	7.6	7.4	4.9	4.6	4.1	3.2	4.2	8.4	12.8	17.2	21.7	24.1	25.3	25.3	25.7	25.6	25.1	22.8	20.6	18.3	17.5	14.5	14.0	12.3	15.3	25.7	3.2
26	10.9	10.0	9.7	9.3	8.5	7.7	9.0	12.1	17.8	21.1	22.6	23.4	23.2	24.0	23.1	22.9	21.9	20.5	18.0	17.3	15.6	14.1	13.5	10.6	16.1	24.0	7.7
27	9.3	8.8	7.7	7.4	6.3	6.1	6.2	9.8	13.7	18.0	20.7	22.4	22.8	24.3	24.6	22.9	23.9	22.3	20.3	18.0	15.8	14.9	13.8	11.9	15.5	24.6	6.1
28	9.9	9.2	7.5	6.4	5.6	5.3	5.6	9.4	13.7	18.8	22.5	24.9	25.3	25.9	26.0	26.0	25.5	24.4	20.9	18.1	16.9	15.1	12.1	10.5	16.1	26.0	5.3
29	9.6	9.0	7.6	7.1	7.3	6.9	6.2	10.9	15.5	19.8	23.3	25.6	26.5	26.7	26.8	26.5	24.3	21.8	20.9	20.1	19.9	19.4	18.5	17.2	17.4	26.8	6.2
30	15.8	15.1	14.6	14.5	14.1	13.7	13.2	13.5	14.3	15.5	16.4	18.2	18.7	20.1	22.3	23.0	23.0	21.8	19.3	18.0	15.9	13.9	12.0	10.5	16.6	23.0	10.5
MEAN	12.3	11.7	10.9	10.5	10.0	9.6	9.9	12.2	15.2	18.0	20.3	21.5	22.3	22.7	22.8	22.4	21.7	20.5	18.7	17.4	16.3	14.8	14.0	13.0	16.2		
MAX	18.9	18.1	17.3	17.2	16.4	16.2	16.4	17.6	20.6	23.9	26.9	27.2	26.8	27.2	27.2	27.4	26.8	24.4	22.7	22.3	21.5	20.9	20.2	19.9		27.4	
MIN	7.5	6.3	4.9	4.6	3.7	3.1	4.2	7.7	12.4	13.8	14.6	16.0	16.9	17.4	15.6	11.5	12.4	12.9	12.8	12.6	12.5	11.3	10.6	9.0			3.1

POSSIBLE NUMBER OF OBSERVATIONS = 720 ACTUAL NUMBER OF OBSERVATIONS = 720 DATA RECOVERY RATE = 100 %

MONTHLY MEAN = 16.2 Deg C

MAXIMUM 10M TEMPERATURE WAS 27.4 Deg C ON 9/ 2 AT 1600 MAXIMUM DAILY MEAN WAS 20.8 Deg C ON 9/ 3

MINIMUM 10M TEMPERATURE WAS 3.1 Deg C ON 9/23 AT 600 MINIMUM DAILY MEAN WAS 13.4 Deg C ON 9/ 9

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Appendix D
Relative Humidity Data for July through September 2011

Homestake

RELATIVE HUMIDITY in % for JULY, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MN	MAX	MIN
01	20	22	25	28	31	31	28	21	16	13	11	11	10	9	8	8	8	8	9	10	10	18	22	23	17	31	8
02	25	31	29																								
03																											
04																											
05																											
06											20	16	15	14	13	12	12	13	20	25	31	34	39	43			
07	44	47	49	51	53	52	46	38	34	29	24	19	17	14	15	15	15	16	20	25	26	30	36	40	31	53	14
08	44	48	53	63	69	68	57	44	35	27	22	22	17	18	24	24	25	24	26	31	41	40	46	52	38	69	17
09	56	60	59	69	72	71	59	46	40	26	21	20	23	29	34	44	54	48	42	48	53	56	64	73	49	73	20
10	78	74	76	73	80	78	65	55	48	38	31	21	20	24	20	22	26	28	30	33	40	42	41	42	45	80	20
11	49	57	63	64	67	67	62	53	45	38	27	25	34	41	41	40	50	58	63	59	63	69	63	68	53	69	25
12	72	76	81	84	86	87	82	77	72	68	72	62	45	34	31	38	65	60	56	61	68	75	80	81	67	87	31
13	82	84	86	88	88	90	82	68	58	47	32	30	29	27	26	23	21	20	25	29	43	47	44	52	51	90	20
14	62	45	36	31	49	52	47	31	18	15	15	14	14	13	13	13	13	13	13	15	16	18	17	21	25	62	13
15	20	16	21	27	30	28	23	17	12	11	11	12	11	11	12	12	12	14	15	16	18	21	23	24	17	30	11
16	27	27	32	37	37	35	32	23	18	16	19	19	18	17	15	14	14	14	14	22	27	29	34	33	24	37	14
17	47	55	64	71	76	75	72	65	40	34	31	28	25	23	22	23	23	22	23	27	28	29	31	37	40	76	22
18	41	52	56	60	62	65	57	49	35	30	26	24	22	19	16	16	15	15	15	19	26	31	35	39	34	65	15
19	43	42	44	46	51	50	48	40	35	31	26	37	26	23	22	26	66	72	73	76	78	78	83	87	50	87	22
20	89	84	88	90	87	89	82	73	57	45	36	42	56	44	26	30	33	44	56	59	60	62	72	71	61	90	26
21	74	78	82	86	86	88	84	65	53	42	34	28	31	35	31	34	42	48	44	55	57	60	59	65	57	88	28
22	76	79	72	76	80	78	75	58	39	24	21	20	19	17	16	16	14	14	17	21	22	30	37	41	40	80	14
23	41	44	51	58	63	62	60	53	33	14	10	10	10	11	11	11	11	11	13	27	36	37	38	34	31	63	10
24	37	45	47	48	52	52	46	41	37	34	31	28	26	27	34	30	24	20	34	47	61	80	78	76	43	80	20
25	69	76	83	82	81	78	83	69	65	44	40	35	33	31	41	53	50	48	53	59	65	74	75	77	61	83	31
26	77	73	80	83	84	83	76	62	53	42	36	33	35	61	64	68	57	59	63	75	80	83	83	86	67	86	33
27	87	88	89	87	90	88	83	74	64	56	48	40	35	32	28	26	24	24	27	32	39	43	51	57	55	90	24
28	64	67	68	65	69	65	68	52	39	30	26	24	21	19	17	15	14	14	14	29	31	34	41	47	39	69	14
29	52	56	60	58	57	56	51	48	47	47	45	45	39	31	27	23	25	46	60	71	80	87	89	83	53	89	23
30	82	81	84	86	91	92	90	85	74	55	46	43	34	30	28	25	30	31	54	65	67	64	70	82	62	92	25
31	83	84	83	86	89	81	64	60	58	45	38	35	31	31	32	30	32	40	51	69	72	68	66	68	58	89	30
MEAN	57	59	62	65	68	68	62	53	43	35	30	27	26	25	25	26	29	30	34	41	46	50	52	56	44		
MAX	89	88	89	90	91	92	90	85	74	68	72	62	56	61	64	68	66	72	73	76	80	87	89	87		92	
MIN	20	16	21	27	30	28	23	17	12	11	10	10	10	9	8	8	8	8	9	10	10	18	17	21			8

POSSIBLE NUMBER OF OBSERVATIONS = 744 ACTUAL NUMBER OF OBSERVATIONS = 641 DATA RECOVERY RATE = 86.2 %

MONTHLY MEAN = 44 %

MAXIMUM RELATIVE HUMIDITY WAS 92 % ON 7/30 AT 600

MINIMUM RELATIVE HUMIDITY WAS 8 % ON 7/ 1 AT 1700

MAXIMUM DAILY MEAN WAS 67 % ON 7/12

MINIMUM DAILY MEAN WAS 17 % ON 7/ 1

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Homestake

RELATIVE HUMIDITY in % for AUGUST, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MN	MAX	MIN
01	66	76	71	71	80	79	69	57	51	46	41	39	43	68	66	69	75	73	73	74	74	72	74	77	66	80	39
02	86	88	91	93	93	94	86	77	66	54	43	38	37	39	33	33	34	38	45	51	52	53	59	63	60	94	33
03	69	70	76	80	81	84	78	67	56	44	37	29	46	45	48	30	28	42	44	53	59	62	69	67	57	84	28
04	69	64	66	68	67	72	66	56	48	38	32	29	27	31	31	28	26	26	29	32	38	42	49	52	45	72	26
05	56	56	63	70	72	75	71	55	38	31	26	22	22	23	25	24	40	68	57	59	64	77	77	67	52	77	22
06	71	75	83	87	90	90	85	74	58	32	22	18	16	16	15	14	14	15	16	18	21	27	31	41	43	90	14
07	41	45	48	57	55	53	49	36	27	21	17	14	13	14	15	15	15	14	14	16	20	23	32	33	29	57	13
08	37	41	43	47	47	48	48	30	20	13	9	9	8	7	8	7	8	8	8	11	14	15	17	26	22	48	7
09	28	30	30	35	42	47	38	27	20	14	10	9	9	9	10	13	14	16	19	22	26	28	28	28	23	47	9
10	32	38	40	45	49	49	46	37	30	29	25	23	23	36	42	48	53	50	56	58	67	74	76	73	46	76	23
11	72	72	76	86	86	84	83	74	63	53	44	35	28	43	37	30	28	31	31	48	54	57	53	57	55	86	28
12	67	68	72	79	81	83	78	65	56	45	34	24	19	19	18	16	17	16	19	22	30	36	40	45	44	83	16
13	52	51	53	58	62	63	67	55	42	36	30	27	25	23	20	17	31	66	75	77	79	78	78	77	52	79	17
14	78	73	71	75	71	76	71	61	50	45	36	32	28	24	21	19	17	17	18	21	26	29	33	43	43	78	17
15	51	55	58	67	74	75	69	57	48	43	34	29	27	25	23	22	22	29	39	45	49	48	49	55	46	75	22
16	60	58	60	62	67	67	64	52	43	35	29	23	20	18	19	21	22	24	27	29	32	37	35	40	39	67	18
17	42	44	50	53	52	53	58	56	50	43	37	32	30	29	41	65	70	67	59	65	73	72	73	69	53	73	29
18	67	68	67	79	85	89	85	81	62	47	36	30	28	25	30	37	38	42	46	48	50	53	60	67	55	89	25
19	73	74	82	84	89	89	78	63	58	48	39	32	31	29	30	29	37	40	45	50	49	52	55	64	55	89	29
20	77	86	87	87	89	88	90	86	81	70	67	62	62	51	41	35	34	37	42	54	71	80	84	85	69	90	34
21	82	84	88	88	89	91	88	80	75	71	63	53	45	57	62	71	65	60	64	65	69	77	84	80	73	91	45
22	82	87	87	87	88	88	84	74	67	54	39	30	26	23	22	23	25	26	32	40	44	57	63	67	55	88	22
23	70	77	81	84	84	85	78	67	54	39	29	24	19	18	17	16	16	17	21	28	35	37	44	47	45	85	16
24	45	47	51	59	66	69	64	52	42	33	24	21	19	20	20	28	45	62	76	82	86	87	87	80	53	87	19
25	82	78	78	84	87	89	83	78	68	55	48	44	39	33	31	28	27	35	43	47	48	58	59	66	58	89	27
26	71	78	77	76	82	81	80	72	58	42	32	27	26	25	23	23	23	30	41	48	50	48	55	62	51	82	23
27	68	74	78	78	77	82	81	64	52	41	31	25	21	21	24	23	21	20	24	32	40	46	50	44	47	82	20
28	54	59	63	69	80	76	78	67	50	35	30	25	24	29	25	23	23	27	29	39	38	41	44	46	45	80	23
29	63	66	75	77	77	73	71	63	50	37	31	25	22	20	16	14	12	13	15	23	31	30	32	38	41	77	12
30	42	50	55	60	65	65	66	50	39	31	24	17	14	14	12	12	11	11	13	17	24	28	31	35	33	66	11
31	33	40	50	48	59	59	58	45	34	27	22	19	18	19	36	58	69	58	64	75	69	69	74	75	49	75	18
MEAN	61	64	67	71	74	75	71	61	50	40	33	28	26	27	28	29	31	35	38	44	48	51	55	57	48		
MAX	86	88	91	93	93	94	90	86	81	71	67	62	62	68	66	71	75	73	76	82	86	87	87	85		94	
MIN	28	30	30	35	42	47	38	27	20	13	9	9	8	7	8	7	8	8	8	11	14	15	17	26			7

POSSIBLE NUMBER OF OBSERVATIONS = 744 ACTUAL NUMBER OF OBSERVATIONS = 744 DATA RECOVERY RATE = 100 %

MONTHLY MEAN = 48 %

MAXIMUM RELATIVE HUMIDITY WAS 94 % ON 8/ 2 AT 600

MINIMUM RELATIVE HUMIDITY WAS 7 % ON 8/ 8 AT 1600

MAXIMUM DAILY MEAN WAS 73 % ON 8/21

MINIMUM DAILY MEAN WAS 22 % ON 8/ 8

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Homestake

RELATIVE HUMIDITY in % for SEPTEMBER, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MN	MAX	MIN
01	75	78	80	79	80	79	78	79	67	48	35	30	29	38	48	60	57	61	70	75	74	83	89	88	66	89	29
02	89	85	90	92	93	93	92	82	72	58	46	31	29	28	28	26	26	34	41	41	49	45	47	53	57	93	26
03	60	63	68	68	77	73	72	71	51	36	25	22	24	25	24	27	40	43	40	44	50	54	51	52	48	77	22
04	57	61	64	64	68	71	72	68	66	63	56	51	48	47	45	45	59	58	69	70	64	76	79	78	62	79	45
05	78	77	75	73	71	74	69	68	65	60	52	49	43	38	35	35	30	32	34	36	40	47	52	55	54	78	30
06	58	60	66	72	76	73	74	72	65	61	54	49	43	40	41	38	49	71	80	82	82	84	79	82	65	84	38
07	82	84	88	92	94	94	94	93	83	69	52	54	56	55	57	57	54	59	62	62	60	69	73	76	72	94	52
08	84	84	87	84	82	80	79	70	64	53	46	45	48	44	40	37	45	54	60	64	61	65	69	69	63	87	37
09	68	72	74	74	72	76	81	86	81	74	70	57	49	48	60	84	83	83	82	80	80	84	84	82	74	86	48
10	84	86	86	85	84	86	85	81	70	62	61	58	55	50	46	53	55	47	47	50	56	66	73	72	67	86	46
11	66	70	73	76	71	72	76	65	53	50	47	44	38	34	33	31	36	53	70	77	78	75	67	74	60	78	31
12	78	86	89	90	90	91	90	80	65	57	48	38	36	33	33	54	75	69	79	79	80	83	78	81	70	91	33
13	84	80	86	87	88	89	91	87	74	64	55	48	41	37	36	34	34	38	48	56	60	69	64	62	63	91	34
14	73	77	79	77	76	73	84	80	68	64	56	50	44	39	34	25	40	40	50	59	79	79	83	85	63	85	25
15	84	74	73	77	86	89	89	82	75	63	56	50	45	48	49	38	43	66	72	75	77	84	87	89	70	89	38
16	89	91	92	93	93	94	94	91	75	57	40	34	28	24	26	25	32	43	48	50	51	55	62	64	60	94	24
17	68	71	78	78	84	86	81	83	71	53	49	42	37	38	40	35	34	49	53	55	63	75	78	81	62	86	34
18	84	87	89	87	90	90	86	76	64	52	41	31	29	28	26	25	27	31	37	41	48	54	61	64	56	90	25
19	66	70	74	76	76	80	80	66	53	41	28	26	25	23	22	21	22	23	27	33	40	51	56	60	47	80	21
20	64	69	72	74	75	75	74	62	49	37	26	20	17	16	15	15	16	19	25	29	29	38	43	48	42	75	15
21	55	54	58	57	66	70	66	55	46	35	25	22	19	15	18	18	17	17	23	37	37	48	50	57	40	70	15
22	65	64	63	69	69	72	65	49	35	27	24	17	14	13	13	13	14	15	20	24	28	32	33	43	37	72	13
23	47	53	56	54	56	63	58	48	35	24	17	14	12	11	9	10	11	11	14	18	22	28	32	37	31	63	9
24	40	40	39	45	55	60	53	38	30	22	15	12	11	11	9	7	9	11	15	17	21	26	27	33	27	60	7
25	37	40	43	43	47	52	51	36	28	22	15	13	12	11	11	12	12	17	22	26	28	32	36	43	29	52	11
26	47	47	51	55	54	57	56	43	31	24	21	19	19	18	20	20	23	27	31	33	38	41	41	49	36	57	18
27	54	57	58	60	62	62	66	52	41	31	26	21	19	15	16	18	15	21	26	31	34	37	39	46	38	66	15
28	51	54	61	61	64	66	66	53	41	30	23	17	15	14	13	13	13	15	19	22	24	29	32	36	35	66	13
29	40	38	46	43	45	51	55	38	28	22	16	14	14	13	13	13	18	25	26	29	29	31	33	36	30	55	13
30	38	40	40	39	39	40	41	40	38	35	34	31	30	28	23	20	19	22	26	29	33	40	45	49	34	49	19
MEAN	65	67	70	71	73	74	74	67	56	47	39	34	31	29	29	30	34	38	44	47	51	56	58	61	52		
MAX	89	91	92	93	94	94	94	93	83	74	70	58	56	55	60	84	83	83	82	82	82	84	89	89		94	
MIN	37	38	39	39	39	40	41	36	28	22	15	12	11	11	9	7	9	11	14	17	21	26	27	33			7

POSSIBLE NUMBER OF OBSERVATIONS = 720 ACTUAL NUMBER OF OBSERVATIONS = 720 DATA RECOVERY RATE = 100 %

MONTHLY MEAN = 52 %

MAXIMUM RELATIVE HUMIDITY WAS 94 % ON 9/16 AT 700 MAXIMUM DAILY MEAN WAS 74 % ON 9/ 9

MINIMUM RELATIVE HUMIDITY WAS 7 % ON 9/24 AT 1600 MINIMUM DAILY MEAN WAS 27 % ON 9/24

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Appendix E
Precipitation Data for July through September 2011

Homestake

PRECIPITATION in Inches for JULY, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOT	MAX HR
01								.01															.02		.03	.02
02				---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
03	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
04	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
05	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
06	---	---	---	---	---	---	---	---	---	---															---	---
07																									.00	.00
08																									.00	.00
09														.06											.06	.06
10																									.00	.00
11																									.00	.00
12																.02									.02	.02
13																									.00	.00
14																									.00	.00
15																									.00	.00
16																									.00	.00
17																									.00	.00
18																									.00	.00
19																	.02								.02	.02
20																									.00	.00
21																									.00	.00
22																									.00	.00
23																									.00	.00
24																									.00	.00
25																									.00	.00
26														.03	.05										.08	.05
27																									.00	.00
28																									.00	.00
29																		.07	.08		.12	.09	.01		.37	.12
30																									.00	.00
31																									.00	.00

POSSIBLE NUMBER OF OBSERVATIONS = 744 ACTUAL NUMBER OF OBSERVATIONS = 641 DATA RECOVERY RATE = 86.2 %

TOTAL PRECIPITATION for the MONTH = .58 Inches

MAXIMUM DAILY PRECIPITATION WAS .37 Inches on 7/29

MAXIMUM HOURLY PRECIPITATION WAS .12 Inches on 7/29 at 2100

MISSING DATA IS INDICATED BY ---
BLANKS INDICATE ZERO PRECIPITATION

Homestake

PRECIPITATION in Inches for AUGUST, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOT	MAX HR
01																									.00	.00
02																									.00	.00
03													.04												.04	.04
04																									.00	.00
05																	.01								.01	.01
06																									.00	.00
07																			.01	.03			.01		.05	.03
08																			.01	.01	.01	.01			.04	.01
09																		.01		.01	.02		.01		.05	.02
10													.01	.05	.03		.01							.06	.16	.06
11	.01			.05	.01																				.07	.05
12																									.00	.00
13																									.00	.00
14																									.00	.00
15																									.00	.00
16																									.00	.00
17																.02	.02								.04	.02
18																									.00	.00
19																									.00	.00
20		.02	.03				.01														.01	.33	.03	.01	.44	.33
21	.01			.01																					.02	.01
22																									.00	.00
23																									.00	.00
24																.06		.05	.09	.20	.04	.01			.45	.20
25																									.00	.00
26																									.00	.00
27																									.00	.00
28																									.00	.00
29														.01											.01	.01
30																									.00	.00
31															.54	.02	.01								.57	.54

POSSIBLE NUMBER OF OBSERVATIONS = 744 ACTUAL NUMBER OF OBSERVATIONS = 744 DATA RECOVERY RATE = 100 %

TOTAL PRECIPITATION for the MONTH = 1.95 Inches

MAXIMUM DAILY PRECIPITATION WAS .57 Inches on 8/31

MAXIMUM HOURLY PRECIPITATION WAS .54 Inches on 8/31 at 1500

MISSING DATA IS INDICATED BY ---
BLANKS INDICATE ZERO PRECIPITATION

Homestake

PRECIPITATION in Inches for SEPTEMBER, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOT	MAX HR
01														.12		.01									.13	.12
02																									.00	.00
03																									.00	.00
04																									.00	.00
05																									.00	.00
06																		.04	.06		.02		.01		.13	.06
07													.01												.01	.01
08																									.00	.00
09								.01							.09	.13									.23	.13
10																									.00	.00
11																		.01						.01	.02	.01
12																.09	.04	.01							.14	.09
13																									.00	.00
14					.01	.01	.02														.02				.06	.02
15																									.00	.00
16																									.00	.00
17					.02				.01																.03	.02
18																									.00	.00
19																									.00	.00
20																									.00	.00
21																									.00	.00
22																									.00	.00
23																									.00	.00
24																									.00	.00
25																									.00	.00
26																									.00	.00
27																									.00	.00
28																									.00	.00
29																									.00	.00
30																									.00	.00

POSSIBLE NUMBER OF OBSERVATIONS = 720 ACTUAL NUMBER OF OBSERVATIONS = 720 DATA RECOVERY RATE = 100 %

TOTAL PRECIPITATION for the MONTH = .75 Inches

MAXIMUM DAILY PRECIPITATION WAS .23 Inches on 9/ 9

MAXIMUM HOURLY PRECIPITATION WAS .13 Inches on 9/ 9 at 1600

MISSING DATA IS INDICATED BY ---
BLANKS INDICATE ZERO PRECIPITATION

Appendix F
Solar Radiation Data for July through September 2011

Homestake

SOLAR RADIATION in W/M^2 for JULY, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL	MAX
01	1	1	1	1	1	68	263	473	675	848	975	1038	1051	1008	910	763	584	184	164	14					9023	1051
02				---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
03	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
04	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
05	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
06	---	---	---	---	---	---	---	---	---	---	962	1064	947	690	916	751	549	106	25	8	1	1	1	1	---	---
07	1	1	1	1	1	56	234	440	637	810	950	1090	1052	821	843	697	493	238	84	7	1	1	1	1	8461	1090
08	1	1	1	1	1	54	231	437	635	811	976	674	752	325	151	484	102	43	24	4	1	1	1	1	5712	976
09	1	1	1	1	1	53	233	437	637	808	937	666	765	256	706	138	86	100	55	5	1	1	1	1	5891	937
10	1	1	1	1	1	52	231	437	635	806	932	1022	413	609	490	275	344	108	34	2	1	1	1	1	6399	1022
11	1	1	1	1	1	29	232	431	629	800	945	1024	736	209	189	108	52	33	16	3	1	1	1	1	5445	1024
12	1	1	1	1	1	36	80	100	151	177	297	565	965	899	673	103	63	219	131	9	1	1	1	1	4477	965
13	1	1	1	1	1	55	231	434	633	805	966	721	565	370	631	471	519	354	180	11	1	1	1	1	6955	966
14	1	1	1	1	1	24	120	465	650	822	961	1003	1121	1007	702	761	537	329	188	13	1	1	1	1	8712	1121
15	1	1	1	1	1	48	236	455	673	746	958	1017	1032	926	323	210	145	53	21	2	1	1	1	1	6854	1032
16	1	1	1	1	1	36	140	439	553	793	924	870	920	351	543	804	518	81	43	6	1	1	1	1	7030	924
17	1	1	1	1	1	47	162	376	612	777	902	983	961	930	895	730	540	327	118	3	1	1	1	1	8372	983
18	1	1	1	1	1	32	202	423	624	798	926	1002	1022	994	899	612	547	322	69	2	1	1	1	1	8483	1022
19	1	1	1	1	1	31	168	409	496	786	963	302	1074	974	321	114	5	4	10	5	1	1	1	1	5671	1074
20	1	1	1	1	1	38	215	415	614	790	951	212	161	488	965	444	177	138	59	2	1	1	1	1	5678	965
21	1	1	1	1	1	11	185	315	595	587	920	790	192	297	275	244	243	162	63	5	1	1	1	1	4893	920
22	1	1	1	1	1	12	180	418	622	796	896	945	875	772	746	489	426	372	69	4	1	1	1	1	7631	945
23	1	1	1	1	1	35	176	316	593	811	764	1058	1017	921	665	520	552	221	33	2	1	1	1	1	7693	1058
24	1	1	1	1	1	34	203	408	610	702	726	1069	756	336	227	332	271	59	44	5	1	1	1	1	5791	1069
25	1	1	1	1	1	20	145	436	613	601	740	987	943	450	150	142	152	122	51	3	1	1	1	1	5564	987
26	1	1	1	1	1	32	197	405	607	787	671	392	182	300	68	374	219	150	51	2	1	1	1	1	4446	787
27	1	1	1	1	1	36	200	402	602	774	900	953	1002	1010	837	717	502	148	48	4	1	1	1	1	8144	1010
28	1	1	1	1	1	20	103	244	486	586	808	664	961	998	905	535	258	148	72	3	1	1	1	1	6800	998
29	1	1	1	1	1	5	57	201	189	173	265	213	620	959	778	684	265	33	5	1	1	1	1	1	4457	959
30	1	1	1	1	1	30	129	373	586	698	849	885	991	959	880	572	502	243	16	1	1	1	1	1	7723	991
31	1	1	1	1	1	11	75	153	345	797	624	979	994	736	543	320	236	141	62	3	1	1	1	1	6028	994
MEAN	1	1	1	1	1	35	178	378	565	719	840	822	817	689	601	459	329	164	64	5	1	1	1	1	6628	
MAX	1	1	1	1	1	68	263	473	675	848	976	1090	1121	1010	965	804	584	372	188	14	1	1	1	1		1121
MIN	0	0	0	1	1	5	57	100	151	173	265	212	161	209	68	103	5	4	5	1	0	0	0	0		

POSSIBLE NUMBER OF OBSERVATIONS = 744 ACTUAL NUMBER OF OBSERVATIONS = 641 DATA RECOVERY RATE = 86.2 %

MONTHLY MEAN OF DATA > 0 = 281 W/M^2 MAXIMUM DAILY TOTAL WAS 9023 W/M^2 ON 7/ 1

MAXIMUM SOLAR RADIATION WAS 1121 W/M^2 ON 7/14 AT 1300 MINIMUM DAILY TOTAL WAS 4446 W/M^2 ON 7/26

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY ---

Homestake

SOLAR RADIATION in W/M^2 for AUGUST, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL	MAX
01	1	1	1	1	1	11	159	408	596	798	933	888	432	163	93	62	91	75	21	1	1	1	1	1	4740	933
02	1	1	1	1	1	31	204	254	563	690	842	938	479	748	740	660	506	122	36	2	1	1	1	1	6824	938
03	1	1	1	1	1	21	183	390	591	770	931	641	153	103	281	644	202	100	35	1	1	1	1	1	5055	931
04	1	1	1	1	1	35	191	316	592	764	896	971	821	176	475	722	478	202	26	1	1	1	1	1	6675	971
05	1	1	1	1	1	7	155	393	596	769	877	980	500	392	810	524	44	98	147	3	1	1	1	1	6304	980
06	1	1	1	1	1	23	189	389	596	773	904	1009	997	941	862	705	187	116	99	4	1	1	1	1	7803	1009
07	1	1	1	1	1	24	186	411	422	781	635	930	976	971	898	653	503	305	92	2	1	1	1	1	7798	976
08	1	1	1	1	1	20	197	422	610	770	867	1013	1026	986	876	719	520	299	92	2	1	1	1	1	8428	1026
09	1	1	1	1	1	20	188	408	617	628	835	995	939	908	778	175	178	208	35	1	1	1	1	1	6922	995
10	1	1	1	1	1	8	89	326	597	755	889	1014	384	107	128	86	112	199	18	1	1	1	1	1	4722	1014
11	1	1	1	1	1	4	79	373	581	777	885	967	802	188	561	675	313	185	51	1	1	1	1	1	6451	967
12	1	1	1	1	1	20	158	371	578	762	892	976	704	893	779	574	486	257	38	2	1	1	1	1	7499	976
13	1	1	1	1	1	7	109	361	580	725	832	947	933	854	553	594	126	14	13	1	1	1	1	1	6658	947
14	1	1	1	1	1	8	110	152	279	575	836	838	590	352	643	463	193	109	31	1	1	1	1	1	5189	838
15	1	1	1	1	1	12	153	366	479	558	874	916	748	684	869	692	364	198	36	1	1	1	1	1	6959	916
16	1	1	1	1	1	15	167	350	541	667	859	943	865	524	465	243	207	102	31	1	1	1	1	1	5989	943
17	1	1	1	1	1	6	47	115	188	372	534	911	970	664	66	22	48	34	15	1	1	1	1	1	4002	970
18	1	1	1	1	1	9	78	317	551	744	878	576	260	480	229	79	38	23	7	1	1	1	1	1	4279	878
19	1	1	1	1	1	6	183	213	280	777	876	951	753	342	254	232	97	48	9	1	1	1	1	1	5031	951
20	1	1	1	1	1	1	32	89	164	387	309	308	467	955	803	656	438	95	11	1			1	1	4723	955
21	1	1	1	1	1	9	158	348	552	743	873	997	637	127	83	117	104	54	21	1	1	1	1	1	4833	997
22	1	1	1	1	1	10	147	351	556	731	863	941	971	491	894	569	322	200	31	1	1	1	1	1	7087	971
23	1	1	1	1	1	8	142	350	558	735	867	963	908	998	736	541	195	105	20	1	1	1	1	1	7136	998
24	1	1	1	1	1	8	145	438	652	742	881	978	936	804	632	118	74	7	1		1	1	1	1	6425	978
25	1	1	1	1	1	6	140	317	557	821	812	724	954	913	798	654	425	208	31	1	1	1	1	1	7370	954
26	1	1	1	1	1	7	135	393	542	720	853	939	891	728	728	384	306	96	20		1	1	1	1	6751	939
27	1	1	1	1	1	5	114	323	532	710	843	929	956	899	598	395	376	250	35		1	1	1	1	6974	956
28	1	1	1	1	1	6	83	273	540	717	849	851	214	274	882	600	335	81	12	1	1	1	1	1	5727	882
29	1	1	1	1	1	4	126	333	513	718	858	950	878	755	692	527	394	228	34		1	1	1	1	7019	950
30	1	1	1	1	1	5	125	339	552	730	861	953	960	919	816	653	427	208	27			1	1	1	7583	960
31	1	1	1	1	1	4	120	330	543	721	871	928	947	228	16	7	51	107	31	1	1	1	1	1	4914	947
MEAN	1	1	1	1	1	12	138	330	519	707	833	899	744	599	582	443	263	140	36	1	1	1	1	1	6254	
MAX	1	1	1	1	1	35	204	438	652	821	933	1014	1026	998	898	722	520	305	147	4	1	1	1	1		1026
MIN	1	1	1	1	1	1	32	89	164	372	309	308	153	103	16	7	38	7	1	0	0	0	1	1		

POSSIBLE NUMBER OF OBSERVATIONS = 744 ACTUAL NUMBER OF OBSERVATIONS = 744 DATA RECOVERY RATE = 100 %

MONTHLY MEAN OF DATA > 0 = 263 W/M^2 MAXIMUM DAILY TOTAL WAS 8428 W/M^2 ON 8/ 8

MAXIMUM SOLAR RADIATION WAS 1026 W/M^2 ON 8/ 8 AT 1300 MINIMUM DAILY TOTAL WAS 4002 W/M^2 ON 8/17

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY ---

Homestake

SOLAR RADIATION in W/M^2 for SEPTEMBER, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL	MAX
01	1	1	1	1	1	3	73	175	432	778	576	614	501	140	110	50	158	65	7	1	1	1	1	1	3692	778
02	1	1	1	1	1	4	123	320	532	704	834	907	886	680	472	605	233	148	9	1	1	1	1	1	6467	907
03	1	1	1	1	1	3	36	194	532	709	849	485	257	343	285	115	171	61	33	1	1	1	1	1	4083	849
04	1	1	1	1	1	3	115	280	359	602	832	874	915	401	272	113	64	60	22	1	1	1	1	1	4922	915
05	1	1	1	1	1	4	111	319	525	702	832	904	918	833	726	563	362	66	7	1	1	1	1	1	6882	918
06	1	1	1	1	1	5	67	93	233	467	435	496	872	608	259	355	257	31	4	1	1	1	1	1	4192	872
07	1	1	1	1	1	2	46	156	442	653	902	360	679	466	649	411	181	78	10	1	1	1	1	1	5045	902
08	1	1	1	1	1	3	105	320	506	677	711	413	151	332	130	94	22	36	7	1	1	1	1	1	3517	711
09	1	1	1	1	1	1	9	61	184	264	370	539	363	238	35	49	142	52	5	1	1	1	1	1	2322	539
10	1	1	1	1	1	2	43	131	304	375	917	897	726	866	790	212	127	55	9	1	1	1	1	1	5464	917
11	1	1	1	1	1	2	105	312	524	700	834	904	807	760	587	248	70	42	5	1	1	1	1	1	5910	904
12	1	1	1	1	1	2	88	326	459	581	739	675	546	507	331	70	64	46	4	1	1	1	1	1	4448	739
13	1	1	1	1	1	1	31	95	411	685	815	892	863	721	673	501	337	134	4	1	1	1	1	1	6173	892
14	1	1	1	1	1	1	25	169	514	690	820	846	483	387	485	361	118	120	5	1	1	1	1	1	5034	846
15	1	1	1	1	1	2	94	305	462	686	831	640	642	313	406	200	93	111	5	1	1	1	1	1	4800	831
16	1	1	1	1	1	2	88	297	507	685	686	586	862	804	641	327	175	58	5	1	1	1	1	1	5733	862
17	1	1	1	1	1	1	36	146	320	706	559	621	830	529	767	552	326	79	3	1	1	1	1	1	5485	830
18	1	1	1	1	1	2	88	289	495	672	807	883	848	839	587	516	271	59	3	1	1	1	1	1	6369	883
19	1	1	1	1	1	2	84	289	497	674	803	877	763	844	568	410	257	84	3	1	1	1	1	1	6165	877
20	1	1	1	1	1	2	83	290	498	676	815	881	887	839	671	539	249	23	3	1	1	1	1	1	6466	887
21	1	1	1	1	1	1	71	295	500	687	806	896	806	799	596	486	195	102	2	1	1	1	1	1	6252	896
22	1	1	1	1	1	1	82	294	505	683	811	879	883	822	699	524	312	94	2	1	1	1	1	1	6601	883
23	1	1	1	1	1	1	83	297	510	691	820	884	884	821	702	526	315	99	2	1	1	1	1	1	6645	884
24	1	1	1	1	1	1	81	295	505	684	812	877	877	811	690	521	309	94	1	1	1	1	1	1	6568	877
25	1	1	1	1	1	1	77	288	496	670	800	869	809	688	702	544	271	37	1	1	1	1	1	1	6263	869
26	1	1	1	1	1	1	73	269	475	648	774	507	450	750	264	258	116	37	1	1	1	1	1	1	4633	774
27	1	1	1	1	1	1	39	221	341	480	586	425	583	808	544	311	253	82	1	1	1	1	1	1	4685	808
28	1	1	1	1	1	1	67	268	474	648	772	837	840	778	658	482	278	73	1	1	1	1	1	1	6187	840
29	1	1	1	1	1	1	65	264	469	642	772	935	850	904	710	253	119	52	1	1	1	1	1	1	6047	935
30	1	1	1	1	1	1	38	129	242	519	579	698	458	586	638	473	263	58	1	1	1	1	1	1	4693	698
MEAN	1	1	1	1	1	2	71	240	442	635	750	737	708	641	522	356	204	71	5	1	1	1	1	1	5391	
MAX	1	1	1	1	1	5	123	326	532	778	917	935	918	904	790	605	362	148	33	1	1	1	1	1		935
MIN	1	1	1	1	1	1	9	61	184	264	370	360	151	140	35	49	22	23	1	1	1	1	1	1		

POSSIBLE NUMBER OF OBSERVATIONS = 720 ACTUAL NUMBER OF OBSERVATIONS = 720 DATA RECOVERY RATE = 100 %

MONTHLY MEAN OF DATA > 0 = 225 W/M^2

MAXIMUM DAILY TOTAL WAS 6882 W/M^2 ON 9/ 5

MAXIMUM SOLAR RADIATION WAS 935 W/M^2 ON 9/29 AT 1200

MINIMUM DAILY TOTAL WAS 2322 W/M^2 ON 9/ 9

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY ---

Appendix G
Barometric Pressure Data for July through September 2011

Homestake

STATION PRESSURE in Inches of Mercury for JULY, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MN	MAX	MIN
01	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.6
02	23.7	23.7	23.7																								
03																											
04																											
05																											
06											23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7			
07	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.8	23.6
08	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.6
09	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.7	23.7	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.6
10	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.6
11	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.7	23.7	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6
12	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6
13	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.5
14	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.5
15	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.6
16	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.6	23.7	23.6
17	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.7	23.8	23.7
18	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.7
19	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.7
20	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6
21	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.6
22	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.5
23	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6
24	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7
25	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.7
26	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6
27	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.6
28	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6
29	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7
30	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7
31	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7
MEAN	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.7		
MAX	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8		23.8	
MIN	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.6			23.5

POSSIBLE NUMBER OF OBSERVATIONS = 744 ACTUAL NUMBER OF OBSERVATIONS = 641 DATA RECOVERY RATE = 86.2 %

MONTHLY MEAN = 23.7 Inches of Mercury

MAXIMUM STATION PRESSURE WAS 23.8 Inches of Mercury ON 7/31 AT 800 MAXIMUM DAILY MEAN WAS 23.8 Inches of Mercury ON 7/31

MINIMUM STATION PRESSURE WAS 23.5 Inches of Mercury ON 7/14 AT 1800 MINIMUM DAILY MEAN WAS 23.6 Inches of Mercury ON 7/14

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Homestake

STATION PRESSURE in Inches of Mercury for AUGUST, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MN	MAX	MIN
01	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8
02	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.7
03	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.7
04	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7
05	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.7
06	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.7
07	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.8	23.6
08	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.6
09	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.6
10	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.6	23.7	23.6
11	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.6
12	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.6
13	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.8	23.7
14	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.7
15	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.6
16	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.7	23.8	23.7
17	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8
18	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.7	23.8	23.8	23.7
19	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.6
20	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.7	23.7	23.7	23.8	23.8	23.8	23.7	23.8	23.6
21	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7
22	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.7
23	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.7
24	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.8	23.7
25	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7
26	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7
27	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.7
28	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.6
29	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.6
30	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.6
31	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.7	23.8	23.6
MEAN	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7		
MAX	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8		23.8	
MIN	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7			23.6

POSSIBLE NUMBER OF OBSERVATIONS = 744 ACTUAL NUMBER OF OBSERVATIONS = 744 DATA RECOVERY RATE = 100 %

MONTHLY MEAN = 23.7 Inches of Mercury

MAXIMUM STATION PRESSURE WAS 23.8 Inches of Mercury ON 8/24 AT 2100 MAXIMUM DAILY MEAN WAS 23.8 Inches of Mercury ON 8/ 1

MINIMUM STATION PRESSURE WAS 23.6 Inches of Mercury ON 8/30 AT 1700 MINIMUM DAILY MEAN WAS 23.6 Inches of Mercury ON 8/10

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Homestake

STATION PRESSURE in Inches of Mercury for SEPTEMBER, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MN	MAX	MIN
01	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7
02	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6
03	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6
04	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.8	23.8	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7
05	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.7
06	23.8	23.8	23.8	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7
07	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8
08	23.8	23.8	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.9	23.7
09	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.7
10	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.7	23.8	23.7
11	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.9	23.9	23.8	23.9	23.7
12	23.8	23.8	23.8	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.9	23.9	23.9	23.9	23.8	23.9	23.9	23.8
13	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.7	23.7	23.8	23.8	23.7
14	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6
15	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6
16	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6
17	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.7	23.8	23.7
18	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8
19	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.7
20	23.8	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.7
21	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.7
22	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7
23	23.8	23.8	23.8	23.8	23.9	23.9	23.9	23.9	23.9	23.9	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.9	23.8
24	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.7
25	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.6
26	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6
27	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.7	23.8	23.7
28	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.7
29	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7
30	23.8	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.8	23.8	23.8	23.8	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.9	23.7
MEAN	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.7		
MAX	23.8	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.9	23.9	23.9	23.9	23.9		23.9	
MIN	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6			23.6

POSSIBLE NUMBER OF OBSERVATIONS = 720 ACTUAL NUMBER OF OBSERVATIONS = 720 DATA RECOVERY RATE = 100 %

MONTHLY MEAN = 23.7 Inches of Mercury

MAXIMUM STATION PRESSURE WAS 23.9 Inches of Mercury ON 9/30 AT 900 MAXIMUM DAILY MEAN WAS 23.9 Inches of Mercury ON 9/12

MINIMUM STATION PRESSURE WAS 23.6 Inches of Mercury ON 9/25 AT 1700 MINIMUM DAILY MEAN WAS 23.7 Inches of Mercury ON 9/25

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

Homestake

STATION PRESSURE in Inches of Mercury for JUNE, 2011

HR END DAY	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MN	MAX	MIN
01	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.8	23.6
02	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.6	23.6	23.5
03	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.6	23.7	23.6
04	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.8	23.7	23.8	23.7
05	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.8	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.7
06	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.5
07	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.5
08	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.5
09	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.6
10	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.7	23.5
11	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.6	23.6	23.5
12	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.5
13	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.6
14	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7
15	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.7	23.5
16	23.5	23.5	23.6	23.5	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.5	23.4	23.4	23.4	23.4	23.4	23.4	23.5	23.5	23.5	23.5	23.5	23.6	23.4
17	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.5
18	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.6	23.6	23.7	23.5
19	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.4	23.4	23.4	23.4	23.4	23.3	23.3	23.3	23.3	23.3	23.4	23.4	23.5	23.5	23.5	23.4	23.5	23.3
20	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.5	23.6	23.5
21	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.6	23.7	23.6
22	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.6
23	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.6
24	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.6
25	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.6
26	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.6	23.7	23.6
27	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.7	23.6
28	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.7
29	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.6
30	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.6
MEAN	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6		
MAX	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.8	23.7	23.7	23.8	23.8	23.8		23.8	
MIN	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.4	23.4	23.4	23.4	23.4	23.3	23.3	23.3	23.3	23.3	23.4	23.4	23.5	23.5	23.5			23.3

POSSIBLE NUMBER OF OBSERVATIONS = 720 ACTUAL NUMBER OF OBSERVATIONS = 720 DATA RECOVERY RATE = 100 %

MONTHLY MEAN = 23.6 Inches of Mercury

MAXIMUM STATION PRESSURE WAS 23.8 Inches of Mercury ON 6/ 5 AT 800 MAXIMUM DAILY MEAN WAS 23.8 Inches of Mercury ON 6/ 5

MINIMUM STATION PRESSURE WAS 23.3 Inches of Mercury ON 6/19 AT 1700 MINIMUM DAILY MEAN WAS 23.4 Inches of Mercury ON 6/19

MEANS REQUIRE 75% VALID DATA
MISSING DATA DENOTED BY BLANKS

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3.0 TOPOGRAPHY

***New Mexico Administrative Code (NMAC) 19.10.6.602 D.(13)* (b)**

Baseline data shall include, as applicable: Topographic maps clearly showing: the boundaries of the permit area, and the location of all buildings within 1/2 mile of the permit area; the kinds of information set forth on U.S.G.S. topographic maps; and all man-made features within the permit area existing on the date of application. The map shall be at a scale of 1 inch equals 2,000 feet (1:24,000) or a scale approved by the Director to accurately represent the permit and potentially affected area.

Topographic considerations are important in the mine planning process for assessing engineering, construction, and drainage issues. Plate 1 provides an overview of the proposed La Jara Mesa Permit Area and surrounding topography at a scale of 1:24,000. The topography shown in Plate 1 is from the United States Geological Survey (USGS) quadrangle maps: Dos Lomas, San Mateo, Grants and Lobo Springs, NM. The general topography of the proposed Permit Area ranges from nearly level mesa tops and alluvial fans and valleys, to near vertical cliffs with slope gradients up to 120 percent. The proposed Permit Area is characterized as a gently to steeply sloping, dissected, pediment that ranges in elevation from approximately 6,800 to 7,600 feet above mean sea level (amsl). An access road and utility corridor would extend south from the portal to the United States Department of Agriculture Forest Service (Forest Service) boundary. The road crosses gently sloping, dissected pediment and alluvial fan surfaces that roughly parallel the mesa's southwestern escarpment. The proposed escape raise and associated generator housing will be sited on the surface of the nearly level La Jara Mesa top at an elevation of about 8,060 feet amsl. The proposed Permit Area is drained by several ephemeral channels that begin along the escarpment and drain south and west toward San Mateo Creek, approximately 4 miles to the west of the proposed Permit Area.

The proposed locations of the mine surface facilities are near the base of the La Jara Mesa escarpment (Plate 2). Topography in this area is shown as it exists as of the DATE photography procured by Laramide Resources (USA) Inc. to develop site-specific topography for the mine surface facilities. The air photos were interpreted to provide contour maps with intervals of 5 feet. Plate 2 is also presented at a larger scale (1:9,600) than 1:24,000 to show the 5-foot contour intervals. Topographic considerations are vital in developing operational and reclamation plans. The available topographic information is considered adequate for this phase of mine and reclamation planning, and no additional topographic information was included in the baseline data collection.

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4.0 VEGETATION

***New Mexico Administrative Code (NMAC) 19.10.6.602 D.(13)* (c)**

A map which delineates existing vegetation types and a description, including cover, density and productivity of the plant communities within the proposed permit area. The description of the vegetation types and plant communities may be based upon data from adjacent areas if vegetation within the permit area has been adversely impacted by previous mining operations or other disturbances. Included in this description shall be the results of an inventory conducted for any sensitive, threatened or endangered plant species within the permit area.

4.1 Introduction

Vegetation conditions in the proposed Permit Area prior to mining are important for establishing revegetation goals for post-mining land use. In addition, it is important to determine whether federal- or state-status threatened and endangered (T&E) plants occur at the site.

The distribution of vegetation surrounding the proposed La Jara Mesa Project Permit Area reflects the combined influences of environmental gradients (soils, elevation, climate, etc.), disturbance history (mineral development, fire, grazing, etc.) and other management practices. The major structural characteristics of vegetation are controlled primarily by the prevailing environment gradients. The vegetation at the proposed Permit Area is broadly classified as Piñon-Juniper Woodland. Within the proposed Permit Area, the specific composition of the vegetation and amount of ground cover vary as a function of the topography and soils.

Baseline vegetation data will support revegetation success analyses and will determine if sensitive or T&E species are present within the potentially disturbed surface of the proposed Permit Area.

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4.2 Methods

The following sections describe the methods employed for determining the baseline vegetation information, including the type and frequency of data collection. Plant inventory methods and sampling frequency are discussed in Section 4.2.1. The methods for vegetation classification are discussed in Section 4.2.2. The approach to determine cover, density, and production is outlined in Section 4.2.3. Section 4.2.4 describes T&E species.

4.2.1 Plant Inventory

Vegetation surveys were performed by Golder Associates Inc. (Golder) biologists and ecologists in May and September 2011 to inventory plants growing in the proposed Permit Area. The entire proposed Permit Area was surveyed including the road and utility corridor and escape raise. The surveys were conducted in the spring and late-summer to facilitate recognition of the short-lived annuals. The

vegetation survey by Golder was to identify existing vegetation within the Permit Area as the baseline inventory.

4.2.2 Vegetation Mapping

The vegetation communities were differentiated based on species dominance and structure. Abrupt changes in environmental gradients such as soils, topography, slope exposure, etc., have resulted in distinct types of vegetation with clear boundaries. The proposed Permit Area lies on Forest Service lands; as such, the area was mapped using the Southwestern Region Terrestrial Ecosystem Survey (TES; US Department of Agriculture-US Forest Service [USDA-USFS] 2007). Golder refined the TES map unit delineations to represent the local variation of vegetation communities within the proposed Permit Area. A combination of field surveys and aerial photography interpretation were used to refine the TES delineations and map the current vegetation communities present. Only TES map units intercepted by the proposed Permit Area (road and utility corridor, portal, mine surface facilities, and escape raise) were modified.

The vegetation was classified using the nomenclature and hierarchical classification of the United States National Vegetation Classification system (Grossman et al., 1998). The vegetation was classified on the Alliance level, which represents the sixth tier in a seven-tiered hierarchy. The Alliance level is roughly equivalent to the series level used by the Forest Service (Pfister and Arno, 1980; USDA, 1997), except that it tends to emphasize the existing dominants rather than end-member climax plant species (Grossman et al., 1998).

4.2.3 Canopy Cover, Shrub Density, and Productivity

The post-mining land use for the proposed Permit Area would be grazing and wildlife habitat. As such, information from the USDA may be used to establish vegetation success standards (Mining and Minerals Division [MMD], 1996). The proposed Permit Area is relatively small, and grazing capacity in portions of the proposed permit area are limited due to topographic barriers (e.g., talus and steep slopes), coarse-grained soils with low productivity, and vegetation communities have been disturbed by roads and prior mining activities. Therefore, canopy cover and production data was obtained from existing information available from the Forest Service (USDA-USFS 2007). The Forest Service does not provide data regarding shrub density. The Forest Service data has been collected from a larger area and over a longer period of time; therefore, they are expected to provide better estimates of cover and productivity than survey data from the proposed Permit Area alone. The long-term nature of the Forest Service data also accounts for the climactic variability of the region.

4.2.4 Floral Threatened and Endangered Surveys

The Forest Service biologist for the Mt. Taylor Ranger District indicated that T&E plant species are unlikely to occur in the proposed Permit Area (Golder, 2009). Nonetheless, a ground survey and

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database search was performed. State and federal databases were searched and results compared to the plants inventoried by the vegetation mapping, as described in Section 4.2.2.

4.3 Results

The results of the vegetation baseline data collection are discussed in the following sections.

4.3.1 Plant Inventory

Plants occurring in each TES map unit intercepted by the proposed Permit Area are listed on Table 4-1. The current vegetation over most of the area is characterized as Piñon-Juniper Woodland and Shrubland. Common plant species include blue grama (*Bouteloua gracilis)*, spike dropseed (*Sporobolus contractus*), indian ricegrass (*Achnatherum hymenoides*), purple threeawn (*Aristida purpurea*), broom snakeweed (*Gutierrezia sarothrae*), sand sage (*Artemisia filifolia)*, green rabbitbrush (*Ericameria teretifolia*), winterfat (*Krascheninnikovia lanata*), Piñon pine (*Pinus edulis*), and one-seeded juniper (*Juniperus monosperma*).

The spring and late-summer vegetation surveys on the proposed Permit Area identified 25 grasses, 53 forbs, 19 shrubs, and 3 trees in the six TES map units (Table 4-1). Warm season grasses were the dominant component of most plant communities including gramas (*Bouteloua spp*), dropseeds (*Sporobolus spp.*) and threeawns (*Aristida spp.*). We suspect the dry winter and spring in 2011 resulted in fewer early-season forbs observed during the spring field survey. Of the TES map units, the escarpment plant community (TES 502) had the greatest number of species (54) while the plant community associated with eolian sands (TES 34) in the portal area was found to be the least diverse with only 18 species.

4.3.2 Vegetation Mapping

The Southwestern Region TES approach classifies terrestrial ecosystems at the landscape level, depicting broad patterns of soil families and potential natural vegetation (PNV). TES map units are delineated and classified based on biotic and abiotic factors that comprise the physical environment (USDA-USFS, 2005) including bedrock, geomorphic processes, regional climate, surface geology, landform, local climate, topography, soils, and PNV. The purpose is to classify ecosystem types and map areas with similar capabilities and management potential. Because of their management significance, soils and PNV are the primary criteria for classifying ecosystems and delineating ecological map units. However, PNV (or the vegetation that would occur under present climatic conditions if natural and human disturbances were excluded) is a reflection of the environmental setting and the biological potential of a site. Thus, existing vegetation is commonly not at the PNV state (USDA-USFS, 2005). Therefore, it was necessary to delineate, or map, the current vegetation communities as they currently exist in the proposed Permit Area.

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Eight vegetation communities were identified in the proposed Permit Area (Figure 4-1). Representative photographs for each community are presented as Attachment 4A. Total area within the proposed Permit Area of each vegetation community is listed on Table 4-2. The vegetation communities mapped at the proposed Permit Area generally fit the TES map delineations; however, some modifications were made for site-specific vegetation characterization.

The road and utility corridor of the proposed Permit Area begins on the alluvial fan and valley landforms of TES map unit 34. TES 34 was divided into two vegetation Alliances: *Artemisia filifolia-Ericameria teretifolia/Bouteloua gracilis* Shrubland Alliance and *Krascheninnikovia lanata* Shrubland Alliance (Table 4-2). Access to the portal continues onto the dissected pediment, comprised of a small escarpment (TES 166) and mesa (TES 165) of the Entrada and Wingate Sandstones, and Todilto Limestone respectively. The vegetation supported on the escarpment is characterized as a *Pinus edulis-Juniperus monosperma* Woodland Alliance. The limestone mesa vegetation is an open *Pinus edulis-Juniperus monosperma/Krascheninnikovia lanata* Shrubland Alliance.

Mine surface facilities would be partially on TES 105, the eolian sand sheet and dune ridges formed on the break in slope at the base of the La Jara Mesa escarpment. Two Alliances occur in this map unit; *Pinus edulis-Juniperus monosperma/Artemisia filifolia* Woodland Alliance on the dune ridges and *Pinus edulis-Juniperus monosperma* Woodland Alliance on the sand sheet (Table 4-2). The rocky slopes of the La Jara Mesa escarpment (TES 502) support *Pinus edulis-Juniperus monosperma/Bouteloua gracilis* Woodland Alliance. The near vertical basalt outcrop of the escarpment is not intercepted by the Permit Area. The proposed escape raise is located in TES 107 on top of the La Jara Mesa. An eolian deposited sand sheet covers the basalt mesa. The vegetation community is comprised of *Pinus edulis-Juniperus monosperma* Woodland Alliance.

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4.3.3 Canopy Cover, Shrub Density, and Productivity

Since the baseline period spanned only one year, and precipitation was less than normal, the more stable PNV data collected by the Forest Service were used to estimate canopy cover, shrub density, and productivity.

4.3.3.1 Canopy Cover

Potential natural vegetation canopy cover data is presented in Table 4-3; percent canopy cover for each life form (grass, forb, shrub, and tree) is listed. Vegetation characterization by the Forest Service represents the modal concept for the potential plant community (climax). Because the vegetation in this region is primarily regulated by soil and climate conditions, the TES vegetation estimates are for each soil subgroup (map unit component). The current overstory canopy cover (Table 4-3) ranges from 5 to 50 percent in the proposed Permit Area. The escape raise, located in TES 107, has the greatest canopy cover and is dominated by trees. The lowest canopy cover areas are in TES 34 along the road and utility

corridor, which is dominated by grass and shrubs. Within a mapping unit, variation in canopy coverage and species composition occurs from subtle changes in environmental factors such as climate, soil, slope, surface-rock content, and aspect.

Surface components include rock fragments (larger than 2 millimeters), litter (more than 2.54 centimeters deep), bare soil, and vegetation basal area. The current conditions of the surface components are presented in Table 4-4. As expected, the map units of the La Jara Mesa escarpment (TES 502) and the Entrada and Wingate Sandstones escarpment (TES 166) have the highest rock fragment surface components. Bare soil is greatest in TES 165 and TES 34, which have 50 to 75 percent bare soil. The vegetation basal areas, ranging from 5 to 20 percent, seem high for the area. The Forest Service also documents natural condition surface components. The natural condition data tend to show slightly higher litter and basal area percentages and a lower bare soil surface component than the current conditions, which is characteristic of a stable and developed vegetation community.

4.3.3.2 Shrub Density

Shrub density data are not available from the USFS (2007). Based on canopy cover information, shrub cover in the PNV at the mine site ranges from 0.1 to 5.1 percent and 3.5 to 10.9 percent along the access road corridor (Table 4-3).

Ocular estimates of shrub density within existing plant communities were made at the mine site, along access road, and on the mesa. At the mine site, shrub density ranged from 250 stems/acre in TES 105A (sand sheet) to over 1,000 stems/acre in TES 105B (dune ridge). The escarpment (TES 502) had an estimated 600 stems/acre (TES 502) and in the vicinity of the escape raise on the mesa top shrub density was approximately 200 stems/acre (TES 107). Along the access road, shrub density in TES 34 ranged from 500 stems/acre in sand sage (*Artemisia filifolia)* dominated communities to over 1,500 stems/acre in the winterfat (*Krascheninnikovia lanata*) phase of the plant community. TES units 165 and 166 had an estimated shrub densities of 200 and 750 stems/acre respectively.

4.3.3.3 Productivity

Production potentials are based on estimates and measurements from the Forest Service survey area. The values correlate primarily to soil/vegetation/climate and general slope restriction. Rangeland productivity estimates for the site are presented in Table 4-5. Estimates for herbaceous and woody plant growth include growth of graminoids, forbs, and the leaves, twigs, and fruits of woody plants. Grass is the most abundant herbaceous cover in the proposed Permit Area as shown in Table 4-3. Total annual yield of forage (edible herbaceous and woody vegetation) available to grazing animals (livestock and wildlife) ranges from 125 (TES 166) to 275 (TES 107, TES 165, and TES 34) pounds/acre/year. These values reflect the most limiting feature in the proposed Permit Area, which is slope. Both map units in escarpment landforms (TES 166 and TES 502) have the lowest rangeland production potentials. Forage

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maximum is an estimation of the total annual yield of forage vegetation after elimination of the non-forage species (i.e. the removal of juniper to maximize forage production).

4.3.4 Threatened and Endangered Species

A combined list of the federal, Forest Service, and State of New Mexico listed sensitive, threatened, or endangered plant species are shown in Table 4-6. Table 4-6 lists these species with their protection status, habitat, and potential to occur within the proposed Permit Area. A discussion of species status according to each agency (Forest Service, other federal, and state) follows.

4.3.4.1 Federally Listed Species

There are two US Fish and Wildlife Service threatened plant species known to occur, or that might potentially occur, in Cibola County. The two species, Zuni fleabane (*Erigeron rhizomatus*) and Pecos sunflower (*Helianthus paradoxus*), do not have appropriate habitat in the proposed Permit Area and no plants of these species were found during the field surveys. There are no listed endangered species.

4.3.4.2 US Forest Service Listed Species

The Forest Service lists five special status plant species that occur or may occur in the Mt. Taylor Ranger District. Two of these species are also listed federally and by the State of New Mexico as species of concern: Zuni milkvetch (*Astragalus missouriensis var. accumbens*) and Parish's alkali grass (*Puccinellia parishii*). Based on the vegetative, geological, and topological characteristics of the proposed Permit Area and the life requisites of these species, no Forest Service listed sensitive plant species occur within the proposed Permit Area. No specimens were observed during the plant surveys.

4.3.4.3 State of New Mexico Listed Species

Ten species are listed by the State of New Mexico as Endangered or Species of Concern that are known to occur in Cibola County. One of these species is federally listed as threatened; Pecos sunflower (*Helianthus paradoxus*). Pecos sunflower and Parish's alkali grass (*Puccinellia parishii*) are listed endangered by the state; however, the proposed Permit Area does provide habitat to support these species. One listed species of concern; Acoma fleabane (*Erigeron acomanus*), has the potential to occur at the Permit Area. The outcrop of the Entrada Sandstone and escarpment located within the proposed Permit Area (TES 166) is considered potential habitat (Table 4-6). However, the proposed road and utility corridor only occupy about 1.64 acres of this habitat (Table 4-2). No specimens were observed during the plant surveys.

4.4 References

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TABLES

Table 4-1: Vegetation Inventory by TES Map Unit

Scientific Name	Common Name	Code	TES Map Unit					
			107	105	165	502	166	34
Grasses and Grass-like								
Achnatherum hymenoides	Indian ricegrass	ACHY		X	X	X	X	X
Aristida adscensionis	Six weeks threeawn	ARAD			X			
Aristida harvardii	Harvard's threeawn	ARHA				X		
Aristida purpurea	Purple threeawn	ARPU		X	X	X	X	X
Bouteloua curtipendula	Sideoats grama	BOCU				X	X	
Bouteloua eriopodia	Black grama	BUER				X	X	
Bouteloua gracilis	Blue grama	BOGR	X	X	X	X	X	X
Bouteloua hirsuta	Hairy grama	BOHI				X	X	
Dasyochloa pulchella	Fluff grass	DAPU	X	X	X			
Carex spp	Sedge	CAREX					X	
Elymus elymoides	Bottlebrush squirreltail	ELEL	X		X			
Hesperostipa comata	Needle and thread	HECO		X				
Hesperostipa neomexicana	New Mexico feathergrass	HENE		X	X	X	X	
Koeleria macrantha	Junegrass	KOMA	X					
Lycurus setosus	Wolftail	LYSE				X		
Muhlenbergia arenicola	Sand muhly	MUAR		X	X	X		X
Muhlenbergia torreyi	Ring muhly	MUTO		X	X		X	
Muhlenbergia spp	Muhly grass	MUHLY			X			
Pleuraphis jamesii	Galleta	PLJA				X	X	
Poa secunda	Sandberg bluegrass	POSE	X					
Sporobolus airoides	Alkali sactaton	SPAI					X	
Sporobolus contractus	Spike dropseed	SPCO		X	X			X
Sporobolus cryptandrus	Sand dropseed	SPCR	X		X	X		
Sporobolus flexiosus	Mesa dropseed	SPFL		X	X	X		
Sporobolus gigantus	Giant dropseed	SPGI		X				X
Forbs								
Ambrosia psilostachya	Western ragweed	AMPS		X				
Arabis drummondii	Drummond's arabis	ARDR1	X		X	X		
Arabis fendleri	Fendler's arabis	ARFE	X					
Artemisia dracunculus	Tarragon	ARDR2	X	X				
Artemisia ludoviciana	White sagebrush	ARLU				X		
Aster 1	Unknown composite 1	ASTR1	X					
Aster 2	Unknown composite 2	ASTR2		X				
Astragalus mollissimus	Wooly loco	ASMO	X					
Calylophus hartwegii	Berlandier's sundrops	CAHA		X				
Chaetopappa ericoides	Rose heath	CHER	X			X	X	
Chamaesyce serpyllifolia	Thymeleaf spurge	CHME	X	X	X	X	X	X
Commelina diantherifolia	Birdbill dayflower	CODI		X				
Cyrptantha crassisepala	Thicksepal cryptatha	CRCR		X				
Dalea spp.	Prairie clover	DALEA				X		
Dimorphocarpa wislizeni	Spectacle pod	DIWI		X		X		
Dysphania graveolens	Fetid goosefoot	DYGR	X	X		X		
Eriogonum cernuum	red buckwheat	ERCE		X		X	X	

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Table 4-1: Vegetation Inventory by TES Map Unit

Scientific Name	Common Name	Code	TES Map Unit					
			107	105	165	502	166	34
Forbs (continued)								
Euphorbia cuphosperma	Hairy-fruit spurge	EUCO				X		
Evolvulus nuttallianus	Hairy evolvulus	EVNU				X		
Giliastrum rigidula	Blue bowls	GIRI					X	
Heterotheca villosa	Hairy false golden aster	HEVI				X		
Helianthus annuus	Sunflower	HEAN		X	X	X		
Hymenopappus filifolius	Fineleaf hymenopappus	HYFI	X			X		
Hymenopappus spp	Hymenopappus	HYspp	X					
Hymenoxys odorata	Bitter rubberweed	HYOD	X	X			X	
Ipomopsis longiflora	Long flowered trumpet gilia	IMLO			X			
Ipomopsis multiflora	Many-flowered ipomopsis	IPMU	X	X				
Lesquerella fendleri	Fendler's bladderpod	LEFE	X	X	X	X	X	
Machaeranthera canescens	Hoary tansyaster	MACA	X			X		
Machaeranthera gracilis	Slender goldenweed	MAGR	X			X		
Melilotus officinalis	Yellow sweet clover	MEOF		X				
Mentzelia pumila	Little yellow blazing star	MEPU		X	X	X		X
Mirabilis glabra	Smooth four o'clock	MIGL				X		
Mirabilis multiflora	Giant four o'clock	MIMU		X	X	X	X	X
Notholaena standelyi	Star cloak fern	NOST				X		
Mirabilis oxybaphoides	Spreading four o'clock	MIOX		X	X	X		
Penstemon spp	Penstemon	PENST			X			
Penstemon virgatus	Blue beardtongue	PEVE	X					
Phacelia spp	Phacelia	PHACE		X				
Phoradendron spp.	Mistletoe	PHORA	X					
Physalis hederifolia	Ivy-leaved groundcherry	PHHE		X				
Physalis Virginiana	Virginia groundcherry	PHVI		X				
Pomaria jamesii	James' holdback	POJA	X					
Portulaca spp.	Purslane	PORTU	X					
Psilostrophe tagetina	Paper daisy	PSTA			X			
Ratibida columnifera	Prairie coneflower	RACO				X		
Salsola tragus	Russian thistle	SATR		X	X	X	X	X
Sanvitalis abertii	Abert's creeping zinnia	SAAB		X	X	X	X	
Senecio spp. 1	Ragwort 1	SENEC1				X	X	
Senecio spp. 2	Ragwort 2	SENEC2	X					
Senecio wootonii	Wooton's ragwort	SEWO	X					
Sphaeralcea fendleri	Fendler's globemallow	SPFE			X		X	X
Townsendia eximia	Tall easter daisy	TOEX				X		
Shrubs								
Artemisia nova	Black sagebrush	ARNO				X	X	
Artemisia filifolia	Sand sage	ARFI		X	X	X	X	X
Atriplex canescens	Four-wing saltbush	ATCA		X	X	X		X
Cercocarpus montanus	Alderleaf mountain mahogany	CEMO				X		
Echinocereus viridiflorus	Nylon hedgehog cactus	ECVI		X		X		

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Table 4-1: Vegetation Inventory by TES Map Unit

Scientific Name	Common Name	Code	TES Map Unit					
			107	105	165	502	166	34
Shrubs (continued)								
Ephedra torreyana	Torrey's ephedra	EPTO				X	X	
Ericameria teretifolia	Green rabbitbrush	ERTE		X	X			X
Eriogonum umbellatum	Sulfur-flower buckwheat	ERUM	X					
Escobaria spp.	Pincoushion cactus	ESCOB	X					
Gutierrezia sarothrae	Broom snakeweed	GUSA	X	X	X	X	X	X
Krascheninnikovia lanata	Winterfat	KRLA			X	X	X	X
Lycium pallidum	Pale desert-thorn	LYPA		X	X			X
Nolina microcarpa	Beargrass	NOMI				X		
Opuntia engelmannii	Brown spined prickly pear	OPEN	X			X		
Opuntia imbrecata	Tree cholla	OPIM		X	X	X	X	
Ribes cereum var. pediculare	Wax currant	RICE	X					
Tetradymia canescens	Spineless horsebrush	TECA			X			
Yucca baccata	Banana yucca	YUBA	X	X		X		
Zinnia grandiflora	Rocky Mountain zinnia	ZIGR		X	X	X		
Trees								
Pinus edulis	Piñon pine	PIED	X	X	X	X	X	
Pinus ponderosa	Ponderosa pine	PIPO	X					
Juniperus monosperma	One-seeded juniper	JUMO	X	X	X	X	X	X

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Table 4-2: Vegetation Community Acreages

TES Map Unit	Vegetation Community	Total Permit Area (acres)
Mine Site		
107	*Pinus poderosa-Pinus edulis-Juniperus monosperma* Forest Alliance	0.25
502	*Pinus edulis-Juniperus monosperma/Bouteloua gracilis* Woodland Alliance	25.12 of 77
105	*Pinus edulis-Juniperus monosperma/Artemisa filifolia* Woodland Alliance	26.94 of 77
	Pinus edulis-Juniperus monosperma Woodland Alliance	31.24 of 77
Access Roads		
165	*Pinus edulis-Juniperus monosperma / Krascheninnikovia lanata* Shrubland Alliance	14.62 of 30
166	*Pinus edulis-Juniperus monosperma* Woodland Alliance	1.64 of 30
34	*Artemisia filifolia-Ericameria teretifolia/Bouteloua gracilis* Shrubland Alliance	4.90 of 30
	Krascheninnikovia lanata Shrubland Alliance	6.55 of 30

Note: TES = Terrestrial Ecosystem Survey

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Table 4-3: Vegetation Canopy Cover by Lifeform

TES Map Unit	PNV Class	Soil Subgroup	Grasses	Forbs	Shrubs	Trees	Overstory Canopy Cover[†]
Mine Site							
107	PIED/JUMO	Calcic Haplustalfs	24	10	0.1	40	35
		Typic Haplustalfs	4.9	5.1	0.1	60	50
502	PIED/JUMO/BOGR	Calcic Haplustalfs	18	4.3	4.8	15	15
		Typic Argiustolls	23	4.4	5.1	7	10
105	PIED/JUMO/QUPA	Calcic Haplustepts	10.1	2.7	0.7	57	45
		Typic Haplustepts	6.6	3.1	1.1	47	45
Access Roads							
165	PIED/JUMO	Typic Haplustalfs	12.7	4.1	10.9	27	25
		Typic Haplustalfs	8.5	4.2	10.2	22	25
		Lithic Haplustalfs	13	7.4	3.5	11	15
166	PIED/JUMO	Typic Haplustepts	12	4.3	9.1	18	20
34	PIED/JUMO/KRLA	Inceptic Haplustalfs	31	2.2	10.2	5	10
	PIED/JUMO/ARFI	Inceptic Haplustalfs	17.7	1.0	9.8	5	10
	PIED/JUMO	Typic Haplustepts	25.6	2.1	7.7	5	5

Notes:

Source: Terrestrial Ecosystem Survey (USDA-USFS, 2007)

PNV = Potential Natural Vegetation

[†] Overstory includes the percent canopy coverage by trees and shrubs that intercept rainfall (current vegetation condition)

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Table 4-4: Surface Cover Components (current)

TES Map Unit	PNV Class	Soil Subgroup	Rock Fragments	Bare Soil	Litter	Vegetation Basal Area
			%			
Mine Site						
107	PIED/JUMO	Calcic Haplustalfs	0	50	30	20
		Typic Haplustalfs	0	50	40	10
502	PIED/JUMO/BOGR	Calcic Haplustalfs	75	15	5	5
		Typic Argiustolls	65	10	15	15
105	PIED/JUMO/QUPA	Calcic Haplustepts	0	45	45	10
		Typic Haplustepts	0	65	30	5
Access Roads						
165	PIED/JUMO	Typic Haplustalfs	5	65	20	5
		Typic Haplustalfs	5	75	15	5
		Lithic Haplustalfs	5	70	15	10
166	PIED/JUMO	Typic Haplustepts	65	20	5	10
34	PIED/JUMO/KRLA	Inceptic Haplustalfs	0	50	20	20
	PIED/JUMO/ARFI	Inceptic Haplustalfs	0	75	10	10
	PIED/JUMO	Typic Haplustepts	0	75	15	10

Notes:

Source: USDA Forest Service; US Forest Service Terrestrial Ecological Survey Data

PNV = Potential Natural Vegetation

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Table 4-5: Rangeland Productivity

TES Map Unit	PNV Class	Soil Subgroup	Average dry weight production potential		
			Herbaceous/ Woody	Forage[1]	Forage Maximum[1]
			lb/ac/yr		
Mine Site					
107	PIED/JUMO	Calcic Haplustalfs	700	275	1200
		Typic Haplustalfs	700	275	1200
502	PIED/JUMO/BOGR	Calcic Haplustalfs	650	150	1100
		Typic Argiustolls	750	225	1275
105	PIED/JUMO/QUPA	Calcic Haplustepts	650	225	1100
		Typic Haplustepts	650	225	1100
Access Roads					
165	PIED/JUMO	Typic Haplustalfs	700	275	1200
		Typic Haplustalfs	700	275	1200
		Lithic Haplustalfs	650	225	1100
166	PIED/JUMO	Typic Haplustepts	550	125	950
34	PIED/JUMO/KRLA	Inceptic Haplustalfs	700	275	1200
	PIED/JUMO/ARFI	Inceptic Haplustalfs	700	275	1200
	PIED/JUMO	Typic Haplustepts	650	225	1100

Notes:

Source: Terrestrial Ecosystem Survey (USDA-USFS, 2007)

PNV = Potential Natural Vegetation

[1]Edible herbaceous/woody vegetation

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Table 4-6: Special Status Plant Species That May Occur in Cibola County

Species	Typical Habitat	Status			Potential to Occur in the Permit Area[1]
		Federal (FWS)	Forest Service	New Mexico	
Astragalus missouriensis var. accumbens Zuni milkvetch	Gravelly clay banks and knolls, in dry alkaline soils derived from sandstone, piñon-juniper woodland.	Species of Concern	Sensitive	Species of Concern	No
Astragalus humistratus var. crispulus Villous groundcover milkvetch	Slopes, benches, and large ledges on sandy soils from volcanic origin in xeric pine forests; known only in Catron County.	--	Sensitive	--	No
Astragalus micromerius Chaco milkvetch	Gypseous or limy sandstones in piñon-juniper woodland or Great Basin desert scrub.	--	Sensitive	--	No
Clematis hirsutissima var. hirsutissima Arizona leatherflower	Moist mountain meadows, prairies, and open woods and thickets on limestone soils in mixed conifer and poderosa pine woodlands.	--	Sensitive	--	No
Erigeron acomanus Acoma fleabane	Sandy slopes and benches beneath sandstone cliffs of the Entrada Sandstone in piñon-juniper woodland.	Species of Concern	--	Species of Concern	Limited areas of potential habitat. No species were observed
Erigeron rhizomatus Zuni fleabane	Nearly barren detrital clay hillsides with soils derived from shales of the Chinle or Baca formations	Threatened	--	--	No
Erigeron sivinskii Sivinski's fleabane	Chinle shale in piñon-juniper woodland and Great Basin desert scrub; known to occur in McKinley County	--	Sensitive	--	No
Helianthus paradoxus *Pecos sunflower*	Desert wetlands or cienegas with saline soils	Threatened	--	Endangered	No
Helianthus praetermissus Lost sunflower	Perhaps wet ground based on the collection locality for the only specimen. Only specimen collected in 1851 along the Rio San Jose at Ojo de la Gallina, Zuni Mountains.	Species of Concern	--	Species of Concern	No

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Table 4-6: Special Status Plant Species That May Occur in Cibola County

Species	Typical Habitat	Status			Potential to Occur in the Permit Area[1]
		Federal (FWS)	Forest Service	New Mexico	
Mentzelia todiltoensis Todilto stickleaf	Outcrops of gypsum in the Todilto Formation	Species of Concern	--	Species of Concern	No
Phacelia serrata Cinders phacelia	Primarily in deep volcanic cinders associated with volcanic cones, but also roadcuts and abandoned quarries in open, exposed, sunny locations; neat ponderosa pine and piñon-juniper woodlands.	Species of Concern	--	Species of Concern	No
Phacelia sivinskii Sivinskis scorpionweed	Restricted to gypsum from Upper Jurassic Todilto Formation of northwestern and north-central New Mexico and from the Permian Yeso Formation in sparse juniper/desert scrub communities.	Species of Concern	--	Species of Concern	No
Physaria newberryi var. yesicola Yeso twinpod	Sandy gypsum and silty strata of the Yeso Formation in short grass steppe and juniper savanna.	Species of Concern	--	Species of Concern	No
Puccinellia parishii Parish's alkali grass	Alkaline springs, seeps, and seasonally wet areas that occur at the heads of drainages or on gentle slopes.	Species of Concern	Sensitive	Endangered	No
Talinum brachypodum Laguna fame flower	Very shallow pockets of calcareous silt to clay soils overlying limestone or travertine, or fine silty sand overlying calcareous sandstones; open piñon-juniper woodland with little understory and scattered cacti shrubs or Chihuahuan desert scrub.	Species of Concern	--	Species of Concern	No

Notes:

Source: USDI FWS 2012; NMRPTC 1999 (updated 2010); USDA FS XXX

1 = Based on habitat of species compared with vegetative, geographical, geological, and topographical characteristics of the Permit Area.

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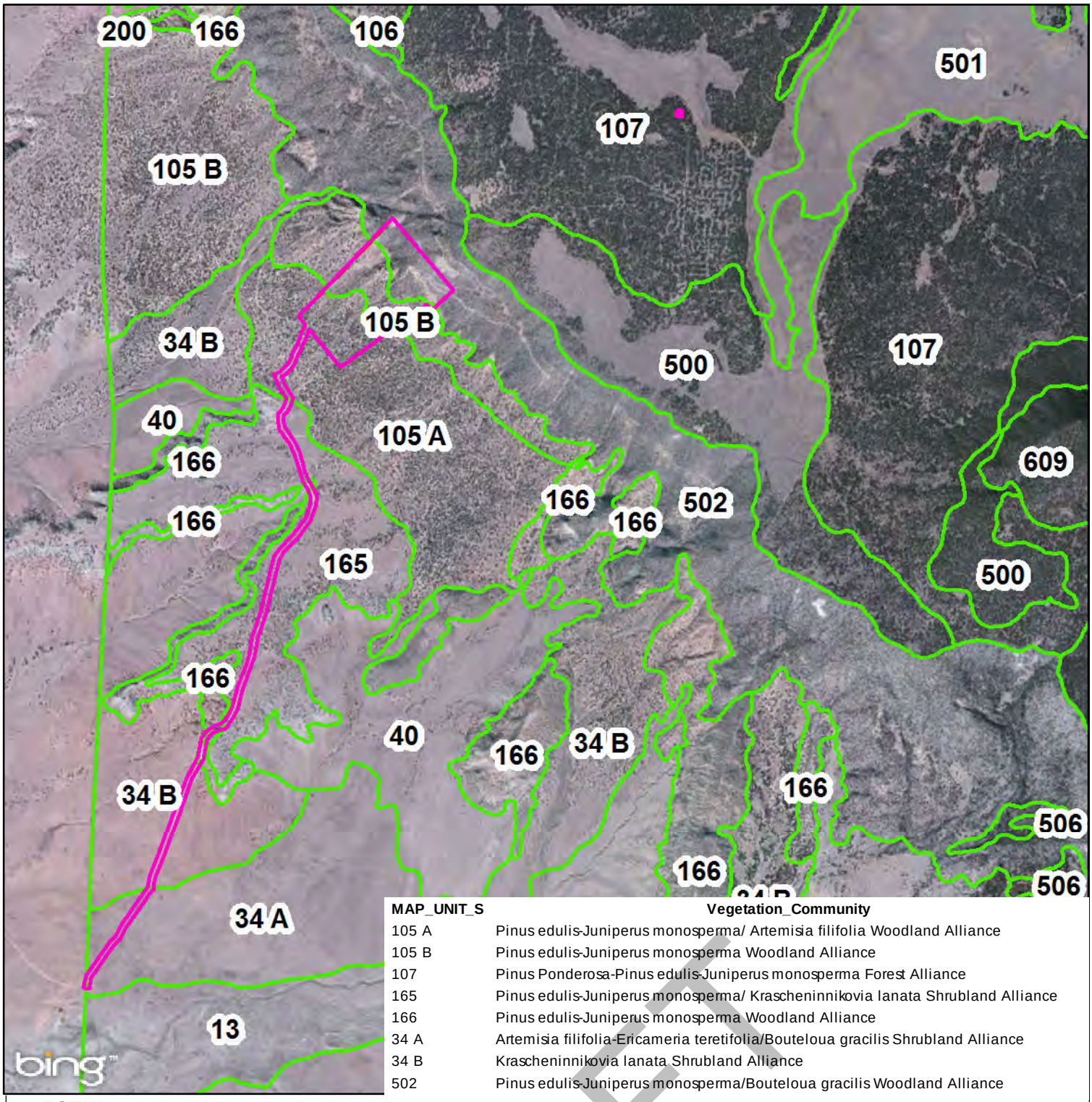
FIGURES



MAP_UNIT_S	Vegetation_Community
105 A	Pinus edulis-Juniperus monosperma/ Artemisia filifolia Woodland Alliance
105 B	Pinus edulis-Juniperus monosperma Woodland Alliance
107	Pinus Ponderosa-Pinus edulis-Juniperus monosperma Forest Alliance
165	Pinus edulis-Juniperus monosperma/ Kraschenninnikovia lanata Shrubland Alliance
166	Pinus edulis-Juniperus monosperma Woodland Alliance
34 A	Artemisia filifolia-Ericameria teretifolia/Bouteloua gracilis Shrubland Alliance
34 B	Kraschenninnikovia lanata Shrubland Alliance
502	Pinus edulis-Juniperus monosperma/Bouteloua gracilis Woodland Alliance

LEGEND

- Proposed Permit Boundary
- TEU Vegetation Type Map Units

N

0 1,250 2,500 5,000 Feet

SCALE 1:30,000 FEET

REFERENCES

1. Projection: NAD 1983 UTM Zone 13N
2. Source Aerial: Bing Maps (c) 2010 Microsoft Corporation and its data suppliers
3. Figure is for illustration purposes only; NOT FOR CONSTRUCTION.

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PROJECT/REPORT

LARAMIDE RESOURCES (USA) INC.
LA JARA MESA PROJECT
CIBOLA COUNTY, NEW MEXICO

TITLE

LA JARA MESA VEGETATION COMMUNITIES

Golder Associates

PROJECT No. 083-9338SI

FIGURE 4-1

Map: W:\La Jara Mesa\Maps\Figure 4_1.mxd | Modified: 4/5/2013 3:49:08 PM | Plotted: 4/5/2013 3:50:14 PM by MPetersen

ATTACHMENT 4A
LA JARA MESA VEGETATION COMMUNITIES – PHOTOGRPHS

La Jara Mesa Vegetation Communities

TERRESTRIAL ECOSYSTEM SYSTEM (TES) UNIT 34 A *Artemisia filifolia-Ericameria teretifolia/Bouteloua gracilis* Shrubland Alliance	
TES UNIT 34 B *Krascheninnikovia lanata* Shrubland Alliance	

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TES 166 *Pinus edulis-Juniperus monosperma* Woodland Alliance	
TES UNIT 165 *Pinus edulis-Juniperus monospermal Krascheninnikovia lanata* Shrubland Alliance	

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TES UNIT 105 B (DUNE RIDGE) *Pinus edulis-Juniperus monosperma/Artemisia filifolia* Woodland Alliance	
TES UNIT 105 A (SAND SHEET) *Pinus edulis-Juniperus monosperma* Woodland Alliance	

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TES UNIT 502 *Pinus edulis-Juniperus monosperma/Bouteloua gracilis* Woodland Alliance	
TES UNIT 107 *Pinus ponderosa-Pinus edulis-Juniperus monosperma* Woodland Alliance	

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List of Attachments

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5.0 WILDLIFE

***New Mexico Administrative Code (NMAC) 19.10.6.602 D.(13)* (d)**

Wildlife information shall be developed for the permit area and, to the extent practicable, the affected area. Where species may be impacted beyond these areas, the information shall include, to the extent practicable, the area of potential impact. Wildlife information shall include the following:

i. *A map showing habitat types. The applicant is encouraged to contact the Director for recommendations on the preferred habitat classification system. Special or unique wildlife habitat features (e.g., cliffs, talus slopes, ponds, springs, known nests, etc.) within the area of potential impact by the mining operation, shall also be mapped.*

ii. *A list of species potentially occurring on the permit or affected area and any additional species potentially impacted by the mining operations. This list must also indicate legal status of each species and which species were confirmed present during baseline studies.*

iii. *Data gathered shall include: presence/absence, distribution by season and habitat type, and relative abundance. Key habitat areas shall be identified such as calving/fawning, nesting, foraging, wintering areas, etc. The quality and quantity of the data must be suitable for measuring the success of reclamation and the impacts of the mining operation. Survey methods must be suitable for each species.*

iv. *Information collected pursuant to this Part shall be summarized in a report which includes a discussion of the faunal characteristics of the habitats in the permit and affected area. The report shall discuss the anticipated direct, indirect, short- and long-term impacts associated with the proposed operation.*

5.1 Introduction

Ecosystem Management, Inc. (EMI) was contracted by Golder Associates, Inc. (Golder) to perform the baseline wildlife surveys for the La Jara Mesa Project's proposed Permit Area. The survey objectives were to map and describe habitat types within the proposed Permit Area and assess the potential value for calving/fawning, nesting, foraging, and wintering. Wildlife field surveys were conducted from February 21 to 24, 2011 (winter survey) and from May 31 to June 3, 2011 (summer survey). Morning and evening pedestrian surveys were conducted along three 200-m-long transects and recorded any signs of wildlife (e.g., scat, tracks, sightings, bird calls). The EMI report is in Attachment 5-A.

The area was also assessed for the occurrence of federal threatened, endangered, or candidate wildlife species and state threatened, endangered, and sensitive wildlife species. Appendix 5-B provides the report from the Mt. Ranger District's biologist. A general description of wildlife in the proposed Permit Area, by habitat and wildlife communities, is presented below.

5.2 Wildlife Habitat

The habitat within the proposed Permit Area has variable relief, ranging from nearly level mesa tops and alluvial valleys, to near vertical cliffs of the La Jara Mesa escarpment. The elevation of the portal and main mine facility ranges from about 6,800 to 7,600 feet above mean sea level (amsl) and the escape

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raise at the top of the mesa is at an elevation of 8060 feet amsl. The soils are formed in unconsolidated quaternary alluvium and eolian materials from mixed sources, as well as residuum and colluvium derived primarily from Cretaceous and Jurassic sandstone and shale, Tertiary basalt, and tuffs from Mt. Taylor volcanic activity. Soils are generally course to moderately coarse textured with variable amounts of rock fragments. The eolian deposits at the base of the escarpment have few to no rock fragments; while the shallow soils on the escarpment have as much as 70 percent rock fragments on the surface (see section 6.0).

The vegetation community in the permit area is broadly defined as Great Basin Conifer Woodland (Brown et al., 1994). The dominant vegetation consists of piñon pine (*Pinus edulis*), one-seeded juniper (*Juniperus monosperma*), sand sage (*Artemisia filifolia*), broom snakeweed (*Gutierrezia sarothrae*), cholla (*Cylindropuntia imbricata*), galleta (*Pleuraphis jamesii*), blue grama (*Bouteloua gracilis*), spike dropseed (*Sporobolus contractus*), mesa dropseed (*Sporobolus flexiosus*), indian ricegrass (*Achnatherum hymenoides*), threeawn (*Aristida* spp.), and sideoats grama (*Bouteloua curtipendula*). The summer surveys were conducted during a dry year and most of the grasses and deciduous shrubs had not yet sprouted new growth.

Wildlife habitats based on the US Department of Agriculture-US Forest Service (USDA-USFS) Terrestrial Ecosystem Survey (TES: 2005 and 2007) in the vicinity of La Jara Mesa Project are shown on Figure 5-1. The proposed portal area is primarily located in piñon-juniper habitat which is wide-spread throughout the Mt. Taylor Ranger District and considered a wildlife habitat type of concern (Zamora 2009a). The piñon-juniper habitat provides: readily available forage for many wildlife species including nuts and berries; critical winter range for game mammals and birds; travel corridors; thermal cover; dead and down woody material; snags for cavity nesting species; and human created water sources.

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5.3 Wildlife Species Potentially Occurring On and Around Permit Area

The ecosystem for the proposed Permit Area is the White Mountain-San Francisco Peaks-Mogollon Rim (McNab and Avers, 1994). Typical wildlife within this ecosystem includes mule deer (*Odocoileus hemionus*), piñon jay (*Gymnorhinus cyanocephalus*), black-throated gray warbler (*Setophaga nigrescens*), and plateau striped whiptail lizard (*Aspidoscelis velox*). Site-specific wildlife surveys were conducted in the proposed Permit Area and are described below.

5.3.1 Wildlife Signs and Sightings

A list of mammal species with the potential to occur in the proposed Permit Area is in Table 5-1. Field data sheets are included in EMI's report (Attachment 5-A).

5.3.2 Pellet Group Count Surveys

Mule deer and packrat scat were found during the baseline wildlife surveys. The density of mule deer scat for the survey period was 10 pellet groups/hectare (ha). Pack rat scat density for the surveys was 15 pellet groups/ha. Although several cottontails were observed, no fresh scat was located within the pellet count transects.

5.3.3 Avian Surveys

Eight bird species were identified during the winter survey. Total mean bird density (± Standard Error [SE]) of all species for the winter survey was 2.58 (±0.09) birds/ha. More American robins (*Turdus migratorius*) were observed than any other bird species, mainly due to a large flock. During summer surveys 20 bird species were identified. Total mean bird density (± SE) of all species for the summer survey was 0.91 (±0.09) birds/ha. Table 5-2 lists the bird species that were identified within the Permit Area during the baseline avian surveys. More species were observed during the summer survey than winter survey, but overall bird density was lower in the summer. Juniper titmouse (*Baeolophus ridgwayi*) and black-throated gray warbler (*Setophaga nigrescens*) had the highest summer densities.

5.3.4 Faunal Threatened and Endangered Survey

A list of federal- and state-listed species, United States Department of Agriculture Forest Service (Forest Service) Management Indicator Species (MIS), and species protected by the Migratory Bird Treaty Act, was developed for the La Jara Mesa Project's proposed Permit Area (USDA-USFS, 2011 and New Mexico Department of Game and Fish [NMDGF], 2011). The species are listed on Table 5-3 and are discussed below.

5.3.4.1 Federally Listed Threatened and Endangered Wildlife Species

There are six designated United States Fish & Wildlife Service threatened, endangered, or candidate wildlife species known to occur, or potentially occur, in Cibola County (Table 5-3). The bald eagle (*Haliaeetus leucocephalus*) was delisted June 28, 2007, but is still protected by the Bald and Golden Eagle Protection Act. No federally listed species or their critical habitat exists in the proposed Permit Area.

5.3.4.2 Forest Service Regional Foresters' Sensitive Species List

A list of sensitive species with potential to occur within the proposed Permit Area was obtained from the Forest Service. The Forest Service lists 15 sensitive wildlife species that occur or may occur in the Mt. Taylor Ranger District (Table 5-3). Based on the vegetative, geographical, and topographical characteristics of the proposed Permit Area, it was determined that four sensitive species may occur: Merriam's shrew (Sorex merriami leucogenys), Gunnison's prairie dog (*Cynomys gunnisoni*), spotted bat (*Euderma maculatum*), and gray vireo (*Vireo vicinior*) (Table 5-3). The Forest Service concluded that no significant habitats for these sensitive occur in the proposed Project Area. The Forest Service

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recommended performing any vegetation removal (grubbing) for construction outside of the spring breeding season for the gray vireo.

5.3.4.2.1 Management Indicator Species

The "Cibola National Forest Land and Resource Management Plan," adopted in July 1985, amended May 1990, and updated in 2011, identifies 13 Management Indicator Species (MIS; USDA-USFS, 2011). Three MIS, elk, mule deer, and juniper titmouse, could occur within the La Jara Mesa Project Area (Zamora, 2009). These MIS and habitat descriptions are in Table 5-4.

5.4 Summary

The local wildlife habitat types near the La Jara Mesa Project's proposed Permit Area are broadly characterized as the Great Basin Conifer Woodland dominated by piñon-juniper overstory. The proposed Permit Area provides suitable habitat for numerous bird species. Small mammals appear to reside in or around the Permit Area including packrats, desert cottontails, and other hard-to-detect rodents (Attachment 5A). Large ungulates may pass through the area or include it in their larger home range, but the overall habitat within the portal area is probably not preferred by these animals due to steep slopes, rocky ground, and limited vegetation.

5.5 References

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TABLES

Table 5-1: Wildlife Signs and Sightings

Common Name	Scientific Name	Season Sighted	Observation
Elk	*Cervus canadensis*	Winter	tracks
Coyote	*Canis latrans*	Winter/Summer	scat and yelps
Mule deer	*Odocoileus hemionus*	Winter/Summer	scat and tracks
Desert Cottontail	*Sylvilagus audubonii*	Winter/Summer	scat and tracks
Packrat	*Neotoma spp.*	Winter/Summer	middens and scat
Western rattlesnake	*Crotalus oreganus*	Summer	sight

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Table 5-2: Sighted Bird Species

Common Name	Scientific Name	Season Sighted
Red-tailed Hawk	*Buteo jamaicensis*	Winter
Golden Eagle	*Aquila chrysaetos*	Winter/Summer
Northern Flicker	*Colaptes auratus*	Winter
Downy Woodpecker	*Picoides pubescens*	Winter
Juniper Titmouse	*Baeolophus ridgwayi*	Winter/Summer
Bushtit	*Psaltriparus minimus*	Winter/Summer
Pinyon Jay	*Gymnorhinus cyanocephalus*	Winter/Summer
Western Scrub Jay	*Aphelocoma californica*	Winter/Summer
Common Raven	*Corvus corax*	Winter/Summer
Western Bluebird	*Sialia Mexicana*	Winter
Mountain Bluebird	*Sialia currucoides*	Winter
Townsend's Solitaire	*Myadestes townsendi*	Winter
American Robin	*Turdus migratorius*	Winter
Sage Thrasher	*Oreoscoptes montanus*	Winter
Canyon Towhee	*Melozone fuscus*	Winter
Dark-eyed Junco	*Junco hyemalis*	Winter
House Finch	*Carpodacus mexicanus*	Winter/Summer
Prairie Falcon	*Falco mexicanus*	Summer
Mourning Dove	*Zenaida asiatica*	Summer
Great Horned Owl	*Bubo virginianus*	Summer
Common Nighthawk	*Chordeiles minor*	Summer
Common Poorwill	*Phalaenoptilus nuttallii*	Summer
White-throated Swift	*Aeronautes saxatalis*	Summer
Broad-tailed Hummingbird	*Selasphorus platycercus*	Summer
Olive-sided Flycatcher	*Contopus cooperi*	Summer
Western Wood Pewee	*Contopus sordidulus*	Summer
Cassin's Kingbird	*Tyrannus vociferans*	Summer
Ash-throated Flycatcher	*Myiarchus cinerascens*	Summer
Say's Phoebe	*Sayornis Saya*	Summer
Warbling Vireo	*Vireo gilvus*	Summer
Western Scrub Jay	*Aphelocoma californica*	Summer
Violet-green Swallow	*Tachycineta thalassina*	Summer
Rock Wren	*Salpinctes obsoletus*	Summer
Bewick's Wren	*Thryomanes bewickii*	Summer
Black-throated Gray Warbler	*Setophaga nigrescens*	Summer
Yellow-rumped Warbler	*Setophaga coronate*	Summer
Spotted Towhee	*Pipilo maculatus*	Summer
Chipping Sparrow	*Spizella passerina*	Summer
Black-headed Grosbeak	*Pheucticus melanocephalus*	Summer
Western Tanager	*Piranga ludoviciana*	Summer
Scott's Oriole	*Icterus parisorum*	Summer
Pine Siskin	*Spinus pinus*	Summer
Lesser Goldfinsh	*Spinus psaltria*	Summer

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Table 5-3: USFWS and NMDGF Listed Species with Potential to Occur in the Proposed Permit Area

Common Name	Federal Status	State Status	Typical Habitat Description	Potential to Occur in the Permit Area[†]
Mammals				
Black-footed ferret *Mustela nigripes*	*E*	--	Open grasslands, typically associated with prairie dog colonies.	None
Merriam's shrew *Sorex merriami leucogenys*	--	*S*	Grasslands, sagebrush scrub, pinyon-juniper woodlands, mixed conifer woodlands.	Suitable Habitat; Species not present
Dwarf shrew *Sorex nanus*	--	*S*	Grasslands, chaparral, bare rock/scree, mixed conifer woodlands.	None
Spotted bat *Euderma maculatum*	--	*T*	Highly varied habitats from coniferous forest to desert scrub; roosts on cliffs and rock crevices; permanent water body for foraging habatat.	Variety of Habitats Suitable
Gunnison's prairie dog *Cynomys gunnisoni*	*C*	*S*	Level to gently sloping grasslands, semidesert and montane shrublands (6,000–12,000 feet).	Suitable Habitat; Species present
Cebolleta southern pocket gopher *Thomomys bottae paguatae*	--	*S*	This species occurs in the vicinity of the village of Cebolleta, Cibola County, on the Rio Paquate on the southeast side of Mt. Taylor. Gophers were collected only in the areas of the flood plain that were, or had been, under cultivation.	None
Mt. Taylor northern pocket gopher *Thomomys talpoides taylori*	--	*S*	This species has been collected in the pine and fir belts above 8,500 feet about 6 miles northeast of the summit of Mt. Taylor, and on the southwest slope of Mt. Taylor.	None
Birds				
Yellow-billed cuckoo *Coccyzus americanus*	*C* *MBTA*	*S*	Broadleaf riparian forest	None
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	--	*S*	Open riparian woodlands and broad-leaf forests.	None
Southwestern willow flycatcher *Empidonax traillii extimus*	*E* *MBTA*	*E*	Dense, shrubby riparian habitats, typically in close proximity to surface water or saturated soils .	None
Bald eagle *Haliaeetus leucocephalus*	*BGEPA* *MBTA*	*T*	Large trees along rivers, lakes, or reservoirs for roosts and nests; riparian and upland habitats for foraging.	None

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Table 5-3: USFWS and NMDGF Listed Species with Potential to Occur in the Proposed Permit Area

Common Name	Federal Status	State Status	Typical Habitat Description	Potential to Occur in the Permit Area†
Birds				
Mexican spotted owl *Strix occidentalis lucida*	*T* *MBTA* *CH*	*S*	Mature ponderosa pine and mixed conifer forest, typically associated with steep slopes and cliff/canyon complexes.	None
Northern goshawk *Accipiter gentilis*	*SOC*	*S*	Ponderosa pine, mixed conifer, and spruce-fir forests.	None
American peregrine falcon *Falco peregrinus anatum*	*SOC*	*T*	Rocky, steep cliff areas, generally near water or mesic canyons.	None
Gray vireo *Vireo vicinior*	--	*T*	Thorn scrub, oak-juniper woodland, pinyon-juniper, dry chapparal, mesquite, and riparian willow habitats.	Suitable Habitat; Species not present
Fish				
Rio Grande sucker *Catostomus plebeius*	--	*S*	Currently inhabits the northern portion of the Rio Grande and its tributaries.	None
Zuni bluehead sucker *Catostomus discobolus*	*C*	*E*	Shaded, pool and riffle habitats with coarse substrates; only found in one location in the Zuni Mountains.	None
Amphibian				
Northern leopard frog *Rana pipiens*	--	*S*	Wetlands with abundant aquatic vegetation and perennial water source.	None
Crustaceans				
Clam shrimp *Eulimnadia follisimillis*	--	*S*	Vernal and ephemeral pools	None
Fairy shrimp *Streptocephalus n. sp.*	--	*S*	Vernal and ephemeral pools	None

Notes:

Sources: NMGFD 2010, USDI FWS 2010.

BGEPA = Bald Eagle Protection Act; C = Cadidate, E= Endangered, MTB = Migratory Bird treaty Act; T = Treatened, CH = Designated Critical Habitat

S = Sensitive; SOS = Species of Concern

†Based on habitat of species compared with vegetative, geographical, geological, and topographical characteristics of the Permit Area.

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Table 5-4: Forest Service Management Indicator Species for La Jara Mesa

Common Name	Habitat Indicator Listing Rationale	Habitat Description	Proposed Habitat Disturbance Acres
Elk	Mountain Grassland/ mixed conifer	In general, elk prefer open grassy meadows located less than ½ mile from water. Hiding cover for elk occurs in stands of trees 30-60 acres in size with 70 percent canopy cover.	16.4
Mule deer	Mountain shrub/ piñon-juniper	Early stages of plant succession with an abundance of browse plants are more beneficial to mule deer than late stages. Mixtures of plant species are preferable to single species plant communities. Food requirements for deer average about 5 to 7 pounds of green forage per day depending on the size of the deer. Mule deer depend on early growing grasses and forbs in the spring and forbs in summer.	16.4
Juniper titmouse	Piñon-juniper	The juniper titmouse prefers warm, dry habitats of open pinyon-juniper woodland sometimes mixed with oak. It is most common where juniper is dominant and where large, mature trees are present to provide cavities for nesting.	16.4

Notes:
Sources: USDA Forest Service 2010

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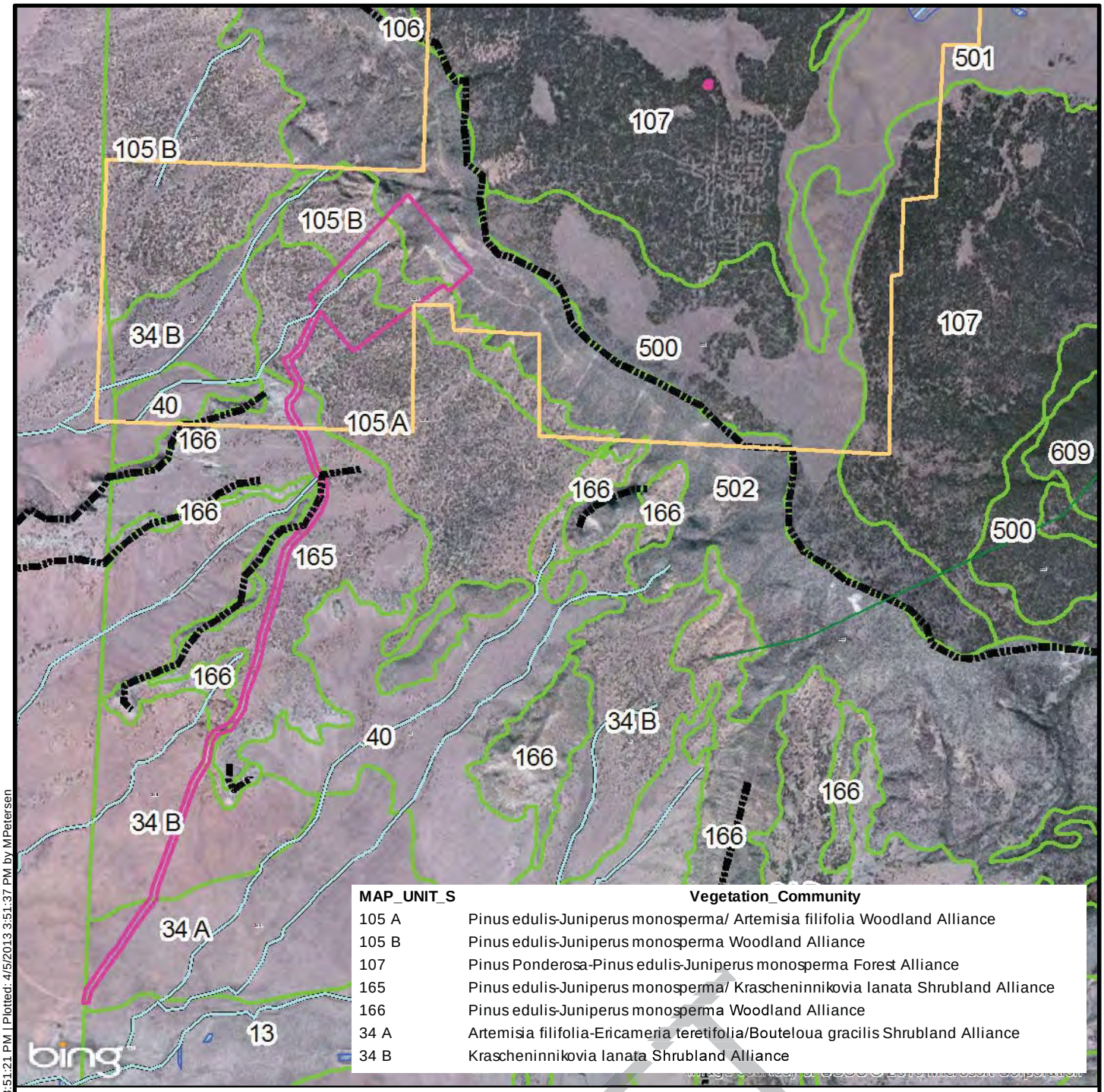
FIGURES



MAP_UNIT_S	Vegetation_Community
105 A	Pinus edulis-Juniperus monosperma/ Artemisia filifolia Woodland Alliance
105 B	Pinus edulis-Juniperus monosperma Woodland Alliance
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34 A	Artemisia filifolia-Ericameria teretifolia/Bouteloua gracilis Shrubland Alliance
34 B	Krascheninnikovia lanata Shrubland Alliance

LEGEND

- Claim Boundary
- Arroyos
- Rock/Cliffside
- Roundy Stock Tank
- Proposed Permit Boundary
- TES Map Units

REFERENCES & NOTES

1. Projection: NAD 1983 UTM Zone 13N
2. Source Aerial: Bing Maps (c) 2010 Microsoft Corporation and its data suppliers
3. Figure is for illustration purposes only; NOT FOR CONSTRUCTION.

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SCALE 1:30,000 FEET

PROJECT/REPORT

LARAMIDE RESOURCES (USA) INC.
LA JARA MESA PROJECT
CIBOLA COUNTY, NEW MEXICO

TITLE

WILDLIFE HABITAT TYPES

Golder Associates

PROJECT No. 083-9338SI

FIGURE 5-1

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Map: W:\La Jara Mesa\Maps\Figure 5_1.mxd | Modified: 4/5/2013 3:51:21 PM | Plotted: 4/5/2013 3:51:37 PM by MPetersen

ATTACHMENT 5A
EMI REPORT

Wildlife Survey Report for Proposed La Jara Mesa Mining Project on U.S. Forest Service Land

Cibola County, New Mexico
Cibola National Forest, Mt. Taylor Ranger District

November 2012

Prepared for:

Golder Associates, Inc.
5200 Pasadena Ave. NE, Suite C
Albuquerque, NM 87113

Prepared by:

Ecosystem Management, Inc.
3737 Princeton Dr. NE, Suite 150
Albuquerque, NM 87107

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List of Figures

1.0 INTRODUCTION

Ecosystem Management, Inc. (EMI) was contracted by Golder Associates, Inc. to perform wildlife surveys at the proposed La Jara Mesa Project mining site located along the La Jara Mesa in Cibola National Forest, Mt. Taylor Ranger District, in Cibola County, NM (Figure 1).

2.0 METHODOLOGY

Surveys were conducted according to protocol provided by Golder Associates, Inc. Surveys were conducted February 21–24, 2011 ("winter surveys") and May 31–June 3, 2011 ("summer surveys"). During each survey period, three evening wildlife surveys were conducted and three morning avian point count surveys were conducted. One pellet survey was conducted during the summer surveys. Three 200-m-long transects were established for avian and pellet counts (Figure 2).

Evening wildlife surveys were conducted two hours before sunset for three evenings each during winter and summer. The biologists conducted pedestrian surveys across the project area and recorded any signs of wildlife (e.g., scat, tracks, sightings, bird calls). Any incidental observations made outside the evening survey period were also noted. Complete lists of all bird species seen or heard during the 4-day survey periods were compiled for winter and summer surveys (Appendix A and B).

Pellet group count surveys were conducted within a 2-m fixed width along the three 200-m-long transects. All pellet groups from the current year were counted and identified to species. Older pellets tended to be drier, fragile, paler, and smaller. Pellet groups falling partly within the 2-m transect width were counted. The total survey area of all three transects combined was 0.2 ha (~ 0.5 acres). Pellet group counts were combined across all transects to provide the number of pellet groups/0.2 ha. This was than extrapolated to provide an estimate of pellet groups/ha. Raw pellet numbers were used for density estimates rather than the mean for all three transects because so few groups were found.

Avian surveys were conducted two hours after sunrise for three mornings each during winter and summer surveys. A 5-minute point count was conducted at one end point of each transect, and then transects were walked. All birds seen or detected were identified to species, the method of detection was recorded, the number of individuals was recorded, and the linear distance of the bird to the point (point counts) or perpendicular distance of the bird to the transect (transects) was visually estimated or measured with a range finder. Birds detected beyond 100 m of the transect or count point were excluded from density estimates. Birds were not counted twice on the same transect or among transects; hence, the transects were treated independently from each other. The total area sampled across all three transects was 21.3 ha (~ 52.6 acres). Thus, mean (± SE) density for each species was estimated by dividing the number of individuals of each species detected across all three transects during one survey morning by 21.3. The density estimates were then averaged for the three repeat visits. Densities for winter and summer survey periods were calculated separate. The third survey morning during the winter period was snowed out midway. These data were not included in estimates; thus, the mean density for winter birds is based on two repeat visits. Detection probabilities and corresponding density corrections based

on distance or repeat visits could not be estimated because of the small sample size. All surveys were conducted by experienced wildlife biologists with significant birding experience.

2.1 Description of the project area

The project area consists of mostly undeveloped land covered by a small network of two-track dirt roads. The area contains an old, small open pit mine and appears to have operated as a dumping area in the past, as is evident from the amount of trash and debris that emerges from the ground and wash banks at various locations. Most of the project area consists of rolling sandy hills, but the northern portion of the project area consists of rocky cliffs and ledges that make up the southern base of La Jara Mesa. The elevation is approximately 2,160–2,320 meters (7,100–7,600 feet).

The geology is mapped as Quaternary alluvium and landslide deposits (New Mexico Bureau of Geology & Mineral Resources 2003). The soil along the flatter, southwestern portion of the project area is silt–sand with few rocks. The northeastern portion along the base of La Jara Mesa is dominated by sandy soils with basalt rocks and boulders.

The vegetation community is mapped as Great Basin Conifer Woodland (Brown et al. 1994). The dominant vegetation consists of piñon pine (*Pinus edulis*), one-seeded juniper (*Juniperus monosperma*), sand sage (*Artemisia filifolia*), snakeweed (*Gutierrezia sarothrae*), joint fir (*Ephedra viridis*), cholla (*Cylindropuntia imbricata*), galleta (*Pleuraphis jamesii*), blue grama (*Bouteloua gracilis*), spike dropseed (*Sporobolus contractus*), mesa dropseed (*Sporobolus flexuosus*), Indian ricegrass (*Oryzopsis hymenoides*), three awn (*Aristida* sp.), side-oats grama (*Bouteloua curtipendula*), and Sandhill Muhly (*Muhlenbergia pungens*). The summer surveys were conducted during an extended drought and most of the grasses and deciduous shrubs had not begun to sprout new growth for this growing season at the time of the surveys.

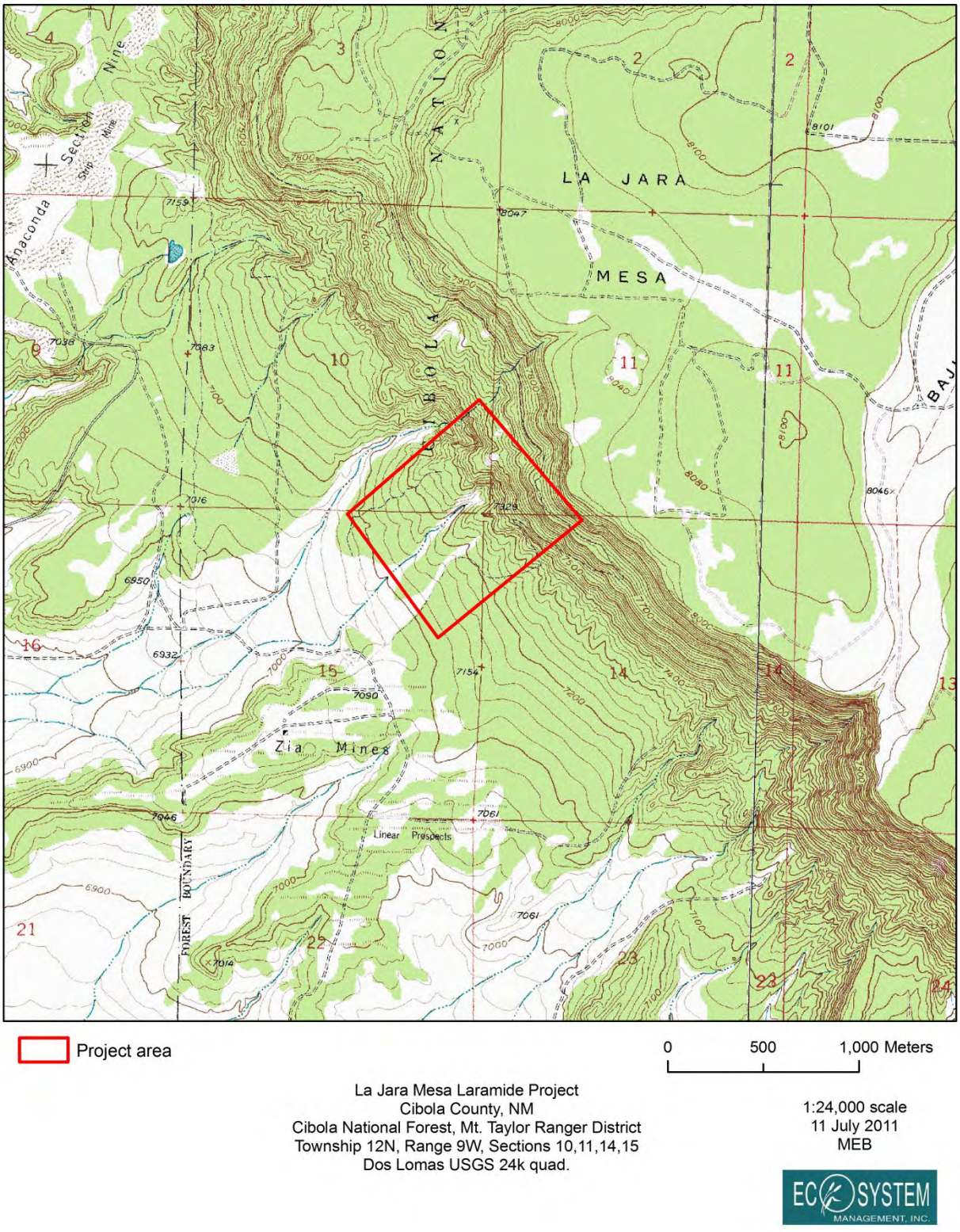

Figure 1. Map of project area.

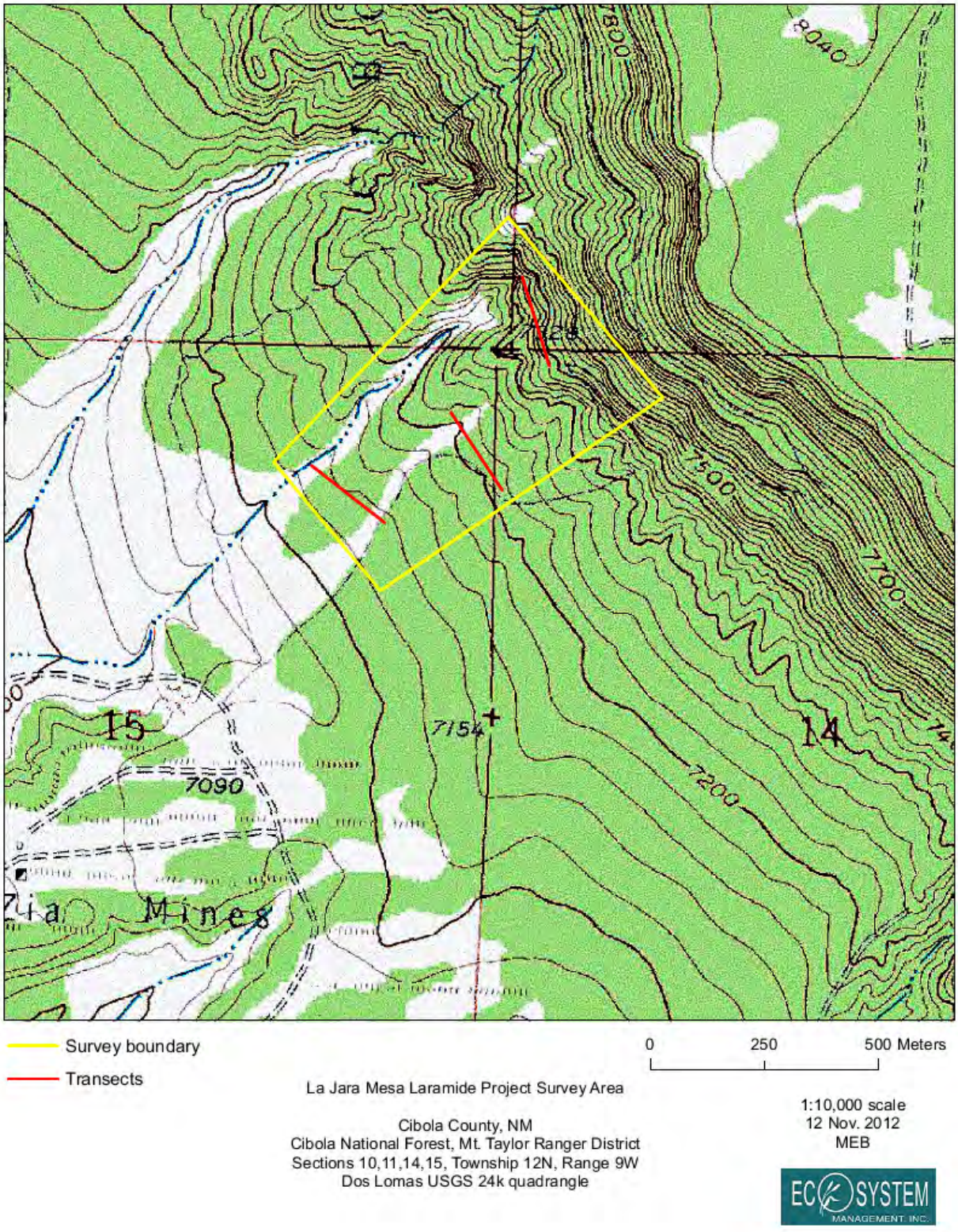

Figure 2. Survey area.

3.0 SURVEY RESULTS

Evening Wildlife Surveys

Winter—Wildlife signs observed during winter surveys included elk (*Cervus canadensis*) tracks, coyote (*Canis latrans*) scat, mule deer (*Odocoileus hemionus*) scat and tracks, desert cottontail (*Sylvilagus audubonii*) scat, and packrat (*Neotoma* spp.) middens and scat. No live mammals were observed.

Summer—Wildlife signs observed during summer surveys included mule deer scat and tracks (fresh), desert cottontail scat and tracks, coyote scat and yelps, and packrat middens and scat. Two juvenile cottontails were also seen outside the evening survey period. There may be two species of packrat occupying the project area. Two types of middens are common throughout the area. One type is made of sticks and occurs under junipers. These frequently are covered with fresh juniper branch cuttings. The other type occurs in the rocky ledges along the mesa bottom. These are covered with cholla spines and large piles of packrat scat. There are three species of *Neotoma* that could occur in the area. Available browse for herbivores was severely limited because of the drought-induced delayed spring growth of numerous grasses, forbs, and deciduous shrubs in the area.

Pellet Group Count Surveys

Scat of two species from this year was detected during surveys. Two mule deer pellet groups and three packrat pellet groups were found at the three transects. The density of mule deer scat for the survey was 10 pellet groups/ha (2 pellet groups/0.2 ha). Pack rat scat density for the survey was 15 pellet groups/ha (3 pellet groups/0.2 ha). Although several cottontails were observed, no recent scat was located within the transects.

Avian Surveys

Winter—Eight bird species were detected and identified during point counts/transects. Total mean bird density (± SE) for all species across the two surveys was 2.58 (± 0.09) birds/ha. American Robins (*Turdus migratorius*) occurred in much higher densities than any other species (Figure 3), mainly due to a large flock that was occupying the project area.

Summer—Twenty bird species were detected and identified during point counts/transects. Total mean bird density (± SE) for all species across the three surveys was 0.91 (± 0.09) birds/ha. More species were detected during summer surveys compared to the winter surveys (Figure 4), but overall bird density was lower. Juniper Titmouse (*Baeolophus ridgwayi*) and Black-throated Gray Warbler (*Setophaga nigrescens*) had the highest summer densities.

The project area contains suitable Gray Vireo (*Vireo vicinior*) piñon–juniper habitat. The Gray Vireo has been documented in Cibola County, NM, with three records from June (New Mexico Game and Fish 2010; New Mexico Ornithological Society 2012). No Gray Vireos were detected during summer surveys at the La Jara Mesa project area. The Plumbeous Vireo (*Vireo plumbeus*)

may be confused with the Gray Vireo in song and appearance; however, no Plumbeus Vireos were detected.

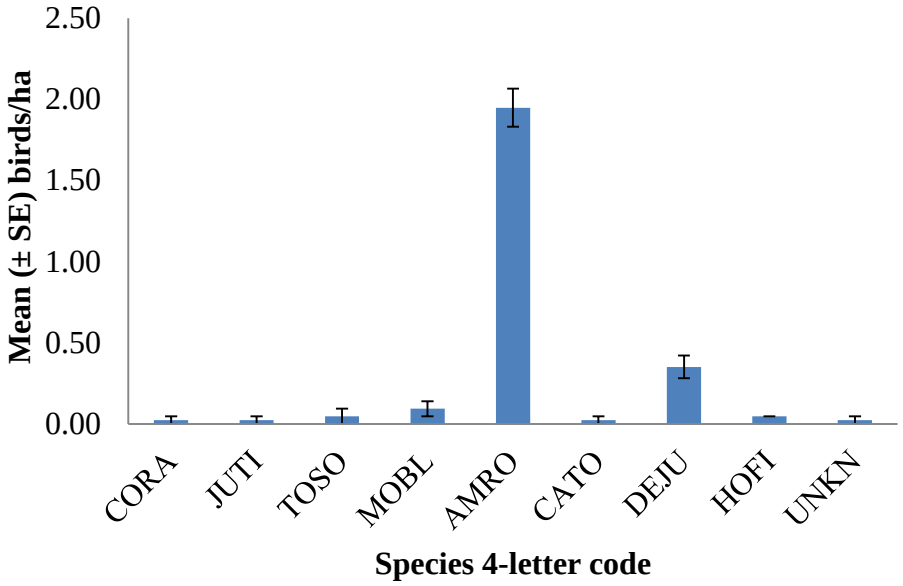

Figure 3. Graph of winter bird densities by species. Four-letter codes are defined in Appendix A and B.

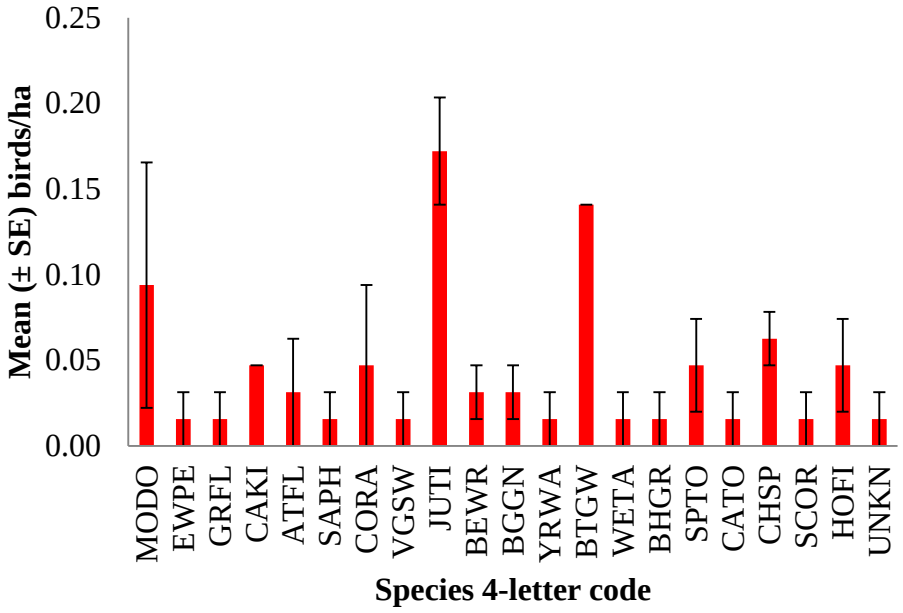

Figure 4. Graph of summer bird densities by species. Four-letter codes are defined in Appendix A and B.

Other Wildlife Sightings

Other incidental wildlife detections included western rattlesnake (*Crotalus oreganus*) and an unidentified lizard.

5.0 LIST OF PREPARERS

Prepared by Matthew E. Brooks, Wildlife Biologist, Ecosystem Management, Inc.

6.0 CONCLUSION

The project area appears to currently provide suitable habitat for numerous bird species. The only mammals that are perhaps resident in or around the area are packrats, desert cottontails, and other hard-to-detect rodents. Large ungulates may pass through the area or include it in their larger home range, but the overall habitat with its sandy soils, rocky cliffs, and limited vegetative growth is probably not the most preferred by these animals. Local habitat changes from mining are not expected to affect large mammals, but many bird species and small mammals could be displaced if habitat is disturbed during the nesting and denning season (March–July). The local wildlife habitat types are abundant in the La Jara Mesa area, and the small loss of vegetation within the project area would be an annoyance to birds and large mammals during the nonbreeding season. Species dependent on dens or middens year round may be affected regardless of the time of disturbance.

7.0 LITERATURE CITED

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New Mexico Game and Fish. 2010. Biotic information system of New Mexico, species reports: Gray Vireo. Online: http://www.bison-m.org/speciesbooklet.aspx.

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APPENDIX A. List of all bird species observed during winter surveys.

Common name	Scientific name	Code
Red-tailed Hawk	*Buteo jamaicensis*	RTHA
Golden Eagle	*Aquila chrysaetos*	GOEA
Northern Flicker	*Colaptes auratus*	NOFL
Downy Woodpecker	*Picoides pubescens*	DOWO
Juniper Titmouse	*Baeolophus ridgwayi*	JUTI
Bushtit	*Psaltriparus minimus*	BUSH
Pinyon Jay	*Gymnorhinus cyanocephalus*	PIJA
Western Scrub Jay	*Aphelocoma californica*	WESJ
Common Raven	*Corvus corax*	CORA
Western Bluebird	*Sialia mexicana*	WEBL
Mountain Bluebird	*Sialia currucoides*	MOBL
Townsend's Solitaire	*Myadestes townsendi*	TOSO
American Robin	*Turdus migratorius*	AMRO
Sage Thrasher	*Oreoscoptes montanus*	SATH
Canyon Towhee	*Melozone fuscus*	CATO
Dark-eyed Junco	*Junco hyemalis*	DEJU
House Finch	*Carpodacus mexicanus*	HOFI

APPENDIX B. List of all bird species observed during summer surveys.

Common name	Scientific name	Code
Golden Eagle	*Aquila chrysaetos*	GOEA
Prairie Falcon	*Falco mexicanus*	PRFA
Mourning Dove	*Zenaida asiatica*	MODO
Great Horned Owl	*Bubo virginianus*	GHOW
Common Nighthawk	*Chordeiles minor*	CONI
Common Poorwill	*Phalaenoptilus nuttallii*	COPO
White-throated Swift	*Aeronautes saxatalis*	WTSW
Broad-tailed Hummingbird	*Selasphorus platycercus*	BTHU
Olive-sided Flycatcher	*Contopus cooperi*	OSFL
Western Wood Pewee	*Contopus sordidulus*	WEWP
Cassin's Kingbird	*Tyrannus vociferans*	CAKI
Ash-throated Flycatcher	*Myiarchus cinerascens*	ATFL
Say's Phoebe	*Sayornis saya*	SAPH
Warbling Vireo	*Vireo gilvus*	WAVI
Western Scrub Jay	*Aphelocoma californica*	WESJ
Pinyon Jay	*Gymnorhinus cyanocephalus*	PIJA
Common Raven	*Corvus corax*	CORA
Violet-green Swallow	*Tachycineta thalassina*	VGSW
Juniper Titmouse	*Baeolophus ridgwayi*	JUTI
Bushtit	*Psaltriparus minimus*	BUSH
Rock Wren	*Salpinctes obsoletus*	ROWR
Bewick's Wren	*Thryomanes bewickii*	BEWR
Blue-gray Gnatcatcher	*Polioptila caerulea*	BGGN
Black-throated Gray Warbler	*Setophaga nigrescens*	BTGW
Yellow-rumped Warbler	*Setophaga coronata*	YRWA
Spotted Towhee	*Pipilo maculatus*	SPTO
Canyon Towhee	*Melozone fuscus*	CATO
Chipping Sparrow	*Spizella passerina*	CHSP
Black-headed Grosbeak	*Pheucticus melanocephalus*	BHGR
Western Tanager	*Piranga ludoviciana*	WETA
Scott's Oriole	*Icterus parisorum*	SCOR
House Finch	*Carpodacus mexicanus*	HOFI
Pine Siskin	*Spinus pinus*	PISI
Lesser Goldfinch	*Spinus psaltria*	LEGO

APPENDIX C. Winter survey data sheets.

Transect WT1 Date 02/22/11 Temp. 20 F Cloud cover 0 % Wind scale 0 Page 1 of 1

Observer MEB Start time 0640 hr End time 0653 hr Trans NW UTM 247905 E 3907122 N; SE 248071 E, 3906943 N

Visit # 1 Datum NAD83 Notes

PC/T: point count or transect survey. Detection: V = visual, A = Audio, V&A = both. Sex = M, F, or U for unknown. Distance in meters.

PC/T	Species	#	Detection	Distance	Bearing	Sex	Notes
PC	DEJU	1	A	30	E		
PC	JUTI	1	A	28	N		
PC	DEJU	1	A	30	NE		
PC	CORA	1	A,V	100	SE		Flyby
T	DEJU	1	A	30	E		
T	DEJU	1	A	25	W		
T	AMRO	1	A	8	E		
T	DEJU	1	V	20	E		
T	MOBL	1	V	20	E	M	
T	TOSO	1	A	150	W		
T	DEJU	1	V,A	25	E		

Wildlife, nests, other sightings: Coyote Calling

Lajara Mesa Project pellet-count sheet • Ecosystem Management, Inc. 3737 Princeton Dr. NE, Ste. 150, Albuquerque, NM 87107 • 505-884-8300 • mattb@emi-nm.com • transect = 2 x 202 m • transect area = 404m² • 5-min counts • 100-m radius

Transect WT2 Date 02 / 22 / 11 Temp. 20 °F Cloud cover 0 % Wind scale 0 Page 1 of 1

Observer MEB Start time 0704 hr End time 0716 hr Trans NW UTM 248208 E 3907226 N; SE 248318 E, 3907059 N

Visit # 1 (6th) Datum NAD 83 Notes

PC/T: point count or transect survey. Detection: V = visual, A = Audio, V&A = both. Sex = M, F, or U for unknown. Distance in meters.

PC/T	Species	#	Detection	Distance	Bearing	Sex	Notes
	NO BIRDS AU			PC			
T	MOBC	1	V,A	60	N		
T	HAWK	1	V,A	30	SW		Fly by

Wildlife, nests, other sightings: coyote calling

Lajara Mesa Project pellet-count sheet • Ecosystem Management, Inc. 3737 Princeton Dr. NE, Ste. 150, Albuquerque, NM 87107 • 505-884-8300 • mattb@emi-nm.com • transect = 2 x 202 m • transect area = 404m² • 5-min counts • 100-m radius

Transect WT3 Date 02/22/11 Temp. 25 °F Cloud cover 0 % Wind scale 0 Page 1 of 1

Observer MEB Start time 0732 hr End time 0752 hr Trans NW UTM 248432 E 3907332 N; SE 248382 E, 3907516 N

Visit # 1 (Win) Datum NAD83 Notes

PC/T: point count or transect survey. Detection: V = visual, A = Audio, V&A = both. Sex = M, F, or U for unknown. Distance in meters.

PC/T	Species	#	Detection	Distance	Bearing	Sex	Notes
PC	CATO	1	A	99	W		
PC	MOBL	1	A	50	E		
PC	AMRO	1	V	30	W		
T	AMRO	15	V,A	15	E		
T	TUSO	1	A	200	SW		
T	AMRO	1	V,A	10	W		
T	AMRO	1	V	15	W		
T	AMRO	5	V,A	100	NW		
T	AMRO	10	V,A	0	N		
T	AMRO	10	V,A	80	W		

Wildlife, nests, other sightings: Coyote calling

Lajara Mesa Project pellet-count sheet • Ecosystem Management, Inc. 3737 Princeton Dr. NE, Ste. 150, Albuquerque, NM 87107 • 505-884-8300 • mattb@emi-nm.com • transect = 2 x 202 m • transect area = 404m² • 5-min counts • 100-m radius

Transect WT1 Date 12/23/11 Temp. 25 °F Cloud cover 0 % Wind scale 1 Page 1 of 1

Observer MEB Start time 0639 hr End time 0655 hr Trans NW UTM _____ E _____ N; SE _____ E, _____ N

Visit # 24 Datum NAD83 Notes _____

PC/T: point count or transect survey. Detection: V = visual, A = Audio, V&A = both. Sex = M, F, or U for unknown. Distance in meters.

PC/T	Species	#	Detection	Distance	Bearing	Sex	Notes
PC	DEJU	1	A	43	W		
T	UNKN	1	V	20	S		
T	GOEA	1	A	>500	E		by CRES
T	DEJU	2	A, V	35	NE		
T	DEJU	2	A, V	30	E		
T	TOSO	1	A	80	SW		
T	CORA	1	A	300	NW		
T	DEJU	2	A, V	19	E		
T	TOSO	1	A	70	N		
T	DEJU	2	A, V	27	SW		
T	AMRO	2	A, V	85	S		
T	AMRO	1	V	65	S		ad fly

Wildlife, nests, other sightings: old nest (Jay?) on transect. Large w/ sticks. In Juniper.

Lajara Mesa Project pellet-count sheet • Ecosystem Management, Inc. 3737 Princeton Dr. NE, Ste. 150, Albuquerque, NM 87107 • 505-884-8300 • mattb@emi-nm.com • transect = 2 x 202 m • transect area = 404m² • 5-min counts • 100-m radius

Transect WT2 Date 02 / 23 / 11 Temp. 25 °F Cloud cover 0 % Wind scale 1 Page 1 of 1

Observer MEB Start time 0705 hr End time 0714 hr Trans NW UTM _____ E _____ N; SE _____ E, _____ N

Visit # 2 wr Datum NAD 83 Notes _____

PC/T: point count or transect survey. Detection: V = visual, A = Audio, V&A = both. Sex = M, F, or U for unknown. Distance in meters.

PC/T	Species	#	Detection	Distance	Bearing	Sex	Notes
PC	AMRO	2	A	90	E		
PC	HOFI	1	A	60	NW		
T	AMRO	4	V	100	S		
T	AMRO	1	A	85	SW		

Wildlife, nests, other sightings:

Lajara Mesa Project pellet-count sheet • Ecosystem Management, Inc. 3737 Princeton Dr. NE, Ste. 150, Albuquerque, NM 87107 • 505-884-8300 • mattb@emi-nm.com • transect = 2 x 202 m • transect area = 404m² • 5-min counts • 100-m radius

Transect WT 3 Date 02/23/11 Temp 26 °F Cloud cover 0 % Wind scale 1 Page 1 of 1

Observer MEB Start time 0727 hr End time 0740 hr Trans NW UTM _____ E _____ N; SE _____ E, _____ N

Visit # 2 w Datum NAD83 Notes _____

PC/T: point count or transect survey. Detection: V = visual, A = Audio, V&A = both. Sex = M, F, or U for unknown. Distance in meters.

PC/T	Species	#	Detection	Distance	Bearing	Sex	Notes
PC	MOBL	1	A	40	SW		
PC	AMRO	1	A	50	NE		
T	AMRO	26	V,A	30	N		flyby
T	AMRO	2	V,A	15	E		

Wildlife, nests, other sightings:

Lajara Mesa Project pellet-count sheet • Ecosystem Management, Inc. 3737 Princeton Dr. NE, Ste. 150, Albuquerque, NM 87107 • 505-884-8300 • mattb@emi-nm.com • transect = 2 x 202 m • transect area = 404m² • 5-min counts • 100-m radius

Transect WT1 Date 02/24/11 Temp. 35 °F Cloud cover 100 % Wind scale 2 Page 1 of 1

Observer MEB Start time 0641 hr End time 0657 hr Trans NW UTM _____ E _____ N; SE _____ E, _____ N

Visit # 3w Datum NAD83 Notes _____

PC/T: point count or transect survey. Detection: V = visual, A = Audio, V&A = both. Sex = M, F, or U for unknown. Distance in meters.

PC/T	Species	#	Detection	Distance	Bearing	Sex	Notes
PC	DETA	2	A	35	SW		
PC	UNKN	1	V	15	SE		ANHO?
PC	CORA	1	V/A	100	N		
T	CORA	1	A	50	SW		same bird as on PC

Wildlife, nests, other sightings:

Lajara Mesa Project pellet-count sheet • Ecosystem Management, Inc. 3737 Princeton Dr. NE, Ste. 150, Albuquerque, NM 87107 • 505-884-8300 • mattb@emi-nm.com • transect = 2 x 202 m • transect area = 404m² • 5-min counts • 100-m radius

Transect WT2 Date 02 / 24 / 11 Temp. 35 °F Cloud cover 100 % Wind scale 2 Page 1 of 1

Observer MEB Start time 0700 hr End time 0710 hr Trans NW UTM _____ E _____ N; SE _____ E, _____ N

Visit # 34 Datum NAD83 Notes Light snow starting, last ½ of transect

PC/T: point count or transect survey. Detection: V = visual, A = Audio, V&A = both. Sex = M, F, or U for unknown. Distance in meters.

PC/T	Species	#	Detection	Distance	Bearing	Sex	Notes
PC	MEJA	1	A	60	SW		
T	no birds on transect						

Wildlife, nests, other sightings:

Lajara Mesa Project pellet-count sheet • Ecosystem Management, Inc. 3737 Princeton Dr. NE, Ste. 150, Albuquerque, NM 87107 • 505-884-8300 • mattb@emi-nm.com • transect = 2 x 202 m • transect area = 404m² • 5-min counts • 100-m radius

Transect LVT 3 Date 02 / 24 / 11 Temp. ___ °F Cloud cover ___ % Wind scale ___ Page 1 of 1

Observer MEB Start time ___ hr End time ___ hr Trans NW UTM ___ E ___ N; SE ___ E, ___ N

Visit # 3rd Datum NAD83 Notes Couldn't count because of snow

PC/T: point count or transect survey. Detection: V = visual, A = Audio, V&A = both. Sex = M, F, or U for unknown. Distance in meters.

PC/T	Species	#	Detection	Distance	Bearing	Sex	Notes

Wildlife, nests, other sightings:

Lajara Mesa Project pellet-count sheet • Ecosystem Management, Inc. 3737 Princeton Dr. NE, Ste. 150, Albuquerque, NM 87107 • 505-884-8300 • mattb@emi-nm.com • transect = 2 x 202 m • transect area = 404m² • 5-min counts • 100-m radius

Page 1 of 1

Wildlife Survey Field Data Sheet

Location: Laramide	Date: Feb 24, 2011	Temp: 50°F
Transect ID: WT1-3	Start Time: 1610	End Time: 1810
Personnel: MEB, SMM	Weather: Sky = 0% clouds, wind = 1, Rain -	

Species Observed:

Species:	Observed	Heard	Distance	Comments (location, behavior, etc.)
Elk tracks, scat Mule Deer tracks, scat Desert Cottontail scat	No mammals seen			Throughout

Incidental Wildlife Sightings: A pair of Golden Eagles flying around cliffs of mesa top to the east.

Other Observations/Comments:

P:\ABQ Projects\2009 Projects\083-9936SI Laramide Site Investigation\Field Forms\Wildlife Survey.xlsx

Page 1 of 1

Wildlife Survey Field Data Sheet

Location: Laramide WT1-3	Date: 02-22-11	Temp: 55°F
Transect ID: 1-3	Start Time: 1600	End Time: 1800
Personnel: MEB, SMM	Weather: clouds 0%, wind 4-5	

Species Observed:

Species:	Observed / Heard / Distance	Comments (location, behavior, etc.)
Coyote scat & tracks Desert cottontail tracks & scat mule deer tracks & scat	No mammals seen	near WT3 throughout

Incidental Wildlife Sightings:

Other Observations/Comments:
Mice seen at night on entrance Rd.

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Page 1 of 1

Wildlife Survey Field Data Sheet

Location: Laramide	Date: 23 Feb. 2011	Temp: 55°F - 50°F
Transect ID: WT 1-3	Start Time: 1600	End Time: 1800
Personnel: MEB, SMM	Weather: wind 4-5, Clouds 0% - 80% Stormclouds moving in last half of survey - no rain	

Species Observed:

Species:	Observed / Heard / Distance	Comments (location, behavior, etc.)
Elk tracks Coyote scat mule deer tracks & scat Desert cottontail scat Pack rat ~~middens~~ dens, scat under Junipers (Neotoma sp.)	No mammals seen.	} throughout

Incidental Wildlife Sightings:

Other Observations/Comments:
3 Golden Eagles flying around cliffs

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APPENDIX D. Summer survey data sheets.

Transect W2-1 Date June 1 11 Temp. 81 °F Cloud cover 20 % Wind scale 2 Page 1 of ____

Observer MEB Start time 0611 hr End time 0630 hr Trans NW UTM _____ E _____ N; SE _____ E, _____ N

Visit # 1 Datum NAD83 Notes _____

PC/T: point count or transect survey. Detection: V = visual, A = Audio, V&A = both. Sex = M, F, or U for unknown. Distance in meters.

PC/T	Species	#	Detection	Distance	Bearing	Sex	Notes
PC	BEWR	1	A	40	NE	U	
PC	CHSP	1	A	30	S	U	
PC	JUTI	1	A	10	E	U	
PC	CORA	1	VA	100	NE	U	
T	YRWA	1	V,A	0	SE	U	
T	BTGN	1	V,A	38	NE	U	
T	WETA	1	A	20	NW	U	
T	BTGN	1	A	50	SE	U	
T	JUTI	1	A	15	N	U	
T	JUTI	1	A	25	S	U	
T	CALT	1	A	60	N	U	

Wildlife, nests, other sightings:

Lajara Mesa Project ~~pellet-count sheet~~ • Ecosystem Management, Inc. 3737 Princeton Dr. NE, Ste. 150, Albuquerque, NM 87107 • 505-884-8300 • mattb@emi-nm.com • transect = 2 x 202 m • transect area = 404m² • 5-min counts • 100-m radius

Transect WL2 Date Jun 1 11 Temp. 18.7°C Cloud cover 10 % Wind scale 2 Page 1 of ____

Observer MEB Start time 0642 hr End time 0656 hr Trans NW UTM _____ E _____ N; SE _____ E, _____ N

Visit # 1 Datum NAD83 Notes _____

PC/T: point count or transect survey. Detection: V = visual, A = Audio, V&A = both. Sex = M, F, or U for unknown. Distance in meters.

PC/T	Species	#	Detection	Distance	Bearing	Sex	Notes
PC	SPTO	1	A	44	E	M	
T	BOEA	1	V	300	E	U	
T	EWPE	1	A	150	SE	U	
T	BTBW	1	A	44	W	U	
T	CORA	2	A,V	50	W	U	Same as transect 1

Wildlife, nests, other sightings:

ATFL, NMOC, VGSW

Lajara Mesa Project ~~pellet-count sheet~~ • Ecosystem Management, Inc. 3737 Princeton Dr. NE, Ste. 150, Albuquerque, NM 87107 • 505-884-8300 • mattb@emi-nm.com • transect = 2 x 202 m • transect area = 404m² • 5-min counts • 100-m radius

Transect WL3 Date Jun 1 1 11 Temp 18 °F Cloud cover 20 % Wind scale 3 Page 1 of ____

Observer MEB Start time 0722 hr End time 0748 hr Trans NW UTM _____ E _____ N; SE _____ E, _____ N

Visit # 1 Datum NAD83 Notes _____

PC/T: point count or transect survey. Detection: V = visual, A = Audio, V&A = both. Sex = M, F, or U for unknown. Distance in meters.

PC/T	Species	#	Detection	Distance	Bearing	Sex	Notes
T	GRFL	1	A	136	W	U	
T	CATO	1	A	50	W	U	
T	GRFL	1	A	60	N	U	

Wildlife, nests, other sightings: SAPH No birds on PC

Lajara Mesa Project ~~pellet count sheet~~ • Ecosystem Management, Inc. 3737 Princeton Dr. NE, Ste. 150, Albuquerque, NM 87107 • 505-884-8300 • mattb@emi-nm.com • transect = 2 x 202 m • transect area = 404m² • 5-min counts • 100-m radius

Transect WL1 Date Jun 12 2011 Temp. 14 °F Cloud cover 30% Wind scale 1 Page 1 of ____

Observer MEB Start time 0616 hr End time 0631 hr Trans NW UTM ____ E ____ N; SE ____ E, ____ N

Visit # 2 Datum NAD83 Notes ____

PC/T: point count or transect survey. Detection: V = visual, A = Audio, V&A = both. Sex = M, F, or U for unknown. Distance in meters.

PC/T	Species	#	Detection	Distance	Bearing	Sex	Notes
PC	CHSP	1	A	30	E	U	
PC	EWPE	1	A	45	E	U	
PC	BHGR	1	A		SW	M	
PC	JUTI	1	A	30	E	U	
PC	Pass. sp.	1	V	10	E	U	Small, gray brown
PC	HOFI	1	V,A	35	NE	U	
T	JUTI	1	A	20	SW	U	
T	SPTO	1	A	50	S	M	
T	BTGW	1	A	20	S	U	
T	BTGW	1	A	40	SE	M	
T	JUTI	2	V	15	S	U	

Wildlife, nests, other sightings:

Lajara Mesa Project ~~pellet-count sheet~~ • Ecosystem Management, Inc. 3737 Princeton Dr. NE, Ste. 150, Albuquerque, NM 87107 • 505-884-8300 • mattb@emi-nm.com • transect = 2 x 202 m • transect area = 404m² • 5-min counts • 100-m radius

Transect LJL2 Date Jun 12 11 Temp. 16 °F Cloud cover 60 % Wind scale 1 Page 1 of ___

Observer MEB Start time 0644 hr End time 0700 hr Trans NW UTM ____ E ____ N; SE ____ E, ____ N

Visit # 2 Datum NAD 83 Notes ____

PC/T: point count or transect survey. Detection: V = visual, A = Audio, V&A = both. Sex = M, F, or U for unknown. Distance in meters.

PC/T	Species	#	Detection	Distance	Bearing	Sex	Notes
PC	BGGN	1	A	25	S	U	
PC	SPTO	1	A	40	S	M	
PC	BTGN	1	A	20	SW	M	
PC	JUNT	1	A	30	W	U	
T	CAKT	2	A, V	15	N	U	

Wildlife, nests, other sightings: PIJA, CAKT

Lajara Mesa Project ~~pellet-count sheet~~ • Ecosystem Management, Inc. 3737 Princeton Dr. NE, Ste. 150, Albuquerque, NM 87107 • 505-884-8300 • mattb@emi-nm.com • transect = 2 x 202 m • transect area = 404m² • 5-min counts • 100-m radius

Transect WL3 Date Jun / 2 / 11 Temp. 17 °F Cloud cover 80 % Wind scale 2 Page 1 of ____

Observer MEB Start time 0714 hr End time 1730 hr Trans NW UTM _____ E _____ N; SE _____ E, _____ N

Visit # 2 Datum NAD83 Notes _____

PC/T: point count or transect survey. Detection: V = visual, A = Audio, V&A = both. Sex = M, F, or U for unknown. Distance in meters.

PC/T	Species	#	Detection	Distance	Bearing	Sex	Notes
PC	ATFL	1	A,V	8	N	U	
PC	ATFL	1	A	70	S	U	
PC	VGSW	1	V	15	W	U	
T	SAPH	1	A	75	W	U	
T	NOBO	1	A	20	E	U	
T	BEWR	1	A	35	W	U	

Wildlife, nests, other sightings: PISA

Lajara Mesa Project ~~pellet count sheet~~ • Ecosystem Management, Inc. 3737 Princeton Dr. NE, Ste. 150, Albuquerque, NM 87107 • 505-884-8300 • mattb@emi-nm.com • transect = 2 x 202 m • transect area = 404m² • 5-min counts • 100-m radius

Transect WL1 Date Jun 13 11 Temp. 9 °F Cloud cover 0 % Wind scale 0 Page 1 of ___

Observer MEB Start time 0607 hr End time 0619 hr Trans NW UTM _____ E _____ N; SE _____ E, _____ N

Visit # 3 Datum NAD83 Notes _____

PC/T: point count or transect survey. Detection: V = visual, A = Audio, V&A = both. Sex = M, F, or U for unknown. Distance in meters.

PC/T	Species	#	Detection	Distance	Bearing	Sex	Notes
PC	MODO	1	A	80	S	U	
PC	CHSP	1	A	75	NE	U	
PC	BTGW	1	A	30	NW	M	
PC	CHSP	1	A	40	W	U	
PC	MODO	1	A	60	E	U	
T	HOFI	1	A	30	W	U	
T	BTGW	1	A	35	E	M	
T	JUTI	1	A	25	E	U	
T	MODO	1	A	45	E	U	

Wildlife, nests, other sightings: PIJA

Lajara Mesa Project ~~pellet-count sheet~~ • Ecosystem Management, Inc. 3737 Princeton Dr. NE, Ste. 150, Albuquerque, NM 87107 • 505-884-8300 • mattb@emi-nm.com • transect = 2 x 202 m • transect area = 404m² • 5-min counts • 100-m radius

Transect WL2 Date Jun / 3 / 11 Temp. 9 °C Cloud cover 0 % Wind scale 0 Page 1 of ____

Observer MEB Start time 0928 hr End time 0940 hr Trans NW UTM _____ E _____ N; SE _____ E, _____ N

Visit # 3 Datum NAD83 Notes _____

PC/T: point count or transect survey. Detection: V = visual, A = Audio, V&A = both. Sex = M, F, or U for unknown. Distance in meters.

PC/T	Species	#	Detection	Distance	Bearing	Sex	Notes
PC	SCOR	1	A	90	E	M	
PC	BGGN	1	A	25	SW	U	
PC	MODO	1	A	40	W	U	
PC	JUTI	1	A	20	N	U	
PC	HOFI	1	A	30	E	U	
PC	BTGW	1	A	100	SE	M	
T	JUTI	1	A	30	W	U	

Wildlife, nests, other sightings: SPTO

Lajara Mesa Project ~~pellet count sheet~~ • Ecosystem Management, Inc. 3737 Princeton Dr. NE, Ste. 150, Albuquerque, NM 87107 • 505-884-8300 • mattb@emi-nm.com • transect = 2 x 202 m • transect area = 404m² • 5-min counts • 100-m radius

Transect NW3 Date Jun / 3 / 11 Temp. 65°F Cloud cover 0 % Wind scale 0 Page 1 of ___

Observer MEB Start time 0651 hr End time 0705 hr Trans NW UTM _____ E _____ N; SE _____ E, _____ N

Visit # 3 Datum NAD83 Notes _____

PC/T: point count or transect survey. Detection: V = visual, A = Audio, V&A = both. Sex = M, F, or U for unknown. Distance in meters.

PC/T	Species	#	Detection	Distance	Bearing	Sex	Notes
PC	MODO	1	A	60	N	U	
PC	CAKI	1	A	90	SE	U	

Wildlife, nests, other sightings: No birds on transect

Lajara Mesa Project ~~pellet count sheet~~ • Ecosystem Management, Inc. 3737 Princeton Dr. NE, Ste. 150, Albuquerque, NM 87107 • 505-884-8300 • mattb@emi-nm.com • transect = 2 x 202 m • transect area = 404m² • 5-min counts • 100-m radius

Transect WL1 Date Jan 1 11 Temp. 25 °F Cloud cover 80 % Wind scale 2 Page 1 of 1

Observer MEB, MTO Start time 0956 hr End time 1010 hr Trans NW UTM _____ E _____ N; SE _____ E, _____ N

Datum NAD83 Notes _____

Species	# groups	Habitat	Notes
MUDE	1	P-J	several months old
Total:			

Wildlife, nests, other sightings:

Lajara Mesa Project pellet-count sheet • Ecosystem Management, Inc. 3737 Princeton Dr. NE, Ste. 150, Albuquerque, NM 87107 • 505-884-8300 • mattb@emi-nm.com • transect = 2 x 202 m • transect area = 404m² • pellets on the line count as in

Transect LM2 Date Jun 16 11 Temp. 27°F Cloud cover 80% Wind scale 3 Page 1 of 1

Observer MEB, MTD Start time 1021 hr End time 1042 hr Trans NW UTM _____ E _____ N; SE _____ E, _____ N

Datum NAD83 Notes _____

Species	# groups	Habitat	Notes
MUDE	1	PJ	
Total:			

Wildlife, nests, other sightings: Baby rabbit seen
Old nest on ground. Large, juniper bark, cup

Lajara Mesa Project pellet-count sheet • Ecosystem Management, Inc. 3737 Princeton Dr. NE, Ste. 150, Albuquerque, NM 87107 • 505-884-8300 • mattb@emi-nm.com • transect = 2 x 202 m • transect area = 404m² • pellets on the line count as in

Transect WL3 Date Jan / 1 / 11 Temp. 30 °F Cloud cover 40 % Wind scale 3-4 Page 1 of 1

Observer MEB, MJD Start time 1058 hr End time 1134 hr Trans NW UTM ____ E ____ N; SE ____ E, ____ N

Datum NAD83 Notes ____

Species	# groups	Habitat	Notes
Neotoma sp.	1	Rocky slopes, P-J	under rocks in hole.
Neotoma sp.	1	" "	pack rat midden
Neotoma sp.	1	" "	large pile of droppings & midden
			nearby, also pile of juniper
			clippings w/ cholla spines
Total:			

Wildlife, nests, other sightings:

Lajara Mesa Project pellet-count sheet • Ecosystem Management, Inc. 3737 Princeton Dr. NE, Ste. 150, Albuquerque, NM 87107 • 505-884-8300 • mattb@emi-nm.com • transect = 2 x 202 m • transect area = 404m² • pellets on the line count as in

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Wildlife Survey Field Data Sheet

Location: Laramide, Cibola N.F.	Date: May 31 - Jun. 2, 2011	Temp: 27°C, 25°C, 33 C°
Transect ID: All, entire site	Start Time: 1820	End Time: 2020
Personnel: MEB, MJO	Weather: 5/31 - wind 3-4, clouds 0%; 6/1 - wind 9, clouds 100%, precip 0; 6/2 - wind 4, clouds 20%, precip 0;	

Species Observed:

Species:	Observed	Heard	Distance	Comments (location, behavior, etc.)
Neotoma spp. scat & 2 types of middens	NA			Everywhere, Frequent
mule deer scat	NA			some fresh, most old
desert cottontail scat & tracks	NA			most rabbit scat very old
coyote scat + calling		✓	>100m	probably outside project area, but in similar habitat.
				-Soil very sandy, Tracks hard to discern. -Very dry spring. Little browse for mule deer.

Incidental Wildlife Sightings: Cotton tails during midday, 2 adult sightings & 2 young sightings

Other Observations/Comments: Site has a high density of pack rat middens. One type of sticks located beneath junipers; another type in rock crevises on rocky mesa slope. Juniper types covered w/ green juniper clippings. Rock type [illegible] by cholla spines & scat.

P:\ABQ Projects\2009 Projects\083-9938St Laramide Site Investigation\Field Forms\Wildlife Survey.xlsx

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6.0 SOILS

New Mexico Administrative Code (NMAC) 19.10.6.202 D.(13) (e)

Baseline data shall include, as applicable: if revegetation is part of the reclamation plan, a description of the thickness and nature of the topsoil, if any, over the proposed permit area. A soil survey and soil analyses conducted in accordance with standard methods acceptable to the Director may be required to show variations in topsoil depth and suitability. Where the applicant proposes to use something other than topsoil, the application shall provide the results of analyses as necessary to determine the suitability of the proposed materials to use as a topdressing.

6.1 Introduction

The proposed La Jara Mine would potentially affect approximately 16.4 acres of the surface of the Permit Area (Plate 2). Reclamation of the disturbed surface would be completed once the mine surface facilities (surface-water diversions and sedimentation controls, waste rock pile, buildings, the portal, and the road and utility corridor) are no longer needed or following closure of the mine. Laramide proposes to salvage and stockpile materials that will ultimately be used as soil cover to reclaim the disturbed area.

The United States Department of Agriculture (USDA) Forest Service (USFS; Forest Service) mapped the soils in the proposed Permit Area of the La Jara Mesa Project using the Southwestern Region Terrestrial Ecosystem Survey (TES) approach (USDA-USFS, 2007). TES units and soils are classified at the landscape level, depicting broad patterns of soil families and potential natural vegetation. The distribution of TES units in the proposed Permit Area and surrounding lands is shown on Figure 6-1. Soil types in the proposed Permit Area vary, as soils are products of the interactions among parent materials, topography, vegetation, climate, and time. Parent materials are derived from sedimentary and igneous rocks. The soils in the proposed disturbed surface footprint, near the portal, are formed in eolian deposits from undifferentiated sources and colluvium of the La Jara Mesa escarpment (basalt). The soils in the road and utility corridor are formed in mixed alluvium and eolian materials derived from sedimentary rocks. A minor component of corridor is comprised of soils formed in residuum derived from the Entrada and Wingate Sandstones.

Because the purpose of the TES is to classify ecosystem types and map areas with similar capabilities and management potential, TES data provides important information on the general soil qualities, but lacks chemical and physical data needed to evaluate soil suitability for reclamation. Therefore, the soil baseline data collection and analyses focused on gathering site-specific data necessary to evaluate the soils' suitability for reclamation. Mine operators are expected to salvage, store, and redistribute suitable soil materials for revegetation of mine-related disturbances. As part of the conceptual mine layout, a reclamation growth medium stockpile will be in this disturbed area (Plate 2). Therefore, Golder Associates Inc. (Golder) collected site-specific soils data from the proposed portal area.

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Closeout plan guidelines from the Mining Act Reclamation Bureau of the Mining and Minerals Division (MMD) of the New Mexico Energy, Minerals and Natural Resources Department (MMD, 1996) contain criteria for the suitability of soils and soil substitutes for reclamation applications. The suitability criteria proposed by MMD are derived primarily from coal mining reclamation programs; however, they are generally applicable to non-coal reclamation activities in New Mexico, and these standards were used to evaluate the suitability of the soils and soil substitutes.

6.2 Methods

Soil samples were collected from the proposed disturbed surface of the Permit Area (Plate 2) and were characterized. Soil data were collected in compliance with applicable guidance, including the MMD guidelines (1996) and the USDA National Cooperative Soil Survey (Soil Survey Staff, 2007). Samples were collected from three locations in the projected disturbance areas. The sample locations are provided on Figure 6.2. The location of each soil profile/sample location was determined using a handheld global positioning system (GPS) device.

Soil profiles (pedons) were described to a depth of about 100 centimeters (cm) using standard soil morphological terminology (Soil Survey Staff, 1993). Pedons were located at existing cut features, i.e. gully erosion, to take advantage of the exposed profile without creating disturbance by excavating. A fresh profile was exposed by hand using a shovel to clean the face. Field descriptions included horizon designations, depth interval, soil texture, color, structure, consistence, roots, reaction with weak acid, rock fragment content, and other important accessory characteristics (e.g. slope, aspect, general vegetation; Attachment 6A). The soils were classified to the family level according to the “Keys to Soil Taxonomy” (Soil Survey Staff, 2010).

A total of 10 samples were collected from the three pedons. The soil samples were collected from each genetic soil horizon in the pedons. Three to four horizons were sampled from each pedon and placed into 1-gallon plastic bags. The fine-earth fraction (particles less than 2 millimeters [mm] in diameter) was collected and the larger rock fragments (greater than 75 mm) removed. The samples were shipped to Energy Laboratories in Billings, Montana, for laboratory analyses. The bulk soil samples collected for fine-earth analysis were air-dried and passed through a 2-mm sieve at the laboratory. The less than 2-mm soil fraction was analyzed for the parameters listed in Table 6-1. Very fine sand was analyzed to support the estimation of the K-factor (soil erodibility). The soil analyses methods are consistent with the MMD guidelines (1996). The primary references for the analytical techniques include Agricultural Handbook No. 60 (Salinity Laboratory Staff, 1954) and Methods of Soil Analysis (Agron 9, 1982).

Alternative (or substitute) materials were also analyzed for reclamation potential. Geologic materials representative of potential waste rock from the underground workings were collected as part of the Orebody and Geology baseline data characterization (section 7). A subset of the geologic samples was

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selected to analyze as alternative cover materials. Eight selected crushed rock samples were analyzed for the parameters listed in Table 6-1, with the exception of available phosphorus, which was analyzed using the Bray extraction (Bray and Kurtz, 1954) due to laboratory capability. The OIsen method is preferred in calcareous soils (pH greater than 7.2), in which calcium phosphates are the dominant phosphate minerals. Thus, the reported phosphorus concentrations for the geologic materials may be underestimated.

The sampling and analysis methods for the representative samples from the waste rock samples are further discussed in Section 7. Methods of sample collection, preparation, and analysis are critical to the interpretation of laboratory results from soils and other geologic materials. Large differences in results may occur due to variations in sample preparation and analytical methods. The waste rock samples were sent to ACZ Laboratories in Steamboat Springs, Colorado; where the samples were crushed and pulverized prior to analysis.

Additional background soil samples were collected from the surface (0 to 6 inch interval) in and around the proposed permit area. Laboratory methods, results and summary tables for these data are included in Appendix A.

6.3 Results

This section presents the results of the baseline soils investigation.

6.3.1 Map Unit Descriptions

The baseline soil investigation was focused near the portal (Figure 6-2). Soils in TES map unit 105 include about 13 acres of the proposed disturbed area, while the escarpment soils in TES 502 only occupy about 3.5 acres. Thus, two of the three pedons were located in TES 105 and the third in TES 502. Pedon descriptions are included in Attachment 6A. Profile and overview photographs are included in Attachment 6B.

TES Map Unit 105 – Sandy, mixed, mesic, Typic Halpustepts and mixed, mesic, Typic Ustipsamments

The map unit consists of deep, excessively drained soils formed in coarse textured eolian sand deposits. These soils occur on simple, convex slopes ranging from 10 to 20 percent. The dominant soils in this map unit are coarse textured, therefore, are droughty and subject to wind erosion. Runoff is low to moderate. Water holding capacity is very low. Two distinct land forms are recognized in this map unit: the eolian sand sheet on low gradient portions of the pediment and dune ridges that formed on the break in slope at the base of the La Jara Mesa escarpment.

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The dominant vegetation of this map unit is composed of piñon pine (*Pinus edulis*), one-seed juniper (*Juniperus monosperma*), sand sage (*Artemisia filifolia*), four-wing saltbush (*Atriplex canescens*), green rabbitbush (*Ericameria teretifolia*), broom snakeweed (*Gutierrezia sarothrae)*, sideoats grama (*Bouteloua curtipendula*), blue grama (*Bouteloua gracilis*), and spike dropseed (*Sporobolus contractus*). Canopy cover ranges from 25 to 30 percent. The dune ridge supports a more shrub-dominant overstory, while the sand sheet is comprised of open piñon-juniper woodland.

TES Map Unit 502 – Loamy-skeletal, mixed, mesic, shallow, Typic Ustorthents

The map unit consists of shallow, moderately well drained soils formed in moderately-coarse textured colluvium and residuum from sandstone and basalt. These soils occur on 15 to 80 percent, complex, convex, and concave linear slopes of the escarpment. Rock outcrop of the La Jara Mesa escarpment and rubble lands occur on 40- to 120-percent slopes. The water holding capacity is very low due to rocks and paralithic contact. Runoff is high to very high. Steep slopes and stones in the soil profile limit use and management. The soils in this map unit have a moderate soil erosion hazard. Mass wasting hazard is high.

The dominant vegetation of this map unit is composed of piñon pine (*Pinus edulis*), one-seed juniper (*Juniperus monosperma*), beargrass (*Nolina microcarpa*), four-wing saltbush (*Atriplex canescens*), snake weed (*Gutierrezia sarothrae)*, tree cholla (*Opuntia imbrecata*), sideoats grama (*Bouteloua curtipendula*), blue grama (*Bouteloua gracilis*), and black grama (*Bouteloua eriopodia*). Canopy cover is about 40 percent.

6.3.2 Reclamation Suitability

Soils near the proposed portal were evaluated with respect to reclamation suitability. The ability of a soil to establish and maintain vegetation is a function of inherent fertility, including soil texture, soil pH, slope gradient, and rock fragment content. Fertility criteria are outlined in the MMD guidelines (1996). Reclamation suitability is also dependent on the revegetation potential of a site or the probable success and ease in the establishment of native grasses and shrubs as a function of climate and soil characteristics.

Soil physical properties and secondary interpretations to evaluate soil suitability for reclamation are included in Table 6-2. Laboratory reports are included as Appendix A. The soils near the portal are coarse- to moderately coarse-textured. Rock fragments (greater than 2 mm) occur in the residual soils of the escarpment, TES 502. Secondary interpretations included on Table 6-2 include soil erodibility (K-factors, wind erosion group), permeability, and available water capacity. These are discussed below.

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The fine-earth soil erodibility (Kf) is estimated solely from the greater than 2-mm fraction, whereas the whole soil-erodibility (Kw) is estimated by adjusting Kf for the appropriate rock fragment content. K-factors quantify soil detachment by runoff and raindrop impact and are used in the Revised Universal Soil Loss Equation (RUSLE). RUSLE primarily predicts soil loss associated with sheet erosion (Renard et al., 1997). Soils with rock fragments have an armoring affect, thus Kw reflects the degree of protection provided by those fragments. The soils at La Jara Mesa have relatively low K-factors, indicating low erodibility potential from water erosion (Table 6-2). The Kf-factors are higher for soils in TES 502 because of the increased silt content; however, soils in this map unit have high amounts of rock fragments so erodibility is based on the Kw-factor and overall erodibility is low.

Wind erosion can be widespread in regions of low rainfall, especially during periods of drought. Susceptibility to becoming wind-blown is evaluated in the surface layer of the soil and assigning the appropriate wind erodibility group. Since reclamation activities would involve salvaging and stockpiling soils, each soil horizon was assigned a wind erodibility group, as a homogenized growth medium stockpile would include all soil horizons. The soils in TES 105 are formed in eolian deposits, thus the wind erodibility of these soils is severe (Table 6-2). The residual soils in TES 502 have a moderate to minimal wind erodibility hazard.

Available water capacity (AWC) was estimated from soil texture and corrected for rock fragments. Commonly referred to as water retention, it is the amount of water that the soil can hold between field capacity and the wilting point pressures. Two estimates were made for the La Jara Mesa soils: the total water retention (cm of water) for each individual horizon in-situ (profile AWC) and the amount (inches of water) in 1 foot of soil based on the horizon's physical characteristics (AWC). The profile AWC can be summed to determine total water retention for the profile in-situ. The second determination, AWC in inches of water per 1 foot of soil, is intended to characterize the water retention for the soils after salvaging. Estimates of available water capacity range from 0.03 to 1.2 inches of water per 1 foot of soil for the La Jara Mesa soils (Table 6-2). Total in-situ water retention for the three pedons is considered very low (less than 7.5 cm).

Generally, the soils have few inherent chemical limitations for growth of native and reclamation plant species. The chemical properties of the soils are listed in Table 6-3. Laboratory reports are included in Appendix A. The soils are non-saline (electrical conductivity less than 2.0 deciSiemens/meter), non-sodic (sodium adsorption ratio less than 13) and are slightly alkaline (pH 7.4 to 7.8). They are non-calcareous to weakly calcareous. Hot water extractable boron and selenium concentrations are at or below laboratory method detection limits. Selenium concentrations are well below MMD suitability guidelines (1996); however, boron concentrations are considered low for nutrient suitability. Primary macronutrients nitrogen, phosphorus, and potassium are at low to moderate concentration ranges for nutrient suitability ratings.

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The ammonium bicarbonate–diethylene-triamine penta-acetic acid (AB-DTPA) extractable metals are listed in Table 6-4. The soil samples had high concentrations of copper and manganese according to the MMD standards; however, these elements are considered micronutrients, and are essential for plant growth. Toxicity levels are organism-specific and the availability of these nutrients to plants is dependent on pH, redox potential, and degree of weathering. Specifically, copper and manganese solubility (availability to plants) is lower with increasing pH and under aerobic soil conditions. Neither copper nor manganese concentrations are in the range considered unsuitable for use in reclamation covers by MMD (1996).

The acid-forming potentials of the soil samples were evaluated through static sulfur-speciation tests (Sobek et al., 1978). The soils in the proposed Permit Area have positive acid-base accounts (ABA) and little to no potential to generate acid (Table 6-5). ABA were calculated from the nitric acid (HNO_3) extractable sulfur, which extracts the acid-producing sulfur forms. Total sulfur was measureable in two samples from location LJM-502, the A and AC horizons. The sulfur concentrations are low (0.02 percent) and the sulfur in the AC horizon are non-acid-generating forms (e.g. gypsum), while 0.01 percent sulfides (pyritic, acid-forming) occurred in the A horizon. The eolian-deposited soils in TES 105 have low neutralizing potentials, as expected from non-calcareous coarse-textured soils.

On the basis of these data, the chemical characteristics of the soil samples are suitable with respect to pH, salinity, and specific ion plant toxicity. The ABA data suggest the materials are unlikely to generate excess acidity. The limiting factor for use of these soils in reclamation is related to physical characteristics. Coarse textures, low water-holding capacity, and high wind erodibility in TES 105 limit the use of the soils for plant establishment. High volumetric rock fragments, shallow soil depth, and topographic constraints in TES 502 may potentially limit soil salvage.

6.3.3 Alternative Cover Sources

As the soils in the proposed Permit Area have limited use as reclamation material, alternative sources were investigated and evaluated for reclamation suitability. The best cover resource may be the waste rock generated by underground mining. A subset of the geologic samples was analyzed for reclamation suitability. These samples were selected from the geologic units estimated to comprise significant volumes of the waste rock pile (Table 6-6). These units are primarily Jurassic-aged sandstones and shales.

The geologic materials vary in their suitability as soil substitute. The results presented here are representative of a range in characteristics for the fine-earth fraction of these materials, but not a definitive characterization for the distribution of the materials. Selected physical and chemical properties are listed in Tables 6-6 and 6-7. Laboratory Reports are included in Appendix B.

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Underground mining activities are expected to generate a wide range of particle size distribution, including coarse fragments (greater than 2 mm). In general, the fine-earth fractions are coarse-textured to moderately coarse-textured. One fine-textured (clay) sample was collected from the Westwater Canyon sandstone. The geologic samples are considered non-sodic, non-saline to slightly saline, and have moderate to high water contents at saturation. Saturation percentage of fine- and coarse-textured soils can vary depending on mineralogy, the rate of water added and amount of stirring during the saturated paste preparation. Geologic samples LR-12-5C-5, BS-1, BS-3, and RS-1 have higher saturation percentages than expected for coarse-textured soils (Table 6-6). The deviation is likely a result of sample preparation (crushed and pulverized) and preparation of the saturated paste. In general, the variation in textures from crushed and pulverized rocks is to be expected.

Erodibility of the waste rock materials is estimated to be low (Table 6-6). Because salvage activities are expected to generate variable textures and a significant amount of coarse fragments (rocks greater than 2 mm in diameter), erosion from wind and water are assumed to be minimal. Water erodibility (Kf and Kw) and wind erosion were estimated using the particle size data from the geologic samples and assuming 50 percent rock fragments by volume.

The hot water soluble selenium and boron concentrations are low (Table 6-7). Concentrations of primary macronutrients nitrogen, phosphorus, and potassium are also low; however, there are no unsuitable concentrations, according to MMD guidelines (1996), for nutrient suitability ratings.

The AB-DTPA-extractable metals concentrations are listed in Table 6-8 for the geologic samples. Extractable metal concentrations in most samples are below laboratory method detection limits. Four of the geologic sample concentrations of manganese are considered high according to the MMD standards (1996), but are not in the unsuitable concentration range. The molybdenum concentration in sample LR-12-5C-6 is considered unsuitable according to the MMD standards.

The ABA data suggest the geologic materials are generally unlikely to generate acidity. Total sulfur concentrations ranged from less than 0.01 to 1.05 percent (Table 6-9). Samples had positive ABA when evaluated on the basis of nitric acid-extractable sulfur (sulfides), with the exception of sample LR-12-5C-5. There are a few anomalies in the ABA data. As mentioned previously, differences in analytical results of geologic samples may occur due to variations in sample preparation and analytical methods. The method used to assess the geologic samples did not include an extraction of the most soluble sulfur forms (sulfates salts) using hot water extraction. Therefore, some of the concentrations of the extractable sulfur forms are higher than the total sulfur percentage. Anomalies in the ABA data may be related to preparation of the sample splits for each extraction subset; these samples may not have been homogenized thoroughly prior to splitting or represent heterogeneities in the homogenized samples.

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Overall the geologic materials are considered suitable for use as an alternative reclamation source, on the basis of these data. The chemical characteristics are suitable with respect to pH, salinity, and extractable metals. Physically, the majority of the geologic materials evaluated would have few limitations as a reclamation substrate for final closure. Particle size distribution of the waste rock is expected to be more variable than the majority of potentially salvageable soil materials. Additionally, coarse fragments present in waste rock generated by underground mining would reduce wind and water erosion hazards. Logistical procedures may need to be established to segregate waste rock to ensure that sufficient amounts of suitable materials are stockpiled for final reclamation.

6.4 References

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TABLES

Table 6-1: Analytical Methods for Chemical and Physical Soil Characterization

Analysis	Source-Method
Saturated Paste pH	SLS, Method 2 and 21a
Electrical Conductivity	SLS, Method 3a and 4b
$CaCO_3$ equivalent percent (lime)	SLS, Method 23c
Saturation percentage	SLS, Method 27a
Ca, Mg and Na extracts and Sodium adsorption ratio	SLS, Method 3a and 20b
Particle Size Distribution, including very fine sand	Gee and Bauder (1986)
Rock Fragment	Dry sieve/gravimetric
Nitrogen (as Nitrate), KCl extract	Agron 9, Method 10-2.3.2
Extractable Potassium (Ammonium acetate extraction)	Agron. 9, Method 13-3.5
Available Phosphorus (Olsen extract)	Agron. 9, Method 24-5.4
Selenium (hot water soluble)	Agron. 9, Method 80/3.2.1
Boron (hot water soluble)	Agron. 9, Method 75-4
AB-DTPA extraction	Agron. 9: Method 3-5.2
AB-DTPA extractable metals (As, Cd, Cu, Hg, Pb, Mn, Mo and Ni)	EPA Method 6010/6020
Acid-Base Account, Total sulfur[1]	Sobek et al., 1978
Neutralization potential	Sobek et al., 1978

Notes:

[1] Phased to include sulfur forms

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Table 6-2: Physical Properties and Secondary Interpretations for the Soil Samples

Pedon/ Horizon	Depth (cm)	RUSLE		Permeability Class	Profile AWC (cm)	AWC (in/ft)	Wind Erosion	Particle Size Distribution (%)			USDA Texture Class	Very Fine Sand wt%	Rock Fragments	
		Kf	Kw					Sand	Silt	Clay			wt %	vol % [1]
LJM-105														
A	0-10	0.09	0.08	1	0.6	0.7	2	87	8	5	LS	0	< 2	-
BW	10-30	0.07	0.07	1	0.8	0.5	1	91	4	5	S	2	< 2	-
BC	30-69	0.08	0.08	2	1.6	0.5	1	91	3	6	S	0	< 2	-
C	69-99	0.09	0.09	2	1.2	0.5	1	93	3	4	S	2	< 2	-
LJM-105D														
A	0-7	0.09	0.08	1	0.3	0.5	1	89	6	5	S	2	< 2	-
C1	7-48	0.06	0.06	1	1.6	0.5	1	91	4	5	S	0	< 2	-
C2	48-99	0.08	0.08	1	2.0	0.5	1	91	5	4	S	2	< 2	-
LJM-502														
A	0-13	0.20	0.06	2	0.7	0.7	3	71	17	12	SL	5	< 2	50
AC	13-23	0.18	0.14	2	1.0	1.2	3	73	14	13	SL	5	< 2	10
Cr	23-91	0.28	0.03	6	0.1	0.03	8	77	12	11	SL	7	< 2	-

Notes:

Kf = Revised Universal Soil Loss Equation (RUSLE) soil erodibility factor for the fine-earth fraction (<2mm)

Kw = Revised Universal Soil Loss Equation (RUSLE) soil erodibility factor fo the whole soil

Wind erosion group estimated from NRCS 2007 ; 1 is severe, 8 is minimal.

AWC = Available water capacity (corrected for rock fragments)

Profile AWC is the water retention amount for the specified horizon

Permeability Classes (SCS, 1951); 6 is slow, 1 is rapid

[1] Rock fragments by volume were estimated in the field

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Table 6-3: Chemical Properties of the Soil Samples

Pedon/ Horizon	Depth (cm)	Paste pH	Saturated Paste Extract					Saturation Percentage (%)	Hot Water Soluble		Nitrate as N (mg/kg)	Phosphorus (mg/kg)	Potassium (mg/kg)	CaCO3 Equivalent Percent (%)
			EC (dS/m)	Ca (meq/L)	Mg (meq/L)	Na (meq/L)	SAR		Boron (mg/kg)	Selenium (mg/kg)				
LJM-105														
A	0-10	7.70	0.50	4.33	0.3	0.11	0.07	21.2	0.1	< 0.01	2	6	87	1.1
BW	10-30	7.60	0.40	3.29	0.3	0.14	0.11	21.9	< 0.1	< 0.01	2	5	63	1.4
BC	30-69	7.70	0.40	3.68	0.5	0.35	0.24	21.1	< 0.1	< 0.01	3	5	56	1.7
C	69-99	7.70	0.40	3.4	0.4	0.33	0.24	21.9	< 0.1	< 0.01	2	4	46	1.6
LJM-105D														
A	0-7	7.40	0.30	2.58	0.4	0.08	0.06	23.4	< 0.1	< 0.01	2	7	80	0.3
C1	7-48	7.50	0.40	2.93	0.4	0.13	0.11	22.2	< 0.1	< 0.01	2	6	44	0.4
C2	48-99	7.50	0.30	2.4	0.5	0.17	0.14	21.8	< 0.1	< 0.01	< 1	5	46	0.2
LJM-502														
A	0-13	7.60	0.60	5.83	0.3	0.11	0.06	32.7	0.1	< 0.01	3	6	160	3.8
AC	13-23	7.40	0.50	5.12	0.4	0.12	0.07	36.1	0.1	< 0.01	5	5	91	8.5
Cr	23-91	7.50	0.60	4.72	1.0	0.25	0.15	36.2	0.1	< 0.01	6	5	91	9.8

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Table 6-4: AB-DTPA Extractable Metals for the Soil Samples

Pedon/ Horizon	Depth (cm)	AB-DTPA Extractable Metals (mg/kg)							
		Arsenic	Cadmium	Copper	Lead	Manganese	Mercury	Molybdenum	Nickel
LJM-105									
A	0-10	0.04	< 0.1	1.9	0.4	2.2	< 0.1	< 0.1	< 0.1
BW	10-30	0.02	< 0.1	0.7	0.2	0.7	< 0.1	< 0.1	< 0.1
BC	30-69	0.03	< 0.1	0.3	0.2	0.4	< 0.1	< 0.1	< 0.1
C	69-99	0.03	< 0.1	0.3	0.3	0.3	< 0.1	< 0.1	< 0.1
LJM-105D									
A	0-7	0.03	< 0.1	0.7	0.7	2.3	< 0.1	< 0.1	< 0.1
C1	7-48	0.03	< 0.1	0.5	0.3	1	< 0.1	< 0.1	< 0.1
C2	48-99	0.02	< 0.1	0.2	0.2	0.4	< 0.1	< 0.1	< 0.1
LJM-502									
A	0-13	0.07	< 0.1	1.1	0.9	4	< 0.1	< 0.1	< 0.1
AC	13-23	0.10	< 0.1	0.6	0.2	3.1	< 0.1	< 0.1	< 0.1
Cr	23-91	0.06	< 0.1	0.6	0.2	1.6	< 0.1	< 0.1	< 0.1

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Table 6-5: Acid-Base Accounts for the Soil Samples

Pedon/ Horizon	Depth (cm)	Paste (pH)	Pyritic Sulfur Basis			Total Sulfur (%)	Extractable Sulfur Forms			Residual (%)
			ANP (t/kt)	AGP (t/kt)	ABA (t/kt)		Hot Water (%)	HCl (%)	HNO_3 (%)	
LJM-105										
A	0-10	7.7	11	0	11	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
BW	10-30	7.6	14	0	14	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
BC	30-69	7.7	17	0	17	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
C	69-99	7.7	16	0	16	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
LJM-105D										
A	0-7	7.4	3	0	3	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
C1	7-48	7.5	4	0	4	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
C2	48-99	7.5	2	0	2	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
LJM-502										
A	0-13	7.6	38	0.3	37	0.02	< 0.01	< 0.01	0.01	< 0.01
AC	13-23	7.4	85	0	85	0.02	0.0	< 0.01	< 0.01	< 0.01
Cr	23-91	7.5	98	0	98	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Notes:

t/kt = tons CaCO3 per 1,000 tons of soil

ANP = Acid Neutralization Potential, in tons CaCO3 per 1,000 tons of soil

AGP = Acid Generation Potential, in tons CaCO3 per 1,000 tons of soil

ABA = Acid Base Account, in tons CaCO3 per 1,000 tons of soil

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Table 6-6: Physical Properties and Secondary Interpretations for the Waste Rock Samples

Sample	Particle Size Distribution (%)			RUSLE		AWC	Wind Erosion	USDA Texture Class	Geologic Unit	Volume Percentage of Waste Rock Pile
	Sand	Silt	Clay	Kf	Kw	(in/ft)				
LR-12-3C-1	82.5	7.5	10	0.22	0.07	0.36	3	LS	Lower Brushy Basin Sh - core	5%
LR-12-5C-5	88.8	5	6.3	0.22	0.07	0.24	2	S	Westwater Canyon Ss - core/outcrop	56%
WW-1	57.5	28.8	13.8	0.36	0.11	0.66	5	SL		
LR-12-5C-6	31.3	18.8	50	0.20	0.06	0.96	6	C		
LR-12-1C-2	77.5	7.5	15	0.21	0.06	0.66	5	SL	Westwater Canyon Ss - core	
RS-1	85	7.5	7.5	0.23	0.07	0.36	3	LS	Recapture Shale - outcrop	6%
BS-1	92.5	1.3	6.3	0.17	0.05	0.24	2	S	Bluff Sandstone - outcrop	32%
BS-3	90	2.5	7.5	0.18	0.05	0.24	2	S		

Notes:

Samples were crushed and pulvarized

Kf = Revised Universal Soil Loss Equation (RUSLE) soil erodibility factor for the fine-earth fraction (<2mm)

Kw = Revised Universal Soil Loss Equation (RUSLE) soil erodibility factor fo the whole soil

Wind erosion group estimated from NRCS 2007 ; 1 is severe, 8 is minimal.

AWC = Available water capacity (corrected for rock fragments)

Rock fragments estimated at 50% by volume

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Table 6-7: Chemical Properties for the Waste Rock Samples

Sample	Paste pH	Saturated Paste Extract					Saturation Percentage (%)	Hot Water Soluble		Nitrate as N (mg/kg)	Nitrite as N (mg/kg)	Nitrate/Nitrite as N (mg/kg)	Phosphorus (mg/kg)	Potassium (mg/kg)
		EC (dS/m)	Ca (meq/L)	Mg (meq/L)	Na (meq/L)	SAR		Boron (mg/kg)	Selenium (mg/kg)					
LR-12-3C-1	8.30	0.22	11.8	2.1	1.32	0.5	28.4	<0.05	<0.01	3.1	0.9	4	0.8	0.45
LR-12-5C-5	7.20	1.52	22	3.1	1.03	0.29	32	<0.05	<0.01	4.7	0.7	5.4	0.9	0.24
WW-1	8.50	0.22	12.9	3.9	6.21	2.14	38.2	0.17	0.01	9.2	0.8	10	0.1	0.53
LR-12-5C-6	7.50	1.15	0.46	0.2	0.4	0.72	87.2	0.62	0.04	4.9	0.7	5.6	0.8	2.8
LR-12-1C-2	7.60	0.43	1.21	0.3	0.95	1.09	36.5	0.09	<0.01	3	0.8	3.8	0.6	0.65
RS-1	7.70	4.17	1.61	0.3	0.28	0.28	31.9	<0.05	<0.01	3.9	0.9	4.8	0.1	0.34
BS-1	7.80	0.14	1.07	0.3	0.89	1.07	33.3	0.06	<0.01	2.2	0.8	3	0.3	0.3
BS-3	8.20	0.29	1.53	0.3	0.2	0.21	37.1	0.08	<0.01	3.5	0.8	4.3	0.1	0.83

Note:
Samples were crushed and pulvarized

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Table 6-8: AB-DTPA Extractable Metals for the Waste Rock Samples

Sample	AB-DTPA Extractable Metals (mg/kg)							
	Arsenic	Cadmium	Copper	Lead	Manganese	Mercury	Molybdenum	Nickel
LR-12-3C-1	<3	<0.3	<0.5	<2	1.3	<0.002	<0.5	<0.5
LR-12-5C-5	<3	<0.3	<0.5	<2	1.7	<0.002	<0.5	<0.5
WW-1	<3	<0.3	<0.5	<2	1	<0.002	<0.5	<0.5
LR-12-5C-6	<3	<0.3	<0.5	<2	1.3	<0.002	0.6	<0.5
LR-12-1C-2	<3	<0.3	<0.5	<2	<0.3	<0.002	<0.5	<0.5
RS-1	<3	<0.3	<0.5	<2	<0.3	<0.002	<0.5	<0.5
BS-1	<3	<0.3	<0.5	<2	<0.3	<0.002	<0.5	<0.5
BS-3	<3	<0.3	<0.5	<2	0.3	<0.002	<0.5	<0.5

Note:

Samples were crushed and pulvarized

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Table 6-9: Acid-Base Accounts for the Waste Rock Samples

Sample	Paste (pH)	Pyritic Sulfur Basis			Total Sulfur (%)	Extractable Sulfur Forms (%)			Residual (%)
		ANP (t/kt)	AGP (t/kt)	ABA (t/kt)		Hot Water (%)	HCl (%)	HNO_3 (%)	
LR-12-3C-1	8.3	35	0	35	<0.01	NA	<0.01	<0.01	0.05
LR-12-5C-5	7.2	20	37	-17	0.84	NA	<0.01	1.18	<0.01
WW-1	8.5	231	0	231	<0.01	NA	<0.01	<0.01	<0.01
LR-12-5C-6	7.5	58	37	21	1.05	NA	<0.01	1.17	0.06
LR-12-1C-2	7.6	4	3.8	0.3	0.12	NA	<0.01	0.12	<0.01
RS-1	7.7	74	0	74	<0.01	NA	<0.01	<0.01	<0.01
BS-1	7.8	12	0	12	<0.01	NA	<0.01	<0.01	<0.01
BS-3	8.2	155	0	155	<0.01	NA	<0.01	<0.01	<0.01

Notes:

t/kt = tons CaCO3 per 1,000 tons of soil

ANP = Acid Neutralization Potential, in tons CaCO3 per 1,000 tons of soil

AGP = Acid Generation Potential, in tons CaCO3 per 1,000 tons of soil

ABA = Acid Base Account, in tons CaCO3 per 1,000 tons of soil

NA = Not Analalyzed

Samples were crushed and pulvarized

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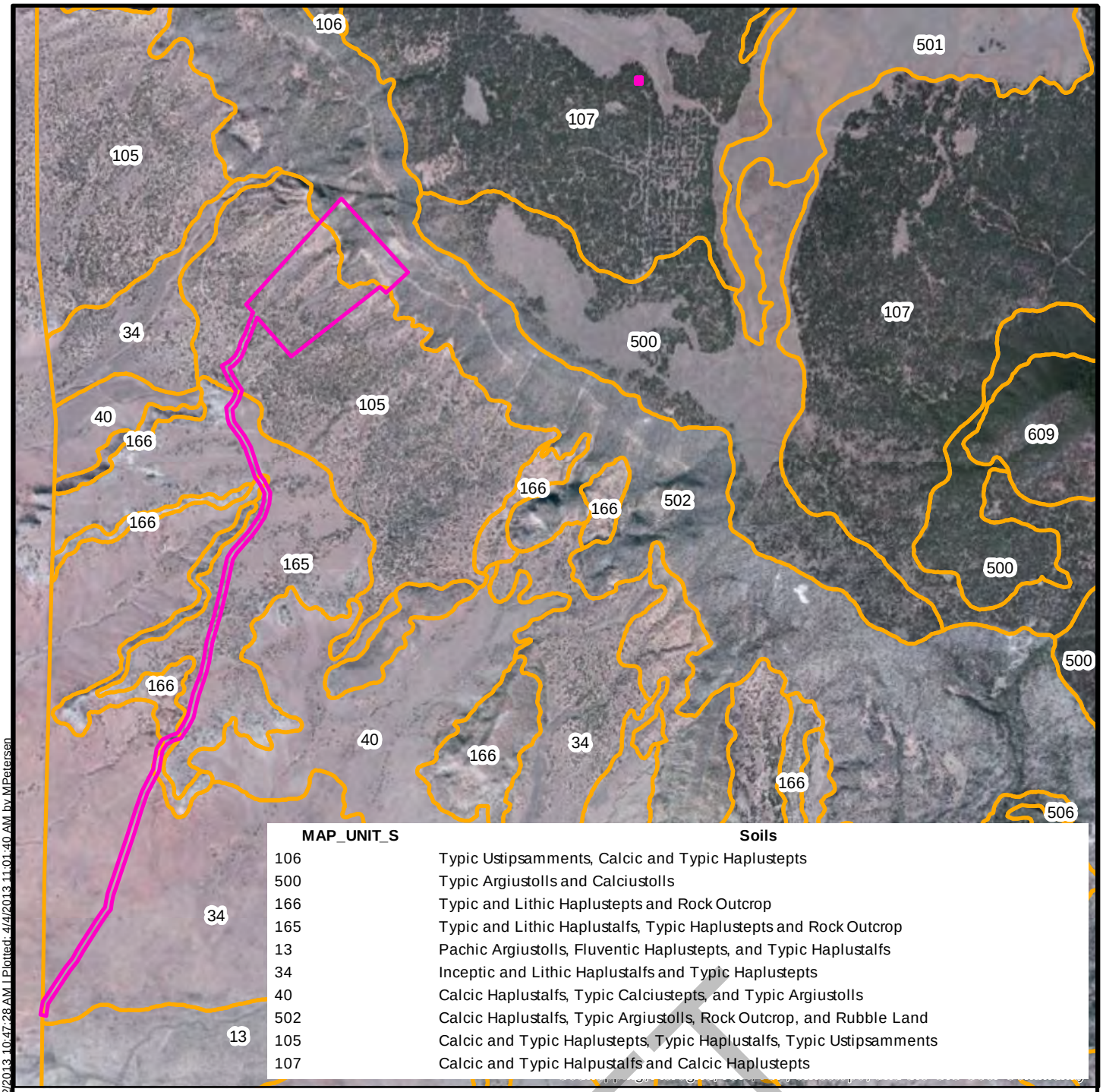
FIGURES



MAP_UNIT_S	Soils
106	Typic Ustipsamments, Calcic and Typic Haplustepts
500	Typic Argiustolls and Calciustolls
166	Typic and Lithic Haplustepts and Rock Outcrop
165	Typic and Lithic Haplustalfs, Typic Haplustepts and Rock Outcrop
13	Pachic Argiustolls, Fluventic Haplustepts, and Typic Haplustalfs
34	Inceptic and Lithic Haplustalfs and Typic Haplustepts
40	Calcic Haplustalfs, Typic Calciustepts, and Typic Argiustolls
502	Calcic Haplustalfs, Typic Argiustolls, Rock Outcrop, and Rubble Land
105	Calcic and Typic Haplustepts, Typic Haplustalfs, Typic Ustipsamments
107	Calcic and Typic Halpustalfs and Calcic Haplustepts

LEGEND

- Proposed Permit Boundary
- TEU Land Soil Type

N

2,500 1,250 0 2,500

SCALE 1:30,000 FEET

REFERENCES & NOTES

1. Projection: NAD 1983 HARN StatePlane New Mexico West FIPS 3003 Feet
2. Source Aerial: Bing Maps (c) 2010 Microsoft Corporation and its data suppliers
3. Figure is for illustration purposes only; NOT FOR CONSTRUCTION.

PROJECT/REPORT

LARAMIDE RESOURCES (USA) INC.
LA JARA MESA PROJECT
CIBOLA COUNTY, NEW MEXICO

TITLE

DISTRIBUTION OF TERRESTRIAL ECOSYSTEM SURVEY UNITS

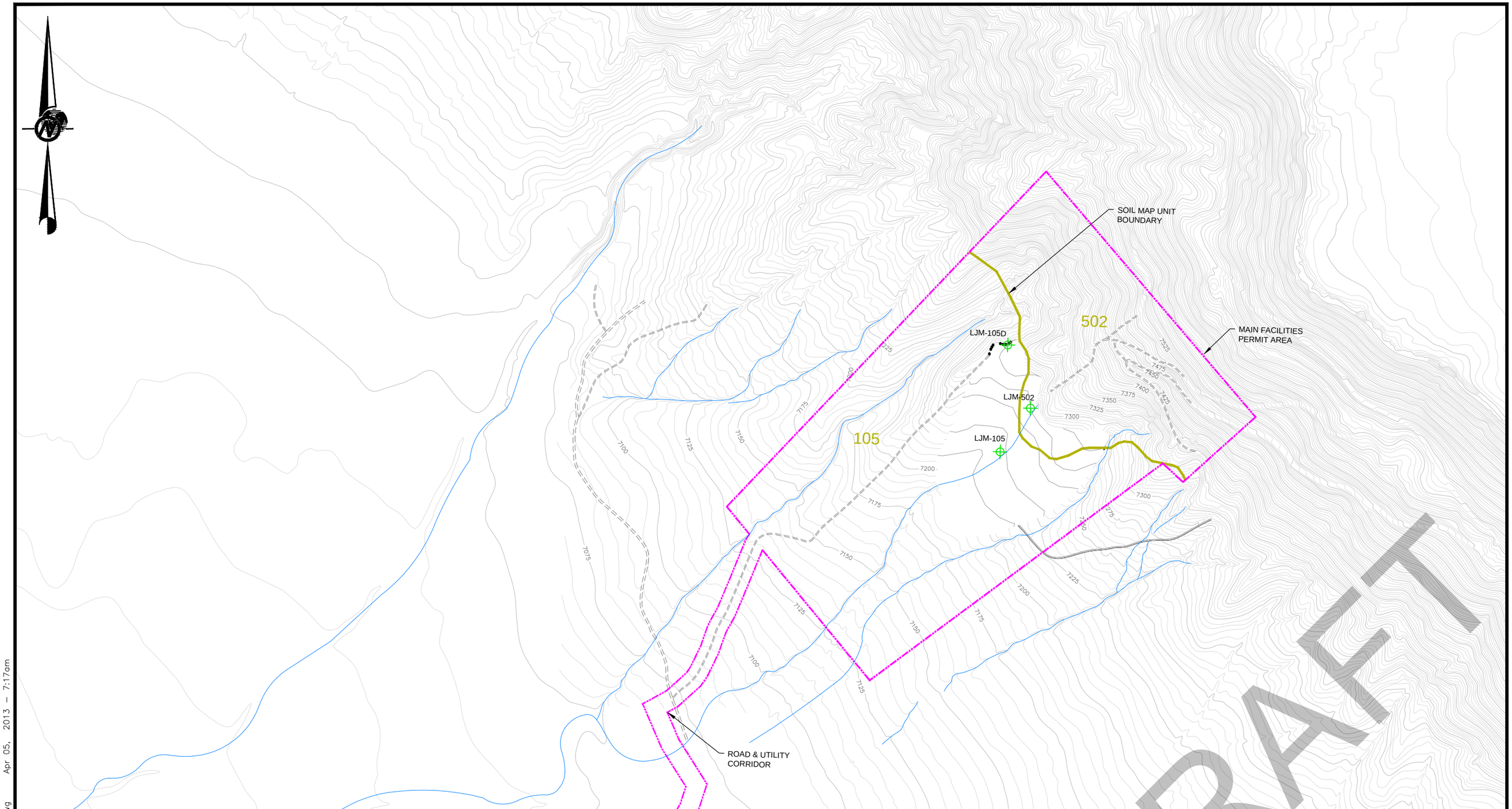
Golder Associates

PROJECT No. 083-9338SI

FIGURE 6-1

DRAFT

Map: W:\La Jara MesaMaps\Figure 6_1_merge.mxd | Modified: 4/2/2013 10:47:28 AM | Plotted: 4/4/2013 11:01:40 AM by MPetersen



LEGEND

PEDON LOCATION AND SAMPLE ID

502 TES MAP UNIT

150 0 150 300

SCALE METERS

MAP UNIT	SOIL
502	LOAMY-SKELETEAL, MIXED, MESIC, SHALLOW, TYPIC USTORTHENTS
105	SANDY, MIXED, MESIC, TYPIC HAPLUSTEPTS SANDY, MIXED, MESIC, TYPIC USTIPSAMMENTS

PROJECT

LARAMIDE RESOURCES (USA) INC.
LA JARA MESA PROJECT
CIBOLA COUNTY, NEW MEXICO

TITLE

SOIL SAMPLE LOCATIONS

Golder Associates
Albuquerque, New Mexico

PROJECT No.		0839338SI	FILE No.	Soils Samp
DESIGN	LM	04/30/09	SCALE AS SHOWN	REV. 0
CADD	CM	03/27/13		
CHECK	EC	03/27/13		
REVIEW	BN	03/27/13		

FIGURE 6-2

DRAFT

Drawing file: Figure 6-2_Soil Samp.dwg Apr 05, 2013 - 7:17am

ATTACHMENT 6A
PEDON DESCRIPTIONS

Soil Observation Point Description

Site No: LJM-502	**GPS Coordinates:** UTM NAD 83 0248372, 3907038	**Classification/Series** Loamy-skeletal, mixed, mesic, shallow Typic Haplocryept	**Soil Scientist** E Clark, D Romig
Date 8/17/2011	**Slope %** 30%	**Epipedon** Ochric	**Photos** 1, 2, 3
Weather mostly cloudy	**Landform** Escarpment	**Diagnostic Subsurface** Para Lithic Contact	**Comments** Efflor. - EV throughout Bluff - Intermt FM 4 sample A, 4 0-6 Backg'd AC Cr
Parent Material Colluvium / Residuum	**Aspect:** SW		
Elevation 2216 m	**Slope Position** Lower	**Runoff:** High	
Surface Rock 70%	**Relief** Backslope, convex, complex	**Moisture Status:** Dry	
Vegetation cholla, juniper, yucca, mammillaria BOER, BOCU, PIED, BUSA	**Drainage:** mod. well	**Ground Water (ft):** —	
Canopy Cover (%) 40	**Erosion** Rill, Class 2	**Hydr. Conditions:** —	

Atca
Noma
Boer

Horizon	Depth Top	Depth Bot	Boundary	Texture Class	Texture S%	Texture C%	Rock Frag	Color Dry	Color Moist	Structure Type	Structure Size	Structure Grade	Mottles	Roots	Consistence Dry	Consistence Moist	Consistence Wet
A	0	13cm	c/s	LFS	86	7	50	10YR 5/3	10YR 3/3	SBK	m	w	—	M F T	so	—	—
AC	13	23cm	a/s	LFS	87	5	10	10YR 6/3	10YR 5/3	SBK	f	w	—	C F P	so	—	—
Cr	23	91+												F F T			

Soil Observation Point Description

Site No: LJM-105D	**GPS Coordinates:** UTM NAD83 Zone 13 S 0248336 3907137	**Classification/Series** Mixed, Mesic, Typic Ustipsamment	**Soil Scientist** E Clark, D. Romig
Date 8/17/2011	**Slope %** 20	**Epipedon** Ochric	**Photos** 7, 8, 9
Weather ~¼ Cloudy	**Landform** Dune Ridge	**Diagnostic Subsurface** None	**Comments** Spider wort (Veg) HYOD C1 is very weakly cemented Sampled: A, C1, C2 and Background (0-6")
Parent Material Eolian	**Aspect:** SW		
Elevation 2226 m	**Slope Position** middle slope	**Runoff:** low	
Surface Rock trace	**Relief** Simple, Convex	**Moisture Status:** DRY	
Vegetation ACHY, BOER, SPCO, ATFI, ARTR, MUGR, ERTE, MUTO	**Drainage:** Excessively well	**Ground Water (ft):** —	
Canopy Cover (%) 25	**Erosion** sheet 2	**Hydr. Conditions:** —	

Horizon	Depth Top	Depth Bot	Boundary	Texture Class	Texture S%	Texture C%	Rock Frag	Color Dry	Color Moist	Structure Type	Structure Size	Structure Grade	Mottles	Roots	Consistence Dry	Consistence Moist	Consistence Wet
A	0	7 cm	C/W	S	94	2	—	10YR 5/4	10YR 4/3	SG	—	—	—	m VF T	LO	—	—
C1	7	48 cm	C/W	S	96	2	—	—	10YR 5/4	SG	—	—	—	F m T	—	LO	—
C2	48	99+ cm	—	S	96	2	—	7.5YR 5/4	7.5YR 4/4	M	—	—	—	—	SH	—	—

Soil Observation Point Description

Site No: LJM - 105	**GPS Coordinates:** UTM NAD 83 0248324, 3906967	**Classification/Series** Sandy, mixed, mesic Typic Haplustept	**Soil Scientist** E Clark, D. Romig
Date 8/17/2011	**Slope %** 13%	**Epipedon** Ochric	**Photos** 4, 5, 6
Weather mostly cloudy	**Landform** hillslope	**Diagnostic Subsurface** Cambic	**Comments** Samples A, Bw, BC, C; Backgrid 0-6"
Parent Material eolian	**Aspect:** SW		
Elevation 2204 m	**Slope Position** midslope	**Runoff:** Moderate	
Surface Rock —	**Relief** convex	**Moisture Status:** Moist	
Vegetation Spco Grass, Opuntias BOGR, BOCU, Art: Atcan, Pied, Juno	**Drainage:** Excessively drained	**Ground Water (ft):** —	
Canopy Cover (%) 30	**Erosion** Cls 3 sheet	**Hydr. Conditions:** —	

Horizon	Depth Top	Depth Bot	Boundary	Texture Class	Texture S%	Texture C%	Rock Frag	Color Dry	Color Moist	Structure Type	Structure Size	Structure Grade	Motties	Roots	Consistence Dry	Consistence Moist	Consistence Wet
A	0	10cm	c/s	LS	85	5	∅	10YR 5/3	10YR 4/3	sg	—	—	—	M VF T	lo	l	—
Bw	10	30cm	g/d	LS	85	5	∅	—	10YR 5/4	sbk	m	w	—	F vf T	—	vfr	—
BC	30	69cm	g/d	LS	85	5	∅	—	10YR 6/4	sbk	m	w	—	C M T	—	vfr	—
C	69	99+cm	—	S	92	3											

ATTACHMENT 6B
PEDON PHOTOGRAPHS

Project Title: La Jara Mesa Baseline Data Report – Pedon Photographs

Map Unit 105 – dune ridge

Pedon LJM-105D

Map Unit 105 – hillslope

Pedon LJM-105

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Map Unit 502 – escarpment	Pedon LJM-502

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7.0 ORE BODY AND GEOLOGY DESCRIPTIONS

New Mexico Administrative Code (NMAC) 19.10.6.202 D. (13) (f)

Baseline data shall include, as applicable: A description of the ore body in the proposed permit area, including geologic plans and cross-sections depicting the nature and depth of overburden, mineralized zone or ore body, aquifers and springs. A description of the potential for geochemical alteration of overburden, ore body and other materials present within the permit area. Detailed analyses may be required if the substrata is suspected to contain substances that are likely to create acid drainage or might degrade surface water or ground water or hinder reclamation.

7.1 Introduction

The proposed La Jara Mesa Project's Permit Area is approximately 10 miles northeast of Grants in west-central New Mexico (Plate 1). The proposed Permit Area is within the central portion of the Grants Mineral Belt, near the far southeastern end of the Ambrosia Lake mining district. Many of the uranium ore deposits in the Grants Mineral Belt, similar to the La Jara Mesa deposit, occur in certain fluvial sandstone and mudstone interbeds in the Morrison Formation (Jurassic). The uranium tends to be concentrated by organic rich zones in the more permeable sedimentary strata and typically contain humate material (Fitch, 1980).

7.2 Regional Geology

From a regional geologic perspective, the proposed Permit Area lies within the San Juan Basin on the northeastern flank of the Zuni uplift, and within the regional dip of the sedimentary rocks to the north into the basin. The regional structure is a broad homocline, dipping gently northeast. The homocline has been modified by Tertiary folds and faults and possibly structures from the younger volcanic and igneous activity associated with the Mt. Taylor volcanic field. Some of these volcanic rocks cap La Jara Mesa and other mesas to the east. Geologic maps that include the proposed Permit Area and surrounding land include Cather (2011), Goff and others (2008), Thaden and others (1967), and McCraw and others (2009). The geology of the Grants Uranium Region was presented in a map prepared by Chapman, Griswold and Wood Inc. (1979).

According to Lorenz and Cooper (2003), the San Juan Basin and bounding structures were largely formed during the Laramide orogeny that initiated near the end of the Cretaceous and continued through the Eocene (early Tertiary time). The orogeny was a period of north-northeasterly directed compression of the San Juan Basin between the San Juan and Zuni uplifts.

The uranium deposits in the Grants Mineral Belt are mainly associated with fluvial sandstone deposits in the Upper Jurassic Morrison Formation, Todilto Formation, and Upper Cretaceous Dakota Sandstone. These deposits are part of a wide scattering of uranium occurrences in northwestern New Mexico that

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tend to be concentrated largely in Jurassic strata. As mentioned, the most consistent feature of most of these deposits is their association with fluvial sediments or rarely lacustrine deposits. These “sandstone uranium” deposits appear to have been influenced to a large degree by the permeability of the sandstone units. The migration of uranium-bearing groundwater and deposition and concentration in zones containing organic material led to the development of ore deposits.

The mineralization associated with uranium ore deposits in the Grants Mineral Belt has occurred at several times during a period from 140 million years ago to the present (Brookins, 1979). Initial uranium mineralization in the sedimentary rocks likely followed their deposition in Jurassic time and some of the mineralization was redistributed by oxidized groundwater, with re-concentration of the uranium within reducing zones along downgradient flow paths.

7.3 Ore Deposit Description

According to Alief (2006), exploration on and near La Jara Mesa has been intermittently pursued since the discovery of uranium in the Todilto Limestone at Haystack Mesa in the Grants area in the early 1950s. The uranium deposit at La Jara Mesa occurs as uranium oxides (coffinite) with humates cementing sandstones in the Poison Canyon sandstone member of the Jurassic-age Morrison Formation. The mineral deposits are elongate, generally tabular, and associated with the more permeable fluvial channels. They’re generally oriented in a southeasterly direction. The mineralized zones range from a few inches to tens of feet thick and extend from a few feet to greater than a hundred feet long.

Smith and Petersen (1980) have classified the uranium deposits in the area of La Jara Mesa as being formed by redistribution of both uranium and humate material from more primary deposits in the main area of the Ambrosia Lake mining district to the northwest. The redistribution occurred as oxidizing conditions and fluids migrated through the fluvial sediments. The localized migration of these fluids was largely influenced by the differences in transmissivity developed within the fluvial facies of the host rocks, relative to the less permeable, finer grained sedimentary facies. These resulting deposits include remnant zones of primary mineralization and redistributed uranium isolated by hematitic oxidation in localized areas of lower permeability. The localization of the mineralization is generally controlled by organic accumulations deposited adjacent to zones of greater groundwater flux.

7.4 Stratigraphy and Unit Descriptions

According to Galloway (1980), the Jurassic-age Morrison Formation of the Colorado Plateau region consists of a coalesced sequence of large, low-gradient alluvial fans, wet alluvial fan systems derived from source areas to the south and southwest in the former Mogollon Highlands in central Arizona. In ascending sequence, the Morrison overlies the Recapture Shale and Bluff Sandstone and consists of the Westwater Canyon and Brushy Basin Members in the La Jara Mesa area. The Poison Canyon sandstone beds, which are the ore-bearing horizons, are within the Brushy Basin Member. The stratigraphic

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sequence in the La Jara Mesa area is shown in Figure 7-1. The Morrison Formation and underlying and overlying units are described in the following sections.

7.4.1 Bluff Sandstone

The Bluff Sandstone is Jurassic age and is part of the San Rafael Group. The portal to the mine near the base of the mesa escarpment would start in this unit. The Bluff consists of light gray, yellowish gray, and pale orange crossbedded eolian sandstone. It varies in thickness from 90 to 300 feet.

7.4.2 Recapture Shale

The Recapture Shale (once considered a member in the Morrison Formation and shown this way in early reports) is now the youngest unit in the underlying Jurassic-age San Rafael Group (shown in more recent publications and reports), and underlies the Morrison Formation. The Recapture Shale in the project area is generally about 50 feet thick and separates the Morrison Formation from the underlying Bluff Sandstone. Both the Recapture Shale and Bluff Sandstone are Jurassic in age. The Recapture Shale consists largely of mottled, red mudstone and siltstone.

7.4.3 Westwater Canyon Member of Morrison Formation

The Westwater Canyon Member of the Morrison Formation, which overlies the Recapture Shale, consists primarily of light gray arkosic sandstone with green mudstone beds. Some pyrite and hematite mineralization is common, depending on the redox conditions. The thickness in the La Jara Mesa area is estimated to be approximately 80 to 100 feet.

7.4.4 Brushy Basin Member of Morrison Formation

The Brushy Basin Member, which hosts the Poison Canyon beds and the ore horizons, overlies the Westwater Canyon member and is 130 to 265 feet thick. The unit can be described primarily as green mudstone with interbedded chert limestone scours filled with sandstone and arkose. According to Alief (2006), the Poison Canyon beds in the proposed Permit Area contains from one to four sand units separated by thin, but distinct, shale layers. Each of these sands may host uranium mineralization.

7.4.5 Dakota Sandstone

The Dakota Sandstone (Cretaceous age) overlies the Brushy Basin Member and is between 40 and 90 feet thick. It is generally yellowish-brown to light-gray sandstone, with some gray mudstone and conglomeratic beds.

7.4.6 Other Geologic Units

The other geologic units that are above the Dakota Sandstone and beneath the top of the mesa, from oldest to youngest, are the Mancos Shale (Cretaceous age), Tertiary basalt and possibly other volcanic rocks of similar age, and Quaternary alluvial materials. These units would be mined through during

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construction of the escape raise from the mesa top to the ore horizons. All of these units would be volumetrically very minor, and not expected to contribute any environmental geochemical concerns.

7.5 Geochemistry and Reactivity

Geochemical characterization of the mineralized and non-mineralized rocks expected to be mined at the La Jara Mesa Project was performed during the baseline monitoring period (January 1 through December 31, 2011). The primary focus of the baseline geochemical characterization was to determine if the materials exposed as part of the mining process have the potential to generate excess acidity and/or react with water to produce conditions that could degrade surface water or groundwater quality or hinder reclamation.

7.5.1 Methods

Representative samples of the geologic units were collected from existing drill core and rock outcrops to represent, on a volume-proportional basis, the materials associated with the ore and waste rock in the proposed Permit Area. Table 7-1 contains the sample list, type, geologic unit, and predicted volume of the waste rock pile.

Samples of the Bushy Basin Member of the Morrison Formation and underlying units were sampled from archived core when it was available. Additional samples of the Westwater Canyon Member and Recapture Shale were collected from rock outcrops above the proposed portal. Outcrop samples were needed because the drilling was typically terminated below the Bushy Basin Member, or was not retained in storage. Some of the core included material from the Westwater Canyon Member and Recapture Shale, but was limited. The outcrop samples included material from the Westwater Canyon Member, Recapture Shale, and Bluff Sandstone.

The samples were sent to ACZ Laboratories in Steamboat Springs, Colorado, for analytical testing. The samples were crushed and pulverized at the laboratory prior to analysis. Analytical testing of the samples included acid-base accounting (ABA) using the modified Sobek method (Sobek et al., 1978) and the analysis of metals and other analytes in leachate from Synthetic Precipitation Leaching Procedure (SPLP; US Environmental Protection Agency [EPA], 1994).

7.5.2 Results

This section presents the results of the geochemistry and reactivity characterization. The laboratory reports are included in Appendix B. The estimated volumes of waste rock and ore by geologic unit based on the current Plan of Operations are presented in Table 7-1.

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7.5.2.1 Ore and Sub-Ore Mineralization

According to Smith and Peterson (1980) and Alief (2006), uranium mineralization within the Poison Canyon beds is mainly restricted to the lower two Poison Canyon sandstone lenses. The uranium mineralization is principally localized in geochemically reduced ground and only small pods of mineralization are found in the oxidized (hematitic) ground. The uranium occurs primarily as coffinite [$U(SiO_4)_{1-X}(OH)_{4X}$] in tabular deposits and as c-shaped trends or roll fronts that represent the redistributed mineralization (Alief, 2006). The mineralization is generally associated with carbon-rich material and indistinct organic matter, or humates, in the sedimentary strata. Pyrite (FeS_2) and jordisite (black, soft molybdenum mineral [MoS_2]) are frequently associated minerals in the arkosic sandstone host rock, and have the potential to oxidize and form acid leachates. The mineralization is found as coating on the sand grains and as fillings in the interstices between grains. The interstices are also filled with very fine kaolin.

The sub-ore grade material from the Poison Canyon beds contains mineralization of similar nature and character to the ore horizons, but contains uranium concentrations below the cut-off grade (Alief, 2006). These sub-ore grade materials would either be managed as waste rock or remain within the underground mine workings. These materials (waste rock) would comprise an extremely small overall volume of the mined material in the ore-bearing horizons, given the localized and concentrated nature of the ore deposits. The ore is already concentrated in the organic-rich intervals or pods within the sedimentary strata. The sub-ore materials form as halos around the ore zones.

7.5.2.2 Ore and Waste Rock Materials

The non-ore (waste rock) materials that would be mined and managed in the proposed Permit Area would be those rocks mined only to reach the ore-bearing zones. The proposed portal starts in the Bluff Sandstone and extends through the Recapture Shale, Westwater Canyon, and lower portion of the Brushy Basin Members before reaching the ore deposit in the Poison Canyon beds. Additional materials, although of much smaller volumes, would be mined as the escape raise is constructed from the mesa top to intercept the underground mine in the ore-bearing horizons.

The analytical data suggests the waste rock would largely not have the potential to generate acid drainage (Table 7-2). ABA data was evaluated through static sulfur speciation tests using the modified Sobek method (Sobek et al., 1978). The modification to the Sobek method bases the acid potential on sulfide sulfur (soluble in nitric acid) rather than total sulfur. Using total-sulfur analyses can result in errors if non-acid producing sulfates, such as gypsum (calcium sulfate) and/or barite (barium sulfate) are present in the samples. Although pyritic sulfur is present in the Poison Canyon Sandstone, Lower Brushy Basin Shale, and Westwater Canyon Shale samples, there are also generally sufficient amounts of carbonate available in the samples to neutralize potential acidity. The ABA of these three units range from -17 to 231 tons of calcium carbonate per 1,000 tons of material ($tCaCO_3/kt$), where, by convention,

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negative values indicate net-acid generating potential and positive values indicate net-neutralizing potential. The pyritic sulfur concentrations range from non-detectable to 1.42 weight percent. The Recapture Shale and Bluff Sandstone samples have pyritic sulfur concentrations at or below detection limits. Samples from the Recapture Shale and Bluff Sandstone have acid-base potentials ranging from -0.3 to 155 tCaCO3/kt. The ABA values for these two units generally represent the calcium carbonate content of the samples.

There are a few anomalies in the ABA data. Several samples have higher concentrations of the extractable sulfur forms than the total sulfur percentage. Differences in analytical results of geologic samples may occur in response to variations in sample preparation and analytical methods. Anomalies in the ABA data may be related to preparation of the sample splits for each extraction subset; these samples may not have been homogenized thoroughly prior to splitting or represent heterogeneities within the homogenized samples. In addition, the laboratory did not include an extraction of the most soluble sulfur forms (sulfates salts) using a hot water extraction.

The concentrations of metals and other analytes measured with the SPLP (EPA, 1994) were compared to New Mexico Water Quality Control Commission (WQCC) standards in 20.6.2.3103 NMAC to assess the material's potential for degrading surface water or groundwater. The EPA SPLP (1994) is generally used to determine the metals and other inorganic analytes present in materials that might leach under acid rain. Samples from the Poison Canyon beds have concentrations of leachable arsenic, molybdenum, selenium, and uranium higher than WQCC standards (Table 7-3). These metals are typically enriched in the ore and sub-grade ore zones associated with the ore deposits. No metals concentrations were higher than WQCC standards in samples from the underlying lower portion of the Brushy Basin Member, Westwater Canyon Member, and Recapture Shale. Aside from three high iron concentrations in the Bluff Sandstone samples, which may be anomalies, no other metal concentrations were higher than standards. Additional concentrations of leachable analytes (chloride, nitrate, TDS and sulfate) from the SPLP method are included in Table 7-4.

7.6 Aquifers and Springs

The uppermost water-bearing interval is expected to be unconfined water in the Jurassic-age Entrada Sandstone underlying the proposed Permit Area. The only reliable aquifer for a water supply beneath proposed Permit Area is expected to be either confined sandstone beds in the Triassic-age Chinle Formation (if they are present under the La Jara Mesa Permit Area) and the limestone and sandstone of Permian-age San Andres-Glorieta Formation. These aquifers are discussed in more detail in Section 9 (Groundwater). There are no springs within several miles of the proposed Permit Area. The proposed underground mine would be entirely above any regional water table and would be dry.

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TABLES

Table 7-1: Sample List and Estimated Waste Rock/Ore Volumes by Geologic Unit

Sample ID	Geologic Unit - Sample Type	Dominant Lithology	Volume Percentage of Waste Rock Pile	Volume (yd^3)
LR-12-4C-1	Poison Canyon "ore" - core	Sandstone	<1%	NS
LR-12-8C-1	Poison Canyon "ore" - core			
LR-12-5C-1	Poison Canyon - core	Sandstone	<1%	140
LR-12-5C-2	Poison Canyon - core			
LR-12-2C-1	Poison Canyon - core			
LR-12-8C-2	Poison Canyon - core			
LR-12-5C-3	Lower Brushy Basin - core	Shale	5%	12,300
LR-12-3C-1	Lower Brushy Basin - core			
LR-12-9C-1	Lower Brushy Basin - core			
LR-12-2C-2	Lower Brushy Basin - core			
LR-12-5C-5	Westwater Canyon - core	Sandstone	56%	151,900
LR-12-5C-7	Westwater Canyon - core			
LR-12-5C-8	Westwater Canyon - core			
WW-1	Westwater Canyon - outcrop			
LR-12-5C-6	Westwater Canyon - core			
LR-12-5C-4	Westwater Canyon - core			
LR-12-1C-2	Westwater Canyon - core			
LR-12-1C-1	Westwater Canyon - core			
RS-1	Recapture Shale - outcrop	Shale	6%	17,380
RS-2	Recapture Shale - outcrop			
LR-12-5C-9	Recapture Shale - core			
BS-1	Bluff Sandstone - outcrop	Sandstone	32%	86,600
BS-2	Bluff Sandstone - outcrop			
BS-3	Bluff Sandstone - outcrop			
BS-4	Bluff Sandstone - outcrop			
BS-5	Bluff Sandstone - outcrop			

Note:
yd^3 = cubic yard
NS = Not Specified

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Table 7-2: Acid Base Accounting

Sample	EC mmhos/cm	Paste pH s.u.	Pyritic Sulfur Basis			Neutralization Potential as $CaCO_3$ wt %	Total Sulfur %	Extractable Sulfur Forms (wt %)		
			AGP t/kt	ANP t/kt	ABA t/kt			Sulfates (HCl extractable)	Pyritic Sulfides (HNO_3 extractable)	Organic (Residual)
Poison Canyon "Ore"										
LR-12-4C-1	2.94	6.4	59	153	94	15.3	2.36	0.4	1.9	0.06
Poison Canyon Sandstone										
LR-12-5C-1	1.07	7.5	9	83	74	8.3	0.29	<0.01	0.28	<0.01
LR-12-5C-2	1.5	7.4	44	177	133	17.7	1.55	0.13	1.42	<0.01
LR-12-2C-1	0.894	7.8	31	50	19	5	0.78	<0.01	1.00	<0.01
LR-12-8C-2	2.88	6.4	8	217	209	21.7	0.4	0.15	0.25	<0.01
Lower Brushy Basin Shale										
LR-12-5C-3	0.329	8.1	0	0	0	<0.1	<0.01	<0.01	<0.01	<0.01
LR-12-3C-1	0.215	8.3	0	35	35	3.5	<0.01	<0.01	<0.01	0.05
LR-12-9C-1	0.375	7.8	3	173	171	17.3	0.24	0.1	0.08	0.06
LR-12-2C-2	0.25	7.9	0.3	90	90	9	<0.01	<0.01	0.01	<0.01
Westwater Canyon Sandstone										
LR-12-5C-5	1.52	7.2	37	20	-17	2	0.84	<0.01	1.18	<0.01
LR-12-5C-7	0.695	7.4	10	40	30	4	0.35	0.03	0.32	<0.01
LR-12-5C-8	0.456	8.5	3	160	158	16	0.17	0.09	0.08	<0.01
WW-1	0.215	8.5	0	231	231	23.1	<0.01	<0.01	<0.01	<0.01
LR-12-5C-6	1.15	7.5	37	58	21	5.8	1.05	<0.01	1.17	0.06
LR-12-5C-4	0.362	8	7	218	211	21.8	0.48	0.16	0.21	0.11
LR-12-1C-1	0.956	7.4	8	0	-8	<0.1	0.25	0.01	0.24	<0.01
LR-12-1C-2	0.426	7.6	3.8	4	0.3	0.4	0.12	<0.01	0.12	<0.01
Recapture Shale										
RS-1	4.17	7.7	0	74	74	7.4	<0.01	<0.01	<0.01	<0.01
RS-2	1.76	7.8	0	26	26	2.6	0.05	0.05	<0.01	<0.01
LR-12-5C-9	0.348	7.9	0	23	23	2.3	<0.01	<0.01	<0.01	<0.01
Bluff Sandstone										
BS-1	0.135	7.8	0	12	12	1.2	<0.01	<0.01	<0.01	<0.01
BS-2	0.227	7.8	0.3	0.0	-0.3	<0.1	<0.01	<0.01	0.01	<0.01
BS-3	0.294	8.2	0	155	155	15.5	<0.01	<0.01	<0.01	<0.01
BS-4	0.249	8.2	0	43	43	4.3	<0.01	<0.01	<0.01	<0.01
BS-5	1.3	8	1	9	8	0.9	0.03	<0.01	0.04	<0.01

Notes:

EC = electrical conductivity; mmhos/cm = millimohs per centimeter

t/kt = tons of calcium carbonate (CaCO3) per 1,000 tons of soil

ANP = Acid Neutralization Potential

AGP = Acid Generation Potential

ABA = Acid-Base Account

Samples were crushed and pulvarized

< = concentration below the indicated laboratory method detection limit

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Table 7-3: Metal Leaching Analysis

Sample ID	Metals - Synthetic Precipitation Leaching Procedure (EPA 1312) Concentration, mg/L																	
	Al	As	Ba	B	Cd	Cr	Co	Cu	Fe	Pb	Hg	Mo	Ni	Se	Ag	U	V	Zn
NMWQCC Standards	***5.0***	***0.1***	***1.0***	***0.75***	***0.01***	***0.05***	***0.05***	***1.0***	***1.0***	***0.05***	***0.002***	***1.0***	***0.2***	***0.05***	***0.05***	***0.03***	***NS***	***10.0***
Poison Canyon "ore"																		
LR-12-4C-1	-0.03	0.0604	0.012	<0.01	0.0003	<0.01	<0.01	0.03	<0.02	0.0043	<0.0002	**2.88**	0.01	**0.0935**	<0.01	**5.970**	0.020	0.02
Poison Canyon Sandstone																		
LR-12-5C-1	0.03	**0.1532**	<0.003	<0.01	0.0002	<0.01	<0.01	<0.01	<0.02	0.0011	<0.0002	**3.15**	<0.01	0.0164	<0.01	**0.3878**	0.016	<0.01
LR-12-5C-2	0.06	0.0239	0.005	<0.01	<0.0001	<0.01	<0.01	<0.01	<0.02	<0.0001	<0.0002	**1.38**	<0.01	**0.0740**	<0.01	0.0234	0.006	<0.01
LR-12-2C-1	0.12	0.0073	0.005	<0.01	<0.0001	<0.01	<0.01	<0.01	0.03	0.0006	<0.0002	0.42	0.01	0.0329	<0.01	**0.2292**	0.030	<0.01
LR-12-8C-2	0.33	0.0034	0.034	<0.01	<0.0001	<0.01	<0.01	0.08	0.16	0.0007	<0.0002	0.05	0.01	0.0042	<0.01	0.0036	<0.005	0.03
Lower Brushy Basin Shale																		
LR-12-5C-3	0.05	0.0013	0.007	0.02	<0.0001	<0.01	<0.01	<0.01	0.04	<0.0001	<0.0002	<0.01	<0.01	0.0007	<0.01	0.0004	<0.005	<0.01
LR-12-3C-1	0.20	0.0331	0.006	0.05	0.0001	<0.01	<0.01	<0.01	0.05	0.0004	<0.0002	0.05	0.02	0.0031	<0.01	0.0012	<0.005	<0.01
LR-12-9C-1	0.04	0.0526	0.003	0.03	<0.0001	<0.01	<0.01	0.08	0.16	0.0001	<0.0002	0.56	0.01	0.0085	<0.01	0.0287	0.008	<0.01
LR-12-2C-2	0.15	0.0598	0.004	0.03	<0.0001	<0.01	<0.01	<0.01	0.03	0.0007	<0.0002	0.04	0.01	0.0012	<0.01	0.0005	<0.005	<0.01
Westwater Canyon Sandstone																		
LR-12-5C-5	0.03	0.0057	<0.003	<0.01	<0.0001	<0.01	<0.01	<0.01	<0.02	<0.0002	<0.0002	0.02	<0.01	<0.0001	<0.01	0.0204	<0.005	<0.01
LR-12-5C-7	0.32	0.0016	<0.003	<0.01	<0.0001	<0.01	<0.01	<0.01	0.05	<0.0001	<0.0002	<0.01	<0.01	<0.0001	<0.01	0.0042	<0.005	<0.01
LR-12-5C-8	0.17	0.0011	<0.003	<0.01	<0.0001	<0.01	<0.01	<0.01	<0.02	<0.0001	<0.0002	<0.01	<0.01	0.0003	<0.01	0.0083	<0.005	<0.01
WW-1	0.19	0.0012	0.015	<0.01	<0.0001	<0.01	<0.01	<0.01	0.05	0.0006	<0.0002	<0.01	<0.01	0.0001	<0.01	0.0004	0.024	<0.01
LR-12-5C-6	0.19	0.0009	0.01	0.02	<0.0001	<0.01	<0.01	<0.01	0.07	<0.0001	<0.0002	<0.01	<0.01	0.0007	<0.01	0.0003	<0.005	<0.01
LR-12-5C-4	0.17	0.0043	0.082	<0.01	<0.0001	<0.01	<0.01	0.01	0.05	0.0009	<0.0002	<0.01	<0.01	0.0051	<0.01	0.0002	<0.005	<0.01
LR-12-1C-2	0.92	0.0014	0.003	<0.01	<0.0001	<0.01	<0.01	<0.01	0.43	0.0003	<0.0002	<0.01	0.01	0.0001	<0.01	0.0007	0.006	<0.01
LR-12-1C-1	<0.03	0.0052	0.009	<0.01	<0.0001	<0.01	<0.01	<0.01	<0.02	0.0003	<0.0002	<0.01	0.01	0.0004	<0.01	0.0069	<0.005	<0.01
Recapture Shale																		
RS-1	-0.03	0.0015	0.037	<0.01	<0.0001	<0.01	<0.01	<0.01	0.02	<0.0001	<0.0002	<0.01	<0.01	0.0004	<0.01	0.0004	0.020	<0.01
RS-2	0.09	0.0008	0.01	<0.01	<0.0001	<0.01	<0.01	<0.01	0.07	<0.0001	<0.0002	<0.01	<0.01	0.0006	<0.01	0.0002	0.032	<0.01
LR-12-5C-9	0.07	0.0026	<0.003	<0.01	<0.0001	<0.01	<0.01	0.01	0.04	0.0003	<0.0002	<0.01	0.02	0.0024	<0.01	0.0004	0.006	<0.01
Bluff Sandstone																		
BS-1	**20.60**	0.0040	0.031	<0.01	0.0001	<0.01	<0.01	<0.01	**20.20**	0.0063	<0.0002	0.01	<0.01	0.0002	<0.01	0.0009	0.132	0.04
BS-2	3.28	0.0020	0.008	<0.01	<0.0001	<0.01	<0.01	<0.01	**2.47**	0.0011	<0.0002	<0.01	<0.01	<0.0001	<0.01	0.0002	0.059	<0.01
BS-3	2.06	0.0015	0.007	<0.01	<0.0001	<0.01	<0.01	<0.01	**1.12**	0.0005	<0.0002	<0.01	<0.01	0.0001	<0.01	0.0002	0.056	<0.01
BS-4	0.52	0.0012	<0.003	<0.01	<0.0001	<0.01	<0.01	<0.01	0.23	0.0002	<0.0002	<0.01	<0.01	<0.0001	<0.01	<0.0001	0.024	<0.01
BS-5	0.06	0.0018	0.018	<0.01	<0.0001	<0.01	<0.01	<0.01	0.06	<0.0001	<0.0002	<0.01	<0.01	0.0017	<0.01	<0.0001	0.075	<0.01

Notes:

WQCC = New Mexico Water Quality Control Commission, 20.6.2.3103 NMAC Standards

NS = No standard has been established

Bold = concentration higher than WQCC standards for discharge to groundwater

< = concentration below the indicated laboratory method detection limit

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Table 7-4: Inorganic Leaching Analysis

Sample ID	Synthetic Precipitation Leaching Procedure (EPA 1312) Concentration, mg/L			
	Chloride	Nitrate / Nitrite as N	TDS	Sulfate
NMWQCC Standards	***250***	***10***	***1000***	***600***
Poison Canyon "ore"				
LR-12-4C-1	2	0.06	130	51
Poison Canyon Sandstone				
LR-12-5C-1	1	0.03	80	35
LR-12-5C-2	<1	<0.02	50	12
LR-12-2C-1	<1	0.05	40	6
LR-12-8C-2	1	<0.02	170	86
Lower Brushy Basin Shale				
LR-12-5C-3	<1	0.04	60	<1
LR-12-3C-1	<1	<0.02	60	<1
LR-12-9C-1	<1	3.70	70	10
LR-12-2C-2	<1	0.09	79	<1
Westwater Canyon Sandstone				
LR-12-5C-5	1	<0.02	60	26
LR-12-5C-7	<1	<0.02	40	<1
LR-12-5C-8	<1	<0.02	30	<1
WW-1	<1	0.14	40	<1
LR-12-5C-6	<1	0.02	40	10
LR-12-5C-4	<1	0.03	40	<1
LR-12-1C-2	<0.03	0.02	50	<1
LR-12-1C-1	<1	0.11	70	20
Recapture Shale				
RS-1	4	0.38	70	<1
RS-2	3	1.93	70	<1
LR-12-5C-9	<1	0.02	30	<1
Bluff Sandstone				
BS-1	<1	0.11	80	1
BS-2	<1	0.07	50	2
BS-3	<1	0.14	60	<1
BS-4	<1	0.08	40	<1
BS-5	8	4.52	100	<1

Notes:

WQCC = New Mexico Water Quality Control Commission, 20.6.2.3103 NMAC Standar

Bold = concentration higher than WQCC standards for discharge to groundwater

TDS = Total dissolved solids

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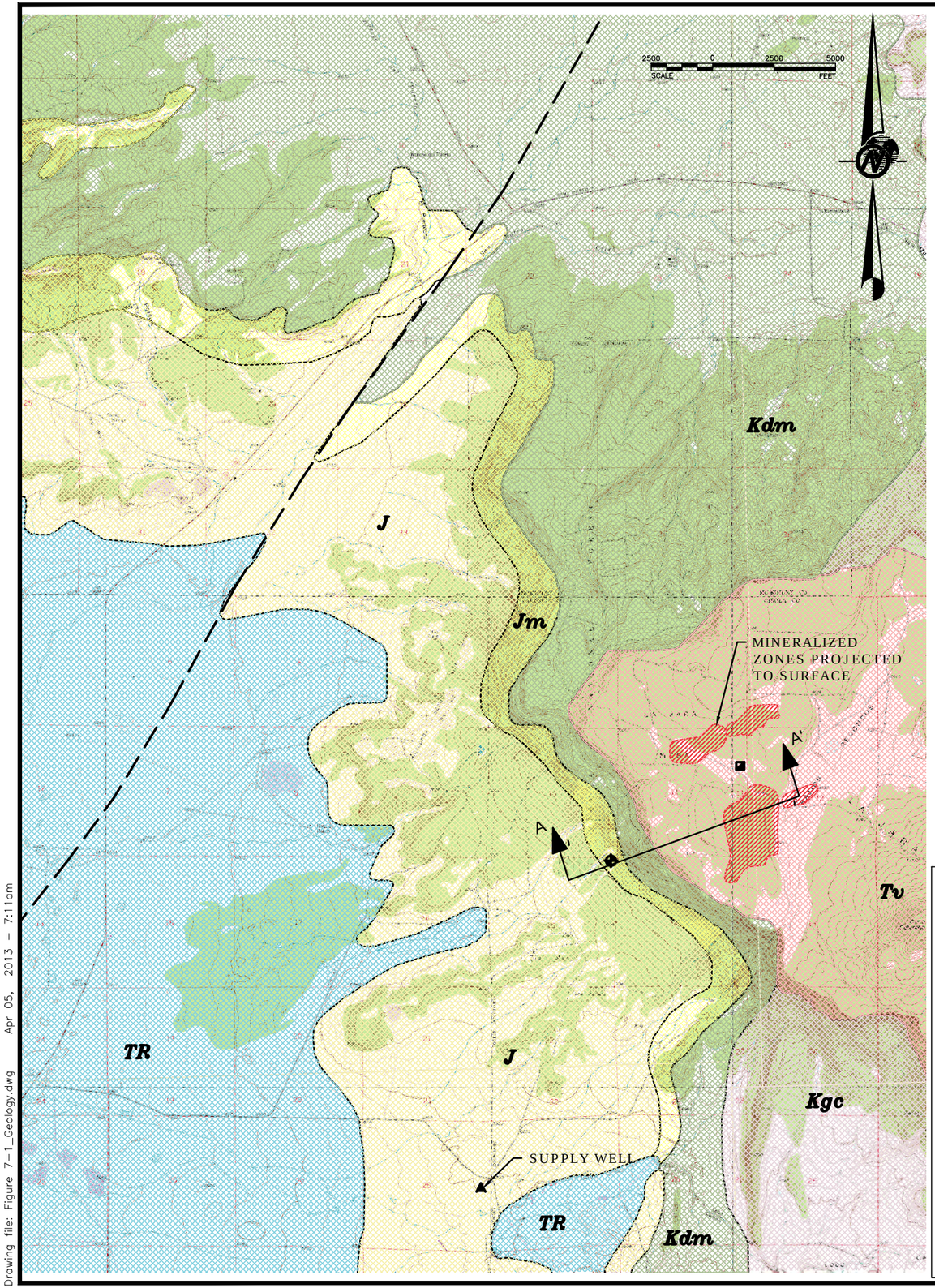
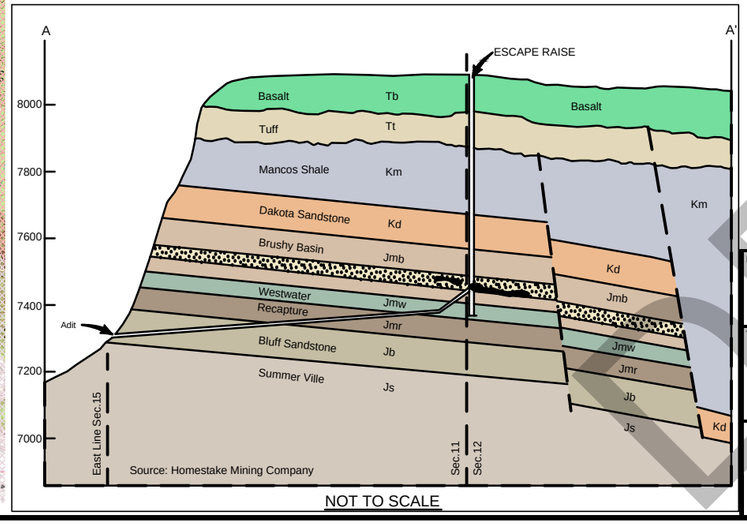
FIGURES



MAP UNITS	AGE	FORMATION	MEMBER	LITHOLOGY	THICKNESS	DESCRIPTION
Tv	TERTIARY	MT. TAYLOR VOLCANIC (Tv)	EXTRUSIVE FLOW		85-110 FEET	Black Basalt
Kgo	CRETACEOUS	MESA VERDE GROUP	EXTRUSIVE FLOW		190-230 FEET	Pumice fragments, abundant quartz phenocrysts cemented with fine light colored ash.
Kdm	CRETACEOUS	MANCOS SHALE Km			150-200 FEET	Black marine shale
		DAKOTA SANDSTONE (Kd)			40-90 FEET	Lt. brown, coarse to medium grained sandstone, limited black shale partings
Jm	JURASSIC	MORRISON FORMATION (Jm)	BRUSHY BASIN (Jmb)		100-180 FEET	Green shale with interbeds sandy shale
			POISON CANYON (Jmbp)		30-85 FEET	Lt. Brown to grayish-brown, fine to very coarse-grained arkosic-to sub arksoic sandstone, interbeds of grayish green mudstone, up to five sand units.
			WESTWATER CANYON (Jmw) SAND		80-100 FEET	
			RECAPTURE SHALE (Jmr) SHALE		50 FEET	Lt. gray to bleached, medium to coarse grained sandstone.
J						grayish red and gray
		BLUFF SANDSTONE (Jb)			235 370 FEET	Pale-red to a pale brown, fine to medium-grained eolian sandstone
		SUMMERVILLE FORMATION (Js)			160-270 FEET	Interbedded veriegated mudstone siltstone to very fine grained sandstone
		TODILTO LIMESTONE (Jt)			25-35 FEET	Pale olive gray, dark gray and pale yellow, thick bedded limestone
		ENTRADA SANDSTONE (Je)			150-185 FEET	Medium brown to reddish eolian Sandstone
TR	TRIASSIC	CHINLE GROUP (Tc)			1000-1600 FEET	Grayish to pale reddish mudstone, siltstone and fine grained sandstone
	PERMIAN	SAN ANDRES LIMESTONE			95-115 FEET	Dense gray and yellowish brown to red limestone with interbedded yellow, fine to medium grained, crossbedded sandstone, upper surface karst.



NOT TO SCALE

LEGEND

- MINERALIZED ZONE
- FAULT
- LA JARA MESA PROJECT PORTAL FACILITY AREA
- SUPPLY WELL
- ESCAPE RAISE

SOURCE: LARAMIDE RESOURCES (USA) INC.

PROJECT

LARAMIDE RESOURCES (USA) INC.
LA JARA MESA PROJECT
CIBOLA COUNTY, NEW MEXICO

TITLE

GENERALIZED SITE GEOLOGY

Golder Associates
Albuquerque, New Mexico

PROJECT No.		0839338SI	FILE No.	Figure7-1_Geology	
DESIGN	LM	04/30/09	SCALE	AS SHOWN	REV. 0
CADD	CM	03/12/13			
CHECK	LM	03/12/13			
REVIEW	BN	03/12/13			

FIGURE 7-1

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Drawing file: Figure 7-1_Geology.dwg Apr 05, 2013 - 7:11am

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8.0 SURFACE WATER

***New Mexico Administrative Code (NMAC) 19.10.6.602 D.(13)* (g)**

Surface water… information shall include the following:

i. A map indicating the location of surface waters and the locations and size of watersheds in and adjacent to the proposed permit area. The map shall depict all watercourses, lakes, reservoirs, springs and riparian and wetland areas. Streams shall be classified as ephemeral, intermittent or perennial. The map shall identify all watercourses, lakes, springs, and riparian and wetland areas into which surface or pit drainage will be discharged or may possibly be expected to reach;

ii. A description of surface drainage systems sufficient to identify the seasonal variations in surface water quantity and quality within the proposed permit and affected areas to the extent possible;

v. A determination of the probable hydrologic consequences of the operation and reclamation, on both the permit and affect areas, with respect to the hydrologic regime, quantity and quality of surface and ground water systems that may be affected by the proposed operations, including the dissolved and suspended solids under seasonal flow conditions.

8.1 Introduction

The La Jara Mesa Project Permit Area, proposed by Laramide Resources (USA) Inc. (Laramide), is located within the San Mateo Creek subbasin of the Rio San Jose Basin, in northern Cibola County, New Mexico. The Rio San Jose Basin is a western tributary basin to the Rio Grande Basin in northwestern New Mexico (Williams, 1986). The location of the proposed Permit Area relative to San Mateo Creek, the Rio San Jose, and the Rio San Jose Basin is shown in Figure 8-1. The mine surface facilities and escape raise would be developed in a poorly integrated, 2,658-acre watershed of an unnamed ephemeral drainage (Figure 8-2). The road and utility corridor would be in the catchment area that drains to Lobo Creek, which flows to San Mateo Creek. San Mateo Creek is an ephemeral stream throughout much of its length, flowing in direct response to precipitation or snow melt events. The surface water regime is influenced by the arid to semi-arid climate of the region, the relative medium- to high-permeability of the soils, and the exposed bedrock outcrops.

Surface water baseline data were collected to document the current surface water quality and sediment characteristics within the ephemeral channels that drain the proposed Permit Area. Baseline data is intended to provide the information necessary to characterize the potential effects of mining operations on the surface water features in the area.

8.2 Methods

Delineation of the watershed and the nature and extent of the ephemeral drainages of the proposed Permit Area were developed using United States Geological Survey (USGS) 7.5-minute topographic maps (1957 and 1995) and from digital topographic (5-foot contour) maps of the proposed Permit Area

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and mine facility plan provided by Laramide. The digital topographic maps were generated from aerial photography. The termination points of the ephemeral drainages were verified during the field investigations to further define the extent of the potentially affected surface water or channel sediments downgradient from the proposed Permit Area. Aerial photographs were also consulted in this analysis.

Surface water quality monitoring was conducted in representative channels that could receive stormwater discharges from the proposed surface facilities in the proposed Permit Area. Four monitoring locations were established downgradient of the proposed surface facilities (Figure 8-2). Shallow piezometers were installed at three of the four locations and stormwater samplers were installed at all four locations.

The shallow piezometers were installed in excavations made using a hand auger to depths of 13 feet, or when the hole could not be advanced further by hand. The piezometers were completed in the unconsolidated fluvial sediment in the drainages using 2-inch schedule 40 PVC well points placed to the total depth. The holes were advanced by hand until refusal. The total depths were 13.24 feet (bgs) for LJM-MW-2, 6.52 feet (bgs) for LJM-MW-3, and 12.7 feet (bgs) for LJM-WM-4.

Stormwater samplers were installed in the ephemeral channels using ditch-mounting techniques (Figure 8-3). At each location, a shallow hand dug excavation was made within the lowest point of the active channel (Attachment 8A, Photos 1 and 2). A 24-inch steel stake was placed in the excavation and the mounting tube secured to the bracket, then the excavation was backfilled. Each mounting tube was installed with the water intake (perforations on the side of the tube) level with the ground surface. The stormwater samplers were monitored approximately quarterly for one year, although water samples were only collected following specific storm events. The internal stormwater sample bottles were replaced after each sample collection. These stormwater samples were placed on ice immediately after collection and shipped to ACZ Laboratory in Steamboat Springs, Colorado. The samples were analyzed for total dissolved solids (TDS) and total suspended solids (TSS), pH, and dissolved metals (Table 8-1). If the bottles contained a sufficient amount of stormwater, primary anions and cations were also analyzed.

Sediment samples (grab) were collected from the surface (0 to 12 inches) within the ordinary high water mark at eight channel locations downstream from the proposed Permit Area (Figure 8-2). Four of these samples were collected from the surface water quality monitoring locations, specifically from the shallow excavations to install the stormwater samplers. The other four samples were collected from the drainages downstream of the proposed surface facilities. The sediment samples were placed in 1-gallon plastic bags, labeled and sealed, and shipped to Energy Laboratories in Billings, Montana. The sediment samples were analyzed for the chemical and physical properties, including radionuclides, listed on Table 8-2.

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8.3 Surface Water Baseline Results

The nature and extent of surface water in the proposed Permit Area is discussed in Section 8.3.1. Surface water quality results are presented in Section 8.3.2. The characterization of channel sediment is discussed in Section 8.3.3. Springs and other surface water features are described in Section 8.3.4.

8.3.1 Nature and Extent of Flows within Ephemeral Drainages

Surface water in the proposed Permit Area is limited to ephemeral drainages that flow episodically during the late spring and summer storm events. The ephemeral drainages originating within the proposed Permit Area flow to the southwest and terminate in the valley, approximately 2 miles to the west (Figure 8-2). These drainages are not integrated with the regional surface system; there are no other perennial drainages on or near the proposed Permit Area.

Three unnamed ephemeral drainages (channels) drain the proposed Permit Area (Figure 8-4). These channels are steeply sloped and are generally in moderate to poor condition within the proposed Permit Area. Pre-existing roads have altered the natural drainage patterns by redirecting stormwater into undersized channels. The channels are incised in the erodible eolian deposits overlying the inflection point at the base of the escarpment. Channel scour, head cutting, and redistribution of sediment were observed during field investigations (Attachment 8A). The northern most of these channels appears as the unnamed ephemeral drainages on the USGS quadrangle map (Figure 8-2) and ultimately terminate in the dune fields west of the Permit Area. The other two drainages appear to have been induced from the previous road clearing and subsequent use. The central channel is tributary to the northern channel (unnamed ephemeral drainage). The confluence occurs as the gradient of the landscape flattens southwest of the proposed Permit Area boundary (Figure 8-4). The southernmost channel appears to dissipate into a broad sediment apron after exiting the proposed Permit Area as the drainage nears the road. Flow may continue onto the road after heavy rains, and ultimately merge with the other two channels. Similar ephemeral channels that drain La Jara Mesa and the surrounding watershed, outside of the proposed Permit Area, merge with the unnamed ephemeral drainage in the valley.

Interpretation of aerial photography and USGS quadrangle map topography, further supported by field investigations, indicates there is no apparent hydrologic connection between the ephemeral channels that drain the proposed Permit Area and San Mateo Creek. Approximately 2 miles downgradient from the proposed Permit Area and west of a private ranch road, the main unnamed ephemeral drainage terminates in a dune field (Figure 8-2).

Field inspection of the valley near the ranch road (Golder, 2010) confirmed a dune field west of the road with no discernible bed and bank structures indicative of an active channel or Ordinary High Water Mark (OHWM). The OHWM is used to identify the lateral limits of non-wetland waters and is defined as “the line on the shore established by the fluctuations of water and indicated by physical characteristics such as a

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clear natural line impressed on the bank, shelving, changes in the character of the soil, destruction of terrestrial vegetation, or the presence of litter and debris" (Lichvar and McColley, 2008). In ephemeral channels of the arid west, low to moderate discharge events with 5- to 10-year return intervals often form an OHWM. The watercourse conditions around the dune field do not have the physical characteristics of an OHWM, and it is unlikely that stormwater from the proposed Permit Area flows more than a mile away. Channel-like features near the dune field also appear to be discontinuous both laterally and longitudinally. These are better described as swales and they tend to end in sediment aprons that are nearly level.

High intensity, short-duration rains of limited areal extent are common in the proposed Permit Area during the summer months (See Section 2.0). Although infrequent, the magnitude, frequency, and areal extent of these rains can be important. The thunderstorm season is concentrated in July, August, and early September. Heavy rainfall occurs during the summer with a low chance of occurrence at any specific time and place. The stormwater flow events follow these infrequent storms during an average year in the proposed Permit Area. Significant amounts of sediment can be transported down the ephemeral channels during stormwater flow events. Sediment transport has been exacerbated by grazing and vehicle traffic on the dirt roads near the proposed Permit Area.

8.3.2 Baseline Surface Water Quality

Diversions and stormwater controls are planned in and around the proposed surface facilities (Plate 2). The planned surface water controls are to limit interaction of the stormwater and any reactive material, and to retain the water and sediment on site.

The downstream stretches of the three ephemeral channels of the proposed Permit Area constitute potential affected areas. Surface water sample collection sites were located along these channels (Figures 8-2 and 8-4) because they would receive stormwater runoff from the surface facilities. Surface-water sample location LJM-SW-01 is in the northern channel (main unnamed ephemeral drainage), west of the proposed Permit Area, and immediately downgradient of the proposed surface facilities. Situated adjacent to the road and utility corridor, surface-water sample location LJM-SW-02 is in the central channel, downgradient from the proposed stormwater containment basin (Plate 2 and Figure 8-4). Surface-water sample location LJM-SW-03 is upgradient from confluence of the ephemeral channels of the proposed Permit Area. Surface-water sample location LJM-SW-04 is downgradient, in the western watershed area at the private ranch road, where the main ephemeral drainage broadens into a non-defined channel (Figure 8-2).

Golder field personnel visited each surface water sample location immediately following a rain event. No water was present at the shallow piezometers (LJM-MW-02, -03, and -04) during the baseline monitoring period; however, water was successfully collected from all four stormwater samplers (LJM-SW-01, -02, -03, and -04). Surface water was not present at each sample location during each monitoring event, even

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after a heavy rain event. In some instances channel scour, debris flow, and/or sediment deposition were the only evidence of water flow. Selected photographs of the channel conditions and stormwater samplers are in Attachment 8A. Sediment deposition buried the mounting tube at locations LJM-SW-02 and -03 from the August 2011 rainstorms (Attachment 8A, Photos 3 and 4).

Sample volumes collected from the stormwater samplers during the baseline period were highly variable. Low volumes of water may be attributed to sand-locking, burial, and high velocity flow. The winter sampling event tended to have higher collection volumes, likely from snow melt. Because of the limited sample volume, in some cases, Golder instructed the laboratory to prioritize the analyses: dissolved metals first; and second priority anions, TDS, and alkalinity.

General water quality parameters for the stormwater samples are presented on Table 8-3, while dissolved metal concentrations are listed on Table 8-4. Laboratory reports are included in Appendix B. The stormwater samples tend to be slightly alkaline (pH 7.7 to 8.2), calcium bicarbonate dominant, with relatively low TDS. TSS was analyzed for when samples had sufficient volume. The TSS is expected to be high due to the collection method (ditch-mounted stormwater sampler). The sampler is designed to shed debris (Figure 8-3), but on several occasions the sample bottles were “sand-locked” inside the mounting tube. The sample bottles were difficult to remove in these situations and it was necessary to remove the debris-shedding dome to extract the sample bottle from the mounting tube. During this process, sediment that was trapped between the bottle and mounting tube fell into the sample bottle.

Metal concentrations were less than the relative New Mexico Water Quality Control Commission standards (20.6.2.3103 NMAC). The sample concentrations for cadmium, chromium, and mercury concentrations are below laboratory method detection limits.

8.3.3 Stream Sediment Characteristics

Because the alluvium downstream of the proposed Permit Area was derived from potentially mineralized materials from natural sources and prior mining activities, it is important to understand the geochemical characteristics of the sediments prior to mining by Laramide. The channel sediments are coarse- to moderately coarse-textured, slightly alkaline, and non-saline (Table 8-5). A total metals analysis was performed and the results are in Table 8-6. Metals concentrations in the sediments are less than or near laboratory method detection limits with the exception of barium, manganese, vanadium, and zinc. Barium and manganese are relatively abundant in soils and sediment (US Environmental Protection Agency [EPA], 1995), particularly from leaching and erosion of sedimentary rocks. Barium concentrations range between 23 and 95 milligrams per kilogram (mg/kg). Manganese concentrations range from 78 to 305 mg/kg. Vanadium concentrations in the sediments are generally less than 10 mg/kg; however, the concentration in sediment sample LJM-SW-03-SED is 112 mg/kg. Vanadium is widely distributed in the earth’s crust at an average concentration of 100 parts per million (approximately 100 mg/kg), similar to

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that of zinc and nickel (Byerrum, 1991). Zinc concentrations in the sediment samples range between 6 and 20 mg/kg. Radionuclides were assessed and are presented in Table 8-7.

8.3.4 Springs and Surface Water Features

The closest springs currently identified to the proposed Permit Area are Pumic Springs and Cliff Spring, both approximately 3 miles southeast of the proposed Permit Area.

In addition to the unnamed ephemeral drainage channels, other surface water features include a pond/tank located approximately 1.4 mile northwest of the proposed Permit Area, Roundy Stock tank located approximately 3 miles south, and Lobo Creek located approximately 2.1 miles south. All of the springs and surface water features are located outside of the La Jara Mesa proposed Permit Area watershed. There are no other perennial drainages on or near the mine site itself.

8.4 Probable Hydrologic Consequences

At its nearest point to the proposed Permit Area, San Mateo Creek is ephemeral. San Mateo Creek is not hydrologically connected and would not be affected by pumping from any of the bedrock aquifers that may be used for water supply for the project. All other surface water features within the watershed are ephemeral. There are no springs that could be affected by activities or disturbances associated with the project.

8.5 References

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TABLES

Table 8-1: Water Quality Sample Analytical Suite, Methods, and Detection Limits

Dissolved Analyte	WQCC Standard for Groundwater (mg/L or as noted)	EPA MCL (mg/L or as noted)	EPA Analytical Method	Method Detection Limit (mg/L or as noted)
Alkalinity	NS	NS	SM2320B	2
Aluminum	5	NS	EPA 200.7	0.03
Antimony	NS	0.006	EPA 200.8	0.0004
Arsenic	0.1	0.01	EPA 200.8	0.0005
Barium	1	2	EPA 200.7	0.003
Boron	0.75	NS	EPA 200.7	0.01
Cadmium	0.01	0.005	EPA 200.8	0.0001
Calcium	NS	NS	EPA 200.7	0.2
Chloride	250	NS	SM4500Cl-E	1
Chromium	0.05	0.1	EPA 200.8	0.0005
Cobalt	0.05	NS	EPA 200.8	0.01
Copper	1	1.3	EPA 200.8	0.01
Cyanide	0.2	0.2	335.4	0.005
Fluoride	NS	4	SM4500F-C	0.1
Iron	1	0.3	EPA 200.7	0.02
Lead	0.05	0.015	EPA 200.8	0.0001
Magnesium	NS	NS	EPA 200.7	0.2
Manganese	0.2	0.05	EPA 200.7	0.005
Mercury	0.002	0.002	EPA 200.8	0.0002
Molybdenum	1	NS	EPA 200.8	0.0005
Nickel	0.2	0.1	EPA 200.8	0.0006
Nitrate as N	10	10	353.2	0.02
Nitrite as N	NS	1	353.2	0.02
Nitrate+Nitrite as N	NS	NS	353.2	0.01
Potassium	NS	NS	EPA 200.7	0.3
Selenium	0.05	0.05	EPA 200.8	0.0001
Silicon	NS	NS	EPA 200.8	0.2
Sodium	NS	NS	EPA 200.7	0.3
Sulfate	600	250	D516-02	40
Total Dissolved Solids	1000	NS	SM2540C	10
Zinc	10	5	EPA 200.7	0.01
pH	6.0-9.0 s.u.	6.5-8.5 s.u.	SM4500H+ B	0.1 s.u.
Uranium	0.03	0.03	EPA 200.8	0.0005
Vanadium	NS	NS	EPA 200.7	0.01
Gross Alpha	NS	15 pCi/L	EPA 900.0	1.0 pCi/L
Gross Beta & Photon	NS	4 mrem/yr	EPA 900.0	4.0 piC/L
Radium-226 + 228	30.0 pCi/L	5.0 pCi/L	903.1 / 904.0	1.0 pCi/L
Radon-222	NS	300 pCi/L	SM7500-RN	200.0 pCi/L
TSS	NS	NS	E160.2	10

Notes:

WQCC = New Mexico Water Quality Control Commission, 20.6.2.3103 NMAC Standards

US Environmental Protection Agency (EPA) maximum contaminant level (MCL)

s.u. = standard units

mg/L = milligrams per liter

NS = No standard established

pCi/L = picocuries per liter

EPA beta particle standard = 4 millirems per year, equivalent to 50 pCi/L (EPA, 2002)

EPA MCL is for combined Ra-226 and Ra-228.

TSS = total suspended solids

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Table 8-2: Sediment Sample Analytical Suite, Methods and Detection Limits

Analysis	Standard-Method	Detection Limit
Saturated Paste pH	SLS, Method 2 and 21a	0.01 standard units
Electrical Conductivity	SLS, Method 3a and 4b	0.01 dS/m
Saturation percentage	SLS, Method 27a	0.1 wt %
Particle Size Distribution	Gee and Bauder (1986)	0.1 wt %
Rock Fragment	Dry sieve/gravimetric	2 wt %
Arsenic	SW3050, EPA200.8	5 mg/kg
Barium	SW3050, EPA200.8	5 mg/kg
Cadmium	SW3050, EPA200.7	1 mg/kg
Chromium	SW3050, EPA200.8	5 mg/kg
Cobalt	SW3050, EPA200.8	5 mg/kg
Copper	SW3050, EPA200.8	5 mg/kg
Lead	SW3050, EPA200.8	5 mg/kg
Manganese	SW3050, EPA200.8	5 mg/kg
Mercury	SW7471, EPA200.8	1 mg/kg
Molybdenum	SW3050, EPA200.8	5 mg/kg
Nickel	SW3050, EPA200.8	5 mg/kg
Selenium	SW3050, EPA200.8	5 mg/kg
Silver	SW3050, EPA200.8	5 mg/kg
Uranium	SW3050, EPA200.8	5 mg/kg
Vanadium	SW3050, EPA200.8	5 mg/kg
Zinc	SW3050, EPA6010C	5 mg/kg
Gross Alpha	SW3050, EPA 900.0	pCi/L
Gross Beta	SW3050, EPA 900.0	pCi/L
Radium 226 + 228	SW3050, EPA 904.0	pCi/L

Notes:

dS/m = decisiemens per meter
mg/kg - miligram per kilogram
pCi/L = picocuries per liter

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Table 8-3: Water Quality of Stormwater Samples

Constituent	Units	LJM-SW-01			LJM-SW-02		LJM-SW-03				LJM-SW-04			
		08/17/11	09/13/11	02/21/12	08/17/11	09/13/11	08/17/11	08/26/11	09/13/11	02/21/12	08/18/11	08/26/11	09/13/11	02/21/12
Sample Volume[1]	*mL*	1,000	50	500	500	50	100	50	50	1,000	250	75	50	250
pH @ 20°C	*s.u.*	8	NA	7.7	8.2	NA	NA	NA	NA	8.2	NA	NA	NA	7.7
Calcium	*mg/L*	41.3	48.7	6.3	72.5	57.1	87.4	26.5	63.8	27.1	44.9	15.2	18.5	6.8
Magnesium	*mg/L*	3.2	3.5	0.5	5.9	3.3	5.7	1.3	4.2	1.2	1.9	0.5	0.8	0.5
Sodium	*mg/L*	1	0.9	<0.3	1.5	1.1	3.3	3	2.4	<0.3	2.5	<0.3	0.7	0.8
Potassium	*mg/L*	3.9	6.6	1	5.7	5.3	12.2	4.2	5.8	2	11.7	2.6	7.7	3.1
Chloride	*mg/L*	2	NA	<1.0	49	NA	NA	NA	NA	1	NA	NA	NA	2
Fluoride	*mg/L*	<0.1	NA	<0.1	0.1	NA	NA	NA	NA	<0.1	0.1	NA	NA	<0.1
Nitrate as N	*mg/L*	0.08	NA	0.27	0.12	NA	NA	NA	NA	0.68	2.48	NA	NA	0.38
Nitrite as N	*mg/L*	0.03	NA	<0.01	0.01	NA	NA	NA	NA	0.03	<0.01	NA	NA	<0.01
Nitrate /Nitrite as N	*mg/L*	0.11	NA	0.27	0.13	NA	NA	NA	NA	0.71	2.48	NA	NA	0.38
TSS @ 105°C	*mg/L*	8,340	NA	40	98,800	NA	NA	NA	NA	870	NA	NA	NA	NA
TDS @ 180°C	*mg/L*	180	NA	20	250	NA	NA	NA	NA	120	180	NA	NA	30
TDS (calculated)	*mg/L*	140	NA	22	273	NA	NA	NA	NA	87	87	NA	NA	25
TDS ratio (measured/calculated)	*mg/L*	1.29	NA	0.91	0.92	NA	NA	NA	NA	1.38	2.07	NA	NA	1.2
Sulfate	*mg/L*	2	NA	1	7	NA	NA	NA	NA	4	6	NA	NA	1
Bicarbonate as $CaCO_3$	*mg/L*	118	NA	17	189	NA	NA	NA	NA	75	NA	NA	NA	14
Carbonate as $CaCO_3$	*mg/L*	<2.0	NA	<2.0	<2.0	NA	NA	NA	NA	<2.0	NA	NA	NA	<2.0
Hydroxide as $CaCO_3$	*mg/L*	<2.0	NA	<2.0	<2.0	NA	NA	NA	NA	<2.0	NA	NA	NA	<2.0
Total Alkalinity	*mg/L*	118	NA	17	189	NA	NA	NA	NA	75	NA	NA	NA	14
Silica	*mg/L*	14.4	17.4	1.5	15.9	16.3	18.3	8.7	17	3.4	5.7	3.1	2.2	0.6
Silicon (calculated from SiO_2)	*mg/L*	6.7	8.1	0.701	7.4	7.6	8.5	4	7.9	1.6	2.6	1.4	1	0.3

Notes:

1 = Estimated volume, including sediment

s.u. = standard units

mg/L = milligrams per liter

NA = not analyzed

< = concentration below the indicated laboratory method detection limit

TDS = total dissolved solids

TSS = total suspended solids

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Table 8-4: Dissolved Metals in Stormwater Samples

Constituent	Units	LJM-SW-01			LJM-SW-02		LJM-SW-03				LJM-SW-04			
		08/17/11	09/13/11	02/21/12	08/17/11	09/13/11	08/17/11	08/26/11	09/13/11	02/21/12	08/18/11	08/26/11	09/13/11	02/21/12
Aluminum	*mg/L*	<0.03	0.09	0.26	0.05	0.05	0.04	0.25	0.21	0.6	0.1	<0.03	<0.03	<0.03
Antimony	*mg/L*	0.0009	0.0008	0.0006	<0.0004	0.0022	0.0016	0.0024	0.0033	0.0032	0.0021	<0.008	<0.008	<0.008
Arsenic	*mg/L*	0.005	0.0075	0.0075	0.0011	0.0022	<0.0005	0.0365	0.0387	0.07	0.0095	<0.01	<0.01	<0.01
Barium	*mg/L*	0.117	0.235	0.242	0.134	0.073	0.035	0.137	0.152	0.187	0.056	0.01	0.052	0.016
Boron	*mg/L*	0.03	0.05	0.05	0.02	0.02	<0.01	0.08	0.09	0.14	0.02	<0.01	<0.01	<0.01
Cadmium	*mg/L*	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.002	<0.002	<0.002
Chromium	*mg/L*	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0007	0.0006	<0.0005	<0.0005	<0.01	<0.01	<0.01
Cobalt	*mg/L*	0.00159	0.00158	0.00322	0.00055	0.00126	0.00025	0.00071	0.00082	0.0011	0.00046	<0.001	<0.001	<0.001
Copper	*mg/L*	0.0015	0.0027	0.0033	0.0013	<0.0005	<0.0005	0.003	0.0025	0.004	0.001	<0.01	<0.01	<0.01
Iron	*mg/L*	0.03	0.2	0.19	<0.02	0.11	<0.02	0.12	0.07	0.31	0.02	<0.02	<0.02	0.03
Lead	*mg/L*	<0.0001	0.0002	0.0004	<0.0001	0.0008	0.0003	0.0004	0.0004	0.0012	0.0003	<0.002	<0.002	<0.002
Manganese	*mg/L*	0.577	1.28	0.737	<0.005	0.019	<0.005	0.037	0.115	0.071	0.008	<0.005	<0.005	0.015
Mercury	*mg/L*	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum	*mg/L*	0.0024	0.0044	0.0013	0.0032	0.0024	0.0008	0.001	0.0018	<0.0005	0.0008	<0.01	<0.01	<0.01
Nickel	*mg/L*	0.0035	0.0043	0.0049	0.0014	0.0012	<0.0006	0.0025	0.0023	0.003	0.0008	<0.01	<0.01	<0.01
Selenium	*mg/L*	0.0004	0.0007	0.0006	0.0002	0.0004	0.0002	0.0002	0.0002	<0.0001	0.0003	<0.002	<0.002	<0.002
Uranium	*mg/L*	0.0039	0.0038	0.0019	0.0006	0.0007	<0.0001	0.0004	0.0011	0.0024	<0.0001	<0.002	<0.002	<0.002
Vanadium	*mg/L*	0.008	0.013	0.011	<0.005	0.012	<0.005	0.005	0.011	0.011	<0.005	<0.005	<0.005	<0.005
Zinc	*mg/L*	<0.01	<0.01	0.02	<0.01	0.04	<0.01	0.02	<0.01	0.01	0.04	0.02	<0.01	0.09

Notes:

mg/L = milligrams per liter

< = concentration below the indicated laboratory method detection limit

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Table 8-5: Chemical and Physical Properties of Sediment Samples

Sample Name	Sample Date	Coarse Fragments	Sand	Silt	Clay	USDA (Texture)	pH (s.u.)	EC (dS/m)	Saturation (%)
		%							
LJM-SW1-SED	2/25/2011	< 2	90	4	6	S	7.8	0.38	21.5
LJM-SW2-SED	2/25/2011	< 2	90	4	6	S	7.6	0.36	21.8
LJM-SW3-SED	2/25/2011	7	60	24	16	SL	7.5	0.61	27.6
LJM-SW4-SED	2/25/2011	< 2	70	16	14	SL	7.8	0.49	25.0
LJM-SW5-SED	2/28/2011	< 2	86	6	8	LS	7.9	0.39	21.5
LJM-SW6-SED	2/28/2011	< 2	92	3	5	S	7.8	0.32	21.8
LJM-SW7-SED	2/28/2011	2	90	5	5	S	7.7	0.34	22.7
LJM-SW8-SED	2/28/2011	< 2	90	4	6	S	7.9	0.29	22.4

Notes:
EC = Electrical Conductivity
saturated paste pH and EC

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Table 8-6: Selected Total Metals in Sediment Samples

Sample Name	Sample Date	As	Ba	Cd	Cr	Co	Cu	Pb	Mn	Hg	Mo	Ni	Se	Ag	U	V	Zn
LJM-SW-01-SED	2/25/2011	< 5	35	< 1	< 5	< 5	< 5	3	93	< 0.1	0.3	< 5	< 0.2	< 0.1	< 0.5	6	9
LJM-SW-02-SED	2/25/2011	< 5	33	< 1	< 5	< 5	< 5	2	91	< 0.1	0.2	< 5	< 0.2	< 0.1	< 0.5	8	8
LJM-SW-03-SED	2/25/2011	< 5	95	< 1	5	< 5	6	< 2	305	< 0.1	0.3	5	0.3	< 0.1	1.1	112	20
LJM-SW-04-SED	2/25/2011	< 5	65	< 1	< 5	< 5	< 5	3	153	< 0.1	0.3	< 5	0.2	< 0.1	0.5	9	12
LJM-SW-05-SED	2/28/2011	< 5	34	< 1	< 5	< 5	< 5	3	100	< 0.1	< 0.2	< 5	0.1	< 0.1	< 0.5	7	8
LJM-SW-06-SED	2/28/2011	< 5	23	< 1	< 5	< 5	< 5	2	78	< 0.1	< 0.2	< 5	0.1	< 0.1	< 0.5	6	6
LJM-SW-07-SED	2/28/2011	< 5	36	< 1	< 5	< 5	< 5	2	80	< 0.1	0.3	< 5	0.2	< 0.1	< 0.5	9	8
LJM-SW-08-SED	2/28/2011	< 5	35	< 1	< 5	< 5	< 5	2	80	< 0.1	0.2	< 5	0.1	< 0.1	< 0.5	8	7

Notes:

mg/kg = miligram per kilogram

< = concentration below the indicated laboratory method detection limit

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Table 8-7: Radionuclides (pCi/g -dry) in Sediment Samples

Sample Name	Sample Date	Gross Alpha	Gross Alpha precision (±)	Gross Beta	Gross Beta precision (±)	Radium 226	Radium 226 MDC	Radium 226 precision (±)	Radium 228	Radium 228 MDC	Radium 228 precision (±)
LJM-SW1-SED	2/25/2011	2.1	0.6	14.9	0.7	0.04	0.09	0.06	0.5	0.5	0.3
LJM-SW2-SED	2/25/2011	2.1	0.6	9.6	0.7	0.20	0.09	0.09	0.3	0.5	0.3
LJM-SW3-SED	2/25/2011	4.5	0.6	21.2	0.8	1.30	0.09	0.20	0.6	0.5	0.3
LJM-SW4-SED	2/25/2011	2.9	0.6	19.6	0.8	0.70	0.09	0.10	0.3	0.6	0.4
LJM-SW5-SED	2/28/2011	1.7	0.6	16.8	0.7	0.20	0.08	0.08	0.5	0.5	0.3
LJM-SW6-SED	2/28/2011	2.1	0.6	13.6	0.7	0.20	0.09	0.08	0.7	0.5	0.4
LJM-SW7-SED	2/28/2011	-0.3	0.5	9.4	0.7	0.40	0.09	0.10	0.2	0.5	0.3
LJM-SW8-SED	2/28/2011	2.1	0.6	12.8	0.7	0.20	0.10	0.09	0.1	0.6	0.4

Notes:
pCi/g = picocuries per gram

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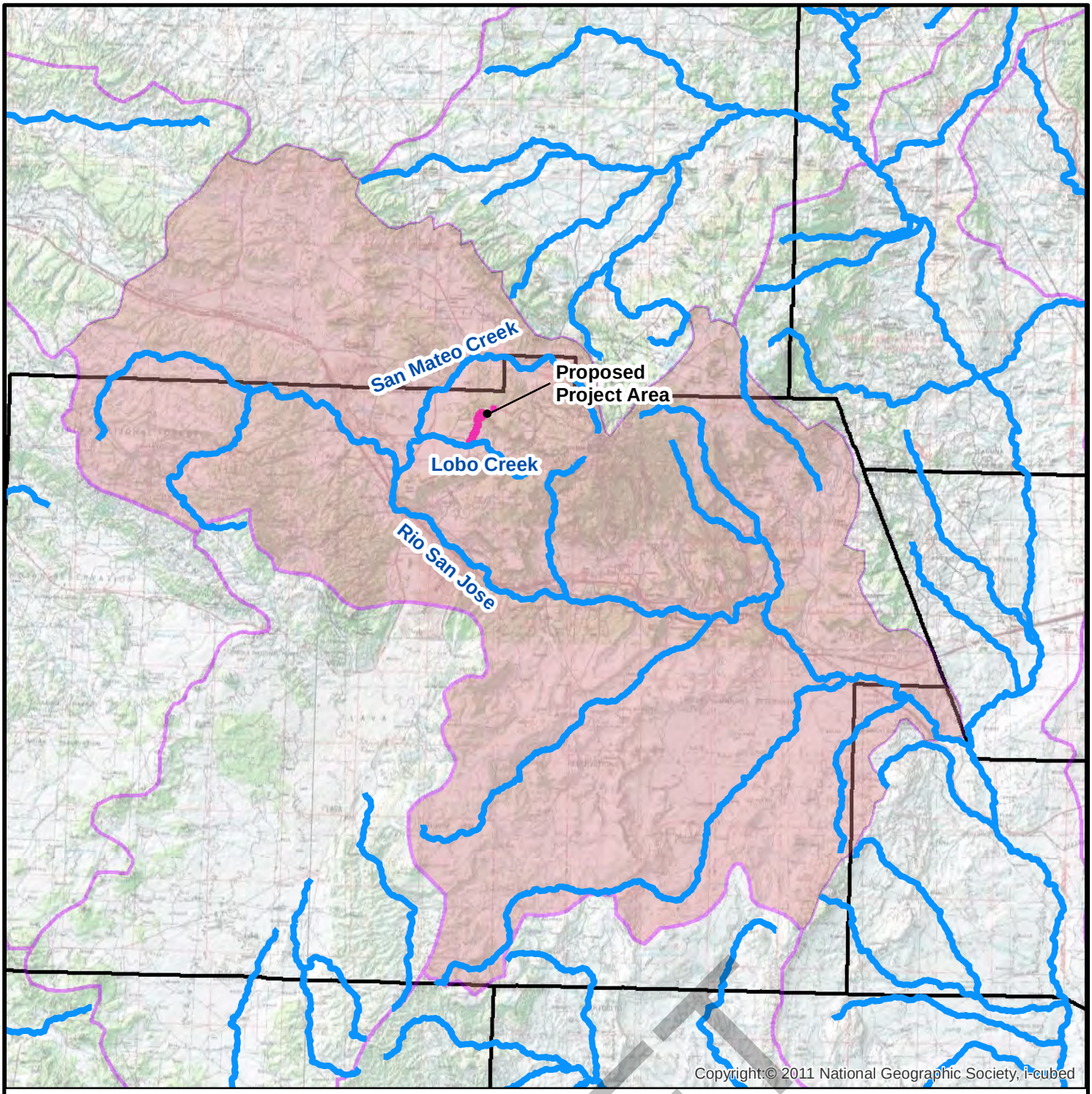
FIGURES



LEGEND

- NM Surface Waters
- NM Watersheds
- Rio San Jose Watershed - 13020207
- New Mexico Counties

N

62,500 31,250 0 62,500 Feet

SCALE 1:750,000 FEET

REFERENCES & NOTES

1. Projection: NAD 1983 UTM Zone 13N
2. Source Aerial: Bing Maps (c) 2010 Microsoft Corporation and its data suppliers
3. Figure is for illustration purposes only; NOT FOR CONSTRUCTION.

PROJECT/REPORT

LARAMIDE RESOURCES (USA) INC.
LA JARA MESA PROJECT
CIBOLA COUNTY, NEW MEXICO

TITLE

REGIONAL SURFACE WATER

Golder Associates

PROJECT No. 083-9338SI

FIGURE 8-1

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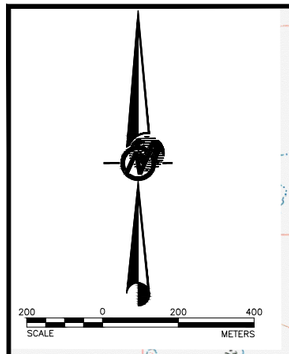
Map: W:\La Jara Mesa\Maps\Figure 8-1.mxd | Modified: 4/9/2013 12:39:58 PM | Plotted: 4/9/2013 12:40:10 PM by CHERParker



ESCAPE RAISE

PROPOSED PERMIT BOUNDARY

TERMINATION POINTS OF EPHEMERAL DRAINAGES

LJM-SW-01
LJM-SW-01-SED

LJM-SW-07-SED

LJM-SW-05-SED

LJM-SW-08-SED

LJM-SW-02
LJM-MW-02
LJM-SW-02-SED

LJM-SW-03
LJM-MW-03
LJM-SW-03-SED

LJM-SW-06-SED

LJM-SW-04
LJM-MW-04
LJM-SW-04-SED

LEGEND

- PROPOSED PERMIT BOUNDARY
- ROAD & UTILITY CORRIDOR
- WATERSHED BOUNDARY
- ESCAPE RAISE
- SAMPLE LOCATION
- SEDIMENT SAMPLE LOCATION

LJM-SW-02 STORMWATER SAMPLE
LJM-MW-02 PIEZOMETER
LJM-MW-02-SED SEDIMENT SAMPLE

PROJECT
LARAMIDE RESOURCES (USA) INC.
LA JARA MESA PROJECT
CIBOLA COUNTY, NEW MEXICO

TITLE
SURFACE WATER MONITORING AND SEDIMENT SAMPLE LOCATIONS

Golder Associates
Albuquerque, New Mexico

PROJECT No.		083-9338SI	FILE No.	Figure 8-1_Surf-Wtr
DESIGN	LM	05/05/09	SCALE	AS SHOWN
CADD	CM	03/11/13	REV.	0
CHECK	EC	03/11/13		
REVIEW	LM	03/11/13		

FIGURE 8-2

Drawing file: Figure 8-2_Surf-Wtr.dwg Apr 04, 2013 - 11:42am

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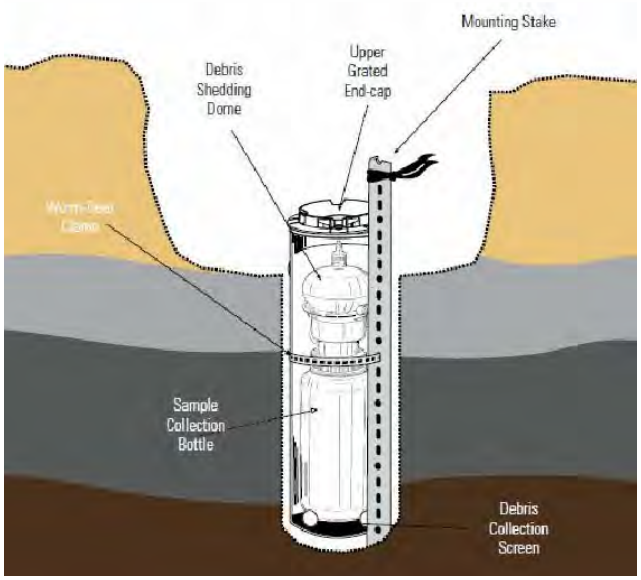

DITCH MOUNT NALGENE STORMWATER SAMPLER SCHEMATIC

NOT TO SCALE

STORMWATER SAMPLER LJM-SW-02

NOT TO SCALE

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PROJECT

LARAMIDE RESOURCES (USA) INC.
LA JARA MESA PROJECT
CIBOLA COUNTY, NEW MEXICO

TITLE

STORMWATER SAMPLER

Golder Associates
Albuquerque, New Mexico

PROJECT No.	083-9338SI		FILE No.	FIGURE8-3
DESIGN	EC	03/12/13	SCALE AS_SHOWN	REV. 0
CADD	CM	03/12/13		
CHECK	EC	03/12/13		
REVIEW	BN	03/12/13		

FIGURE 8-3

40 0 40 80
SCALE METERS

LJM-SW-01
LJM-SW-01-SED
LJM-SW-05-SED
LJM-SW-02
LJM-MW-02
LJM-SW-02-SED
LJM-SW-08-SED
LJM-SW-07-SED
LJM-SW-03
LJM-MW-03
LJM-SW-03-SED
LJM-SW-06-SED

LEGEND

- PROPOSED PERMIT BOUNDARY
- ROAD & UTILITY CORRIDOR
- WATERSHED BOUNDARY
- EPHEMERAL DRAINAGE
- SAMPLE LOCATION
- SEDIMENT SAMPLE LOCATION
- **LJM-SW-02** STORMWATER SAMPLE
- **LJM-MW-02** PIEZOMETER
- **LJM-SW-02-SED** SEDIMENT SAMPLE

DRAFT

PROJECT
LARAMIDE RESOURCES (USA) INC.
LA JARA MESA PROJECT
CIBOLA COUNTY, NEW MEXICO

TITLE
PERMIT AREA
EPHEMERAL DRAINAGES

Golder Associates
Albuquerque, New Mexico

PROJECT No.		083-93385	FILE No.	Figure 8-4
DESIGN	EC	03/12/13	SCALE AS SHOWN	REV. 0
CADD	CM	03/12/13		
CHECK	EC	03/12/13		
REVIEW	BN	03/12/13		

FIGURE 8-4

K:\2008 Projects\083-93385\ Laramide Site Investigation\GISK\Figure 8-4.mxd

ATTACHMENT 8A
SURFACE WATER PHOTOGRAPHS

La Jara Mesa Project Baseline Data Report – Surface Water Monitoring Photos	
PHOTO 1 February 25, 2011 Installing a stormwater sampler at location LJM-SW-01	
PHOTO 2 February 25, 2011 Completed stormwater sampler at location LJM-SW-02	

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PHOTO 3 August 17, 2011 Sediment burial of stormwater sampler LJM-SW-02 and debris flow	
PHOTO 4 August 17, 2011 Sediment burial of stormwater sampler LJM-SW-03 and debris flow	

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PHOTO 5 August 18, 2011 Debris flow over stormwater sampler LJM-SW-04	
PHOTO 6 September 13, 2011 Channel reworking within the ephemeral drainage at LJM-SW-02 and LJM-MW-02.	

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PHOTO 7

September 13, 2011

Channel scour and debris flow at stormwater sampler LJM-SW-02

PHOTO 8

September 13, 2011

Channel scour and evidence of flow upgradient of stormwater sampler LJM-SW-01

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PHOTO 9

September 13, 2011

Channel scour and debris flow at stormwwater sampler LJM-SW-01

PHOTO 10

LJM-SW-03
September 13, 2011

Evidence of flow at stormwater sampler LJM-SW-03

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9.0 GROUNDWATER

***New Mexico Administrative Code (NMAC) 19.10.6.602 D.(13)* (g)**

Groundwater information shall include the following:

iii. lithology and thickness of each geologic unit below the site indicating which units are water bearing, cross sections and potentiometric maps indicating the location of wells and ground water flow direction in the vicinity of the site, and references or sources for this information;

iv. a description of the aquifer characteristics including total dissolved solids concentration, maximum and minimum depths to groundwater, direction of flow and gradients, transmissivity and storativity, and a general description of ground water quality, and references or sources for this information; and

v. a determination of the probable hydrologic consequences of the operation and reclamation, on both the permit and affected areas, with respect to the hydrologic regime, quantity and quality of surface and ground water systems that may be affected by the proposed operations, including the dissolved and suspended solids under seasonal flow conditions.

9.1 Introduction

Understanding groundwater conditions in relation to mining operations are important for determining the probable hydrologic consequences of the mining activity in the proposed Permit Area and potential affected area. The La Jara Mesa Project proposed Permit Area is located in the southeastern part of the San Juan structural basin, within the Ambrosia Lake Mining District, which has been subjected to previous uranium mining and associated dewatering activities from the 1960s through the 1980s. The proposed Permit Area is located in the Bluewater Groundwater Basin (an Office of the State Engineer designated administrative basin), which is a fully appropriated (from a water rights standpoint) sub-basin of the Middle Rio Grande Basin.

The proposed Permit Area is in unsaturated rocks, situated as much as 600 feet above the shallowest regional aquifer in the area. The proposed mine surface facilities, portal, and waste rock pile would be several hundred feet above any potential significant saturated horizons. The proposed underground mine would be advanced beneath La Jara Mesa through unsaturated rocks to access ore deposits in sandstone of the Poison Canyon Member of the Morrison Formation. These proposed mine workings would therefore be hundreds of feet above any regional aquifer, if present beneath the site. The anticipated dry mine conditions is based on exploratory drilling at the site and research and study of regional groundwater conditions in the area.

The objectives of the groundwater baseline assessment included: 1) describing the groundwater regime in the proposed Permit Area and potentially affected area, with emphasis on identifying the character and location of water-bearing units and the direction of groundwater flow; and 2) developing a baseline

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inventory of wells, springs, and groundwater uses within 1 mile, or reasonable radius, from the surface facility portion of the proposed Permit Area (Plate 2).

9.2 Hydrogeologic Regime

There is an extensive amount of groundwater data available for the San Juan Basin. Both the geology and hydrogeology in the La Jara Mesa region have been described in several published reports, including Kelley (1963), Baldwin and Rankin (1995), Lucas and others (1999), and Lucas and others (2003). A regional geologic map with the location of the proposed Permit Area is provided on Plate 3. Published investigations of groundwater and hydrogeologic conditions have been prepared by Gordon (1961), Cooper and John (1968), Stone and others (1983), Frenzel (1992), Kernodle (1996), and Craigg (2001). Regional geologic mapping of the Grants area was originally completed by Thaden and others (1967a and 1967b) and Chapman, Wood and Griswold, Inc. (1979) and was recently updated by Cather (2011).

The hydrogeologic regimes in the proposed Permit Area and potential affected area are discussed using the aforementioned publications, geologic maps and cross-sections, well records, as well as recent exploration borehole drilling program in support of the La Jara Mesa Project (Laramide Resources (USA) Inc. [Laramide], 2008). Groundwater information was also obtained from a recent report associated with on-going environmental monitoring at the Homestake Mill (Homestake Mining Company of California [Homestake], 2010) located approximately 5 miles southwest of the proposed mine site. More recently, John Shomaker & Associates, Inc. prepared a groundwater supply report for Laramide that provides an overview of the regional hydrogeologic setting at La Jara Mesa.

9.2.1 Regional Hydrogeology

The Permit Area is located in the central portion of the Grants Uranium Belt. It extends from near the Rio Grande River on the east to the Gallup area to the west. Structurally, it crossed the Zuni uplift and the Chaco slope, which is the southern flank of the Rio San Juan structural basin. The Grants Uranium Belt also extends beneath Mt. Taylor, where it crosses the Acoma sag.

This region has been the subject of several minor and one major deformation since Morrison (Jurassic age; Kelley, 1963). The first deformation occurred shortly following the Morrison Formation deposition and created minor folding in the Ambrosia Lake area. The major deformation in the region occurred in the Late Cretaceous-Early Tertiary, and is referred to as the Laramide Orogeny, which gave rise to the Zuni uplift, the San Juan Basin, and the Acoma embayment. In this time, principal folds and faults in the Grants and Ambrosia Lake region were developed and the northerly dips of the sedimentary strata were established.

The next stage of significant structural deformation began in Pliocene time with the development of the Rio Grande Rift. The Mt. Taylor eruptions developed their modern aspect in late Pliocene time. The

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Mount Taylor volcanic center is part of a larger, northeast-trending volcanic field that includes Mesa Chivato, a broad plateau located northeast of Mt. Taylor. Basalt that caps Mesa Chivato and other mesas surrounding Mt. Taylor (including La Jara Mesa) make up about 80 percent of the volume of the volcanic field (Perry et al., 1990). The Mt. Taylor volcanic field lies on the southern flank of the San Juan Basin on the Colorado Plateau and straddles the extensional transition zone between the Colorado Plateau and the Rio Grande rift. It is considered part of the Jemez lineament, a zone of volcanism aligned along a Precambrian suture in the Earth's crust.

Historical and recent exploratory drilling in support of the La Jara Mesa Project determined the strata beneath the proposed Permit Area represent the same sequence of lithology as found in the San Juan structural basin. Similarly, the hydraulic characteristics and groundwater quality of the proposed Permit Area are within the ranges described for other groundwaters in the San Juan Basin identified in previous studies.

Groundwater flow in the southern San Juan Basin is thought to be generally toward the interior of the basin to the north and upward from deeper parts of the aquifer where artesian conditions exist. Gordon (1961) constructed a pre-development potentiometric surface of the alluvial and bedrock aquifers in the Grants and Bluewater region. While water-levels near the towns of Grants and Milan have likely changed due to groundwater development, and water levels at Homestake are influenced by current remediation activities, the Gordon potentiometric surface provides a good indication of the groundwater flow direction in the proposed Permit Area, due to limited groundwater development. The pre-development potentiometric surface suggests regional groundwater in this area flows to the southwest. In contrast, groundwater that is recharged from precipitation that falls on top of La Jara Mesa appears to flow to the north and east, as evidenced by the numerous springs located along the east side of the mesa.

The most significant aquifer in the region is the San Andres-Glorieta Aquifer, which receives recharge along the northern flank of the Zuni Mountains. The Zuni uplift has exposed the San Andres-Glorieta Aquifer system in outcrop over a relatively wide area approximately 10 miles southwest of the proposed Permit Area. Recharge to this aquifer moves down-dip, generally from south to north. The overlying Chinle Formation (consisting largely of low-permeability shales) act as confining beds to water within the aquifer, and an artesian pressure is developed. The water level in wells completed in this unit rise above the top of the system, sometimes reaching the surface and creating a flowing well. The geometry of the San Andres-Glorieta Aquifer and potentiometric surface in the vicinity of the project site are depicted on the hydrogeologic cross section in Plate 4.

9.2.2 Permit Area Hydrogeology and Aquifer Characteristics

Potential water-bearing geologic units near the proposed Permit Area include the shallow Quaternary alluvial deposits, Entrada Sandstone, Sonsela sandstone, or fractured shale of the Triassic Chinle

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Formation, and limestone and sandstone beds of the Permian San Andres Limestone and Glorieta Sandstone (San Andres-Glorieta Aquifer). The closest supply wells to the proposed Permit Area produce water from Entrada Sandstone and San Andres-Glorieta Aquifer. An inventory of the known wells within a 1-mile radius of the surface facilities in the proposed Permit Area was performed (Figure 9-1). The baseline monitoring well locations are shown on Figure 9-2. Pertinent characteristics of the aquifers and groundwater quality were determined and described using the historical well data and water quality data collected at the baseline monitoring well locations. The hydrostratigraphy of area is presented in Table 9-1 and the hydrogeologic cross section included on Plate 4. Table 9-1 provides descriptions and water-bearing potentials of the geologic units at the proposed Permit Area.

The US Environmental Protection Agency (EPA) and New Mexico Environment Department Water Quality Control Commission (WQCC; 20.6.23103 NMAC) regulate a number of organic and inorganic constituents that may be found in drinking water (Table 9-2). Groundwater samples collected from the baseline monitoring well locations were analyzed for the parameters listed in Table 9-2. The analytical results and a description of each of the water-bearing units at the proposed Permit Area are described below.

9.2.2.1 Quaternary Alluvium

Several wells southwest of the proposed Permit Area are completed in unconsolidated alluvium; locations of these wells are shown on the Figure 9-1. No yield or water quality data is available for these wells; however, depths are 100 feet or less. These units are expected to be generally limited spatially to the drainage areas and have thin saturated thicknesses, which would not provide a reliable supply of water. Water in these deposits is also expected to be ephemeral.

Three shallow piezometers were installed in the alluvium within the Permit Area watershed boundary, but no water was encountered at these wells during the baseline monitoring period (Section 8.0 – Surface Water).

9.2.2.2 Todilto Limestone

There are no wells in the area that produce water from the Todilto Limestone, which underlies the Permit Area. The Todilto near the Permit Area is about 25 to 35 feet thick and composed largely of lime mudstone and gypsiferous limestone reef deposits. In some areas this unit hosts uranium mineralization. The unit overlies the Entrada Sandstone.

9.2.2.3 Entrada Sandstone Aquifer

The Entrada Sandstone is the shallowest geologic unit yielding groundwater to wells south of the proposed Permit Area and the unit may potentially contain groundwater beneath the Permit Area. If present, the groundwater in this unit would be under water-table conditions. The estimated depth to the

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Entrada Sandstone where surface facilities will be located is about 320 feet and the depth to water, if present, would be greater. Depths to this formation are greater beneath the mesa due the higher elevation of the mesa and northeastward dip of the formation. South of the proposed Permit Area the Entrada Sandstone contains sufficient saturation to provide water for livestock use.

The closest well, Elkins well (well B-1272), is located approximately 3 miles southwest of the site (Figure 9-1) and is completed in the Entrada Sandstone aquifer (John Shomaker & Associates, Inc., 2009a and 2009b). Water produced from this well complies with WQCC groundwater standards (Tables 9-3 and 9-4). The total dissolved solids (TDS) concentration at the well ranges from 500 and 520 milligrams/liter (mg/L). The water was a calcium-sulfate type . The water produced from the well complies with EPA Maximum Contaminant Level (MCL) drinking water standards with the exception of arsenic (MCL = 0.01 mg/L), which ranges from 0.0107 to 0.0115 mg/L, and some radioactive constituents, including radon 307 picocuries per liter (pCi/L), radium (isotopes 226 + 228) 5.49 pCi/L, and gross alpha activity 23.2 pCi/L (Table 9-5).

The New Mexico Office of the State Engineer (OSE) record for the Elkins well indicates it is completed in gravelly sandstones between 70 and 155 feet below grade and produces 25 gallons per minute (gpm) or 36,000 gallons per day. John Shomaker & Associates (2009b) estimated the specific capacity of the well at 0.49 gpm per foot and a transmissivity of 51.5 feet squared per day.

9.2.2.4 Sandstone Beds of the Chinle Formation

Deeper sandstone beds (if present) within the middle and lower portions of the Chinle Group may also contain groundwater, if they are present. The sandstone beds represent paleo-fluvial system deposits and are therefore, discontinuous both vertically and laterally. Chinle sandstone beds in the area of the former Homestake Mill site, located several miles southwest of La Jara Mesa (Homestake, 2010), yield water to wells. These beds, if present in the subsurface near the Permit Area, would be expected to be under confined conditions and may yield quantities of water to wells, although potential yields and sustainability are unknown. The top of the Chinle Formation is projected at a depth of approximately 450 feet below the Permit Area.

Several wells in the vicinity of the proposed Permit Area are completed in the upper portion of the Chinle Formation; locations of these wells are shown on Figure 9-1. Depths of these wells range from 91 feet to 200 feet; water levels range from 46 feet to 85 feet below grade (Stone et al., 1983). No yields for these wells were reported by Stone and others (1983). The quality of water from upper Chinle wells in the area is variable, with estimated TDS ranging from approximately 16,000 mg/L to 550 mg/L, based upon electrical conductance data reported by Stone and others (1983). Uranium concentrations in wells representing ambient conditions in the former Homestake Mill site area vary spatially and have ranged

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from less than 0.0003 to 0.106 mg/L. Radium concentrations have ranged from less than 1.0 to 7.6 pCi/L (Homestake, 2010).

9.2.2.5 San Andres-Glorieta Aquifer

The principal source of reliable potable groundwater in this region is the San Andres-Glorieta Aquifer, a confined aquifer system (White and Kelly, 1989). This unit generally provides adequate water for domestic and stock wells and is locally a prolific producer where karst features or structural shearing conditions are present, particularly closer to outcrop areas in the Grants-Milan area. The San Andres Limestone and underlying Glorieta Sandstone are generally hydraulically connected and behave as a single hydrologic unit. The San Andres-Glorieta Aquifer is present at a depth of about 1,800 feet. White and Kelly (1989) estimated the thickness of the San Andres Limestone and Glorieta Sandstone at 25 and 50 feet, respectively, in the proposed Permit Area. Analytical data for the groundwater samples collected during the baseline study are shown on Tables 9-3, 9-4, and 9-5. Baseline data were collected from two wells completed in the San Andres-Glorieta Aquifer, B-1771 and B-1458 (Figure 9-1). Analytical reports are included in Appendix B. The TDS concentrations at these two wells are between 1,130 and 2,150 mg/L (Table 9-3), which is above the WQCC standards. The water quality at well B-1771 may be influenced by groundwater from basal sandstone units of the Chinle. Well B-1771 appears to be screened in the San Andres-Glorieta Aquifer; however, the annular space of this well was backfilled with pea gravel (Attachment 9A), allowing for cross-communication between groundwater in the Chinle and San Andres-Glorieta aquifers. Samples from well B-1458 also have higher concentrations of chloride (>250 mg/L) and sulfate (>600 mg/L) higher than standards (Table 9-3). Boron concentrations in samples from both San Andres-Glorieta wells are higher than the WQCC standard, ranging from 1.81 to 2.42 mg/L (Table 9-4). Radioactive constituents, including uranium 0.0304 mg/L (B-1771), radon 350 to 1,100 pCi/L, radium (isotopes 226 + 228) 5.29 pCi/L (B-1771), and gross alpha activity 21 to 28 pCi/L (Table 9-5) are above the EPA MCL standards.

Prolific production has been noted from the San Andres-Glorieta Aquifer in the region, particularly closer to recharge areas where cavernous permeability has developed. Production exceeding 1,500 gpm was obtained from two wells completed in the San Andres-Glorieta Aquifer approximately 5 miles west of the Permit Area in Sections 23 and 26 of Township 12 North Range 10 West (US Department of Agriculture [USDA] Forest Service, 2012).

Water from the San Andres-Glorieta Aquifer is invariably very hard, from a potable water standpoint, due to the calcium, magnesium, and bicarbonate concentrations, and would typically need some form of treatment if used for drinking water, although it is suitable for many other uses. Uranium concentrations in wells near the former Homestake Mill, which represent ambient conditions, have ranged from less than 0.01 to 0.25 mg/L (Table 9-4). The WQCC standard for uranium in groundwater is 0.03 mg/L. Radium concentrations in these same wells have ranged from less than 1.0 to 3.05 pCi/L (Homestake, 2010).

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9.3 Probable Hydrologic Consequences

The proposed La Jara Mesa Project is expected to be a dry mine based on observations made during the implementation of the exploration borehole program and its stratigraphic position in the La Jara Mesa escarpment (Laramide, 2008). Exploration boreholes were advanced through several geologic units to the uranium mineralization of the Poison Canyon Member of the Morrison Formation. Groundwater under saturated conditions was not observed in any of the boreholes. The sedimentary rocks in the mesa also tend to dip toward the north, which would allow any water that may be present from surface recharge at the top of the mesa, to move to the north away from the proposed Permit Area.

Quaternary alluvium along the base of the mesa and under the proposed Permit Area is unsaturated. Shallow, hand dug, alluvial piezometers installed at the site to support a baseline characterization study (Golder, 2009) remained dry during four quarters of monitoring in 2010.

During development and mining, groundwater for the Project is anticipated to be pumped from the Entrada Sandstone aquifer and supplemented by pumping from deeper Chinle Sandstone aquifer or by pumping the entire amount from the deeper San Andres-Glorieta aquifer. During the development, Phase 1, the pumping rate would be 34,500 gpd. During the mining, Phase 2, it would be 50,000 gpd. If this supply is pumped from the shallower Entrada/Chinle for the anticipated 20 years of mine life, the additional drawdown in the nearest pumping well, which is at a radial distance of 4,700 feet, is estimated to be about 2 feet. If the supply is pumped from the deeper confined San Andres-Glorieta aquifer, the additional drawdown at this same radial distance at the nearest well is less, estimated to be on the order of 0.15 foot (2 inches). There are no surface-water bodies in hydrologic connection with these aquifers within 3 miles of the proposed Permit Area; therefore, the pumping of groundwater for water supply would not have any measurable effect on surface waters during the life of the mine, including any effect on San Mateo Creek.

The mining operations are not expected to have any water quality impacts to aquifers in the proposed Permit Area because the mine workings will be entirely in unsaturated rocks, no processing solutions will be used, and the ore will be segregated and contained on-site before being hauled offsite to a licensed mill. Water supply for the mine will come from an offsite production well and the use of water at the mine will be restricted to drilling uses for cooling and lubricating, underground and surface dust control, and for sanitary uses by the mine workers.

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TABLES

Table 9-1: La Jara Mesa and Vicinity Hydrostratigraphy

Age	Geologic Unit	Geologic Subunit	Thickness (feet)	Lithologic Description	Water-Bearing Potential	Reference
Quaternary	alluvium, colluvium, talus, landslide and dune sand	--	0 - 140	unconsolidated sediments	Unsaturated	Thaden et al. (1967)
Tertiary	basalt	--	85 - 110	basaltic lava flows	Unsaturated	Thaden et al. (1967)
	rhyolitic tuff	--	190 - 230	ash flow tuff	Unsaturated	Thaden et al. (1967)
Cretaceous	Mancos Shale	--	150 - 200	dark-gray, friable silty shale with minor thin light-brown sandstone and dark-gray fissle shale beds	Unsaturated	Thaden et al. (1967)
	Dakota Sandstone	--	40 - 90	pale yellowish-brown, moderate-orange, and light-gray fine- and medium-grained sandstone	Unsaturated	Thaden et al. (1967)
Jurassic	Morrison Formation	Brushy Basin Member (includes the Poison Canyon Sandstone beds)	100 - 180	grayish-green sandstone with minor lenticular light- and yellowish-gray fine- and medium-grained sandstone	Unsaturated	Thaden et al. (1967)
		Westwater Canyon Member	80 - 100	light-, yellowish- and reddish-gray fine- and medium-grained sandstone, minor light-greenish-gray lenticular mudstone	Unsaturated	Thaden et al. (1967)
		Recapture Shale Member	50	variegated claystone, siltstone, and sandstone, crossbedded, even-bedded, and structureless	Unsaturated	Thaden et al. (1967)
	Bluff Sandstone	--	235 - 370	yellow fine-grained well-sorted friable sandstone; crossbedded in upper part, even-bedded in lower few feet	Unsaturated	Thaden et al. (1967)
	Summerville Formation	--	160 - 270	white, maroon and pale-brown fine- to very-fine-grained clayey and silty sandstone interbedded with dark-brown claystone and siltstone	Unsaturated	Thaden et al. (1967)
	Todilto Limestone	--	25 - 35	pale-olive-gray, dark-olive-brown, and pale-yellow limestone, thick bedded to coarsely crystalline in top part, crinkly bedded in middle part, and platy bedded at base	Unsaturated	Thaden et al. (1967)
	Entrada Sandstone	--	150 - 185	moderate-brown fine-grained crossbedded sandstone in upper part, medial silty sandstone in lower part	Saturated, 5-20 gpm in well south of proposed project site - water table conditions	Thaden et al. (1967)

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Table 9-1: La Jara Mesa and Vicinity Hydrostratigraphy

Age	Geologic Unit	Geologic Subunit	Thickness (feet)	Lithologic Description	Water-Bearing Potential	Reference
Triassic	Wingate Sandstone	--	150 - 185	sandstone	Saturated, 5-20 gpm in well south of proposed project site - water table conditions	Heckert and Lucas (2003)
	Chinle Group	Rock Point Formation	1,000 - 1,600	dark-purplish-red and pale-bluish-gray limy siltstone interbedded with olive-gray to dark-greenish-gray silty limestone in upper 180 ft; reddish-brown even-bedded siltstone in lower 150 ft	Confining hydrologic unit	Heckert and Lucas (2003)
		Owl Rock Formation		reddish-brown even-bedded siltstone	Confining hydrologic unit	Heckert and Lucas (2003)
		Petrified Forest Formation (includes when present Sonsela Sandstone beds)		white, blue, purple and brown claystone; Sonsela Sandstone = white, buff, yellow and brown crossbedded clayey conglomeratic sandstone	Confining hydrologic unit	Heckert and Lucas (2003)
		Bluewater Creek Formation		variegated clayey and sandy siltstone interbedded with lenticular white, yellow, purple, and brown crossbedded conglomeratic sandstone	Confined water-bearing sandstone units laterally discontinuous, present near former Homestake Mill site	Heckert and Lucas (2003)
Permian	San Andres Formation and Glorieta Sandstone	--	75	Grayish-yellow and brown to red dense limestone interbedded with yellow fine- to medium-grained crossbedded sandstone in upper part	Confined aquifer- San Andres and Glorieta Sandstone(where present) are treated as a single hydrostratigraphic unit - regional in extent	White and Kelly (1989)

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Table 9-2: Water Quality Sample Analytical Suite, Methods, and Detection Limits

Dissolved Analyte	WQCC Standards Groundwater (mg/L or as noted)	EPA MCL (mg/L or as noted)	EPA Analytical Method	Detection Limit (mg/L or as noted)
Alkalinity	N.A.	N.A.	SM2320B	2
Aluminum	5	N.A.	EPA 200.7	0.03
Antimony	N.A.	0.006	EPA 200.8	0.0004
Arsenic	0.1	0.01	EPA 200.8	0.0005
Barium	1	2	EPA 200.7	0.003
Boron	0.75	N.A.	EPA 200.7	0.01
Cadmium	0.01	0.005	EPA 200.8	0.0001
Calcium	N.A.	N.A.	EPA 200.7	0.2
Chloride	250	N.A.	SM4500Cl-E	1
Chromium	0.05	0.1	EPA 200.8	0.0005
Cobalt	0.05	N.A.	EPA 200.8	0.01
Copper	1	1.3	EPA 200.8	0.01
Cyanide	0.2	0.2	335.4	0.005
Fluoride	N.A.	4	SM4500F-C	0.1
Iron	1	0.3	EPA 200.7	0.02
Lead	0.05	0.015	EPA 200.8	0.0001
Magnesium	N.A.	N.A.	EPA 200.7	0.2
Manganese	0.2	0.05	EPA 200.7	0.005
Mercury	0.002	0.002	EPA 200.8	0.0002
Molybdenum	1	N.A.	EPA 200.8	0.0005
Nickel	0.2	0.1	EPA 200.8	0.0006
Nitrate, as N	10	10	353.2	0.02
Potassium	N.A.	N.A.	EPA 200.7	0.3
Selenium	0.05	0.05	EPA 200.8	0.0001
Silicon	N.A.	N.A	EPA 200.8	0.2
Sodium	N.A.	N.A	EPA 200.7	0.3
Sulfate	600	250	D516-02	40
TDS	1000	N.A.	SM2540C	10
Zinc	10	5	EPA 200.7	0.01
pH	6.0-9.0 s.u.	6.5-8.5 s.u.	SM4500H+ B	0.1 s.u.
Uranium	0.03	0.03	EPA 200.8	0.0005
Vanadium	N.A.	N.A.	EPA 200.7	0.01
Gross Alpha	N.A.	15 pCi/L	EPA 900.0	1.0 pCi/L
Gross Beta & Photon	N.A.	4 mrem/yr	EPA 900.0	4.0 piC/L
Radium-226 + 228	30.0 pCi/L	5.0 pCi/L	903.1 / 904.0	1.0 pCi/L
Radon-222	N.A.	300 pCi/L	SM7500-RN	200.0 pCi/L

Notes:
WQCC = New Mexico Water Quality Control Commission, 20.6.2.3103 NMAC Standards
US Environmental Protection Agency (EPA) maximum contaminant level (MCL)
s.u. = standard units
mg/L = milligrams per liter
pCi/L = picocuries per liter
TDS = total dissolved solids
EPA beta particle standard = 4 millirems per year equivalent to 50 pCi/L (EPA, 2002)
EPA MCL is for combined Ra-226 and Ra-228.

DRAFT

Table 9-3: Water Quality Major Constituents (mg/L unless otherwise noted)

Well and Sample ID	Aquifer	Collection Date	pH s.u.	TDS	Ca	K	Mg	Na	Cl	F	SO_4	Alkalinity, as $CaCO_3$	Silica	Nitrate, as N
B-1458	San Andres-Glorieta	2/24/2011	8.6	**2150**	13	2.9	0.8	746	**510**	2	**600**	254	11	0.02
B-1458	San Andres-Glorieta	6/23/2011	8.5	**2130**	12	0.8	0.8	765	**540**	2	**660**	261	12	0.07
B-1458	San Andres-Glorieta	2/21/2012	8.5	**2060**	12	1.5	1.2	738	**530**	2.1	590	288	11.6	0.22
B-1771	San Andres-Glorieta	2/24/2011	8.9	**1140**	3.8	1.6	<0.2	406	65	1.9	400	245	9.2	0.052
B-1771	San Andres-Glorieta	6/23/2011	8.9	**1130**	3.4	0.5	<0.2	397	66	1.8	460	297	9.7	0.42
B-1771	San Andres-Glorieta	2/21/2012	8.9	**1120**	3.3	0.8	0.4	388	68	1.9	460	306	9.6	0.58
B-1771	San Andres-Glorieta	2/21/2012D	8.9	**1120**	3.2	0.8	0.4	390	68	1.9	460	306	9.7	0.61
B-1272	Entrada	5/21/2009	7.7	520	63	1	8.46	98	32	1.5	160	180	--	5.5
B-1272	Entrada	2/24/2011	8.3	500	67	1.4	8.5	103	31	1.5	130	176	21.2	5.29
B-1272	Entrada	5/25/2011	8.3	510	63	1.1	8.1	100	33	1.5	148	180	20.4	5.5
Homestake #1 Deep Well	San Andres	8/27/2008	7.47	**1970**	244	13	80.6	318	224	--	**738**	585	--	1
Homestake #2 Deep Well	San Andres	8/27/2008	7.51	**1900**	251	12	81.8	272	216	--	**719**	512	--	4.8
Homestake DD	San Mateo Alluvium	5/4/2009	7.28	**2760**	347	<6	87.8	309	63	--	**1560**	372	--	4.4
Homestake DD2	San Mateo Alluvium	5/4/2009	7.31	**2350**	298	<6	73.2	262	60	--	**1330**	373	--	<0.1
Homestake 950	San Mateo Alluvium	5/6/2009	8.02	**2090**	86	3.2	18.8	613	94	--	**1180**	251	--	7.1
Homestake 934	Chinle Upper Sandstone	6/23/2009	8.1	**1870**	13	1.2	2.3	718	191	--	**695**	670	--	1.4
Homestake CW1	Chinle Middle Sandstone	6/23/2009	8.5	**1380**	6.6	1.2	1.2	515	64	--	**636**	360	--	1.3
Homestake CW29	Chinle Lower Sandstone	6/15/2009	7.63	**1580**	124	5	33.7	324	134	--	**703**	300	--	2.9

Notes:

Homestake well data obtained from 2009 annual monitoring report and performance review (Homestake and Hydro-Engineering, 2010)

-- = not measured or reported

Bold values are equal to or above the indicated standard.

mg/L = milligrams per liter

pCi/L = picocuries per liter

s.u. = standard unit

< concentration below the indicated laboratory method detection limit

DRAFT

Table 9-4: Water Quality - Minor Constituents

Well and Sample ID	Aquifer	Collection Date	Al	Sb	As	Ba	B	Cd	Cr	Co	Cu	Fe	Pb	Mn	Hg	Mo	Ni	Se	U	V	Zn	CN
			mg/L																			
B-1458	San Andres-Glorieta	2/24/2011	0.07	<0.0008	<0.001	0.01	**2.38**	<0.0002	<0.001	<0.0001	<0.001	<0.04	<0.0002	0.03	<0.0002	0.037	<0.001	0.0002	0.0009	<0.01	<0.02	<0.003
B-1458	San Andres-Glorieta	6/23/2011	<0.03	<0.0008	0.001	0.009	**2.42**	<0.0002	<0.001	0.0001	0.001	<0.02	0.0011	0.013	<0.0002	0.037	<0.001	<0.0002	0.0009	<0.005	<0.01	<0.003
B-1458	San Andres-Glorieta	2/21/2012	<0.06	<0.0008	<0.001	0.008	**2.34**	<0.0002	<0.001	<0.0001	<0.001	<0.04	<0.0002	<0.01	<0.0002	0.043	<0.001	<0.0002	0.001	<0.01	<0.02	<0.003
B-1771	San Andres-Glorieta	2/24/2011	<0.03	<0.0004	0.0064	0.009	**1.31**	<0.0001	<0.0005	<0.00005	0.001	<0.02	<0.0001	<0.005	<0.0002	0.0092	<0.0006	0.0277	0.0286	0.018	<0.01	<0.003
B-1771	San Andres-Glorieta	6/23/2011	<0.03	<0.0004	0.0079	0.006	**1.25**	<0.0001	<0.0005	0.00011	0.0011	<0.02	0.0003	<0.005	<0.0002	0.0102	<0.0006	0.0314	0.0291	0.02	<0.01	<0.003
B-1771	San Andres-Glorieta	2/21/2012	<0.03	<0.0004	0.0061	0.007	**1.18**	<0.0001	<0.0005	<0.00005	<0.0005	<0.02	0.0002	<0.005	<0.0002	0.0098	<0.0006	0.0333	**0.0304**	0.021	<0.01	0.006
B-1771	San Andres-Glorieta	2/21/2012D	<0.03	<0.0004	0.0059	0.008	**1.2**	<0.0001	<0.0005	<0.00005	0.0005	<0.02	0.0002	<0.005	<0.0002	0.0093	<0.0006	0.0337	0.0283	0.02	<0.01	<0.003
B-1272	Entrada	5/21/2009	0.0073	<0.00010	**0.0115**	0.064	0.256	<0.0000	<0.0005	<0.0005	<0.0005	<0.050	0.00017	<0.0005	<0.0002	0.0067	<0.0005	0.0117	0.0186	--	0.0198	--
B-1272	Entrada	2/24/2011	<0.03	<0.0004	**0.0111**	0.059	0.25	<0.0001	<0.0005	0.00011	<0.0005	<0.02	<0.0001	<0.005	<0.0002	0.006	0.0006	0.0124	0.0198	0.031	<0.01	<0.003
B-1272	Entrada	5/25/2011	<0.03	<0.0004	**0.0107**	0.057	0.25	<0.0001	<0.0005	0.00018	<0.0005	<0.02	0.0006	<0.005	<0.0002	0.0061	<0.0006	0.0124	0.0169	0.031	<0.01	<0.003
Homestake #1 Deep Well	San Andres	8/27/2008	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.03	--	0.013	0.0073	--	--	--
Homestake #2 Deep Well	San Andres	8/27/2008	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.03	--	0.007	0.0155	--	--	--
Homestake DD	San Mateo Alluvium	5/4/2009	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.03	--	0.035	**0.168**	<0.01	--	--
Homestake DD2	San Mateo Alluvium	5/4/2009	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.03	--	<0.0050	**0.246**	<0.01	--	--
Homestake 950	San Mateo Alluvium	5/6/2009	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.03	--	**0.291**	**0.187**	--	--	--
Homestake 934	Chinle Upper Sandstone	6/23/2009	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.03	--	0.009	**0.0424**	--	--	--
Homestake CW1	Chinle Middle Sandstone	6/23/2009	--	--	--	--	--	--	--	--	--	--	--	--	--	0.04	--	0.046	**0.0898**	--	--	--
Homestake CW29	Chinle Lower Sandstone	6/15/2009	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.03	--	**0.103**	**0.272**	--	--	--

Notes:
Homestake well data obtained from 2009 annual monitoring report and performance review (Homestake and Hydro-Engineering, 2010)
-- = not measured or reported
Bold values are equal to or above the indicated standard.
mg/L = milligrams per liter

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Table 9-5: Water Quality - Radionuclides

Well and Sample ID	Aquifer	Collection Date	Gross Alpha	Gross Beta	Ra-226	Ra-228	Rn-222
			pCi/L				
B-1458	San Andres-Glorieta	2/24/2011	-1.6	3.4	0.26	1.2	**870**
B-1458	San Andres-Glorieta	6/23/2011	13	5.6	0.03	1.5	**570**
B-1458	San Andres-Glorieta	2/21/2012	4	6.5	0.26	0.58	**1100**
B-1771	San Andres-Glorieta	2/24/2011	**21**	8.6	**0.09**	**5.2**	**350**
B-1771	San Andres-Glorieta	6/23/2011	13	5.6	0.03	1.5	**570**
B-1771	San Andres-Glorieta	2/21/2012	**28**	5	<0.22	0.12	**540**
B-1771	San Andres-Glorieta	2/21/2012D	**23**	6.9	0.66	0.23	**480**
B-1272	Entrada	5/21/2009	**23.2**	4.51	-0.257	0.594	**307**
B-1272	Entrada	2/24/2011	12	4.4	**0.29**	**5.2**	250
B-1272	Entrada	5/25/2011	**16**	3.3	0.02	0.23	280
Homestake #1 Deep Well	San Andres	8/27/2008	--	--	0.04	--	--
Homestake #2 Deep Well	San Andres	8/27/2008	--	--	0.07	--	--
Homestake DD	San Mateo Alluvium	5/4/2009	--	--	-0.1	-0.08	--
Homestake DD2	San Mateo Alluvium	5/4/2009	--	--	0.12	-0.1	--
Homestake 950	San Mateo Alluvium	5/6/2009	--	--	-0.08	--	--
Homestake 934	Chinle Upper Sandstone	6/23/2009	--	--	-0.07	--	--
Homestake CW1	Chinle Middle Sandstone	6/23/2009	--	--	-0.05	--	--
Homestake CW29	Chinle Lower Sandstone	6/15/2009	--	--	0.15	--	--

Notes:

Homestake well data obtained from 2009 annual monitoring report and performance review (Homestake and Hydro-Engineering

-- = not measured or reported

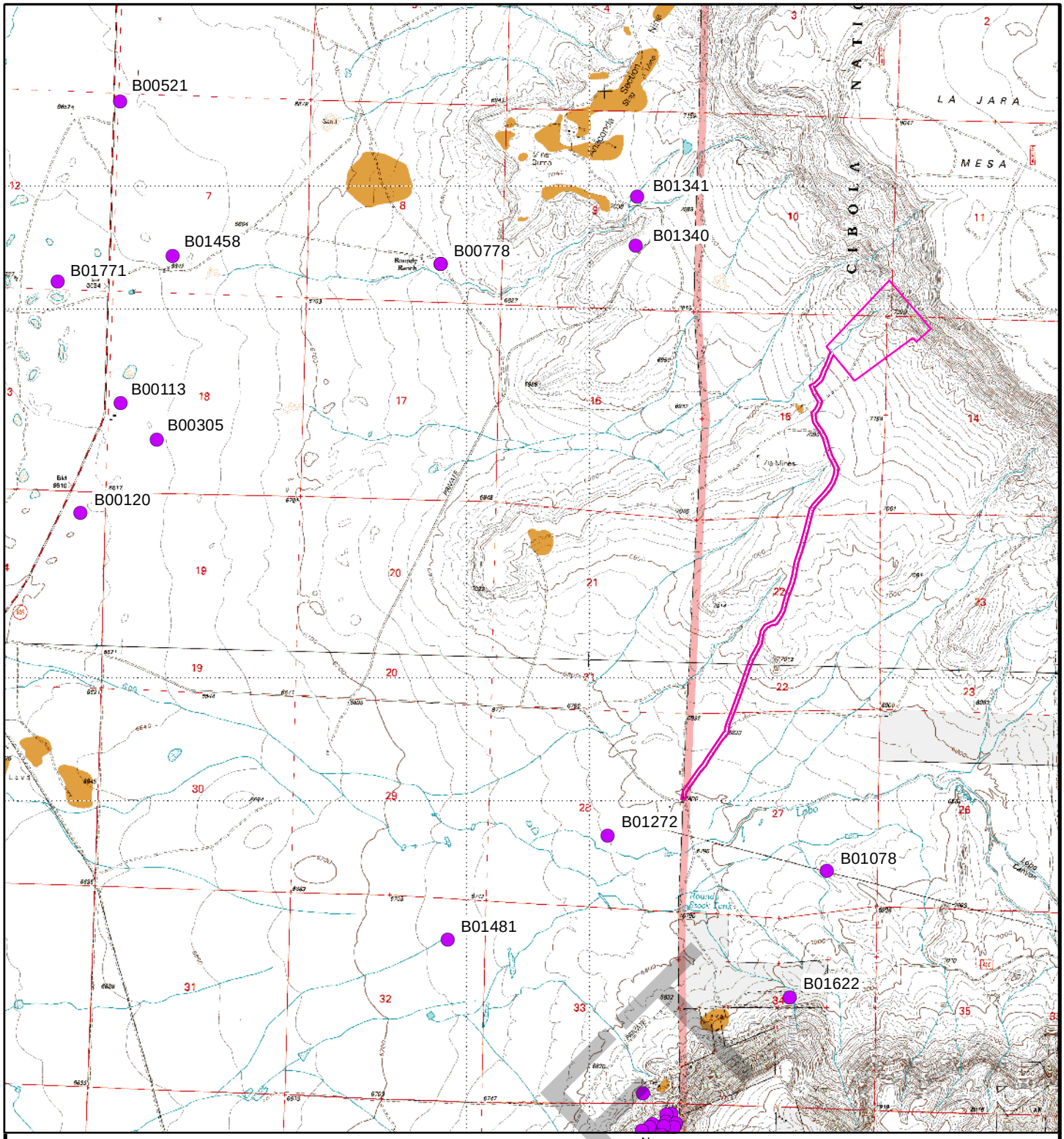
Bold values are equal to or above the indicated standard.

pCi/L = picocuries per liter

s.u. = standard unit

DRAFT

FIGURES



LEGEND

B01272 — OSE designation

Well location

Road and utility corridor

Proposed Permit Boundary

Note:
Permits for B00778, B01340, and B01341 are expired.
These wells appear to have never been installed.

REFERENCES

1. Projection: NAD 1983 UTM Zone 13N
2. New Mexico Office of the State Engineer (OSE) WATERS database (January 2011)

N

3,500 1,750 0 3,500

SCALE 1:45,000 FEET

PROJECT/REPORT

LARAMIDE RESOURCES (USA) INC
LA JARA MESA PROJECT
CIBOLA COUNTY, NEW MEXICO

TITLE

NEARBY OSE PERMITTED WELLS

Golder Associates

PROJECT No. 083-9338SI

FIGURE 9-1

DRAFT

Map: W:\La Jara Mesa\Maps\FIGURE 9_1_OSE_wells.mxd | Modified: 4/10/2013 8:30:57 AM | Plotted: 4/10/2013 8:31:11 AM by CHERParker

B00521

SAN ANDRES-GLORIETA

B01458

B01771

TERMINATION POINTS OF EPHEMERAL DRAINAGES

ENTRADA

B01272

ESCAPE RAISE

PROPOSED PERMIT BOUNDARY

CIBOLA NATIONAL

LA JARA MESA

Roundy Ranch

Mine Sump

Anaconda Mine

Section Mine

Nine Mine

Lobo Canyon

Round Stock Tank

Lava

PIPELINE

PRIVATE

LEGEND

B01272 — OSE designation

Ranch Wells - Monitoring Locatons (Aquifer)

Road and utility corridor

Proposed Permit Boundary

Note:
Permits for B00778, B01340, and B01341 are expired. These wells appear to have never been installed.

REFERENCES

1. Projection: NAD 1983 UTM Zone 13N
2. New Mexico Office of the State Engineer (OSE) WATERS database (January 2011)

DRAFT

N

2,500 1,250 0 2,500

SCALE 1:30,000 FEET

PROJECT/REPORT

LARAMIDE RESOURCES (USA) INC
LA JARA MESA PROJECT
CIBOLA COUNTY, NEW MEXICO

TITLE

BASELINE GROUNDWATER MONITORING LOCATIONS

Golder Associates

PROJECT No. 083-9338SI

FIGURE 9-2

Map: W:\La Jara Mesa\Maps\FIGURE 9_2_Baseline_GW_Locations.mxd | Modified: 4/1/2013 4:28:36 PM | Plotted: 4/4/2013 11:04:13 AM by MPetersen

ATTACHMENT 9A
OSE WELL RECORDS – MONITORING WELLS

235524

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION '95 JAN 10 PM 10 51

(A) Owner of well Larry H. Elkins Owner's Well No. ?
Street or Post Office Address P.O. Box 2051 STATE ENGINEER OFFICE
City and State Milan, New Mexico 87021 SANTA FE NEW MEXICO

Well was drilled under Permit No. B-1272 and is located in the:

a. ___ ¼ ___ ¼ NW ¼ SE ¼ of Section 28 Township 12N Range 9W N.M.P.M.

b. Tract No. ___ of Map No. ___ of the ___

c. Lot No. 1 of Block No. ___ of the ___
Subdivision, recorded in Cibola County.

d. X= ___ feet, Y= ___ feet, N.M. Coordinate System ___ Zone in the ___ Grant.

(B) Drilling Contractor L.C. Jones License No. WD-381

Address 913 Washington Grants, New Mexico 87021

Drilling Began 5-19-94 Completed 5-20-94 Type tools Rotary Size of hole 8" in.

Elevation of land surface or ___ at well is ___ ft. Total depth of well 160 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 70 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
70	120	50	White Sandstone	5 G.P. M.
135	155	40	White Sandstone	20 G.P.M.

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
5"ID	P.V.C.		0	160	160	None	70	160
8 5/8	Steel	Surface casing	20ft. &	cemented			0	20

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement

94 MAY 26 P 4:41
STATE ENGINEER OFFICE ALBUQUERQUE, N. MEX.

Section 5. PLUGGING RECORD

Plugging Contractor ___
Address ___
Plugging Method ___
Date Well Plugged ___
Plugging approved by:
___
State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received 5/26/94

Quad ___ FWL ___ FSL ___

File No. B-1272 Use Dom Location No. 12N.09W.28.41

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	15	15	Sand stone gravel red
15	70	55	Sandstone white
70	120	65	Sandstone white water @ 70ft.
120	135	15	Red shell
135	155	20	Sandstone white Water
155	160	5	Red Shell

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1 and Section 5 need be completed.

Revised June 1972

STATE ENGINEER OFFICE
WELL RECORD

197329

Section 1. GENERAL INFORMATION

(A) Owner of well Roy Mark ELKINS Owner's Well No. _____

Street or Post Office Address PO Box 1854

City and State GRANTS NM 87020

Well was drilled under Permit No. [redacted] and is located in the:

a. NW ¼ SE ¼ SW ¼ ¼ of Section 7 Township 12 N Range 9 W N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____

Subdivision, recorded in CIBOLA County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in the _____ Grant.

(B) Drilling Contractor ROTARY DRILLING Inc. License No. WD 645

Address PO Box 129 GRANTS NM 87020

Drilling Began 3/3/01 Completed 3/7/01 Type tools Rock bit Size of hole 6 ½ in.

Elevation of land surface or Casing at well is +2 ft. Total depth of well 702 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 126 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
690	702	12	limestone	20

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
4	Sch 40		+2	702	704	—	682	702

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
Mech	Packers	@ 682 – 582	– 482	– 382 - 282 - 182 - 82	

Section 5. PLUGGING RECORD

Plugging Contractor _____

Address _____

Plugging Method _____

Date Well Plugged _____

Plugging approved by:

_____ State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

01 MAR 21 PM 2:

FOR USE OF STATE ENGINEER ONLY

Date Received 3-21-01

Quad _____ FWL _____ FSL _____

File No. B 1458 Use DOM Location No. 12N.09W.07.340

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thick in Feet	Color and Type of Material Encountered
0	52	52	Alluvial fill
52	690	638	Red shale & Clay
690	702	12	Limestone

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

WATER WELL RECORD. All sections, except Section 7, shall be described as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

STATE ENGINEER OFFICE
ALBUQUERQUE, NEW MEXICO

2009 MAR 27 PM 2:18

CRA

1. GENERAL AND WELL LOCATION

POD NUMBER (WELL NUMBER)	OSE FILE NUMBER(S): B-1771
WELL OWNER NAME(S): Kit K. South	PHONE (OPTIONAL):
WELL OWNER MAILING ADDRESS: 2046 ZUNI CANYON RD.	CITY: GRANTS STATE: NM ZIP: 87020

WELL LOCATION (FROM GPS)

	DEGREES	MINUTES	SECONDS	
LATITUDE	35	16	35.9	N
LONGITUDE	107	50	26.2	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS: 7.3 mile Nth. on Hi-WAY 605 WEST ½ mile AT White GATE

2. OPTIONAL

(2.5 ACRE)	(10 ACRE)	(40 ACRE)	(160 ACRE)	SECTION	TOWNSHIP	RANGE
¼	SW¼	SE ¼	SE ¼	12	12 ☑ NORTH ☐ SOUTH	10 ☐ EAST ☑ WEST

SUBDIVISION NAME	LOT NUMBER	BLOCK NUMBER	UNIT/TRACT

HYDROGRAPHIC SURVEY	MAP NUMBER	TRACT NUMBER

3. DRILLING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
1646	DENNIS M. Wellington	Wellington Drilling INC.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
3-5-09	3-17-09	600	635	360

COMPLETED WELL IS: ☐ ARTESIAN ☐ DRY HOLE ☒ SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT): 145

DRILLING FLUID: ☐ AIR ☒ MUD ☐ ADDITIVES – SPECIFY:

DRILLING METHOD: ☒ ROTARY ☐ HAMMER ☐ CABLE TOOL ☐ OTHER – SPECIFY:

DEPTH (FT) FROM	DEPTH (FT) TO	BORE HOLE DIA. (IN)	CASING MATERIAL	CONNECTION TYPE (CASING)	INSIDE DIA. CASING (IN)	CASING WALL THICKNESS (IN)	SLOT SIZE (IN)
0	520	8"	PVC	Glued	5	.040	
520	600	8"	P.V.C	Glued	5	.040	.020

4. WATER BEARING STRATA

DEPTH (FT) FROM	DEPTH (FT) TO	THICKNESS (FT)	FORMATION DESCRIPTION OF PRINCIPAL WATER-BEARING STRATA (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)	YIELD (GPM)
520	600	80	SAN Andrea	40

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: Air-lift

TOTAL ESTIMATED WELL YIELD (GPM): 40

FOR OSE INTERNAL USE

FILE NUMBER	B-1771	POD NUMBER		TRN NUMBER	425313
LOCATION	X=2721096 Y=1556027 (W) Zone				

WELL RECORD & LOG (Version 6/9/08)

PAGE 1 OF 2

5. SEAL AND PUMP

TYPE OF PUMP: ☒ SUBMERSIBLE ☐ JET ☐ NO PUMP – WELL NOT EQUIPPED
☐ TURBINE ☐ CYLINDER ☐ OTHER – SPECIFY:

ANNULAR SEAL AND GRAVEL PACK	DEPTH (FT) FROM	DEPTH (FT) TO	BORE HOLE DIA. (IN)	MATERIAL TYPE AND SIZE	AMOUNT (CUBIC FT)	METHOD OF PLACEMENT
	520	600	8	SILICA 10-20	14	POURED AT SURFACE
	200	520	8	PEA GRAVEL 3/8"	27	GRAVEL AT SURFACE

6. GEOLOGIC LOG OF WELL

DEPTH (FT) FROM	DEPTH (FT) TO	THICKNESS (FT)	COLOR AND TYPE OF MATERIAL ENCOUNTERED (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)	WATER BEARING?
0	5	5	BROWN CLAY	☐ YES ☒ NO
5	10	5	BROWN CLAY - SAND	☐ YES ☒ NO
10	20	10	TAN SAND - SANDSTONE	☐ YES ☒ NO
20	60	40	TAN SAND	☐ YES ☒ NO
60	75	15	TAN GRAVEL - SAND	☐ YES ☒ NO
75	360	285	RED CLAY	☐ YES ☒ NO
360	400	40	LIGHT TAN SANDSTONE - SHALE mix	☒ YES ☐ NO
400	540	140	RED SHALE - CLAY mix	☐ YES ☒ NO
540	600	60	WHITE SAND - SANDSTONE	☒ YES ☐ NO
600	635	35	BROWN - TAN SAND - SANDSTONE SHALE	☐ YES ☒ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO

ATTACH ADDITIONAL PAGES AS NEEDED TO FULLY DESCRIBE THE GEOLOGIC LOG OF THE WELL

7. TEST & ADDITIONAL INFO

WELL TEST — METHOD: ☐ BAILER ☐ PUMP ☒ AIR LIFT ☐ OTHER – SPECIFY:

TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

ADDITIONAL STATEMENTS OR EXPLANATIONS:
Air-lift water thru casing at 260ft thru drill pipe for 3-HRS.
Approx. 30-45 G.P.M.

SEAL CASING with Benonite pellets at 200ft up.

8. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

D.M. Wellington — SIGNATURE OF DRILLER
3-25-09 — DATE

2009 MAR 27 PM 2:18
STATE ENGINEER OFFICE ROSWELL, NEW MEXICO

FOR OSE INTERNAL USE — WELL RECORD & LOG (Version 6/9/08)

FILE NUMBER	B-1771	POD NUMBER	1	TRN NUMBER	425313
LOCATION	X=2721096 Y=1556027 (W) Zone			PAGE 2 OF 2	

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10.0 PRIOR EXPLORATION AND MINING

New Mexico Administrative Code (NMAC) 19.10.6.602 D.(13) **(h)**

Baseline data shall include, as applicable: A description and delineation on topographic maps of any prior mining operations which may have affected the permit area including, if know, the type of mining and processing method and a list of any processing chemicals or reagents used.

10.1 Introduction

The proposed La Jara Mesa Project's Permit Area is within the Ambrosia Lake Mining District, which is, in turn, within the Grants Mineral Belt. Uranium was discovered in the Grants Mineral Belt in the early 1950s. The Grants region was the source of more uranium production than any other area in the United States between 1950 and 1978 (Chenoweth and Holen, 1980). Exploration and prospecting has occurred in and around La Jara Mesa and the proposed Permit Area since then. Historical disturbances from exploration (drill pads, boreholes, and prospect trenches/pits and access roads) exist in and around the proposed Permit Area (Figure 10-1). Other land-surface disturbances within the proposed Permit Area and surrounding areas are from logging, grazing, and recreation; in some instances, these are difficult to distinguish from prior mining and exploration activities (Attachment 10A). There has been considerable historical exploration, prospecting and development of mine workings of uranium mineralization immediately north, west, and south of the proposed Permit Area (Figure 10-1; Table 10-1). A brief discussion of the historical operations and associated impacts to the proposed Permit Area are provided in the following sections.

10.2 History of Uranium Exploration and Mining in Grants Mineral Belt

A Navajo prospector is reportedly responsible for the uranium discovery near Haystack Butte in the Grants region in 1950 (Melancon, 1963). The Grants Mineral Belt would become one of the most prolific uranium-producing regions in the world. In the Ambrosia Lake Mining District of the Grants Mineral Belt, the initial discovery didn't occur until 1955 when an oil and gas exploration drillhole encountered radioactive cuttings. According to Alief (2006), exploration on and near La Jara Mesa has occurred sporadically since the discovery at Haystack Butte.

The uranium discovered at Haystack Butte was in the Jurassic Todilto Limestone. Historical exploration and mining operations in the deposits of the Todilto Limestone near the proposed Permit Area are primarily located in Sections 15 and 22 T12N, R9W (Figure 10-1; Table 10-1). Approximately 3,573 tons of ore was mined from the Todilto at La Jara #1-9 and the Zia Mine (Table 10-1) from 1952 to 1960, reportedly yielding 31,277 pounds of uranium (U_3O_8) and 613 pounds of vanadium (V_2O_5; McLemore, 1983). A small occurrence of uranium mineralization in the Poison Canyon beds of the Morrison Formation was identified on the slope of La Jara Mesa in the southwest quarter of Section 11, T12N,

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R9W (Taffy Mine) near the site of the proposed project portal. In 1961, approximately 110 tons of uranium ore was mined at this location that yielded 350 pounds of yellow cake uranium (U_3O_8), but a significant deposit was not discovered.

Exploration in the region occurred between the late 1950s until 1967, when utility companies became significant markets for uranium and the US Atomic Energy Commission provided a purchase plan to induce the uranium industry (Alief, 2006). With this renewed activity, Homestake Mining Company (Homestake) and others claimed the portion of area that would become the La Jara Mesa Project's Permit Area. Homestake, in a joint venture with United Nuclear Corporation, drilled 86 exploration holes between 1967 and 1971 (Laramide Resources (USA) Inc. (Laramide); 2008). Several thin, high-grade intervals were intercepted in the exploration drillholes. These deposits had not been sufficiently defined and evaluated when, in 1971, a recession in the uranium industry slowed exploration.

In 1974, Melvin Richards restaked claims in the area as increasing uranium prices spurred renewed interest. The property was leased to Gulf Resources in 1976 and additional exploration holes were drilled, mostly with limited success in expanding and increasing the value of the resource.

The first hole that encountered ore-grade deposits was drilled in 1980 in Section 12 by heirs of Melvin Richards, in contract with Midas International. In 1981, a systematic drilling program was initiated, which ultimately delineated a significant uranium resource. Homestake became involved again in 1983, and in 1984 submitted a mine plan to develop the La Jara Mesa deposit. The proposed plan was similar to the current proposed plan by Laramide (2008). The United States Department of Agriculture (USDA) Forest Service approved the plan in the fall of 1984, along with an environmental assessment in 1988; however, Homestake did not develop the mine due to fluctuating markets and decreasing uranium prices. Interest in the area was renewed again in the late 1980s, but was short-lived. Homestake decided to suspend all uranium mining and milling in the Grants Uranium Belt in 1989.

Alief (2006) outlined the current mineral rights associated with the La Jara Mesa property. The rights are owned by Laramide through a purchase agreement with Homestake. The current La Jara Mesa uranium claim block includes portions of Sections 1, 2, 10, 11, 12, 13, 14, and 15 T12N, R9W (Table 10-1).

10.3 Historical Mining Impacts

Mine workings and land disturbances from exploration were identified at approximately 21 locations in the proposed La Jara Mesa Project area (generally based on a three-mile radius from the proposed incline portal); five of these locations are within the proposed Permit Area or potential affected area (Figure 10-1). Table 10-1 lists each of the identified exploration and mining operations. Some land disturbances are not the result of mining, and are likely the results of logging, grazing, and recreation. Potential radiation hazards are associated with the natural mineralization, prior mining activities, and other

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disturbances in the Todilto Limestone, and the Brushy Basin and Poison Canyon Members of the Morrison Formation. Locations with elevated radiation at La Jara Mesa include the Taffy Mine, Zia Mine, and La Jara #1-9 mine workings; natural outcroppings of mineralized rock; and transported ore materials via drainages and historical haul roads. A background Radiological Survey (see Section 13.0) was conducted for the proposed La Jara Mesa Project Permit Area and the radiation hazards are described in more detail.

10.4 References

Alief, M.H., 2006, Technical report on La Jara Mesa uranium property, Cibola County, New Mexico. Prepared for Laramide Resources, Ltd., August 31, 2006, 61p.

Chenoweth, W.L., and H.K. Holen, 1980. Exploration in Grants uranium region since 1963 in Geology and Mineral Technology of the Grants Uranium Region 1979. New Mexico Bureau of Mines & Mineral Resources. Memoir 38. pp. 17-22.

Laramide Resources (USA), Inc. 2008. Plan of Operations Amendment (Updated). Prepared for the USDA Forest Service, Cibola National Forest, Mt. Taylor Ranger District. October 2008.

McLaughlin, Jr. E.D. 1963. Uranium deposits in the Todilto Limestone of the Grants District. New Mexico Bureau of Mines & Mineral Resources. Memoir 15. Pp. 136-149.

McLemore, V.T., 1983. Uranium and Thorium Occurrences in New Mexico: Distribution, Geology, Production, and Resources with Selected bibliography. New Mexico Bureau of Mines & Mineral Resources. Open-file Report OF-183.

Melancon, P.E., 1963. History of exploration. New Mexico Bureau of Mines & Mineral Resources. Memoir 15. pp 3-5.

US Department of Agriculture (USDA), Forest Service. 1984. Letter from John P. Caffrey, District Ranger of Mt. Taylor Ranger District and Tom White, Homestake Mining Company, re: approval of mine operations plan.

USDA Forest Service, 1988. Letter from Ray Thompson, District Ranger of Mt. Taylor Ranger District to Wind River Mining Company/Homestake, re: environmental assessment.

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TABLES

Table 10-1: Historical Exploration and Mining Operations

Operation Name	Type of Disturbance	Production/ Exploration	Formation	PLSS	Years Active
Christmas Day	Open pit (20 feet deep)	Production	Todilto Limestone	Sec. 4 T 12N R9W	1954-1956
F-33 Mine	Three declines (one 1,800 feet long)	Production	Todilto Limestone	Sec. 33, 34 T12N R9W	1954-1959; 1971-1977
Forrest Group	Drilling; mined as part of F-33	Exploration	Todilto Limestone	Sec. 34 T12N R9W	See above
Gay Eagle	Open pit (40 feet deep)	Production	Todilto Limestone	Sec. 4 T12N R9W	1952-1965
La Jara Mesa Section 12	Drilling (600 feet deep); Extension of Taffy orebody	Exploration	Morrison Formation- Brushy Basin Member - Poison Canyon Sandstone	Sec. 12 T12N R9W	DOE Files 1983
La Jara #1-9	Open pit, trenching (30 ft deep)	Production	Todilto Limestone	Sec. 15 T12N R9W	1952-1960
Last Chance	Open pit (15 feet deep)	Production	Todilto Limestone	Sec. 8 T12N R9W	1952-1956
Red Bluff #1	Shallow pit	Production	Todilto Limestone	Sec. 4 T12N R9W	1952-1956[a]
Red Bluff #2 and 4	Open pit	Production	Todilto Limestone	Sec. 4 T12N R9W	1952-1956[a]
Red Bluff #3, 5 and 9	Open pit	Production	Todilto Limestone	Sec. 4 T12N R9W	1952-1956
Red Bluff #7	Open pit	Production	Todilto Limestone	Sec. 4 T12N R9W	1953-1958
Red Bluff #8	Open pit	Production	Todilto Limestone	Sec. 4 T12N R9W	1953-1958[a]
Red Bluff #10	Open pit	Production	Todilto Limestone	Sec. 4 T12N R9W	1953-1958[a]
Section 9 Mine	Open pits (35 feet deep)	Production	Todilto Limestone, Summerville Formation	Sec. 9 T12N R9W	1950, 1953-1962
Section 9 Adit	Open cut, adit	Production	Todilto Limestone	Sec. 9 T12N R9W	1953-1962
Section 9	Open pit	Production	Todilto Limestone	Sec. 9 T12N R9W	1953-1962
Section 9 NE	Open pit	Production	Todilto Limestone	Sec. 9 T12N R9W	1953-1962
Section 22 Linear Trenches	Linear prospecting trenches (2.5 feet deep)	Exploration	Todilto Limestone	Sec. 22 T12N R9W	1950[a]
Taffy	Open cuts (51 feet deep)	Production	Morrison Formation- Brushy Basin Member - Poison Canyon Sandstone	Sec. 11 T12N R9W	1961
UDC #1-5	Open Pit (80 feet deep)	Production	Todilto Limestone	Sec. 4 T12N R9W	1953-1954
Zia Mine	Open Pit, adit	Production	Todilto Limestone, Entrada Sandstone	Sec. 15 T12N R9W	1952-1960

Notes:
Source: McLemore, 1983
DOE = US Department of Energy
a = Estimated date

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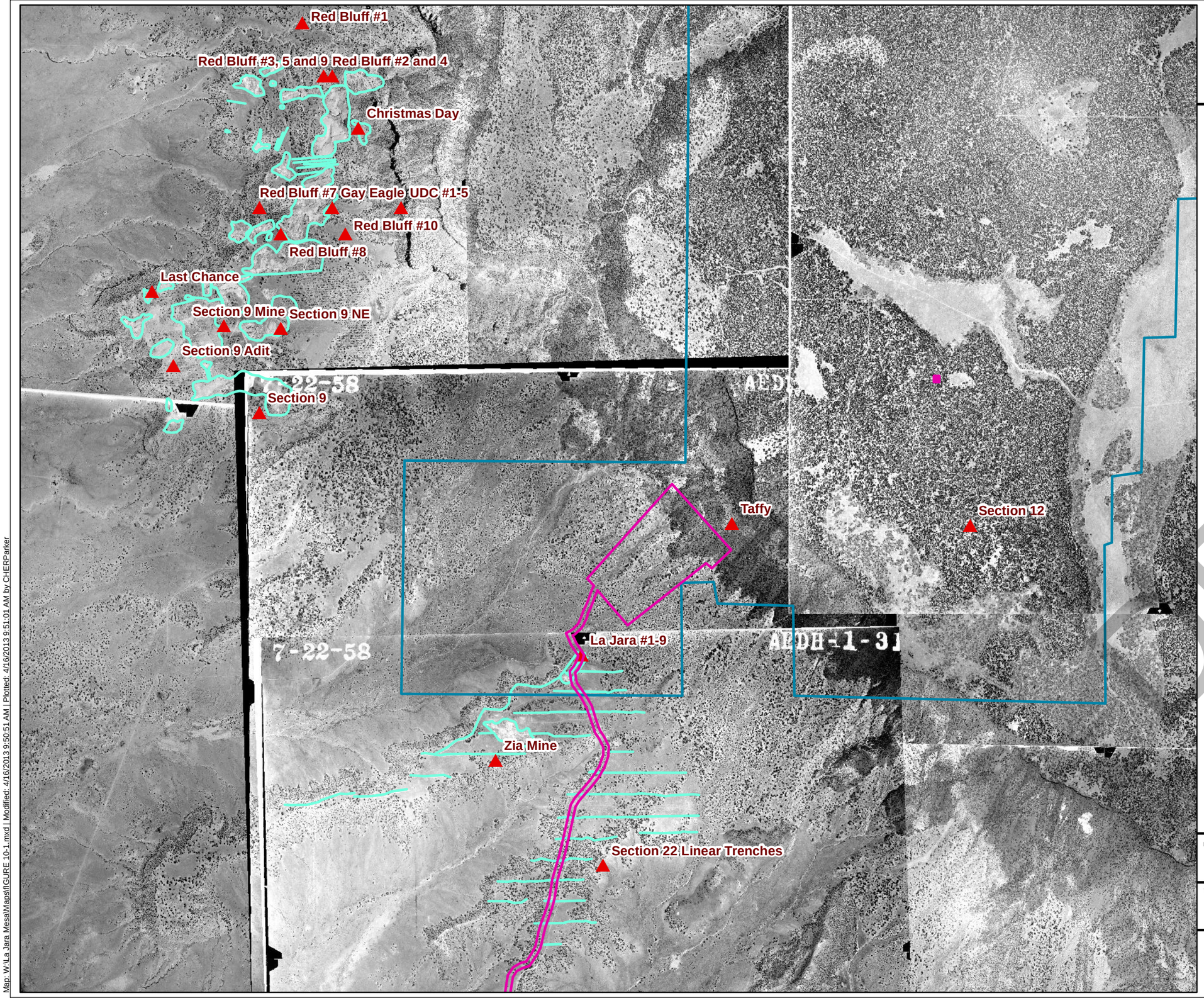
FIGURES



Legend

- Proposed Permit Boundary
- Uranium and Thorium Occurrences
- Claim Boundary
- Disturbed areas

Projection: WGS 1984 Web Mercator Auxiliary Sphere

Sources:
Uranium and Thorium -McLemore, V.T., 1983.
Uranium and Thorium Occurrences in New Mexico: Distribution, Geology, Production, and Resources with Selected bibliography. New Mexico Bureau of Mines & Mineral Resources. Open-file Report OF-183.

Disturbance delineations were made using the 1959 aerial photography

Scale 1:27,000

N

2,250 1,125 0 2,250 4,500 Feet

PROJECT
LARAMIDE RESOURCES (USA) INC
LA JARA MESA PROJECT
CIBOLA COUNTY, NEW MEXICO

TITLE
HISTORICAL MINING OPERATIONS AND DISTURBANCES

Golder Associates

PROJECT No. 083-9338SI

FIGURE 10-1

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Map: W:\La Jara MesaMaps\fIGURE 10-1.mxd | Modified: 4/16/2013 9:50:51 AM | Plotted: 4/16/2013 9:51:01 AM by CHERParker

ATTACHMENT 10A
PHOTOGRAPHS

Attachment 10A: Photographs of Site Disturbances

PHOTO 1 Dozer Cut/Push	
PHOTO 2 Exposed Bluff Sandstone	

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Attachment 10A: Photographs of Site Disturbances

PHOTO 3 Linear Trench	
PHOTO 4 Roads (switch-backs up the mesa)	

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Attachment 10A: Photographs of Site Disturbances

PHOTO 5 Zia Mine Disturbance	
PHOTO 6 Zia Mine Disturbance	

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11.0 HISTORIC PLACES AND CULTURAL PROPERTIES

New Mexico Administrative Code (NMAC) 19.10.6.602 D.(13) **(i)**

Baseline data shall include, as applicable: A list and accompanying map indicating all sites on or eligible for listing on the National Register of Historic Places and/or the State Register of Cultural Properties and known cemeteries and human burials within the proposed permit area. Including with this list and map shall be a description of the effects the proposed mining operation may have on these sites and any proposed mitigation measures.

11.1 Introduction

Cultural resources surveys were conduction by Ecosystems Management, Inc. (EMI, 2009) for the La Jara Mesa Project's proposed Permit Area in June 2009, prior to any activity on site. This work complies with Federal Section 106 of the National Historic Preservation Act of 1966, as amended, and the New Mexico Administrative Code stated above. In order to protect the integrity of the sites and minimize the likelihood of their disturbance, maps and/or tables identifying the locations of cultural sites are considered confidential. Detailed site information and methodology is presented in the cultural resources survey report (EMI, 2009), which has been submitted to the New Mexico State Historical Preservation Office (SHPO) and the United States Department of Agriculture Forest Service (Forest Service) for their review.

The cultural resource inventories for the proposed Permit Area and road and utility corridor were conducted in consultation with the Forest Service and SHPO. Data collection consisted of records review (Class I) and pedestrian field surveys (Class III). The Class I and III studies inventoried all archaeological sites within the proposed Permit Area, as per directives from the Forest Service and SHPO, to comply with Federal Section 106 and NMAC Title 4 Chapter 10.4.10.15.

11.2 Records Review

A Class I records review of cultural resource studies conducted within 1 mile of the La Jara Mesa Project's Permit Area was conducted. Searches were performed of the New Mexico Cultural Resources Information Survey (NMCRIS), maintained by the Archaeological Records Management Section (ARMS), and of pertinent files at the Cibola National Forest Supervisor's Office. Archived records were reviewed in May and June 2009, prior to conducting the Class III pedestrian field survey. The most recent listings of the National Register of Historic Places (NRHP) were consulted. No listed NRHP properties are located within 1 mile of the proposed Permit Area. One State Register of Cultural Properties, Traditional Cultural Property (TCP) is located at Mt. Taylor (LA 156475). Results of the records search indicate that 34 previous studies and 53 previously recorded sites are within 1 mile of the proposed Permit Area. Eight sites identified by these surveys are located within the proposed Permit Area or the road and utility corridor.

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11.3 Field Investigation

A 100-percent pedestrian field survey (Class III) of the La Jara Mesa Project's Permit Area was conducted in June 2009, with an additional field survey performed in February 2011, at an alternate access route. A total of 125 acres was surveyed for this project. The field surveys focused on the physical footprint of the proposed surface facilities, portal, and escape raise, as well as the road and utility corridor. Specifically, a block survey of approximately 22 acres of the proposed mine surface facilities, a block survey of approximately 6 acres at the escape raise, and 200-foot (100 feet from center line) corridor survey of the access roads, for a total of 125 acres. The field surveys were conducted under US Forest Service, Cibola National Forest ARPA Permit #CIB108 and Permit #NM 09-107.

11.3.1 Sites on or Eligible for Listing

A total of 6 newly recorded archaeological sites and 28 isolated occurrences (IOs) were identified during the Class III survey. One Traditional Cultural Property (Mt. Taylor TCP) and eight previously recorded archaeological sites are located within the La Jara Mesa Project's proposed Permit Area. Eligibility status of these cultural resources sites are discussed below. Further details regarding these sites can be found in the EMI report (2009) and review files submitted to the US Forest Service (Cibola National Forest) and SHPO.

11.3.1.1 Traditional Cultural Property

The US Forest Service (Cibola National Forest) in consultation with the SHPO, Advisory Council, and tribes, has designated Mt. Taylor as a TCP under federal guidelines, and determined in 2008 that the mountain is eligible for listing on the NRHP (Benedict and Hudson, 2008). A TCP is a location, frequently a landform or landscape, recognized for its association with the cultural practices and beliefs of a living community that are rooted in history and are important to maintaining cultural identity. The proposed Permit Area is within the western boundary of the Mt. Taylor TCP.

The Mt. Taylor TCP has been determined eligible for inclusion in the NRHP because of its significant association with traditional cultural uses (criterion A), because of its association with spirit beings that figure prominently in the oral tradition of the tribes (criterion B), and because it is a property that has yielded important information through ethnographic and archaeological research (criterion D).

11.3.1.2 Archaeological Resources

Archaeological resources include physical artifacts as they appear on the surface. The pedestrian field surveys documented eight previously recorded archaeological sites and six new sites. A total of 28 IOs were identified during the Class III pedestrian field survey of the proposed Permit Area. IOs include lithics, tin cans, and bottle glass, or bottles that are found with no apparent association with other cultural material or features. The field documentation of the IOs formally exhausted their information potential

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and, therefore, they require no further consideration. None of the IOs are deemed eligible for listing on the National Register or State Register of Cultural Properties.

A total of 14 archaeological sites are located within La Jara Mesa Project's proposed Permit Area (Table 11-1). The inventory of archaeological sites within the Permit Area has been shared with the SHPO and a consensus determination was reached on site eligibility. Eleven of the archaeological sites are currently regarded to have undetermined eligibility, and will be treated as eligible until a further determination of eligibility is made. Two sites were previously determined not eligible for inclusion on the National Register. One site has been previously determined as eligible for listing on the NRHP.

11.4 Effects and Proposed Mitigation Measures

Cultural resources are nonrenewable resources. Federal regulations obligate federal agencies to manage cultural resource properties and prohibit the destruction of significant cultural sites without first mitigating the "adverse effect" to the site. Mitigation measure may include, but are not limited to, complete detailed site documentation, complete avoidance of the site, and/or data recovery efforts.

11.4.1.1 Traditional Cultural Property

The La Jara Mesa Project activities would have an adverse effect upon the Mt. Taylor Traditional Cultural Property. Mining activities would alter the characteristics of the property that qualify it for inclusion in the NRHP that would diminish the property's integrity of relationship. It is the relationship, or the connection the beliefs and traditional practices have to the property that give the property its significance. Mt. Taylor has an integral relationship with beliefs and traditional cultural practices of the consulted tribes, and is critical to the maintenance of their cultural identity and transmittal of their beliefs.

The La Jara Mesa Project would result in the disruption, alteration, and displacement of traditional cultural activities that are critical to the continuity of cultural beliefs and practices of these tribes. In the view of the tribes, impacts to the traditional practitioners' ability to conduct their traditional cultural activities in the area will reduce the overall effectiveness of their prayers, medicine, and healing ceremonies. Development on the mountain has not stopped all traditional and cultural activities, but it adversely impacts the traditional practices and diminishes their value.

Adverse effects, according to the regulations (36 Code of Federal Regulations Part 800), that would occur at the Permit Area include physical damage to all or part of a property, and introduction of visual, atmospheric, or audible elements that damage the integrity of the property's significance. Physical damage of the landform caused by construction of the mine would occur, but is considered secondary to the impact to the integrity of relationship. The degree of physical alteration is limited; the primary mining operation would impact approximately 16 acres, within a property that is 442,659 acres in size. The size of the impact would not significantly alter the landform which constitutes the TCP. For this reason, the

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size of the damage in relation to the scale of the property, physical damage is not a primary criterion for determining the effect of the project on the Mt. Taylor TCP. Even though the mining activities would be confined to a localized area, the auditory effects would not be considered temporary. Based on the viewshed analysis of Hudson (2010), there is a visual effect, but it is limited. The 16-acre footprint of the mine's surface facilities cannot be seen from the summits of Mt. Taylor or La Mosca Peak. The primary view of the mine is from the southwest. Due to its small size and presence of trees on the mesa, the visual effect would be negligible.

11.4.1.2 Archaeological Resources

Generally site avoidance is the recommended mitigation option for La Jara Mesa; however, there a few locations where this is not possible. Testing of these locations is required to determine positive, intact, cultural deposits and will allow for further management recommendations, which may include data recovery. Of the eleven archaeological sites eligible (or undetermined) for listing on the NRHP at La Jara Mesa, seven would be impacted by the project construction (Table 11-1). The Forest Service and SHPO have determined that these seven sites need to be tested to determine eligibility (Harris and Hayden, 2011; Report Number 2009-03-133). Ineligible sites (AR-03-03-05-820/LA 48226 and AR-03-03-02-821/LA 48227) do not constrain project activities and require no further management. For those eligible (or undetermined) sites impacted by the project, testing will be done to determine their eligibility for the NRHP and/or spatial extent. Testing will provide data pertinent for addressing the site's integrity and nature as well as recommendation for further site management. Testing may indicate that some of the sites are not eligible to the National Register and would no longer be managed by the Forest Service. Or, testing may indicate that the sites are eligible to the National Register and would require data recovery.

Most of the sites that will be impacted by the La Jara Mesa Project are along the 200-foot road and utility corridor. EMI recommends testing within the 40-foot road improvement and utility corridor to determine whether there are intact cultural deposits in and adjacent to the road(s) that will be adversely impacted. Sites bisected by the road and utility corridor include LA 163198, AR-03-03-02-2770/LA 153873 and AR-03-03-02-2771/LA 153872, LA 163194/AR-03-03-02-2881, LA 163193/AR-03-03-02-2880, LA 48225/AR-03-03-02-819, and LA 48224/AR-03-03-02-818. Based on the results of the testing, the sites, or portions of the sites, that still retain integrity should be avoided and protected from project-related ground-disturbing activities using double flagging. Periodic monitoring of impacts to sites due to project activities is also recommended. Three sites (LA 163195, LA 163196, LA 163197), located on private land, are no longer within the area of potential effect because the road will be rerouted to avoid impacts to these sites.

There is one site (AR-03-03-02-2880/LA 163193) located within the footprint of the mine's surface facilities. The site would be bisected by a facility road that would be improved to provide access to the portal. The explosives shed and growth medium stockpile would also overlap portions of the site. This site

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would be directly impacted by these facilities. The project management has agreed to relocate these facilities away from the site. EMI recommends avoidance of this site by relocating the mine facilities and fencing the site boundary to prevent disturbance during construction and operation.

Site AR-03-03-02-2317/LA 131426 is adjacent to the road, but would not be impacted by routine road maintenance. There is one site (AR-03-03-02-2768/LA 153870) adjacent to the road and near the escape raise, but the site is located sufficiently distant from both that no impacts are anticipated. These sites are unlikely to be impacted by the project activities, but will nonetheless be avoided. These sites will be flagged prior to construction. If avoidance is not possible at these sites, then testing will be conducted.

EMI recommends that cultural resources clearance be granted with the provision that recommendations outlined are followed. If unanticipated cultural materials are encountered during project activities, work will stop and a qualified archaeologist will be contacted to assess the site and determine appropriate mitigation measures. Effects on archaeological resources during mine construction and operations are essentially the same because the impacts to the sites would occur at the beginning of project construction.

All of the sites are potentially at a higher risk of vandalism, or theft of artifacts, due to the increased human presence at the worksite and improved access to the area.

11.5 References

Benedict, Cynthia Buttery and Erin Hudson. 2008. Mt. Taylor Traditional Cultural Property Determination of Eligibility Heritage Resource Report # 2008-03-021 USDA Forest Service, Cibola National Forest, Albuquerque, NM.

Harris and Hayden 2011?

Hudson 2010?

United States Department of Agriculture (USDA) Forest Service. 2012. Draft Environmental Impact Statement for the La Jara Mesa Mine Project. Mt. Taylor Ranger District, Cibola National Forest, Cibola County, New Mexico. Southwestern Region. March 2012.

Ecosystem Management, Inc. (EMI) 2009. Results of a Cultural Resource Survey of 6.3 Miles of Roads (103 Acres) on Private and Forest Lands, and Approximately 22 Block Acres for Mine Facilities and an Escape Raise in the Cibola National Forest, Mt. Taylor Field Office, Cibola County, New Mexico. On file US Forest Service, Cibola National Forest, Albuquerque, NM.

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TABLES

Table 11-1: Archaeological Sites at La Jara Mesa

Site	Eligibility	Impacted (y/n)	Mitigation
New Sites			
AR-03-03-02-2880/LA 163193	Undetermined	y	Testing, fencing
AR-03-03-02-2881/LA 163194	Undetermined	y	Testing
LA 163195	Undetermined	n	Avoidance
LA 163196	Undetermined	n	Avoidance
LA 163197	Undetermined	n	Avoidance
LA 163198	Undetermined	y	Testing
Previously Recorded Sites			
AR-03-03-02-818/LA 48224	Undetermined	y	Testing
AR-03-03-02-819/LA 48225	Eligible[1]	y	Testing, avoidance
AR-03-03-02-820/LA 48226	Not eligible	n	No further management
AR-03-03-02-821/LA 48227	Not eligible	n	No further management
AR-03-03-02-2317/LA 131426	Undetermined	unlikely	Avoidance, flagging
AR-03-03-02-2768/LA 153870	Undetermined	unlikely	Avoidance, flagging
AR-03-03-02-2770/LA 153873	Undetermined	y	Testing
AR-03-03-02-2771/LA 153872	Undetermined	y	Testing

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ATTACHMENT 11A
CONFIDENTIAL ATTACHMENT
EMI REPORT

FINAL

Results of a Cultural Resource Survey of 6.2 Miles of Roads (125 Acres) on Private and Forest Lands, and Approximately 22 Block Acres for Mine Facilities and an Escape Raise in the Cibola National Forest, Mt Taylor Field Office, Cibola County, New Mexico

Prepared For

Golder Associates, Inc.
5200 Pasadena Ave NE # C
Albuquerque, NM 87113

Prepared By

Ecosystem Management, Inc.
3737 Princeton Dr. NE, Suite 150
Albuquerque, New Mexico 87107

Ecosystem Management, Inc. Report Number 846
Forest Service report #2009-03-133

February 2011

FINAL
Results of a Cultural Resource Survey of 6.2 Miles of Roads (125 Acres) on Private and Forest Lands, and Approximately 22 Block Acres for Mine Facilities and an Escape Raise in the Cibola National Forest, Mt Taylor Field Office, Cibola County, New Mexico

Prepared by

Nina Harris, R.P.A., Garth Hayden and Kate Wright

NMCRIS NO. 114095

Organization

Ecosystem Management, Inc.
3737 Princeton Dr. NE, Suite 150
Albuquerque, New Mexico 87107
(505) 884-8300
FAX (505) 884-8305

For

Golder Associates, Inc.
5200 Pasadena Ave NE # C
Albuquerque, NM 87113

EMI Report Number 846

February 2011

NMCRIS INVESTIGATION ABSTRACT FORM (NIAF)

1. NMCRIS Activity No.: 114095	2a. Lead (Sponsoring) Agency: US Forest Service, Cibola National Forest	2b. Other Permitting Agency(ies):	3. Lead Agency Report No.: **2009-03-133**

4. Title of Report:
Results of a Cultural Resource Survey of 6.2 Miles of Roads (125 Acres) on Private and Forest Lands, and Approximately 22 Block Acres for Mine Facilities and an Escape Raise in the Cibola National Forest, Mt Taylor Field Office, Cibola County, New Mexico

Author(s) Nina Harris, Garth Hayden and Kate Wright

5. Type of Report
☐ **Negative**
☒ **Positive**

6. Investigation Type
☐ Research Design ☒ Survey/Inventory ☐ Test Excavation ☐ Excavation ☐ Collections/Non-Field Study
☐ Overview/Lit Review ☐ Monitoring ☐ Ethnographic study ☐ Site specific visit ☐ Other

7. Description of Undertaking (what does the project entail?):
Class III cultural resource survey for Golder Associates, Inc. of a total of approximately 125 acres prior to road improvements and uranium mine facilities construction on both private lands and lands within the Cibola National Forest, in Cibola County, New Mexico.

8. Dates of Investigation: (from: to:)
6/11/09 – 6/16/09

9. Report Date:
February 2011

10. Performing Agency/Consultant:

Ecosystem Management, Inc
3737 Princeton Dr. NE, Suite 150
Albuquerque, New Mexico 87107
(505) 884-8300

11. Performing Agency/Consultant Report No.:
846

12. Applicable Cultural Resource Permit No(s):
USFS-Cibola National Forest ARPA Permit #CIB108

13. Client/Customer (project proponent):
Golder Associates, Inc.

Contact: Grant Bailey
Address: 2200 – 6th Avenue, Suite 600, Seattle, WA 98121

Phone: (206) 267-1166 X5001

14. Client/Customer Project No.:

15. Land Ownership Status ***(Must be indicated on project map):***

Land Owner	Acres Surveyed	Acres in APE
US Forest Service	61	45
Private	64	64
TOTALS	125	109

16 Records Search(es): Prior to conducting the Class III pedestrian field survey, record searches were conducted at the Archaeological Records Management Section (ARMS) of the Museum of New Mexico for previously recorded sites within 1 mile of the project area on May 22, 2009 by Nina Harris, EMI Cultural Resources Program Director. A review of State and National Register of Historic Places was also conducted at that time. In addition, site record searches of the United States Forest Service, Cibola National Forest Office records were conducted on June 3, 2009 by Kate Wright, EMI archaeologist. No National Register of Historic Places (NRHP) listed properties are within one mile (1.6 km) of the project area. One State Register of Cultural Properties Traditional Cultural Property is located at Mt. Taylor as of June 2009 (LA 156475). Results of the record search indicate 34 previous studies and 53 previously record sites within one 1.6 km (1 mile) of the project area. One previous survey was conducted within the project area (FR 544) by Lone Mountain Archaeological Services in 2007 that identified three sites (AR-2668, AR-2770 and AR-2771) along the road.

Date(s) of ARMS File Review 5/22/09	**Name of Reviewer(s)** Nina Harris	
Date(s) of NR/SR File Review	**Name of Reviewer(s)**	
Date(s) of Other Agency File Review 6/3/09	**Name of Reviewer(s)** Kate Wright	**Agency** USFS

17. Survey Data:

a. Source Graphics ☒ **NAD 27** ☐ **NAD 83**

☒ **USGS 7.5' (1:24,000) topo map** ☐ **Other topo map, Scale:**

☐ **GPS Unit** **Accuracy** ☐ **<1.0m** ☒ **1-10m** ☐ **10-100m** ☐ **>100m**

b. USGS 7.5' Topographic Map Name **USGS Quad Code**

Dos Lomas	35107-C7
Grants	35107-B7
San Mateo	35107-C

c. County(ies): Catron

17. Survey Data (continued):

d. Nearest City or Town: Milan, NM

e. Legal Description:

Township (N/S)	**Range (E/W)**	**Section**	¼ ¼ ¼
12 N	10 W	24 & 25	
12N	9 W	11, 15, 19, 20, 21, 22, 27, 28, 29, 30	

Projected legal description? Yes [X] , No [ ] **Unplatted [ ]**

f. Other Description (e.g. well pad footages, mile markers, plats, land grant name, etc.):

18. Survey Field Methods:

Intensity: ☒ 100% coverage ☐ <100% coverage

Configuration: ☒ block survey units ☒ linear survey units (l x w): 6.2 miles X 100 ft ☐ other survey units (specify):

Scope: ☒ non-selective (all sites recorded) ☐ selective/thematic (selected sites recorded)

Coverage Method: ☒ systematic pedestrian coverage ☐ other method (describe)

Survey Interval (m): 15 m **Crew Size:** 3 to 4 **Fieldwork Dates:** June 11, 12, 15 and 16, 2009 and February 9, 2011

Survey Person Hours: 245 **Recording Person Hours:** 5 **Total Hours:** 250

Additional Narrative:

19. Environmental Setting (NRCS soil designation; vegetative community; elevation; etc.): The project area includes a 40-foot wide access road from NM 605 to FR 450, which passes through low elevation sand dunes, to FR 450 and the mine facilities area which passes into intermediate elevations along colluvial finger ridges and the slope at the base of La Jara Mesa and an escape raise area on the mesa top. Elevations in the project area range from 2050 meters amsl where FR 450 meets NM 605 to 2200 meters amsl at the block survey mining facilities area. The block survey for the escape raise is at an elevation of 2468 meters amsl.

The NRCS Web Soils Survey indicates that Penistaja soils are the primary soil type in the lower elevations of the project area along Elkin's Road, the private access road to FR 450. Penistaja soils are fine sandy loams derived from sandstone slope alluvium, 2 to 10 percent slopes. Soils along the slopes and finger ridges extending out from La Jara Mesa are Rock outcrop-Mion complex soils derived from slope alluvium over colluvium derived from calcareous shale, 15 to 65 percent slopes. The project area on top of La Jara Mesa is not listed on the NRCS Web Soil Survey, but consists of sandstone derived sandy loam over basalt and vesicular basalt bedrock. Slopes are approximately 1 to 3 percent.

The vegetative community in the lower elevation areas was sage, rabbit brush, Indian rice grass and other native forbs and grasses. At mid elevations along ridges and the slopes of La Jara Mesa the vegetation was piñon, juniper, cholla, snakeweed, sage and native forbs and grasses. Vegetation on the mesa top was primarily piñon, juniper, snakeweed, native forbs and grasses.

20. a. Percent Ground Visibility: 70-90 **b. Condition of Survey Area (grazed, bladed, undisturbed, etc.):** grazed and bladed with road cuts in areas

21. CULTURAL RESOURCE FINDINGS ☒ **Yes, See Page 3** ☐ **No, Discuss Why:**

22. Required Attachments (check all appropriate boxes):
- ☒ **USGS 7.5 Topographic Map with sites, isolates, and survey area clearly drawn**
- ☒ **Copy of NMCRIS Mapserver Map Check**
- ☒ **LA Site Forms - new sites (*with sketch map & topographic map*)**
- ☒ **LA Site Forms (update) - previously recorded & un-relocated sites (*first 2 pages minimum*)**
- ☐ **Historic Cultural Property Inventory Forms**
- ☒ **List and Description of isolates, if applicable**
- ☐ **List and Description of Collections, if applicable**

23. Other Attachments:
- ☐ **Photographs and Log**
- ☐ **Other Attachments**

***(Describe)*:** Photographs

24. I certify the information provided above is correct and accurate and meets all applicable agency standards.

Principal Investigator/Responsible Archaeologist: Nina Harris

Signature _____  _____ **Date** February 25, 2011 **Title (if not PI):**

25. Reviewing Agency: Reviewer's Name/Date Accepted ( ) Rejected ( ) Tribal Consultation (if applicable): ☐ Yes ☐ No	26. SHPO Reviewer's Name/Date: HPD Log #: SHPO File Location: Date sent to ARMS:

SURVEY RESULTS:

Sites discovered and registered: 6
Sites discovered and NOT registered: 0
Previously recorded sites revisited (site update form required): 9
Previously recorded sites not relocated (site update form required): 0
TOTAL SITES VISITED: 14
Total isolates recorded: 26 Non-selective isolate recording? ☐
Total structures recorded (new and previously recorded, including acequias): 0

MANAGEMENT SUMMARY A total of six newly recorded archaeological sites (AR-03-03-02-2880, AR-03-03-02-2881, LA 163195, LA 163196, LA 163197, and LA 163198) and 28 isolated occurrences (IOs) were identified during the Class III survey. One Traditional Cultural Property (Mt. Taylor, LA 156475) and a total of eight previously recorded archaeological sites (AR-03-03-02-818/LA 48224, AR-03-03-02-819/LA 48225, AR-03-03-02-820/LA 48226, AR-03-03-02-821/LA 48227, AR-03-03-02-2317/LA 131426 , AR-03-03-02-2768/LA 153870, AR-03-03-02-2770/LA 153873 and AR-03-03-02-2771/LA 153872) are located within the project area.

One of the sites (AR-03-03-02-819/LA 48225), located in the project area is recommended as eligible for nomination to the National Register of Historic Places and will need to be avoided. Two sites AR-03-03-02-820/LA 48226 and AR-03-03-02-821/LA 48227 are previously determined not eligible for NRHP listing and require no further management. Due to the shallow soils and disturbed nature of site AR-03-03-02-820/LA 48226 and potential for little additional study, EMI concurs the site is recommended not eligible for NRHP listing. AR-03-03-02-821/LA 48227 was previously determined not eligible in 1998 by the Forest Service and has since been destroyed.

Eleven sites (AR-03-03-02-818/LA 48224, AR-03-03-02-2317/LA 131426, AR-03-03-02-2768/LA 153870, AR-03-03-02-2770/LA 153873, AR-03-03-02-2771/LA 153872, AR-03-03-02-2880/LA 163193, AR-03-03-02-2881/LA 163194, LA 163195, LA 163196, LA 163197 and LA 163198) are recommended as having undetermined status.

Seven sites (AR-03-03-02-818/LA 48224, AR-03-03-02-819/LA 48225, AR-03-03-02-2770/LA 153873 and AR-03-03-02-2771/LA 153872, AR-03-03-02-2880/LA 163193, AR-03-03-02-2881/LA 163194, and LA 163198) are recommended for testing. Testing will provide data addressing integrity and nature of the sites as well as for further site management recommendations. Sites LA 163195, LA 163196, and LA 163197 will be avoided by access road rerouting and no further management is required for these sites at this time.
Isolated artifacts included lithics, tin cans, and bottle glass or bottles numbering a total of 26 IOs across the project areas. The field recordation of the IOs formally exhausted their information potential and, therefore, they require no further work. None of the IOs are deemed eligible for listing on the National Register of Historic Places or State Register of Cultural Properties.

If the above recommendations are followed, and subject to further comment, the criteria of no adverse effect have been applied to the undertaking.

If unanticipated cultural materials are encountered during project activities, work shall stop and a qualified archaeologist contacted to assess the find.

IF REPORT IS NEGATIVE YOU ARE DONE AT THIS POINT.

SURVEY LA NUMBER LOG
Sites Discovered:

LA No.	Field/Agency No.	Eligible? (Y/N, applicable criteria)
163193	AR-03-03-02-2880	Undetermined

163194	AR-03-03-02-2881	Undetermined
163195	EMI-GL-03	Undetermined
163196	EMI-GL-04	Undetermined
163197	EMI-GL-05	Undetermined
163198	EMI-GL-06	Undetermined

Previously recorded revisited sites:

LA No.	Field/Agency No.	Eligible? (Y/N, applicable criteria)
153872	AR-03-03-02-2771	Undetermined
153873	AR-03-03-02-2770	Undetermined
153870	AR-03-03-02-2768	Undetermined
156475	AR-03-03-02-2800	Y (TCP)
131426	AR-03-03-02-2317	Undetermined
48227	AR-03-03-02-821	N
48226	AR-03-03-02-820	N
48225	AR-03-03-02-819	Y Criterion D
48224	AR-03-03-02-818	Undetermined

MONITORING LA NUMBER LOG *(site form required)*

Sites Discovered (*site form required*) **:** **Previously recorded sites** ***(Site update form required):***

LA No.	Field/Agency No.	LA No.	Field/Agency No.

Areas outside known nearby site boundaries monitored? Yes ☐, No ☐ If no explain why:

TESTING & EXCAVATION LA NUMBER LOG (*site form required)*

Tested LA number(s)	Excavated LA number(s)

ABSTRACT

Between June 11th and 16th, 2009 and on February 9th, 2011, Ecosystem Management, Inc. (EMI) conducted a Class III cultural resource survey for Golder Associates, Inc. of a total of approximately 125 acres prior to road improvements and uranium mine facilities construction on both private lands and lands within the Cibola National Forest, in Cibola County, New Mexico. The project area is located approximately 10 miles northeast of Milan, New Mexico. The project areas are located within Township 12 North, Range 10 West, Sections 24 and 25, and Township 12 North, Range 9 West, Sections 11, 15, 19, 20, 21, 22, 27, 29 and 30 on US Geological Survey (USGS) San Mateo, Dos Lamas, and Grants 7.5 minute quadrangles. The additional survey performed on February 9th, 2011 was to plan a rerouting of the access road and well location in order to avoid sites LA 163195, LA 163196, and LA 163197. Both survey sessions are documented in this report.

This undertaking complies with the provisions of the National Historic Preservation Act of 1966, as amended through 1992, and applicable regulations. The report is consistent with applicable federal and state standards for cultural resource management. The lead agency for the project is US Forest Service, Cibola National Forest. Nina Harris served as Project Manager and Field Director, Garth Hayden served as Crew Chief, Kate Wright and Zach Kneebone served as Field Crew. The survey was conducted under Permit #NM 09-107 and USFS-Cibola National Forest Permit #CIB108. The EMI project number is 846.

A total of six newly recorded archaeological sites (AR-03-03-02-2880/LA 163193, AR-03-03-02-2881/LA 163194, LA 163195, LA 163196, LA 163197, and LA 163198) and 28 isolated occurrences (IOs) were identified during the Class III survey. One Traditional Cultural Property (Mt. Taylor, LA 156475) and a total of eight previously recorded archaeological sites (AR-03-03-02-818/LA 48224, AR-03-03-02-819/LA 48225, AR-03-03-02-820/LA 48226, AR-03-03-02-821/LA 48227, AR-03-03-02-2317/LA 131426 , AR-03-03-02-2768/LA 153870, AR-03-03-02-2770/LA 153873 and AR-03-03-02-2771/LA 153872) are located within the project area.

One site, (AR-03-03-02-819/LA 48225), that is located in the project area is recommended as eligible for nomination to the National Register of Historic Places and will need to be avoided. Two sites AR-03-03-02-820/LA 48226 and AR-03-03-02-821/LA 48227 are previously determined not eligible for NRHP listing and require no further management. Due to the shallow soils and disturbed nature of site AR-03-03-02-820/LA 48226 and potential for little additional study, EMI concurs the site is recommended not eligible for NRHP listing. AR-03-03-02-821/LA 48227 was previously determined not eligible in 1998 by the Forest Service and has since been destroyed.

Eleven sites (AR-03-03-02-818/LA 48224, AR-03-03-02-2317/LA 131426, AR-03-03-02-2768/LA 153870, AR-03-03-02-2770/LA 153873, AR-03-03-02-2771/LA 153872, AR-03-03-02-2880/LA 163193, AR-03-03-02-2881/LA 163194, LA 163195, LA 163196, LA 163197 and LA 163198) are recommended as having undetermined NRHP eligibility status.

Seven sites (AR-03-03-02-818/LA 48224, AR-03-03-02-819/LA 48225, AR-03-03-02-2770/LA 153873 and AR-03-03-02-2771/LA 153872, AR-03-03-02-2880/LA 163193, AR-03-03-02-2881/LA 163194, and LA 163198) are recommended for testing. Testing will provide data addressing integrity and nature of the sites as well as for further site management recommendations. Sites LA 163195, LA 163196, and LA 163197 will be avoided by access road re-routing and no further management is required for these sites at this time.

Isolated artifacts included lithics, tin cans, and bottle glass or bottles numbering a total of 26 IOs across the project areas. The field recordation of the IOs formally exhausted their information potential and,

therefore, they require no further work. None of the IOs are deemed eligible for listing on the National Register of Historic Places or State Register of Cultural Properties.

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INTRODUCTION/PROJECT DESCRIPTION

Between June 11th and 16th, 2009 and on February 9th, 2011, Ecosystem Management, Inc. (EMI) conducted a Class III cultural resource survey for Golder Associates, Inc. of a total of approximately 125 acres prior to road improvements and uranium mine facilities construction on both private lands (on the Elkin Ranch) and lands within the Cibola National Forest, in Cibola County, New Mexico. The project area is located approximately 10 miles northeast of Milan, New Mexico. The project areas are located within Township 12 North, Range 10 West, Sections 24 and 25, and Township 12 North, Range 9 West, Sections 11, 15, 19, 20, 21, 22, 27, 28, 29 and 30 on US Geological Survey (USGS) San Mateo, Dos Lamas, and Grants 7.5 minute quadrangles (Figures 1 and 2).

The project includes the use of existing roadways that pass through both private lands on the Elkins Ranch and Cibola National Forest lands for purposes of hauling, and accessing the mining facilities and portal. These roads include: Forest Road 450, Forest Road 544, and Elkin's Road (a dirt road located on private land that connects Forest Road 450 to State Road 605). It is the intention of the project proponents to access the facilities location on these existing roads as well as construct one new road segment. The new road segment was surveyed as an alternative to avoid sites identified during the course of this investigation.

The Area of Potential Effect (APE) includes 16.4 acres for a mining facilities and portal at the base of La Jara Mesa, six acres for the escape rise on top of La Jara Mesa. The APE also includes portions of Forest Road 450, Forest Road 544 and Elkin's Road (Located on private land) and an approximately half mile segment of new road A clearance width of 40 feet along roadways is recommended for the transport of equipment and the placement of waterlines and transmission lines next to the haul road which may result in the temporary or permanent widening of road segments to a maximum width of 40 feet (20 feet on either side of the road center line) and defines the access roadway the APE (Figure 4). A survey corridor of 200 feet (100 feet on either side of the center line) was surveyed along Elkin's Road and Forest Road 450. Laramide has no plans to widen or improve previously surveyed Forest Road 544 and it will only be subjected to routine maintenance, so a survey buffer was not necessary. Previously recorded sites along Forest Road 544 were revisited during the 2009 survey.

Construction activities will include a 2.5 mile transmission line, a variety of surface structural facilities and infrastructure at the portal location, an escape raise with hoist and generator shed, and storm water and sediment control structures. Installation will be required for underground phone and internet connections, a water well and pump station on the Elkin's ranch with a 10,000 gallon water tank, 1-2 additional 10,000 gallon water tanks near the portal, a buried waterline in or immediately adjacent to the road, upgrade of existing roads with cattle guards and culverts, septic tank and leach field, and two portals/dual inclines. Other activities include storm water collection basins installation and maintenance, use and maintenance of existing roadways, a waste rock pile, surface storage of bulk material, reclamation activities, removal, stockpiling and stabilization of growth medium snow plowing of Forest Road 544 in the winter. See the Environmental Impact Statement for a full project description.

This undertaking complies with the provisions of the National Historic Preservation Act of 1966, as amended through 1992, and applicable regulations. The report is consistent with applicable federal and state standards for cultural resource management. The lead agency for the project is US Forest Service, Cibola National Forest. Nina Harris served as Project and Field Director, Garth Hayden served as Crew Chief and Field Director, and Kate Wright and Zach Kneebone served as Field Technicians during 250 field hours required to complete the survey. The research was conducted under Cibola National Forest Permit No. CIB108 and New Mexico General Archaeological Investigation Permit Number NM-09-107-S. The NMCRIS number is 114095, and the EMI report number is 846.

The project area legal descriptions are provided in Table 1.

Table 1: Project Area UTMs

Project Area UTMs (NAD 27 UTM Zone 13 N)								
Point	**Township**	**Range**	**Section**	**1/4 section**	**1/4 section**	**1/4 section**	**Easting**	**Northing**
West End	12 N	10 W	24	SW	SE	SW	241088	3904301
USFS Fence (FR450 Start)	12 N	9 W	28	NE	SE	NE	246667	3903008
FR 450 Center	12 N	9 W	22	NE	SW	NE	247727	3905027
Mine Facilities NW Corner	12 N	9 W	10	SE	SE	SE	248084	3906715
Mine Facilities SW Corner	12 N	9 W	15	NE	NE	NE	248096	3906493
Mine Facilities NE Corner	12 N	9 W	11	SW	SW	SW	248490	3906974
Mine Facilities SE Corner	12 N	9 W	14	NW	NW	NW	248613	3906703
Well	12 N	9 W	28	NE	SE	NE	246692	3902958
Escape Raise	12 N	9 W	11	NE	SE	NE	250030	3907740
FR 544 Start of site revisit	12 N	8 W	21	NE	SW	NE	255664	3904594
FR 544 Mid Point of site revisit	12 N	8 W	8	SW	SE	SW	253734	3907074
FR 544 End of site revisit	12 N	9 W	12	NW	SW	NW	250135	3907744
Alternative Access Route – West End	12 N	9 W	28	NW	NW	NE	246089	390357
Alternative Access Route - East End	12 N	9 W	27	NE	NW	NW	247123	3903410

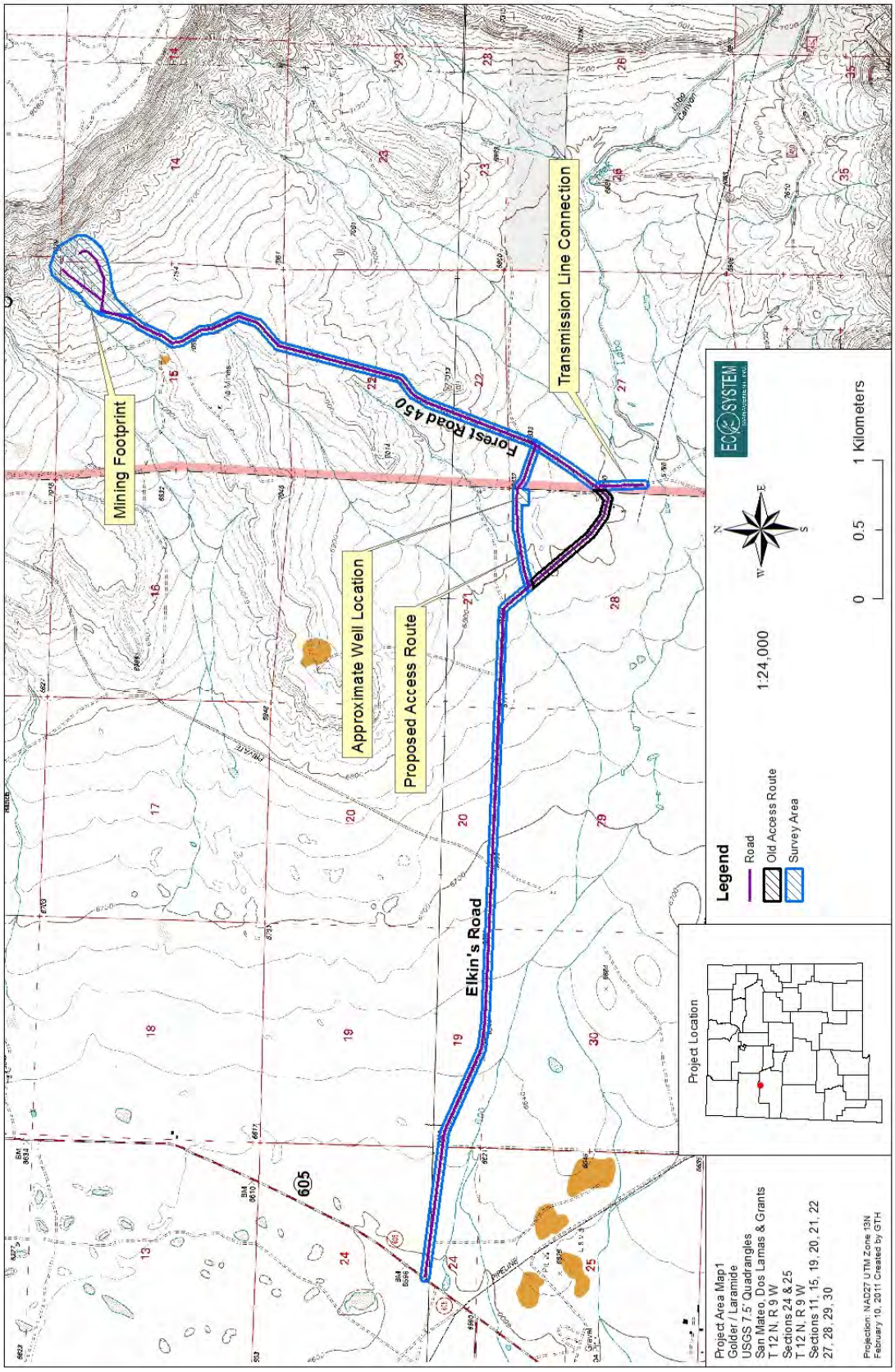

Figure 1: Project Area Map 1

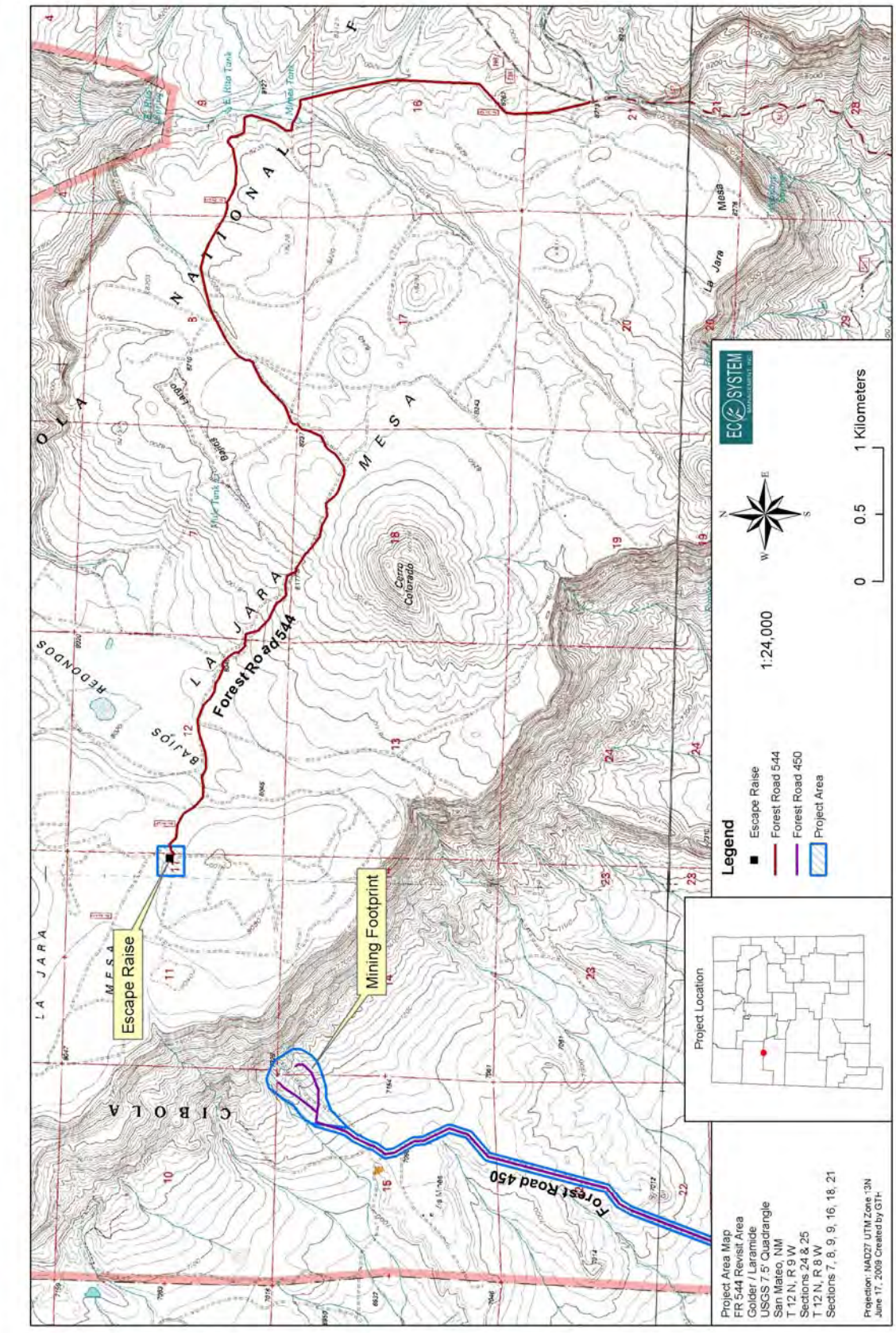

Figure 2: Project Area Map 2

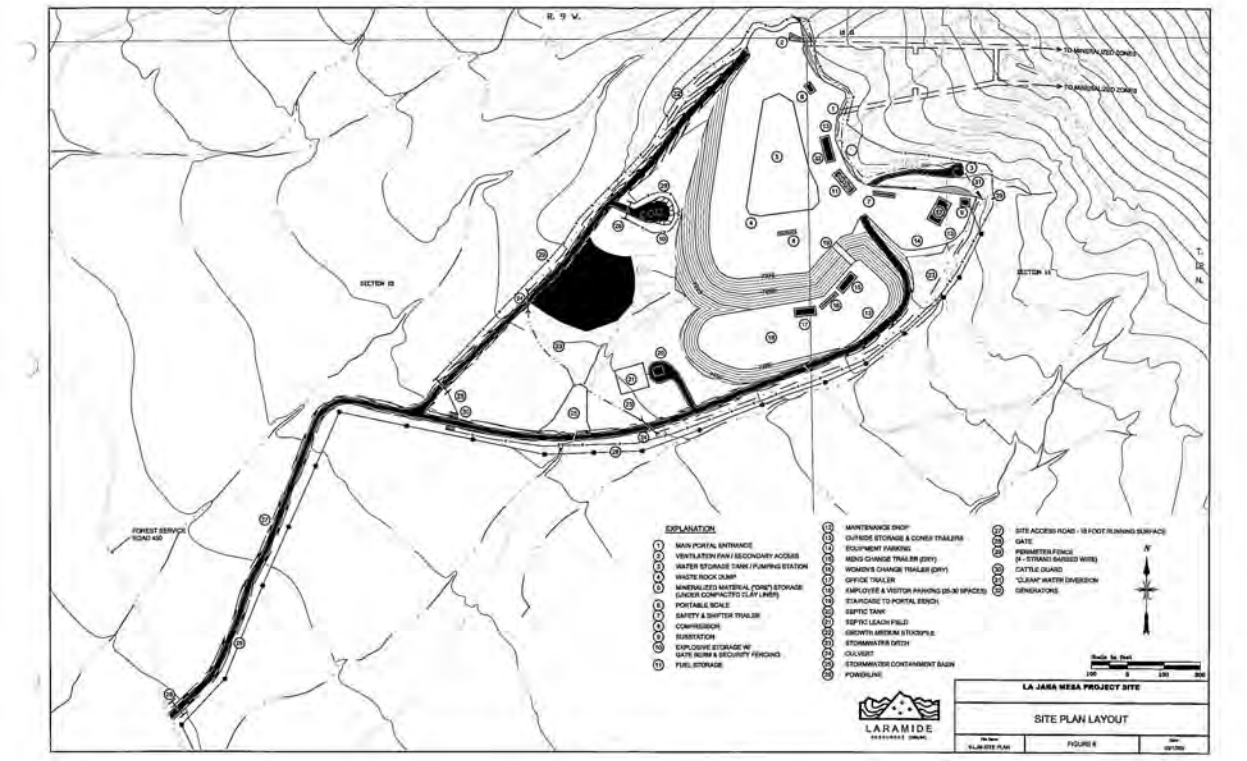

Figure 3: Mine footprint detail

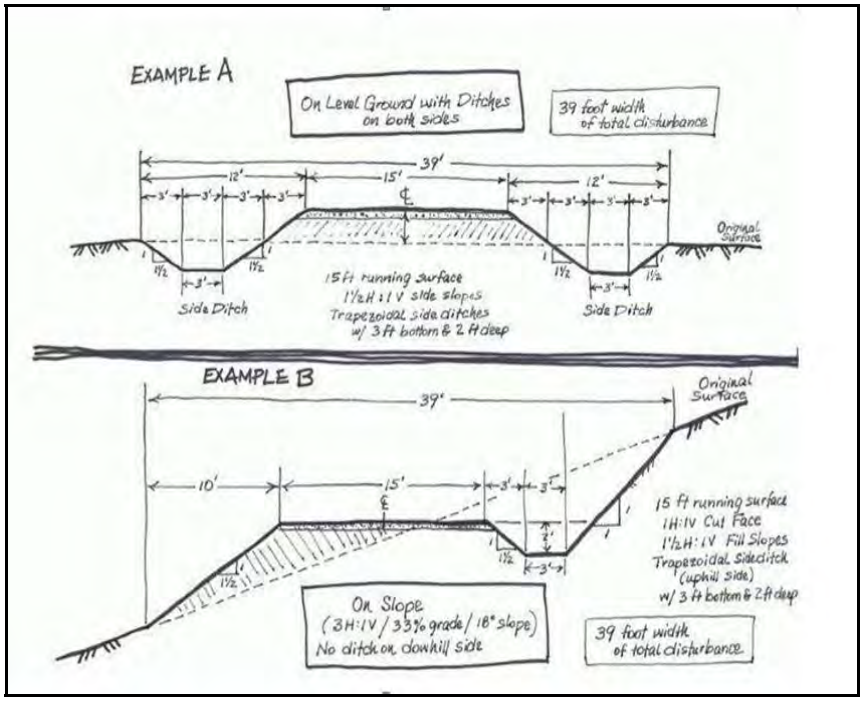

Figure 4: Road Improvement Cross Section Diagram

ENVIRONMENTAL SETTING

Physiography

The project location is within the north central portion of Cibola County (Figure 1). This area is generally within the Navajo Section of the Colorado Plateau Province of the North American continent. The Colorado Plateau is characterized by deep canyons, high altitude, steep escarpments, flat plateaus comprised of gently dipping sedimentary rocks, and an arid climate (Thornbury 1965). The most distinctive structural feature of the province is its large number of monoclines. The monoclines are broken throughout the province by structural basins and up warps of considerable relief. Volcanic structures are concentrated around the plateau's margin but are also scattered throughout its interior (Kelley 1955).

The Navajo Section of the province is a poorly defined area of scarped plateaus that lack the degree of dissection that occurs elsewhere in the province (Thornbury 1965). Surfaces in the Navajo Section are mesas, buttes, and cuestas rather than clinal ridges and hogbacks. The section is bounded on the west and south by the Little Colorado River and the Echo Cliffs monocline near the Colorado River. The northern boundary is along the lower San Juan River to the Four Corners area, then northeast to the San Juan Mountains. The southeast boundary extends from the Sierra Nacimiento to Mt. Taylor and onward to the Puerco River.

The Navajo Section has numerous volcanic features that include vents, flows, and pyroclastic deposits that are referred to collectively as the Navajo-Hopi Volcanic Field. Other major structural features of the section include the Black Mesa Basin, the Defiance Upwarp, and the San Juan Basin. The Navajo-Hopi Volcanic Field is comprised of the Hopi Buttes, Monument Valley, and the Chuska Mountains. Basalt-capped mesas and buttes are common throughout the section (Thornbury 1965).

The exposed rocks of the Colorado Plateau range from the Precambrian to the Recent period in age (Thornbury 1965). Black Mesa is capped by the Cretaceous Mancos Shale and Mesa Verde Sandstone formations. The Defiance Upwarp has exposed the much older De Chelly Sandstone. The Navajo Section is characterized as a basin with thick layers of gently dipping Mesozoic and Cenozoic sedimentary shale, mudstone, and sandstone that contain coal seams. The area is generally characterized as rolling plains with cuestas and tablelands capped by sandstone. Canyons are typically broad and shallow (Williams 1986).

The character of the Colorado Plateau is a product of the interaction of three processes: uplift, volcanism, and erosion. Erosion is the primary force that has created the extant landscape. The tectonic event that uplifted the Colorado Plateau involved the westward movement of the North American plate, beginning about 75 million years ago. Over a period of the next 25 million years, the western portion of the North American plate broke, buckled, and was uplifted, forming the Rocky Mountains. The following 45 million years has been degradation as material has been removed from the surface of the plateau to form the Middle and Late Tertiary deposits in other regions. As recent as 10 million years ago, a large lake formed in what is now northeastern Arizona. Streams carried eroded materials from the south, east, and north. This ancient lake is referred to as Hopi Lake (Repenning et al. 1958).

The project area falls specifically in the Mount Taylor region on and near La Jara Mesa. Mt. Taylor is a young (3.3 to 1.5 million years old) composite volcano on the southern boundary of the San Juan Basin and is part of the large northeast/southwest trending Mt Taylor Volcanic Field. La Jara Mesa is 2,440 meters to 2,530 meters (8005-8300 ft) above sea level and contains uranium mineralization within four levels of the Poison Canyon sandstone member of the Morrison formation. The uranium deposit is a roll front uranium deposit occurring within a sequence of clastic Jurassic and Cretaceous sedimentary rocks. Tertiary basaltic lavas occur on top of

the cretaceous sediments (http://www.laramide.com/SiteResources). The basalt that caps La Jara Mesa, in the project area, is part of this volcanic field. The deposits beneath the basalt cap of the mesa are sandstones and shales that were deposited along the shoreline of the Cretaceous Western Interior Seaway during the Cretaceous period 84 to 99 million years ago (Kelly 2008). Grants Ridge and Horace Mesa, approximately 1.6 miles south of La Jara Mesa, contain obsidian producing rhyolite magmas. The obsidian procured from these areas was an important prehistoric commodity (http://www.swxrflab.net/grants.htm).

Soils

The Natural Resources Conservation Service Web Soils Survey indicates that Penistaja soils are the primary soil type in the lower elevations of the project area along the private access road to FR 450. Penistaja soils are fine sandy loams derived from sandstone slope alluvium, 2 to 10 percent slopes. Soils along the slopes and finger ridges extending out from La Jara Mesa are rock outcrop-Mion complex soils derived from slope alluvium over colluvium derived from calcareous shale, 15 to 65 percent slopes. The project area on top of La Jara Mesa is not listed on the NRCS Web Soil Survey, but consists of sandstone derived sandy loam over basalt and vesicular basalt bedrock. Slopes are approximately 1 to 3 percent.

Hydrologic System

Major hydrological systems in the region include Lobo and Grants Canyons. Several unnamed ephemeral drainages flow to the southwest from the project area into Lobo Creek. Lobo Creek drains Lobo Canyon in a westerly direction and ultimately flows into the Rio San Jose. The Rio San Jose is a tributary to the Rio Puerco.

Climate

The climate is characterized as being arid to semi-arid with hot summers and mild winters. Temperatures across northwestern New Mexico vary mainly as a result of elevation and latitude. Winter temperatures drop about 1° centigrade (C) for every one-degree increment in latitude. Summer temperatures drop about 1°C for every 150 m (492 ft) increase in elevation (Sellers and Hill 1974). For Grants, New Mexico (1971 to 2000 records), the mean average summer high temperature ranges between 29° and 31° C (85° to 88° Fahrenheit [F]) and the average winter high temperature ranges between 7° and 10.5° C (46° to 51° F). The average number of frost-free days is about 120 days (Bennett 1986:38, 47).

Annual precipitation for Grants, New Mexico (southwest of the project area), is 25.4 centimeters (cm) (10 inches [in]). Most precipitation occurs from July through October. Average snowfall in Grants is 30.4 cm (12 in). Summer precipitation originates primarily from the Gulf of Mexico and the Atlantic Ocean. Precipitation from summer storms is brief, occurring primarily in the evening. These thunderstorms tend to be localized. Winter precipitation originates from the Pacific Ocean (Sellers and Hill 1974). Precipitation from winter storms is usually light to moderate. Most mountainous areas receive winter precipitation as snow.

The prevailing winds are from the southwest with winds from the west and southeast not uncommon. The most frequent wind velocities range between 13 and 19 km per hour (8 to 12 mi per hour) from March through June, with the predominate direction being from the southwest (Bennett 1986:50–51).

Biotic Communities

The project area lies in the Great Basin Conifer Woodland biotic community. This plant community is dominated by juniper and piñon. Habitats tend to be rocky mesas and canyons with semi-grasslands that exhibit parkland and savanna-like mosaics. The open range grassland/scrubland vegetation community at this elevation ranges from 6060 to 6200 feet above mean sea level and consists of occasional, scattered juniper and piñon standing over a mixture of rocky mountain mahogany, cholla, prickly pear, saltbush, broom snakeweed,

rubberweed, sunflower, yucca, chenopodium, Indian ricegrass, ring muhly, grama, fescue, bromes, and other range grasses.

The Great Basin Conifer Woodland has several distinctive mammalian and reptilian species that inhabit the vegetation communities of this biome that include the coyote, black-tailed jackrabbit, pronghorn antelope, cottontail, and collared lizards. Mule deer and black bear are located in the project area in limited numbers. Several avian species are characteristic of the Great Basin Conifer Woodland. These include the turkey vulture and various hawks.

CULTURE HISTORY OVERVIEW

Paleoindian Period (11,000 to 6000 B.C.)

Paleoindian peoples are defined as early Holocene hunters and foragers who were the first to inhabit the North American continent. Originally believed to be dependent on now extinct megafauna such as bison, mammoth, and mastodon, recent research has shown that Paleoindian groups also utilized varied flora and fauna resources (Cordell 1997). Material remains include a toolkit consisting of lanceolate projectile points, end and side scrapers, knives, gravers, chisel gravers, drills, spokeshaves, and utility flakes (Judge 1973:327). Regional settlement is believed to have been seasonal although some reoccupation of campsites may have occurred. Kelley and Todd (1988) make a point that given the new migrants unfamiliarity with newly encountered flora and fauna species, the Paleoindians would have tended to concentrate on proven sources of food, i.e., nomadic game animals such as mammoth and bison. Paleoindian mobility is, therefore, explained by the necessity to follow wide-ranging herd animals. Paleoindian sites are often found on promontories near water sources and are generally within the seasonal range of herbivorous animals (Judge 1973:330).

The various Paleoindian cultures represented in the region include Clovis (9500–9000 B.C.), Folsom (8800–8300 B.C.), and Plano Complexes (7000–6000 B.C.) (Irwin-Williams and Haynes 1970). In the San Juan basin there is thought to be a lapse in human occupation between 8000 and 6600 B.C., possibly as a result in a decrease of effective moisture during this period (Stuart and Gauthier 1981:29; Vivian 1990:81). Also, Paleoindians likely occupied upland areas (elevations from 2,128 to 3,040 m [7,000 to 10,000 ft]) in the region (Stuart and Gauthier 1981:29). The Paleoindian toolkit includes lanceolate projectile points/knives, end and side scrapers, knives, gravers, chisel gravers, drills, spokeshaves, and utility flakes (Judge 1973). There is a growing diversification in tool kits throughout the period, possibly explained by the extinction of megafauna later in the period and the tendency for groups to settle into territories and focus on local resources in a more restricted area (Stone 1999). There is little current evidence of Paleoindian use or occupation of the Mt Taylor region, though sites have been discovered in the Puerco Valley to the east (Benedict and Hudson 2008).

Archaic Period (6000 to 400 B.C.)

The Archaic period is characterized by continuation of the hunting and foraging economy of the preceding Paleoindian period with technological adaptations to changing climatic conditions. Around 6000 B.C. the North American climate changed to a much warmer and drier Altithermal pattern, causing widespread fauna and floral changes (Cordell 1997). Most megafauna became extinct and smaller modern species became predominant. Human populations adapted to these changes and material culture became diversified. A distinction is made between northern Archaic groups, referred to as the Oshara Tradition (Irwin-Williams 1973), and more southerly groups, referred to as the Cochise Tradition (Sayles and Antevs 1941). The Oshara Tradition includes five phases: Jay (5500–4800 B.C.), Bajada (4800–3300 B.C.), San Jose (3300–1800 B.C.), Armijo (1800–800 B.C.) and En Medio (800 B.C.–A.D. 400). This typological division is somewhat arbitrary as projectile point types from both traditions frequently overlap. Both groups employ smaller point styles with shouldered hafting elements occurring sometime around 3200 B.C.

A growing reliance on plant foods during the Archaic period is also evidenced by grinding tools such as one-hand manos and basin metates. Settlement patterns are diverse with no ecological determinants except that Archaic populations tended to camp near areas of high floral and fauna diversity. Later in the period, ca. 1800 B.C., maize was introduced. In some areas maize is quickly adopted and becomes a staple, in others it is less important compared to wild plant resources and is not habitually grown until the Basketmaker III period (Dello-Russo 1999).

The first evidence of definable architecture appears during the middle-to-late Archaic period (1800 B.C.–A.D. 600). Pitstructures, archaeologically defined by shallow oval enclosures surrounded by postholes and often associated with fire-cracked rock, appear to have been used for short term or seasonal habitation near abundant resource locations. This adaptation is scattered widely across the San Juan Basin. Habitation and resource areas tend to be located near permanent water sources and on upland dune ridges and mesa-canyon associations. Populations tended to depend on collecting wild plant foods such as grass seeds, piñon nuts, juniper berries, hackberry, amaranth, and cacti (Vivian 1990:99–105). Evidence of Archaic occupations near the project area has been found on both La Jara Mesa and Lobo Canyon (Benedict and Hudson 2008).

Basketmaker II–III Period (400 B.C. to A.D. 720)

The beginning of the Basketmaker period (Basketmaker II 400 B.C. to A.D. 500) is characterized by hunters/gatherers engaging in horticulture, while later in the period (Basketmaker III A.D. 500–720) storing excess foodstuffs beyond their seasonal needs. Instead of a mobile lifeway based on natural resource abundance, these people begin a longer seasonal habitation and possibly even permanent habitation in areas that are both productive for maize-based agriculture and seasonal hunting (Stuart and Gauthier 1981:36). The timing of this shift in subsistence strategy seems to vary widely across the southwest, and Stuart and Gauthier note that these changes are probably “fragile, sporadic and determined by local population density”. They further note that this period is highly variable in terms of settlement pattern and site size and that surface surveys may miss Archaic period remains that lie beneath later occupations. The few consistent patterns during this period are the location of sites near permanent water sources and their proximity to mountainous areas (Stuart and Gauthier 1981:409).

Later habitation sites increase in size indicating population aggregation into villages generally in upland settings that average 1,976 m (6,500 ft) in elevation (Stuart and Gauthier 1981). Some authors argue that some peoples retained the hunting and gathering lifeway and that these groups essentially lived among sedentary groups (Stuart and Gauthier 1981). Pottery was developed at about A.D. 300 (Vivian 1990:99) and a significant reduction in the size of projectile point forms indicates the use of the bow and arrow. Although Basket Maker and Pueblo I use of the areas around Mt. Taylor has been documented, settlement density is low until the late Pueblo I to early Pueblo II periods.

Pueblo I Period (A.D. 720 to 920)

The Pueblo I period is characterized by linear and crescent-shaped surface storage and living structures in association with pitstructures. During this period there was a decrease in effective moisture with an increasing oscillation in precipitation from year to year. Most aggregated settlements were dependent on maize-based agriculture supplemented by seasonal hunting and wild seed gathering. Wild plant foods were probably still very important in years when precipitation would not permit excess agricultural production to last throughout the winter.

In the Chaco Canyon area, the initial construction of “Great Houses” begins during the Pueblo I period (Vivian 1990). Previously undecorated pottery assumed new decorated forms that included mineral-based paints and neck-banding on plain vessels (Dello-Russo 1992:43). Larger settlements continued to be occupied in upland settings (Stuart and Gauthier 1981). In some areas, populations were more mobile with a segment of the population leaving seasonally and returning for the winter and/or summer months (Schmader 1994).

Pueblo II Period (A.D. 920 to 1120)

The Pueblo II period is defined by the building of small, linear, above ground habitation structures or roomblocks while retaining the pitstructure form as an auxiliary habitation or religious structure (kiva). Initially, there is a trend in aggregated settlements to be at higher elevations in riverine settings. By A.D. 1000, in nearly all areas of New Mexico, there is a reversal in this trend. There is an abandonment of higher elevation areas in favor of lower elevation basin settings (Stuart and Gauthier 1981). Pottery types such as Red Mesa and Gallup Black-on-white are characteristic of the period.

In the central San Juan Basin, local adaptations are referred to as the Early Bonito phase (A.D. 920 to 1020) and the Classic Bonito phase (A.D. 1020 to 1120). These phases indicate a shift in architecture and settlement patterns. The development of Chacoan communities begins, marked by the construction of planned, multi-storied "Great Houses" and large "Great Kivas". There is also a continuation of small house sites with linear pueblos associated with subterranean kivas (Vivian 1990:203–206). The population is estimated to have increased throughout the period and six-fold in the Chuska River Valley (Gillespe and Powers 1983). Subsistence resource shortfalls may have become more common and maize-based farming became more intensive with water control and conservation features becoming more common (Vivian 1990:214). An extensive road system was built that extended in a general radial pattern from Chaco Canyon to the margins of the San Juan Basin (Nials et al. 1983). Tainter and Gillio (1980) relate the rapid growth of population during the period in the San Mateo Valley that coincides with a period of increased and stable moisture. Pueblo II sites increase in density from approximately 4.8 per square mile early in the period, to 15.6 in the middle and 28.4 in the latter stages. During the middle to late Pueblo II period Chacoan influence in the San Mateo area produced three outlier sites El Rito, San Mateo, and Kin Nizhoni. Chacoan use of the region has also been documented in Chaco Canyon with many of the roof beams originating from Mt. Taylor.

Pueblo III Period (A.D. 1120 to 1320)

The Pueblo III period was one of great change in the southwest. The San Juan Basin saw community development in its peripheries such as at Mesa Verde, Cibola, and Acoma. The Chaco core area fluoresces and then collapses with a general abandonment by the late 1170s. There is a reoccupation of Chaco Canyon by Mesa Verde peoples during the 1175 to 1250 period based on the sudden appearance of Mesa Verde style pottery and new pueblo construction as well as older pueblo reconstruction. In the San Mateo Valley, Tainter and Gillio (1980) portray a sudden drop in population during the Hosta Butte Phase. The very high site density of the Late Pueblo II period dropped to 5.2 per square mile after the first 50 years of the period. A brief reoccupation occurred at approximately A.D. 1250 in the El Rito outlier area. Ceramics during this period relate to Mesa Verde influence in the Chaco outlier system.

The Rio Grande districts saw an increase in population. Aggregation of peoples in the eastern pueblos resulted in larger planned communities (50+ rooms). This probably resulted from a combination of immigration and local population growth (Crown et al. 1996). In addition to population growth there is a shift in settlements away from river terraces and floodplains to elevated upland settings. There was a corresponding shift to dry land agricultural techniques. New pottery decoration techniques were adopted using vegetal-based paints to create the nearly ubiquitous Santa Fe Black-on-white type.

Pueblo IV Period (A.D. 1320 to 1540)

The Pueblo IV period is considered one of cultural florescence in the Rio Grande region (Wendorf and Reed 1955). The tendency of aggregation into fewer and larger pueblos continued, and sites with 1000+ rooms being common. These large settlements tend to be in riverine and valley bottom settings, lower in elevation than aggregated settlements during the preceding Pueblo III period. Outlying small fieldhouse sites were also built near varied resource areas (Snead 1995). It is during the Pueblo IV period that the population is considered to have reached its maximum levels, and material culture attained its most sophisticated level. Glaze-painted pottery becomes predominant and is roughly contemporaneous with Katsina cult iconography that indicates a

new religion had spread into the region from the south (Adams 1991). Pueblo IV sites in western New Mexico are associated with ancestral villages of Acoma and Zuni.

Another development during this time is the migration of Athapaskan (Dineh and Apache) peoples from the north. The arrival date of the Athapaskans into northwest New Mexico is debated by scholars (Kelley 1982). Spanish colonists in the mid-sixteenth century referred to local Athapaskan peoples as "Apaches", and those living west of the Rio Grande as "Apaches de Navajo" (Brugge 1984). Exactly when the Navajo became distinct from other Apaches is not known. The subsistence pattern of the early Navajo was probably based on horticulture combined with hunting and gathering. Early Spanish records indicate the Navajo were farming by the early 1600s (McNitt 1972; Wozniak 1988), but whether they adopted horticulture from local Puebloan peoples or prior to their arrival in the Dinetah is unclear (Bailey and Bailey 1986). Betancourt (1980) uses the presence or absence of horticulture as the basis for distinction between the Navajo and other Athapaskan (Apache) peoples.

Historic Period (A.D. 1540 to Present)

The first Spanish colonial capital was established at the Tewa community of Yunge Oweenge in 1598. This changed Puebloan culture radically in economic, religious, social, and political terms. Endemic disease; raiding by Navajo, Ute, Apache, and Comanche peoples; and the Spanish system of land grants and mission establishment also took their toll. They drastically reduced traditionally held areas and population. The first European presence in the Grants and Bluewater areas was during the late sixteenth to mid-seventeenth centuries with Spanish exploratory and military expeditions. The early Spanish community of San Rafael is an example of an early Spanish colonial occupation with its mission and settlement. The arrival of the Spanish created tension between the indigenous peoples and Europeans.

In 1599 the Spanish, under the command of Viceroy Don Juan de Oñate, conducted punitive military action against Ácoma Pueblo, killing some 500 residents and imprisoning, enslaving, and maiming others. This action was in response to attacks on Spanish military scouting parties transgressing on Pueblo lands. The Pueblo Revolt of 1680 was a reaction to Spanish authority and the revolt did remove, temporarily, Spanish rule. In 1692, however, Spain with an army under De Vargas reasserted its claim on northern New Mexico and held it until 1821 when Mexico won its independence. Mexico held claim to what is now New Mexico until 1846 when the U.S. Army, under S. W. Kearny, took possession of the territory during the U.S. and Mexico War. Throughout this period:

> …The landscape produced a dispersed pattern of settlement consisting of numerous small enclaves of population and culture. These Pueblo and Hispano villages became bastions of cultural preservation, for they were at once so self-sufficient that they had little need for the outside world and yet so poor that the outside world had little need for them. In isolation they persisted for centuries, changing little [DeBuys 1985].

The San Juan Basin remained Navajo territory throughout the early historic period while the Ute claimed the territory generally north of the San Juan River. The economy of the area was dominated by sheep herding and small-scale agriculture. In 1863, the U. S. Army forced an initial 8,000 Navajos to relocate to the Mescalero Apache reservation at Bosque Redondo in east-central New Mexico (McNitt 1972). This action was a punitive reaction to raids by Navajos in the area and on the community of Santa Fe in 1860. A punitive military expedition mounted by Kit Carson in the San Juan Basin resulted in scorched earth policies and the persuasion of Navajo leaders Barboncito and Delgado to gather their followers and relocate to Bosque Redondo. More militant leaders, such as Manuelito, maintained guerilla warfare against the New Mexico militia and their Ute, Zuni, and Hopi allies. At Bosque Redondo, the relocated Navajos faced starvation and extremely poor living conditions that resulted in more than 2,000 deaths from disease and starvation. The Navajo returned to the San Juan Basin in 1868 under the guidelines of the Treaty of 1868 that was negotiated in Washington, D.C. by Federal officials and the Navajo leaders. In the 1870s a United States Army facility was established along the

eastern flank of the San Juan Basin (Williams 1986:112). The facility was established to discourage periodic Navajo raiding of Puerco and Chama River Euroamerican settlements.

Euroamerican settlements that include Grants, Coolidge, and Thoreau were established during the late nineteenth century. Their settlement coincided with the construction of the Atlantic and Pacific railroad. The railroad made farming and ranching profitable. Mining and lumber milling developed in the region in response to cheaper shipping by railroad. The railroad stimulated economic development in the Grants and Bluewater areas.

PREVIOUS RESEARCH

Archival Research

Prior to conducting the Class III pedestrian field survey, record searches were conducted at the Archaeological Records Management Section (ARMS) of the Museum of New Mexico for previously recorded sites within 1 mile of the project area on May 22, 2009 by Nina Harris, EMI Cultural Resources Program Director. A review of State and National Register of Historic Places was also conducted at that time. In addition, site record searches of the United States Forest Service, Cibola National Forest Office records were conducted on June 3, 2009 by Kate Wright, EMI archaeologist. No National Register of Historic Places (NRHP) listed properties are within 1 mile (1.6 km) of the project area. One State Register of Cultural Properties Traditional Cultural Property was located at Mt. Taylor as of June 2009 (LA 156475). Results of the record search indicate 34 previous studies and 53 previously record sites within one mile (1.6 km) of the project area. One previous survey was conducted within the project area (FR 544) by Lone Mountain Archaeological Services in 2007 that identified three sites (LA 153870/AR-03-03-02-2768, LA 153873/AR-03-03-02-2770 and LA 153872/AR-03-03-02-2771) along the road. Cibola National Forest archaeologists requested that EMI revisit these sites to confirm locations and further identify site characteristics. Five additional previously recorded sites (LA 48224, LA 48225, LA 48226, LA 48227, and LA 131426) are also located within the project area. In 1998, Linda Popelish surveyed sites LA 48224, LA 48225, LA 48226 and LA 48227 to estimate damages made by unauthorized road blading (Forest Report #1998-03-069). LA 48224 and LA 48225 were tested and found to only be slightly impacted but LA 48226 and LA 48227 were severely impacted contributing to NRHP ineligibility of these two sites. One state Traditional Cultural Property is located at Mt. Taylor as of June 2009. Tables 2 and 3 provide the record search results. ARMS maps are provided as Appendix A.

NATIONAL AND STATE REGISTER HISTORIC PROPERTIES

A review of State and National Register of Historic Places was conducted on May 22, 2009. No sites within one mile (1.6 km) of the survey area are listed on the National Register of Historic Places (NRHP).One listing (the Mt Taylor TCP) on State Register of Cultural Properties (SRCP). ARMS maps are provided as Appendix A.

Table 2: Surveys conducted within one mile (1.6 kilometers) of the project area

NMCRIS Number	Performing Agency	Survey End Date	Acres	Number of Sites
11684	UNMOCA	1979	0.85	0
9075	PLAC	1984	89	4
39385	CASA	1992	26.35	0
61952	CASA	1994	135	0
8308	LAB-N	1977	1387.87	7
NMCRIS Number	**Performing Agency**	**Survey End Date**	**Acres**	**Number of Sites**

NMCRIS Number	Performing Agency	Survey End Date	Acres	Number of Sites
79151	MT TAYLOR RD	2002	70	1
8292	DCA	1980	118.7	0
35332	QRCA	1991	2.26	0
30401	FS-R3	1981	30	0
44100	SAC	1993	1200	19
62120	MT TAYLOR RD	1998	20.2	4
17514	UNMOCA	1979	23.25	3
30619	FS-R3	1985	24.6	14
2438	UNMOCA	1981	unknown	1
9076	PLAC	1984	37	0
16759	CAS	1983	9.36	0
40084	FS-R3	1992	1.5	0
9632	CAS	1980	1280	11
11683	UNMOCA	1978	17.5	0
8274	UNMOCA	1981		13
35929	FS-R3	1991	5.2	0
11134	CRMD	1980	15.36	0
17655	NAU	1980	4.89	2
30586	FS-R3	1985	48.5	2
23637	SHTD	1988	112.12	4
45618	MT TAYLOR RD	1994	2.8	1
76087	CIBOLA NF	2001	859	4
33116	FS-R3	1990	22	0
30466	FS-R3	1984	30	1
46845	CIBOLA NF	1994	7	0
48415	CRC	1995	143.6	9
38790	SHTD	1991	33.1	5
30434	FS-R3	1982	348	2
28164	LAB-N	1975	3.24	0

Table 3: Sites within one mile (1.6 kilometers) of the project area

LA Number	Site Type	Occupation Type
100356	Nonstructural	Unknown
100357	Nonstructural	Unknown
100358	Nonstructural	Unknown
15889	Structural	Unknown
48224*	Nonstructural	Unknown
15886	Nonstructural	Unknown
48225*	Nonstructural	Prehistoric
15892	Structural	Prehistoric
123239	Structural	Prehistoric
48226*	Nonstructural	Prehistoric

LA Number	Site Type	Occupation Type
153869	Nonstructural	Prehistoric
15891	Structural	Prehistoric
153870*	Nonstructural	Prehistoric/Historic
32496	Structural	Unknown
32506	Structural	Historic
49912	Nonstructural	Prehistoric
153872*	Nonstructural	Prehistoric
154736	Nonstructural	Prehistoric
153871	Nonstructural	Prehistoric
32505	Structural	Historical
15890	Structural	Historical
61486	Structural	Historical
49913	Structural	Prehistoric/Historic
76682	Structural	Prehistoric/Historic
32501	Structural	Unknown
154739	Nonstructural	Unknown
65953	Nonstructural	Prehistoric
154738	Nonstructural	Historical
133864	Structural	Historical
65951	Nonstructural	Unknown
32503	Structural	Unknown
32498	Nonstructural	Unknown
65950	Nonstructural	Unknown
32508	Structural	Unknown
154737	Nonstructural	Unknown
32502	Structural	Historical
65948	Nonstructural	Unknown
65942	Nonstructural	Prehistoric
76683	Nonstructural	Unknown
32499	Structural	Unknown
131426*	Nonstructural	Prehistoric
104559	Nonstructural	Prehistoric
65947	Nonstructural	Prehistoric
76681	Nonstructural	Prehistoric
65952	Nonstructural	Unknown
32500	Structural	Unknown
133866	Structural	Historical
153873*	Nonstructural	Prehistoric/Historic
133865	Structural	Historical
133863	Nonstructural	Prehistoric
131427	Structural	Prehistoric
131426*	Nonstructural	Prehistoric
48227*	Nonstructural	Unknown

*Sites in Project Area

EXPECTED RESOURCES

The site types noted within the area are typically prehistoric/historic artifact scatters that have often not been more closely defined. Resources dating to as early as the Archaic period extending into the historic period have been noted. Based upon the review of the extant literature, EMI expected resources comparable to those previously identified in the general vicinity.

FIELD METHODS

Cultural Resources

The term "cultural resources" refers to any historic or prehistoric resource. The term "historic property" specifically refers to a cultural resource that has been determined eligible for inclusion to the National Register of Historic Places (NRHP). These terms imply a great deal more than prehistoric and historic material remains, ruins, or standing structures. They encompass a wide range of material remains that have the potential to provide information about the occupation of the project area. These terms also refer to any records related to such a resource or property. A total of five classes of historic properties (districts, buildings, structures, sites, and objects) are defined as eligible for listing on the NRHP (36 CFR 60.3). Usually, historic properties are classified within more than one of these categories.

Archaeological Categories

- **Archaeological Site**
  A site is a concentration of cultural remains inferred to be the location of specific human activities.
- **Archaeological Features**
  A feature is defined as nonportable cultural remains including but not limited to hearths, storage pits, firepits, architecture, or undisturbed layers of deposited material.
- **Artifact**
  Artifacts are portable cultural remains that exhibit evidence of human use or alteration.
- **Culturally Altered Landscape**
  A culturally altered landscape is a landscape modified by human activity, including but not limited to roadways, agricultural fields, farming terraces, and irrigation ditches or other water control devices.
- **Component**
  A site component is defined by the New Mexico State Historic Preservation Division as a generally continuous site occupation with a single cultural affiliation.
- **Historical Site**
  An historic site is a location, building, or neighborhood more than 50 years old.

The NRHP guidelines read:

National Register criteria for eligibility includes sites retaining "the quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

> **a.** That are associated with events that have made a significant contribution to the broad patterns of our history; or

b. That are associated with the lives of significant persons in or past; or

c. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

d. That have yielded or may be likely to yield, information important in history or prehistory. ”

Isolated Occurrences

Resources not meeting these criteria, in a severely disturbed, highly mobile context, or with very low artifact density or diversity were recorded as isolated occurrences (IOs).

Archival Research

Reviews of the previous archaeological and/or historical work carried out in the vicinity of the project area were completed on May 22 and June 3, 2009. These reviews included the records at the New Mexico Cultural Resources Information System (NMCRIS) maintained by the Archaeological Records Management Section (ARMS) and at the United States Forest Service, Cibola National Forest Office.

Field Survey

A 100 percent pedestrian survey (Class III) of the project area was conducted between June 11th and 16th 2009, with an additional survey for an alternate route conducted on February 9th, 2011. The project consisted of a block survey of approximately 22 acres (mine facilities area), a block survey of approximately 6 acres (escape portal) and roads for a total of approximately 125 acres (Elkin’s Road and Forest Road 450). A survey corridor of 200 feet (100 feet on either side of the center line) was surveyed along Elkin’s Road and Forest Road 450. Nina Harris served as Project and Field Director, Garth Hayden served as Crew Chief and Field Director, Kate Wright and Zach Kneebone served as Field Technicians. Non-overlapping transects spaced at no greater than 15 meters (50 feet) were used to traverse the project terrain. Cultural resources were recorded as a site using the following USFS Region 3 criteria: (1) one or more features, (2) one formal tool if associated with other cultural materials or more than one formal tool, (3) an occurrence of cultural material (i.e., pottery sherds, debitage, or historic artifacts that contains one of the following; a) three or more types of raw material, b) two types of artifacts or material in a density of at least ten items per 100 square meters, or c) a single type of artifact or material in a density of at least 25 items per 100 square meters). Resources not meeting these criteria, in a severely disturbed, highly mobile context, or very low artifact density or diversity were recorded as isolated occurrences (IOs).

Sites were marked with a permanent datum in the field and all cultural resources were documented using standard procedures and forms. Archaeological site information was recorded and isolated occurrence location information was collected using a Garmin GPS unit that has an accuracy of ± 3 meters (10 feet).

In-Field Analysis

The procedure for sites with artifact scatters consisting of less than 100 artifacts was that all artifacts were recorded in the field. A sample of 100 artifacts was recorded in the field for sites containing more that 100 artifacts.

Classificatory schemes utilized in artifact and site description followed standard identification procedure using written records and electronic resources to assist in artifact identification. Previous experience within west-central New Mexico also provides a detailed understanding of the cultural resources to be expected within the project area. These resources largely relate to Archaic and Ancestral Puebloan periods.

Methods used for determining chronological affiliation for artifacts and sites rely on previous archaeological experience within the region, as well as written and electronic resources to assist in artifact identification. Examples of this include the chronological indicators of projectile point sequences, Norman “Ted” Oppelt’s “Prehistoric Southwest Pottery Types and Wares: Descriptions and Color Illustrations” (2007), and Noel D.

Justices' "Stone Age Spear and Arrow Points of the Southwestern United States" (2002) which are applicable to the current project area.

SURVEY RESULTS

The project area consists of a mine facilities area at the base of La Jara Mesa, a portion of Forest Road 450 F, an access road through private land connecting FR 450 F to NM 605 (Elkins Road) and a six acre block survey for an escape raise on top of La Jara Mesa. In addition, previously recorded sites were revisited along the access road to the escape raise (FR 544). The project area spans multiple environments from the more mature piñon juniper woodland on top of La Jara Mesa, to the shale talus slopes and sparse piñon/juniper at the base of the mesa to the sandy dune areas along the private access road.

A total of 14 sites and 28 isolated occurrences (IOs) were identified during the course of the survey. During the survey eight previously recorded sites were revisited and updated (LA 48224/AR-03-03-02-818 , LA 48225/AR-03-03-02-819, LA 48226/AR-03-03-02-820, LA 48227/AR-03-03-02-821, LA 153870/AR-03-03-02-2768, LA 153873/AR-03-03-02-2770, LA 153872/AR-03-03-02-2771, and LA 131426/AR-03-03-02-2317), and six sites were newly recorded (LA 163193/AR-03-03-02-2880, LA 163194/AR-03-03-02-2881, LA 163195, LA 163196, LA 163197 and LA 163198). These sites are described below. Site location maps are provided in Appendix B. IOs are described in Table 4.

Previously Recorded Sites

LA Number: LA 48224
Forest Service Number: AR-03-03-02-818
Site Type: Prehistoric artifact scatter
No. of Components: 1
Cultural Affiliation: Anasazi
Occupation Dates: Unknown
Elevation: 7060 ft amsl
Site Dimensions: 90 m by 40 m

Site Description: The site was originally recorded in 1984 by Plano Archaeological Consultants (PAC). The site was considered deflated, and erosion was estimated to have impacted at least 20% of the site. Further investigation at LA 48224/AR-03-03-02-818 occurred in 1998 by the Cibola National Forest, Mt. Taylor Ranger District personnel to assess damages incurred by unauthorized road work, and included mapping, artifact analysis, photography and sub-surface testing. Testing yielded an indication of possible subsurface deposits (two flakes from four shovel test units). The site was reported to have been damaged by unauthorized road maintenance and mining activities as well as active wind and water erosion. Testing was for impact assessment only and the site was assigned an undetermined eligibility for inclusion to the NRHP by Cibola National Forest personnel at that time.

During the current investigation the site was revisited. The area near the location of the site is very heavily disturbed by vehicular traffic on FR 450 as well as alluvial and aeolian erosion. The current surface evidence of the site at the location listed for LA 48224/AR-03-03-02-818 consisted of one tertiary obsidian flake. Although there is currently minimal surface manifestations of cultural material, intact subsurface deposits are possible.

Eligibility and Recommendation: Previous subsurface testing on the site did reveal subsurface cultural material indicating the possibility of intact subsurface deposits that may retain data to address questions about prehistoric land use. EMI recommends the site as having undetermined status and recommends testing to

determine the nature, integrity and extent of the site within the 40 ft wide improvement corridor along the FR 450 access roadway, for NRHP eligibility status and further management recommendations.

Evaluation of Undertaking: The site is located along Forest Road 450, the main haul road, and will be impacted by planned project activities. Testing within the 40 foot road improvement and utility corridor is recommended to determine the depth and extent of cultural deposits to determine the National Register eligibility status and to provide further management recommendations.

Figure 5: LA 48224/AR-03-03-02-818 Site Overview

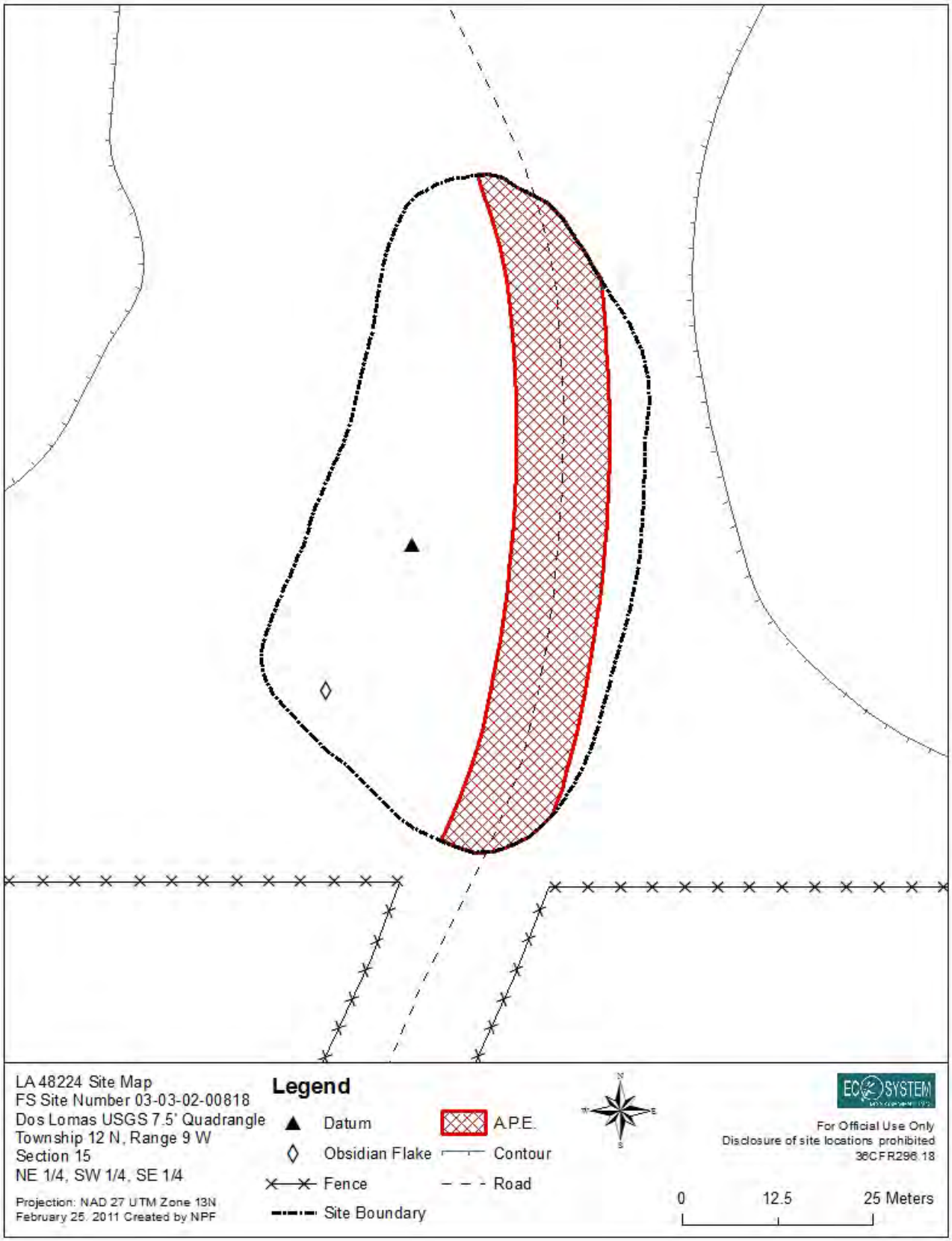

Figure 6: LA 48224/AR-03-03-02-818 Site Map

LA Number: LA 48225
Forest Service Number: AR-03-03-02-819
Site Type: Lithic Scatter
No. of Components: 1
Cultural Affiliation: Undetermined
Occupation Dates: Undetermined
Elevation: 7000 ft amsl
Site Dimensions: 87 m by 97 m

Site Description: LA 48225/AR-03-03-02-819 is a lithic scatter that was first recorded in 1984 by PAC and was determined at the time to be eligible for NRHP listing at the time. The site was revisited by Cibola National Forest- Mt. Taylor Ranger District personnel in 1998 to assess damages incurred by unauthorized road work and subsurface testing was also conducted at that time. Testing yielded an indication of possible subsurface deposits (two flakes from four shovel test units). The site was reported to have been damaged by unauthorized road maintenance and mining activities as well as active wind and water erosion. Testing was for impact assessment only. During the present site visit, a lithic scatter, comprised primarily of Grants Ridge obsidian flakes, was observed. There were three concentrations of flakes (labeled Features 1, 2 and 3). The vegetation on the site consisted of piñon, juniper and snakeweed. LA 48225/AR-03-03-02-819 is in good condition with approximately 80 percent of the site remaining intact. Disturbance to the site includes grading and maintenance for FR 450, which bisects the site along the northwestern edge. Artifacts were present in the road cut sidewalls. Artifacts were also present in the road bed but may have become embedded in the road way after having been displaced from road way sidewalls during the road activities. Intact deposits are unlikely in the road bed since the road cuts well below the sediments containing the artifacts in the side wall.

Feature 1 is a concentration of 22 Grants Ridge obsidian flakes representing all stages of reduction including; 11 tertiary flakes, 2 secondary flakes, 3 primary flakes and 6 pieces of angular debris.

Feature 2 is a concentration of flakes that occurs in a bladed area, possibly the previous FR 450 road bed. The concentration contained 9 tertiary Grants Ridge obsidian flakes, 6 secondary Grants Ridge obsidian flakes, 2 primary Grants Ridge obsidian flakes and 2 tertiary flakes of black translucent obsidian.

Feature 3 is a concentration of 16 tertiary Grants Ridge obsidian flakes and 2 primary Grants Ridge obsidian flakes along with several slabs of fine grained basalt.

The total flaked stone artifact assemblage on the site was 90% Grants Ridge obsidian (53 tertiary flakes, 9 secondary flakes, 6 primary flakes and 7 pieces of angular debris) and the remaining 10% of the flaked stone assemblage was comprised of chert and chalcedony.

The site appears to be an activity area where stone tools were manufactured. These lithic concentrations may have functioned as knapping areas. No diagnostic artifacts were identified on the site that would indicate age or cultural affiliation, the site location and artifact assemblage are consistent with an Archaic occupation.

Eligibility and Recommendation: FR 450 cuts through LA 48225/AR-03-03-02-819 and has impacted this portion of the site, but remaining portion is 80 percent intact. However, due to the artifact density and evidence of artifacts in the road cut sidewalls the site likely retains intact subsurface cultural that may yield important scientific information about Archaic settlement, subsistence, and stone tool technology. The site was recommended eligible for nomination to the NRHP under criterion D in 1984. EMI concurs with eligible status and recommends testing to determine the nature, integrity and extent of the site within the 40 ft wide improvement corridor along the FR 450 access roadway, for NRHP eligibility status for the roadway portion and further management recommendations.

Evaluation of Undertaking: The equipment haul road FR 450, water lines and transmission lines will intersect the site. Since complete avoidance is not possible and it is unknown whether intact cultural deposits exist in the roadway portion, EMI recommends testing to determine the nature, integrity and extent of the site within the 40 ft wide improvement corridor along the FR 450 access roadway, for NRHP eligibility status for the roadway portion and further management recommendations which may include data recovery.

Figure 7: LA 48225/AR-03-03-02-819 Site overview of Feature 2 flagged near road, view to north

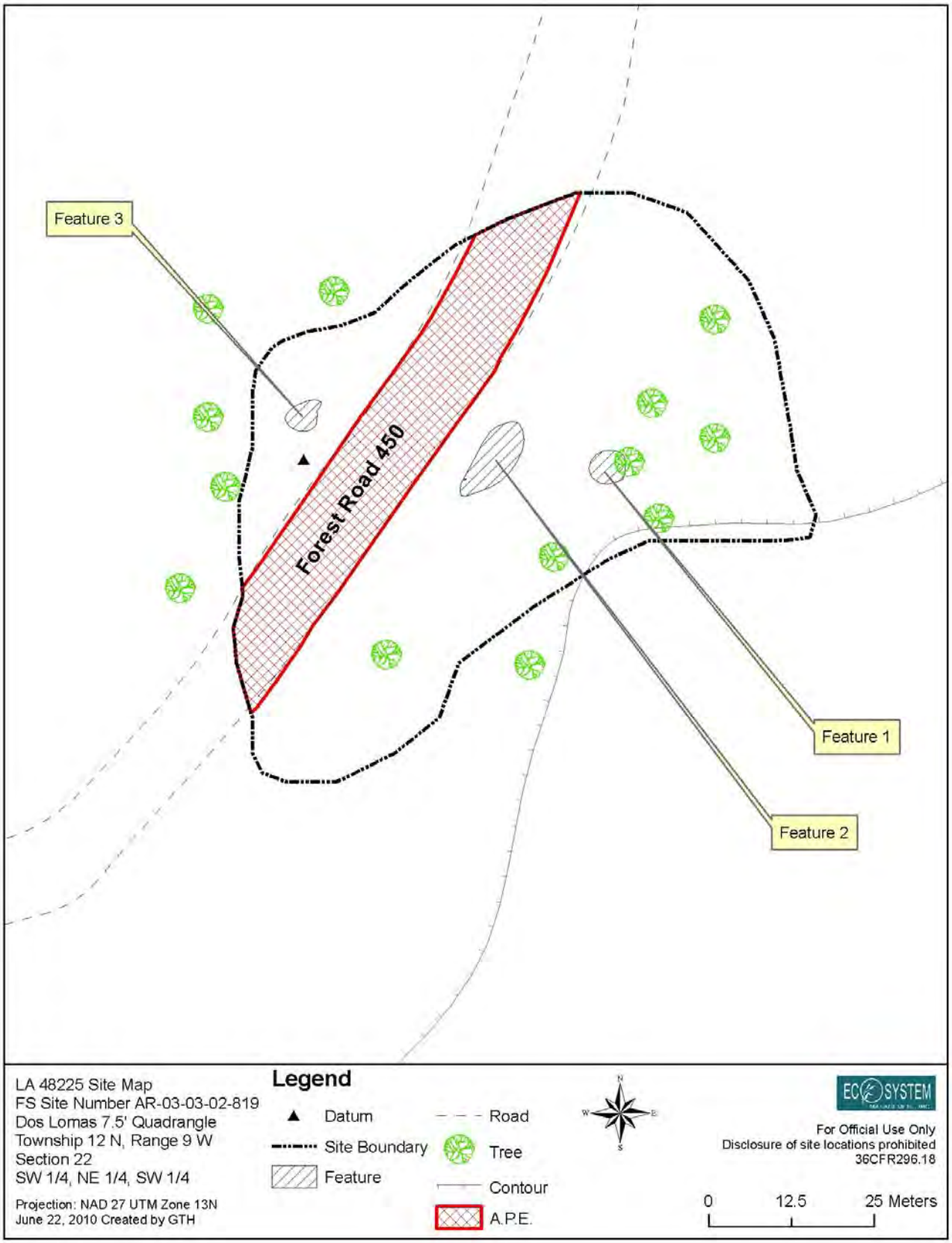

Figure 8: LA 48225/AR-03-03-02-819 Site Map

LA Number: LA 48226
Forest Service Number: AR-03-03-02-820
Site Type: Lithic Scatter
No. of Components: 1
Cultural Affiliation: Undetermined
Occupation Dates: Undetermined
Elevation: 6950 ft amsl
Site Dimensions: 4 m x 4 m

Site Description: LA 48226 /AR-03-03-02-820 is a low density lithic scatter located on the east side of FR 450 near a mining prospect trench and associated dirt spoil pile. The site was originally recorded in 1984 by PAC. The site was revisited by Cibola National Forest-Mt. Taylor Ranger District personnel in 1998 to assess damages incurred by unauthorized road work. LA 48226/AR-03-03-02-820 is located approximately 5 meters east of the road cut for FR 450. The site was recommended as not eligible for listing on the National Register in 1998. This visit saw no evidence of sub-surface deposition in the exploratory trench or the nearby road cut and only four flakes of Grants Ridge obsidian were observed.

The current investigation found the site to be in similar condition to the 1998 recording which described additional site damage (tree-cutting) and noted very few artifacts present on the surface. The soils on the site have been heavily disturbed by previous minerals prospecting activities. Only two tertiary lithic flakes, both of Grants Ridge obsidian, were observed during this site visit near the prospect ditch in a disturbed soil context. Observation of the walls of a prospect ditch revealed no evidence of intact subsurface cultural deposits

Eligibility and Recommendation: LA 48226/AR-03-03-02-820 has a limited number of surface artifacts and no evidence of subsurface deposition. The site was determined as not eligible for listing on the National Register in 1998, and EMI concurs with that determination.

Evaluation of Undertaking*:* LA 48226/AR-03-03-02-820 is not eligible for listing on the National Register. As an ineligible site it requires no further management consideration. The site and potential effects to the area where it was originally documented will not be addressed further in this report.

Figure 9: LA 48226/AR-03-03-02-820 Site overview facing south

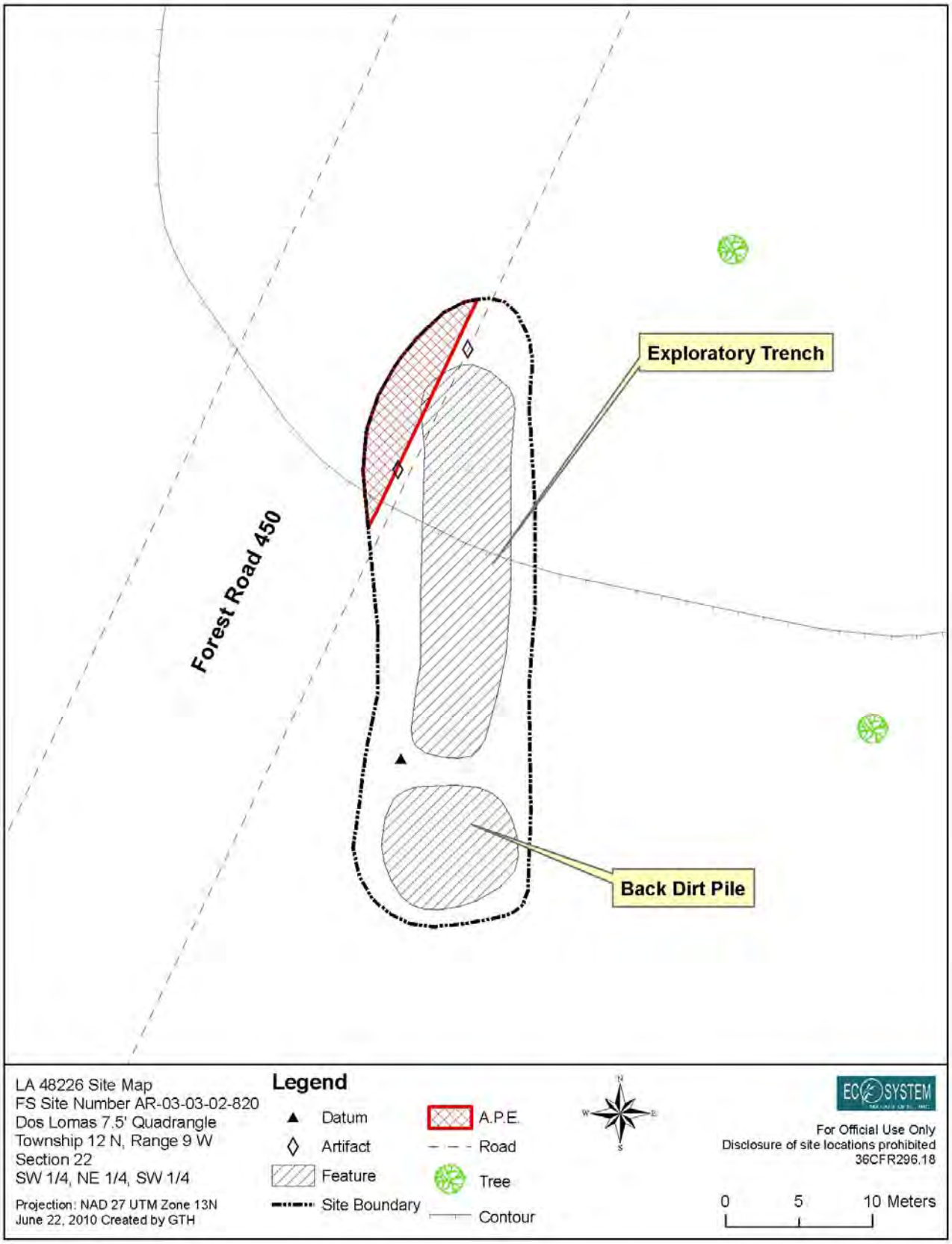

Figure 10: LA 48226/AR-03-03-02-820 Site Map

LA Number: LA 48227
Forest Service Number: AR-03-03-02-821
Site Type: Prehistoric artifact scatter
No. of Components: 1
Cultural Affiliation: Unknown
Occupation Dates: Unknown
Elevation: 6810 ft amsl
Site Dimensions: 35 m x 27 m

Site Description: The site was originally recorded in 1984 by PAC who also excavated three test pits on site to determine if any subsurface deposits were present. At that time, the site was considered deflated and erosion was estimated to have taken at least 50% of the site. Further investigation at LA 48227/AR-03-03-02-821 occurred in 1998 by the Cibola National Forest-Mt. Taylor Ranger District personnel, and included mapping, artifact analysis, photography and subsurface testing. The 1998 recording detailed limited surface artifacts and testing revealed no intact subsurface deposits. Road traffic and erosion are thought to have obliterated the site and therefore no evidence remains. The site was, at that time, determined ineligible for inclusion to the NRHP by Cibola National Forest personnel.

During the current investigation the site tag was relocated, but no surface artifacts were observed. The area near the location of the site is very heavily disturbed by vehicular traffic on FR 450 as well as alluvial and aeolian erosion. It appears that the previous (FR 450 F) road bed has become a drainage with down-cutting to a depth of approximately two feet in the area of the site.

Eligibility and Recommendation: Previous testing of the site in 1998 determined that no intact subsurface deposits exist, and no cultural material was encountered on the site surface during the present study. LA 48227/AR-03-03-02-821 was determined not eligible for listing on the National Register in 1998, and EMI concurs with that determination.

Evaluation of Undertaking: LA 48227/AR-03-03-02-821 is not eligible for listing on the National Register. As an ineligible site, and requires no further management consideration. The site and potential effects to the area where it was originally documented will not be addressed further in this report.

Previously Recorded Sites Revisited Along FR 544

LA Number: LA 153870
Forest Service Number: AR-03-03-02-2768
Site Type: Prehistoric artifact scatter
No. of Components: 1
Cultural Affiliation: Ancestral Puebloan
Occupation Dates: A.D. 1- A. D. 1600
Elevation: 8080 ft amsl
Site Dimensions: 80 m by 40 m

Site Description: LA 153870 /AR-03-03-02-2768 was originally recorded by Lone Mountain Archaeological Services in 2007 under NMCRIS activity number 100734. There is currently no information in the ARMS database regarding the scope and size of the original survey nor is there information regarding the site. However, records at the Cibola National Forest Supervisors Office included a copy of the report generated from the project and more information regarding this site. LA 153870/AR-03-03-02-2768 was reported as a lithic and ceramic scatter with an Ancestral Puebloan component as evidenced by a Kiatuthlana Black-on-white sherd.
During the present survey, artifacts observed on the site consisted of Grants Ridge obsidian flakes. Intact subsurface deposits are thought to be present based on observations by EMI archaeologists during the present visit and the site is in good condition and estimated at 80 percent intact. Artifacts were observed in areas cleared and disturbed by wood cutting, micro-flakes were present in two ant mounds, and artifacts appearing in areas of

mild alluvial erosion which suggests the presence of intact subsurface deposits. LA 153870 /AR-03-03-02-2768 is located approximately 40 meters south of Forest Road 544 and 90 meters southeast of the escape raise. The site is in the southeast corner of the escape raise 200-foot buffer. The site location information and site map included in the 2007 report are accurate and up to date.

Eligibility and Recommendation: In 2007 Lone Mountain Archaeological Services left the eligibility of LA 153870/AR-03-03-02-2768 undetermined due to direct lack of evidence for subsurface cultural deposits. However, intact subsurface deposits are thought to be present and the site is estimated at 80 percent intact. The site may retain datable subsurface cultural deposits that may yield important scientific information about Archaic settlement, subsistence and stone tool technology. The site is recommended as having undetermined eligibility for nomination to the NRHP. Planned project activities are unlikely to impact the site considering its location. However, it is recommended that the site boundaries should be flagged prior to any project related activities to ensure the site is avoided during equipment transportation.

Evaluation of Undertaking: The site will be flagged prior to project construction. This site will be avoided and protected during project construction. If avoidance is not possible then testing is recommended to determine the extent and nature of any intact subsurface deposits and to provide data for additional management recommendations which may include data recovery.

Figure 11: LA 153870/AR-03-03-02-2768 Site overview facing south

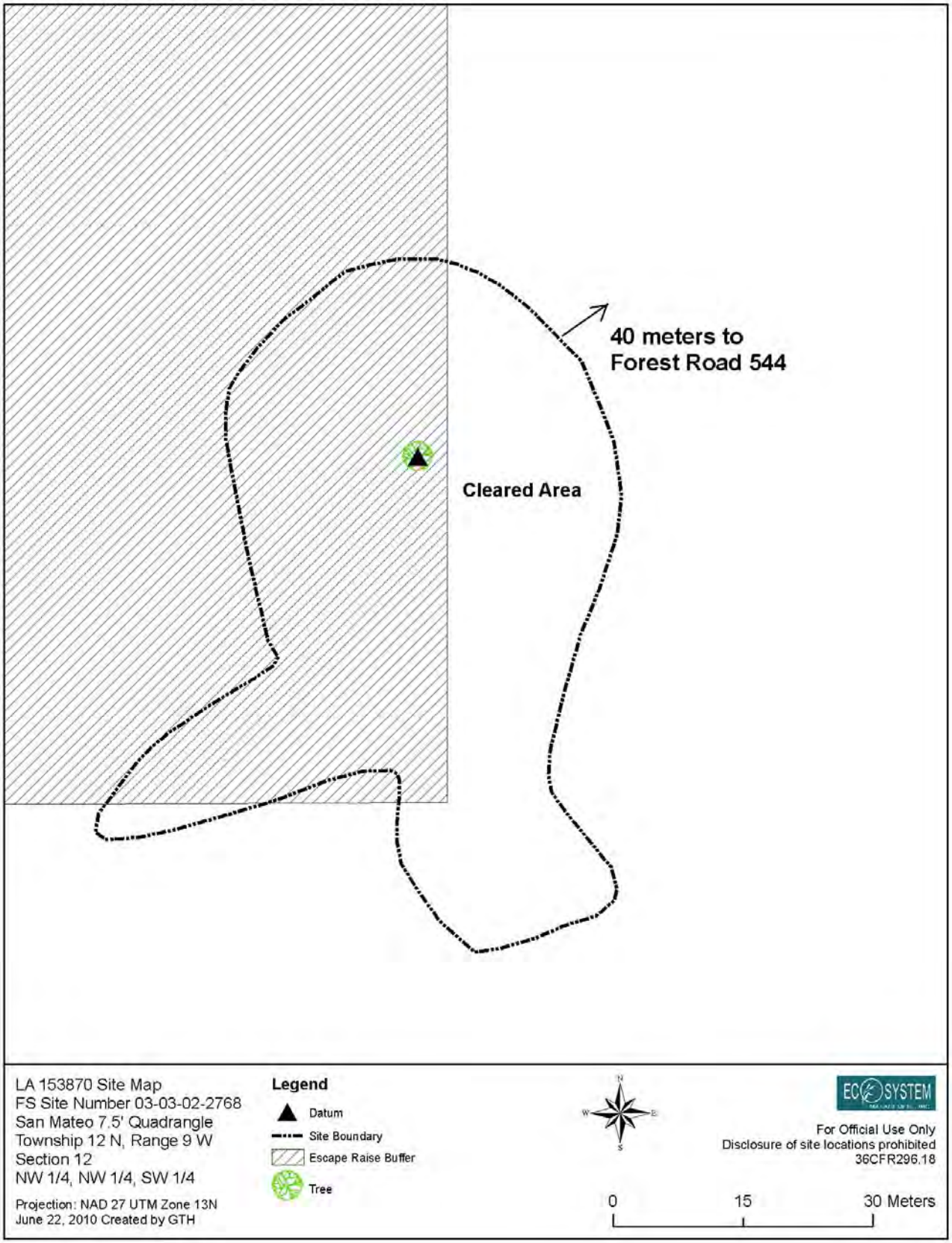

Figure 12: LA 153870/AR-03-03-02-2768 Site Map

LA Number: LA 153873
Forest Service Number: AR-03-03-02-2770
Site Type: Prehistoric artifact scatter
No. of Components: 1
Cultural Affiliation: Ancestral Puebloan
Occupation Dates: A.D. 1- A.D. 1600
Elevation: 7800 ft amsl
Site Dimensions: 76 m by 70 m

Site Description: LA 153873/AR-03-03-02-2770 was originally recorded by Lone Mountain Archaeological Services in 2007. In the 2007 report the site numbers were transposed for AR-03-03-02-2771 and AR-03-03-02-2770. A field check of both sites confirms that the problem has been corrected. The site was described as a lithic and ceramic scatter of 79 lithic artifacts and two ceramic sherds, both possibly Kiatuthana Black-on-white. Lithics consisted of primarily Grants Ridge obsidian although chalcedony, chert and petrified wood were also observed on site along with a basalt hammerstone fragment. Site condition was reported as heavily disturbed due to road construction, recent camping (campfire rings), and ranching activities (site was near a corral).

During the present survey, artifacts observed on the site consisted predominantly of Grants Ridge obsidian flakes. Artifacts were also observed in the road bed, road cut and areas of mild alluvial erosion possibly indicating the presence of intact subsurface deposits. FR 544 cuts through the extreme southern portion of the site but has not impacted a large portion of the site. The portion of the site in the roadway has previously incurred impacts and appears to be heavily disturbed. The remaining portion of the site is in good condition and 80 percent intact. The site location information and site map included in the 2007 report are accurate and up to date.

Eligibility and Recommendation: In 2007, Lone Mountain Archaeological Services left the eligibility of LA 153873/AR-03-03-02-2770 undetermined due to lack of direct evidence for subsurface cultural deposits at the time. The site is determined to be 80 percent intact and the site may have datable subsurface cultural deposits that may yield important scientific information about Ancestral Puebloan settlement, subsistence and stone tool technology. Forest Road 544 intersects the site, but it is uncertain how much of the site will be impacted by road maintenance activities. The site was recommended as having undetermined eligibility for nomination to the NRHP in 2007. EMI concurs with undetermined status and recommends testing to determine the nature, integrity and extent of the site within the FR 544 access roadway for NRHP eligibility status and further management recommendations.

Evaluation of Undertaking: Since complete avoidance is not possible, testing is recommended to determine the extent and nature of any intact subsurface deposits within the FR 544 access roadway and for eligibility determinations and additional management recommendations which may include data recovery.

Figure 13: LA 153873/AR-03-03-02-2770 Site overview facing north

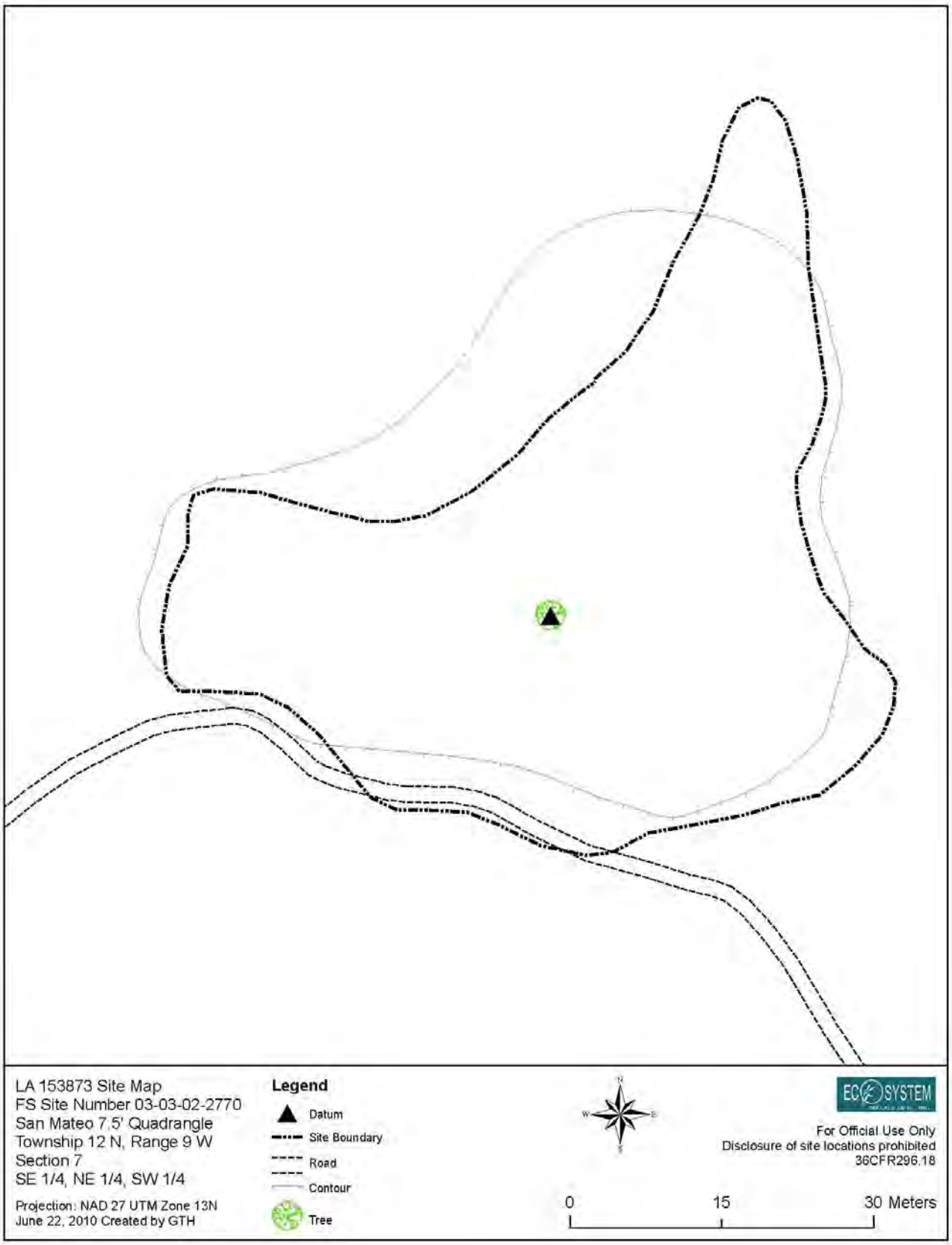

Figure 14: LA 153873/AR-03-03-02-2770 Site Map

LA Number: LA 153872
Forest Service Number: AR-03-03-02-2771
Site Type: Prehistoric artifact scatter
No. of Components: 1
Cultural Affiliation: Unidentified
Occupation Dates: Unidentified Prehistoric
Elevation: 8200 ft amsl
Site Dimensions: 46 m by 43 m

Site Description: LA 153872/AR-03-03-02-2771 was originally recorded by Lone Mountain Archaeological Services in 2007. In the 2007 report the site numbers were transposed for AR-03-03-02-2771 and AR-03-03-02-2770. A field check of both sites confirms that the problem has been corrected. Artifacts noted during the present survey consist of 16 Grants Ridge obsidian flakes. Impacts to the site include road maintenance and improvements. FR 544 bisects the middle of the site east to west. All observed cultural material was located in the roadway. The portion of the site in the roadway appears to be heavily disturbed. The site outside the roadway is in good condition and estimated to be 80 percent intact. During the present revisit artifacts were observed in the road bed, road cut and appearing in areas of mild alluvial erosion.

Eligibility and Recommendation: In 2007 Lone Mountain Archaeological Services left the eligibility of LA 153872/AR-03-03-02-2771 undetermined due to lack of direct evidence for subsurface cultural deposits. Artifacts were observed in disturbed areas of the site during the present survey suggestion subsurface cultural deposits may be present that may yield important scientific information about prehistoric settlement, subsistence and stone tool technology and chronology. EMI concurs with undetermined status and recommends testing to determine the nature, integrity and extent of the site within the FR 544 access roadway, for NRHP eligibility status and further management recommendations.

Evaluation of Undertaking*:* Forest Road 544 intersects the site, but it is uncertain how much of the site will be impacted. Since complete avoidance is not possible, testing is recommended to determine the extent and nature of any intact subsurface deposits within the FR544 corridor, for eligibility determination and to provide data for additional management recommendations which may include data recovery.

Figure 15: LA 153872/AR-03-03-02-2771 Site overview facing west

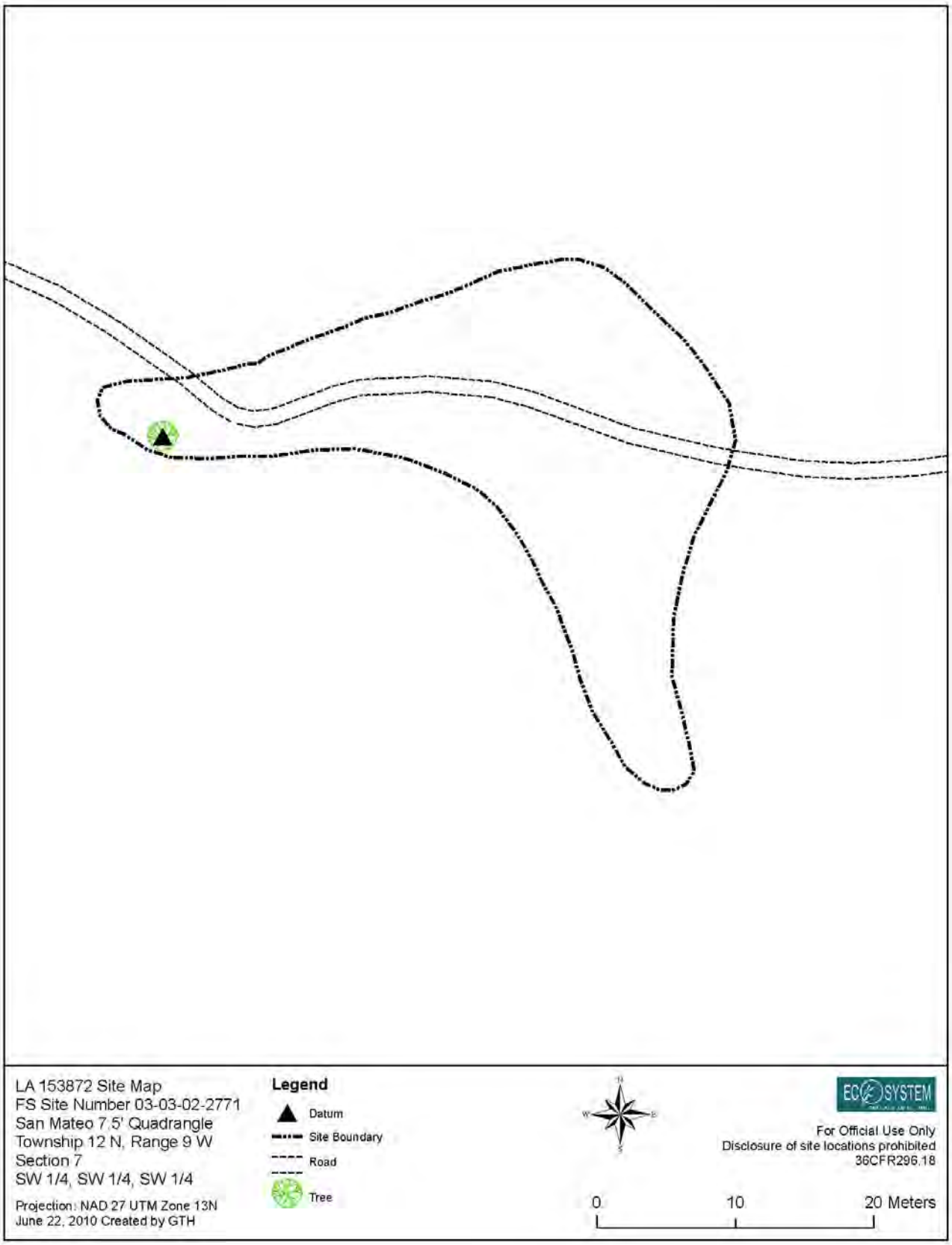

Figure 16: LA 153872/AR-03-03-02-2771 Site Map

LA Number: LA 131426
Forest Service Number: AR-03-03-02-2317
Site Type: Prehistoric artifact scatter
No. of Components: 1
Cultural Affiliation: Ancestral Puebloan
Occupation Dates: Pueblo II 1050 AD – 1200 AD
Elevation: 8100 ft amsl
Site Dimensions: 65 m by 16 m

Site Description: The site was originally recorded in 1999 by the Cibola National Forest, Mt. Taylor Ranger District personnel as an Ancestral Puebloan ceramic sherd scatter consisting of unidentified Black-on-white sherds, indented corrugated gray ware, and unidentified Black-on-red sherds. The site was recorded as being at least 76% intact with minor damage from vandalism and bioturbation.

During the present site visit observed cultural material consisted ceramic sherds eroding out of forest slope soils. The assemblage included a total of 13 ceramic sherds (7 Wingate Black on Red, 4 plain grayware sherds and 2 corrugated gray ware sherds). The ceramics are evident in areas of mild alluvial erosion. The site seems to be much the same as recorded in 1999 and no updated site map was needed.

Eligibility and Recommendation: LA 131426/AR-03-03-02-2317 site eligibility was undetermined when originally recorded in 1999. Artifacts in eroded areas indicate the possibility of subsurface deposits that may retain data to address questions about Ancestral Puebloan subsistence, ceramic technology and chronology. EMI concurs with the recommendation as having undetermined eligibility for nomination to the NRHP. Planned project activities are unlikely to impact the site considering its location. However, it is recommended that the site boundaries should be flagged prior to any project related activities to ensure the site is avoided during equipment transportation.

Evaluation of Undertaking*:* The boundaries of the site do not intersect with Forest Road 544 or the area of potential effect. This site will be avoided. If avoidance is not possible then testing is recommended to determine the extent and nature of any intact subsurface deposits and to provide data for additional management recommendations which may include data recovery.

Figure 17: LA 131426/AR-03-03-02-2317 Site overview facing south

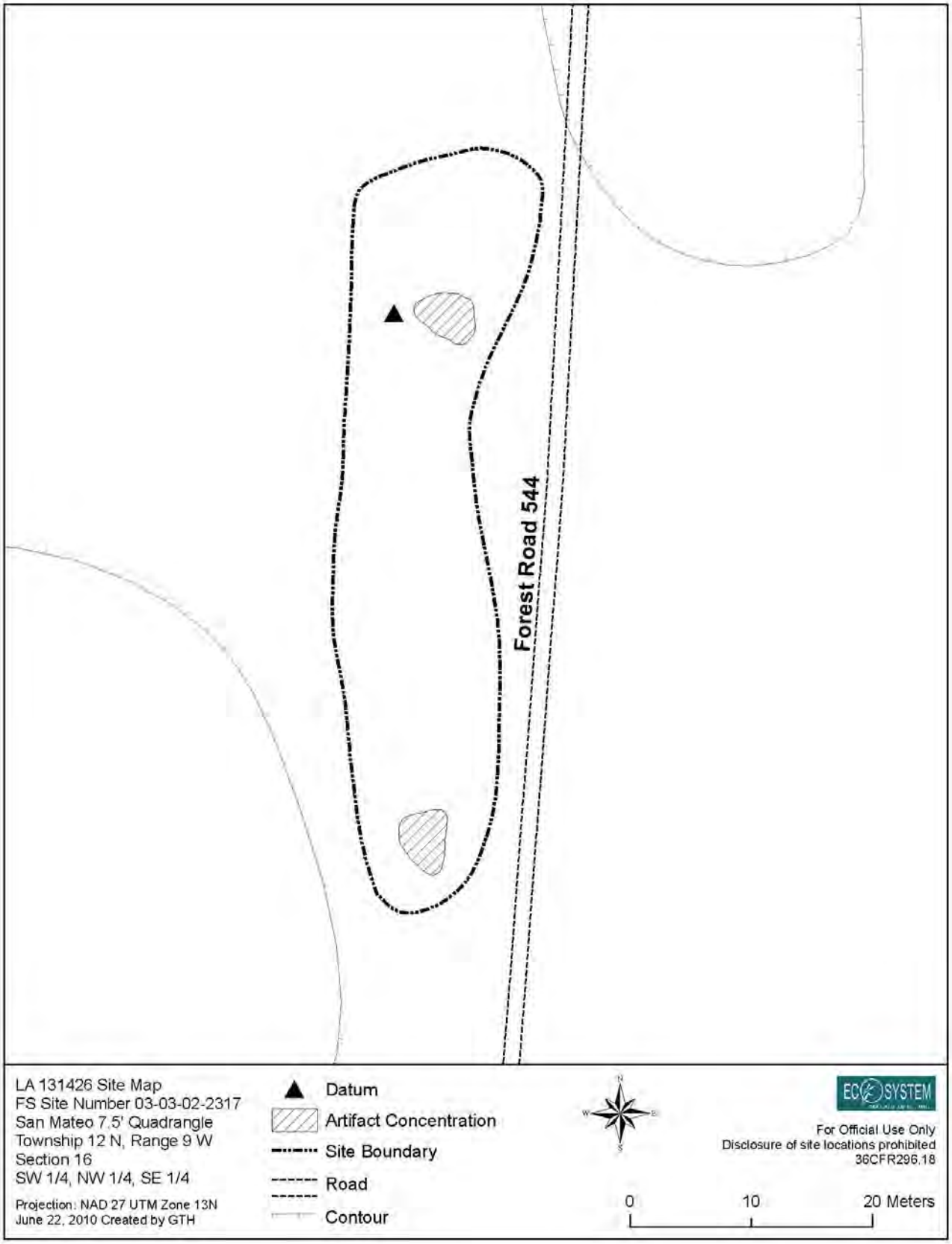

Figure 18: LA 131426/AR-03-03-02-2317 Site Map

Newly Recorded Sites

Field Number: EMI-GL-01
LA Number: LA 163193
Forest Service Number: AR-03-03-02-2880
Site Type: Prehistoric Non-structural
No. of Components: 1
Cultural Affiliation: Ancestral Puebloan
Occupation Dates: Late Pueblo I to Early Pueblo II
Elevation: 7300 ft amsl
Site Dimensions: 109 m by 87 m
Vegetation: Piñon, Juniper, Cholla, Snakeweed, Sage
Land Form: Wide finger ridge that trends to the southeast from the base of La Jara Mesa
Soils: Yellowish brown sandy loam

Site Description: LA 163193/AR-03-03-02-2880 is an extensive prehistoric artifact scatter with lithic, ceramic and ground stone artifacts. The site is located at the base of La Jara Mesa along a finger ridge between two unnamed drainages to the northwest and southeast respectively. The soils on the site consist of a yellowish brown sandy loam mixed with basalt inclusions from La Jara Mesa. Vegetation observed on the site included piñon, juniper, sage, cholla and snakeweed. Two features were identified on the site (Feature 1 and Feature 2). The site is currently bisected by an unnamed dirt road. Other disturbances to the site include moderate alluvial and aeolian erosion as well as some livestock trampling. Artifacts were noted in eroded areas suggesting some intact deposits may be present. The site is in good condition with 85 percent of the site remaining intact.

Feature 1 is an artifact concentration with associated soil color change. The feature measures 25 meters by 22 meters. The density of artifacts within this feature and the change in soil color may indicate that the feature was a midden. Artifacts within Feature 1 were mostly corrugated and plain grayware ceramic sherds, with three black on white painted ceramic sherds.

Feature 2 consists of 23 obsidian flakes concentrated in a 14 m by 5 m area. No other lithic material was observed within this obsidian concentration. Nearly half of the sample (48%) consisted of whole flakes while the remainder consisted of distal, proximal, and medial flakes. Shatter comprised only two flakes. The average length of the whole flakes is 2.8 cm.

Forty-eight lithic artifacts were observed on the site, and all were analyzed in the field. Observed lithic artifacts consisted of lithic debitage and expediently-used flakes. Raw material type present on the site was dominated by locally available Grants Ridge obsidian (77 %). Other raw material types represented on the site consisted of basalt, chert, and chalcedony. Forty-four percent of the debitage exhibited some amount (>10 %) of cortex indicating raw material reduction occurred on site. One brown chert core and one obsidian core were observed on site and both were exhausted, although the brown chert core did exhibit some edge modification. Four flake tools were also observed and analyzed. Three were obsidian flakes with one edge expediently worked and one was a brown chert flake with edge modification.

Ground stone artifacts included a sandstone sharpener with multiple ground sharpening grooves measuring 12 cm by 7 cm by 6 cm (with a sharpening groove approximately 6 cm in length), and a shaped vesicular basalt slab (possibly a metate blank) measuring 19 cm by 12 cm by 6 cm.

Ceramic artifacts on the site numbered over 100 sherds. A representative sample of 50 sherds was analyzed in the field. Sherds analyzed on the site included 8 sherds of Tusayan Corrugated (1030 AD to 1300 AD), 23 sherds of Mancos Corrugated (930 AD to 1100 AD), 11 sherds of Arboles Neck Banded (850 AD to 975 AD), 5 sherds of Rosa Gray, 1 sherd of Reserve Black on White (1050 AD to 1200 AD), 2 sherds of Kaituthlana Black

on White and 1 sherd of Escavada Black on White (1000 AD to 1100 AD). The ceramic assemblage places the site in the early Pueblo II period.

LA 163193/AR-03-03-02-2880 appears to be an activity area where stone tools were manufactured and food was processed. The presence of a midden (Feature 1) and the artifact assemblage suggest that this may be a habitation site, though no structural features were identified. Based on the artifact assemblage the site appears to date to the early Pueblo II period.

Eligibility and Recommendation: LA 163193/AR-03-03-02-2880 is in good condition with 85 percent of the site remaining intact with possible subsurface cultural deposits that may yield important scientific information about Ancestral Puebloan settlement, subsistence and stone tool procurement and technology. The site is recommended as having undetermined eligibility for nomination to the NRHP. EMI recommends the site as having undetermined status and recommends testing to determine the nature, integrity and extent of the site and for NRHP eligibility status within the 40 ft. wide improvement corridor along the unnamed access roadway.

Evaluation of Undertaking*:* The site occurs in the area proposed for the "Growth Medium Stockpile" (pile of topsoil) as well as part of the "Explosive Storage" area near the mining facilities. These proposed activities would impact the site and adverse affects to the site from project activities would occur. The project proponent has agreed to relocate both the "Growth Medium Stockpile" and "Explosive Storage" areas from the site boundary. In addition to testing in the 40 ft improvement corridor, EMI recommends the site be fenced off to prevent access outside the roadway during construction and operation.

The unnamed access road extends through the site. EMI recommends the site as having undetermined status and recommends testing to determine the nature and extent of the site within the 40 ft wide improvement corridor along the access roadway, for eligibility determination and further management recommendations which may include data recovery. In addition it is recommended the site be fenced off to prevent access to portions outside the roadway during construction and operation.

Figure 19: LA 163193/AR-03-03-02-2880 Site Overview

Figure 20: LA 163193/AR-03-03-02-2880 Corrugated Ceramics

Figure 21: LA 163193/AR-03-03-02-2880 Sharpener

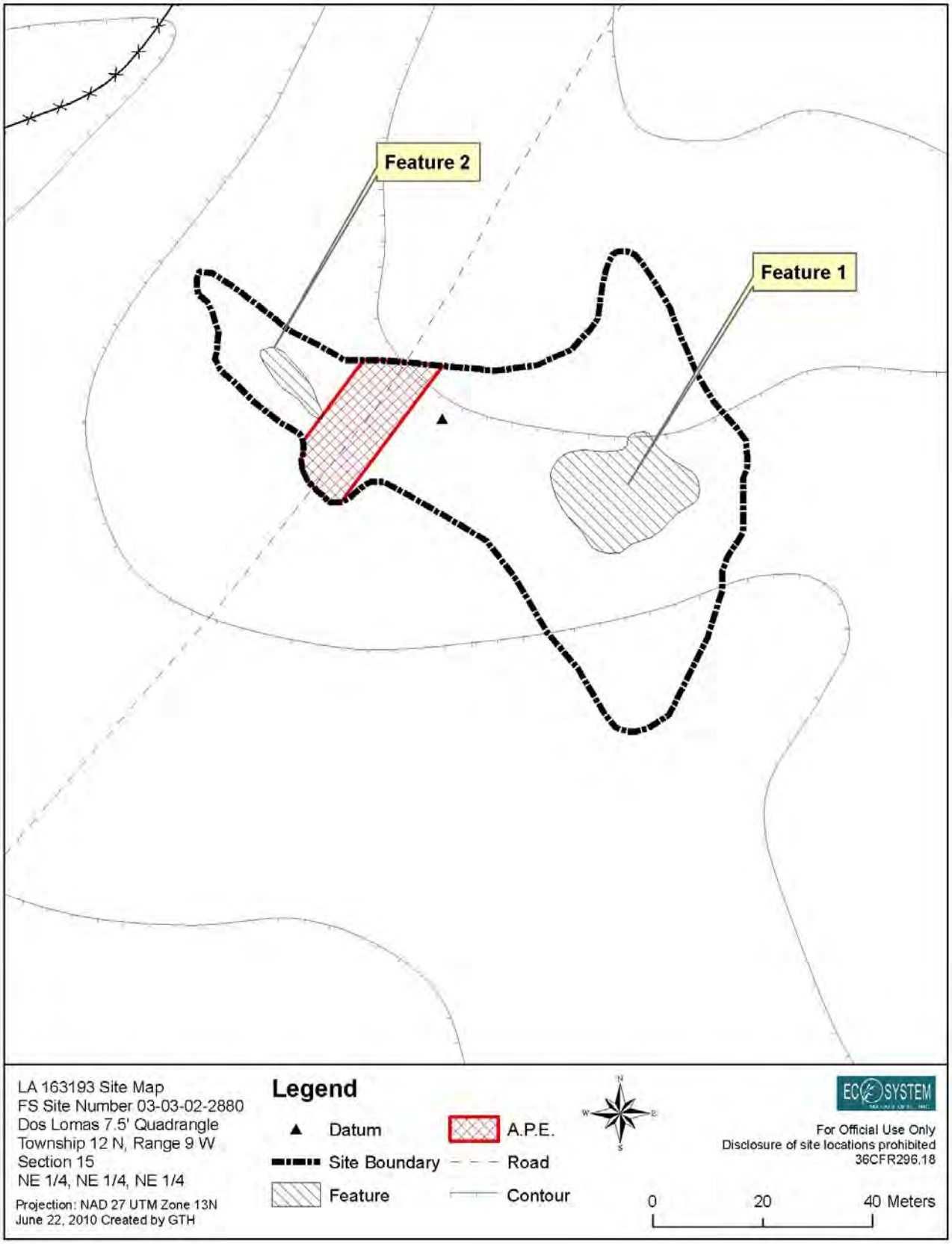

Figure 22: LA 163193/AR-03-03-02-2880 Site Map

Field Number: EMI-GL-02
LA Number: LA 163194
Forest Service Number: 03-03-02-2881
Site Type: Prehistoric Non-structural
No. of Components: 1
Cultural Affiliation: Oshara Tradition Archaic
Occupation Dates: 3300 BC – 1800 BC
Elevation: 7000 ft amsl
Site Dimensions: 56 m by 30 m
Vegetation: Piñon, Juniper, Cholla, Gramma, Sage
Land Form: Wide finger ridge that trends to the southeast from the base of La Jara Mesa
Soils: Reddish brown sandy loam

Site Description: LA 163194/03-03-02-2881 is a lithic scatter consisting primarily of Grants Ridge obsidian lithic debitage. The site is located on both the east and west sides of FR 450 F, though no artifacts were visible in the road bed or road cut. Current manifestations of the site occur approximately 5 meters from the road cut on both sides. The absence of artifacts in the road cut or road bed may indicate that the site has already been obliterated in that area. Artifacts are eroding out of areas of mild alluvial erosion indicating subsurface intact cultural deposits. All stages of lithic reduction are represented on the site. One distal fragment of a projectile point (PP1) was also located on the site. The site was divided into two loci, on the east and west sides of the road, respectively. Although FR 450 extends between the two loci, no artifacts were observed near the fence lines, in the road cut, the road bed or the intervening distance between the loci. LA 163194 is in good condition despite disturbances and appears to retain approximately 85 percent of cultural deposits intact.

All of the lithic debitage observed on the site consisted of Grants Ridge Obsidian and included in Locus 1; 10 tertiary flakes, 2 secondary flakes and 1 primary flake. Numerous micro flakes from pressure flaking activity were also observed in an ant hill within Locus 1. Locus 2 consisted of Grants Ridge Obsidian flakes including; 7 tertiary flakes and 2 secondary flakes.

PP1 was located in Locus 1 and is a distal fragment of a projectile point made from Grants Ridge obsidian. The blade has an excurvate edge with shallow serrations. The flaking pattern is random. Although the base is missing, the excurvate blade edge and serration of the blade are consistent with a San Jose projectile point (Justice 2002).

The site appears to be an activity area where stone tools were manufactured. Although not definitive, the distal projectile point fragment (PP1) is consistent with an Archaic San Jose Phase occupation (3300 BC to 1800 BC).

Eligibility and Recommendation: LA 163194/03-03-02-2881 is in good condition despite disturbances and appears to retain approximately 85 percent of cultural deposits intact. The site may have subsurface cultural deposits that may yield important scientific information about Archaic settlement, subsistence, stone tool technology and chronology. EMI recommends the site as having undetermined status and recommends testing to determine the nature, integrity and extent of the site within the 40 ft wide improvement corridor along the FR 450 F access roadway, for NRHP eligibility status and further management recommendations.

Evaluation of Undertaking*:* LA 163194/03-03-02-2881 is located on both the east and west sides of FR 450. The equipment haul road, water lines and transmission lines will intersect the site. Since complete avoidance is not possible, EMI recommends testing to determine the nature and extent of the site within the 40 ft wide improvement corridor along the access roadway, for eligibility determination and further management recommendations which may include data recovery.

Figure 23: LA 163194/AR-03-03-02-2881 Site Overview

Figure 24: LA 163194/AR-03-03-02-2881 Projectile Point Fragment

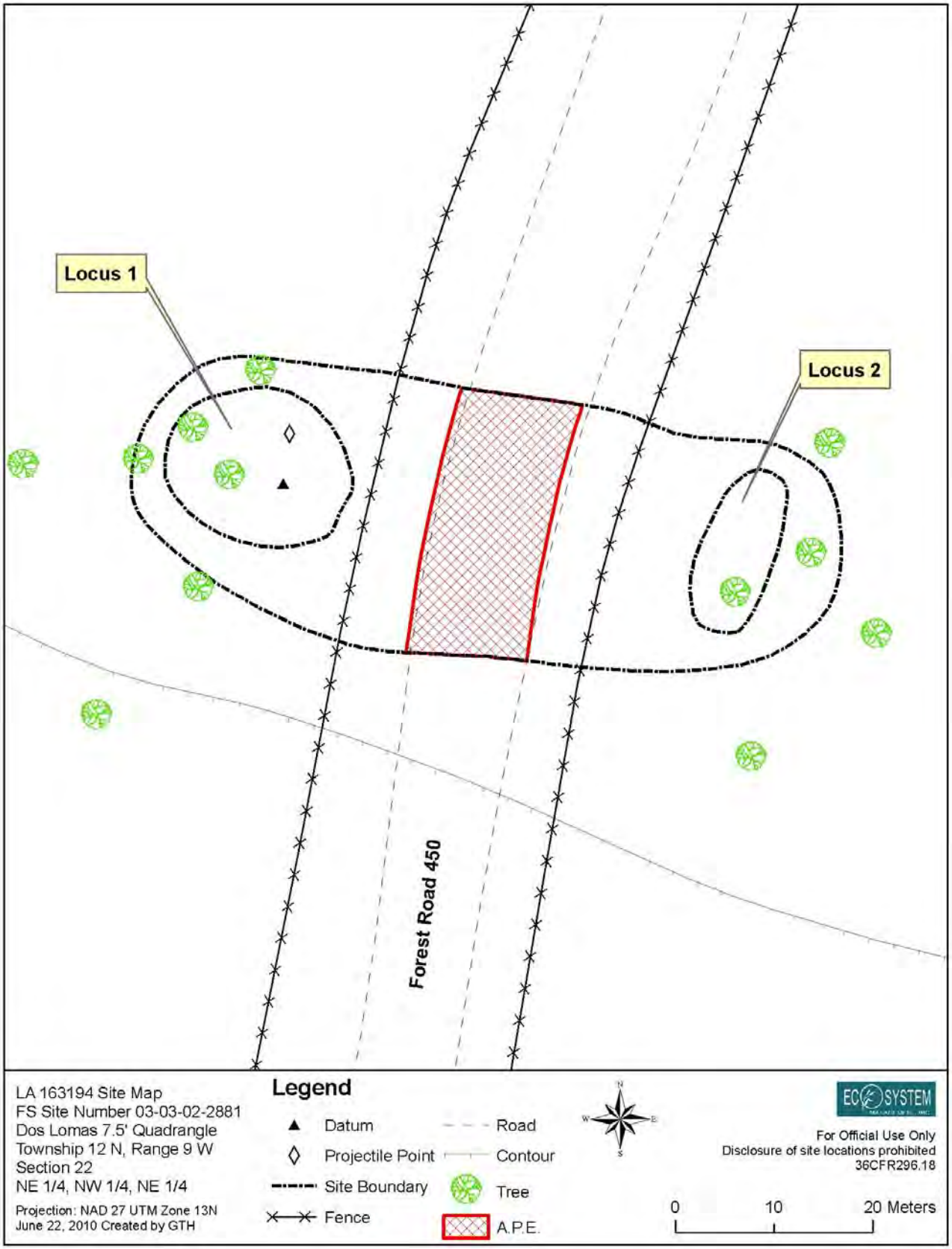

Figure 25: LA 163194/AR-03-03-02-2881 Site Map

Field Number: EMI-GL-03
LA Number: LA 163195
Forest Service Number: NA- Private land
Site Type: Prehistoric Non-structural
No. of Components: 1
Cultural Affiliation: Oshara Tradition Archaic
Occupation Dates: 3300 BC – 1800 BC
Elevation: 7000 ft amsl
Vegetation: Sage, Indian Rice Grass and Rabbit Brush
Land Form: Wide finger ridge that trends to the southeast from the base of La Jara Mesa
Soils: Reddish brown sandy loam

Site Description: LA 163195 is a lithic scatter consisting of ground and flaked stone artifacts. Vegetation on the site is sparse, primarily consisting of sage, Indian rice grass and rabbitbrush. The site is currently bisected by Elkin's Road as well as a stock tank area. The portion of the site in the existing roadway is disturbed; however, intact deposits in the roadway are possible. The site has been further disturbed by vehicular traffic, heavy livestock trampling and aeolian erosion. There is evidence of artifacts in the road cut sidewall and in the roadway.

Flaked stone artifacts on the site were mostly of Grants Ridge obsidian and included 9 tertiary flakes, 4 secondary and 2 primary flakes and one projectile point fragment. The two secondary flakes were of fine grained basalt. The projectile point fragment, Projectile Point 1 (PP1), is a side notched and basally ground projectile point base fragment of Grants Ridge obsidian and appears to be a San Jose type. A ground stone mano (GS1) of vesicular basalt was also observed on the site and measured 12 cm by 11.5 cm by 4.5 cm.

The site appears to be an activity area where stone tools were manufactured and food was processed. One San Jose point fragment (PP1) was located on the site indicating a San Jose Phase Archaic occupation.

NOTE: This site is located on original access road. The alternative access road will now re-route to avoid this site.

Eligibility and Recommendation: Despite the road and livestock damage, LA 163195 is in good condition with an estimated 80 percent remaining intact. The site may have datable subsurface cultural deposits that may yield important scientific information about Archaic settlement, subsistence and stone tool technology. The site is recommended as having undetermined eligibility for nomination to the NRHP. Avoidance of this site was recommended. The site should be avoided by utilizing the alternate route to access Forest Road 450. If avoidance is not possible then EMI recommends testing to determine the nature, extent, and integrity for NRHP eligibility status and further management recommendations. The project proponent has agreed to use the alternate route for project related activities in order to avoid the site.

Evaluation of Undertaking*:* The initially proposed location of the equipment haul road, well and water lines would have intersected the site. EMI recommends that the site be avoided. The site should be avoided by utilizing the alternate route to access Forest Road 450. The project proponent has agreed to use an alternate route for project related activities in order to avoid the site. If avoidance is not possible then EMI recommends testing to determine the nature, extent and integrity for NRHP eligibility status and further management recommendations. Provided that the proponent constructs and uses the alternate route to access the mine, this site will not be affected as it will be outside of the area of potential effect.

Figure 26: LA 163195 Site overview facing southwest

Figure 27: LA 163195 Projectile Point 1

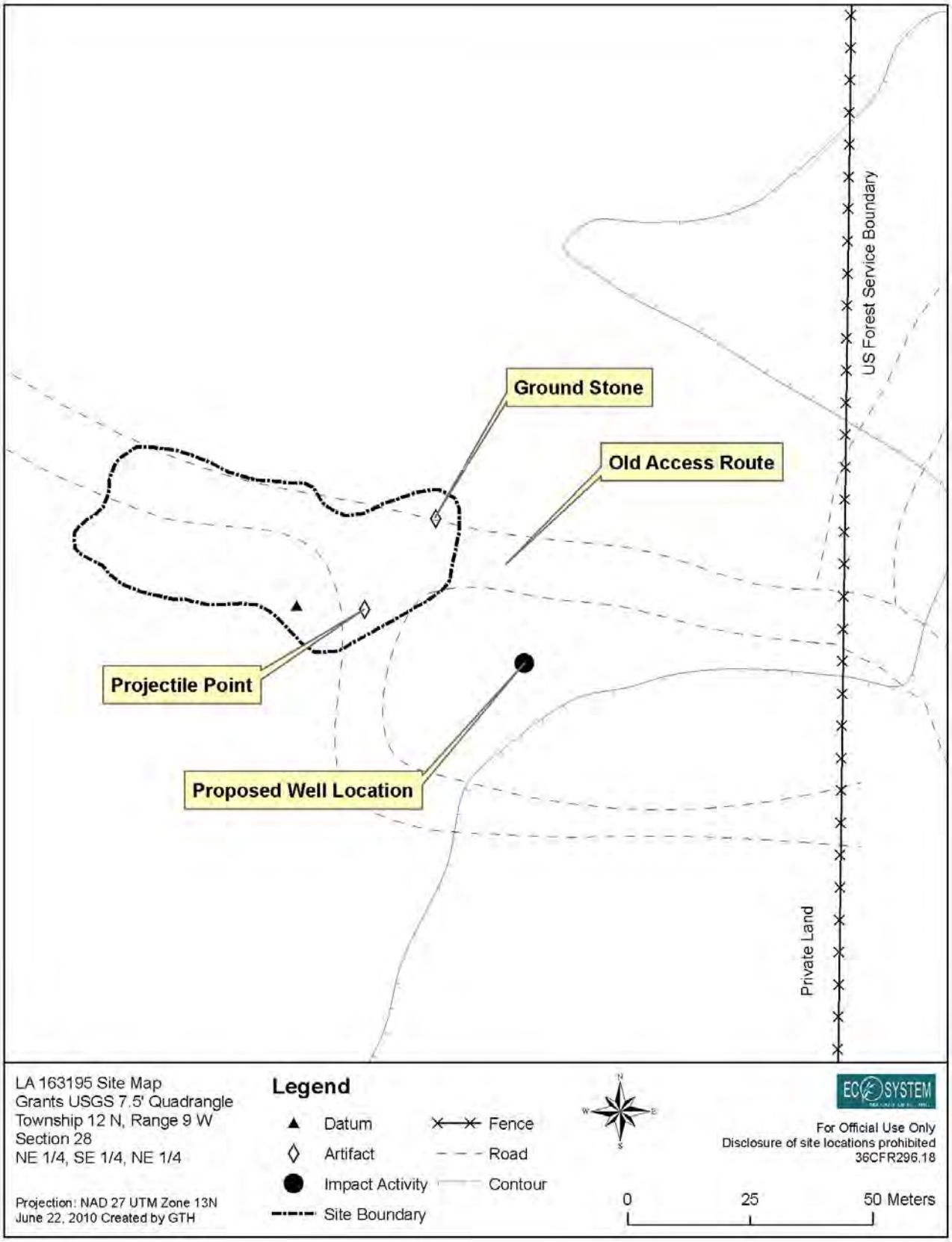

Figure 28: LA 163195 Site Map

Field Number: EMI-GL-04
LA Number: LA 163196
Forest Service Number: NA- Private land
Site Type: Prehistoric Non-structural
No. of Components: 1
Cultural Affiliation: Undetermined
Occupation Dates: Undetermined Prehistoric
Elevation: 7100 ft amsl
Vegetation: Sage and Rabbit Brush
Land Form: Sand dune at base of La Jara Mesa
Soils: Fine yellow-brown sandy loam

Site Description: LA 163196 is a lithic scatter located in a partially solidified sand dune that is bisected by Elkin's Road. Artifacts are exposed in the road bed and road cut to a height of approximately 50 cm above the road. The site has been further disturbed by vehicular traffic, heavy livestock trampling and aeolian erosion and site is 50 percent intact. Vegetation on the site is sparse, primarily consisting of sage and rabbitbrush. Soils on the site are a very fine sandy loam.

Lithics on the site were wholly comprised of Grants Ridge obsidian with the exception of one heat treated (possibly Narbona Pass) chert flake. Obsidian flakes included 13 tertiary flakes, 4 secondary flakes and one primary flake.

The site appears to be an activity area where stone tools were manufactured. Although no diagnostic artifacts were identified on the site that would indicate age or cultural affiliation, the site location and artifact assemblage are consistent with an Archaic occupation.

NOTE: This site is located on original access road. The alternative access road will now re-route to avoid this site.

Eligibility and Recommendation: LA 163196 is in fair condition with 50 percent remaining intact despite the road damage. The site may have subsurface cultural deposits that may yield important scientific information about prehistoric settlement, subsistence, and stone tool technology. The site is recommended as having undetermined eligibility for nomination to the NRHP. The site should be avoided by utilizing the alternate route to access Forest Road 450. If avoidance is not possible then EMI recommends testing to determine the nature, extent, and integrity for NRHP eligibility status and further management recommendations. The project proponent has agreed to use the alternate route for project related activities in order to avoid the site. No further management is required at this time.

Evaluation of Undertaking: The initially proposed location of the equipment haul road, well and water lines would have intersected the site. EMI recommends that the site be avoided. If avoidance is not possible then EMI recommends testing to determine the nature, extent and NRHP eligibility status. The project proponent has agreed to use an alternate route for project related activities in order to avoid the site. Provided that the proponent constructs and uses the alternate route to access the mine, this site will not be affected as it will be outside of the area of potential effect.

Figure 29: LA 163196 Site overview facing west

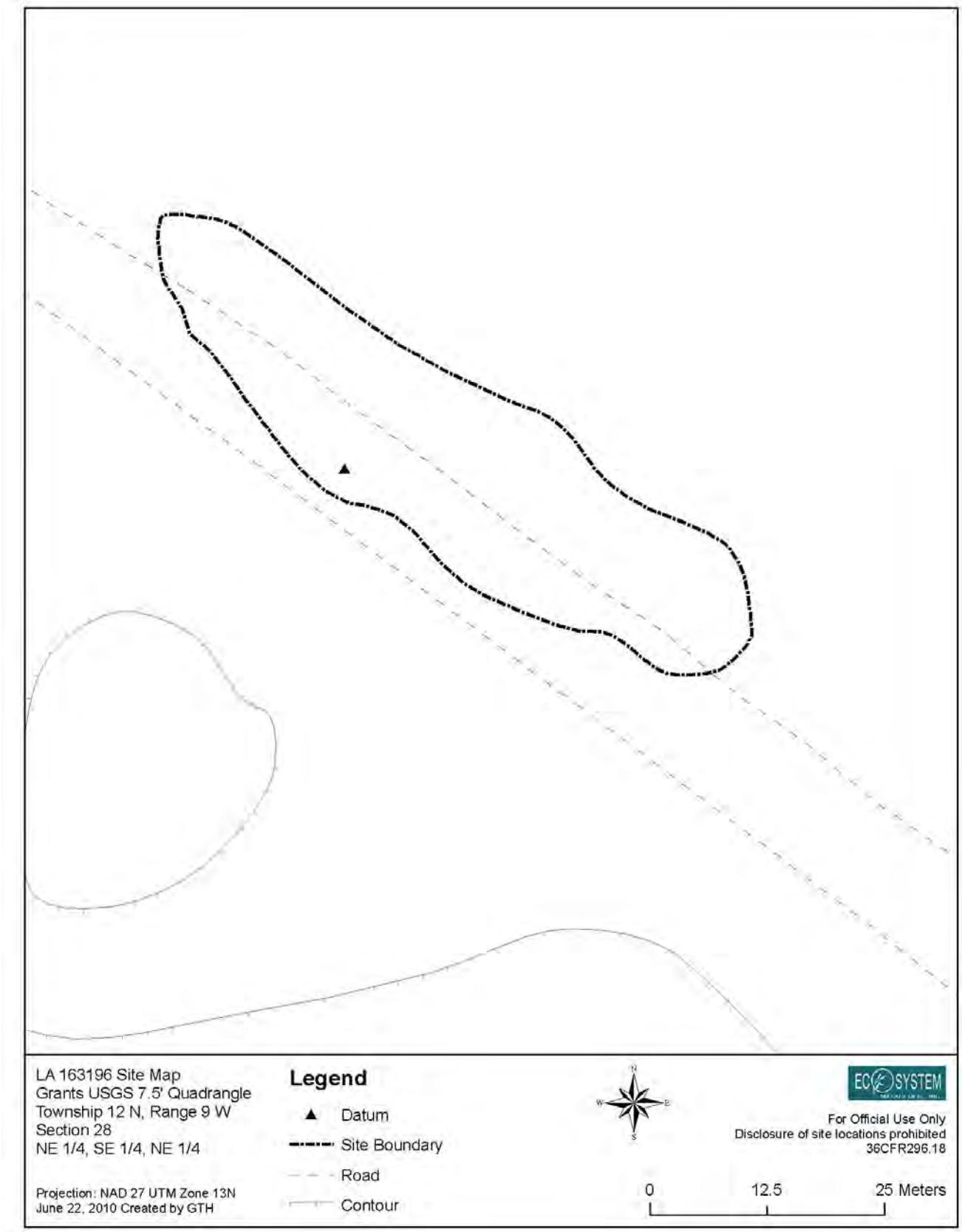

Figure 30: LA 163196 Site Map

Field Number: EMI-GL-05
LA Number: LA 163197
Forest Service Number: NA- Private land
Site Type: Prehistoric Non-structural
No. of Components: 1
Cultural Affiliation: Undetermined
Occupation Dates: Undetermined Prehistoric
Elevation: 7100 ft amsl
Vegetation: Sage and Indian Rice Grass
Land Form: Partially solidified sand dune at base of La Jara Mesa
Soils: Fine yellow-brown sandy loam

Site Description: LA 163197 is a lithic scatter comprised of flaked and ground stone artifacts and numerous ash stain features. This site is located in a partially solidified sand dune that is bisected by Elkin's Road. Artifacts are exposed in the road bed and in the road cut to a height of approximately 1 meter above the road. The site has been further disturbed by vehicular traffic, heavy livestock trampling, and aeolian erosion. Vegetation on the site is sparse, primarily consisting of sage and Indian rice grass. Soils on the site are a very fine sandy loam. The site encompasses two dunes where most artifacts and features are located (Locus 1 and Locus 2) with a low density artifact scatter connecting the dunes. The artifact scatter in the intervening distance between dunes appears to be displaced artifacts from road maintenance.

Lithic artifacts in Locus 1 included 22 Grants Ridge obsidian flakes and 1 tertiary white chert flake. The Grants Ridge obsidian flakes consisted of 16 tertiary flakes, 4 secondary flakes and 2 primary flakes. A small biface (thumbnail scraper) was recorded in Locus 1 that measured 30 mm by 20 mm by 7 mm. Lithic artifacts in Locus 2 included 11 tertiary flakes and 3 secondary flakes of Grants Ridge obsidian, 2 tertiary flakes of black translucent obsidian, 2 tertiary quartzite flakes, 1 fine grained basalt secondary flake and a fine grained basalt hammerstone measuring 8.5 cm by 6.3 cm by 3.5 cm. In between the two loci were 5 tertiary flakes of Grant Ridge obsidian and a Grants Ridge obsidian core (with 4 flake scars) that measured 6.5 cm by 3.9 cm by 2.8 cm.

Feature 1 is located in Locus 1 and is an ash stain measuring 3 m by 0.5 m. The feature occurs in the road cut approximately 15 cm above the current road surface. Feature 2 is located in Locus 1 and is an ash stain measuring 2 m by 1 m. The feature occurs in the road cut. Feature 3 is located in Locus 2 and is an ash stain measuring 1.5 m by 0.5 m. The feature occurs in the road bed. Feature 4 is located in Locus 2 and is an ash stain measuring 1.5 m by 1.5 m and is located in the road cut approximately 20 cm above the current road surface.

The site appears to be an activity area where stone tools were manufactured and some resource processing was conducted that utilized fire. Although no diagnostic artifacts were identified on the site that would indicate age or cultural affiliation, the site location and artifact assemblage are consistent with an Archaic occupation.

NOTE: This site is located on original access road. The alternative access road will now re-route to avoid this site.

Eligibility and Recommendation: LA 163197 is in good condition with an estimated 80 percent remaining intact. The site likely has datable subsurface cultural deposits that may yield important scientific information about prehistoric settlement, subsistence, and stone tool technology and chronology. The site is recommended as having undetermined eligibility for nomination to the NRHP. The site should be avoided by utilizing the alternate route to access Forest Road 450. If avoidance is not possible then EMI recommends testing to determine the nature, extent, and integrity for NRHP eligibility status and further management recommendations. The project proponent has agreed to use the alternate route for project related activities in order to avoid the site. No further management is required at this time.

Evaluation of Undertaking*:* The initially proposed location of the equipment haul road, well and water lines would have intersected the site. EMI recommends that the site be avoided. The project proponent has agreed to

use an alternate route for project related activities in order to avoid the site. If avoidance is not possible then EMI recommends testing to determine the nature, extent and NRHP eligibility status. Provided that the proponent constructs and uses the alternate route to access the mine, this site will not be affected as it will be outside of the area of potential effect.

Figure 31: LA 163197 Site overview facing east

Figure 32: LA 163197, Feature 1

Figure 33: LA 163197, Feature 2

Figure 34: LA 163197, Feature 3

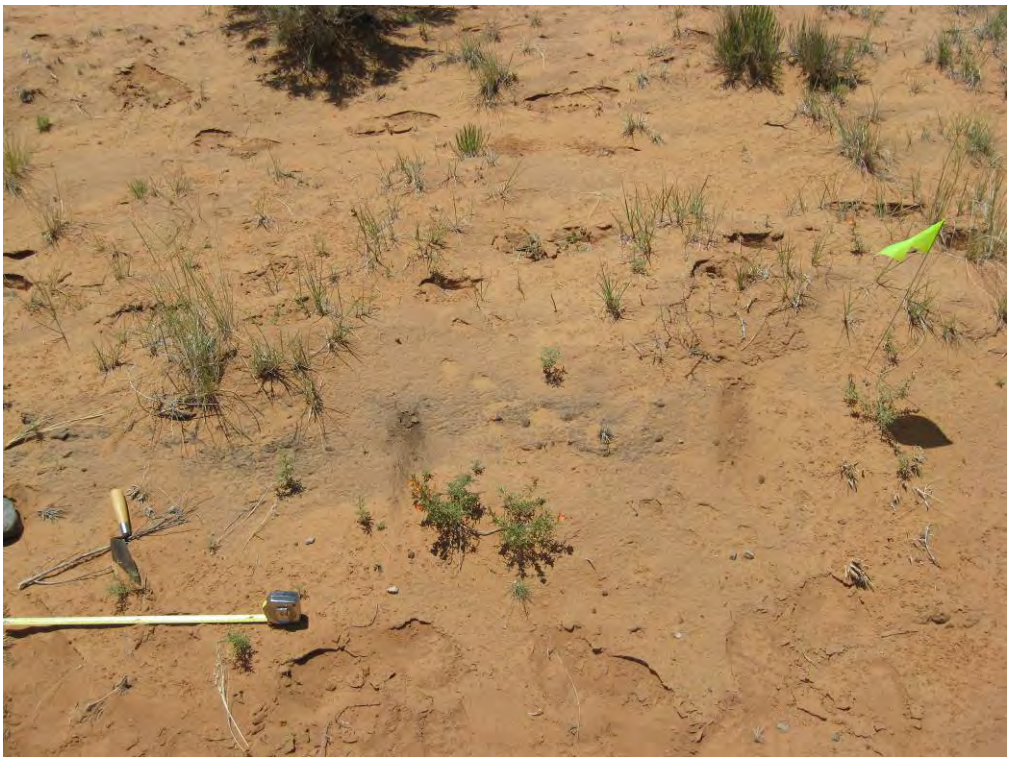

Figure 35: LA 163197, Feature 4

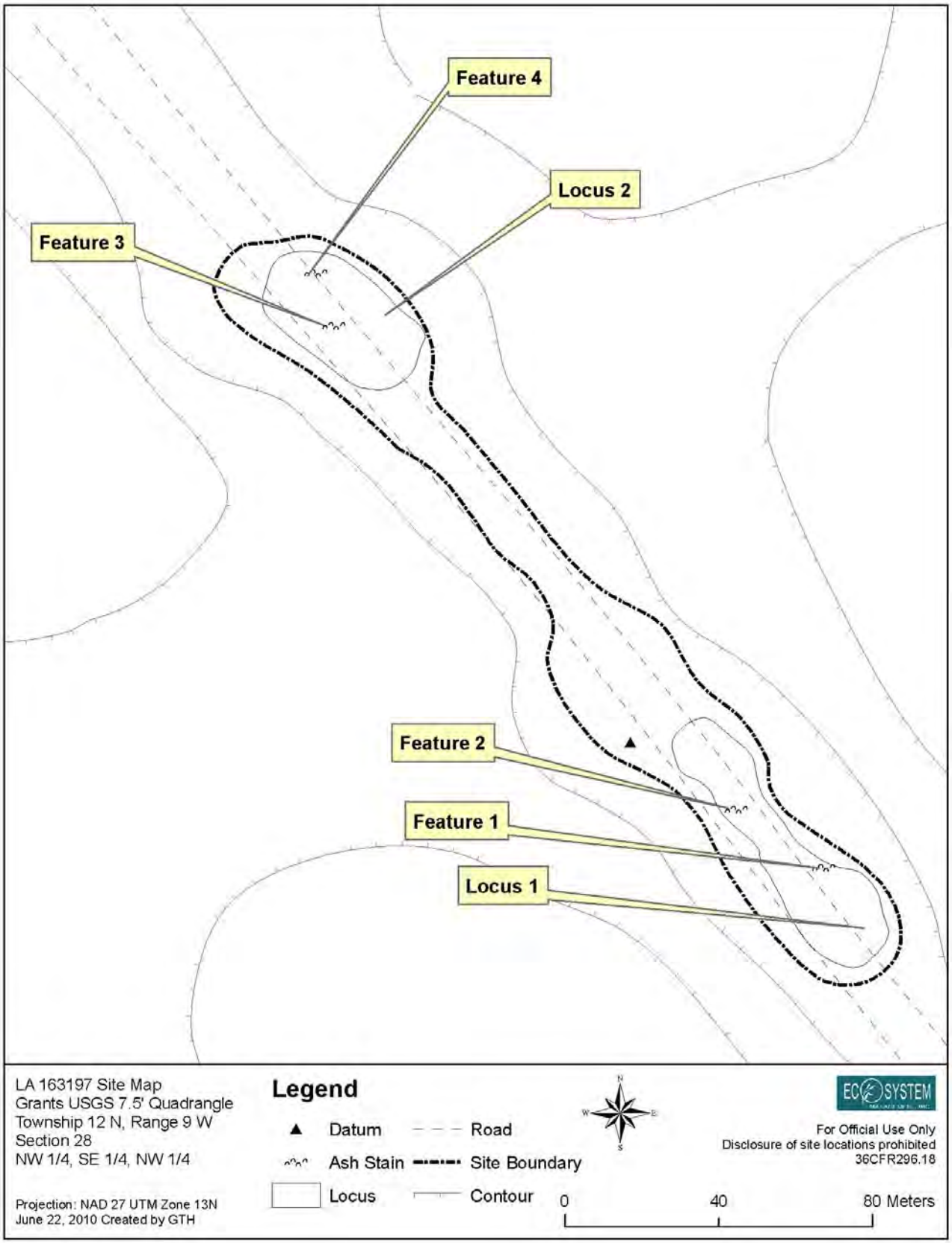

Figure 36: LA 163197 Site Map

Field Number: EMI-GL-06
LA Number: LA 163198
Forest Service Number: NA- Private land
Site Type: Prehistoric Non-structural
No. of Components: 1
Cultural Affiliation: Undetermined
Occupation Dates: Undetermined Prehistoric
Elevation: 7100 ft amsl
Vegetation: Sage and Rabbit Brush
Land Form: Partially solidified sand dune at base of La Jara Mesa
Soils: Fine yellow-brown sandy loam

Site Description: LA 163198 is a lithic scatter located in a partially solidified sand dune that is bisected by Elkin's Road. Artifacts are exposed in the road bed and in the road cut sidewall to a height of approximately 40 cm above the road and in a wing ditch cut deposit just east of the site boundary. The site has been disturbed by the road cut, vehicular traffic, heavy livestock trampling, and aeolian erosion. Vegetation on the site is sparse, primarily consisting of sage and rabbit brush. Soils on the site are a very fine sandy loam.

Lithic artifacts on the site included flakes of Grants Ridge obsidian and several tools. Grants Ridge obsidian flakes included 7 tertiary flakes, 2 secondary flakes and one primary flake. Flaked stone tools included 3 choppers; Chopper 1 is constructed of fine grained basalt with bifacial flaking and measures 11.5 cm by 9.5 cm by 3 cm, Chopper 2 is constructed of fine grained basalt with bifacial flaking and measures 15 cm by 8 cm by 3 cm, Chopper 3 is constructed of fine grained basalt with bifacial flaking and measures 12.5 cm by 11 cm by 2 cm.

Ground stone artifacts included a vesicular basalt one handed mano (GS1) with a single ground surface measuring 9 cm by 6 cm by 4 cm, 3 fragments of a sandstone slab metate with a pecked and ground surface measuring 3-5 cm in thickness, a basalt slab metate with light use wear measuring 22 cm by 19 cm by 6 cm and a fine grained basalt ground adze with a use wear polish along one face measuring 9 cm by 5 cm by 2.5 cm.

The site appears to be an activity area where food was processed and stone tools were manufactured. Although no diagnostic artifacts were identified on the site that would indicate age or cultural affiliation, the site location and artifact assemblage are consistent with an Archaic occupation.

Eligibility and Recommendation: LA 163198 is in good condition with 80 percent remaining intact. The site likely has subsurface cultural deposits that may yield important scientific information about prehistoric settlement, subsistence, and stone tool technology. The site is recommended as having undetermined eligibility for nomination to the NRHP. EMI recommends testing to determine the nature, integrity and extent of the site within the 40 ft wide improvement corridor along the Elkin's Road access roadway, for NRHP eligibility status and further management recommendations.
Evaluation of Undertaking*:* The equipment haul road will intersect the site. Since complete avoidance is not possible, EMI recommends testing to determine the nature, integrity and extent of the site within the 40 ft wide improvement corridor along the Elkin's Road access roadway, for NRHP eligibility status and further management recommendations which may include data recovery.

Figure 37: LA 163198 Mano

Figure 38: LA 163198 Metate Fragments

Figure 39: LA 163198 Adze

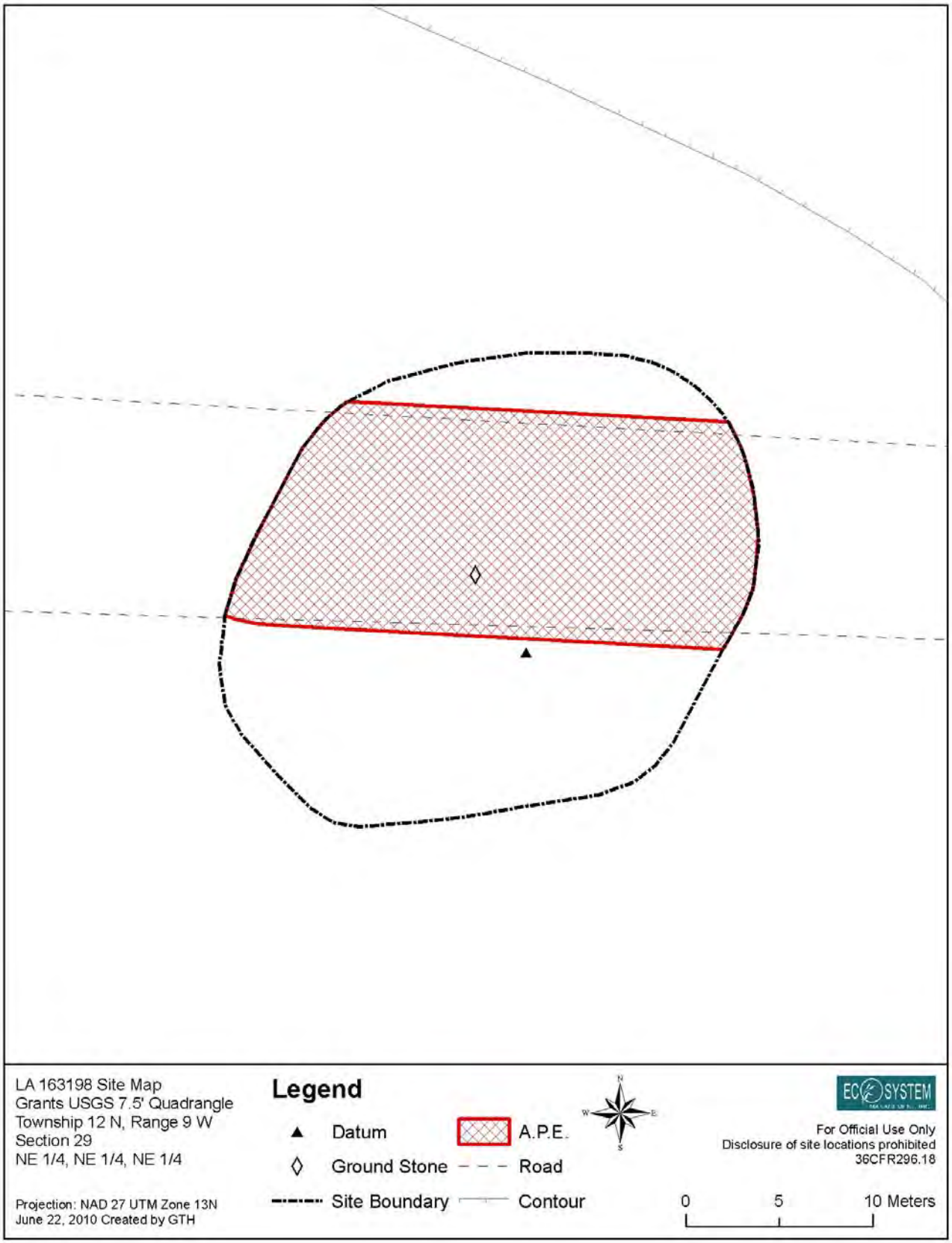

Figure 40: LA 163198 Site Map

Isolated Occurrences

Twenty-eight Isolated Occurrences were recorded during the survey and are summarized below in Table 1. Locational information is provided in Appendices A and B.

Table 4: Isolated Occurrences Summary

Project Area	IO	Description
Mine Facilities	1	Tertiary Grants Ridge obsidian flake, no cortex
Mine Facilities	2	Band saw blade 1" wide and 6-7 teeth per inch. Deteriorated 55 gallon drum. Hollow metal pole with 90 degree curve near one end measuring 1 ½" by 4'
Mine Facilities	3	Corrugated grayware bowl sherd with white interior slip, gray paste and large particle unsorted sand temper
Mine Facilities	4	Wood box measuring 2' by 1' of planed lumber with wire nails, possible dynamite box.
Mine Facilities	5	Tertiary Grants Ridge obsidian flake, no cortex
Mine Facilities	6	Tertiary Grants Ridge obsidian flake, no cortex
Mine Facilities	7	Trash pile consisting of 7 church key opened 3" diameter tin cans
Mine Facilities	8	Sandstone mano, ground on one edge, measuring 11cm by 8cm by 4cm
FR 450	9	Tertiary obsidian flake
FR 450	10	Utilized obsidian flake with retouch pressure flaking along one lateral edge measuring 30 mm by 19 mm by 4 mm. Tertiary chalcedony flake
FR 450	11	3 Grants Ridge obsidian flakes, one primary, one secondary and one small piece of angular debris
FR 450	12	Iron horse shoe
FR 450	13	4 planed timbers with wire 2" nails
FR 450	14	Grants Ridge obsidian tertiary flake
FR 450	15	Oil can lid with threaded spout, steel
FR 450	16	Grants Ridge obsidian core with 6 flake scars and 20% cortex measuring 44 mm by 38 mm by 21 mm.
FR 450	17	Tertiary flake of translucent chert with black speckles
FR 450	18	Paint can
FR 450	19	Obsidian core with 3 flake scars
FR 450	20	Obsidian secondary flake
Elkin's Road	21	One primary and one tertiary obsidian flake
Elkin's Road	22	Planed timber and RR ties with large square headed bolts
Elkin's Road	23	4 obsidian flakes, one primary, one secondary and two tertiary
Elkin's Road	24	3 obsidian tertiary flakes
Elkin's Road	25	Trash dump, aluminum pull top cans, 55 gallon drum cut into a stove and broken bottle glass
Escape Raise	26	Knife opened tin can
Alternate Route	27	Primary obsidian flake fragment and one solder dot can
Alternate Route	28	Primary obsidian flake

The Isolated Occurrences are not eligible for listing on the National Register of Historic Places or State Register of Cultural Properties,, therefore, they require no further work.

TRIBAL CONSULTATION

Tribal consultation for the project is being conducted by Cibola National Forest.

SUMMARY AND MANAGEMENT RECOMMENDATIONS

The sites are subject to testing program where needed, and/or avoidance flagging or fencing, and ongoing periodic monitoring for all eligible or potentially eligible sites and/or portions of sites.

All eligible and undetermined sites that intersect the haul road and utility corridor will be tested within the 40 ft foot print of the road maintenance and utility corridor to provide management recommendations. Flagging of sites will occur along the road edges outside the 40 ft wide corridor and around the remaining portion of the sites, and will include double flagging 30 m either side of the site boundary at the roads' edge in order to provide a warning that the site is nearby. Periodic monitoring of impacts to sites due to project activities is recommended.

Table 5 provides an overview of the site eligibility and specific site recommended treatments.

Table 5: Eligibility and Treatment Recommendations

Project Area	LA Site No.	Forest Service Site No.	Eligibility	Evaluation of the Undertaking and Treatment Recommendation
Mine Facilities Area	163193	AR-03-03-02-2880	Undetermined	The site occurs in the area planned for the "Growth Medium Stockpile" as well as part of the "Explosive Storage" area. The project proponent has agreed to move these facilities. **Testing of the site is recommended** along the access road corridor to determine the depth and extent of the cultural deposits prior to any mitigation recommendation. Fencing of the remainder of the site is recommended
FR 450	163194	AR-03-03-02-2881	Undetermined	The equipment haul road, water lines and transmission lines will intersect the site. Since complete avoidance is not possible, **testing is recommended** within the 40 foot road maintenance and utility corridor to determine the extent and nature of any intact subsurface deposits and to provide data for additional management recommendations which may include data recovery.
Elkin's Road	163195	N/A (private land)	Undetermined	The site should be **avoided** by utilizing the alternate route to access Forest Road 450. If avoidance is not possible then testing is recommended to determine the extent and nature of any intact subsurface deposits and to provide data for additional management recommendations which may include data recovery.
Elkin's Road	163196	N/A (private land)	Undetermined	The site should be **avoided** by utilizing the alternate route to access Forest Road 450. If avoidance is not possible then testing is recommended to determine the extent and nature of any intact subsurface deposits and to provide data for additional management recommendations which may include data recovery.

Elkin's Road	163197	N/A (private land)	Undetermined	The site should be **avoided** by utilizing the alternate route to access Forest Road 450. If avoidance is not possible then testing is recommended to determine the extent and nature of any intact subsurface deposits and to provide data for additional management recommendations which may include data recovery.
Elkin's Road	163198	N/A (private land)	Undetermined	The equipment haul road will intersect the site, but it is uncertain how much of the site will be impacted. Since complete avoidance is not possible, **testing is recommended** to determine the extent and nature of any intact subsurface deposits within the 40 foot road improvement and utility corridor and to provide data for additional management recommendations which may include data recovery.
FR 544	153870	AR-03-03-02-2768	Undetermined	The site should be **avoided**. The site boundaries will be flagged. If avoidance is not possible then testing is recommended to determine the extent and nature of any intact subsurface deposits and to provide data for additional management recommendations which may include data recovery.
FR 544	153873	AR-03-03-02-2770	Undetermined	Forest Road 544 will be used to access the escape raise area. Since complete avoidance is not possible and it is unknown whether intact cultural deposits exist within the current disturbance of the road bed, **testing is recommended** to determine the extent and nature of any intact subsurface deposits within the road bed and to provide data for additional management recommendations which may include data recovery.
FR 544	153872	AR-03-03-02-2771	Undetermined	Forest Road 544 will be used to access the escape raise area. Since complete avoidance is not possible and it is unknown whether intact cultural deposits exist within the current disturbance of the road bed, **testing is recommended** to determine the extent and nature of any intact subsurface deposits within the road bed and to provide data for additional management recommendations which may include data recovery.
FR 544	131426	AR-03-03-02-2317	Undetermined	The site should be **avoided**. The site boundaries will be flagged. If avoidance is not possible then testing is recommended to determine the extent and nature of any intact subsurface deposits and to provide data for additional management recommendations which may include data recovery.

FR 450	48225	AR-03-03-02-819	Eligible, criterion d	The equipment haul road, water lines and transmission lines will intersect the site. Since complete avoidance is not possible and it is unknown whether intact cultural deposits exist within the 40 foot road improvement and utility corridor, **testing is recommended** to determine the extent and nature of any intact subsurface deposits and to provide data for additional management recommendations which may include data recovery.
FR 450	48226	AR-03-03-02-820	Not Eligible	No further action is required.
FR 450	48227	AR-03-03-02-821	Not Eligible	No further action is required.
FR 450	48224	AR-03-03-02-818	Undetermined	The equipment haul road, water lines and transmission lines will intersect the site. Since complete avoidance is not possible and it is unknown whether intact cultural deposits exist within the 40 foot road improvement and utility corridor, **testing is recommended** to determine the extent and nature of any intact subsurface deposits and to provide data for additional management recommendations which may include data recovery.

Clearance Recommendation

Isolated occurrences are not considered eligible for NRHP and therefore require no further management.

The most recent listings of the National Register of Historic Places have been consulted and no sites which appear on the Register and no sites which have been nominated to the Register occur in the project area. This proposal complies with the provisions of the Historic Preservation Act of 1966 and with Executive Order 11593. EMI recommends avoidance of site LA 163193/AR-03-03-02-2880, which occurs in the area planned for the "Growth Medium Stockpile" as well as part of the "Explosive Storage" area. The project proponent has agreed to avoid the site by relocating these facilities. The site will also need to be tested within the road improvement and utility corridor where an access road bisects the site.

The currently planned activities include travel along Elkins Road that cuts LA 163198 as well as construction of a road segment (proposed alternate access route) connecting Elkins Road with FR 450 and construction of a well adjacent to the road segment. The project proponent has agreed to utilize the proposed alternate access route in order to avoid sites LA 163195, LA 163196 and LA 163197.

Access roads and utility corridors bisect a number of sites. Testing is recommended within the 40 foot road improvement and utility corridor to determine whether there are intact deposits in and adjacent to the road(s) that will be adversely impacted. Testing of sites LA 163198, AR-03-03-02-2770/LA 153873 and AR-03-03-02-2771/LA 153872, LA 163194/03-03-02-2881, LA 163193/AR-03-03-02-2880, LA 48225/AR-03-03-02-819, and LA 48224/AR-03-03-02-818 is recommended to determine the depth and extent of the cultural deposits prior to any construction to ensure avoidance. Based on the results of the testing, the sites or portions of the sites that still retain integrity should be avoided and protected from project related ground-disturbing activities. EMI recommends that cultural resources clearance be granted with the provision that recommendations outlined in this report are followed. If unanticipated cultural materials are encountered during project activities, work shall stop and a qualified archaeologist contacted to assess the find.

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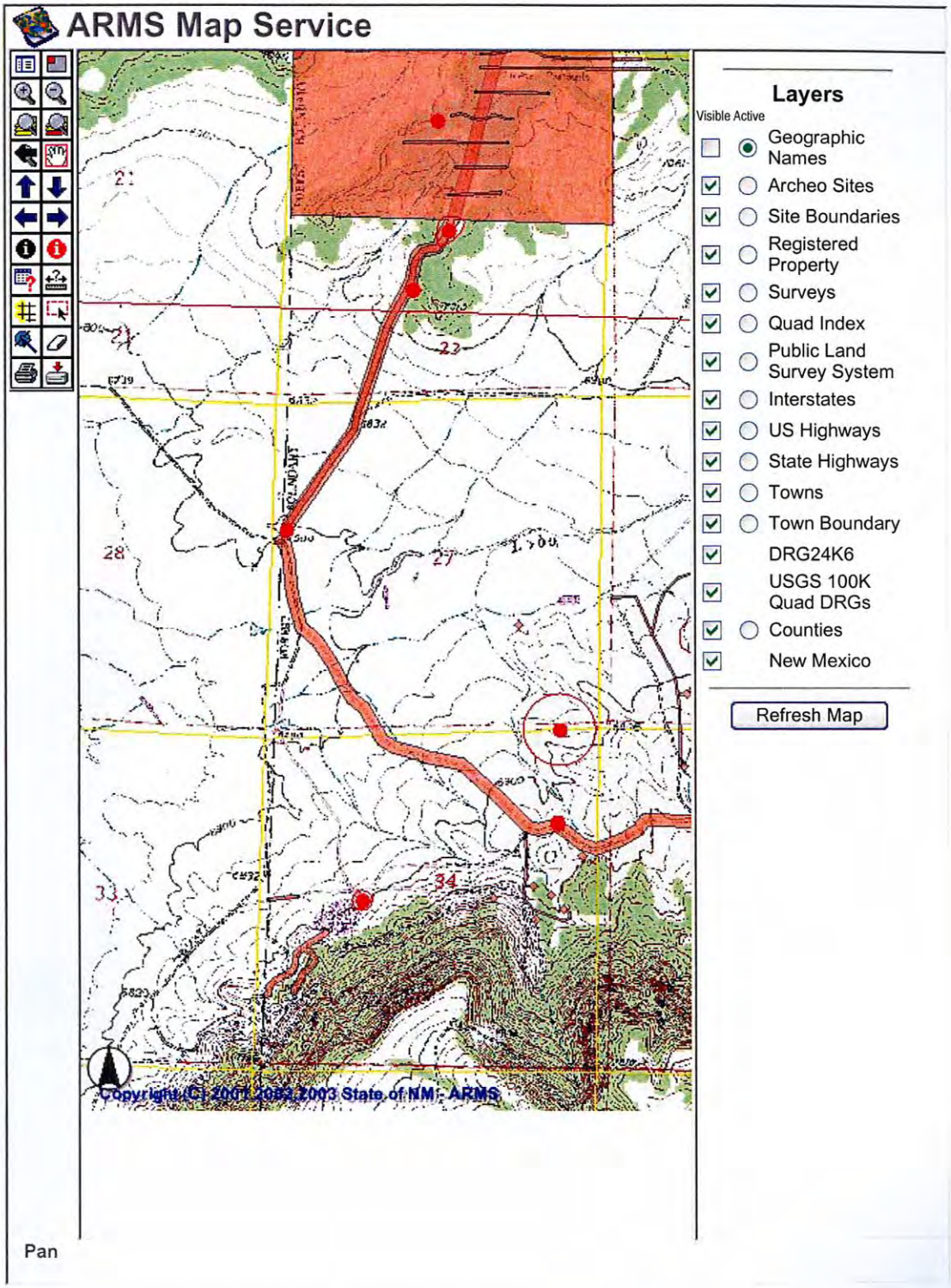
APPENDIX A: ARMS Maps

ATTENTION:

All Contents Of This Appendix Are For Official Use Only.

Disclosure of Site Locations and/or Maps is Prohibited (Section 18-6-11.1 NMSA 1978 (*NMAC 4.10.15.20.O & P*)).


ARMS Map Service
Layers
Visible Active
Geographic Names
Archeo Sites
Site Boundaries
Registered Property
Surveys
Quad Index
Public Land Survey System
Interstates
US Highways
State Highways
Towns
Town Boundary
DRG24K6
USGS 100K Quad DRGs
Counties
New Mexico
Refresh Map
Pan
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http://stubbs.arms.state.nm.us/arms_maps/viewer.htm

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http://stubbs.arms.state.nm.us/arms_maps/MapFrame.htm

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Towns
Town Boundary
DRG24K6
USGS 100K Quad DRGs
Counties
New Mexico
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http://stubbs.arms.state.nm.us/arms_maps/viewer.htm
5/22/2009

APPENDIX B: Site Location Maps

ATTENTION:

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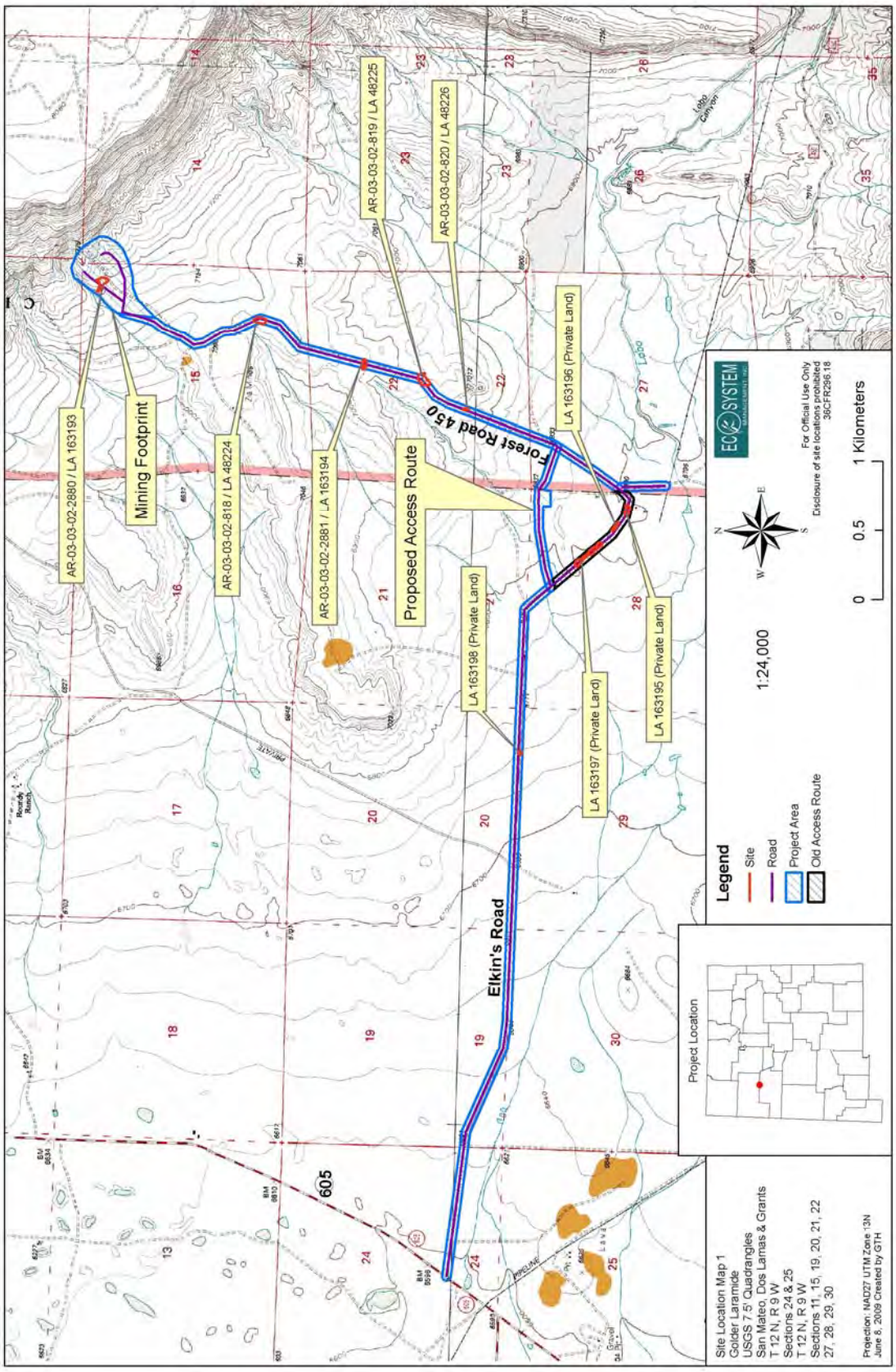

Figure 41: Site Location Map 1

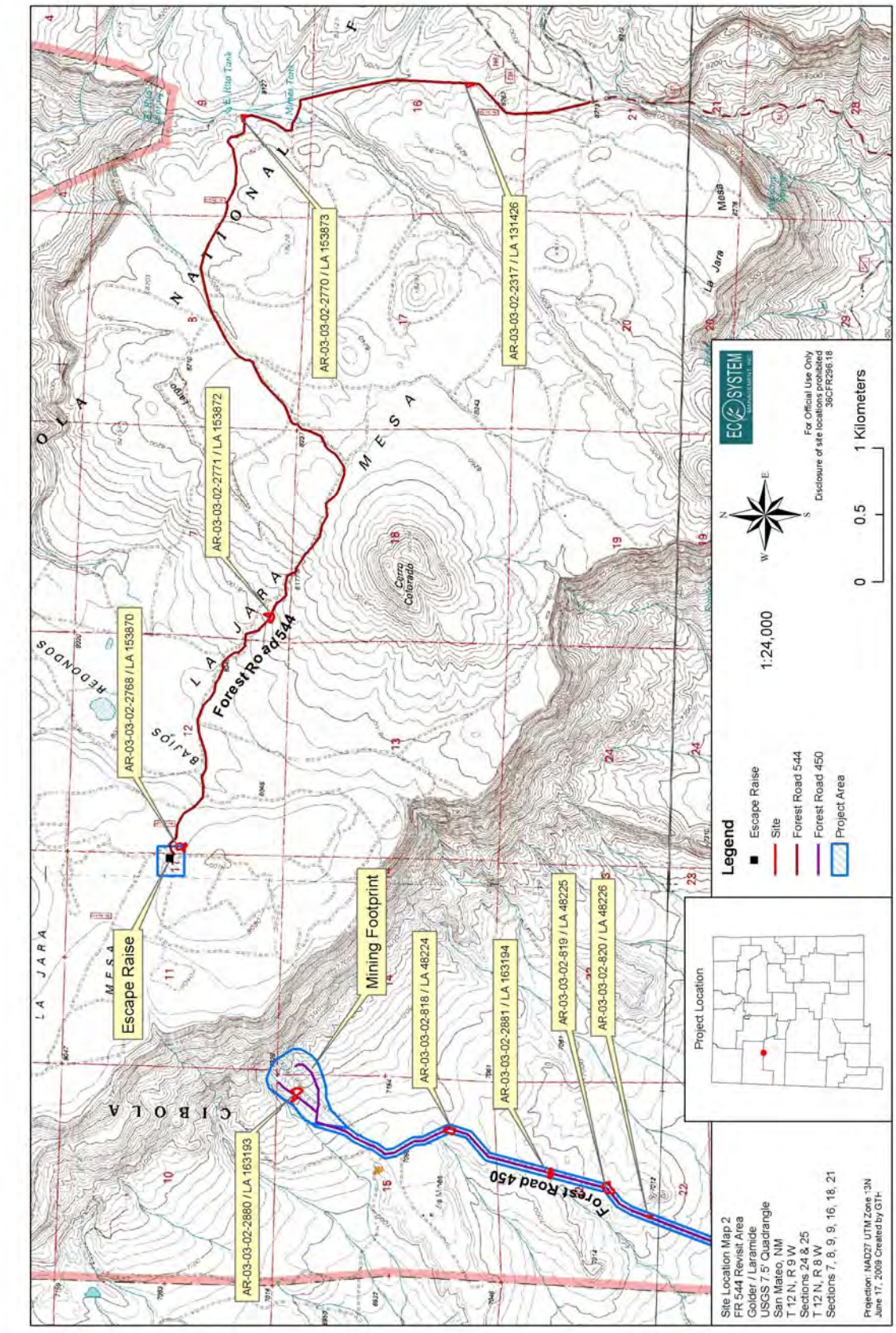

Figure 42: Site Location Map 2

APPENDIX C: Isolated Occurrences Maps

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Disclosure of Site Locations and/or Maps is Prohibited (Section 18-6-11.1 NMSA 1978 (*NMAC 4.10.15.20.O & P*)).

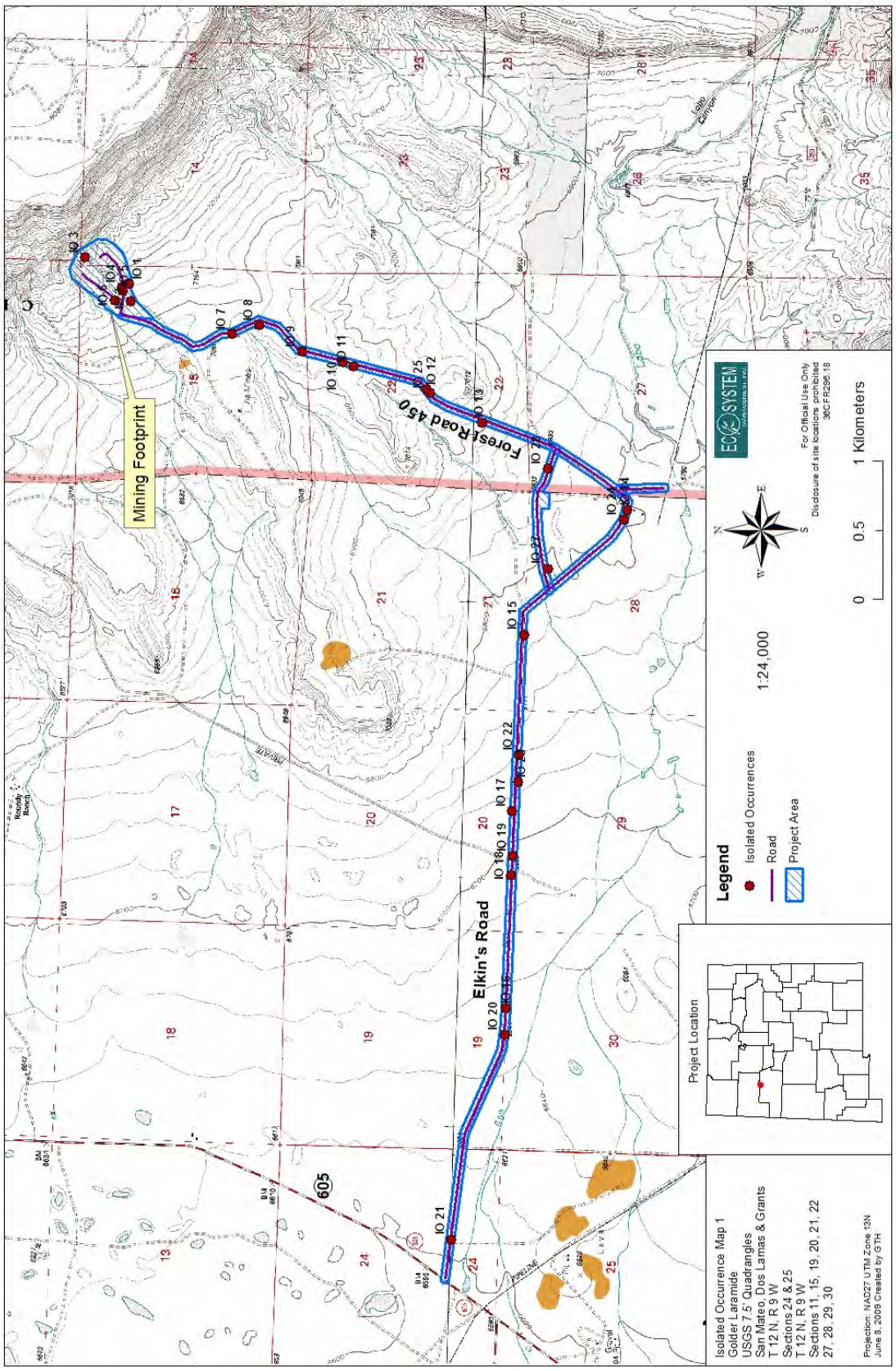

Figure 43: Isolated Occurrence Map 1

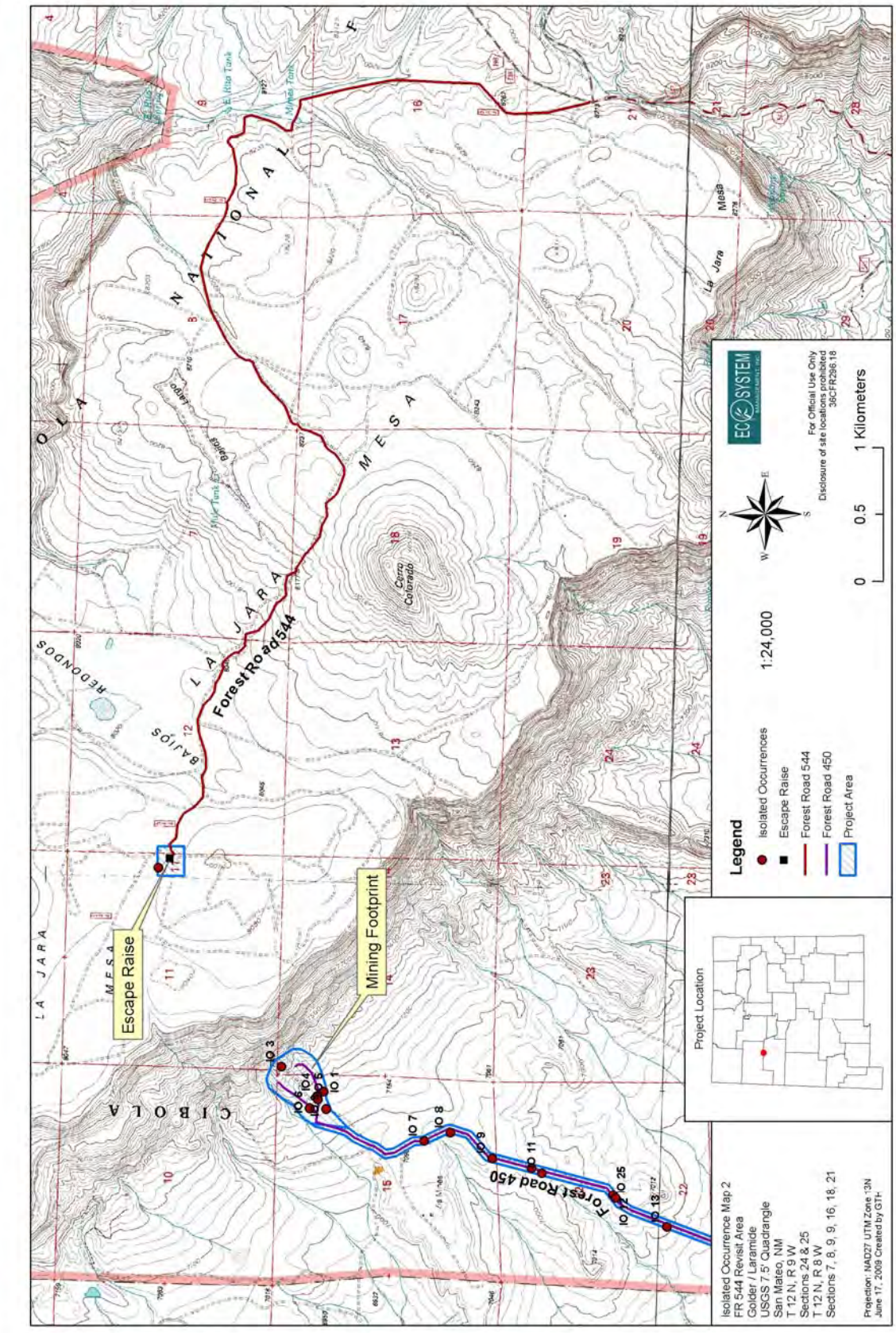

Figure 44: Isolated Occurrence Map 2

APPENDIX D: UTM Location Information

ATTENTION:

All Contents Of This Appendix Are For Official Use Only.

Disclosure of Site Locations and/or Maps is Prohibited (Section 18-6-11.1 NMSA 1978 (*NMAC 4.10.15.20.O & P*)).

Note: All coordinates are projected in the NAD27 UTM zone 13N coordinate system.

Table 6: UTM Isolated Occurrence Locations

IO #	UTM Easting	UTM Northing
1	248157	3906714
2	248168	3906562
3	248495	3906900
4	248250	3906667
5	248236	3906639
6	248171	3906698
7	247931	3905854
8	247869	3905665
9	247785	3905333
10	247722	3905047
11	247677	3904977
12	247525	3904444
13	247283	3904050
14	246655	3903004
15	245747	3903754
16	243048	3903887
17	244483	3903830
18	244007	3903838
19	244153	3903836
20	242864	3903874
21	241379	3904268
22	244871	3903786
23	244681	3903792
24	246592	3903024
25	247500	3904421
26	249958	3907831
27	246222	3903587
28	246955	3903558

Table 7: UTM Site Locations

LA #	Forest Service #	Field Number	Easting	Northing
163193	AR-03-03-02-2880	EMI-GL-01	248363	3906759
163194	AR-03-03-02-2881	EMI-GL-02	247667	3904914
163195	N/A	EMI-GL-03	246641	3902999
163196	N/A	EMI-GL-04	246504	3903097
163197	N/A	EMI-GL-05	246332	3903255
163198	N/A	EMI-GL-06	244882	3903783
153870	AR-03-03-02-2768	AR-03-03-02-2768	250117	3907672
153873	AR-03-03-02-2770	AR-03-03-02-2770	255520	3907195
153872	AR-03-03-02-2771	AR-03-03-02-2771	251824	3906988
131426	AR-03-03-02-2317	AR-03-03-02-2317	255800	3905530
48224	AR-03-03-02-818	AR-03-03-02-818	248000	3905656
48225	AR-03-03-02-819	AR-03-03-02-819	247546	3904482
48226	AR-03-03-02-820	AR-03-03-02-820	247360	3904167
48227	AR-03-03-02-821	AR-03-03-02-821	246753	3903060

LABORATORY OF ANTHROPOLOGY SITE RECORD

1. IDENTIFICATION & OWNERSHIP

LA Number: 48,224 (contact ARMS for site registration) ☒ **Site Update**? (complete at least Sections 1-4)

Site Name(s): _____

Other Site Number(s): **Agency Assigning Number:**

AR-03-03-02-818 USDA-FS

_____ _____

_____ _____

Current Site Owner(s): Cibola National Forest, Mt. Taylor Ranger District

Site Type: Non-Structural **Occupation Type:** Prehistoric

2. RECORDING INFORMATION

NMCRIS Activity No.: 114,095 **Field Site Number:** _____

Site Marker? ☒ (specify ID#)**:** 818 (The site tag from the previous recording was relocated.)

Recorder(s): Garth Hayden, Kate Wright

Agency: EMI **Recording Date (dd-MMM-yyyy):** 09-FEB-2011

Site Accessibility (choose one)**:** ☐ accessible ☐ buried (sterile overburden) ☐ flooded ☐ urbanized ☐ not accessible

Surface Visibility (% visible; choose one)**:** ☐ 0% ☐ 1-25% ☐ 26-50% ☒ 51-75% ☐ 76-99% ☐ 100%

Remarks: The area near the location of the site is very heavily disturbed by vehicular traffic and unauthorized construction on FR 450.

Recording Activities:

☐ sketch mapping
☐ instrument mapping (e.g., total station mapping)
☐ surface collection (controlled or uncontrolled)
☐ in-field artifact analysis
☐ other activities (specify): _____
☐ photography
☐ shovel or trowel tests; probes
☐ test excavation
☐ excavation (data recovery)

Description of Analysis or Excavation Activities: _____

Photographic Documentation: Digital File – AR-818

Surface Collections (choose one)**:**

☒ no surface collection
☐ uncontrolled surface collection
☐ collections of specific items only
☐ controlled (sample: <100%)
☐ controlled (complete: 100%)
☐ other method (describe): _____

Records Inventory:

☒ site location map
☒ sketch map(s)
☐ instrument map(s)
☒ excavation, collection, analysis records
☒ photos, slides, and associated records
☐ other records: _____
☒ field journals, notes
☐ NM Historic Building Inventory form

Repository for Original Records: EMI

Repository for Collected Artifacts: N/A

3. CONDITION

Archaeological Status: ☐ surface collection ☐ test excavation ☐ partial excavation ☐ complete excavation

Disturbance Sources: ☒ wind erosion ☒ water erosion ☐ bioturbation ☐ vandalism ☐ construction/land development

☐ other source (specify): _____

Vandalism: ☐ defaced glyphs ☐ damaged/defaced building ☐ surface disturbance ☐ manual excavation

☐ mechanical excavation ☐ other vandalism (specify): _____

Percentage of Site Intact (choose one)**:** ☐ 0% ☒ 1-25% ☐ 26-50% ☐ 51-75% ☐ 76-99% ☐ 100%

Observations on Site Condition: Limited surface cultural resources were observed during the course of the current survey. The area near the location of the site is very heavily disturbed by vehicular traffic on FR 450 as well as alluvial and aeolian erosion. There appears to be little surface evidence of the site.

4. RECOMMENDATIONS (for Performer/Recorder use only)

National Register Eligibility (choose one)**:** ☐ eligible ☐ not eligible ☒ not sure

Applicable Criteria: ☐ (a) ☐ (c) ☐ (b) ☐ (d)

Basis for Recommendation: Previous subsurface testing on the site did reveal subsurface cultural material indicating the possibility of intact subsurface deposits that may retain data to address questions about prehistoric land use. EMI recommends the site as having undetermined status.

Assessment of Project Impact: The site is located along Forest Road 450, the main haul road, and will be impacted by planned project activities.

Treatment Recommendations: EMI recommends testing to determine the nature, integrity and extent of the site within the 40 ft wide improvement corridor along the FR 450 access roadway, for NRHP eligibility status and further management recommendations.

5. SHPO CONSULTATIONS (for SHPO and Sponsor use only)

Sponsor NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

Sponsor Staff: _____ **Date (dd-MMM-yyyy):** _____

Sponsor Remarks: _____

SHPO NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

HPD Staff: _____ **Date (dd-MMM-yyyy):** _____ **HPD Log No:** _____

Register Status: ☐ listed on National Register ☐ listed on State Register ☐ formal determination of eligibility

State Register No.: _____

SHPO Remarks: _____

6. LOCATION

Source Graphics:

☒ USGS 7.5' (1:24,000) topo maps ☐ rectified aerial photos [Scale: _____]

☐ other topo maps [Scale: _____] ☐ unrectified aerial photos [Scale: _____]

☒ GPS unit GPS accuracy (choose one): ☐ < 1.0 m ☒ 1-10 m ☐ 10-100 m ☐ >100 m

☐ other source (describe): _____

UTM Coordinates (@ center of site; at least one set of coordinates required):

Map-based Coordinates Datum: NAD27 **Zone:** 13 **E:** _____ **N:** _____

GPS-based Coordinates Datum: NAD27 **Zone:** 13 **E:** 248000 **N:** 3905656

Directions to Site: _____ **In highway R-O-W?** ☐

Town (if in city limits): _____ **State:** NM **County:** _____

USGS Quadrangle Name	Date	USGS Code
Dos Lomas, NM	1981	35107-C7

PLSS Meridian	Unplatted	Township	Range	Section	¼ Sections			Protracted?
New Mexico	☐	T 12 N	R 9 W	15	NE	SW	SE	☐
New Mexico	☐	T _____	R _____	__	_____	_____	_____	☐
New Mexico	☐	T _____	R _____	__	_____	_____	_____	☐

7. PHYSICAL DESCRIPTION

Site Dimensions: 90x40 meters **Basis for Dimensions** (choose one): ☐ estimated ☐ measured

Site Area: 3,600 sq m **Basis for Area** (choose one): ☐ estimated ☒ measured **Elevation:** 7,060 feet

Site Boundaries Complete? (choose one): ☒ Yes ☐ No (explain): _____

Basis for Site Boundaries: ☒ distribution of archeological features & artifacts ☐ modern features or ground disturbance

☐ property lines ☐ topographic features ☐ other (specify): _____

Depositional/Erosional Environment: ☐ alluvial ☐ aeolian ☐ colluvial ☒ residual ☐ no deposition (on bedrock)

☐ other process (describe): _____

Stratigraphy & Depth of Archeological Deposits (choose one): ☐ unknown/not determined

☐ no subsurface deposits present ☒ subsurface deposits present ☐ stratified subsurface deposits present

Estimated Depth of Deposits: 10 cm

Basis for Depth Determinations: ☐ estimated ☐ shovel/trowel tests ☐ core/auger tests ☐ excavations

☒ road or arroyo cuts ☐ rodent burrows ☐ other observations (describe): _____

Observations on Subsurface Archeological Deposits: The site was previously tested by Forest Service Archaeologists and found to have limited subsurface deposits (two of four test units were positive with one flake each). During the current revisit there was no evidence of artifacts in the road or road cut and little surface evidence of cultural material on the site.

Local Vegetation (list species in decreasing order of dominance)**:**

Overstory: **Piñon, juniper**

Understory: **sparse grasses**

Vegetation Community (choose one or two): ☐ forest ☒ woodland ☐ grassland ☐ scrubland ☐ desert scrubland ☐ marshland

☐ other community (specify): _____

Topographic Location:

☐ alluvial fan	☐ bench	☐ dune	☐ low rise	☒ ridge
☐ arroyo/wash	☐ blowout	☐ flood plain/valley	☐ mesa/butte	☐ rockshelter
☐ badlands	☐ canyon rim	☐ foothill/mountain front	☐ mountain	☐ saddle
☐ base of cliff	☐ cave	☐ hill slope	☐ open canyon floor	☐ talus slope
☐ base of talus slope	☐ cliff/scarp/bluff	☐ hill top	☐ plain/flat	☐ terrace
☐ other location (describe): _____	☐ constricted canyon	☐ lava flow (malpais)	☐ playa	

Observations on Site Setting: _____

8. ASSEMBLAGE DATA

Assemblage Content (all components)**:**

Lithics:

- ☒ lithic debitage
- ☐ chipped-stone tools
- ☐ diagnostic projectile points
- ☐ non-local lithic material
- ☐ stone-tool manufacturing items (cores, hammerstones, etc.)
- ☐ ground-stone tools
- ☐ other stone tools

Prehistoric Ceramics

- ☐ whole ceramic vessels
- ☐ diagnostic ceramics
- ☐ other prehistoric ceramics

Historic Artifacts:

- ☐ diagnostic glass artifacts
- ☐ other glass artifacts
- ☐ diagnostic metal artifacts
- ☐ other metal artifacts
- ☐ whole ceramic vessel
- ☐ diagnostic ceramics
- ☐ other historic ceramics

Other Artifacts and Materials:

- ☐ bone tools
- ☐ faunal remains
- ☐ macrobotanical remains
- ☐ perishable artifacts
- ☐ ornaments
- ☐ figurines
- ☐ mineral specimens
- ☐ architectural stone
- ☐ burned adobe
- ☐ fire-cracked rock/burned caliche

☐ Other items (specify): _____

Assemblage Size (all components)**:**

artifact class	estimated frequency: 0	1s	10s	100s	1000s	>10,000	*Counts (if <100)
lithic artifacts (choose one): (include debitage)	☐	☒	☐	☐	☐	☐	1
prehistoric ceramics (choose one):	☐	☐	☐	☐	☐	☐	_____
historic artifacts (choose one):	☐	☐	☐	☐	☐	☐	_____
total assemblage size (choose one):	☐	☒	☐	☐	☐	☐	1

Dating Potential: ☐ radiocarbon ☐ dendrochronology ☐ archeomagnetism ☐ obsidian hydration

☒ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Assemblage Remarks: One tertiary obsidian flake was found during the revisit.

9. CULTURAL/TEMPORAL AFFILIATIONS

TOTAL NUMBER OF COMPONENTS DEFINED: 1

COMPONENT #1 (EARLIEST)

Cultural Affiliation: Unknown Aboriginal

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records ☐ associated diagnostic artifact or feature types ☐ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:	Unknown		
Latest Period (if any)**:**			

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration ☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify):

Basis for Cultural/Temporal Affiliation: single obsidian flake

Component Type: Artifact scatter

Remarks:

***Associated Phase/Complex Name(s):**

COMPONENT #2

Cultural Affiliation:

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records ☐ associated diagnostic artifact or feature types ☐ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:			
Latest Period (if any)**:**			

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration ☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify):

Basis for Cultural/Temporal Affiliation:

Component Type:

Remarks:

***Associated Phase/Complex Name(s):**

10. FEATURE DATA

(see NMCRIS User's guide for a list of valid feature types)

Feature Type	Reliable ID ?	# Observed	Assoc. Comp. #s	Feature ID, Notes
None				

Feature Remarks:

11. REFERENCES

Written Sources of Information: Results of a Cultural Resource Survey of 6.2 Miles of Roads (103 Acres) on Private and Forest Lands, and Approximately 22 Block Acres for Mine Facilities and an Escape Raise in the Cibola National Forest, Mt. Taylor Field Office, Cibola County, New Mexico (Harris et al, 2009)

Heritage Report #: 1998-03-069 (NMCRIS #62120) Popelish, Linda

Additional Sources of Information: _____

12. NARRATIVE DESCRIPTION

Site Description: The site was originally recorded in 1984 by Plano Archaeological Consultants (PAC). The site was considered deflated, and erosion was estimated to have impacted at least 20% of the site. Further investigation at LA 48224/AR-03-03-02-818 occurred in 1998 by the Cibola National Forest, Mt. Taylor Ranger District personnel to assess damages incurred by unauthorized road work, and included mapping, artifact analysis, photography and sub-surface testing. Testing yielded an indication of possible subsurface deposits (two flakes from four shovel test units). The site was reported to have been damaged by unauthorized road maintenance and mining activities as well as active wind and water erosion. Testing was for impact assessment only and the site was assigned an undetermined eligibility for inclusion to the NRHP by Cibola National Forest personnel at that time.

During the current investigation the site was revisited. The area near the location of the site is very heavily disturbed by vehicular traffic on FR 450 as well as alluvial and aeolian erosion. The current surface evidence of the site at the location listed for LA 48224/AR-03-03-02-818 consisted of one tertiary obsidian flake. Although there is currently minimal surface manifestations of cultural material, intact subsurface deposits are possible.

Eligibility and Recommendation: Previous subsurface testing on the site did reveal subsurface cultural material indicating the possibility of intact subsurface deposits that may retain data to address questions about prehistoric land use. EMI recommends the site as having undetermined status and recommends testing to determine the nature, integrity and extent of the site within the 40 ft wide improvement corridor along the FR 450 access roadway, for NRHP eligibility status and further management recommendations.

Evaluation of Undertaking: The site is located along Forest Road 450, the main haul road, and will be adversely impacted by planned project activities. Testing within the 40 foot road improvement and utility cross section is recommended to determine the depth and extent of cultural deposits to determine the National Register eligibility status and to provide further management recommendations.

13. SITE RECORD ATTACHMENTS

☒ site location map (USGS 7.5' topo; required) ☒ sketch map or site plan (required) ☐ continuation forms?

☒ other materials (itemize): Photo

Figure 1: Site overview of LA 48224/AR-03-03-02-818

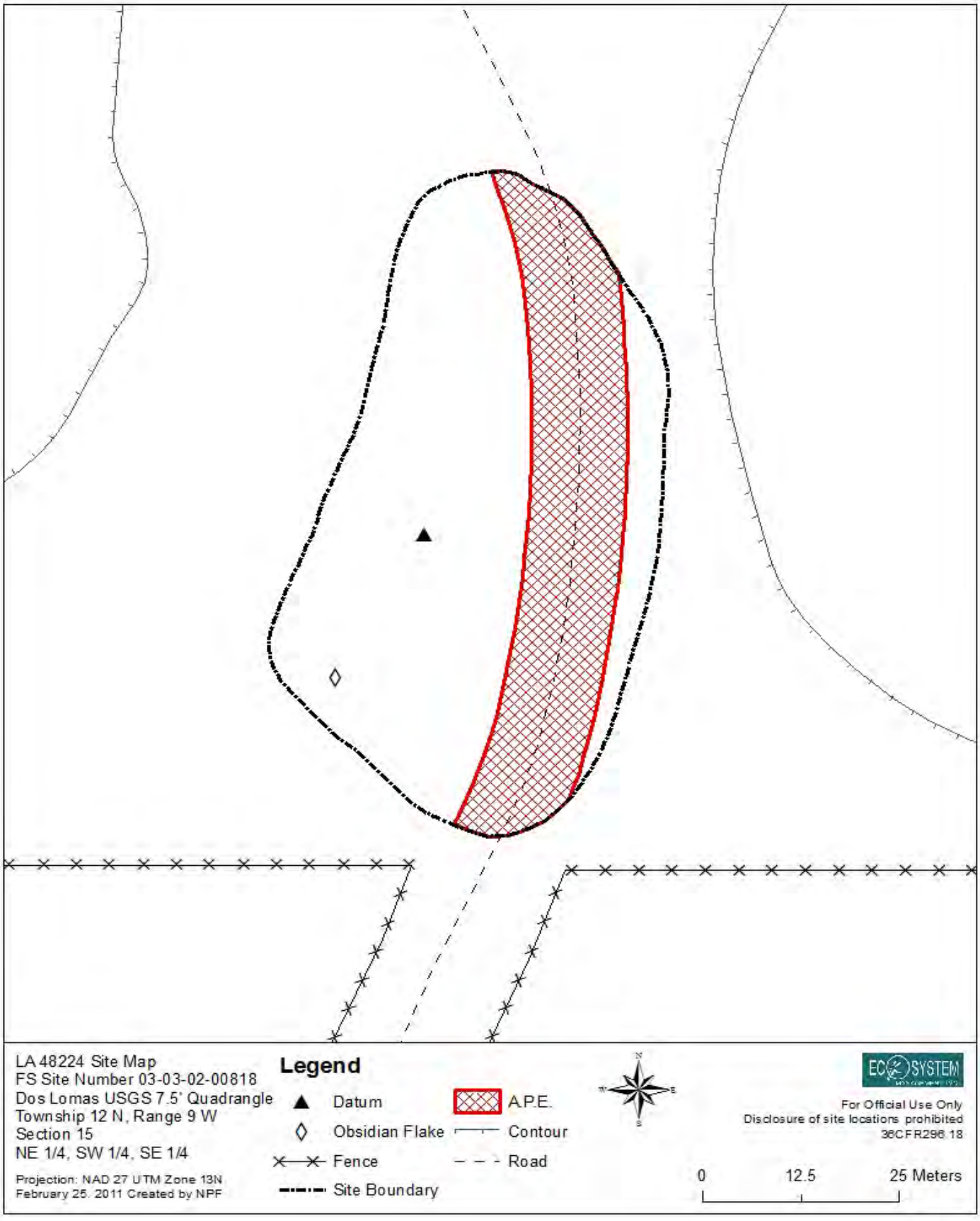

Figure 2: LA 48224/AR-03-03-02-818 Site Map

LABORATORY OF ANTHROPOLOGY SITE RECORD

1. IDENTIFICATION & OWNERSHIP

LA Number: 48,225 (contact ARMS for site registration) ☒ **Site Update**? (complete at least Sections 1-4)

Site Name(s): _____

Other Site Number(s): AR-03-03-02-819

Agency Assigning Number: USDA-FS

_____ _____

_____ _____

Current Site Owner(s): Cibola National Forest, Mt. Taylor Ranger District

Site Type: Non-Structural **Occupation Type:** Prehistoric

2. RECORDING INFORMATION

NMCRIS Activity No.: 114095 **Field Site Number:** _____

Site Marker? ☒ (specify ID#)**:** 819 (The site tag from the previous recording was relocated.)

Recorder(s): Garth Hayden, Zach Kneebone

Agency: EMI **Recording Date (dd-MMM-yyyy):** 15-06-2009

Site Accessibility (choose one)**:** ☒ accessible ☐ buried (sterile overburden) ☐ flooded ☐ urbanized ☐ not accessible

Surface Visibility (% visible; choose one)**:** ☐ 0% ☐ 1-25% ☐ 26-50% ☐ 51-75% ☒ 76-99% ☐ 100%

Remarks: Visibility is very good with little vegetation.

Recording Activities:

- ☒ sketch mapping
- ☐ instrument mapping (e.g., total station mapping)
- ☐ surface collection (controlled or uncontrolled)
- ☒ in-field artifact analysis
- ☐ other activities (specify): _____
- ☒ photography
- ☐ shovel or trowel tests; probes
- ☐ test excavation
- ☐ excavation (data recovery)

Description of Analysis or Excavation Activities: Analysis of all lithics found on surface. Photographs and mapping.

Photographic Documentation: Digital File - 1497

Surface Collections (choose one)**:**

- ☒ no surface collection
- ☐ uncontrolled surface collection
- ☐ collections of specific items only
- ☐ controlled (sample: <100%)
- ☐ controlled (complete: 100%)
- ☐ other method (describe): _____

Records Inventory:

- ☒ site location map
- ☒ sketch map(s)
- ☐ instrument map(s)
- ☒ excavation, collection, analysis records
- ☒ photos, slides, and associated records
- ☐ other records: _____
- ☒ field journals, notes
- ☐ NM Historic Building Inventory form

Repository for Original Records: EMI

Repository for Collected Artifacts: N/A

3. CONDITION

Archaeological Status: ☐ surface collection ☐ test excavation ☐ partial excavation ☐ complete excavation

Disturbance Sources: ☐ wind erosion ☐ water erosion ☐ bioturbation ☐ vandalism ☒ construction/land development

☐ other source (specify): _____

Vandalism: ☐ defaced glyphs ☐ damaged/defaced building ☐ surface disturbance ☐ manual excavation

☐ mechanical excavation ☐ other vandalism (specify): _____

Percentage of Site Intact (choose one)**:** ☐ 0% ☐ 1-25% ☐ 26-50% ☐ 51-75% ☒ 76-99% ☐ 100%

Observations on Site Condition: LA 48225 /AR-03-03-02-819 is in good condition with approximately 80 percent of the site outside the roadway remaining intact. Disturbances to the site include grading and maintenance for FR 450, which bisects the site along the northwestern edge.

4. RECOMMENDATIONS (for Performer/Recorder use only)

National Register Eligibility (choose one)**:** ☒ eligible ☐ not eligible ☐ not sure

Applicable Criteria: ☐ (a) ☐ (c)

☐ (b) ☒ (d)

Basis for Recommendation: FR 450 cuts through LA 48225/AR-03-03-02-819 and has impacted this portion of the site, but remaining portion is 80 percent intact. However, due to the artifact density and evidence of artifacts in the road cut sidewalls the site likely retains intact subsurface cultural that may yield important scientific information about Archaic settlement, subsistence, and stone tool technology. The site was recommended eligible for nomination to the NRHP under criterion D in 1984.

Assessment of Project Impact: Testing is recommended to determine whether there are intact deposits in and adjacent to the road that could be impacted if road maintenance or road improvement is necessary. Based on the results of testing, the portion of the site that sill retains integrity should be avoided and protected from project related ground-disturbing activities.

Treatment Recommendations: The equipment haul road, water lines and transmission lines will intersect the site. Since complete avoidance is not possible and it is unknown whether intact cultural deposits exist in the road bed, testing is recommended to determine the extent and nature of any intact subsurface deposits and to provide data for additional management recommendations which may include data recovery.

5. SHPO CONSULTATIONS (for SHPO and Sponsor use only)

Sponsor NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

Sponsor Staff: _____ **Date (dd-MMM-yyyy):** _____

Sponsor Remarks: _____

SHPO NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

HPD Staff: _____ **Date (dd-MMM-yyyy):** _____ **HPD Log No:** _____

Register Status: ☐ listed on National Register ☐ listed on State Register ☐ formal determination of eligibility

State Register No.: _____

SHPO Remarks: _____

6. LOCATION

Source Graphics:

☒ USGS 7.5' (1:24,000) topo maps ☐ rectified aerial photos [Scale: _____]

☐ other topo maps [Scale: _____] ☐ unrectified aerial photos [Scale: _____]

☒ GPS unit GPS accuracy (choose one): ☐ < 1.0 m ☒ 1-10 m ☐ 10-100 m ☐ >100 m

☐ other source (describe): _____

UTM Coordinates (@ center of site; at least one set of coordinates required):

Map-based Coordinates Datum: NAD27 **Zone:** 13 **E:** _____ **N:** _____

GPS-based Coordinates Datum: NAD27 **Zone:** 13 **E:** 247546 **N:** 3904482

Directions to Site: _____

In highway R-O-W? ☐ **Town** (if in city limits): _____ **State:** NM **County:** Cibola

USGS Quadrangle Name	Date	USGS Code
San Mateo, NM	1981	35107-C6
_____	_____	_____

PLSS Meridian	Unplatted	Township	Range	Section	¼ Sections			Protracted?
New Mexico	☐	T 12 N	R 9 W	22	NE	NE	SW	☐
New Mexico	☐	T _____	R _____	__	_____	_____	_____	☐
New Mexico	☐	T _____	R _____	__	_____	_____	_____	☐

7. PHYSICAL DESCRIPTION

Site Dimensions: 87x97 meters **Basis for Dimensions** (choose one): ☐ estimated ☒ measured

Site Area: 8,439 sq m **Basis for Area** (choose one): ☐ estimated ☒ measured **Elevation:** 7,000 feet

Site Boundaries Complete? (choose one): ☒ Yes ☐ No (explain): _____

Basis for Site Boundaries: ☒ distribution of archeological features & artifacts ☐ modern features or ground disturbance

☐ property lines ☐ topographic features ☐ other (specify): _____

Depositional/Erosional Environment: ☐ alluvial ☐ aeolian ☐ colluvial ☐ residual ☐ no deposition (on bedrock)

☐ other process (describe): _____

Stratigraphy & Depth of Archeological Deposits (choose one): ☒ unknown/not determined

☐ no subsurface deposits present ☐ subsurface deposits present ☐ stratified subsurface deposits present

Estimated Depth of Deposits: unknown

Basis for Depth Determinations: ☒ estimated ☐ shovel/trowel tests ☐ core/auger tests ☐ excavations

☒ road or arroyo cuts ☐ rodent burrows ☐ other observations (describe): _____

Observations on Subsurface Archeological Deposits: Artifacts were present in the road cut sidewalls. Artifacts were also present in the road bed but may have become embedded in the road way after having been displaced from road way sidewalls during the road activities. Intact deposits are unlikely in the road bed since the road cuts well below the sediments containing the artifacts in the side wall.

Local Vegetation (list species in decreasing order of dominance)**:**

Overstory: **Piñon, Juniper**

Understory: **Snakeweed**

Vegetation Community (choose one or two): ☐ forest ☐ woodland ☐ grassland ☐ scrubland ☒ desert scrubland ☐ marshland

☐ other community (specify): _____

Topographic Location:

☐ bench	☐ dune	☐ low rise	☐ ridge	
☐ alluvial fan	☐ blowout	☐ flood plain/valley	☐ mesa/butte	☐ rockshelter
☐ arroyo/wash	☐ canyon rim	☐ foothill/mountain front	☐ mountain	☐ saddle
☐ badlands	☐ cave	☐ hill slope	☐ open canyon floor	☐ talus slope
☐ base of cliff	☐ cliff/scarp/bluff	☐ hill top	☐ plain/flat	☐ terrace
☐ base of talus slope	☐ constricted canyon	☐ lava flow (malpais)	☐ playa	

☐ other location (describe): _____

Observations on Site Setting:

8. ASSEMBLAGE DATA

Assemblage Content (all components)**:**

Lithics:

- ☒ lithic debitage
- ☐ chipped-stone tools
- ☐ diagnostic projectile points
- ☐ non-local lithic material
- ☐ stone-tool manufacturing items (cores, hammerstones, etc.)
- ☐ ground-stone tools
- ☐ other stone tools

Prehistoric Ceramics

- ☐ whole ceramic vessels
- ☐ diagnostic ceramics
- ☐ other prehistoric ceramics

Historic Artifacts:

- ☐ diagnostic glass artifacts
- ☐ other glass artifacts
- ☐ diagnostic metal artifacts
- ☐ other metal artifacts
- ☐ whole ceramic vessel
- ☐ diagnostic ceramics
- ☐ other historic ceramics

Other Artifacts and Materials:

- ☐ bone tools
- ☐ faunal remains
- ☐ macrobotanical remains
- ☐ perishable artifacts
- ☐ ornaments
- ☐ figurines
- ☐ mineral specimens
- ☐ architectural stone
- ☐ burned adobe
- ☐ fire-cracked rock/burned caliche

☐ Other items (specify): _____

Assemblage Size (all components)**:**

artifact class	0	1s	10s	100s	1000s	>10,000	*Counts (if <100)
	estimated frequency						
lithic artifacts (choose one): (include debitage)	☐	☐	☒	☐	☐	☐	**53**
prehistoric ceramics (choose one):	☒	☐	☐	☐	☐	☐	_____
historic artifacts (choose one):	☐	☐	☐	☐	☐	☐	_____
total assemblage size (choose one):	☐	☐	☒	☐	☐	☐	**53**

Dating Potential: ☐ radiocarbon ☐ dendrochronology ☐ archeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Assemblage Remarks: **The site appears to be an activity area where stone tools were manufactured. The lithic concentrations may have functioned as knapping areas. No diagnostic artifacts were identified on the site that would indicate age or cultural affiliation, the site location and artifact assemblage are consistent with an Archaic occupation.**

9. CULTURAL/TEMPORAL AFFILIATIONS

TOTAL NUMBER OF COMPONENTS DEFINED: __

COMPONENT #1 (EARLIEST)

Cultural Affiliation: Unknown (likely Archaic)

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records

☒ associated diagnostic artifact or feature types ☒ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:	_____		
Latest Period (if any)**:**	_____	_____	_____

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Basis for Cultural/Temporal Affiliation: _____

Component Type: _____ _____

Remarks: _____

***Associated Phase/Complex Name(s):** _____

COMPONENT #2

Cultural Affiliation: _____ _____

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records

☐ associated diagnostic artifact or feature types ☐ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:	_____		
Latest Period (if any)**:**	_____	_____	_____

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Basis for Cultural/Temporal Affiliation: _____

Component Type: _____ _____

Remarks: _____

***Associated Phase/Complex Name(s):** _____

10. FEATURE DATA

(see NMCRIS User's guide for a list of valid feature types)

Feature Type	Reliable ID ?	# Observed	Assoc. Comp. #s	Feature ID, Notes
Lithic Scatter	Yes	_____	__	Feature 1 is a concentration of 22 Grants Ridge obsidian flakes representing all stages of reduction including; 11 tertiary flakes, 2 secondary flakes, 3 primary flakes and 6 pieces of angular debris.
Lithic Scatter	Yes	_____	__	Feature 2 is a concentration of flakes

				that occurs in a bladed area, possibly the previous FR 450 road bed. The concentration contained 9 tertiary Grants Ridge obsidian flakes, 6 secondary Grants Ridge obsidian flakes, 2 primary Grants Ridge obsidian flakes and 2 tertiary flakes of black translucent obsidian.
Lithic Scatter	Yes	_____	__	Feature 3 is a concentration of 16 tertiary Grants Ridge obsidian flakes and 2 primary Grants Ridge obsidian flakes along with several slabs of fine grained basalt.

Feature Remarks: The site appears to be an activity area where stone tools were manufactured. These lithic concentrations may have functioned as knapping areas. No diagnostic artifacts were identified on the site that would indicate age or cultural affiliation, the site location and artifact assemblage are consistent with an Archaic occupation.

11. REFERENCES

Written Sources of Information: Results of a Cultural Resource Survey of 6.2 Miles of Roads (103 Acres) on Private and Forest Lands, and Approximately 22 Block Acres for Mine Facilities and an Escape Raise in the Cibola National Forest, Mt. Taylor Field Office, Cibola County, New Mexico (Harris et al, 2009)

Heritage Report #2009-03-133 (NMCRIS #114095)

Heritage Report #: 1998-03-069 (NMCRIS #62120) Popelish, Linda

Additional Sources of Information: _____

12. NARRATIVE DESCRIPTION

Site Description: LA 48225/AR-03-03-02-819 is a lithic scatter that was first recorded in 1984 by PAC and was determined at the time to be eligible for NRHP listing at the time. The site was revisited by Cibola National Forest- Mt. Taylor Ranger District personnel in 1998 to assess damages incurred by unauthorized road work and subsurface testing was also conducted at that time. Testing yielded an indication of possible subsurface deposits (two flakes from four shovel test units). The site was reported to have been damaged by unauthorized road maintenance and mining activities as well as active wind and water erosion. Testing was for impact assessment only. During the present site visit, a lithic scatter, comprised primarily of Grants Ridge obsidian flakes, was observed. There were three concentrations of flakes (labeled Features 1, 2 and 3). The vegetation on the site consisted of piñon, juniper and snakeweed. LA 48225/AR-03-03-02-819 is in good condition with approximately 80 percent of the site remaining intact. Disturbance to the site includes grading and maintenance for FR 450, which bisects the site along the northwestern edge. Artifacts were present in the road cut sidewalls. Artifacts were also present in the road bed but may have become embedded in the road way after having been displaced from road way sidewalls during the road activities. Intact deposits are unlikely in the road bed since the road cuts well below the sediments containing the artifacts in the side wall.

Feature 1 is a concentration of 22 Grants Ridge obsidian flakes representing all stages of reduction including; 11 tertiary flakes, 2 secondary flakes, 3 primary flakes and 6 pieces of angular debris.

Feature 2 is a concentration of flakes that occurs in a bladed area, possibly the previous FR 450 road bed. The concentration contained 9 tertiary Grants Ridge obsidian flakes, 6 secondary Grants Ridge obsidian flakes, 2 primary Grants Ridge obsidian flakes and 2 tertiary flakes of black translucent obsidian.

Feature 3 is a concentration of 16 tertiary Grants Ridge obsidian flakes and 2 primary Grants Ridge obsidian flakes along with several slabs of fine grained basalt.

The total flaked stone artifact assemblage on the site was 90% Grants Ridge obsidian (53 tertiary flakes, 9 secondary flakes, 6 primary flakes and 7 pieces of angular debris) and the remaining 10% of the flaked stone assemblage was comprised of chert and chalcedony.

The site appears to be an activity area where stone tools were manufactured. These lithic concentrations may have functioned as knapping areas. No diagnostic artifacts were identified on the site that would indicate age or cultural affiliation, the site location and artifact assemblage are consistent with an Archaic occupation.

Eligibility and Recommendation: FR 450 cuts through LA 48225/AR-03-03-02-819 and has impacted this portion of the site, but remaining portion is 80 percent intact. However, due to the artifact density and evidence of artifacts in the road cut sidewalls the site likely retains intact subsurface cultural that may yield important scientific information about Archaic settlement, subsistence, and stone tool technology. The site was recommended eligible for nomination to the NRHP under criterion D in 1984. EMI concurs with eligible status and recommends testing to determine the nature, integrity and extent of the site within the 40 ft wide improvement corridor along the FR 450 access roadway, for NRHP eligibility status for the roadway portion and further management recommendations.

Evaluation of Undertaking: The equipment haul road FR 450, water lines and transmission lines will intersect the site. Since complete avoidance is not possible and it is unknown whether intact cultural deposits exist in the roadway portion, EMI recommends testing to determine the nature, integrity and extent of the site within the 40 ft wide improvement corridor along the FR 450 access roadway, for NRHP eligibility status for the roadway portion and further management recommendations which may include data recovery.

13. SITE RECORD ATTACHMENTS

☒ site location map (USGS 7.5' topo; required) ☒ sketch map or site plan (required) ☐ continuation forms?

☒ other materials (itemize): **Photo**

Figure 1: Site overview of LA 48225/AR-03-03-02-819, view to north

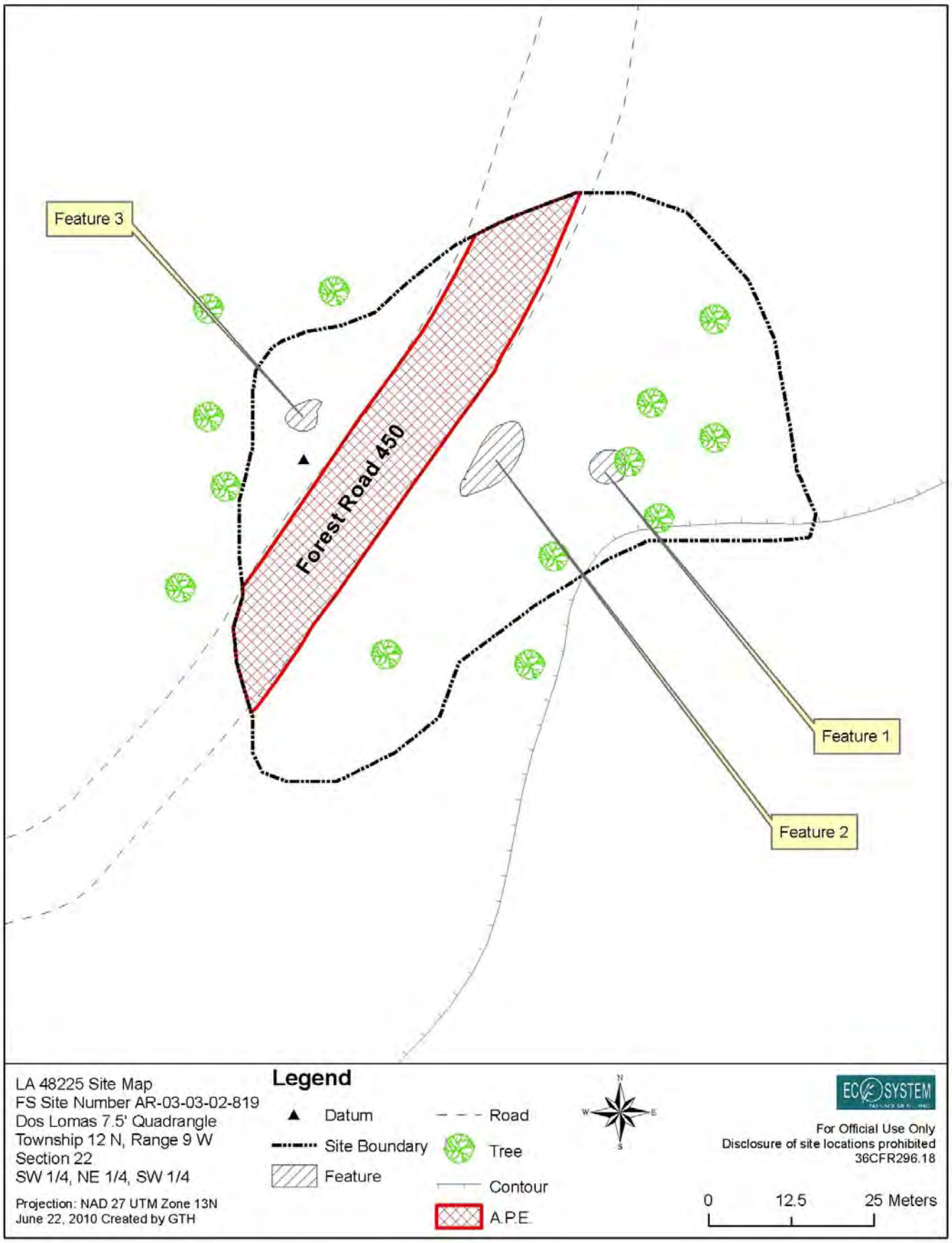

Figure 2: Site Map

LABORATORY OF ANTHROPOLOGY SITE RECORD

1. IDENTIFICATION & OWNERSHIP

LA Number: 48,226 (contact ARMS for site registration) ☒ **Site Update**? (complete at least Sections 1-4)

Site Name(s): _____

Other Site Number(s): AR-03-03-02-820

Agency Assigning Number: USDA-FS

_____ _____

_____ _____

Current Site Owner(s): Cibola National Forest, Mt. Taylor Ranger District

Site Type: Non-Structural **Occupation Type:** Prehistoric

2. RECORDING INFORMATION

NMCRIS Activity No.: 114095 **Field Site Number:** _____

Site Marker? ☒ (specify ID#)**:** 820 (The site tag from the previous recording was relocated.)

Recorder(s): Garth Hayden, Zach Kneebone

Agency: EMI **Recording Date (dd-MMM-yyyy):** 15-06-2009

Site Accessibility (choose one)**:** ☒ accessible ☐ buried (sterile overburden) ☐ flooded ☐ urbanized ☐ not accessible

Surface Visibility (% visible; choose one)**:** ☐ 0% ☐ 1-25% ☐ 26-50% ☐ 51-75% ☒ 76-99% ☐ 100%

Remarks: Visibility is very good with little vegetation.

Recording Activities:

- ☒ sketch mapping
- ☐ instrument mapping (e.g., total station mapping)
- ☐ surface collection (controlled or uncontrolled)
- ☒ in-field artifact analysis
- ☐ other activities (specify): _____
- ☒ photography
- ☐ shovel or trowel tests; probes
- ☐ test excavation
- ☐ excavation (data recovery)

Description of Analysis or Excavation Activities: Analysis of all lithics found on surface. Photographs and mapping.

Photographic Documentation: Digital File - 1495

Surface Collections (choose one)**:**

- ☒ no surface collection
- ☐ uncontrolled surface collection
- ☐ collections of specific items only
- ☐ controlled (sample: <100%)
- ☐ controlled (complete: 100%)
- ☐ other method (describe): _____

Records Inventory:

- ☒ site location map
- ☒ sketch map(s)
- ☐ instrument map(s)
- ☒ excavation, collection, analysis records
- ☒ photos, slides, and associated records
- ☐ other records: _____
- ☒ field journals, notes
- ☐ NM Historic Building Inventory form

Repository for Original Records: EMI

Repository for Collected Artifacts: N/A

3. CONDITION

Archaeological Status: ☐ surface collection ☐ test excavation ☐ partial excavation ☐ complete excavation

Disturbance Sources: ☐ wind erosion ☐ water erosion ☐ bioturbation ☐ vandalism ☒ construction/land development

☐ other source (specify): _____

Vandalism: ☐ defaced glyphs ☐ damaged/defaced building ☐ surface disturbance ☐ manual excavation

☐ mechanical excavation ☐ other vandalism (specify): _____

Percentage of Site Intact (choose one)**:** ☐ 0% ☐ 1-25% ☐ 26-50% ☐ 51-75% ☒ 76-99% ☐ 100%

Observations on Site Condition: The site presently is in similar condition to the 1998 recording which described additional site damage (tree-cutting) and noted very few artifacts present on the surface. Only two tertiary lithic flakes, both of Grants Ridge obsidian, were observed during this site visit near the prospect ditch in a disturbed soil context. The soils on the site have been heavily disturbed by previous minerals prospecting activities.

4. RECOMMENDATIONS (for Performer/Recorder use only)

National Register Eligibility (choose one)**:** ☐ eligible ☒ not eligible ☐ not sure

Applicable Criteria: ☐ (a) ☐ (c)

☐ (b) ☐ (d)

Basis for Recommendation: AR-03-03-02-820/LA 48226 has a limited number of surface artifacts and no evidence of subsurface deposition. The site was determined as not eligible for listing on the National Register in 1998, and EMI concurs with that determination. The site does not possess the integrity of location, design, setting, materials, workmanship, feeling or association. The site is not eligible under any criterion.

Assessment of Project Impact: None; the site has been previously determined not eligible.

Treatment Recommendations: LA 48226/AR-03-03-02-820 is not eligible for listing on the National Register. As an ineligible site, it no longer constrains management activity. The site and potential effects to the area where it was originally documented will not be addressed further in this report.

5. SHPO CONSULTATIONS (for SHPO and Sponsor use only)

Sponsor NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

Sponsor Staff: _____ **Date (dd-MMM-yyyy):** _____

Sponsor Remarks: _____

SHPO NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

HPD Staff: _____ **Date (dd-MMM-yyyy):** _____ **HPD Log No:** _____

Register Status: ☐ listed on National Register ☐ listed on State Register ☐ formal determination of eligibility

State Register No.: _____

SHPO Remarks: _____

6. LOCATION

Source Graphics:

☒ USGS 7.5' (1:24,000) topo maps ☐ rectified aerial photos [Scale: _____]

☐ other topo maps [Scale: _____] ☐ unrectified aerial photos [Scale: _____]

☒ GPS unit GPS accuracy (choose one): ☐ < 1.0 m ☒ 1-10 m ☐ 10-100 m ☐ >100 m

☐ other source (describe): _____

UTM Coordinates (@ center of site; at least one set of coordinates required):

Map-based Coordinates Datum: NAD27 **Zone:** 13 **E:** _____ **N:** _____

GPS-based Coordinates Datum: NAD27 **Zone:** 13 **E:** 247,360 **N:** 3,904,167

Directions to Site: _____ **In highway R-O-W?** ☐

Town (if in city limits): _____ **State:** NM **County:** Cibola

USGS Quadrangle Name	Date	USGS Code
San Mateo, NM	1981	35107-C6
_____	_____	_____

PLSS Meridian	Unplatted	Township	Range	Section	¼ Sections			Protracted?
New Mexico	☐	T 12 N	R 9 W	22	NE	SW	SW	☐
New Mexico	☐	T _____	R _____	__	_____	_____	_____	☐
New Mexico	☐	T _____	R _____	__	_____	_____	_____	☐

7. PHYSICAL DESCRIPTION

Site Dimensions: 4x4 meters **Basis for Dimensions** (choose one): ☐ estimated ☒ measured

Site Area: 16 sq m **Basis for Area** (choose one): ☐ estimated ☐ measured **Elevation:** _____ feet

Site Boundaries Complete? (choose one): ☒ Yes ☐ No (explain): _____

Basis for Site Boundaries: ☒ distribution of archeological features & artifacts ☐ modern features or ground disturbance

☐ property lines ☐ topographic features ☐ other (specify): _____

Depositional/Erosional Environment: ☐ alluvial ☐ aeolian ☐ colluvial ☐ residual ☐ no deposition (on bedrock)

☐ other process (describe): _____

Stratigraphy & Depth of Archeological Deposits (choose one): ☒ unknown/not determined

☐ no subsurface deposits present ☐ subsurface deposits present ☐ stratified subsurface deposits present

Estimated Depth of Deposits: 0cm

Basis for Depth Determinations: ☒ estimated ☐ shovel/trowel tests ☐ core/auger tests ☐ excavations

☐ road or arroyo cuts ☐ rodent burrows ☐ other observations (describe): _____

Observations on Subsurface Archeological Deposits: No evidence of subsurface deposition

Local Vegetation (list species in decreasing order of dominance)**:**

Overstory: _____

Understory: _____

Vegetation Community (choose one or two): ☐ forest ☐ woodland ☐ grassland ☐ scrubland ☐ desert scrubland ☐ marshland

☐ other community (specify): _____

Topographic Location:

☐ alluvial fan	☐ blowout	☐ flood plain/valley	☐ mesa/butte	☐ rockshelter
☐ arroyo/wash	☐ canyon rim	☐ foothill/mountain front	☐ mountain	☐ saddle
☐ badlands	☐ cave	☐ hill slope	☐ open canyon floor	☐ talus slope
☐ base of cliff	☐ cliff/scarp/bluff	☐ hill top	☐ plain/flat	☐ terrace
☐ base of talus slope	☐ constricted canyon	☐ lava flow (malpais)	☐ playa	

☐ other location (describe): _____

Observations on Site Setting: LA 48226 /AR-03-03-02-820 is a low density lithic scatter located on the east side of FR 450 near a mining prospect trench and associated back dirt. The site was originally recorded in 1984 by PAC. The site was revisited by Cibola National Forest- Mt. Taylor Ranger District personnel in 1998. LA 48226/AR-03-03-02-820 is located approximately 5 meters east of the road cut for FR 450.

8. ASSEMBLAGE DATA

Assemblage Content (all components)**:**

Lithics:

- ☒ lithic debitage
- ☐ chipped-stone tools
- ☐ diagnostic projectile points
- ☐ non-local lithic material
- ☐ stone-tool manufacturing items (cores, hammerstones, etc.)
- ☐ ground-stone tools
- ☐ other stone tools

Prehistoric Ceramics

- ☐ whole ceramic vessels
- ☐ diagnostic ceramics
- ☐ other prehistoric ceramics

Historic Artifacts:

- ☐ diagnostic glass artifacts
- ☐ other glass artifacts
- ☐ diagnostic metal artifacts
- ☐ other metal artifacts
- ☐ whole ceramic vessel
- ☐ diagnostic ceramics
- ☐ other historic ceramics

Other Artifacts and Materials:

- ☐ bone tools
- ☐ faunal remains
- ☐ macrobotanical remains
- ☐ perishable artifacts
- ☐ ornaments
- ☐ figurines
- ☐ mineral specimens
- ☐ architectural stone
- ☐ burned adobe
- ☐ fire-cracked rock/burned caliche

☐ Other items (specify): _____

Assemblage Size (all components)**:** estimated frequency

artifact class	0	1s	10s	100s	1000s	>10,000	*Counts (if <100)
lithic artifacts (choose one): (include debitage)	☐	☒	☐	☐	☐	☐	2
prehistoric ceramics (choose one):	☒	☐	☐	☐	☐	☐	
historic artifacts (choose one):	☒	☐	☐	☐	☐	☐	
total assemblage size (choose one):	☐	☒	☐	☐	☐	☐	2

Dating Potential: ☐ radiocarbon ☐ dendrochronology ☐ archeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Assemblage Remarks: Only two tertiary lithic flakes, both of Grants Ridge obsidian, were observed during this site visit near the prospect ditch in a disturbed soil context. Only four flakes total were observed, all of them Grants Ridge obsidian.

9. CULTURAL/TEMPORAL AFFILIATIONS

TOTAL NUMBER OF COMPONENTS DEFINED: __

COMPONENT #1 (EARLIEST)

Cultural Affiliation: Unknown Prehistoric

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records

☐ associated diagnostic artifact or feature types ☒ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:			
Latest Period (if any)**:**			

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Basis for Cultural/Temporal Affiliation: _____

Component Type: _____ _____

Remarks: _____

***Associated Phase/Complex Name(s):** _____

COMPONENT #2

Cultural Affiliation: _____ _____

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records

☐ associated diagnostic artifact or feature types ☐ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:			
Latest Period (if any)**:**			

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Basis for Cultural/Temporal Affiliation: _____

Component Type: _____ _____

Remarks: _____

***Associated Phase/Complex Name(s):** _____

10. FEATURE DATA

(see NMCRIS User's guide for a list of valid feature types)

Feature Type	Reliable ID ?	# Observed	Assoc. Comp. #s	Feature ID, Notes
_____	_____	_____	__	_____

Feature Remarks: None Observed

11. REFERENCES

Written Sources of Information: Results of a Cultural Resource Survey of 6.2 Miles of Roads (103 Acres) on Private and Forest Lands, and Approximately 22 Block Acres for Mine Facilities and an Escape Raise in the Cibola National Forest, Mt. Taylor Field Office, Cibola County, New Mexico (Harris et al, 2009)

Heritage Report #2009-03-133 (NMCRIS #114095)

Heritage Report #: 1998-03-069 (NMCRIS #62120) Popelish, Linda

Additional Sources of Information: _____

12. NARRATIVE DESCRIPTION

Site Description: LA 48226 /AR-03-03-02-820 is a low density lithic scatter located on the east side of FR 450 near a mining prospect trench and associated dirt spoil pile. The site was originally recorded in 1984 by PAC. The site was revisited by Cibola National Forest-Mt. Taylor Ranger District personnel in 1998 to assess damages incurred by unauthorized road work. LA 48226/AR-03-03-02-820 is located approximately 5 meters east of the road cut for FR 450. The site was recommended as not eligible for listing on the National Register in 1998. This visit saw no evidence of sub-surface deposition in the exploratory trench or the nearby road cut and only four flakes of Grants Ridge obsidian were observed.

The current investigation found the site to be in similar condition to the 1998 recording which described additional site damage (tree-cutting) and noted very few artifacts present on the surface. The soils on the site have been heavily disturbed by previous minerals prospecting activities. Only two tertiary lithic flakes, both of Grants Ridge obsidian, were observed during this site visit near the prospect ditch in a disturbed soil context. Observation of the walls of a prospect ditch revealed no evidence of intact subsurface cultural deposits

Eligibility and Recommendation: LA 48226/AR-03-03-02-820 has a limited number of surface artifacts and no evidence of subsurface deposition. The site was determined as not eligible for listing on the National Register in 1998, and EMI concurs with that determination.

Evaluation of Undertaking*:* LA 48226/AR-03-03-02-820 is not eligible for listing on the National Register. As an ineligible site it requires no further management consideration. The site and potential effects to the area where it was originally documented will not be addressed further in this report.

13. SITE RECORD ATTACHMENTS

☒ site location map (USGS 7.5' topo; required) ☒ sketch map or site plan (required) ☐ continuation forms?

☒ other materials (itemize): Photo

Figure 1: Site overview of LA 48226/AR-03-03-02-820, view to south

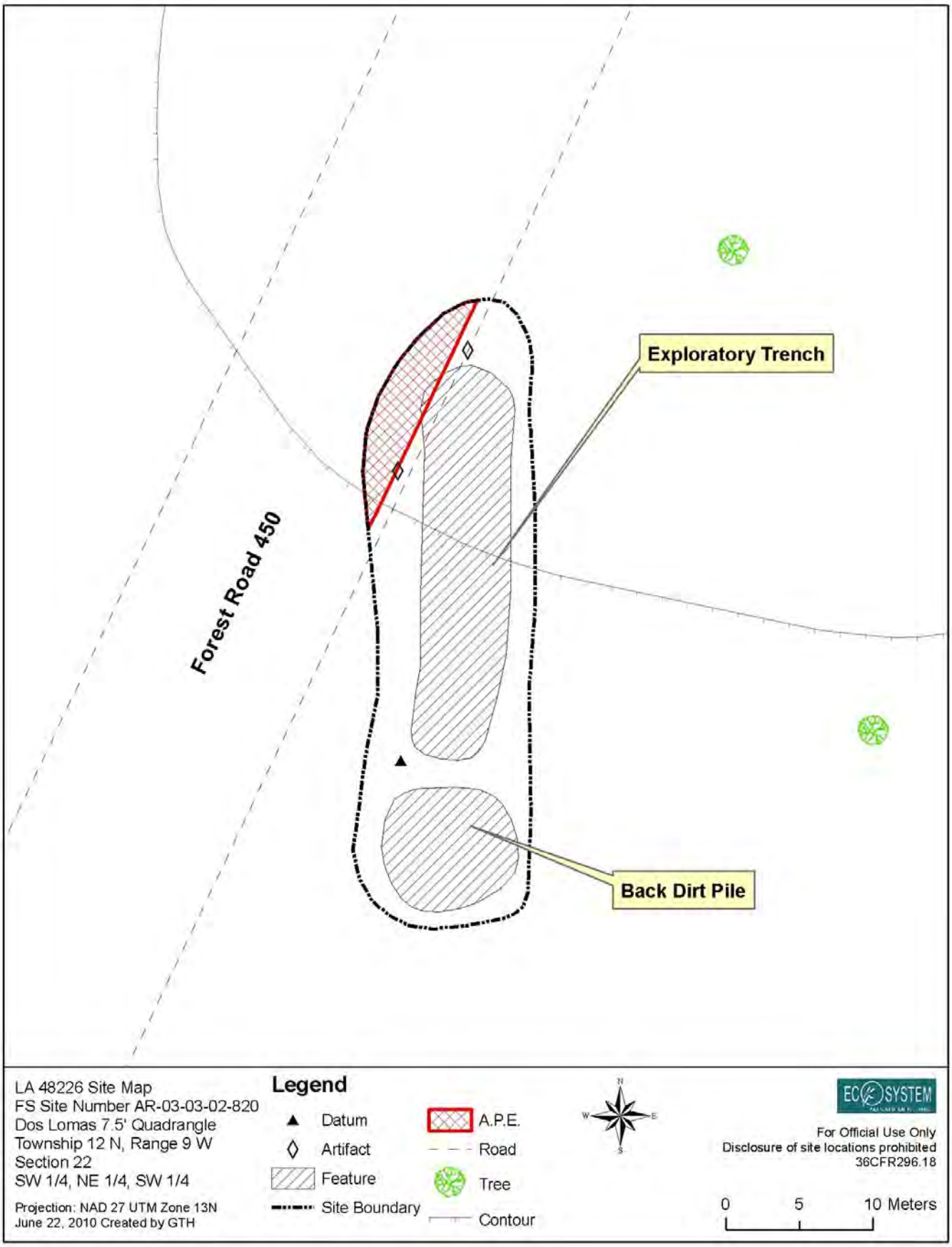

Figure 2: Site map of LA 48226/AR-03-03-02-820

LABORATORY OF ANTHROPOLOGY SITE RECORD

1. IDENTIFICATION & OWNERSHIP

LA Number: 48,227 (contact ARMS for site registration) ☒ **Site Update**? (complete at least Sections 1-4)

Site Name(s): _____

Other Site Number(s): AR-03-03-02-821

Agency Assigning Number: USFS

_____ _____

_____ _____

Current Site Owner(s): Cibola National Forest, Mt. Taylor Ranger District

Site Type: Non-Structural **Occupation Type:** Prehistoric

2. RECORDING INFORMATION

NMCRIS Activity No.: 114,095 **Field Site Number:** 821

Site Marker? ☒ (specify ID#)**:** 821 (The site tag from the previous recording was relocated.)

Recorder(s): Garth Hayden, Zach Kneebone

Agency: EMI **Recording Date (dd-MMM-yyyy):** 15-06-2009

Site Accessibility (choose one)**:** ☐ accessible ☐ buried (sterile overburden) ☐ flooded ☐ urbanized ☐ not accessible

Surface Visibility (% visible; choose one)**:** ☐ 0% ☐ 1-25% ☒ 26-50% ☐ 51-75% ☐ 76-99% ☐ 100%

Remarks: The area near the location of the site is very heavily disturbed by vehicular traffic and unauthorized construction on FR 450.

Recording Activities:
- ☐ sketch mapping
- ☐ instrument mapping (e.g., total station mapping)
- ☐ surface collection (controlled or uncontrolled)
- ☐ in-field artifact analysis
- ☐ other activities (specify): _____
- ☐ photography
- ☐ shovel or trowel tests; probes
- ☐ test excavation
- ☐ excavation (data recovery)

Description of Analysis or Excavation Activities: No surface cultural resoures were located on the site

Photographic Documentation:

Surface Collections (choose one)**:**
- ☒ no surface collection
- ☐ uncontrolled surface collection
- ☐ controlled (sample: <100%)
- ☐ other method (describe): _____
- ☐ collections of specific items only
- ☐ controlled (complete: 100%)

Records Inventory:
- ☒ site location map
- ☒ sketch map(s)
- ☐ instrument map(s)
- ☐ excavation, collection, analysis records
- ☐ photos, slides, and associated records
- ☐ other records: _____
- ☐ field journals, notes
- ☐ NM Historic Building Inventory form

Repository for Original Records: EMI

Repository for Collected Artifacts: N/A

3. CONDITION

Archaeological Status: ☐ surface collection ☐ test excavation ☐ partial excavation ☐ complete excavation

Disturbance Sources: ☐ wind erosion ☐ water erosion ☐ bioturbation ☐ vandalism ☒ construction/land development

☐ other source (specify): _____

Vandalism: ☐ defaced glyphs ☐ damaged/defaced building ☐ surface disturbance ☐ manual excavation

☐ mechanical excavation ☐ other vandalism (specify): _____

Percentage of Site Intact (choose one)**:** ☒ 0% ☐ 1-25% ☐ 26-50% ☐ 51-75% ☐ 76-99% ☐ 100%

Observations on Site Condition: The area near the location of the site is very heavily disturbed by vehicular traffic on FR 450 as well as alluvial and aeolian erosion. It appears that the previous (FR 450 F) road bed has become a drainage with down-cutting to a depth of approximately two feet in the area of the site. Previous recordings detailed limited surface artifacts and testing revealed no intact subsurface deposits. Road traffic and erosion are thought to have obliterated the site and therefore no evidence remains.

4. RECOMMENDATIONS (for Performer/Recorder use only)

National Register Eligibility (choose one)**:** ☐ eligible ☒ not eligible ☐ not sure

Applicable Criteria: ☐ (a) ☐ (c) ☐ (b) ☐ (d)

Basis for Recommendation: No intact subsurface deposits exist and no survey manifestation was encountered during the present study. LA 48227/AR-03-03-02-821 was determined not eligible for listing on the National Register in 1998, and EMI concurs with that determination.

Assessment of Project Impact: None; the site has been previously determined not eligible.

Treatment Recommendations: None; the site has been previously determined not eligible and will not constrain management activities.

5. SHPO CONSULTATIONS (for SHPO and Sponsor use only)

Sponsor NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

Sponsor Staff: _____ **Date (dd-MMM-yyyy):** _____

Sponsor Remarks: _____

SHPO NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

HPD Staff: _____ **Date (dd-MMM-yyyy):** _____ **HPD Log No:** _____

Register Status: ☐ listed on National Register ☐ listed on State Register ☐ formal determination of eligibility

State Register No.: _____

SHPO Remarks: _____

6. LOCATION

Source Graphics:

☐ USGS 7.5' (1:24,000) topo maps ☐ rectified aerial photos [Scale: _____]

☐ other topo maps [Scale: _____] ☐ unrectified aerial photos [Scale: _____]

☐ GPS unit GPS accuracy (choose one): ☐ < 1.0 m ☐ 1-10 m ☐ 10-100 m ☐ >100 m

☐ other source (describe): _____

UTM Coordinates (@ center of site; at least one set of coordinates required):

Map-based Coordinates Datum: NAD27 **Zone:** 13 **E:** _____ **N:** _____

GPS-based Coordinates Datum: NAD27 **Zone:** 13 **E:** 246753 **N:** 3903060

Directions to Site: _____ **In highway R-O-W?** ☐

Town (if in city limits): _____ **State:** NM **County:** _____

USGS Quadrangle Name	Date	USGS Code
Grants, NM	1982	35107-B7
_____	_____	_____

PLSS Meridian	Unplatted	Township	Range	Section	¼ Sections			Protracted?
New Mexico	☐	T 12 N	R 9 W	27	SW	SW	NW	☐
New Mexico	☐	T _____	R _____	__	_____	_____	_____	☐
New Mexico	☐	T _____	R _____	__	_____	_____	_____	☐

7. PHYSICAL DESCRIPTION

Site Dimensions: _____ x _____ meters **Basis for Dimensions** (choose one): ☐ estimated ☐ measured

Site Area: _____ sq m **Basis for Area** (choose one): ☐ estimated ☐ measured **Elevation:** _____ feet

Site Boundaries Complete? (choose one): ☐ Yes ☐ No (explain): _____

Basis for Site Boundaries: ☐ distribution of archeological features & artifacts ☐ modern features or ground disturbance

☐ property lines ☐ topographic features ☐ other (specify): _____

Depositional/Erosional Environment: ☐ alluvial ☐ aeolian ☐ colluvial ☐ residual ☐ no deposition (on bedrock)

☐ other process (describe): _____

Stratigraphy & Depth of Archeological Deposits (choose one): ☐ unknown/not determined

☐ no subsurface deposits present ☐ subsurface deposits present ☐ stratified subsurface deposits present

Estimated Depth of Deposits: _____

Basis for Depth Determinations: ☐ estimated ☐ shovel/trowel tests ☐ core/auger tests ☐ excavations

☐ road or arroyo cuts ☐ rodent burrows ☐ other observations (describe): _____

Observations on Subsurface Archeological Deposits: _____

Local Vegetation (list species in decreasing order of dominance)**:**

Overstory: _____

Understory: _____

Vegetation Community (choose one or two): ☐ forest ☐ woodland ☐ grassland ☐ scrubland ☐ desert scrubland ☐ marshland

☐ other community (specify): _____

Topographic Location:

☐ alluvial fan	☐ blowout	☐ flood plain/valley	☐ mesa/butte	☐ rockshelter
☐ arroyo/wash	☐ canyon rim	☐ foothill/mountain front	☐ mountain	☐ saddle
☐ badlands	☐ cave	☐ hill slope	☐ open canyon floor	☐ talus slope
☐ base of cliff	☐ cliff/scarp/bluff	☐ hill top	☐ plain/flat	☐ terrace
☐ base of talus slope	☐ constricted canyon	☐ lava flow (malpais)	☐ playa	

☐ other location (describe): _____

Observations on Site Setting: _____

8. ASSEMBLAGE DATA

Assemblage Content (all components)**:**

Lithics:

- ☐ lithic debitage
- ☐ chipped-stone tools
- ☐ diagnostic projectile points
- ☐ non-local lithic material
- ☐ stone-tool manufacturing items (cores, hammerstones, etc.)
- ☐ ground-stone tools
- ☐ other stone tools

Prehistoric Ceramics

- ☐ whole ceramic vessels
- ☐ diagnostic ceramics
- ☐ other prehistoric ceramics

Historic Artifacts:

- ☐ diagnostic glass artifacts
- ☐ other glass artifacts
- ☐ diagnostic metal artifacts
- ☐ other metal artifacts
- ☐ whole ceramic vessel
- ☐ diagnostic ceramics
- ☐ other historic ceramics

Other Artifacts and Materials:

- ☐ bone tools
- ☐ faunal remains
- ☐ macrobotanical remains
- ☐ perishable artifacts
- ☐ ornaments
- ☐ figurines
- ☐ mineral specimens
- ☐ architectural stone
- ☐ burned adobe
- ☐ fire-cracked rock/burned caliche

☐ Other items (specify): _____

Assemblage Size (all components)**:**

artifact class	estimated frequency: 0	1s	10s	100s	1000s	>10,000	*Counts (if <100)
lithic artifacts (choose one): (include debitage)	☒	☐	☐	☐	☐	☐	_____
prehistoric ceramics (choose one):	☒	☐	☐	☐	☐	☐	_____
historic artifacts (choose one):	☒	☐	☐	☐	☐	☐	_____
total assemblage size (choose one):	☒	☐	☐	☐	☐	☐	_____

Dating Potential: ☐ radiocarbon ☐ dendrochronology ☐ archeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Assemblage Remarks: No cultural resources were located on the surface of the site

9. CULTURAL/TEMPORAL AFFILIATIONS

TOTAL NUMBER OF COMPONENTS DEFINED: 1

COMPONENT #1 (EARLIEST)

Cultural Affiliation: Unknown

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records ☐ associated diagnostic artifact or feature types ☐ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:	Unknown		
Latest Period (if any)**:**			

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration ☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify):

Basis for Cultural/Temporal Affiliation:

Component Type:

Remarks:

***Associated Phase/Complex Name(s):**

COMPONENT #2

Cultural Affiliation:

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records ☐ associated diagnostic artifact or feature types ☐ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:			
Latest Period (if any)**:**			

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration ☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify):

Basis for Cultural/Temporal Affiliation:

Component Type:

Remarks:

***Associated Phase/Complex Name(s):**

10. FEATURE DATA

(see NMCRIS User's guide for a list of valid feature types)

Feature Type	Reliable ID ?	# Observed	Assoc. Comp. #s	Feature ID, Notes
None				

Feature Remarks:

11. REFERENCES

Written Sources of Information: Results of a Cultural Resource Survey of 6.2 Miles of Roads (103 Acres) on Private and Forest Lands, and Approximately 22 Block Acres for Mine Facilities and an Escape Raise in the Cibola National Forest, Mt. Taylor Field Office, Cibola County, New Mexico (Harris et al, 2009)

Heritage Report #: 1998-03-069 (NMCRIS #62120) Popelish, Linda

Additional Sources of Information: _____

12. NARRATIVE DESCRIPTION

Site Description: The site was originally recorded in 1984 by PAC who also excavated three test pits on site to determine if any subsurface deposits were present. At that time, the site was considered deflated and erosion was estimated to have taken at least 50% of the site. Further investigation at LA 48227/AR-03-03-02-821 occurred in 1998 by the Cibola National Forest-Mt. Taylor Ranger District personnel, and included mapping, artifact analysis, photography and subsurface testing. The 1998 recording detailed limited surface artifacts and testing revealed no intact subsurface deposits. Road traffic and erosion are thought to have obliterated the site and therefore no evidence remains. The site was, at that time, determined ineligible for inclusion to the NRHP by Cibola National Forest personnel.

During the current investigation the site tag was relocated, but no surface artifacts were observed. The area near the location of the site is very heavily disturbed by vehicular traffic on FR 450 as well as alluvial and aeolian erosion. It appears that the previous (FR 450 F) road bed has become a drainage with down-cutting to a depth of approximately two feet in the area of the site.

Eligibility and Recommendation: Previous testing of the site in 1998 determined that no intact subsurface deposits exist, and no cultural material was encountered on the site surface during the present study. LA 48227/AR-03-03-02-821 was determined not eligible for listing on the National Register in 1998, and EMI concurs with that determination.

Evaluation of Undertaking: LA 48227/AR-03-03-02-821 is not eligible for listing on the National Register. As an ineligible site, and requires no further management consideration. The site and potential effects to the area where it was originally documented will not be addressed further in this report.

13. SITE RECORD ATTACHMENTS

☒ site location map (USGS 7.5' topo; required) ☒ sketch map or site plan (required) ☐ continuation forms?

☐ other materials (itemize): _____

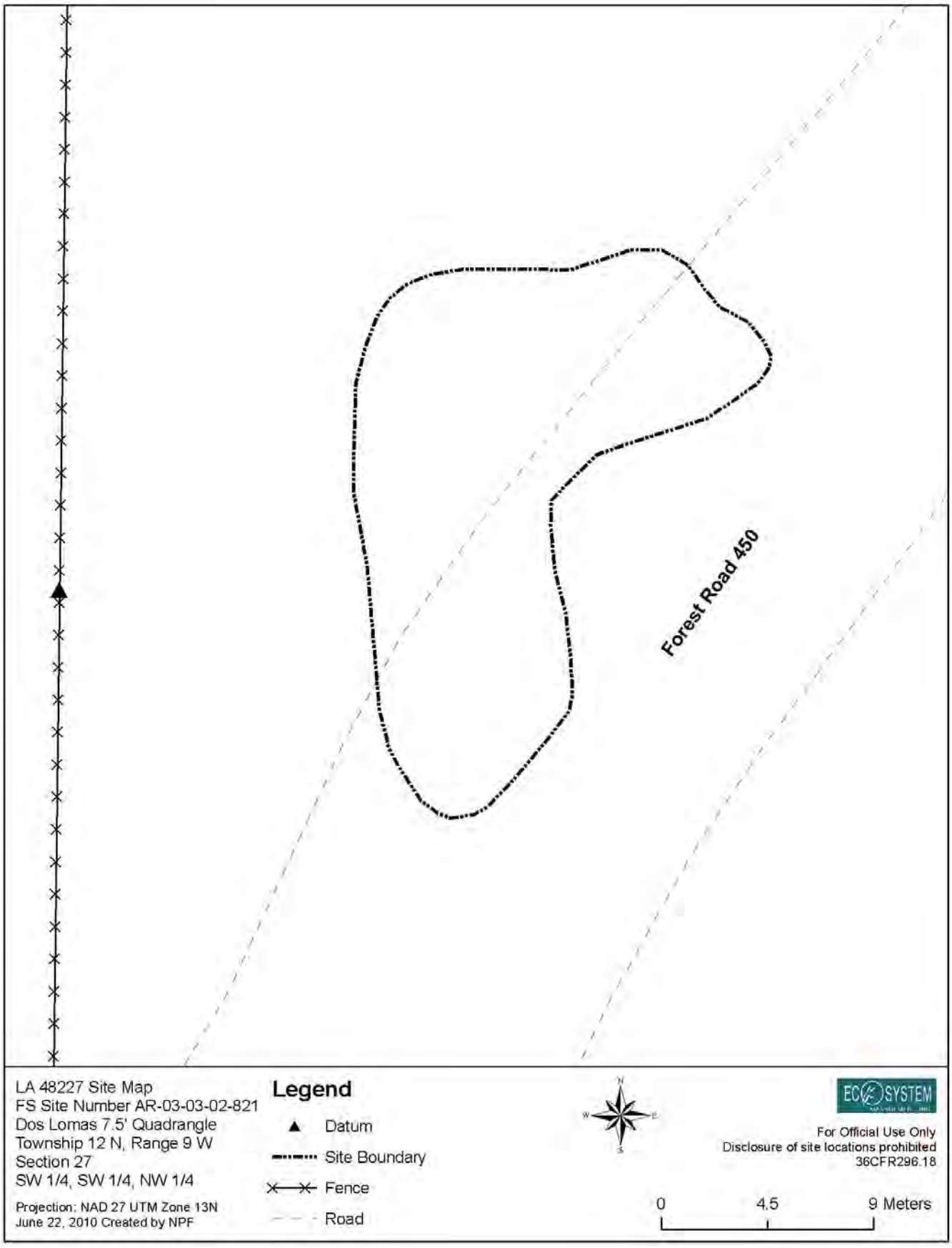

Figure 1: AR-03-03-02-821/LA 48227

LABORATORY OF ANTHROPOLOGY SITE RECORD

1. IDENTIFICATION & OWNERSHIP

LA Number: 131,426 (contact ARMS for site registration) ☒ **Site Update**? (complete at least Sections 1-4)

Site Name(s): _____

Other Site Number(s): AR-03-03-02-2317

Agency Assigning Number: USDA-FS

_____ _____

_____ _____

Current Site Owner(s): Cibola National Forest, Mt. Taylor Ranger District

Site Type: Non-Structural **Occupation Type:** Prehistoric

2. RECORDING INFORMATION

NMCRIS Activity No.: 114,095 **Field Site Number:** _____

Site Marker? ☒ (specify ID#)**:** 2317 (The site tag from the previous recording was relocated.)

Recorder(s): Garth Hayden, Zach Kneebone

Agency: EMI **Recording Date (dd-MMM-yyyy):** 16-06-2009

Site Accessibility (choose one)**:** ☒ accessible ☐ buried (sterile overburden) ☐ flooded ☐ urbanized ☐ not accessible

Surface Visibility (% visible; choose one)**:** ☐ 0% ☐ 1-25% ☐ 26-50% ☐ 51-75% ☒ 76-99% ☐ 100%

Remarks: Visibility is very good with little vegetation.

Recording Activities:

- ☒ sketch mapping
- ☐ instrument mapping (e.g., total station mapping)
- ☐ surface collection (controlled or uncontrolled)
- ☒ in-field artifact analysis
- ☐ other activities (specify): _____
- ☒ photography
- ☐ shovel or trowel tests; probes
- ☐ test excavation
- ☐ excavation (data recovery)

Description of Analysis or Excavation Activities: Analysis of all ceramics found on surface. Photographs and mapping.

Photographic Documentation: Digital File - 1498

Surface Collections (choose one)**:**

- ☒ no surface collection
- ☐ uncontrolled surface collection
- ☐ collections of specific items only
- ☐ controlled (sample: <100%)
- ☐ controlled (complete: 100%)
- ☐ other method (describe): _____

Records Inventory:

- ☒ site location map
- ☒ sketch map(s)
- ☐ instrument map(s)
- ☒ excavation, collection, analysis records
- ☒ photos, slides, and associated records
- ☐ other records: _____
- ☒ field journals, notes
- ☐ NM Historic Building Inventory form

Repository for Original Records: EMI

Repository for Collected Artifacts: N/A

3. CONDITION

Archaeological Status: ☐ surface collection ☐ test excavation ☐ partial excavation ☐ complete excavation

Disturbance Sources: ☐ wind erosion ☐ water erosion ☒ bioturbation ☒ vandalism ☐ construction/land development

☐ other source (specify): _____

Vandalism: ☐ defaced glyphs ☐ damaged/defaced building ☐ surface disturbance ☐ manual excavation

☐ mechanical excavation ☐ other vandalism (specify): _____

Percentage of Site Intact (choose one)**:** ☐ 0% ☐ 1-25% ☐ 26-50% ☐ 51-75% ☒ 76-99% ☐ 100%

Observations on Site Condition: `The site was recorded in 2007 as being at least 76% intact with minor damage from vandalism and bioturbation. Cattle trampling.`

4. RECOMMENDATIONS (for Performer/Recorder use only)

National Register Eligibility (choose one)**:** ☐ eligible ☐ not eligible ☒ not sure

Applicable Criteria: ☐ (a) ☐ (c)

☐ (b) ☐ (d)

Basis for Recommendation: LA 131426/AR-03-03-02-2317 site eligibility was undetermined when originally recorded in 1999. Artifacts in eroded areas indicate the possibility of subsurface deposits that may retain data to address questions about Ancestral Puebloan subsistence, ceramic technology and chronology. EMI concurs with the recommendation as having undetermined eligibility for nomination to the NRHP. Planned project activities are unlikely to impact the site considering its location. However, it is recommended that the site boundaries should be flagged prior to any project related activities to ensure the site is avoided during equipment transportation.

Assessment of Project Impact: The boundaries of the site do not intersect with Forest Road 544 or the area of potential effect.

Treatment Recommendations: This site will be avoided. If avoidance is not possible then testing is recommended to determine the extent and nature of any intact subsurface deposits and to provide data for additional management recommendations which may include data recovery.

5. SHPO CONSULTATIONS (for SHPO and Sponsor use only)

Sponsor NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

Sponsor Staff: _____ **Date (dd-MMM-yyyy):** _____

Sponsor Remarks: _____

SHPO NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

HPD Staff: _____ **Date (dd-MMM-yyyy):** _____ **HPD Log No:** _____

Register Status: ☐ listed on National Register ☐ listed on State Register ☐ formal determination of eligibility

State Register No.: _____

SHPO Remarks: _____

6. LOCATION

Source Graphics:

☒ USGS 7.5' (1:24,000) topo maps ☐ rectified aerial photos [Scale: _____]

☐ other topo maps [Scale: _____] ☐ unrectified aerial photos [Scale: _____]

☒ GPS unit GPS accuracy (choose one): ☐ < 1.0 m ☒ 1-10 m ☐ 10-100 m ☐ >100 m

☐ other source (describe): _____

UTM Coordinates (@ center of site; at least one set of coordinates required):

Map-based Coordinates Datum: NAD27 **Zone:** 13 **E:** _____ **N:** _____

GPS-based Coordinates Datum: NAD27 **Zone:** 13 **E:** 255781 **N:** 3905523

Directions to Site: From Grants, NM take Lobo Canyon Road (NM547) north to Forest Service Road 544. Turn left onto FR 544 the site is approximately .5 miles west side of the road.

In highway R-O-W? ☐ **Town** (if in city limits): _____ **State:** NM **County:** Cibola

USGS Quadrangle Name	Date	USGS Code
San Mateo, NM	1981	35107-C6
_____	_____	_____

PLSS Meridian	Unplatted	Township	Range	Section	¼ Sections			Protracted?
New Mexico	☐	T 12 N	R 9 W	16	SW	NW	SE	☐
New Mexico	☐	T _____	R _____	__	_____	_____	_____	☐
New Mexico	☐	T _____	R _____	__	_____	_____	_____	☐

7. PHYSICAL DESCRIPTION

Site Dimensions: 65x16 meters **Basis for Dimensions** (choose one): ☐ estimated ☒ measured

Site Area: 1,040 sq m **Basis for Area** (choose one): ☐ estimated ☒ measured **Elevation:** 8,100 feet

Site Boundaries Complete? (choose one): ☒ Yes ☐ No (explain): _____

Basis for Site Boundaries: ☒ distribution of archeological features & artifacts ☐ modern features or ground disturbance

☐ property lines ☐ topographic features ☐ other (specify): _____

Depositional/Erosional Environment: ☒ alluvial ☐ aeolian ☐ colluvial ☐ residual ☐ no deposition (on bedrock)

☐ other process (describe): _____

Stratigraphy & Depth of Archeological Deposits (choose one): ☒ unknown/not determined

☐ no subsurface deposits present ☐ subsurface deposits present ☐ stratified subsurface deposits present

Estimated Depth of Deposits: Unknown

Basis for Depth Determinations: ☐ estimated ☐ shovel/trowel tests ☐ core/auger tests ☐ excavations

☒ road or arroyo cuts ☐ rodent burrows ☐ other observations (describe): _____

Observations on Subsurface Archeological Deposits: Ceramic artifacts on the site are evident in areas of mild alluvial erosion, indicating the possibility of subsurface deposits that may address questions about Ancestral Puebloan subsistence, ceramic technology and chronology. However, the absence of visible features and other artifact classes make any estimation regarding subsurface deposition difficult.

Local Vegetation (list species in decreasing order of dominance)**:**

Overstory: _____

Understory: _____

Vegetation Community (choose one or two): ☐ forest ☐ woodland ☐ grassland ☐ scrubland ☐ desert scrubland ☐ marshland

☐ other community (specify): _____

Topographic Location:

☐ alluvial fan	☐ blowout	☐ flood plain/valley	☐ mesa/butte	☐ rockshelter
☐ arroyo/wash	☐ canyon rim	☐ foothill/mountain front	☐ mountain	☐ saddle
☐ badlands	☐ cave	☐ hill slope	☐ open canyon floor	☐ talus slope
☐ base of cliff	☐ cliff/scarp/bluff	☐ hill top	☐ plain/flat	☐ terrace
☐ base of talus slope	☐ constricted canyon	☐ lava flow (malpais)	☐ playa	

☐ other location (describe): _____

Observations on Site Setting: _____

8. ASSEMBLAGE DATA

Assemblage Content (all components)**:**

Lithics:

- ☐ lithic debitage
- ☐ chipped-stone tools
- ☐ diagnostic projectile points
- ☐ non-local lithic material
- ☐ stone-tool manufacturing items (cores, hammerstones, etc.)
- ☐ ground-stone tools
- ☐ other stone tools

Prehistoric Ceramics

- ☐ whole ceramic vessels
- ☒ diagnostic ceramics
- ☒ other prehistoric ceramics

Historic Artifacts:

- ☐ diagnostic glass artifacts
- ☐ other glass artifacts
- ☐ diagnostic metal artifacts
- ☐ other metal artifacts
- ☐ whole ceramic vessel
- ☐ diagnostic ceramics
- ☐ other historic ceramics

Other Artifacts and Materials:

- ☐ bone tools
- ☐ faunal remains
- ☐ macrobotanical remains
- ☐ perishable artifacts
- ☐ ornaments
- ☐ figurines
- ☐ mineral specimens
- ☐ architectural stone
- ☐ burned adobe
- ☐ fire-cracked rock/burned caliche

☐ Other items (specify): _____

Assemblage Size (all components)**:**

artifact class	0	1s	10s	100s	1000s	>10,000	*Counts (if <100)
lithic artifacts (choose one): (include debitage)	☒	☐	☐	☐	☐	☐	_____
prehistoric ceramics (choose one):	☐	☒	☐	☐	☐	☐	**13**
historic artifacts (choose one):	☒	☐	☐	☐	☐	☐	_____
total assemblage size (choose one):	☐	☒	☐	☐	☐	☐	**13**

Dating Potential: ☐ radiocarbon ☐ dendrochronology ☐ archeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Assemblage Remarks: **During this site visit observed cultural material consisted of small corrugated grayware sherds, plain grayware sherds and Wingate Black on Red sherds eroding out of forest slope soils. The assemblage was noted as small, included no lithic artifacts, and a total of 13 ceramic sherds (7 Wingate Black on Red, 4 plain grayware sherds and 2 corrugated gray ware sherds) were observed.**

9. CULTURAL/TEMPORAL AFFILIATIONS

TOTAL NUMBER OF COMPONENTS DEFINED: 1

COMPONENT #1 (EARLIEST)

Cultural Affiliation: Pueblo II

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records

☒ associated diagnostic artifact or feature types ☐ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:	Pueblo II	1,050 AD	1,200 AD
Latest Period (if any)**:**			

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Basis for Cultural/Temporal Affiliation: 7 Wingate Black on Red, 4 plain grayware sherds and 2 corrugated gray ware sherds were observed.

Component Type: Artifact scatter

Remarks: _____

***Associated Phase/Complex Name(s):** Pueblo II

COMPONENT #2

Cultural Affiliation: _____

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records

☐ associated diagnostic artifact or feature types ☐ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:			
Latest Period (if any)**:**			

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Basis for Cultural/Temporal Affiliation: _____

Component Type: _____

Remarks: _____

***Associated Phase/Complex Name(s):** _____

10. FEATURE DATA

(see NMCRIS User's guide for a list of valid feature types)

Feature Type	Reliable ID ?	# Observed	Assoc. Comp. #s	Feature ID, Notes

Feature Remarks: None observed

11. REFERENCES

Written Sources of Information: Results of a Cultural Resource Survey of 6.2 Miles of Roads (103 Acres) on Private and Forest Lands, and Approximately 22 Block Acres for Mine Facilities and an Escape Raise in the Cibola National Forest, Mt. Taylor Field Office, Cibola County, New Mexico (Harris et al, 2009)

Heritage Report #2009-03-133 (NMCRIS #114095)

Additional Sources of Information: _____

12. NARRATIVE DESCRIPTION

Site Description: The site was originally recorded in 1999 by the Cibola National Forest, Mt. Taylor Ranger District personnel as an Ancestral Puebloan ceramic sherd scatter consisting of unidentified Black-on-white sherds, indented corrugated gray ware, and unidentified Black-on-red sherds. The site was recorded as being at least 76% intact with minor damage from vandalism and bioturbation.

During the present site visit observed cultural material consisted ceramic sherds eroding out of forest slope soils. The assemblage included a total of 13 ceramic sherds (7 Wingate Black on Red, 4 plain grayware sherds and 2 corrugated gray ware sherds). The ceramic are evident in areas of mild alluvial erosion. LA 131426/AR-03-03-02-2317 is bisected by Forest Road 544. The site seems to be much the same as recorded in 1999 and no updated site map was needed.

Eligibility and Recommendation: LA 131426/AR-03-03-02-2317 site eligibility was undetermined when originally recorded in 1999. Artifacts in eroded areas indicate the possibility of subsurface deposits that may retain data to address questions about Ancestral Puebloan subsistence, ceramic technology and chronology. EMI concurs with the recommendation as having undetermined eligibility for nomination to the NRHP. Planned project activities are unlikely to impact the site considering its location. However, it is recommended that the site boundaries should be flagged prior to any project related activities to ensure the site is avoided during equipment transportation.

Evaluation of Undertaking*:* The boundaries of the site do not intersect with Forest Road 544 or the area of potential effect. This site will be avoided. If avoidance is not possible then testing is recommended to determine the extent and nature of any intact subsurface deposits and to provide data for additional management recommendations which may include data recovery.

13. SITE RECORD ATTACHMENTS

☒ site location map (USGS 7.5' topo; required) ☒ sketch map or site plan (required) ☐ continuation forms?

☒ other materials (itemize): Photo

Figure 1: Site overview of LA 131426/AR-03-03-02-2317, view to south

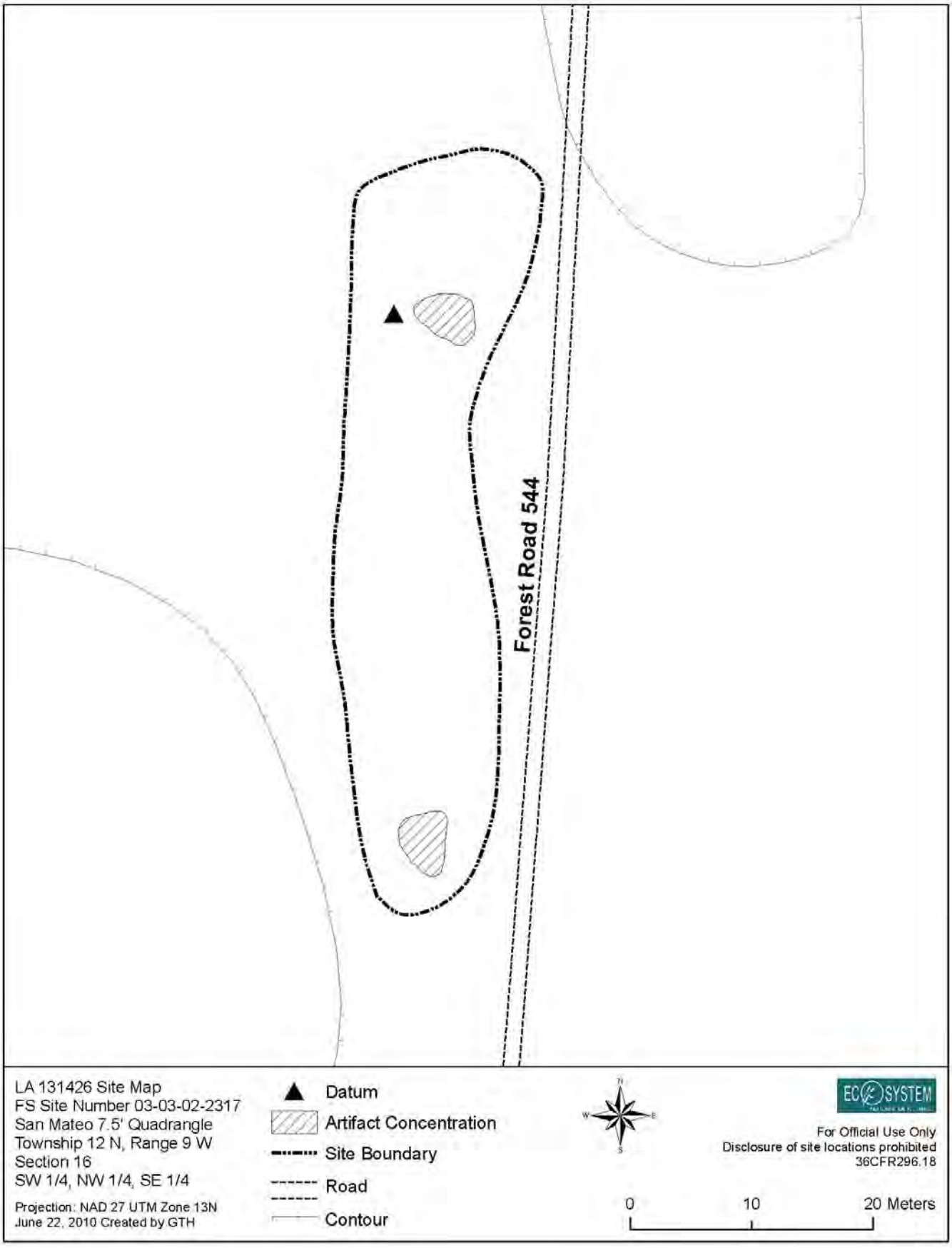

Figure 2: AR-03-03-02-2317/LA 131426 Site Map

LABORATORY OF ANTHROPOLOGY SITE RECORD

1. IDENTIFICATION & OWNERSHIP

LA Number: 153,870 (contact ARMS for site registration) ☒ **Site Update**? (complete at least Sections 1-4)

Site Name(s): _____

Other Site Number(s): AR-03-03-02-2768

Agency Assigning Number: USDA-FS

_____ _____

_____ _____

Current Site Owner(s): Cibola National Forest, Mt. Taylor Ranger District

Site Type: Non-Structural **Occupation Type:** Prehistoric

2. RECORDING INFORMATION

NMCRIS Activity No.: 114,095 **Field Site Number:** _____

Site Marker? ☒ (specify ID#)**:** 2768 (The site tag from the previous recording was relocated.)

Recorder(s): Garth Hayden, Zach Kneebone

Agency: EMI **Recording Date (dd-MMM-yyyy):** 16-06-2009

Site Accessibility (choose one)**:** ☒ accessible ☐ buried (sterile overburden) ☐ flooded ☐ urbanized ☐ not accessible

Surface Visibility (% visible; choose one)**:** ☐ 0% ☐ 1-25% ☐ 26-50% ☐ 51-75% ☒ 76-99% ☐ 100%

Remarks: Visibility is very good with little vegetation.

Recording Activities:

- ☒ sketch mapping
- ☐ instrument mapping (e.g., total station mapping)
- ☐ surface collection (controlled or uncontrolled)
- ☐ in-field artifact analysis
- ☐ other activities (specify): _____
- ☒ photography
- ☐ shovel or trowel tests; probes
- ☐ test excavation
- ☐ excavation (data recovery)

Description of Analysis or Excavation Activities: Photographs and recording.

Photographic Documentation: Digital File - 1490

Surface Collections (choose one)**:**

- ☒ no surface collection
- ☐ uncontrolled surface collection
- ☐ collections of specific items only
- ☐ controlled (sample: <100%)
- ☐ controlled (complete: 100%)
- ☐ other method (describe): _____

Records Inventory:

- ☒ site location map
- ☒ sketch map(s)
- ☐ instrument map(s)
- ☐ excavation, collection, analysis records
- ☒ photos, slides, and associated records
- ☐ other records: _____
- ☐ field journals, notes
- ☐ NM Historic Building Inventory form

Repository for Original Records: EMI

Repository for Collected Artifacts: N/A

3. CONDITION

Archaeological Status: ☐ surface collection ☐ test excavation ☐ partial excavation ☐ complete excavation

Disturbance Sources: ☐ wind erosion ☐ water erosion ☐ bioturbation ☐ vandalism ☐ construction/land development

☐ other source (specify): _____

Vandalism: ☐ defaced glyphs ☐ damaged/defaced building ☐ surface disturbance ☐ manual excavation

☐ mechanical excavation ☐ other vandalism (specify): _____

Percentage of Site Intact (choose one)**:** ☐ 0% ☐ 1-25% ☐ 26-50% ☐ 51-75% ☐ 76-99% ☐ 100%

Observations on Site Condition: _____

4. RECOMMENDATIONS (for Performer/Recorder use only)

National Register Eligibility (choose one)**:** ☐ eligible ☐ not eligible ☒ not sure

Applicable Criteria: ☐ (a) ☐ (c)

☐ (b) ☐ (d)

Basis for Recommendation: In 2007 Lone Mountain Archaeological Services left the eligibility of LA 153870/AR-03-03-02-2768 undetermined due to lack of evidence for subsurface cultural deposits. Intact subsurface deposits are thought to be present based on observations by EMI archaeologists during the present visit and the site is estimated at 80 percent intact. EMI recommends the site as undetermined for inclusion in the National Register.

Assessment of Project Impact: The site is outside of the area of potential effect of both the access road and escape raise and will not be impacted by project related activities.

Treatment Recommendations: The site will be flagged prior to project construction. The site will be avoided and protected during project construction.

5. SHPO CONSULTATIONS (for SHPO and Sponsor use only)

Sponsor NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

Sponsor Staff: _____ **Date (dd-MMM-yyyy):** _____

Sponsor Remarks: _____

SHPO NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

HPD Staff: _____ **Date (dd-MMM-yyyy):** _____ **HPD Log No:** _____

Register Status: ☐ listed on National Register ☐ listed on State Register ☐ formal determination of eligibility

State Register No.: _____

SHPO Remarks: _____

6. LOCATION

Source Graphics:

☒ USGS 7.5' (1:24,000) topo maps ☐ rectified aerial photos [Scale: _____]

☐ other topo maps [Scale: _____] ☐ unrectified aerial photos [Scale: _____]

☒ GPS unit GPS accuracy (choose one): ☐ < 1.0 m ☒ 1-10 m ☐ 10-100 m ☐ >100 m

☐ other source (describe): _____

UTM Coordinates (@ center of site; at least one set of coordinates required):

Map-based Coordinates Datum: NAD27 **Zone:** 13 **E:** _____ **N:** _____

GPS-based Coordinates Datum: NAD27 **Zone:** 13 **E:** 250,117 **N:** 3,907,672

Directions to Site: From Grants, NM take Lobo Canyon Road (NM547) north to Forest Service Road 544. Turn left onto FR 544 the site is approximately 4.5 miles south side of the road. LA 153870 /AR-03-03-02-2768 is located approximately 30 m west of FR 544 and 90 m south of the access road to the escape raise.

In highway R-O-W? ☐ **Town** (if in city limits): _____ **State:** NM **County:** Cibola

USGS Quadrangle Name	Date	USGS Code
San Mateo, NM	1981	35107-C6

PLSS Meridian	Unplatted	Township	Range	Section	¼ Sections			Protracted?
New Mexico	☐	T 12 N	R 9 W	12	NW	NW	SW	☐
New Mexico	☐	T	R					☐
New Mexico	☐	T	R					☐

7. PHYSICAL DESCRIPTION

Site Dimensions: 80x40 meters **Basis for Dimensions** (choose one): ☐ estimated ☒ measured

Site Area: 3,200 sq m **Basis for Area** (choose one): ☐ estimated ☒ measured **Elevation:** 8,080 feet

Site Boundaries Complete? (choose one): ☒ Yes ☐ No (explain): _____

Basis for Site Boundaries: ☒ distribution of archeological features & artifacts ☐ modern features or ground disturbance

☐ property lines ☐ topographic features ☐ other (specify): _____

Depositional/Erosional Environment: ☒ alluvial ☐ aeolian ☐ colluvial ☐ residual ☐ no deposition (on bedrock)

☐ other process (describe): _____

Stratigraphy & Depth of Archeological Deposits (choose one): ☒ unknown/not determined

☐ no subsurface deposits present ☐ subsurface deposits present ☐ stratified subsurface deposits present

Estimated Depth of Deposits: unknown

Basis for Depth Determinations: ☐ estimated ☐ shovel/trowel tests ☐ core/auger tests ☐ excavations

☐ road or arroyo cuts ☐ rodent burrows ☒ other observations (describe): ant hills

Observations on Subsurface Archeological Deposits: During our revisit of the site we observed artifacts in areas disturbed by wood cutting, microflakes in two ant mounds, and artifacts appearing in areas of mild alluvial erosion which are suggestive of the presence of intact subsurface deposits.

Local Vegetation (list species in decreasing order of dominance)**:**

Overstory: _____

Understory: _____

Vegetation Community (choose one or two): ☐ forest ☐ woodland ☐ grassland ☐ scrubland ☐ desert scrubland ☐ marshland

☐ other community (specify): _____

Topographic Location:

☐ alluvial fan	☐ blowout	☐ flood plain/valley	☐ mesa/butte	☐ rockshelter
☐ arroyo/wash	☐ canyon rim	☐ foothill/mountain front	☐ mountain	☐ saddle
☐ badlands	☐ cave	☐ hill slope	☐ open canyon floor	☐ talus slope
☐ base of cliff	☐ cliff/scarp/bluff	☐ hill top	☐ plain/flat	☐ terrace
☐ base of talus slope	☐ constricted canyon	☐ lava flow (malpais)	☐ playa	

☐ other location (describe): _____

Observations on Site Setting: LA 153870 /AR-03-03-02-2768 is located approximately 40 meters south of Forest Road 544 and 90 meters southeast of the escape raise. The site is in the southeast corner of the escape raise 200-foot buffer. The site location information and site map included in the 2007 report are accurate and up to date.

8. ASSEMBLAGE DATA

Assemblage Content (all components)**:**

Lithics:

- ☒ lithic debitage
- ☐ chipped-stone tools
- ☐ diagnostic projectile points
- ☐ non-local lithic material
- ☐ stone-tool manufacturing items (cores, hammerstones, etc.)
- ☐ ground-stone tools
- ☐ other stone tools

Prehistoric Ceramics

- ☐ whole ceramic vessels
- ☒ diagnostic ceramics
- ☒ other prehistoric ceramics

Historic Artifacts:

- ☐ diagnostic glass artifacts
- ☐ other glass artifacts
- ☐ diagnostic metal artifacts
- ☐ other metal artifacts
- ☐ whole ceramic vessel
- ☐ diagnostic ceramics
- ☐ other historic ceramics

Other Artifacts and Materials:

- ☐ bone tools
- ☐ faunal remains
- ☐ macrobotanical remains
- ☐ perishable artifacts
- ☐ ornaments
- ☐ figurines
- ☐ mineral specimens
- ☐ architectural stone
- ☐ burned adobe
- ☐ fire-cracked rock/burned caliche

☐ Other items (specify): _____

Assemblage Size (all components)**:**

artifact class	estimated frequency: 0	1s	10s	100s	1000s	>10,000	*Counts (if <100)
lithic artifacts (choose one): (include debitage)	☐	☐	☐	☐	☐	☐	_____
prehistoric ceramics (choose one):	☐	☐	☐	☐	☐	☐	_____
historic artifacts (choose one):	☐	☐	☐	☐	☐	☐	_____
total assemblage size (choose one):	☐	☐	☐	☐	☐	☐	_____

Dating Potential: ☐ radiocarbon ☐ dendrochronology ☐ archeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Assemblage Remarks: _____

9. CULTURAL/TEMPORAL AFFILIATIONS

TOTAL NUMBER OF COMPONENTS DEFINED: 1

COMPONENT #1 (EARLIEST)

Cultural Affiliation: Pueblo

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records

☒ associated diagnostic artifact or feature types ☐ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:	Ancestral Puebloan	1 AD	1,600 AD
Latest Period (if any)**:**			

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify):

Basis for Cultural/Temporal Affiliation: Kiatuthlanna Black-on-white sherd found in last recording

Component Type: Artifact scatter

Remarks:

***Associated Phase/Complex Name(s):** Ancestral Puebloan

COMPONENT #2

Cultural Affiliation:

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records

☐ associated diagnostic artifact or feature types ☐ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:			
Latest Period (if any)**:**			

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify):

Basis for Cultural/Temporal Affiliation:

Component Type:

Remarks:

***Associated Phase/Complex Name(s):**

10. FEATURE DATA

(see NMCRIS User's guide for a list of valid feature types)

Feature Type	Reliable ID ?	# Observed	Assoc. Comp. #s	Feature ID, Notes

Feature Remarks: None observed

11. REFERENCES

Written Sources of Information: Results of a Cultural Resource Survey of 6.2 Miles of Roads (103 Acres) on Private and Forest Lands, and Approximately 22 Block Acres for Mine Facilities and an Escape Raise in the Cibola National Forest, Mt. Taylor Field Office, Cibola County, New Mexico (Harris et al, 2009)

Heritage Report #2009-03-133 (NMCRIS #114095)

Additional Sources of Information: _____

12. NARRATIVE DESCRIPTION

Site Description: LA 153870 /AR-03-03-02-2768 was originally recorded by Lone Mountain Archaeological Services in 2007 under NMCRIS activity number 100734. There is currently no information in the ARMS database regarding the scope and size of the original survey nor is there information regarding the site. However, records at the Cibola National Forest Supervisors Office included a copy of the report generated from the project and more information regarding this site. LA 153870/AR-03-03-02-2768 was reported as a lithic and ceramic scatter with an Ancestral Puebloan component as evidenced by a Kiatuthlana Black-on-white sherd.

During the present survey, artifacts observed on the site consisted of Grants Ridge obsidian flakes. Intact subsurface deposits are thought to be present based on observations by EMI archaeologists during the present visit and the site is in good condition and estimated at 80 percent intact. Artifacts were observed in areas cleared and disturbed by wood cutting, micro-flakes were present in two ant mounds, and artifacts appearing in areas of mild alluvial erosion which suggests the presence of intact subsurface deposits. LA 153870 /AR-03-03-02-2768 is located approximately 40 meters south of Forest Road 544 and 90 meters southeast of the escape raise. The site is in the southeast corner of the escape raise 200-foot buffer. The site location information and site map included in the 2007 report are accurate and up to date.

Eligibility and Recommendation: In 2007 Lone Mountain Archaeological Services left the eligibility of LA 153870/AR-03-03-02-2768 undetermined due to direct lack of evidence for subsurface cultural deposits. However, intact subsurface deposits are thought to be present and the site is estimated at 80 percent intact. The site may retain datable subsurface cultural deposits that may yield important scientific information about Archaic settlement, subsistence and stone tool technology. The site is recommended as having undetermined eligibility for nomination to the NRHP. Planned project activities are unlikely to impact the site considering its location. However, it is recommended that the site boundaries should be flagged prior to any project related activities to ensure the site is avoided during equipment transportation.

Evaluation of Undertaking: This site will be avoided. If avoidance is not possible then testing is recommended to determine the extent and nature of any intact subsurface deposits and to provide data for additional management recommendations which may include data recovery.

13. SITE RECORD ATTACHMENTS

☒ site location map (USGS 7.5' topo; required) ☒ sketch map or site plan (required) ☐ continuation forms?

☒ other materials (itemize): Photo

Figure 1: Site overview of LA 153870/AR-03-03-02-2768, view to south

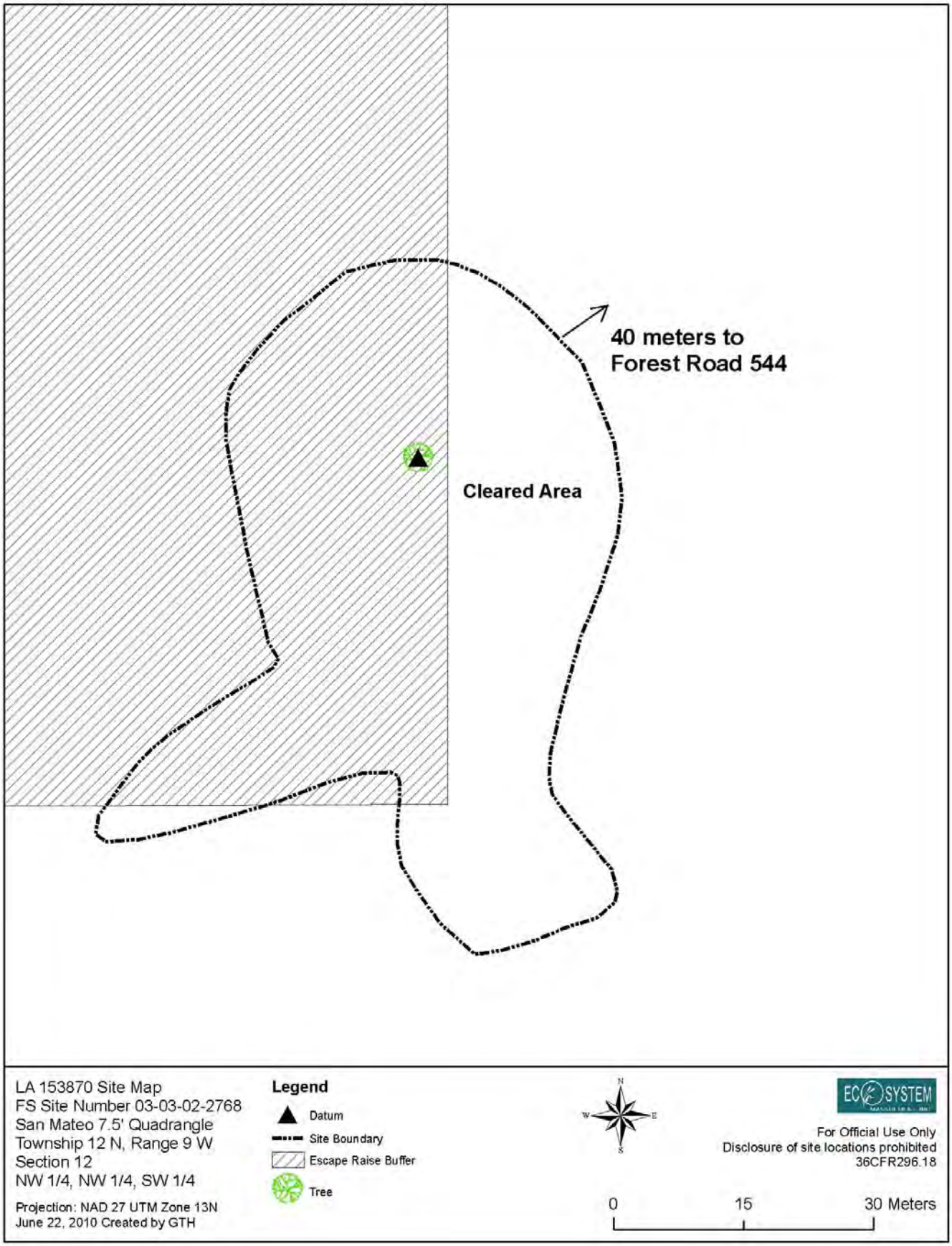

Figure 2: Site Map

LABORATORY OF ANTHROPOLOGY SITE RECORD

1. IDENTIFICATION & OWNERSHIP

LA Number: 153,872 (contact ARMS for site registration) ☒ **Site Update**? (complete at least Sections 1-4)

Site Name(s): _____

Other Site Number(s): AR-03-03-02-2771

Agency Assigning Number: USDA-FS

_____ _____

_____ _____

Current Site Owner(s): Cibola National Forest, Mt. Taylor Ranger District

Site Type: Non-Structural **Occupation Type:** Prehistoric

2. RECORDING INFORMATION

NMCRIS Activity No.: 114,095 **Field Site Number:** _____

Site Marker? ☒ (specify ID#)**:** 2771 (The site tag from the previous recording was relocated.)

Recorder(s): Garth Hayden, Zach Kneebone

Agency: EMI **Recording Date (dd-MMM-yyyy):** 16-06-2009

Site Accessibility (choose one)**:** ☒ accessible ☐ buried (sterile overburden) ☐ flooded ☐ urbanized ☐ not accessible

Surface Visibility (% visible; choose one)**:** ☐ 0% ☐ 1-25% ☐ 26-50% ☐ 51-75% ☒ 76-99% ☐ 100%

Remarks: Visibility is very good with little vegetation.

Recording Activities:

- ☒ sketch mapping
- ☐ instrument mapping (e.g., total station mapping)
- ☐ surface collection (controlled or uncontrolled)
- ☐ in-field artifact analysis
- ☐ other activities (specify): _____
- ☒ photography
- ☐ shovel or trowel tests; probes
- ☐ test excavation
- ☐ excavation (data recovery)

Description of Analysis or Excavation Activities: Photographs and mapping.

Photographic Documentation: Digital File - 1494

Surface Collections (choose one)**:**

- ☒ no surface collection
- ☐ uncontrolled surface collection
- ☐ collections of specific items only
- ☐ controlled (sample: <100%)
- ☐ controlled (complete: 100%)
- ☐ other method (describe): _____

Records Inventory:

- ☒ site location map
- ☒ sketch map(s)
- ☐ instrument map(s)
- ☐ excavation, collection, analysis records
- ☒ photos, slides, and associated records
- ☐ other records: _____
- ☒ field journals, notes
- ☐ NM Historic Building Inventory form

Repository for Original Records: EMI

Repository for Collected Artifacts: N/A

3. CONDITION

Archaeological Status: ☐ surface collection ☐ test excavation ☐ partial excavation ☐ complete excavation

Disturbance Sources: ☐ wind erosion ☐ water erosion ☐ bioturbation ☐ vandalism ☒ construction/land development

☐ other source (specify): _____

Vandalism: ☐ defaced glyphs ☐ damaged/defaced building ☐ surface disturbance ☐ manual excavation

☐ mechanical excavation ☐ other vandalism (specify): _____

Percentage of Site Intact (choose one)**:** ☐ 0% ☐ 1-25% ☐ 26-50% ☐ 51-75% ☒ 76-99% ☐ 100%

Observations on Site Condition: Impacts to the site include road maintenance and improvements. FR 544 bisects the middle of the site east to west. All observed cultural material was located in the roadway and the artifacts were likely to have been redeposited into the roadway during activities on the road. The site outside the roadway is estimated at 80 percent intact.

4. RECOMMENDATIONS (for Performer/Recorder use only)

National Register Eligibility (choose one)**:** ☐ eligible ☐ not eligible ☒ not sure

Applicable Criteria: ☐ (a) ☐ (c)

☐ (b) ☐ (d)

Basis for Recommendation: **Site Description:** LA 153872/AR-03-03-02-2771 was originally recorded by Lone Mountain Archaeological Services in 2007. Artifacts on the site consisted of 16 Grants Ridge obsidian flakes. Impacts to the site include road maintenance and improvements. FR 544 bisects the middle of the site east to west. All observed cultural material was located in the roadway and the artifacts were likely to have been redeposited into the roadway during activities on the road. No features were observed.

Eligibility Recommendation: In 2007 Lone Mountain Archaeological Services left the eligibility of LA 153872/AR-03-03-02-2771 undetermined due to lack of evidence for subsurface cultural deposits. During this revisit of the site artifacts were observed in the road bed, road cut and appearing in areas of mild alluvial erosion. The portion of the site in the roadway appears to be heavily disturbed. The site outside the roadway is estimated at 80 percent intact. The site is recommended as having undetermined eligibility for nomination to the NRHP. EMI recommends nature and extent testing of the site to determine its NRHP eligibility.

Evaluation of Undertaking: Forest Road 544 intersects the site, but it is uncertain how much of the site will be impacted. Since complete avoidance is not possible, testing is recommended to determine the extent and nature of any intact subsurface deposits and to provide data for additional management recommendations which may include data recovery.

5. SHPO CONSULTATIONS (for SHPO and Sponsor use only)

Sponsor NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

Sponsor Staff: _____ **Date (dd-MMM-yyyy):** _____

Sponsor Remarks: _____

SHPO NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

HPD Staff: _____ **Date (dd-MMM-yyyy):** _____ **HPD Log No:** _____

Register Status: ☐ listed on National Register ☐ listed on State Register ☐ formal determination of eligibility

State Register No.: _____

SHPO Remarks: _____

6. LOCATION

Source Graphics:

☒ USGS 7.5' (1:24,000) topo maps ☐ rectified aerial photos [Scale: _____]

☐ other topo maps [Scale: _____] ☐ unrectified aerial photos [Scale: _____]

☒ GPS unit GPS accuracy (choose one): ☐ < 1.0 m ☒ 1-10 m ☐ 10-100 m ☐ >100 m

☐ other source (describe): _____

UTM Coordinates (@ center of site; at least one set of coordinates required):

Map-based Coordinates Datum: NAD27 **Zone:** 13 **E:** _____ **N:** _____

GPS-based Coordinates Datum: NAD27 **Zone:** 13 **E:** 251,824 **N:** 3,906,988

Directions to Site: From Grants, NM take Lobo Canyon Road (NM547) north to Forest Service Road 544. Turn left onto FR 544 the site is approximately 3.5 miles south side of the road.

In highway R-O-W? ☐ **Town** (if in city limits): _____ **State:** NM **County:** Cibola

USGS Quadrangle Name	Date	USGS Code
San Mateo, NM	1981	35107-C6

PLSS Meridian	Unplatted	Township	Range	Section	¼ Sections			Protracted?
New Mexico	☐	T 12 N	R 9 W	7	S 1/2	SW	SW	☐
New Mexico	☐	T _____	R _____	_____	_____	_____	_____	☐
New Mexico	☐	T _____	R _____	_____	_____	_____	_____	☐

7. PHYSICAL DESCRIPTION

Site Dimensions: 46x43 meters **Basis for Dimensions** (choose one): ☐ estimated ☒ measured

Site Area: 1,978 sq m **Basis for Area** (choose one): ☐ estimated ☒ measured **Elevation:** 8,200 feet

Site Boundaries Complete? (choose one): ☒ Yes ☐ No (explain): _____

Basis for Site Boundaries: ☒ distribution of archeological features & artifacts ☐ modern features or ground disturbance

☐ property lines ☐ topographic features ☐ other (specify): _____

Depositional/Erosional Environment: ☒ alluvial ☐ aeolian ☐ colluvial ☐ residual ☐ no deposition (on bedrock)

☐ other process (describe): _____

Stratigraphy & Depth of Archeological Deposits (choose one): ☒ unknown/not determined

☐ no subsurface deposits present ☐ subsurface deposits present ☐ stratified subsurface deposits present

Estimated Depth of Deposits: unknown

Basis for Depth Determinations: ☐ estimated ☐ shovel/trowel tests ☐ core/auger tests ☐ excavations

☒ road or arroyo cuts ☐ rodent burrows ☐ other observations (describe): _____

Observations on Subsurface Archeological Deposits: All observed cultural material was located in the roadway and the artifacts were likely to have been redeposited into the roadway during activities on the road. During our revisit of the site we observed artifacts in the road bed, road cut and appearing in areas of mild alluvial erosion. Based on these observations of possible intact subsurface deposits in the roadway cut sidewall, and the fact that the site outside the roadway is estimated at 80 percent intact, subsurface deposits are likely.

Local Vegetation (list species in decreasing order of dominance)**:**

Overstory: _____

Understory: _____

Vegetation Community (choose one or two): ☐ forest ☐ woodland ☐ grassland ☐ scrubland ☐ desert scrubland ☐ marshland

☐ other community (specify): _____

Topographic Location:

☐ alluvial fan	☐ blowout	☐ flood plain/valley	☐ mesa/butte	☐ rockshelter
☐ arroyo/wash	☐ canyon rim	☐ foothill/mountain front	☐ mountain	☐ saddle
☐ badlands	☐ cave	☐ hill slope	☐ open canyon floor	☐ talus slope
☐ base of cliff	☐ cliff/scarp/bluff	☐ hill top	☐ plain/flat	☐ terrace
☐ base of talus slope	☐ constricted canyon	☐ lava flow (malpais)	☐ playa	

☐ other location (describe): _____

Observations on Site Setting: _____

8. ASSEMBLAGE DATA

Assemblage Content (all components)**:**

Lithics:

- ☒ lithic debitage
- ☐ chipped-stone tools
- ☐ diagnostic projectile points
- ☐ non-local lithic material
- ☐ stone-tool manufacturing items (cores, hammerstones, etc.)
- ☐ ground-stone tools
- ☐ other stone tools

Prehistoric Ceramics

- ☐ whole ceramic vessels
- ☐ diagnostic ceramics
- ☐ other prehistoric ceramics

Historic Artifacts:

- ☐ diagnostic glass artifacts
- ☐ other glass artifacts
- ☐ diagnostic metal artifacts
- ☐ other metal artifacts
- ☐ whole ceramic vessel
- ☐ diagnostic ceramics
- ☐ other historic ceramics

Other Artifacts and Materials:

- ☐ bone tools
- ☐ faunal remains
- ☐ macrobotanical remains
- ☐ perishable artifacts
- ☐ ornaments
- ☐ figurines
- ☐ mineral specimens
- ☐ architectural stone
- ☐ burned adobe
- ☐ fire-cracked rock/burned caliche

☐ Other items (specify): _____

Assemblage Size (all components)**:**

artifact class	estimated frequency: 0	1s	10s	100s	1000s	>10,000	*Counts (if <100)
lithic artifacts (choose one): (include debitage)	☐	☐	☐	☐	☐	☐	_____
prehistoric ceramics (choose one):	☐	☐	☐	☐	☐	☐	_____
historic artifacts (choose one):	☐	☐	☐	☐	☐	☐	_____
total assemblage size (choose one):	☐	☐	☐	☐	☐	☐	_____

Dating Potential: ☐ radiocarbon ☐ dendrochronology ☐ archeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Assemblage Remarks: Artifacts recorded in 2007 on the site consisted of 16 Grants Ridge obsidian flakes.

9. CULTURAL/TEMPORAL AFFILIATIONS

TOTAL NUMBER OF COMPONENTS DEFINED: 1

COMPONENT #1 (EARLIEST)

Cultural Affiliation: Unknown Prehistoric

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records

☐ associated diagnostic artifact or feature types ☒ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:			
Latest Period (if any)**:**			

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify):

Basis for Cultural/Temporal Affiliation:

Component Type: Artifact scatter

Remarks:

***Associated Phase/Complex Name(s):** Unknown Prehistoric

COMPONENT #2

Cultural Affiliation:

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records

☐ associated diagnostic artifact or feature types ☐ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:			
Latest Period (if any)**:**			

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify):

Basis for Cultural/Temporal Affiliation:

Component Type:

Remarks:

***Associated Phase/Complex Name(s):**

10. FEATURE DATA

(see NMCRIS User's guide for a list of valid feature types)

Feature Type	Reliable ID ?	# Observed	Assoc. Comp. #s	Feature ID, Notes

Feature Remarks: None observed

11. REFERENCES

Written Sources of Information: Results of a Cultural Resource Survey of 6.2 Miles of Roads (103 Acres) on Private and Forest Lands, and Approximately 22 Block Acres for Mine Facilities and an Escape Raise in the Cibola National Forest, Mt. Taylor Field Office, Cibola County, New Mexico (Harris et al, 2009)

Heritage Report #2009-03-133 (NMCRIS #114095)

Additional Sources of Information: _____

12. NARRATIVE DESCRIPTION

Site Description: LA 153872/AR-03-03-02-2771 was originally recorded by Lone Mountain Archaeological Services in 2007. In the 2007 report the site numbers were transposed for AR-03-03-02-2771 and AR-03-03-02-2770. A field check of both sites confirms that the problem has been corrected. Artifacts noted during the present survey consist of 16 Grants Ridge obsidian flakes. Impacts to the site include road maintenance and improvements. FR 544 bisects the middle of the site east to west. All observed cultural material was located in the roadway. The portion of the site in the roadway appears to be heavily disturbed. The site outside the roadway is in good condition and estimated to be 80 percent intact. During the present revisit artifacts were observed in the road bed, road cut and appearing in areas of mild alluvial erosion.

Eligibility and Recommendation: In 2007 Lone Mountain Archaeological Services left the eligibility of LA 153872/AR-03-03-02-2771 undetermined due to lack of direct evidence for subsurface cultural deposits. Artifacts were observed in disturbed areas of the site during the present survey suggestion subsurface cultural deposits may be present that may yield important scientific information about prehistoric settlement, subsistence and stone tool technology and chronology. EMI concurs with undetermined status and recommends testing to determine the nature, integrity and extent of the site within the FR 544 access roadway, for NRHP eligibility status and further management recommendations.

Evaluation of Undertaking*:* Forest Road 544 intersects the site, but it is uncertain how much of the site will be impacted. Since complete avoidance is not possible, testing is recommended to determine the extent and nature of any intact subsurface deposits within the FR 544 access roadway, for eligibility determination and to provide data for additional management recommendations which may include data recovery.

13. SITE RECORD ATTACHMENTS

☒ site location map (USGS 7.5' topo; required) ☒ sketch map or site plan (required) ☐ continuation forms?

☒ other materials (itemize): Photo

Figure 1: Site overview of LA 153872/AR-03-03-02-2771, view to west

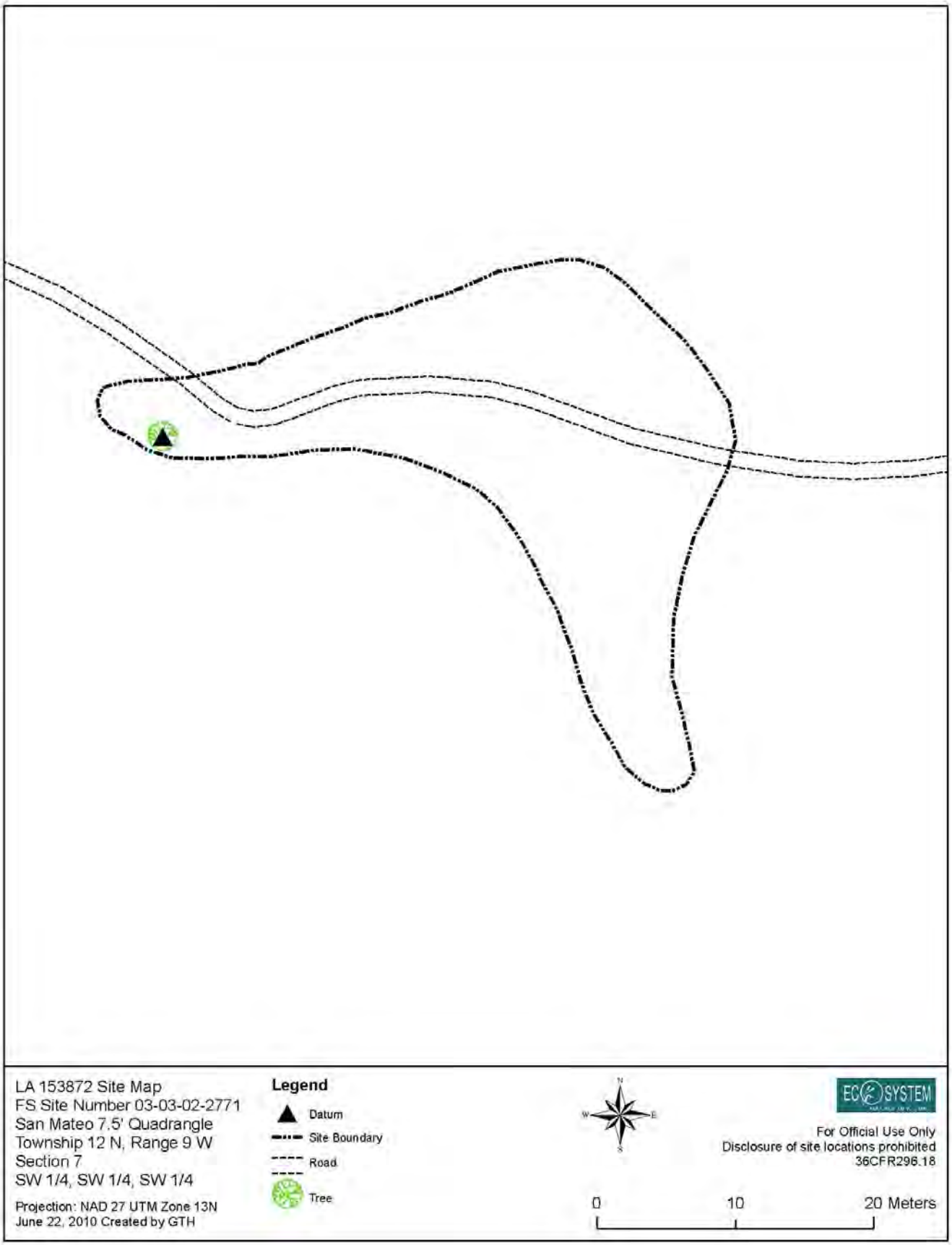

Figure 2: Site Map

LABORATORY OF ANTHROPOLOGY SITE RECORD

1. IDENTIFICATION & OWNERSHIP

LA Number: 153,873 (contact ARMS for site registration) ☒ **Site Update**? (complete at least Sections 1-4)

Site Name(s): _____

Other Site Number(s): AR-03-03-02-2770

Agency Assigning Number: USDA-FS

_____ _____

_____ _____

Current Site Owner(s): Cibola National Forest, Mt. Taylor Ranger District

Site Type: Non-Structural **Occupation Type:** Prehistoric

2. RECORDING INFORMATION

NMCRIS Activity No.: 114095 **Field Site Number:** _____

Site Marker? ☒ (specify ID#): 2770 (The site tag from the previous recording was relocated.)

Recorder(s): Garth Hayden, Zach Kneebone

Agency: EMI **Recording Date (dd-MMM-yyyy):** 16-06-2009

Site Accessibility (choose one): ☒ accessible ☐ buried (sterile overburden) ☐ flooded ☐ urbanized ☐ not accessible

Surface Visibility (% visible; choose one): ☐ 0% ☐ 1-25% ☐ 26-50% ☐ 51-75% ☒ 76-99% ☐ 100%

Remarks: Visibility is very good with little vegetation.

Recording Activities:

- ☒ sketch mapping
- ☐ instrument mapping (e.g., total station mapping)
- ☐ surface collection (controlled or uncontrolled)
- ☐ in-field artifact analysis
- ☐ other activities (specify): _____
- ☒ photography
- ☐ shovel or trowel tests; probes
- ☐ test excavation
- ☐ excavation (data recovery)

Description of Analysis or Excavation Activities: Photographs and recording.

Photographic Documentation: Digital File - 1496

Surface Collections (choose one):

- ☒ no surface collection
- ☐ uncontrolled surface collection
- ☐ collections of specific items only
- ☐ controlled (sample: <100%)
- ☐ controlled (complete: 100%)
- ☐ other method (describe): _____

Records Inventory:

- ☒ site location map
- ☒ sketch map(s)
- ☐ instrument map(s)
- ☐ excavation, collection, analysis records
- ☒ photos, slides, and associated records
- ☐ other records: _____
- ☒ field journals, notes
- ☐ NM Historic Building Inventory form

Repository for Original Records: EMI

Repository for Collected Artifacts: N/A

3. CONDITION

Archaeological Status: ☐ surface collection ☐ test excavation ☐ partial excavation ☐ complete excavation

Disturbance Sources: ☐ wind erosion ☐ water erosion ☐ bioturbation ☐ vandalism ☒ construction/land development

☒ other source (specify): **camping**

Vandalism: ☐ defaced glyphs ☐ damaged/defaced building ☐ surface disturbance ☐ manual excavation

☐ mechanical excavation ☐ other vandalism (specify): _____

Percentage of Site Intact (choose one)**:** ☐ 0% ☐ 1-25% ☒ 26-50% ☐ 51-75% ☐ 76-99% ☐ 100%

Observations on Site Condition: FR 544 cuts through the extreme southern portion of the site and has not impacted a large area of the site. The artifacts are in the roadway are likely redeposited from the activities on the road.

4. RECOMMENDATIONS (for Performer/Recorder use only)

National Register Eligibility (choose one)**:** ☐ eligible ☐ not eligible ☒ not sure

Applicable Criteria: ☐ (a) ☐ (c)

☐ (b) ☐ (d)

Basis for Recommendation: In 2007, Lone Mountain Archaeological Services left the eligibility of LA 153873/AR-03-03-02-2770 undetermined due to lack of evidence for subsurface cultural deposits. The site is 80 percent intact in the area outside the roadway. The portion of the site in the roadway appears to be heavily disturbed and has previously incurred impacts. The site is recommended as having undetermined eligibility for nomination to the NRHP. EMI recommends nature and extent testing of the site to determine its NRHP eligibility.

Assessment of Project Impact: Unknown until road bed is tested for cultural deposits.

Treatment Recommendations: Forest Road 544 intersects the site, but it is uncertain how much of the site will be impacted. Since complete avoidance is not possible, testing is recommended to determine the extent and nature of any intact subsurface deposits in the road bed and to provide data for additional management recommendations which may include data recovery.

5. SHPO CONSULTATIONS (for SHPO and Sponsor use only)

Sponsor NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

Sponsor Staff: _____ **Date (dd-MMM-yyyy):** _____

Sponsor Remarks: _____

SHPO NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

HPD Staff: _____ **Date (dd-MMM-yyyy):** _____ **HPD Log No:** _____

Register Status: ☐ listed on National Register ☐ listed on State Register ☐ formal determination of eligibility

State Register No.: _____

SHPO Remarks: _____

6. LOCATION

Source Graphics:

☒ USGS 7.5' (1:24,000) topo maps ☐ rectified aerial photos [Scale: _____]

☐ other topo maps [Scale: _____] ☐ unrectified aerial photos [Scale: _____]

☒ GPS unit GPS accuracy (choose one): ☐ < 1.0 m ☒ 1-10 m ☐ 10-100 m ☐ >100 m

☐ other source (describe): _____

UTM Coordinates (@ center of site; at least one set of coordinates required):

Map-based Coordinates Datum: NAD27 **Zone:** 13 **E:** _____ **N:** _____

GPS-based Coordinates Datum: NAD27 **Zone:** 13 **E:** 255,520 **N:** 3,907,195

Directions to Site: From Grants, NM take Lobo Canyon Road (NM547) north to Forest Service Road 544. Turn left onto FR 544 the site is approximately 1 mile north side of the road.

In highway R-O-W? ☐ **Town** (if in city limits): _____ **State:** NM **County:** Cibola

USGS Quadrangle Name	Date	USGS Code
San Mateo, NM	1981	35107-C6

PLSS Meridian	Unplatted	Township	Range	Section	¼ Sections			Protracted?
New Mexico	☐	T 12 N	R 9 W	7	SE	NE	SW	☐
New Mexico	☐	T	R					☐
New Mexico	☐	T	R					☐

7. PHYSICAL DESCRIPTION

Site Dimensions: 76x70 meters **Basis for Dimensions** (choose one): ☐ estimated ☒ measured

Site Area: 5,320 sq m **Basis for Area** (choose one): ☐ estimated ☒ measured **Elevation:** 7,800 feet

Site Boundaries Complete? (choose one): ☒ Yes ☐ No (explain): _____

Basis for Site Boundaries: ☒ distribution of archeological features & artifacts ☐ modern features or ground disturbance

☐ property lines ☐ topographic features ☐ other (specify): _____

Depositional/Erosional Environment: ☒ alluvial ☐ aeolian ☐ colluvial ☐ residual ☐ no deposition (on bedrock)

☐ other process (describe): _____

Stratigraphy & Depth of Archeological Deposits (choose one): ☒ unknown/not determined

☐ no subsurface deposits present ☐ subsurface deposits present ☐ stratified subsurface deposits present

Estimated Depth of Deposits: unknown

Basis for Depth Determinations: ☐ estimated ☐ shovel/trowel tests ☐ core/auger tests ☐ excavations

☒ road or arroyo cuts ☐ rodent burrows ☐ other observations (describe): _____

Observations on Subsurface Archeological Deposits: Artifacts in the road bed, road cut and areas of mild alluvial erosion were also observed possibly indicating the presence of intact subsurface deposits. No diagnostic artifacts were identified on the site that would indicate age or cultural affiliation during this visit. FR 544 cuts through the extreme southern portion of the site and has not impacted a large area of the site. The artifacts are in the roadway are likely redeposited from the activities on the road.

Local Vegetation (list species in decreasing order of dominance)**:**

Overstory: _____

Understory: _____

Vegetation Community (choose one or two): ☐ forest ☐ woodland ☐ grassland ☐ scrubland ☐ desert scrubland ☐ marshland

☐ other community (specify): _____

Topographic Location:

☐ alluvial fan	☐ blowout	☐ flood plain/valley	☐ mesa/butte	☐ rockshelter
☐ arroyo/wash	☐ canyon rim	☐ foothill/mountain front	☐ mountain	☐ saddle
☐ badlands	☐ cave	☐ hill slope	☐ open canyon floor	☐ talus slope
☐ base of cliff	☐ cliff/scarp/bluff	☐ hill top	☐ plain/flat	☐ terrace
☐ base of talus slope	☐ constricted canyon	☐ lava flow (malpais)	☐ playa	

☐ other location (describe): _____

Observations on Site Setting: _____

8. ASSEMBLAGE DATA

Assemblage Content (all components)**:**

Lithics:

- ☒ lithic debitage
- ☐ chipped-stone tools
- ☐ diagnostic projectile points
- ☐ non-local lithic material
- ☐ stone-tool manufacturing items (cores, hammerstones, etc.)
- ☐ ground-stone tools
- ☐ other stone tools

Prehistoric Ceramics

- ☐ whole ceramic vessels
- ☒ diagnostic ceramics
- ☒ other prehistoric ceramics

Historic Artifacts:

- ☐ diagnostic glass artifacts
- ☐ other glass artifacts
- ☐ diagnostic metal artifacts
- ☐ other metal artifacts
- ☐ whole ceramic vessel
- ☐ diagnostic ceramics
- ☐ other historic ceramics

Other Artifacts and Materials:

- ☐ bone tools
- ☐ faunal remains
- ☐ macrobotanical remains
- ☐ perishable artifacts
- ☐ ornaments
- ☐ figurines
- ☐ mineral specimens
- ☐ architectural stone
- ☐ burned adobe
- ☐ fire-cracked rock/burned caliche

☐ Other items (specify): _____

Assemblage Size (all components)**:**

artifact class	estimated frequency: 0	1s	10s	100s	1000s	>10,000	*Counts (if <100)
lithic artifacts (choose one): (include debitage)	☐	☐	☐	☐	☐	☐	_____
prehistoric ceramics (choose one):	☐	☐	☐	☐	☐	☐	_____
historic artifacts (choose one):	☐	☐	☐	☐	☐	☐	_____
total assemblage size (choose one):	☐	☐	☐	☐	☐	☐	_____

Dating Potential: ☐ radiocarbon ☐ dendrochronology ☐ archeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Assemblage Remarks: Previously, the site was described as a lithic and ceramic scatter of 79 lithic artifacts and two ceramic sherds, both possibly Kiatuthlanna Black-on-white. Lithics consisted of primarily Grants Ridge obsidian although chalcedony, chert and petrified wood were also observed on site along with a basalt hammerstone fragment. During this survey, artifacts observed on the site consisted predominantly of obsidian flakes.

9. CULTURAL/TEMPORAL AFFILIATIONS

TOTAL NUMBER OF COMPONENTS DEFINED: 1

COMPONENT #1 (EARLIEST)

Cultural Affiliation: Pueblo

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records

☒ associated diagnostic artifact or feature types ☒ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:	Ancestral Puebloan	1 AD	1,600 AD
Latest Period (if any)**:**			

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify):

Basis for Cultural/Temporal Affiliation: Kiatuthana Black-on-white sherds in 2007 recording

Component Type: Artifact scatter

Remarks:

***Associated Phase/Complex Name(s):** Ancestral Puebloan

COMPONENT #2

Cultural Affiliation:

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records

☐ associated diagnostic artifact or feature types ☐ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:			
Latest Period (if any)**:**			

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify):

Basis for Cultural/Temporal Affiliation:

Component Type:

Remarks:

***Associated Phase/Complex Name(s):**

10. FEATURE DATA

(see NMCRIS User's guide for a list of valid feature types)

Feature Type	Reliable ID ?	# Observed	Assoc. Comp. #s	Feature ID, Notes

Feature Remarks: None observed

11. REFERENCES

Written Sources of Information: Results of a Cultural Resource Survey of 6.2 Miles of Roads (103 Acres) on Private and Forest Lands, and Approximately 22 Block Acres for Mine Facilities and an Escape Raise in the Cibola National Forest, Mt. Taylor Field Office, Cibola County, New Mexico (Harris et al, 2009)

Heritage Report #2009-03-133 (NMCRIS #114095)

Additional Sources of Information: _____

12. NARRATIVE DESCRIPTION

Site Description: LA 153873/AR-03-03-02-2770 was originally recorded by Lone Mountain Archaeological Services in 2007. In the 2007 report the site numbers were transposed for AR-03-03-02-2771 and AR-03-03-02-2770. A filed check of both sites confirms that the problem has been corrected. The site was described as a lithic and ceramic scatter of 79 lithic artifacts and two ceramic sherds, both possibly Kiatuthana Black-on-white. Lithics consisted of primarily Grants Ridge obsidian although chalcedony, chert and petrified wood were also observed on site along with a basalt hammerstone fragment. Site condition was reported as heavily disturbed due to road construction, recent camping (campfire rings), and ranching activities (site was near a corral).

During the present survey, artifacts observed on the site consisted predominantly of Grants Ridge obsidian flakes. Artifacts were also observed in the road bed, road cut and areas of mild alluvial erosion possibly indicating the presence of intact subsurface deposits. FR 544 cuts through the extreme southern portion of the site but has not impacted a large portion of the site. The portion of the site in the roadway has previously incurred impacts and appears to be heavily disturbed. The remaining portion of the site is in good condition and 80 percent intact. The site location information and site map included in the 2007 report are accurate and up to date.

Eligibility and Recommendation: In 2007, Lone Mountain Archaeological Services left the eligibility of LA 153873/AR-03-03-02-2770 undetermined due to lack of direct evidence for subsurface cultural deposits at the time. The site is determined to be 80 percent intact and the site may have datable subsurface cultural deposits that may yield important scientific information about Ancestral Puebloan settlement, subsistence and stone tool technology. Forest Road 544 intersects the site, but it is uncertain how much of the site will be impacted by road maintenance activities. The site was recommended as having undetermined eligibility for nomination to the NRHP in 2007. EMI concurs with undetermined status and recommends testing to determine the nature, integrity and extent of the site for NRHP eligibility status and further management recommendations.

Evaluation of Undertaking: Since complete avoidance is not possible, testing is recommended to determine the extent and nature of any intact subsurface deposits within the FR544 corridor and for eligibility determinations and additional management recommendations which may include data recovery.

13. SITE RECORD ATTACHMENTS

☒ site location map (USGS 7.5' topo; required) ☒ sketch map or site plan (required) ☐ continuation forms?

☒ other materials (itemize): Photo

Figure 1: Site overview of LA 153873/AR-03-03-02-2770, view to north

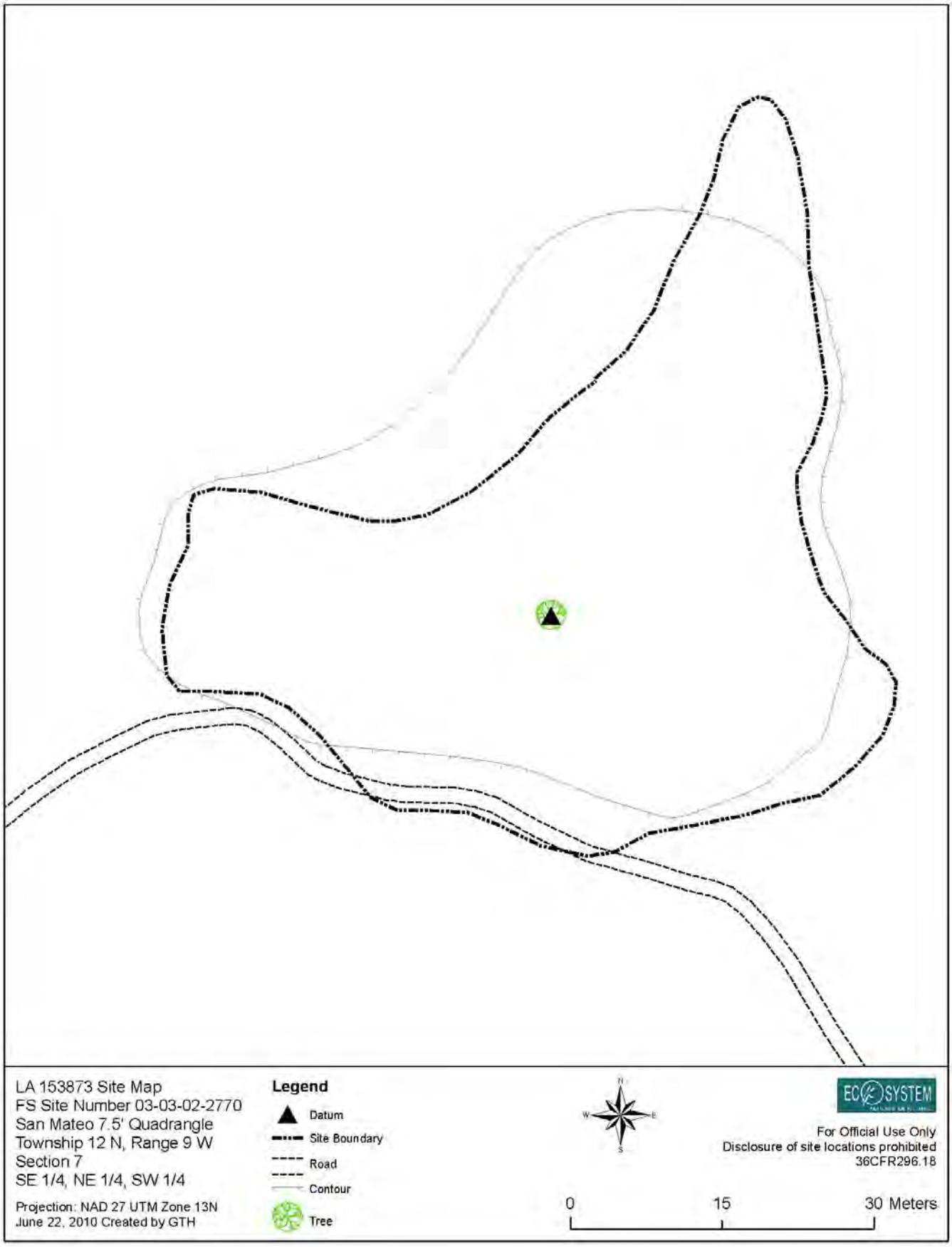

Figure 2: Site Map

LABORATORY OF ANTHROPOLOGY SITE RECORD

1. IDENTIFICATION & OWNERSHIP

LA Number: 163,193 (contact ARMS for site registration) ☐ **Site Update**? (complete at least Sections 1-4)

Site Name(s): EMI-GL-01

Other Site Number(s): **Agency Assigning Number:**

AR-03-03-02-2880 USDA-FS

_____ _____

_____ _____

Current Site Owner(s): Cibola National Forest, Mt. Taylor Ranger District

Site Type: Non-Structural **Occupation Type:** Prehistoric

2. RECORDING INFORMATION

NMCRIS Activity No.: 114095 **Field Site Number:** EMI-GL-01

Site Marker? ☒ (specify ID#)**:** 2880

Recorder(s): Garth Hayden, Zach Kneebone

Agency: EMI **Recording Date (dd-MMM-yyyy):** 11-06-2009

Site Accessibility (choose one)**:** ☒ accessible ☐ buried (sterile overburden) ☐ flooded ☐ urbanized ☐ not accessible

Surface Visibility (% visible; choose one)**:** ☐ 0% ☐ 1-25% ☐ 26-50% ☐ 51-75% ☒ 76-99% ☐ 100%

Remarks: Visibility is very good with little vegetation in a sandy terrain.

Recording Activities:

- ☒ sketch mapping
- ☐ instrument mapping (e.g., total station mapping)
- ☐ surface collection (controlled or uncontrolled)
- ☒ in-field artifact analysis
- ☐ other activities (specify): _____
- ☒ photography
- ☐ shovel or trowel tests; probes
- ☐ test excavation
- ☐ excavation (data recovery)

Description of Analysis or Excavation Activities: Analysis of a representative sample of ceramics and lithics. Photographs and mapping.

Photographic Documentation: Digital -1438, 1443, 1444, 1445

Surface Collections (choose one)**:**

- ☒ no surface collection
- ☐ uncontrolled surface collection
- ☐ collections of specific items only
- ☐ controlled (sample: <100%)
- ☐ controlled (complete: 100%)
- ☐ other method (describe): _____

Records Inventory:

- ☒ site location map
- ☒ sketch map(s)
- ☐ instrument map(s)
- ☒ excavation, collection, analysis records
- ☒ photos, slides, and associated records
- ☐ other records: _____
- ☐ field journals, notes
- ☐ NM Historic Building Inventory form

Repository for Original Records: EMI

Repository for Collected Artifacts: N/A

3. CONDITION

Archaeological Status: ☐ surface collection ☐ test excavation ☐ partial excavation ☐ complete excavation

Disturbance Sources: ☒ wind erosion ☒ water erosion ☐ bioturbation ☐ vandalism ☐ construction/land development

☒ other source (specify): cattle trampling

Vandalism: ☐ defaced glyphs ☐ damaged/defaced building ☐ surface disturbance ☐ manual excavation

☐ mechanical excavation ☐ other vandalism (specify): _____

Percentage of Site Intact (choose one)**:** ☐ 0% ☐ 1-25% ☐ 26-50% ☐ 51-75% ☒ 76-99% ☐ 100%

Observations on Site Condition: A 163193/AR-03-03-02-2880 is in good condition with 85 percent of the site remaining intact. The site is currently bisected by an unnamed dirt road. Other disturbances to the site include moderate alluvial and Aeolian erosion as well as some livestock trampling.

4. RECOMMENDATIONS (for Performer/Recorder use only)

National Register Eligibility (choose one)**:** ☐ eligible ☐ not eligible ☒ not sure

Applicable Criteria: ☐ (a) ☐ (c)

☐ (b) ☐ (d)

Basis for Recommendation: LA 163193/AR-03-03-02-2880 is in good condition with 85 percent of the site remaining intact. The site retains possible subsurface cultural deposits that may yield important scientific information about Ancestral Puebloan settlement, subsistence and stone tool procurement and technology. The site is recommended as having undetermined eligibility for nomination to the NRHP. EMI recommends nature and extent testing of the site to determine its NRHP eligibility.

Assessment of Project Impact: The site occurs in the area proposed for the "Growth Medium Stockpile" as well as part of the "Explosive Storage" area near the mining facilities. These proposed activities would impact the site and adverse affects to the site from project activities will occur.

Treatment Recommendations: LA 163193/AR-03-03-02-2880 likely contains significant subsurface cultural deposits based on observation of artifacts in areas of mild erosion. In addition, the site occurs in the area proposed for the "Growth Medium Stockpile" (pile of topsoil) as well as part of the "Explosive Storage" area near the mining facilities. These proposed activities would impact the site and adverse affects to the site from project activities will occur. The project proponent has agreed to relocate both the "Growth Medium Stockpile" and "Explosive Storage" areas from the site boundary. In addition to testing in the 40 ft improvement corridor, EMI recommends the site be fenced off to prevent access outside the roadway during construction and operation.

5. SHPO CONSULTATIONS (for SHPO and Sponsor use only)

Sponsor NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

Sponsor Staff: _____ **Date (dd-MMM-yyyy):** _____

Sponsor Remarks: _____

SHPO NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

HPD Staff: _____ **Date (dd-MMM-yyyy):** _____ **HPD Log No:** _____

Register Status: ☐ listed on National Register ☐ listed on State Register ☐ formal determination of eligibility

State Register No.: _____

SHPO Remarks: _____

6. LOCATION

Source Graphics:

☒ USGS 7.5' (1:24,000) topo maps ☐ rectified aerial photos [Scale: _____]

☐ other topo maps [Scale: _____] ☐ unrectified aerial photos [Scale: _____]

☒ GPS unit GPS accuracy (choose one): ☐ < 1.0 m ☒ 1-10 m ☐ 10-100 m ☐ >100 m

☐ other source (describe): _____

UTM Coordinates (@ center of site; at least one set of coordinates required):

Map-based Coordinates Datum: NAD27 **Zone:** 13 **E:** _____ **N:** _____

GPS-based Coordinates Datum: NAD27 **Zone:** 13 **E:** 248264 **N:** 3906810

Directions to Site: From Milan New Mexico take NM605 north for 5.4 miles. Turn Right onto an unpaved private road that connects to FR 450. The site is located 3 miles from Forest Service land boundary, at the base of La Jara Mesa along a finger ridge between two unnamed drainages to the northwest and southeast respectively.

In highway R-O-W? ☐ **Town** (if in city limits): _____ **State:** NM **County:** Cibola

USGS Quadrangle Name	Date	USGS Code
Dos Lomas, NM	1981	35107-C7

PLSS Meridian	Unplatted	Township	Range	Section	¼ Sections			Protracted?
New Mexico	☐	T 12 N	R 9 W	15	SE	NE	NE	☐
New Mexico	☐	T	R					☐
New Mexico	☐	T	R					☐

7. PHYSICAL DESCRIPTION

Site Dimensions: 109x87 meters **Basis for Dimensions** (choose one): ☐ estimated ☒ measured

Site Area: 9,483 sq m **Basis for Area** (choose one): ☐ estimated ☒ measured **Elevation:** 7,300 feet

Site Boundaries Complete? (choose one): ☒ Yes ☐ No (explain): _____

Basis for Site Boundaries: ☒ distribution of archeological features & artifacts ☐ modern features or ground disturbance

☐ property lines ☐ topographic features ☐ other (specify): _____

Depositional/Erosional Environment: ☐ alluvial ☒ aeolian ☐ colluvial ☐ residual ☐ no deposition (on bedrock)

☐ other process (describe): _____

Stratigraphy & Depth of Archeological Deposits (choose one): ☒ unknown/not determined

☐ no subsurface deposits present ☐ subsurface deposits present ☐ stratified subsurface deposits present

Estimated Depth of Deposits: unknown

Basis for Depth Determinations: ☐ estimated ☐ shovel/trowel tests ☐ core/auger tests ☐ excavations

☐ road or arroyo cuts ☐ rodent burrows ☐ other observations (describe): _____

Observations on Subsurface Archeological Deposits: Site likely contains significant subsurface cultural deposits based on observation of artifacts in areas of mild erosion.

Local Vegetation (list species in decreasing order of dominance)**:**

Overstory: **Piñon, Juniper, Sage**

Understory: **Cholla, Snakeweed**

Vegetation Community (choose one or two): ☐ forest ☒ woodland ☐ grassland ☐ scrubland ☒ desert scrubland ☐ marshland

☐ other community (specify): _____

Topographic Location:

☐ bench	☐ dune	☐ low rise	☒ ridge	
☐ alluvial fan	☐ blowout	☐ flood plain/valley	☐ mesa/butte	☐ rockshelter
☐ arroyo/wash	☐ canyon rim	☐ foothill/mountain front	☐ mountain	☐ saddle
☐ badlands	☐ cave	☐ hill slope	☐ open canyon floor	☐ talus slope
☐ base of cliff	☐ cliff/scarp/bluff	☐ hill top	☐ plain/flat	☐ terrace
☐ base of talus slope	☐ constricted canyon	☐ lava flow (malpais)	☐ playa	

☐ other location (describe): _____

Observations on Site Setting: **The site is located at the base of La Jara Mesa along a finger ridge between two unnamed drainages to the northwest and southeast respectively. The soils on the site consist of a yellowish brown sandy loam mixed with basalt inclusions from La Jara Mesa.**

8. ASSEMBLAGE DATA

Assemblage Content (all components)**:**

Lithics:

- ☒ lithic debitage
- ☐ chipped-stone tools
- ☐ diagnostic projectile points
- ☐ non-local lithic material
- ☐ stone-tool manufacturing items (cores, hammerstones, etc.)
- ☒ ground-stone tools
- ☐ other stone tools

Prehistoric Ceramics

- ☐ whole ceramic vessels
- ☒ diagnostic ceramics
- ☒ other prehistoric ceramics

Historic Artifacts:

- ☐ diagnostic glass artifacts
- ☐ other glass artifacts
- ☐ diagnostic metal artifacts
- ☐ other metal artifacts
- ☐ whole ceramic vessel
- ☐ diagnostic ceramics
- ☐ other historic ceramics

Other Artifacts and Materials:

- ☐ bone tools
- ☐ faunal remains
- ☐ macrobotanical remains
- ☐ perishable artifacts
- ☐ ornaments
- ☐ figurines
- ☐ mineral specimens
- ☐ architectural stone
- ☐ burned adobe
- ☐ fire-cracked rock/burned caliche

☐ Other items (specify): _____

Assemblage Size (all components)**:**

artifact class	estimated frequency: 0	1s	10s	100s	1000s	>10,000	*Counts (if <100)
lithic artifacts (choose one): (include debitage)	☐	☐	☒	☐	☐	☐	48
prehistoric ceramics (choose one):	☐	☐	☐	☒	☐	☐	200
historic artifacts (choose one):	☒	☐	☐	☐	☐	☐	
total assemblage size (choose one):	☐	☐	☐	☒	☐	☐	248

Dating Potential: ☐ radiocarbon ☐ dendrochronology ☐ archeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Assemblage Remarks: Forty-eight lithic artifacts were observed on the site, and all were analyzed in the field. Observed lithic artifacts consisted of lithic debitage and expediently-used flakes. Raw material type present on the site was dominated by locally available Grants Ridge obsidian (77 %). Other raw material types represented on the site consisted of basalt, chert, and chalcedony. Forty-four percent of the debitage exhibited some amount (>10 %) of cortex indicating raw material reduction occurred on site. One brown chert core and one obsidian core were observed on site and both were exhausted, although the brown chert core did exhibit some edge modification. Four expediently used flake tools were also observed and analyzed. Three were obsidian flakes with one edge expediently worked and one was a brown chert flake with edge modification. Ground stone artifacts included a sandstone sharpener with multiple ground sharpening grooves measuring 12 cm by 7 cm by 6 cm (with a sharpening groove approximately 6 cm in length), and a shaped vesicular basalt slab (possibly a metate blank) measuring 19 cm by 12 cm by 6 cm.

Ceramic artifacts on the site numbered over 100 sherds. A representative sample of 50 sherds was analyzed in the field. Sherds analyzed on the site included 8 sherds of Tusayan Corrugated (1030 AD to 1300 AD), 23 sherds of Mancos Corrugated (930 AD to 1100 AD), 11 sherds of Arboles Neck Banded (850 AD to 975 AD), 5 sherds of Rosa Gray, 1 sherd of Reserve Black on White (1050 AD to 1200 AD), 2 sherds of Kaituthlana Black on White and 1 sherd of Escavada Black on White (1000 AD to 1100 AD). The ceramic assemblage places the site in the early Pueblo II period.

9. CULTURAL/TEMPORAL AFFILIATIONS

TOTAL NUMBER OF COMPONENTS DEFINED: 1

COMPONENT #1 (EARLIEST)

Cultural Affiliation: Anasazi **Pueblo** I-II

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records

☒ associated diagnostic artifact or feature types ☐ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:	Late Pueblo I	900 AD	1,100 AD
Latest Period (if any)**:**	Early Pueblo II		

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Basis for Cultural/Temporal Affiliation: Diagnostic Ceramics

Component Type: Artifact scatter _____

Remarks: _____

***Associated Phase/Complex Name(s): PI - PII**

COMPONENT #2

Cultural Affiliation: _____

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records ☐ associated diagnostic artifact or feature types ☐ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:			
Latest Period (if any)**:**			

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration ☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Basis for Cultural/Temporal Affiliation: _____

Component Type: _____

Remarks: _____

***Associated Phase/Complex Name(s):** _____

10. FEATURE DATA

(see NMCRIS User's guide for a list of valid feature types)

Feature Type	Reliable ID ?	# Observed	Assoc. Comp. #s	Feature ID, Notes
Ceramic Scatter	Yes			Feature 1 is an artifact concentration with associated soil color change. The feature measures 25 meters by 22 meters. The high density of artifacts within this feature and the change in soil color may indicate that the feature was a midden. Artifacts within Feature 1 were mostly corrugated and plain grayware ceramic sherds, with three black on white painted ceramic sherds.
Lithic Scatter	Yes			Feature 2 consists of 23 obsidian flakes concentrated in a 14 m by 5 m area. No other lithic material was observed within this obsidian concentration. Nearly half of the sample (48%) consisted of whole flakes while the remainder consisted of distal, proximal, and medial flakes. Shatter comprised only two flakes. The average length of the whole flakes is 2.8 cm.

Feature Remarks: _____

11. REFERENCES

Written Sources of Information: Results of a Cultural Resource Survey of 6.2 Miles of Roads (103 Acres) on Private and Forest Lands, and Approximately 22 Block Acres for Mine Facilities and an Escape Raise in the Cibola National Forest, Mt. Taylor Field Office, Cibola County, New Mexico (Harris et al, 2009)

Heritage Report #2009-03-133 (NMCRIS #114095)

Additional Sources of Information: _____

12. NARRATIVE DESCRIPTION

Site Description: LA 163193/AR-03-03-02-2880 is an extensive prehistoric artifact scatter with lithic, ceramic and ground stone artifacts. The site is located at the base of La Jara Mesa along a finger ridge between two unnamed drainages to the northwest and southeast respectively. The soils on the site consist of a yellowish brown sandy loam mixed with basalt inclusions from La Jara Mesa. Vegetation observed on the site included piñon, juniper, sage, cholla and snakeweed. Two features were identified on the site (Feature 1 and Feature 2). The site is currently bisected by an unnamed dirt road. Other disturbances to the site include moderate alluvial and aeolian erosion as well as some livestock trampling. Artifacts were noted in eroded areas suggesting some intact deposits may be present. The site is in good condition with 85 percent of the site remaining intact.

Feature 1 is an artifact concentration with associated soil color change. The feature measures 25 meters by 22 meters. The density of artifacts within this feature and the change in soil color may indicate that the feature was a midden. Artifacts within Feature 1 were mostly corrugated and plain grayware ceramic sherds, with three black on white painted ceramic sherds.

Feature 2 consists of 23 obsidian flakes concentrated in a 14 m by 5 m area. No other lithic material was observed within this obsidian concentration. Nearly half of the sample (48%) consisted of whole flakes while the remainder consisted of distal, proximal, and medial flakes. Shatter comprised only two flakes. The average length of the whole flakes is 2.8 cm.

Forty-eight lithic artifacts were observed on the site, and all were analyzed in the field. Observed lithic artifacts consisted of lithic debitage and expediently-used flakes. Raw material type present on the site was dominated by locally available Grants Ridge obsidian (77 %). Other raw material types represented on the site consisted of basalt, chert, and chalcedony. Forty-four percent of the debitage exhibited some amount (>10 %) of cortex indicating raw material reduction occurred on site. One brown chert core and one obsidian core were observed on site and both were exhausted, although the brown chert core did exhibit some edge modification. Four flake tools were also observed and analyzed. Three were obsidian flakes with one edge expediently worked and one was a brown chert flake with edge modification.

Ground stone artifacts included a sandstone sharpener with multiple ground sharpening grooves measuring 12 cm by 7 cm by 6 cm (with a sharpening groove approximately 6 cm in length), and a shaped vesicular basalt slab (possibly a metate blank) measuring 19 cm by 12 cm by 6 cm.

Ceramic artifacts on the site numbered over 100 sherds. A representative sample of 50 sherds was analyzed in the field. Sherds analyzed on the site included 8 sherds of Tusayan Corrugated (1030 AD to 1300 AD), 23 sherds of Mancos Corrugated (930 AD to 1100 AD), 11 sherds of Arboles Neck Banded (850 AD to 975 AD), 5 sherds of Rosa Gray, 1 sherd of Reserve Black on White (1050 AD to 1200 AD), 2 sherds of Kaituthlana Black on White and 1 sherd of Escavada Black on White (1000 AD to 1100 AD). The ceramic assemblage places the site in the early Pueblo II period.

LA 163193/AR-03-03-02-2880 appears to be an activity area where stone tools were manufactured and food was processed. The presence of a midden (Feature 1) and the artifact assemblage suggest that this may be a habitation site, though no structural features were identified. Based on the artifact assemblage the site appears to date to the early Pueblo II period.

Eligibility and Recommendation: LA 163193/AR-03-03-02-2880 is in good condition with 85 percent of the site remaining intact with possible subsurface cultural deposits that may yield important scientific information about Ancestral Puebloan settlement, subsistence and stone tool procurement and technology. The site is recommended as having undetermined eligibility for nomination to the NRHP. EMI recommends the site as having undetermined status and recommends testing to determine the nature, integrity and extent of the site and for NRHP eligibility status within the 40 ft. wide improvement corridor along the unnamed access roadway.

In addition, the site occurs in the area proposed for the “Growth Medium Stockpile” (pile of topsoil) as well as part of the “Explosive Storage” area near the mining facilities. These proposed activities would impact the site and adverse affects to the site from project activities will occur. The project proponent has agreed to relocate both the “Growth Medium Stockpile” and “Explosive Storage” areas from the site boundary. In addition to testing in the 40 ft improvement corridor, EMI recommends the site be fenced off to prevent access outside the roadway during construction and operation.

Evaluation of Undertaking*:* The unnamed access road extends through the site. EMI recommends the site as having undetermined status and recommends testing to determine the nature and extent of the site within the 40 ft wide improvement corridor along the access roadway, for eligibility determination and further management recommendations which may include data recovery. In addition it is recommended the site be fenced off to prevent access to portions outside the roadway during construction and operation. Testing is recommended in the access road area to determine the depth and extent of the cultural deposits prior to any construction.

13. SITE RECORD ATTACHMENTS

☒ site location map (USGS 7.5' topo; required) ☒ sketch map or site plan (required) ☐ continuation forms?

☒ other materials (itemize): **Photos**

Figure 1: LA 163193/AR-03-03-02-2880 Site Overview

Figure 2: LA 163193/AR-03-03-02-2880 Corrugated Ceramics

Figure 3: LA 163193/AR-03-03-02-2880 Sharpener

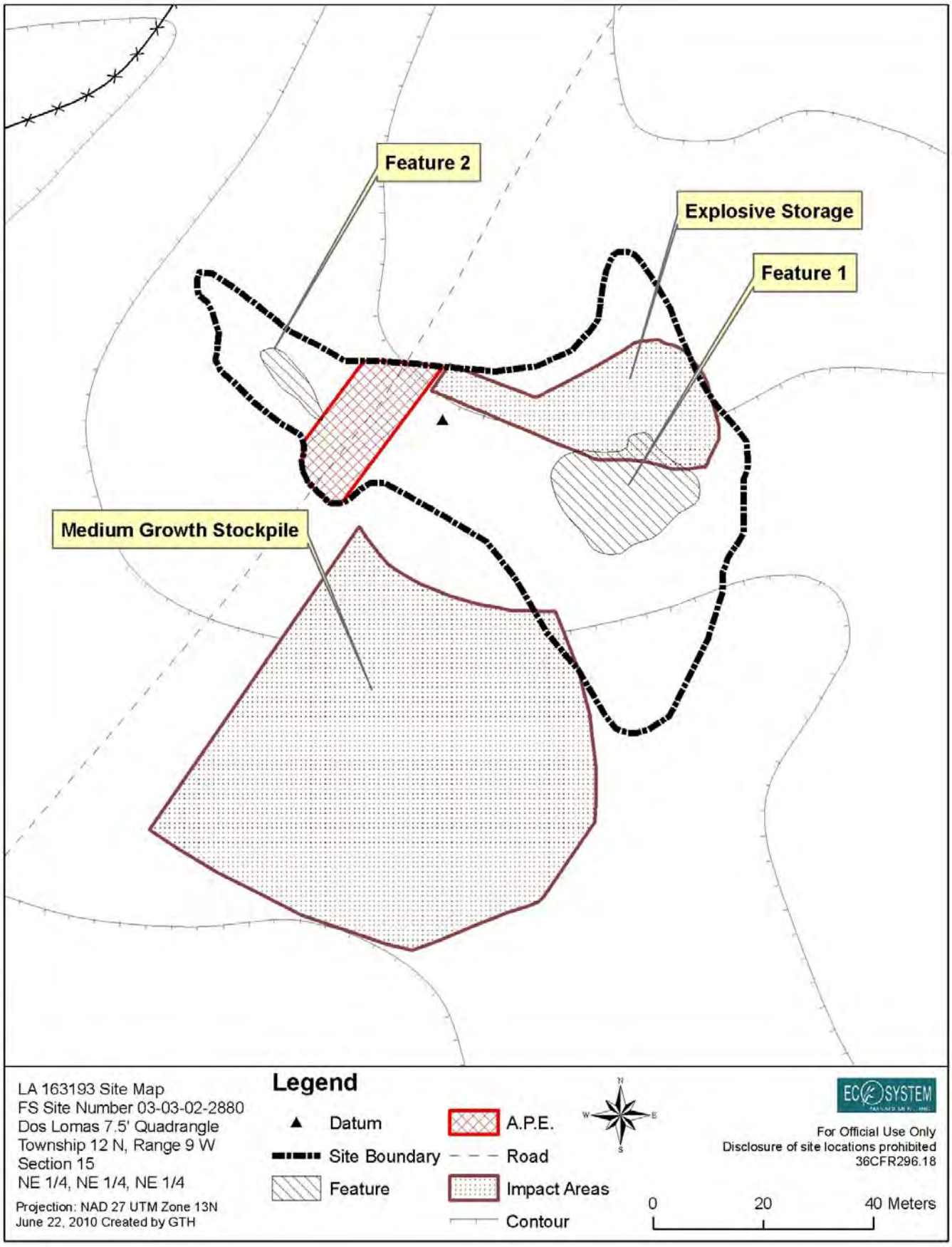

Figure 4: Site Map

LABORATORY OF ANTHROPOLOGY SITE RECORD

1. IDENTIFICATION & OWNERSHIP

LA Number: 163,194 (contact ARMS for site registration) ☐ **Site Update**? (complete at least Sections 1-4)

Site Name(s): EMI-GL-02

Other Site Number(s): AR-03-03-02-2881

Agency Assigning Number: USDA-FS

Current Site Owner(s): Cibola National Forest, Mt. Taylor Ranger District

Site Type: Non-Structural **Occupation Type:** Prehistoric

2. RECORDING INFORMATION

NMCRIS Activity No.: 114095 **Field Site Number:** EMI-GL-02

Site Marker? ☒ (specify ID#)**:** 2881

Recorder(s): Garth Hayden, Zach Kneebone

Agency: EMI **Recording Date (dd-MMM-yyyy):** 12-06-2009

Site Accessibility (choose one)**:** ☒ accessible ☐ buried (sterile overburden) ☐ flooded ☐ urbanized ☐ not accessible

Surface Visibility (% visible; choose one)**:** ☐ 0% ☐ 1-25% ☐ 26-50% ☐ 51-75% ☒ 76-99% ☐ 100%

Remarks: Visibility is very good with little vegetation in a sandy terrain.

Recording Activities:
- ☒ sketch mapping
- ☐ instrument mapping (e.g., total station mapping)
- ☐ surface collection (controlled or uncontrolled)
- ☒ in-field artifact analysis
- ☐ other activities (specify): _____
- ☒ photography
- ☐ shovel or trowel tests; probes
- ☐ test excavation
- ☐ excavation (data recovery)

Description of Analysis or Excavation Activities: Analysis of all lithics. Photographs and mapping.

Photographic Documentation: Digital file number 1487, 1488

Surface Collections (choose one)**:**
- ☒ no surface collection
- ☐ uncontrolled surface collection
- ☐ collections of specific items only
- ☐ controlled (sample: <100%)
- ☐ controlled (complete: 100%)
- ☐ other method (describe): _____

Records Inventory:
- ☒ site location map
- ☒ sketch map(s)
- ☐ instrument map(s)
- ☒ excavation, collection, analysis records
- ☒ photos, slides, and associated records
- ☐ other records: _____
- ☐ field journals, notes
- ☐ NM Historic Building Inventory form

Repository for Original Records: EMI

Repository for Collected Artifacts: N/A

3. CONDITION

Archaeological Status: ☐ surface collection ☐ test excavation ☐ partial excavation ☐ complete excavation

Disturbance Sources: ☐ wind erosion ☒ water erosion ☐ bioturbation ☐ vandalism ☒ construction/land development

☐ other source (specify): _____

Vandalism: ☐ defaced glyphs ☐ damaged/defaced building ☐ surface disturbance ☐ manual excavation

☐ mechanical excavation ☐ other vandalism (specify): _____

Percentage of Site Intact (choose one)**:** ☐ 0% ☐ 1-25% ☐ 26-50% ☐ 51-75% ☒ 76-99% ☐ 100%

Observations on Site Condition: The site is located on both the east and west sides of FR 450 F, though no artifacts were visible in the road bed or road cut. Current manifestations of the site occur approximately 5 meters from the road cut on both sides. The absence of artifacts in the road cut or road bed may indicate that the site has already been obliterated in that area. Artifacts are apparent eroding out of areas of mild alluvial erosion indicating subsurface intact cultural deposits. LA 163194 is in good condition despite disturbances and appears to retain approximately 85 percent of cultural deposits intact.

4. RECOMMENDATIONS (for Performer/Recorder use only)

National Register Eligibility (choose one)**:** ☐ eligible ☐ not eligible ☒ not sure

Applicable Criteria: ☐ (a) ☐ (c) ☐ (b) ☐ (d)

Basis for Recommendation: LA 163194/03-03-02-2881 is in good condition despite disturbances and appears to retain approximately 85 percent of cultural deposits intact. The site may have subsurface cultural deposits that may yield important scientific information about Archaic settlement, subsistence, stone tool technology and chronology. EMI recommends the site as having undetermined status and recommends testing to determine the nature, integrity and extent of the site within the 40 ft wide improvement corridor along the FR 450 F access roadway, for NRHP eligibility status and further management recommendations.

Assessment of Project Impact: LA 164194/03-03-02-2881 is bisected by FR 450 and will likely be affected by road improvements and maintenance.

Treatment Recommendations: LA 163194/03-03-02-2881 is located on both the east and west sides of FR 450. Because the nature and extent of the site are unknown, testing is recommended to determine whether there are intact deposits in and adjacent to the road that could be impacted if road maintenance or road improvement is necessary. Based on the results of testing, the portion of the site that still retains integrity should be avoided and protected from project related ground-disturbing activities.

5. SHPO CONSULTATIONS (for SHPO and Sponsor use only)

Sponsor NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

Sponsor Staff: _____ **Date (dd-MMM-yyyy):** _____

Sponsor Remarks: _____

SHPO NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

HPD Staff: _____ **Date (dd-MMM-yyyy):** _____ **HPD Log No:** _____

Register Status: ☐ listed on National Register ☐ listed on State Register ☐ formal determination of eligibility

State Register No.: _____

SHPO Remarks: _____

6. LOCATION

Source Graphics:

☒ USGS 7.5' (1:24,000) topo maps ☐ rectified aerial photos [Scale: _____]

☐ other topo maps [Scale: _____] ☐ unrectified aerial photos [Scale: _____]

☒ GPS unit GPS accuracy (choose one): ☐ < 1.0 m ☒ 1-10 m ☐ 10-100 m ☐ >100 m

☐ other source (describe): _____

UTM Coordinates (@ center of site; at least one set of coordinates required):

Map-based Coordinates Datum: NAD27 **Zone:** 13 **E:** _____ **N:** _____

GPS-based Coordinates Datum: NAD27 **Zone:** 13 **E:** 247667 **N:** 3904914

Directions to Site: From Milan New Mexico take NM605 north for 5.4 miles. Turn Right onto an unpaved private road that connects to FR 450. The site is located approximately 1.5 miles from Forest Service land boundary, and extends on both the east and west sides of FR 450. **In highway R-O-W?** ☐

Town (if in city limits): _____ **State:** NM **County:** Cibola

USGS Quadrangle Name	Date	USGS Code
Dos Lomas, NM	1981	35107-C7

PLSS Meridian	Unplatted	Township	Range	Section	¼ Sections			Protracted?
New Mexico	☐	T 12 N	R 9 W	22	NE	SW	NE	☐
New Mexico	☐	T _____	R _____	__	_____	_____	_____	☐
New Mexico	☐	T _____	R _____	__	_____	_____	_____	☐

7. PHYSICAL DESCRIPTION

Site Dimensions: 56x30 meters **Basis for Dimensions** (choose one): ☐ estimated ☒ measured

Site Area: 1,680 sq m **Basis for Area** (choose one): ☐ estimated ☐ measured **Elevation:** 7,000 feet

Site Boundaries Complete? (choose one): ☒ Yes ☐ No (explain): _____

Basis for Site Boundaries: ☒ distribution of archeological features & artifacts ☐ modern features or ground disturbance

☐ property lines ☐ topographic features ☐ other (specify): _____

Depositional/Erosional Environment: ☐ alluvial ☐ aeolian ☐ colluvial ☐ residual ☐ no deposition (on bedrock)

☐ other process (describe): _____

Stratigraphy & Depth of Archeological Deposits (choose one): ☒ unknown/not determined

☐ no subsurface deposits present ☐ subsurface deposits present ☐ stratified subsurface deposits present

Estimated Depth of Deposits: Unknown

Basis for Depth Determinations: ☒ estimated ☐ shovel/trowel tests ☐ core/auger tests ☐ excavations

☐ road or arroyo cuts ☐ rodent burrows ☐ other observations (describe): _____

Observations on Subsurface Archeological Deposits: Artifacts are apparent eroding out of areas of mild alluvial erosion approximately 5 m from the roadway indicating subsurface intact cultural deposits in these locations. LA 163194 is in good condition despite disturbances and appears to retain approximately 85 percent of cultural deposits intact.

Local Vegetation (list species in decreasing order of dominance)**:**

Overstory: **Piñon, Juniper**

Understory: **Cholla, Gramma, Sage**

Vegetation Community (choose one or two): ☐ forest ☒ woodland ☐ grassland ☐ scrubland ☒ desert scrubland ☐ marshland

☐ other community (specify): _____

Topographic Location:

☐ bench	☐ dune	☐ low rise	☐ ridge	
☐ alluvial fan	☐ blowout	☐ flood plain/valley	☐ mesa/butte	☐ rockshelter
☐ arroyo/wash	☐ canyon rim	☐ foothill/mountain front	☐ mountain	☐ saddle
☐ badlands	☐ cave	☐ hill slope	☐ open canyon floor	☐ talus slope
☐ base of cliff	☐ cliff/scarp/bluff	☐ hill top	☐ plain/flat	☐ terrace
☐ base of talus slope	☐ constricted canyon	☐ lava flow (malpais)	☐ playa	

☐ other location (describe): _____

Observations on Site Setting: **The site is located on both the east and west sides of FR 450 F, though no artifacts were visible in the road bed or road cut. Current manifestations of the site occur approximately 5 meters from the road cut on both sides.**

8. ASSEMBLAGE DATA

Assemblage Content (all components)**:**

Lithics:

- ☒ lithic debitage
- ☒ chipped-stone tools
- ☐ diagnostic projectile points
- ☐ non-local lithic material
- ☐ stone-tool manufacturing items (cores, hammerstones, etc.)
- ☐ ground-stone tools
- ☐ other stone tools

Prehistoric Ceramics

- ☐ whole ceramic vessels
- ☐ diagnostic ceramics
- ☐ other prehistoric ceramics

Historic Artifacts:

- ☐ diagnostic glass artifacts
- ☐ other glass artifacts
- ☐ diagnostic metal artifacts
- ☐ other metal artifacts
- ☐ whole ceramic vessel
- ☐ diagnostic ceramics
- ☐ other historic ceramics

Other Artifacts and Materials:

- ☐ bone tools
- ☐ faunal remains
- ☐ macrobotanical remains
- ☐ perishable artifacts
- ☐ ornaments
- ☐ figurines
- ☐ mineral specimens
- ☐ architectural stone
- ☐ burned adobe
- ☐ fire-cracked rock/burned caliche

☐ Other items (specify): _____

Assemblage Size (all components)**:** estimated frequency

artifact class	0	1s	10s	100s	1000s	>10,000	*Counts (if <100)
lithic artifacts (choose one): (include debitage)	☐	☐	☒	☐	☐	☐	23
prehistoric ceramics (choose one):	☒	☐	☐	☐	☐	☐	
historic artifacts (choose one):	☒	☐	☐	☐	☐	☐	
total assemblage size (choose one):	☐	☐	☒	☐	☐	☐	23

Dating Potential: ☐ radiocarbon ☐ dendrochronology ☐ archeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Assemblage Remarks: All of the lithic debitage observed on the site consisted of Grants Ridge Obsidian and included in Locus 1; 10 tertiary flakes, 2 secondary flakes and 1 primary flake. Numerous microflakes from pressure flaking activity mwere also observed in an ant hill within Locus 1. Locus 2 consisted of Grants Ridge Obsidian flakes including; 7 tertiary flakes and 2 secondary flakes.

PP1 was located in Locus 1 and is a distal fragment of a projectile point made from Grants Ridge obsidian. The mblade is has an excurvate edge with shallow serrations. The flaking pattern is random. Although the base is missing, the excurvate blade edge and serration of the blade are consistent with a San Jose projectile point (Justice 2002).

The site appears to be an activity area where stone tools were manufactured. Although not definitive, the distal projectile point fragment (PP1) is consistent with an Archaic San Jose Phase occupation (3300 BC to 1800 BC).

9. CULTURAL/TEMPORAL AFFILIATIONS

TOTAL NUMBER OF COMPONENTS DEFINED: 1

COMPONENT #1 (EARLIEST)

Cultural Affiliation: Archaic Oshara Tradition

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records

☒ associated diagnostic artifact or feature types ☒ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:	Oshara Tradition Archaic	3,300 BC	1,800 BC
Latest Period (if any)**:**			

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Basis for Cultural/Temporal Affiliation: Although not definitive, the distal projectile point fragment (PP1) is consistent with an Archaic San Jose Phase occupation (3300 BC to 1800 BC).

Component Type: Artifact scatter _____

Remarks: _____

***Associated Phase/Complex Name(s):** Archaic

COMPONENT #2

Cultural Affiliation: _____

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records ☐ associated diagnostic artifact or feature types ☐ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:			
Latest Period (if any)**:**			

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration ☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Basis for Cultural/Temporal Affiliation: _____

Component Type: _____

Remarks: _____

***Associated Phase/Complex Name(s):** _____

10. FEATURE DATA

(see NMCRIS User's guide for a list of valid feature types)

Feature Type	Reliable ID ?	# Observed	Assoc. Comp. #s	Feature ID, Notes

Feature Remarks: None

11. REFERENCES

Written Sources of Information: Results of a Cultural Resource Survey of 6.2 Miles of Roads (103 Acres) on Private and Forest Lands, and Approximately 22 Block Acres for Mine Facilities and an Escape Raise in the Cibola National Forest, Mt. Taylor Field Office, Cibola County, New Mexico (Harris et al, 2009)

Heritage Report #2009-03-133 (NMCRIS #114095)

Additional Sources of Information: _____

12. NARRATIVE DESCRIPTION

Site Description: LA 163194/03-03-02-2881 is a lithic scatter consisting primarily of Grants Ridge obsidian lithic debitage. The site is located on both the east and west sides of FR 450 F, though no artifacts were visible in the road bed or road cut. Current manifestations of the site occur approximately 5 meters from the road cut on both sides. The absence of artifacts in the road cut or road bed may indicate that the site has already been obliterated in that area. Artifacts are eroding out of areas of mild alluvial erosion indicating subsurface intact cultural deposits. All stages of lithic reduction are represented on the site. One distal fragment of a projectile point (PP1) was also located on the site. The site was divided into two loci, on the east and west sides of the road, respectively. Although FR 450 extends between the two loci, no artifacts were observed near the fence lines, in the road cut, the road bed or the intervening distance between the loci. LA 163194 is in good condition despite disturbances and appears to retain approximately 85 percent of cultural deposits intact.

All of the lithic debitage observed on the site consisted of Grants Ridge Obsidian and included in Locus 1; 10 tertiary flakes, 2 secondary flakes and 1 primary flake. Numerous micro flakes from pressure flaking activity were also observed in an ant hill within Locus 1. Locus 2 consisted of Grants Ridge Obsidian flakes including; 7 tertiary flakes and 2 secondary flakes.

PP1 was located in Locus 1 and is a distal fragment of a projectile point made from Grants Ridge obsidian. The blade has an excurvate edge with shallow serrations. The flaking pattern is random. Although the base is missing, the excurvate blade edge and serration of the blade are consistent with a San Jose projectile point (Justice 2002).

The site appears to be an activity area where stone tools were manufactured. Although not definitive, the distal projectile point fragment (PP1) is consistent with an Archaic San Jose Phase occupation (3300 BC to 1800 BC).

Eligibility and Recommendation: LA 163194/03-03-02-2881 is in good condition despite disturbances and appears to retain approximately 85 percent of cultural deposits intact. The site may have subsurface cultural deposits that may yield important scientific information about Archaic settlement, subsistence, stone tool technology and chronology. EMI recommends the site as having undetermined status and recommends testing to determine the nature, integrity and extent of the site within the 40 ft wide improvement corridor along the FR 450 F access roadway, for NRHP eligibility status and further management recommendations.

Evaluation of Undertaking*:* LA 163194/03-03-02-2881 is located on both the east and west sides of FR 450. The equipment haul road, water lines and transmission lines will intersect the site. Since complete avoidance is not possible, EMI recommends testing to determine the nature and extent of the site within the 40 ft wide improvement corridor along the access roadway, for eligibility determination and further management recommendations which may include data recovery.

13. SITE RECORD ATTACHMENTS

☒ site location map (USGS 7.5' topo; required) ☒ sketch map or site plan (required) ☐ continuation forms?

☒ other materials (itemize): **Photos**

Figure 1: Site 03-03-02-2881/LA 163194 Site Overview

Figure 2: Site 03-03-02-2881/LA 163194 Projectile Point Fragment

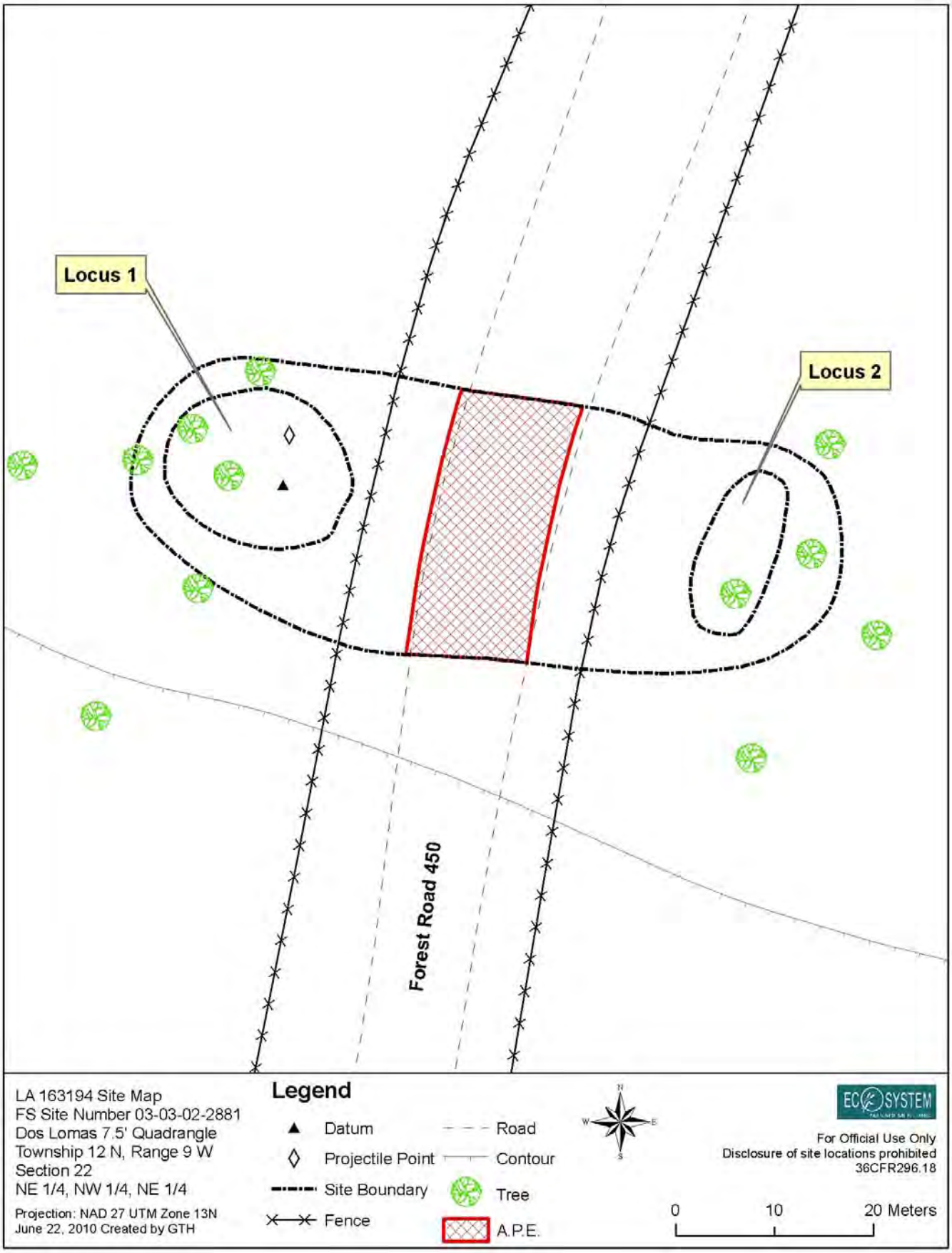

Figure 3: Site Map

LABORATORY OF ANTHROPOLOGY SITE RECORD

1. IDENTIFICATION & OWNERSHIP

LA Number: 163,195 (contact ARMS for site registration) ☐ **Site Update**? (complete at least Sections 1-4)

Site Name(s): EMI-GL-03

Other Site Number(s): **Agency Assigning Number:**

_ _

_____ _____

_____ _____

Current Site Owner(s): Private Land

Site Type: Non-Structural **Occupation Type:** Prehistoric

2. RECORDING INFORMATION

NMCRIS Activity No.: 114095 **Field Site Number:** EMI-GL-03

Site Marker? ☒ (specify ID#)**:** EMI-GL-03

Recorder(s): Garth Hayden, Zach Kneebone

Agency: EMI **Recording Date (dd-MMM-yyyy):** 12-06-2009

Site Accessibility (choose one)**:** ☒ accessible ☐ buried (sterile overburden) ☐ flooded ☐ urbanized ☐ not accessible

Surface Visibility (% visible; choose one)**:** ☐ 0% ☐ 1-25% ☐ 26-50% ☐ 51-75% ☒ 76-99% ☐ 100%

Remarks: Visibility is very good with little vegetation on a sandy terrain.

Recording Activities:

- ☒ sketch mapping
- ☐ instrument mapping (e.g., total station mapping)
- ☐ surface collection (controlled or uncontrolled)
- ☒ in-field artifact analysis
- ☐ other activities (specify): _____
- ☒ photography
- ☐ shovel or trowel tests; probes
- ☐ test excavation
- ☐ excavation (data recovery)

Description of Analysis or Excavation Activities: Analysis of all lithics. Photographs and mapping.

Photographic Documentation: Digital File 1482, 1483

Surface Collections (choose one)**:**

- ☒ no surface collection
- ☐ uncontrolled surface collection
- ☐ collections of specific items only
- ☐ controlled (sample: <100%)
- ☐ controlled (complete: 100%)
- ☐ other method (describe): _____

Records Inventory:

- ☒ site location map
- ☒ sketch map(s)
- ☐ instrument map(s)
- ☒ excavation, collection, analysis records
- ☒ photos, slides, and associated records
- ☐ other records: _____
- ☐ field journals, notes
- ☐ NM Historic Building Inventory form

Repository for Original Records: EMI

Repository for Collected Artifacts: N/A

3. CONDITION

Archaeological Status: ☐ surface collection ☐ test excavation ☐ partial excavation ☐ complete excavation

Disturbance Sources: ☒ wind erosion ☐ water erosion ☐ bioturbation ☐ vandalism ☒ construction/land development

☒ other source (specify): Livestock trampling

Vandalism: ☐ defaced glyphs ☐ damaged/defaced building ☐ surface disturbance ☐ manual excavation

☐ mechanical excavation ☐ other vandalism (specify): _____

Percentage of Site Intact (choose one)**:** ☐ 0% ☐ 1-25% ☐ 26-50% ☐ 51-75% ☒ 76-99% ☐ 100%

Observations on Site Condition: The site is currently bisected by two access roads to FR 450 as well as a stock tank area. The site has been further disturbed by vehicular traffic, heavy livestock trampling and aeolian erosion. Despite the road and livestock damage, LA 163195 is in good condition with an estimated 80 percent remaining intact. The portion of the site in the existing roadway appears to be somewhat disturbed however intact deposits in the roadway are possible considering the fact that these roads are not as heavily traveled as FR 450.

4. RECOMMENDATIONS (for Performer/Recorder use only)

National Register Eligibility (choose one)**:** ☐ eligible ☐ not eligible ☒ not sure

Applicable Criteria: ☐ (a) ☐ (c) ☐ (b) ☐ (d)

Basis for Recommendation: Despite the road and livestock damage, LA 163195 is in good condition with an estimated 80 percent remaining intact. The site may have datable subsurface cultural deposits that may yield important scientific information about Archaic settlement, subsistence and stone tool technology. The site is recommended as having undetermined eligibility for nomination to the NRHP. Avoidance of this site was recommended. The site should be avoided by utilizing the alternate route to access Forest Road 450. If avoidance is not possible then EMI recommends testing to determine the nature, extent, and integrity for NRHP eligibility status and further management recommendations. The project proponent has agreed to use the alternate route for project related activities in order to avoid the site.

Assessment of Project Impact: Provided that the proponent constructs and uses the alternate route to access the mine, this site will not be affected as it will be outside of the area of potential effect.

Treatment Recommendations: The initially proposed location of the equipment haul road, well and water lines would have intersected the site. EMI recommends that the site be avoided. The site should be avoided by utilizing the alternate route to access Forest Road 450. The project proponent has agreed to use an alternate route for project related activities in order to avoid the site. If avoidance is not possible then EMI recommends testing to determine the nature, extent and integrity for NRHP eligibility status and further management recommendations.

5. SHPO CONSULTATIONS (for SHPO and Sponsor use only)

Sponsor NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

Sponsor Staff: _____ **Date (dd-MMM-yyyy):** _____

Sponsor Remarks: _____

SHPO NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

HPD Staff: _____ **Date (dd-MMM-yyyy):** _____ **HPD Log No:** _____

Register Status: ☐ listed on National Register ☐ listed on State Register ☐ formal determination of eligibility

State Register No.: _____

SHPO Remarks: _____

6. LOCATION

Source Graphics:

☒ USGS 7.5' (1:24,000) topo maps ☐ rectified aerial photos [Scale: _____]

☐ other topo maps [Scale: _____] ☐ unrectified aerial photos [Scale: _____]

☒ GPS unit GPS accuracy (choose one): ☐ < 1.0 m ☒ 1-10 m ☐ 10-100 m ☐ >100 m

☐ other source (describe): _____

UTM Coordinates (@ center of site; at least one set of coordinates required):

Map-based Coordinates Datum: NAD27 **Zone:** 13 **E:** _____ **N:** _____

GPS-based Coordinates Datum: NAD27 **Zone:** 13 **E:** 246641 **N:** 3902999

Directions to Site: From Milan New Mexico take NM605 north for 5.4 miles. Turn Right onto an unpaved private road that connects to FR 450. Site is located 3 miles along private road connecting to FR 450.

In highway R-O-W? ☐ **Town** (if in city limits): _____ **State:** NM **County:** Cibola

USGS Quadrangle Name	Date	USGS Code
Grants, NM	1982	35107-B7

PLSS Meridian	Unplatted	Township	Range	Section	¼ Sections			Protracted?
New Mexico	☐	T 12 N	R 9 W	28	SE	SE	NE	☐
New Mexico	☐	T	R					☐
New Mexico	☐	T	R					☐

7. PHYSICAL DESCRIPTION

Site Dimensions: 70x35 meters **Basis for Dimensions** (choose one): ☐ estimated ☒ measured

Site Area: 2450 sq m **Basis for Area** (choose one): ☐ estimated ☐ measured **Elevation:** 7,000 feet

Site Boundaries Complete? (choose one): ☒ Yes ☐ No (explain): _____

Basis for Site Boundaries: ☒ distribution of archeological features & artifacts ☐ modern features or ground disturbance

☐ property lines ☐ topographic features ☐ other (specify): _____

Depositional/Erosional Environment: ☐ alluvial ☒ aeolian ☐ colluvial ☐ residual ☐ no deposition (on bedrock)

☐ other process (describe): _____

Stratigraphy & Depth of Archeological Deposits (choose one): ☒ unknown/not determined

☐ no subsurface deposits present ☐ subsurface deposits present ☐ stratified subsurface deposits present

Estimated Depth of Deposits: Unknown

Basis for Depth Determinations: ☒ estimated ☐ shovel/trowel tests ☐ core/auger tests ☐ excavations

☒ road or arroyo cuts ☐ rodent burrows ☐ other observations (describe): _____

Observations on Subsurface Archeological Deposits: Due to the artifact density and evidence of artifacts in the road cut sidewall and in the roadway, the site may have datable subsurface cultural deposits that may yield important scientific information about Archaic settlement, subsistence and stone tool technology.

Local Vegetation (list species in decreasing order of dominance)**:**

Overstory: _____

Understory: **Sage, Indian Rice Grass and Rabbit Brush**

Vegetation Community (choose one or two): ☐ forest ☐ woodland ☐ grassland ☐ scrubland ☒ desert scrubland ☐ marshland

☐ other community (specify): _____

Topographic Location:	☐ bench	☐ dune	☐ low rise	☒ ridge
☐ alluvial fan	☐ blowout	☐ flood plain/valley	☐ mesa/butte	☐ rockshelter
☐ arroyo/wash	☐ canyon rim	☐ foothill/mountain front	☐ mountain	☐ saddle
☐ badlands	☐ cave	☐ hill slope	☐ open canyon floor	☐ talus slope
☐ base of cliff	☐ cliff/scarp/bluff	☐ hill top	☐ plain/flat	☐ terrace
☐ base of talus slope	☐ constricted canyon	☐ lava flow (malpais)	☐ playa	

☐ other location (describe): _____

Observations on Site Setting: **Wide finger ridge that trends to the southeast from the base of La Jara Mesa. The site is currently bisected by two access roads to FR 450 as well as a stock tank area.**

8. ASSEMBLAGE DATA

Assemblage Content (all components)**:**

Lithics:

- ☒ lithic debitage
- ☒ chipped-stone tools
- ☒ diagnostic projectile points
- ☐ non-local lithic material
- ☐ stone-tool manufacturing items (cores, hammerstones, etc.)
- ☒ ground-stone tools
- ☐ other stone tools

Prehistoric Ceramics

- ☐ whole ceramic vessels
- ☐ diagnostic ceramics
- ☐ other prehistoric ceramics

Historic Artifacts:

- ☐ diagnostic glass artifacts
- ☐ other glass artifacts
- ☐ diagnostic metal artifacts
- ☐ other metal artifacts
- ☐ whole ceramic vessel
- ☐ diagnostic ceramics
- ☐ other historic ceramics

Other Artifacts and Materials:

- ☐ bone tools
- ☐ faunal remains
- ☐ macrobotanical remains
- ☐ perishable artifacts
- ☐ ornaments
- ☐ figurines
- ☐ mineral specimens
- ☐ architectural stone
- ☐ burned adobe
- ☐ fire-cracked rock/burned caliche

☐ Other items (specify): _____

Assemblage Size (all components)**:**

artifact class	0	1s	10s	100s	1000s	>10,000	*Counts (if <100)
lithic artifacts (choose one): (include debitage)	☐	☒	☐	☐	☐	☐	17
prehistoric ceramics (choose one):	☒	☐	☐	☐	☐	☐	
historic artifacts (choose one):	☒	☐	☐	☐	☐	☐	
total assemblage size (choose one):	☐	☒	☐	☐	☐	☐	17

Dating Potential: ☐ radiocarbon ☐ dendrochronology ☐ archeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Assemblage Remarks: Flaked stone artifacts on the site were mostly of Grants Ridge obsidian and included; 9 tertiary flakes, 4 secondary flakes and 2 primary flakes. Two secondary flakes were of fine grained basalt. One projectile point fragment, Projectile Point 1 (PP1), is a side notched and basally ground projectile point base fragment. The point was constructed from Grants Ridge obsidian and appears to be a San Jose type. A ground stone mano (GS1) of vesicular basalt was also observed on the site and it measured 12 cm by 11.5 cm by 4.5 cm.

9. CULTURAL/TEMPORAL AFFILIATIONS

TOTAL NUMBER OF COMPONENTS DEFINED: 1

COMPONENT #1 (EARLIEST)

Cultural Affiliation: Archaic Oshara Tradition

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records

☒ associated diagnostic artifact or feature types ☐ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:	Oshara Tradition Archaic	3,300 BC	1,800 BC
Latest Period (if any)**:**			

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Basis for Cultural/Temporal Affiliation: One San Jose point fragment (PP1) was located on the site indicating a San Jose Phase Archaic occupation.

Component Type: Artifact scatter _____

Remarks: _____

***Associated Phase/Complex Name(s):** Archaic

COMPONENT #2

Cultural Affiliation: _____ _____

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records

☐ associated diagnostic artifact or feature types ☐ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:	_____		
Latest Period (if any)**:**	_____	_____	_____

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Basis for Cultural/Temporal Affiliation: _____

Component Type: _____ _____

Remarks: _____

***Associated Phase/Complex Name(s):** _____

10. FEATURE DATA

(see NMCRIS User's guide for a list of valid feature types)

Feature Type	Reliable ID ?	# Observed	Assoc. Comp. #s	Feature ID, Notes
_____	_____	_____	__	_____

Feature Remarks: None observed

11. REFERENCES

Written Sources of Information: Results of a Cultural Resource Survey of 6.2 Miles of Roads (103 Acres) on Private and Forest Lands, and Approximately 22 Block Acres for Mine Facilities and an Escape Raise in the Cibola National Forest, Mt. Taylor Field Office, Cibola County, New Mexico (Harris et al, 2009)

Heritage Report #2009-03-133 (NMCRIS #114095)

Additional Sources of Information: _____

12. NARRATIVE DESCRIPTION

Site Description: LA 163195 is a lithic scatter consisting of ground and flaked stone artifacts. Vegetation on the site is sparse, primarily consisting of sage, Indian rice grass and rabbitbrush. The site is currently bisected by Elkin's Road as well as a stock tank area. The portion of the site in the existing roadway is disturbed; however, intact deposits in the roadway are possible. The site has been further disturbed by vehicular traffic, heavy livestock trampling and aeolian erosion. There is evidence of artifacts in the road cut sidewall and in the roadway.

Flaked stone artifacts on the site were mostly of Grants Ridge obsidian and included 9 tertiary flakes, 4 secondary and 2 primary flakes and one projectile point fragment. The two secondary flakes were of fine grained basalt. The projectile point fragment, Projectile Point 1 (PP1), is a side notched and basally ground projectile point base fragment of Grants Ridge obsidian and appears to be a San Jose type. A ground stone mano (GS1) of vesicular basalt was also observed on the site and measured 12 cm by 11.5 cm by 4.5 cm.

The site appears to be an activity area where stone tools were manufactured and food was processed. One San Jose point fragment (PP1) was located on the site indicating a San Jose Phase Archaic occupation.

NOTE: This site is located on original access road. The alternative access road will now re-route to avoid this site.

Eligibility and Recommendation: Despite the road and livestock damage, LA 163195 is in good condition with an estimated 80 percent remaining intact. The site may have datable subsurface cultural deposits that may yield important scientific information about Archaic settlement, subsistence and stone tool technology. The site is recommended as having undetermined eligibility for nomination to the NRHP. Avoidance of this site was recommended. The site should be avoided by utilizing the alternate route to access Forest Road 450. If avoidance is not possible then EMI recommends testing to determine the nature, extent, and integrity for NRHP eligibility status and further management recommendations. The project proponent has agreed to use the alternate route for project related activities in order to avoid the site.

Evaluation of Undertaking*:* The initially proposed location of the equipment haul road, well and water lines would have intersected the site. EMI recommends that the site be avoided. The site should be avoided by utilizing the alternate route to access Forest Road 450. The project proponent has agreed to use an alternate route for project related activities in order to avoid the site. If avoidance is not possible then EMI recommends testing to determine the nature, extent and integrity for NRHP eligibility status and further management recommendations. Provided that the proponent constructs and uses the alternate route to access the mine, this site will not be affected as it will be outside of the area of potential effect.

13. SITE RECORD ATTACHMENTS

☒ site location map (USGS 7.5' topo; required) ☒ sketch map or site plan (required) ☐ continuation forms?

☒ other materials (itemize): **Photos**

Figure 1: LA 163195 Overview facing southwest

Figure 2: LA 163195 Projectile Point 1

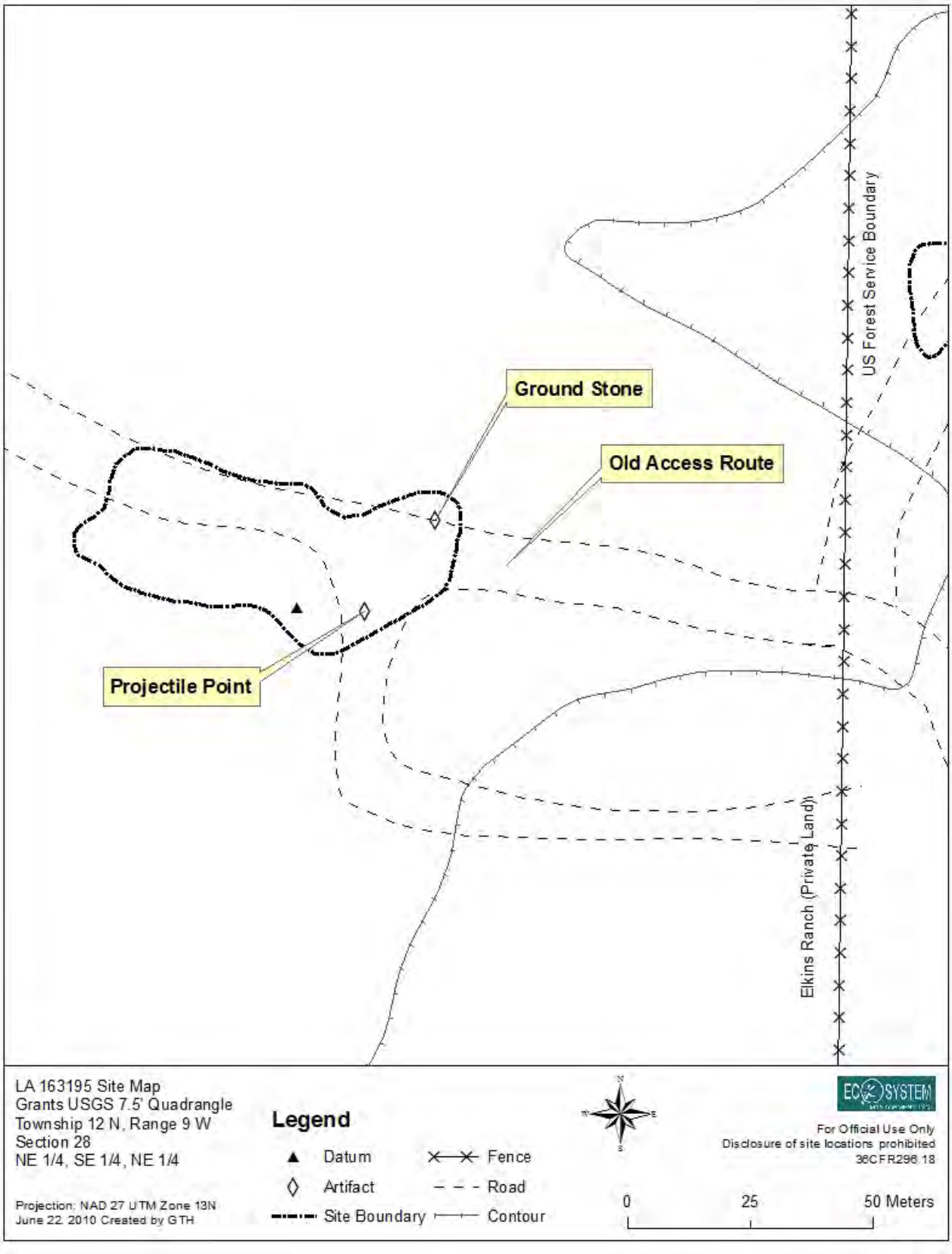

Figure 1: Site Map

LABORATORY OF ANTHROPOLOGY SITE RECORD

1. IDENTIFICATION & OWNERSHIP

LA Number: 163,196 (contact ARMS for site registration) ☐ **Site Update**? (complete at least Sections 1-4)

Site Name(s): EMI-GL-04

Other Site Number(s): **Agency Assigning Number:**

_ _

_____ _____

_____ _____

Current Site Owner(s): Private Land

Site Type: Non-Structural **Occupation Type:** Prehistoric

2. RECORDING INFORMATION

NMCRIS Activity No.: 114095 **Field Site Number:** EMI-GL-04

Site Marker? ☒ (specify ID#)**:** EMI-GL-04

Recorder(s): Garth Hayden, Zach Kneebone

Agency: EMI **Recording Date (dd-MMM-yyyy):** 12-06-2009

Site Accessibility (choose one)**:** ☒ accessible ☐ buried (sterile overburden) ☐ flooded ☐ urbanized ☐ not accessible

Surface Visibility (% visible; choose one)**:** ☐ 0% ☐ 1-25% ☐ 26-50% ☐ 51-75% ☒ 76-99% ☐ 100%

Remarks: Visibility is very good with little vegetation on a sandy terrain.

Recording Activities:

- ☒ sketch mapping
- ☐ instrument mapping (e.g., total station mapping)
- ☐ surface collection (controlled or uncontrolled)
- ☒ in-field artifact analysis
- ☐ other activities (specify): _____
- ☒ photography
- ☐ shovel or trowel tests; probes
- ☐ test excavation
- ☐ excavation (data recovery)

Description of Analysis or Excavation Activities: Analysis of all lithics found on surface. Photographs and mapping.

Photographic Documentation: Digital File 1481

Surface Collections (choose one)**:**

- ☒ no surface collection
- ☐ uncontrolled surface collection
- ☐ collections of specific items only
- ☐ controlled (sample: <100%)
- ☐ controlled (complete: 100%)
- ☐ other method (describe): _____

Records Inventory:

- ☒ site location map
- ☒ sketch map(s)
- ☐ instrument map(s)
- ☒ excavation, collection, analysis records
- ☒ photos, slides, and associated records
- ☐ other records: _____
- ☐ field journals, notes
- ☐ NM Historic Building Inventory form

Repository for Original Records: EMI

Repository for Collected Artifacts: N/A

3. CONDITION

Archaeological Status: ☐ surface collection ☐ test excavation ☐ partial excavation ☐ complete excavation

Disturbance Sources: ☒ wind erosion ☐ water erosion ☐ bioturbation ☐ vandalism ☐ construction/land development

☒ other source (specify): **Livestock trampling**

Vandalism: ☐ defaced glyphs ☐ damaged/defaced building ☐ surface disturbance ☐ manual excavation

☐ mechanical excavation ☐ other vandalism (specify): _____

Percentage of Site Intact (choose one)**:** ☐ 0% ☐ 1-25% ☒ 26-50% ☐ 51-75% ☐ 76-99% ☐ 100%

Observations on Site Condition: **LA 163196 is located in a partially solidified sand dune that is bisected by the access road to FR 450. Artifacts are exposed in the road bed and in the road cut to a height of approximately 50 cm above the road. The site has been further disturbed by vehicular traffic, heavy livestock trampling and aeolian erosion and site damage is estimated at 50%.**

4. RECOMMENDATIONS (for Performer/Recorder use only)

National Register Eligibility (choose one)**:** ☐ eligible ☐ not eligible ☒ not sure

Applicable Criteria: ☐ (a) ☐ (c) ☐ (b) ☐ (d)

Basis for Recommendation: **Despite the road and livestock damage, LA 163195 is in good condition with an estimated 80 percent remaining intact. The site may have datable subsurface cultural deposits that may yield important scientific information about Archaic settlement, subsistence and stone tool technology. The site is recommended as having undetermined eligibility for nomination to the NRHP. Avoidance of this site was recommended. The site should be avoided by utilizing the alternate route to access Forest Road 450. If avoidance is not possible then EMI recommends testing to determine the nature, extent, and integrity for NRHP eligibility status and further management recommendations. The project proponent has agreed to use the alternate route for project related activities in order to avoid the site.**

Assessment of Project Impact: **Provided that the proponent constructs and uses the alternate route to access the mine, this site will not be affected as it will be outside of the area of potential effect.**

Treatment Recommendations: **The initially proposed location of the equipment haul road, well and water lines would have intersected the site. EMI recommends that the site be avoided. The site should be avoided by utilizing the alternate route to access Forest Road 450. The project proponent has agreed to use an alternate route for project related activities in order to avoid the site. If avoidance is not possible then EMI recommends testing to determine the nature, extent and integrity for NRHP eligibility status and further management recommendations.**

5. SHPO CONSULTATIONS (for SHPO and Sponsor use only)

Sponsor NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

Sponsor Staff: _____ **Date (dd-MMM-yyyy):** _____

Sponsor Remarks: _____

SHPO NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

HPD Staff: _____ **Date (dd-MMM-yyyy):** _____ **HPD Log No:** _____

Register Status: ☐ listed on National Register ☐ listed on State Register ☐ formal determination of eligibility

State Register No.: _____

SHPO Remarks: _____

6. LOCATION

Source Graphics:

☒ USGS 7.5' (1:24,000) topo maps ☐ rectified aerial photos [Scale: _____]

☐ other topo maps [Scale: _____] ☐ unrectified aerial photos [Scale: _____]

☒ GPS unit GPS accuracy (choose one): ☐ < 1.0 m ☒ 1-10 m ☐ 10-100 m ☐ >100 m

☐ other source (describe): _____

UTM Coordinates (@ center of site; at least one set of coordinates required):

Map-based Coordinates Datum: NAD27 **Zone:** 13 **E:** _____ **N:** _____

GPS-based Coordinates Datum: NAD27 **Zone:** 13 **E:** 246,504 **N:** 3,903,097

Directions to Site: From Milan New Mexico take NM605 north for 5.4 miles. Turn Right onto an unpaved private road that connects to FR 450. Site is located 2.5 miles along private road connecting to FR 450.

In highway R-O-W? ☐ **Town** (if in city limits): _____ **State:** NM **County:** Cibola

USGS Quadrangle Name	Date	USGS Code
Grants, NM	1982	35107-B7

PLSS Meridian	Unplatted	Township	Range	Section	¼ Sections			Protracted?
New Mexico	☐	T 12 N	R 9 W	28	SW	SE	NE	☐
New Mexico	☐	T	R					☐
New Mexico	☐	T	R					☐

7. PHYSICAL DESCRIPTION

Site Dimensions: 74x17 meters **Basis for Dimensions** (choose one): ☐ estimated ☒ measured

Site Area: 1,258 sq m **Basis for Area** (choose one): ☐ estimated ☐ measured **Elevation:** 7,100 feet

Site Boundaries Complete? (choose one): ☒ Yes ☐ No (explain): _____

Basis for Site Boundaries: ☒ distribution of archeological features & artifacts ☐ modern features or ground disturbance

☐ property lines ☐ topographic features ☐ other (specify): _____

Depositional/Erosional Environment: ☐ alluvial ☒ aeolian ☐ colluvial ☐ residual ☐ no deposition (on bedrock)

☐ other process (describe): _____

Stratigraphy & Depth of Archeological Deposits (choose one): ☒ unknown/not determined

☐ no subsurface deposits present ☐ subsurface deposits present ☐ stratified subsurface deposits present

Estimated Depth of Deposits: unknown

Basis for Depth Determinations: ☒ estimated ☐ shovel/trowel tests ☐ core/auger tests ☐ excavations

☐ road or arroyo cuts ☐ rodent burrows ☐ other observations (describe): _____

Observations on Subsurface Archeological Deposits: Artifacts are exposed in the road bed and in the road cut to a height of approximately 50 cm above the road. Due to the artifact density and evidence of artifacts in the road cut sidewall, the site portion outside the roadway likely has subsurface cultural deposits that may yield important scientific information about prehistoric settlement, subsistence, and stone tool technology.

Local Vegetation (list species in decreasing order of dominance)**:**

Overstory: _____

Understory: **Sage and Rabbit Brush**

Vegetation Community (choose one or two): ☐ forest ☐ woodland ☐ grassland ☐ scrubland ☒ desert scrubland ☐ marshland

☐ other community (specify): _____

Topographic Location:

☐ bench	☒ dune	☐ low rise	☐ ridge	
☐ alluvial fan	☐ blowout	☐ flood plain/valley	☐ mesa/butte	☐ rockshelter
☐ arroyo/wash	☐ canyon rim	☐ foothill/mountain front	☐ mountain	☐ saddle
☐ badlands	☐ cave	☐ hill slope	☐ open canyon floor	☐ talus slope
☐ base of cliff	☐ cliff/scarp/bluff	☐ hill top	☐ plain/flat	☐ terrace
☐ base of talus slope	☐ constricted canyon	☐ lava flow (malpais)	☐ playa	

☐ other location (describe): _____

Observations on Site Setting: **Sand dune at base of La Jara Mesa. LA 163196 is located in a partially solidified sand dune that is bisected by the access road to FR 450.**

8. ASSEMBLAGE DATA

Assemblage Content (all components)**:**

Lithics:

- ☒ lithic debitage
- ☐ chipped-stone tools
- ☐ diagnostic projectile points
- ☐ non-local lithic material
- ☐ stone-tool manufacturing items (cores, hammerstones, etc.)
- ☐ ground-stone tools
- ☐ other stone tools

Prehistoric Ceramics

- ☐ whole ceramic vessels
- ☐ diagnostic ceramics
- ☐ other prehistoric ceramics

Historic Artifacts:

- ☐ diagnostic glass artifacts
- ☐ other glass artifacts
- ☐ diagnostic metal artifacts
- ☐ other metal artifacts
- ☐ whole ceramic vessel
- ☐ diagnostic ceramics
- ☐ other historic ceramics

Other Artifacts and Materials:

- ☐ bone tools
- ☐ faunal remains
- ☐ macrobotanical remains
- ☐ perishable artifacts
- ☐ ornaments
- ☐ figurines
- ☐ mineral specimens
- ☐ architectural stone
- ☐ burned adobe
- ☐ fire-cracked rock/burned caliche

☐ Other items (specify): _____

Assemblage Size (all components)**:**

artifact class	0	1s	10s	100s	1000s	>10,000	*Counts (if <100)
	estimated frequency						
lithic artifacts (choose one): (include debitage)	☐	☒	☐	☐	☐	☐	**18**
prehistoric ceramics (choose one):	☒	☐	☐	☐	☐	☐	_____
historic artifacts (choose one):	☒	☐	☐	☐	☐	☐	_____
total assemblage size (choose one):	☐	☒	☐	☐	☐	☐	**18**

Dating Potential: ☐ radiocarbon ☐ dendrochronology ☐ archeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Assemblage Remarks: **Lithics on the site were wholly comprised of Grants Ridge obsidian with the exception of one heat treated (possibly Narbona Pass) chert flake. Obsidian flakes included; 13 tertiary flakes, 4 secondary flakes and one primary flake.**

9. CULTURAL/TEMPORAL AFFILIATIONS

TOTAL NUMBER OF COMPONENTS DEFINED: 1

COMPONENT #1 (EARLIEST)

Cultural Affiliation: Unknown Prehistoric

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records

☒ associated diagnostic artifact or feature types ☒ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:	Unknown Prehistoric		
Latest Period (if any)**:**			

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify):

Basis for Cultural/Temporal Affiliation:

Component Type: Artifact scatter

Remarks:

***Associated Phase/Complex Name(s):** Unknown Prehistoric

COMPONENT #2

Cultural Affiliation:

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records

☐ associated diagnostic artifact or feature types ☐ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:			
Latest Period (if any)**:**			

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify):

Basis for Cultural/Temporal Affiliation:

Component Type:

Remarks:

***Associated Phase/Complex Name(s):**

10. FEATURE DATA

(see NMCRIS User's guide for a list of valid feature types)

Feature Type	Reliable ID ?	# Observed	Assoc. Comp. #s	Feature ID, Notes

Feature Remarks: None Observed

11. REFERENCES

Written Sources of Information: Results of a Cultural Resource Survey of 6.2 Miles of Roads (103 Acres) on Private and Forest Lands, and Approximately 22 Block Acres for Mine Facilities and an Escape Raise in the Cibola National Forest, Mt. Taylor Field Office, Cibola County, New Mexico (Harris et al, 2009)

Heritage Report #2009-03-133 (NMCRIS #114095)

Additional Sources of Information: _____

12. NARRATIVE DESCRIPTION

Site Description: LA 163195 is a lithic scatter consisting of ground and flaked stone artifacts. Vegetation on the site is sparse, primarily consisting of sage, Indian rice grass and rabbitbrush. The site is currently bisected by Elkin's Road as well as a stock tank area. The portion of the site in the existing roadway is disturbed; however, intact deposits in the roadway are possible. The site has been further disturbed by vehicular traffic, heavy livestock trampling and aeolian erosion. There is evidence of artifacts in the road cut sidewall and in the roadway.

Flaked stone artifacts on the site were mostly of Grants Ridge obsidian and included 9 tertiary flakes, 4 secondary and 2 primary flakes and one projectile point fragment. The two secondary flakes were of fine grained basalt. The projectile point fragment, Projectile Point 1 (PP1), is a side notched and basally ground projectile point base fragment of Grants Ridge obsidian and appears to be a San Jose type. A ground stone mano (GS1) of vesicular basalt was also observed on the site and measured 12 cm by 11.5 cm by 4.5 cm.

The site appears to be an activity area where stone tools were manufactured and food was processed. One San Jose point fragment (PP1) was located on the site indicating a San Jose Phase Archaic occupation.

NOTE: This site is located on original access road. The alternative access road will now re-route to avoid this site.

Eligibility and Recommendation: Despite the road and livestock damage, LA 163195 is in good condition with an estimated 80 percent remaining intact. The site may have datable subsurface cultural deposits that may yield important scientific information about Archaic settlement, subsistence and stone tool technology. The site is recommended as having undetermined eligibility for nomination to the NRHP. Avoidance of this site was recommended. The site should be avoided by utilizing the alternate route to access Forest Road 450. If avoidance is not possible then EMI recommends testing to determine the nature, extent, and integrity for NRHP eligibility status and further management recommendations. The project proponent has agreed to use the alternate route for project related activities in order to avoid the site.

Evaluation of Undertaking*:* The initially proposed location of the equipment haul road, well and water lines would have intersected the site. EMI recommends that the site be avoided. The site should be avoided by utilizing the alternate route to access Forest Road 450. The project proponent has agreed to use an alternate route for project related activities in order to avoid the site. If avoidance is not possible then EMI recommends testing to determine the nature, extent and integrity for NRHP eligibility status and further management recommendations. Provided that the proponent constructs and uses the alternate route to access the mine, this site will not be affected as it will be outside of the area of potential effect.

13. SITE RECORD ATTACHMENTS

☒ site location map (USGS 7.5' topo; required) ☒ sketch map or site plan (required) ☐ continuation forms?

☒ other materials (itemize): Photo

Figure 1: LA 163196 Overview facing west

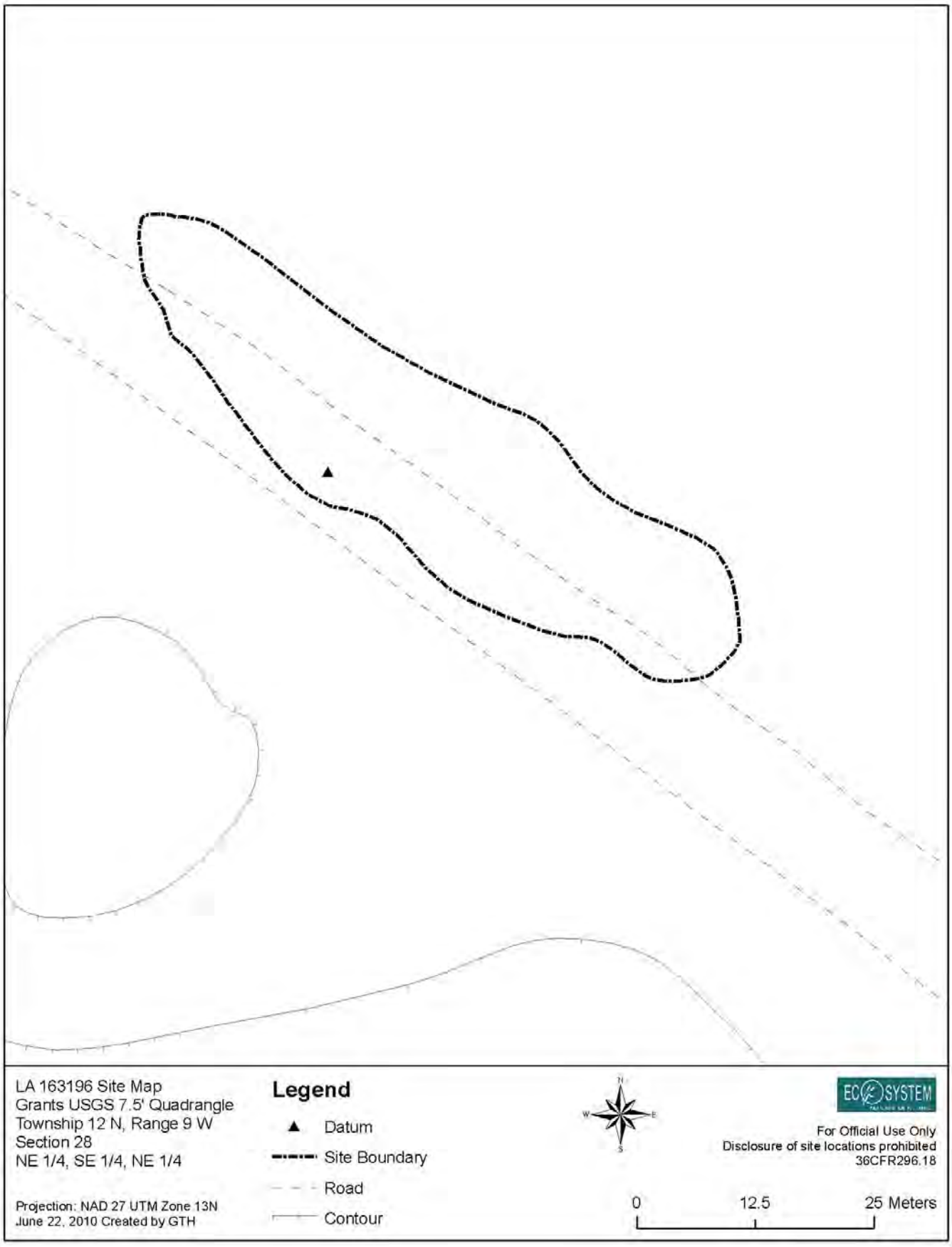

Figure 2: Site Map

LABORATORY OF ANTHROPOLOGY SITE RECORD

1. IDENTIFICATION & OWNERSHIP

LA Number: 163,197 (contact ARMS for site registration) ☐ **Site Update**? (complete at least Sections 1-4)

Site Name(s): EMI-GL-05

Other Site Number(s): **Agency Assigning Number:**

_ _

_____ _____

_____ _____

Current Site Owner(s): Private Land

Site Type: Non-Structural **Occupation Type:** Prehistoric

2. RECORDING INFORMATION

NMCRIS Activity No.: 114095 **Field Site Number:** EMI-GL-05

Site Marker? ☒ (specify ID#)**:** EMI-GL-05

Recorder(s): Garth Hayden, Zach Kneebone

Agency: EMI **Recording Date (dd-MMM-yyyy):** 12-06-2009

Site Accessibility (choose one)**:** ☒ accessible ☐ buried (sterile overburden) ☐ flooded ☐ urbanized ☐ not accessible

Surface Visibility (% visible; choose one)**:** ☐ 0% ☐ 1-25% ☐ 26-50% ☐ 51-75% ☒ 76-99% ☐ 100%

Remarks: Visibility is very good with little vegetation on a sandy terrain.

Recording Activities:

- ☒ sketch mapping
- ☐ instrument mapping (e.g., total station mapping)
- ☐ surface collection (controlled or uncontrolled)
- ☒ in-field artifact analysis
- ☐ other activities (specify): _____
- ☒ photography
- ☐ shovel or trowel tests; probes
- ☐ test excavation
- ☐ excavation (data recovery)

Description of Analysis or Excavation Activities: Analysis of all lithics found on surface. Photographs and mapping.

Photographic Documentation: Digital File 1472 - 1477

Surface Collections (choose one)**:**

- ☒ no surface collection
- ☐ uncontrolled surface collection
- ☐ collections of specific items only
- ☐ controlled (sample: <100%)
- ☐ controlled (complete: 100%)
- ☐ other method (describe): _____

Records Inventory:

- ☒ site location map
- ☒ sketch map(s)
- ☐ instrument map(s)
- ☒ excavation, collection, analysis records
- ☒ photos, slides, and associated records
- ☐ other records: _____
- ☐ field journals, notes
- ☐ NM Historic Building Inventory form

Repository for Original Records: EMI

Repository for Collected Artifacts: N/A

3. CONDITION

Archaeological Status: ☐ surface collection ☐ test excavation ☐ partial excavation ☐ complete excavation

Disturbance Sources: ☒ wind erosion ☐ water erosion ☐ bioturbation ☐ vandalism ☒ construction/land development

☒ other source (specify): livestock trampling

Vandalism: ☐ defaced glyphs ☐ damaged/defaced building ☐ surface disturbance ☐ manual excavation

☐ mechanical excavation ☐ other vandalism (specify): _____

Percentage of Site Intact (choose one)**:** ☐ 0% ☐ 1-25% ☐ 26-50% ☐ 51-75% ☒ 76-99% ☐ 100%

Observations on Site Condition: Artifacts are exposed in the road bed and in the road cut to a height of approximately 1 meter above the road. The site has been further disturbed by vehicular traffic, heavy livestock trampling, and aeolian erosion. LA 163197 is in good condition with an estimated 80 percent remaining intact.

4. RECOMMENDATIONS (for Performer/Recorder use only)

National Register Eligibility (choose one)**:** ☐ eligible ☐ not eligible ☒ not sure

Applicable Criteria: ☐ (a) ☐ (c) ☐ (b) ☐ (d)

Basis for Recommendation: LA 163197 is in good condition with an estimated 80 percent remaining intact. The site likely has datable subsurface cultural deposits that may yield important scientific information about prehistoric settlement, subsistence, and stone tool technology and chronology. The site is recommended as having undetermined eligibility for nomination to the NRHP. The site should be avoided by utilizing the alternate route to access Forest Road 450. If avoidance is not possible then EMI recommends testing to determine the nature, extent, and integrity for NRHP eligibility status and further management recommendations. The project proponent has agreed to use the alternate route for project related activities in order to avoid the site. No further management is required at this time.

Assessment of Project Impact: Provided that the proponent constructs and uses the alternate route to access the mine, this site will not be affected as it will be outside of the area of potential effect.

Treatment Recommendations: The initially proposed location of the equipment haul road, well and water lines would have intersected the site. EMI recommends that the site be avoided. The project proponent has agreed to use an alternate route for project related activities in order to avoid the site. If avoidance is not possible then EMI recommends testing to determine the nature, extent and NRHP eligibility status.

5. SHPO CONSULTATIONS (for SHPO and Sponsor use only)

Sponsor NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

Sponsor Staff: _____ **Date (dd-MMM-yyyy):** _____

Sponsor Remarks: _____

SHPO NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

HPD Staff: _____ **Date (dd-MMM-yyyy):** _____ **HPD Log No:** _____

Register Status: ☐ listed on National Register ☐ listed on State Register ☐ formal determination of eligibility

State Register No.: _____

SHPO Remarks: _____

6. LOCATION

Source Graphics:

☒ USGS 7.5' (1:24,000) topo maps ☐ rectified aerial photos [Scale: _____]

☐ other topo maps [Scale: _____] ☐ unrectified aerial photos [Scale: _____]

☒ GPS unit GPS accuracy (choose one): ☐ < 1.0 m ☒ 1-10 m ☐ 10-100 m ☐ >100 m

☐ other source (describe): _____

UTM Coordinates (@ center of site; at least one set of coordinates required):

Map-based Coordinates Datum: NAD27 **Zone:** 13 **E:** _____ **N:** _____

GPS-based Coordinates Datum: NAD27 **Zone:** 13 **E:** 246332 **N:** 3903255

Directions to Site: From Milan New Mexico take NM605 north for 5.4 miles. Turn Right onto an unpaved private road that connects to FR 450. Site is located 2.5 miles along private road connecting to FR 450.

In highway R-O-W? ☐ **Town** (if in city limits): _____ **State:** NM **County:** Cibola

USGS Quadrangle Name	Date	USGS Code
Grants, NM	1982	35107-B7
_____	_____	_____

PLSS Meridian	Unplatted	Township	Range	Section	¼ Sections			Protracted?
New Mexico	☐	T 12 N	R 9 W	28	SW	NE	NE	☐
New Mexico	☐	T _____	R _____	__	_____	_____	_____	☐
New Mexico	☐	T _____	R _____	__	_____	_____	_____	☐

7. PHYSICAL DESCRIPTION

Site Dimensions: 240x25 meters **Basis for Dimensions** (choose one): ☐ estimated ☒ measured

Site Area: 6,000 sq m **Basis for Area** (choose one): ☐ estimated ☐ measured **Elevation:** 7,100 feet

Site Boundaries Complete? (choose one): ☒ Yes ☐ No (explain): _____

Basis for Site Boundaries: ☒ distribution of archeological features & artifacts ☐ modern features or ground disturbance

☐ property lines ☐ topographic features ☐ other (specify): _____

Depositional/Erosional Environment: ☐ alluvial ☒ aeolian ☐ colluvial ☐ residual ☐ no deposition (on bedrock)

☐ other process (describe): _____

Stratigraphy & Depth of Archeological Deposits (choose one): ☒ unknown/not determined

☐ no subsurface deposits present ☐ subsurface deposits present ☐ stratified subsurface deposits present

Estimated Depth of Deposits: 60-80 cm

Basis for Depth Determinations: ☒ estimated ☐ shovel/trowel tests ☐ core/auger tests ☐ excavations

☐ road or arroyo cuts ☐ rodent burrows ☐ other observations (describe): _____

Observations on Subsurface Archeological Deposits: Artifacts are exposed in the road bed and in the road cut to a height of approximately 1 meter above the road. The site likely has datable subsurface cultural deposits that may yield important scientific information about prehistoric settlement, subsistence, and stone tool technology.

Local Vegetation (list species in decreasing order of dominance)**:**

Overstory: _____

Understory: **Sage and Indian Rice Grass**

Vegetation Community (choose one or two): ☐ forest ☐ woodland ☐ grassland ☐ scrubland ☒ desert scrubland ☐ marshland

☐ other community (specify): _____

Topographic Location:				
☐ alluvial fan	☐ bench	☒ dune	☐ low rise	☐ ridge
☐ arroyo/wash	☐ blowout	☐ flood plain/valley	☐ mesa/butte	☐ rockshelter
☐ badlands	☐ canyon rim	☐ foothill/mountain front	☐ mountain	☐ saddle
☐ base of cliff	☐ cave	☐ hill slope	☐ open canyon floor	☐ talus slope
☐ base of talus slope	☐ cliff/scarp/bluff	☐ hill top	☐ plain/flat	☐ terrace
☐ other location (describe): _____	☐ constricted canyon	☐ lava flow (malpais)	☐ playa	

Observations on Site Setting: **Partially solidified sand dune at base of La Jara Mesa. LA 163197 is an artifact scatter comprised of flaked and ground stone artifacts and numerous ash stain features. This site is located in a partially solidified sand dune that is bisected by the access road to FR 450.**

8. ASSEMBLAGE DATA

Assemblage Content (all components)**:**

Lithics:

- ☒ lithic debitage
- ☐ chipped-stone tools
- ☐ diagnostic projectile points
- ☐ non-local lithic material
- ☐ stone-tool manufacturing items (cores, hammerstones, etc.)
- ☐ ground-stone tools
- ☐ other stone tools

Prehistoric Ceramics

- ☐ whole ceramic vessels
- ☐ diagnostic ceramics
- ☐ other prehistoric ceramics

Historic Artifacts:

- ☐ diagnostic glass artifacts
- ☐ other glass artifacts
- ☐ diagnostic metal artifacts
- ☐ other metal artifacts
- ☐ whole ceramic vessel
- ☐ diagnostic ceramics
- ☐ other historic ceramics

Other Artifacts and Materials:

- ☐ bone tools
- ☐ faunal remains
- ☐ macrobotanical remains
- ☐ perishable artifacts
- ☐ ornaments
- ☐ figurines
- ☐ mineral specimens
- ☐ architectural stone
- ☐ burned adobe
- ☐ fire-cracked rock/burned caliche

☐ Other items (specify): _____

Assemblage Size (all components)**:**

artifact class	estimated frequency: 0	1s	10s	100s	1000s	>10,000	*Counts (if <100)
lithic artifacts (choose one): (include debitage)	☐	☐	☒	☐	☐	☐	68
prehistoric ceramics (choose one):	☒	☐	☐	☐	☐	☐	
historic artifacts (choose one):	☒	☐	☐	☐	☐	☐	
total assemblage size (choose one):	☐	☐	☒	☐	☐	☐	68

Dating Potential: ☐ radiocarbon ☐ dendrochronology ☐ archeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Assemblage Remarks: Lithic artifacts in Locus 1 included 22 Grants Ridge obsidian flakes and 1 tertiary white chert flake. The Grants Ridge obsidian flakes consisted of 16 tertiary flakes, 4 secondary flakes and 2 primary flakes. A small biface (thumbnail scraper) was recorded in Locus 1 that measured 30 mm by 20 mm by 7 mm. Lithic artifacts in Locus 2 included; 11 tertiary flakes and 3 secondary flakes of Grants Ridge obsidian, 2 tertiary flakes of black translucent obsidian, 2 tertiary quartzite flakes, 1 fine grained basalt secondary flake and a fine grained basalt hammerstone measuring 8.5 cm by 6.3 cm by 3.5 cm. In between the two loci were; 5 tertiary flakes of Grant Ridge obsidian and a Grants Ridge obsidian core (with 4 flake scars) that measured 6.5 cm by 3.9 cm by 2.8 cm.

9. CULTURAL/TEMPORAL AFFILIATIONS

TOTAL NUMBER OF COMPONENTS DEFINED: 1

COMPONENT #1 (EARLIEST)

Cultural Affiliation: Unknown Prehistoric

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records

☒ associated diagnostic artifact or feature types ☐ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:	Unknown Prehistoric		
Latest Period (if any)**:**			

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Basis for Cultural/Temporal Affiliation: Although no diagnostic artifacts were identified on the site that would indicate age or cultural affiliation, the site location and artifact assemblage are consistent with an Archaic occupation.

Component Type: Artifact scatter

Remarks: _____

***Associated Phase/Complex Name(s):** Unknown Prehistoric

COMPONENT #2

Cultural Affiliation: _____ _____

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records

☐ associated diagnostic artifact or feature types ☐ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:	_____		
Latest Period (if any)**:**	_____	_____	_____

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Basis for Cultural/Temporal Affiliation: _____

Component Type: _____ _____

Remarks: _____

***Associated Phase/Complex Name(s):** _____

10. FEATURE DATA

(see NMCRIS User's guide for a list of valid feature types)

Feature Type	Reliable ID ?	# Observed	Assoc. Comp. #s	Feature ID, Notes
Ash Stain	Yes	_____	__	Feature 1 is located in Locus 1 and is an ash stain measuring 3 m by .5 m. The feature occurs in the road cut approximately 15 cm above the current road surface.
Ash Stain	Yes	_____	__	Feature 2 is located in Locus 1 and is an ash stain measuring 2 m by 1 m. The feature occurs in the road cut.
Ash Stain	Yes	_____	__	Feature 3 is located in Locus 2 and is an ash stain measuring 1.5 m by .5 m. The feature occurs in the road bed.
Ash Stain	Yes	_____	__	Feature 4 is located in Locus 2 and is an ash stain measuring 1.5 m by 1.5 m and is located in the road cut approximately 20 cm above the current road surface.

Feature Remarks: _____

11. REFERENCES

Written Sources of Information: Results of a Cultural Resource Survey of 6.2 Miles of Roads (103 Acres) on Private and Forest Lands, and Approximately 22 Block Acres for Mine Facilities and an Escape Raise in the Cibola National Forest, Mt. Taylor Field Office, Cibola County, New Mexico (Harris et al, 2009)

Heritage Report #2009-03-133 (NMCRIS #114095)

Additional Sources of Information: _____

12. NARRATIVE DESCRIPTION

Site Description: LA 163197 is a lithic scatter comprised of flaked and ground stone artifacts and numerous ash stain features. This site is located in a partially solidified sand dune that is bisected by Elkin's Road. Artifacts are exposed in the

road bed and in the road cut to a height of approximately 1 meter above the road. The site has been further disturbed by vehicular traffic, heavy livestock trampling, and aeolian erosion. Vegetation on the site is sparse, primarily consisting of sage and Indian rice grass. Soils on the site are a very fine sandy loam. The site encompasses two dunes where most artifacts and features are located (Locus 1 and Locus 2) with a low density artifact scatter connecting the dunes. The artifact scatter in the intervening distance between dunes appears to be displaced artifacts from road maintenance.

Lithic artifacts in Locus 1 included 22 Grants Ridge obsidian flakes and 1 tertiary white chert flake. The Grants Ridge obsidian flakes consisted of 16 tertiary flakes, 4 secondary flakes and 2 primary flakes. A small biface (thumbnail scraper) was recorded in Locus 1 that measured 30 mm by 20 mm by 7 mm. Lithic artifacts in Locus 2 included 11 tertiary flakes and 3 secondary flakes of Grants Ridge obsidian, 2 tertiary flakes of black translucent obsidian, 2 tertiary quartzite flakes, 1 fine grained basalt secondary flake and a fine grained basalt hammerstone measuring 8.5 cm by 6.3 cm by 3.5 cm. In between the two loci were 5 tertiary flakes of Grant Ridge obsidian and a Grants Ridge obsidian core (with 4 flake scars) that measured 6.5 cm by 3.9 cm by 2.8 cm.

Feature 1 is located in Locus 1 and is an ash stain measuring 3 m by 0.5 m. The feature occurs in the road cut approximately 15 cm above the current road surface. Feature 2 is located in Locus 1 and is an ash stain measuring 2 m by 1 m. The feature occurs in the road cut. Feature 3 is located in Locus 2 and is an ash stain measuring 1.5 m by 0.5 m. The feature occurs in the road bed. Feature 4 is located in Locus 2 and is an ash stain measuring 1.5 m by 1.5 m and is located in the road cut approximately 20 cm above the current road surface.

The site appears to be an activity area where stone tools were manufactured and some resource processing was conducted that utilized fire. Although no diagnostic artifacts were identified on the site that would indicate age or cultural affiliation, the site location and artifact assemblage are consistent with an Archaic occupation.

NOTE: This site is located on original access road. The alternative access road will now re-route to avoid this site.

Eligibility and Recommendation: LA 163197 is in good condition with an estimated 80 percent remaining intact. The site likely has datable subsurface cultural deposits that may yield important scientific information about prehistoric settlement, subsistence, and stone tool technology and chronology. The site is recommended as having undetermined eligibility for nomination to the NRHP. The site should be avoided by utilizing the alternate route to access Forest Road 450. If avoidance is not possible then EMI recommends testing to determine the nature, extent, and integrity for NRHP eligibility status and further management recommendations. The project proponent has agreed to use the alternate route for project related activities in order to avoid the site. No further management is required at this time.

Evaluation of Undertaking*:* The initially proposed location of the equipment haul road, well and water lines would have intersected the site. EMI recommends that the site be avoided. The project proponent has agreed to use an alternate route for project related activities in order to avoid the site. If avoidance is not possible then EMI recommends testing to determine the nature, extent and NRHP eligibility status. Provided that the proponent constructs and uses the alternate route to access the mine, this site will not be affected as it will be outside of the area of potential effect.

13. SITE RECORD ATTACHMENTS

☒ site location map (USGS 7.5' topo; required) ☒ sketch map or site plan (required) ☐ continuation forms?

☒ other materials (itemize): **Photos**

Figure 1: LA 163197 Overview looking east

Figure 2: LA 163197, Feature 1

Figure 3: LA 163197, Feature 2

Figure 4: LA 163197, Feature 3

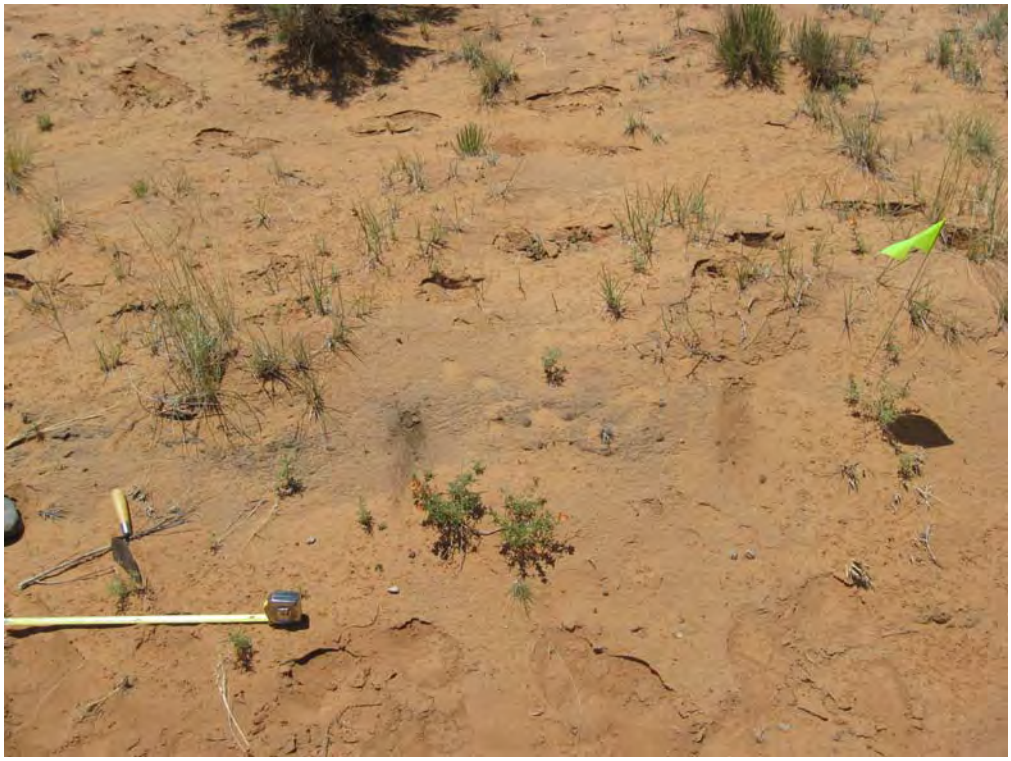

Figure 5: LA 163197, Feature 4

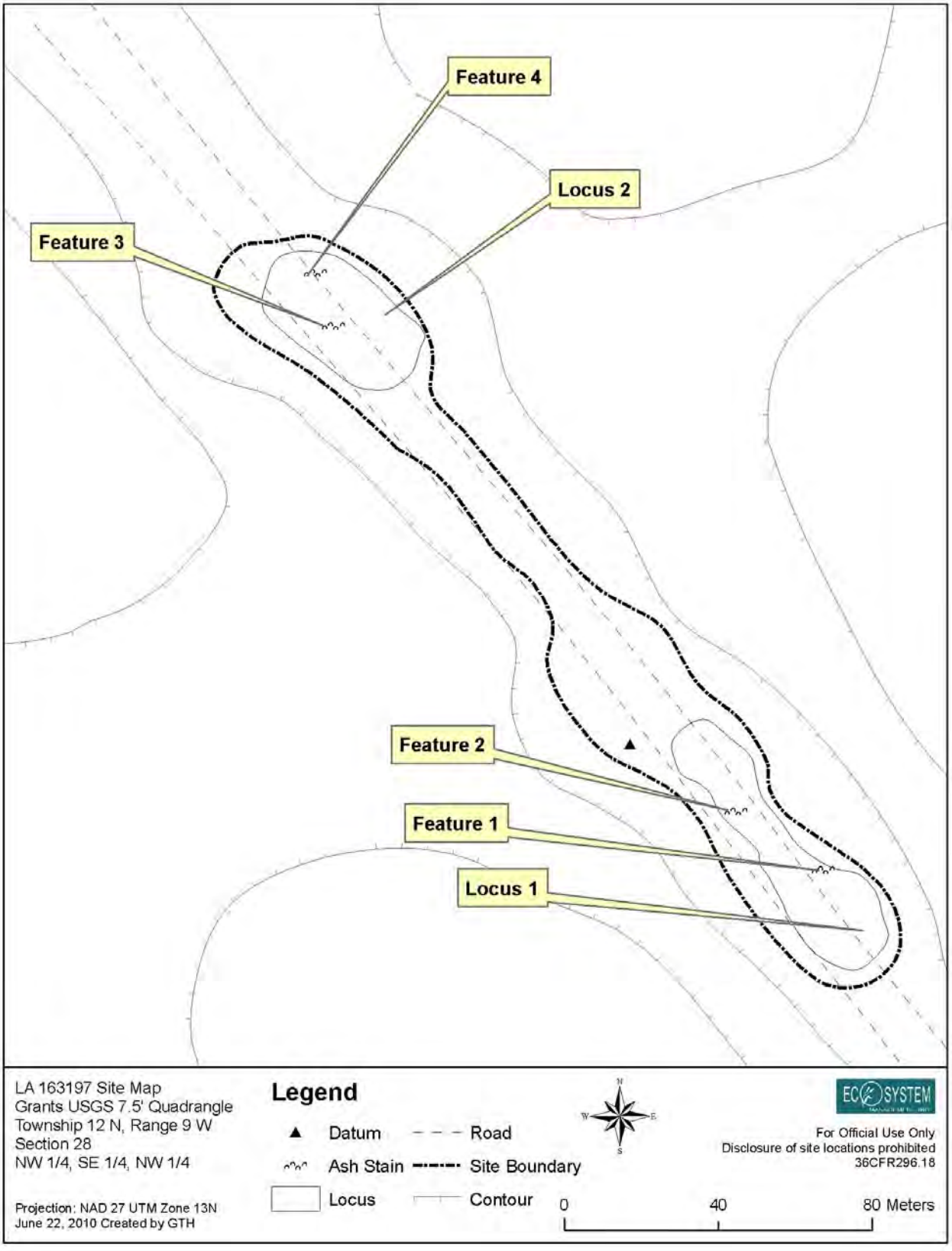

Figure 6: Site Map

LABORATORY OF ANTHROPOLOGY SITE RECORD

1. IDENTIFICATION & OWNERSHIP

LA Number: 163,198 (contact ARMS for site registration) ☐ **Site Update**? (complete at least Sections 1-4)

Site Name(s): EMI-GL-06

Other Site Number(s): **Agency Assigning Number:**

_ _

_____ _____

_____ _____

Current Site Owner(s): Private Land

Site Type: Non-Structural **Occupation Type:** Prehistoric

2. RECORDING INFORMATION

NMCRIS Activity No.: 114095 **Field Site Number:** EMI-GL-06

Site Marker? ☒ (specify ID#)**:** EMI-GL-06

Recorder(s): Garth Hayden, Zach Kneebone

Agency: EMI **Recording Date (dd-MMM-yyyy):** 12-06-2009

Site Accessibility (choose one)**:** ☒ accessible ☐ buried (sterile overburden) ☐ flooded ☐ urbanized ☐ not accessible

Surface Visibility (% visible; choose one)**:** ☐ 0% ☐ 1-25% ☐ 26-50% ☐ 51-75% ☒ 76-99% ☐ 100%

Remarks: Visibility is very good with little vegetation on a sandy terrain.

Recording Activities:

- ☒ sketch mapping
- ☐ instrument mapping (e.g., total station mapping)
- ☐ surface collection (controlled or uncontrolled)
- ☒ in-field artifact analysis
- ☐ other activities (specify): _____
- ☒ photography
- ☐ shovel or trowel tests; probes
- ☐ test excavation
- ☐ excavation (data recovery)

Description of Analysis or Excavation Activities: Analysis of all lithics found on surface. Photographs and mapping.

Photographic Documentation: Digital File 1464 - 1467

Surface Collections (choose one)**:**

- ☒ no surface collection
- ☐ uncontrolled surface collection
- ☐ collections of specific items only
- ☐ controlled (sample: <100%)
- ☐ controlled (complete: 100%)
- ☐ other method (describe): _____

Records Inventory:

- ☒ site location map
- ☒ sketch map(s)
- ☐ instrument map(s)
- ☒ excavation, collection, analysis records
- ☒ photos, slides, and associated records
- ☐ other records: _____
- ☐ field journals, notes
- ☐ NM Historic Building Inventory form

Repository for Original Records: EMI

Repository for Collected Artifacts: N/A

3. CONDITION

Archaeological Status: ☐ surface collection ☐ test excavation ☐ partial excavation ☐ complete excavation

Disturbance Sources: ☒ wind erosion ☐ water erosion ☐ bioturbation ☐ vandalism ☒ construction/land development

☒ other source (specify): Livestock trampling

Vandalism: ☐ defaced glyphs ☐ damaged/defaced building ☐ surface disturbance ☐ manual excavation

☐ mechanical excavation ☐ other vandalism (specify): _____

Percentage of Site Intact (choose one)**:** ☐ 0% ☐ 1-25% ☐ 26-50% ☐ 51-75% ☒ 76-99% ☐ 100%

Observations on Site Condition: Artifacts are exposed in the road bed and in the road cut to a height of approximately 40 cm above the road. The site has been further disturbed by vehicular traffic, heavy livestock trampling, and aeolian erosion. However, LA 163198 is in good condition with 80 percent remaining intact.

4. RECOMMENDATIONS (for Performer/Recorder use only)

National Register Eligibility (choose one)**:** ☐ eligible ☐ not eligible ☒ not sure

Applicable Criteria: ☐ (a) ☐ (c) ☐ (b) ☐ (d)

Basis for Recommendation: LA 163198 is in good condition with 80 percent remaining intact. Due to the artifact density and evidence of artifacts outside the road cut, the site likely has subsurface cultural deposits that may yield important scientific information about prehistoric settlement, subsistence, and stone tool technology. EMI recommends the site undetermined for inclusion in the NRHP pending further testing.

Assessment of Project Impact: The site is bisected by an access road to FR 450 and may be impacted by road maintenance or road improvement activities.

Treatment Recommendations: Testing is recommended to determine whether there are intact deposits in or adjacent to the road that could be impacted if road maintenance or road improvement is necessary. Based on the results of testing, the portion of the site that still retains integrity should be avoided and protected from any project related ground-disturbing activities.

5. SHPO CONSULTATIONS (for SHPO and Sponsor use only)

Sponsor NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

Sponsor Staff: _____ **Date (dd-MMM-yyyy):** _____

Sponsor Remarks: _____

SHPO NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

HPD Staff: _____ **Date (dd-MMM-yyyy):** _____ **HPD Log No:** _____

Register Status: ☐ listed on National Register ☐ listed on State Register ☐ formal determination of eligibility

State Register No.: _____

SHPO Remarks: _____

6. LOCATION

Source Graphics:

☒ USGS 7.5' (1:24,000) topo maps ☐ rectified aerial photos [Scale: _____]

☐ other topo maps [Scale: _____] ☐ unrectified aerial photos [Scale: _____]

☒ GPS unit GPS accuracy (choose one): ☐ < 1.0 m ☒ 1-10 m ☐ 10-100 m ☐ >100 m

☐ other source (describe): _____

UTM Coordinates (@ center of site; at least one set of coordinates required):

Map-based Coordinates Datum: NAD27 **Zone:** 13 **E:** _____ **N:** _____

GPS-based Coordinates Datum: NAD27 **Zone:** 13 **E:** 244,882 **N:** 3,903,783

Directions to Site: From Milan New Mexico take NM605 north for 5.4 miles. Turn Right onto an unpaved private road that connects to FR 450. Site is located 2 miles along private road connecting to FR 450. **In highway R-O-W?** ☐

Town (if in city limits): _____ **State:** NM **County:** Cibola

USGS Quadrangle Name	Date	USGS Code
Grants, NM	1982	35107-B7

PLSS Meridian	Unplatted	Township	Range	Section	¼ Sections			Protracted?
New Mexico	☐	T 12 N	R 9 W	29	NW	NE	NE	☐
New Mexico	☐	T	R					☐
New Mexico	☐	T	R					☐

7. PHYSICAL DESCRIPTION

Site Dimensions: 30x18 meters **Basis for Dimensions** (choose one): ☐ estimated ☐ measured

Site Area: 540 sq m **Basis for Area** (choose one): ☐ estimated ☐ measured **Elevation:** 7,100 feet

Site Boundaries Complete? (choose one): ☒ Yes ☐ No (explain): _____

Basis for Site Boundaries: ☒ distribution of archeological features & artifacts ☐ modern features or ground disturbance

☐ property lines ☐ topographic features ☐ other (specify): _____

Depositional/Erosional Environment: ☐ alluvial ☒ aeolian ☐ colluvial ☐ residual ☐ no deposition (on bedrock)

☐ other process (describe): _____

Stratigraphy & Depth of Archeological Deposits (choose one): ☒ unknown/not determined

☐ no subsurface deposits present ☐ subsurface deposits present ☐ stratified subsurface deposits present

Estimated Depth of Deposits: unknown

Basis for Depth Determinations: ☒ estimated ☐ shovel/trowel tests ☐ core/auger tests ☐ excavations

☐ road or arroyo cuts ☐ rodent burrows ☐ other observations (describe): _____

Observations on Subsurface Archeological Deposits: Artifacts are exposed in the road bed and in the road cut to a height of approximately 40 cm above the road. Due to the artifact density and evidence of artifacts outside the road cut, the site likely has subsurface cultural deposits that may yield important scientific information about prehistoric settlement, subsistence, and stone tool technology.

Local Vegetation (list species in decreasing order of dominance)**:**

Overstory: _____

Understory: **Sage and Rabbit Brush**

Vegetation Community (choose one or two): ☐ forest ☐ woodland ☐ grassland ☐ scrubland ☒ desert scrubland ☐ marshland

☐ other community (specify): _____

Topographic Location:				
☐ alluvial fan	☐ bench	☒ dune	☐ low rise	☐ ridge
☐ arroyo/wash	☐ blowout	☐ flood plain/valley	☐ mesa/butte	☐ rockshelter
☐ badlands	☐ canyon rim	☐ foothill/mountain front	☐ mountain	☐ saddle
☐ base of cliff	☐ cave	☐ hill slope	☐ open canyon floor	☐ talus slope
☐ base of talus slope	☐ cliff/scarp/bluff	☐ hill top	☐ plain/flat	☐ terrace
☐ other location (describe): _____	☐ constricted canyon	☐ lava flow (malpais)	☐ playa	

Observations on Site Setting: **Partially solidified sand dune at base of La Jara Mesa. LA 163198 is located in a partially solidified sand dune that is bisected by the access road to FR 450.**

8. ASSEMBLAGE DATA

Assemblage Content (all components)**:**

Lithics:

- ☒ lithic debitage
- ☐ chipped-stone tools
- ☐ diagnostic projectile points
- ☐ non-local lithic material
- ☐ stone-tool manufacturing items (cores, hammerstones, etc.)
- ☒ ground-stone tools
- ☐ other stone tools

Prehistoric Ceramics

- ☐ whole ceramic vessels
- ☐ diagnostic ceramics
- ☐ other prehistoric ceramics

Historic Artifacts:

- ☐ diagnostic glass artifacts
- ☐ other glass artifacts
- ☐ diagnostic metal artifacts
- ☐ other metal artifacts
- ☐ whole ceramic vessel
- ☐ diagnostic ceramics
- ☐ other historic ceramics

Other Artifacts and Materials:

- ☐ bone tools
- ☐ faunal remains
- ☐ macrobotanical remains
- ☐ perishable artifacts
- ☐ ornaments
- ☐ figurines
- ☐ mineral specimens
- ☐ architectural stone
- ☐ burned adobe
- ☐ fire-cracked rock/burned caliche

☐ Other items (specify): _____

Assemblage Size (all components)**:**

artifact class	estimated frequency: 0	1s	10s	100s	1000s	>10,000	*Counts (if <100)
lithic artifacts (choose one): (include debitage)	☐	☐	☒	☐	☐	☐	19
prehistoric ceramics (choose one):	☒	☐	☐	☐	☐	☐	
historic artifacts (choose one):	☒	☐	☐	☐	☐	☐	
total assemblage size (choose one):	☐	☐	☒	☐	☐	☐	19

Dating Potential: ☐ radiocarbon ☐ dendrochronology ☐ archeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Assemblage Remarks: Lithic artifacts on the site included flakes of Grants Ridge obsidian and several tools. Grants Ridge obsidian flakes included 7 tertiary flakes, 2 secondary flakes and one primary flake. Flaked stone tools included 3 choppers; Chopper 1 is constructed of fine grained basalt with bifacial flaking and measures 11.5 cm by 9.5 cm by 3 cm, Chopper 2 is constructed of fine grained basalt with bifacial flaking and measures 15 cm by 8 cm by 3 cm, Chopper 3 is constructed of fine grained basalt with bifacial flaking and measures 12.5 cm by 11 cm by 2 cm.

Ground stone artifacts included; a vesicular basalt one handed mano (GS1) with a single ground surface measuring 9 cm by 6 cm by 4 cm, 3 fragments of a sandstone slab metate with a pecked and ground surface measuring 3-5 cm in thickness, a basalt slab metate with light use wear measuring 22 cm by 19 cm by 6 cm and a fine grained basalt ground adze with a use wear polish along one face measuring 9 cm by 5 cm by 2.5 cm.

9. CULTURAL/TEMPORAL AFFILIATIONS

TOTAL NUMBER OF COMPONENTS DEFINED: 1

COMPONENT #1 (EARLIEST)

Cultural Affiliation: Unknown Prehistoric

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records

☒ associated diagnostic artifact or feature types ☐ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:	Unknown Prehistoric		
Latest Period (if any)**:**			

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Basis for Cultural/Temporal Affiliation: Although no diagnostic artifacts were identified on the site that would indicate age or cultural affiliation, the site location and artifact assemblage are consistent with an Archaic occupation.

Component Type: Artifact scatter

Remarks: _____

***Associated Phase/Complex Name(s):** Unknown Prehistoric

COMPONENT #2

Cultural Affiliation: _____ _____

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records

☐ associated diagnostic artifact or feature types ☐ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:	_____		
Latest Period (if any)**:**	_____	_____	_____

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Basis for Cultural/Temporal Affiliation: _____

Component Type: _____ _____

Remarks: _____

***Associated Phase/Complex Name(s):** _____

10. FEATURE DATA

(see NMCRIS User's guide for a list of valid feature types)

Feature Type	Reliable ID ?	# Observed	Assoc. Comp. #s	Feature ID, Notes
_____	_____	_____	__	_____

Feature Remarks: None observed

11. REFERENCES

Written Sources of Information: Results of a Cultural Resource Survey of 6.2 Miles of Roads (103 Acres) on Private and Forest Lands, and Approximately 22 Block Acres for Mine Facilities and an Escape Raise in the Cibola National Forest, Mt. Taylor Field Office, Cibola County, New Mexico (Harris et al, 2009)

Heritage Report #2009-03-133 (NMCRIS #114095)

Additional Sources of Information: _____

12. NARRATIVE DESCRIPTION

Site Description: LA 163198 is a lithic scatter located in a partially solidified sand dune that is bisected by Elkin's Road. Artifacts are exposed in the road bed and in the road cut sidewall to a height of approximately 40 cm above the road and in a wing ditch cut deposit just east of the site boundary. The site has been disturbed by the road cut, vehicular traffic, heavy livestock trampling, and aeolian erosion. Vegetation on the site is sparse, primarily consisting of sage and rabbit brush. Soils on the site are a very fine sandy loam.

Lithic artifacts on the site included flakes of Grants Ridge obsidian and several tools. Grants Ridge obsidian flakes included 7 tertiary flakes, 2 secondary flakes and one primary flake. Flaked stone tools included 3 choppers; Chopper 1 is constructed of fine grained basalt with bifacial flaking and measures 11.5 cm by 9.5 cm by 3 cm, Chopper 2 is constructed of fine grained basalt with bifacial flaking and measures 15 cm by 8 cm by 3 cm, Chopper 3 is constructed of fine grained basalt with bifacial flaking and measures 12.5 cm by 11 cm by 2 cm.

Ground stone artifacts included a vesicular basalt one handed mano (GS1) with a single ground surface measuring 9 cm by 6 cm by 4 cm, 3 fragments of a sandstone slab metate with a pecked and ground surface measuring 3-5 cm in thickness, a basalt slab metate with light use wear measuring 22 cm by 19 cm by 6 cm and a fine grained basalt ground adze with a use wear polish along one face measuring 9 cm by 5 cm by 2.5 cm.

The site appears to be an activity area where food was processed and stone tools were manufactured. Although no diagnostic artifacts were identified on the site that would indicate age or cultural affiliation, the site location and artifact assemblage are consistent with an Archaic occupation.

Eligibility and Recommendation: LA 163198 is in good condition with 80 percent remaining intact. The site likely has subsurface cultural deposits that may yield important scientific information about prehistoric settlement, subsistence, and stone tool technology. The site is recommended as having undetermined eligibility for nomination to the NRHP. EMI recommends testing to determine the nature, integrity and extent of the site within the 40 ft wide improvement corridor along the Elkin's Road access roadway, for NRHP eligibility status and further management recommendations.
Evaluation of Undertaking*:* The equipment haul road will intersect the site. Since complete avoidance is not possible, EMI recommends testing to determine the nature, integrity and extent of the site within the 40 ft wide improvement corridor along the Elkin's Road access roadway, for NRHP eligibility status and further management recommendations which may include data recovery.

13. SITE RECORD ATTACHMENTS

☒ site location map (USGS 7.5' topo; required) ☒ sketch map or site plan (required) ☐ continuation forms?

☒ other materials (itemize): **Photos**

Figure 1: LA 163198 Site Overview looking west

Figure 2: LA 163198 Mano

Figure 3: LA 163198 Metate Fragments

Figure 4: LA 163198 Adze

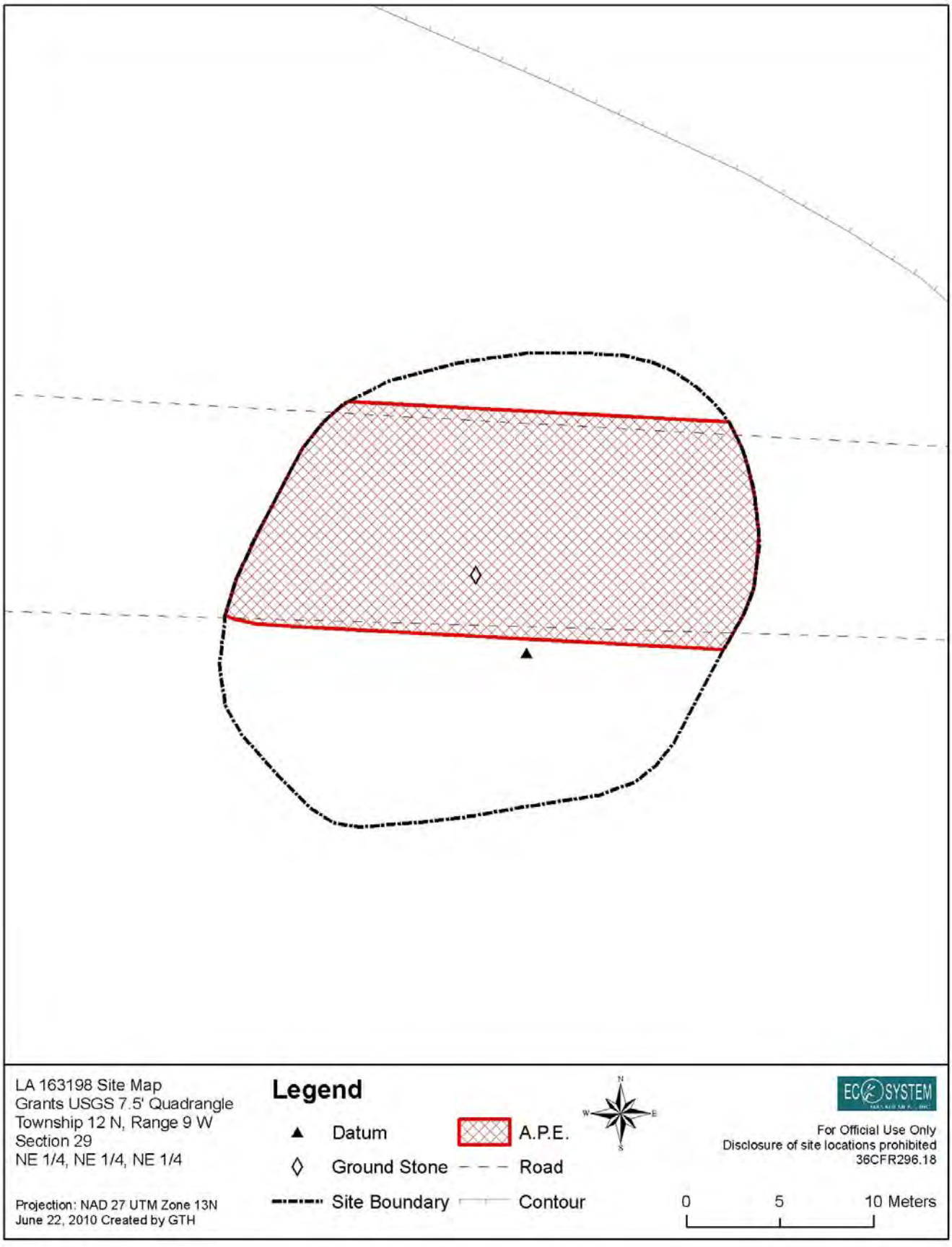

Figure 5: Site Map

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12.0 PRESENT AND HISTORICAL LAND USE

New Mexico Administrative Code (NMAC) 19.10.6.602 D.(13) (j)

Baseline data shall include, as applicable: A description of the present and historical land use of the permit area, the general patterns of land use in the surrounding areas, and a narrative of land capability and productivity based upon U.S. Soil Conservation Service land use capability classes or a similar classification.

12.1 Introduction

The La Jara Mesa Project's proposed Permit Area is located in Sections 1,2,11,12,13,14, and 15, T12N, R9W and Section 11, T12N, R9W in Cibola County, New Mexico (Plate 1). The proposed surface facilities would be located at an elevation of 7,300 feet in the NE ¼ of Section 15, T12N, R9W on claims controlled by Laramide Resources (USA), Inc. (Laramide) under a minerals lease agreement authorized by the US Department of Agriculture Forest Service (Forest Service) at the base of La Jara Mesa. Over the life of the project, approximately 22 acres would be disturbed by the construction and operational activities associated with mine surface facilities and access road improvements. The objective of this baseline data report is to provide relevant information on present and historical land uses of the proposed Permit Area and surround areas.

12.2 Present and Historical Land Use of the Permit Area

The proposed Permit Area is located entirely on Forest Service land. Access to the proposed Permit Area would be northeast from State Highway 605, across private property and then across Forest Service land to the Permit Area. The proposed Permit Area is under the Forest Service's Mt. Taylor Ranger District jurisdiction and within the Cibola National Forest. Land management (as developed by the Forest Service) associated with Forest Service lands (that includes the proposed Permit Area) includes the following land uses: grazing, mineral extraction, hunting, hiking, and other outdoor recreation activities.

Livestock grazing is allowed five months per year in allotments near the proposed Permit Area, from June 1 to October 31. The proposed escape raise would be located within the 40,309-acre El Rito allotment (no. 02208) and 8,117-acre La Jara Pasture (No. 001). The proposed surface facilities and road and utility corridor would be within the El Rito allotment and the 19,148-acre Lobo Canyon pasture (No. 003). The Forest Service determines capability, suitability, and rangeland condition prior to issuing livestock permits for allotments. There are two permitees that graze about 130 cattle each on these allotments.

Historical land use at the La Jara Mesa site includes several previous mining and exploration sites (discussed in Section 10.0 – Prior Exploration and Mining). Taffy Mine (1961) is a historical mine site located just northeast of the proposed Permit Area. The Zia Mine (1952-1960) is located southwest of the

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proposed Permit Area. As described in Section 10, the prior mining and exploration in the region occurred sporadically since the 1950s. Since approximately 1967, the long-term land use of the proposed Permit Area has been rangeland with exploration access and holes drilled periodically across the site (McLemore, 1983).

Section 11, Historic Places and Cultural Properties, in addition to supporting archeological survey documents, describes historical uses of the proposed Permit Area dating back to use by native peoples in the region.

12.3 Land Use Surrounding the Proposed Permit Area.

The general land use patterns in the surrounding area are similar to those found within the proposed Permit Area. Land ownership in the surrounding area is a mixture of state, private, and federal.

The Mt. Taylor Ranger District administers most of the public land surrounding the proposed Permit Area, which is within the Cibola National Forest. The District's responsibilities include general administration, management of timber resources, and development of specific land-use management plans. The proposed Permit Area is located in Management Areas 13 and 14. Land use, management and recreation information was compiled for the project by The Forest Service in the Draft Environmental Impact Statement (USDA-USFS, 2012).

National forest recreation sites in the vicinity of La Jara Mesa include Coal Mine Campground, Lobo Canyon Campground, and the district ranger office. These sites are accessed via State Route 547. Off-highway vehicles are used during the hunting season (late summer and fall).

The La Jara Mesa Project's Permit Area is located approximately 10 miles northeast of the communities of Grants and Milan, in Cibola County, New Mexico. Grants is the largest, with a population of approximately 9,180 people (US Census Bureau, 2013).

12.4 Land Capability and Productivity

Land capability classes were determined for the soils near the proposed La Jara Mesa Project's Permit Area. This system of grouping soils primarily on the basis of the capability to produce common cultivated crops and pasture plants was developed by the Soil Conservation Service (SCS), now the Natural Resource Conservation Service (NRCS; SCS, 1961). The NRCS has mapped the soils outside of the Forest Service boundary. All NRCS map unit components, including miscellaneous areas, are assigned a capability class and subclass. Non-irrigated capability classes were used for this assessment. Several NRCS map units occur west of the Forest Service boundary, but they generally occur on level to gently sloped, loamy to sandy soils of the alluvial fan and valley landforms and are classified as class 6c. These soils are generally unsuitable for cultivation due to climactic limitations, which restricts their use mainly to

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pasture, rangeland, forestland, or wildlife habitat. The soils on the steeper slopes of the small escarpment of the Entrada and Wingate Sandstones are classified as class 8e or class 8s. These soils are susceptible to erosion or have a soil limitation in the rooting zone (depth to bedrock) that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

The soils in the Forest Service boundary were mapped by the Forest Service using the Terrestrial Ecosystem Survey (TES; Section 6.0 - Soils) and do not include the SCS land capability class. However, the soils were placed in classes using the Forest Service TES map units. The soils on eolian sand sheet and dune ridges are class 6c and 6e. They are susceptible to erosion and the climate limits their use for cultivation. The soils along the La Jara Mesa escarpment (class 8s) and sandstone outcrops (classes 7e and 7s) are not suitable for cultivation. The limitations include low water holding capacity, depth to bedrock, and susceptibility to erosion. The soils in the proposed Permit Area or surrounding area are not considered prime farmland.

12.5 References

McLemore, V.T. 1983. *Uranium and Thorium Occurrences in New Mexico.* Santa Fe: New Mexico Bureau of Mines & Mineral Resources.

US Census Bureau. (2013). *2010 Population Finder*. Retrieved March 8, 2013, from US Census Bureau: http://www.census.gov/popfinder/index.php. Website accessed on March 2013.

United States Department of Agriculture (USDA), Forest Service (USFS). 2012. Draft Environmental Impact Statement La Jara Mesa Mine Project. Mt. Taylor Ranger District Cibola National Forest. U.S. Department of Agriculture, Forest Service. Southwestern Region.

US Department of Agriculture Soil Conservation Service (SCS). 1961. Land Capability Classification. US Department of Agriculture Handbook 210.

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List of Attachments

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13.0 RADIOLOGICAL SURVEY

Guidance Document for Part 6, New Mining Operation Permitting Under the New Mexico Mining Act, August 2010:

The proposed scope of work for the radiological survey should provide a baseline for radiochemical content and include a gamma survey of the primary permit areas such as roads and facility locations as well as potential downstream affect areas. Bulk soil samples should be proposed for collection to verify field readings for analysis of uranium (total-238), radium 226, radium 228, thorium (total-232) and gross alpha/beta.

13.1 Introduction

A radiological baseline survey was performed to establish the existing, pre-mining, background gamma radiation conditions. Environmental Restoration Group, Inc. (ERG) was contracted by Laramide Resources (USA) Inc. (Laramide) to perform the radiological survey. The survey provides data on the current radiological conditions in and near the proposed Permit Area, and is appended here as Attachment 13A.

Radiological surveys were performed periodically from May 2011 to June 2012. The survey area was divided into the following four areas; the main facilities Permit Area (MFPA) on the western base of the La Jara Mesa, the associated buffer area, MFPA Buffer, the road access and utility corridor (RUC) consisting of the unimproved road which crosses private land and federal land, and potential downstream affected area (PDAA) west from the MFPA to the stock ponds.

The radiological survey collected data to establish existing natural background radiation, pre-mining radionuclide concentrations in surface soils, and radon-222 in air in representative areas in and around the proposed Permit Area. The results of the radiological survey are discussed in the following sections.

13.2 Gamma Survey

A Global Positioning System (GPS)-base gamma survey of the MFPA, MFPA Buffer, PDAA, and RUC (including an alternate route) was conducted. A total of 238,310 readings were recorded by field personnel, averaging 8,456 counts per minutes (cpm) and a median count rate of 8,004 cpm (Attachment 13A, Table 2-1). Excluding the highest 1 percent of all gamma count rates (greater than 16,000 cpm); the average gamma count rate is 8,260 cpm with a standard deviation 1,420 cpm.

Higher gamma count rates (greater than 12,520 cpm, average cpm plus three standard deviations) were generally found in the MFPA Buffer and the RUC. These higher gamma count rates within the MFPA and MFPA Buffer are likely related to the historical uranium Taffy and Zia Mines and natural outcroppings of mineralized rock containing naturally occurring uranium (Attachment 13A).

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13.3 Soil Sampling

Soil samples were collected from 58 randomly selected locations to characterize the baseline soil conditions throughout the proposed Permit Area (Attachment 13A). Surface soil samples (from ground surface to 15 centimeters deep) were collected from the MFPA, PDAA, and the RUC

The range of concentrations were relatively limited however, the soil samples collected from the RUC had the highest concentrations of all constituents, and the samples collected from the MFPA had the lowest concentrations of natural thorium, uranium radium-226, radium-228, and gross alpha and gross beta.

13.4 Ambient Radon Results

Quarterly monitoring of radon concentrations in ambient air was conducted in the La Jara Mesa Project's proposed Permit Area. Results from the third quarter of 2011 (May 18 to August 29, 2011), fourth quarter of 2011 (August 30 to December 1, 2011), first quarter of 2012 (December 2, 2011 to March 26, 2012), and second quarter of 2012 (March 27 to June 6, 2012) resulted in an average ambient radon concentration of 0.68 picoCuries per liter (pCi/L) for the proposed Permit Area. The highest average concentration of 1.05 pCi/L was recorded in the western part of the proposed Permit Area near the PDAA area (Attachment 13A).

In terms of effluent concentrations, which are published in 10 CFR 20, if 0.1 pCi/L for radon-222 with daughters present, the recorded concentrations exceed the effluent concentrations, site wide and surrounding areas overall, with concentration averages of 0.68 pCi/L. However, these concentrations are within the range of the worldwide ambient background radon concentrations of 0.027 to 2.7 pCi/L set by the United Nations Scientific Committee on the Effects of Atomic Radiation (2000).

13.5 Summary

Ninety-nine percent of the gamma count rates were below 10,000 cpm and 99% of the Permit and surrounding areas had gamma count rates below 15,000 cpm (Attachment 13A). The survey found three distinct locations where the high count rates account for 1 percent of the readings above 15,000 cpm. The area above the MFPA on the La Jara Mesa escarpment close to the historical Taffy Mine, an area in the MFPA Buffer area close to the historical Zia Mine and natural outcroppings of uranium bearing material, and portions of the RUC related to the Lobo Canyon drainage floodplain and likely previous ore spillage along an old haul road all had elevated gamma count rates above 15,000 cpm (Attachment 13A).

Soil samples had an average radium-226 concentration of 0.44 pCi/g for the MFPA (Attachment 13A). Samples from the PDAA and the RUC had higher reported concentrations of radium-226 than those

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from the MFPA. This is likely indicative of the previous uranium mining activities and/or naturally occurring outcrops of mineralized rock near the PDAA and RUC areas.

The ambient radon concentration for the La Jara Mesa Project's Permit Area and surrounding areas ranged from 0.35 to 1.05 pCi/L, with an average of 0.68 pCi/L. The highest concentration (1.09 pCi/L) was recorded in the fourth quarter of 2011. The lowest concentration (0.18 pCi/L) was recorded during the third quarter of 2011. In conclusion, ERG's baseline report on the La Jara Mesa Project's Permit Area shows radiological impacts from historical and/or current anthropogenic activities (Attachment 13A).

13.6 References

United Nations Scientific Committee on the Effects of Atomic Radiation. (2000). Volume I: Report to the General Assembly, with Scientific Annexes. New York, United Nations: UNSCEAR.

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ATTACHMENT 13A
BASELINE RADIOLOGICAL DATA REPORT
FOR
LA JARA MESA PROJECT
ENVIRONMENTAL RESTORATION GROUP, INC.

Baseline Radiological Data Report
for
La Jara Mesa Project

November 2012

Prepared for:

Laramide Resources Ltd
62329 North Star Drive
Montrose, CO 81403

Prepared by:

Environmental Restoration Group, Inc.
8809 Washington St. NE, Suite 150
Albuquerque, NM 87113

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Acronyms and Abbreviations

cm	centimeter
cpm	counts per minute
EPA	Environmental Protection Agency
ERG	Environmental Restoration Group, Inc.
GPS	global positioning system
HPIC	high pressure ionization chamber
ICP-MS	inductively-coupled plasma mass spectrometry
km	kilometer
LJMP	La Jara Mesa Project
m/s	meter per second
MDC	minimum detectable concentration
MFPA	Main Facility Permit Area
NaI	Sodium Iodide
pCi/L	picocurie per liter
PDAA	Potential Downstream Affected Area
Ra-226	radium 226
Ra-228	radium 228
RUC	Road Access and Utility Corridor
UNSCEAR	United Nations Scientific Committee on the Affects of Atomic Radiation
µR/hr	microroentgen per hour
VSP	Visual Sampling Plan

1.0 Introduction

This baseline radiological data report presents the results of a study of the current radiological condition at the La Jara Mesa Project (LJMP) underground uranium mine project proposed by Laramide Resources (USA), Inc (Laramide). This report is a component in an overall site baseline study as required by the New Mexico Mining Act permitting process. The work was performed by Environmental Restoration Group, Inc. (ERG) under contract to Laramide, and performed from February 2011 to March 2012, with the majority of work taking place from March 2011 to July 2011. The field work consisted of a GPS-based gamma walkover survey, a correlation to convert gamma count rate data to units of exposure rate, collecting surface soil samples for laboratory analyses, and quarterly ambient radon measurements. The ambient radon measurements component of this study is ongoing.

1.1 Site Description

The LJMP is located in the Ambrosia Lake Mining District approximately 10 miles northeast of Grants, NM, as shown in Figure 1-1. The proposed mine portal and surface facilities are located on Forest Service lands at the western base of La Jara Mesa. For the purposes of this report, the proposed LJMP consists of three general areas including the Main Facilities Permit Area (MFPA) and associated buffer area, the Road Access and Utility Corridor (RUC), and the Potential Downstream Affected Area (PDAA). The MFPA is located on the western base of the La Jara Mesa. The RUC consists of an unimproved road which crosses private land and federal lands managed by the Bureau of Land Management and Forest Service, and links the MFPA to state highway NM 605. The PDAA extends due west from the MFPA as a bifurcated arroyo until termination at stock ponds. The mine's air escape raise will be located on top of La Jara Mesa about 1 mile east of the mine portal. There will be no ore processing (milling) or mill tailings disposal areas associated with this site. The relative locations of the MFPA, PDAA, and RUC are shown in Figure 1-2.

2.0 Baseline Radiological Investigation

This report provides baseline radiological field investigation data for direct radiation, surface soils, and radon-222 in air representative of areas in and around the LJMP permit area. The scope of work for the baseline radiological investigation consisted of the following activities:

- Performing a Global Positioning System (GPS)-based gamma survey of the:
    - MFPA at 3-meter transects;
    - MFPA Buffer Area at 100-meter transects;
    - PDAA at varying transect spacing; and
    - RUC from NM 605 to the MFPA. Includes an alternate route and a route to the transmission line connection.
- Correlating gamma count rates of the instruments used in the GPS-based gamma survey to exposure rate units using a high pressurized ion chamber (HPIC).
- Collecting surface soil samples (0-15 centimeters [cm]) at 58 locations within the MFPA, PDAA and the RUC.
- Making quarterly measurements of radon concentrations in ambient air at 17 locations; 6 locations on top of La Jara Mesa, and 11 locations around the proposed permit area and western base of La Jara Mesa.

All field work was conducted in accordance with the most current versions of applicable ERG standard operating procedures, attached in Appendix C.

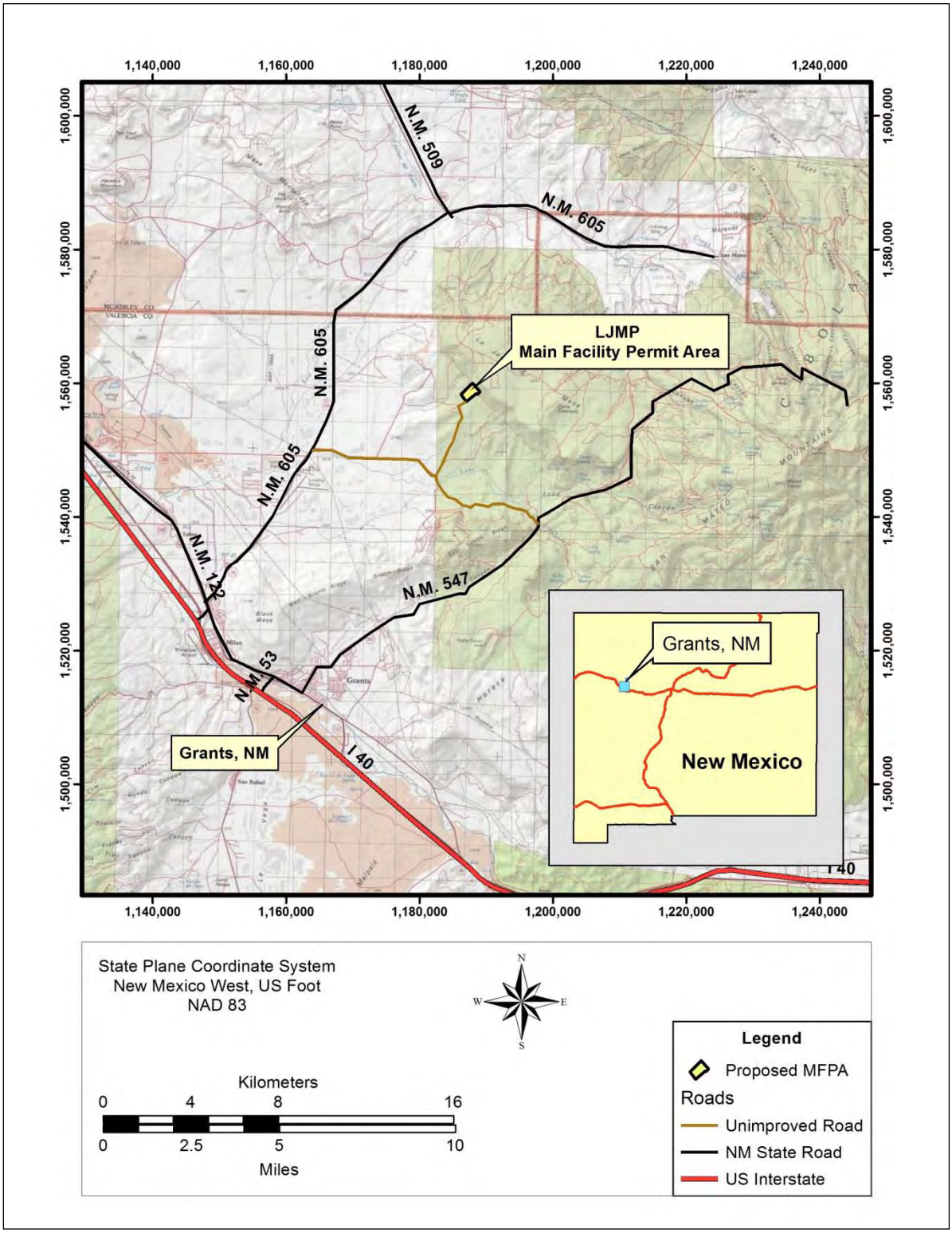


Figure 1-1 Site Relative Location

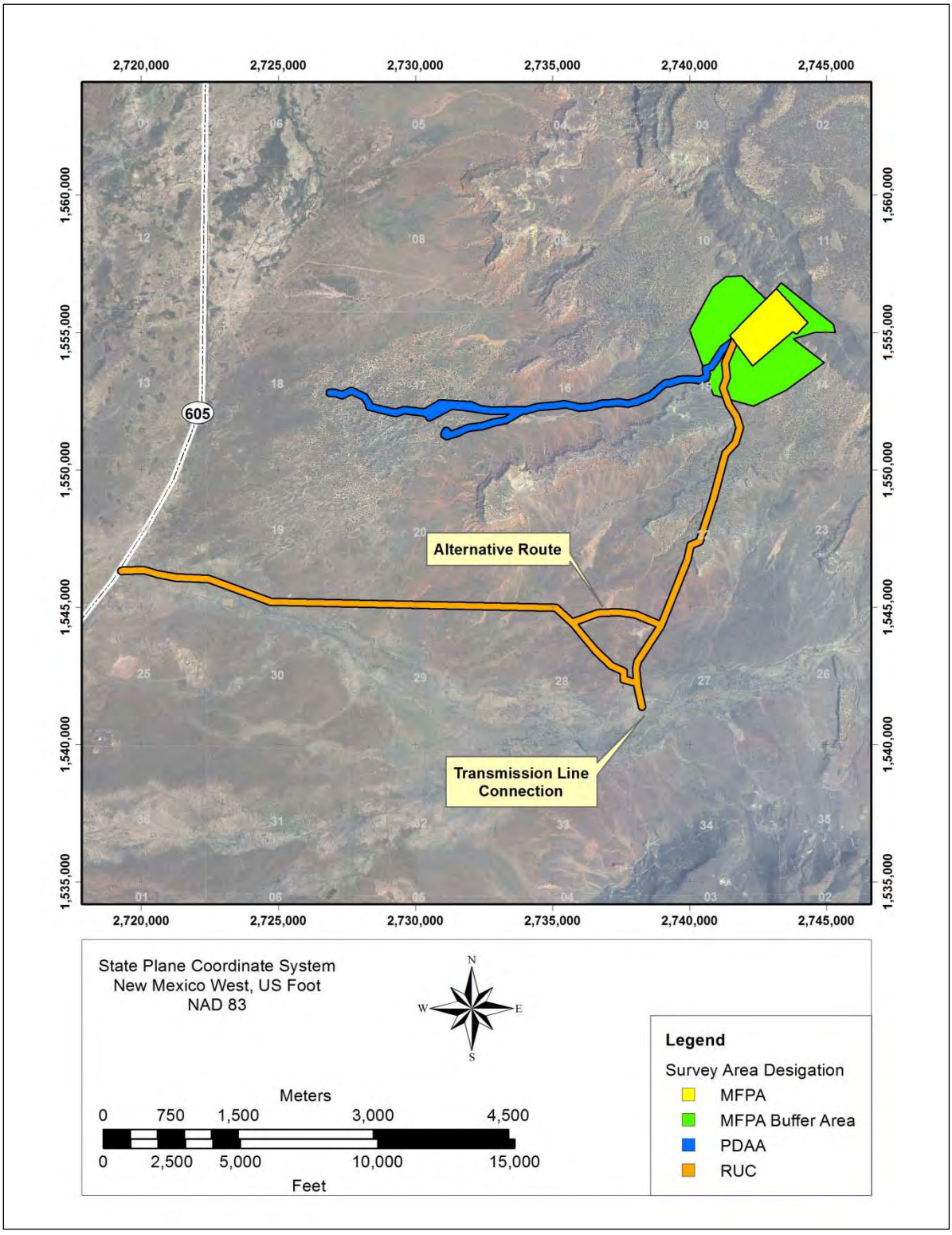


Figure 1-2 Survey Area Designations

2.1 GPS-Based Gamma Surveys

An introduction to the GPS-based survey methods is followed by a discussion of the results.

2.1.1 Survey Method

Each survey system consisted of an unshielded Ludlum Model 44-10 two-inch by two-inch sodium iodide (NaI) detector coupled to a Ludlum Model 2221 ratemeter/scaler and a Trimble ProXRS GPS receiver with handheld datalogger. The Model 2221 was operated in ratemeter mode with the Window setting: Out, and the Response setting: Fast, resulting in a gamma count rate being output to the GPS datalogger every second. The data logger would then log the gamma count rate and its corresponding GPS coordinate position.

The survey of the MFPA was performed using a 3-meter transect spacing. The eastern portion of the MFPA is located in steep terrain of the La Jara Mesa escarpment making much of the area inaccessible. Where accessible, a 400-meter buffer area surrounding the MFPA was surveyed at 100-meter transect spacing. Limited survey data was collected on the eastern escarpment. The RUC consists of unimproved access roads from New Mexico State Highway 605 to the MFPA. The RUC is approximately 10 kilometers (km) in length, includes a proposed alternative access road approximately 1 km long, and unimproved road to a transmission line connection point approximately 0.3 km long. The access road and the unimproved road to the transmission line connection point were surveyed with transects on both sides of the road and 10-meters off each side of the road. The proposed alternative access road was surveyed in four transects 10-meters apart. The PDAA is approximately 5.5 km of drainage that alternates between clearly defined arroyos and flat terrain. Approximately 2.5 km downstream from the MFPA the drainage path splits into two segments. The upper PDAA and both lower segments were surveyed to termination at livestock drinking water ponds. Survey transect spacing was adjusted to encompass the outer most edges of the PDAA and primary drainage path. For all areas on site a survey scan speed of approximately 0.5 meter per second (m/s) and a detector height of approximately 0.5 meter above ground surface were maintained.

2.1.2 Survey Results

The observed gamma-ray count rates for the entire project are presented as colors representing ranges of count rates in Figure 2-1. Table 2-1 presents summary statistics for the total survey and each survey area data set. For the project field personnel collected 238,310 readings ranging from 4,946 to 397,950 counts per minute (cpm), with an average reading of 8,456 cpm, and a median count rate of 8,004 cpm. Less than one-percent of the gamma readings exceed 16,000 cpm, or approximately twice the median count rate.

Table 2-1 Gamma Survey Data Statistics

Survey Area	Records	Average (cpm)	Median (cpm)	Standard Deviation (cpm)	Minimum (cpm)	Maximum (cpm)
Total [(1)]	238,310	8,456	8,004	5,052	4,946	397,950
MFPA	142,183	7,976	7,976	905	4,946	20,275
MFPA Buffer Area	17,909	11,794	11,794	20,277	7,616	397,950
PDAA	22,404	7,890	7,890	952	5,033	15,815
RUC	55,814	9,296	9,296	3,293	5,137	152,957

Note:
(1) Total Survey Area includes MFPA, MFPA Buffer Area, RUC, and the PDAA.

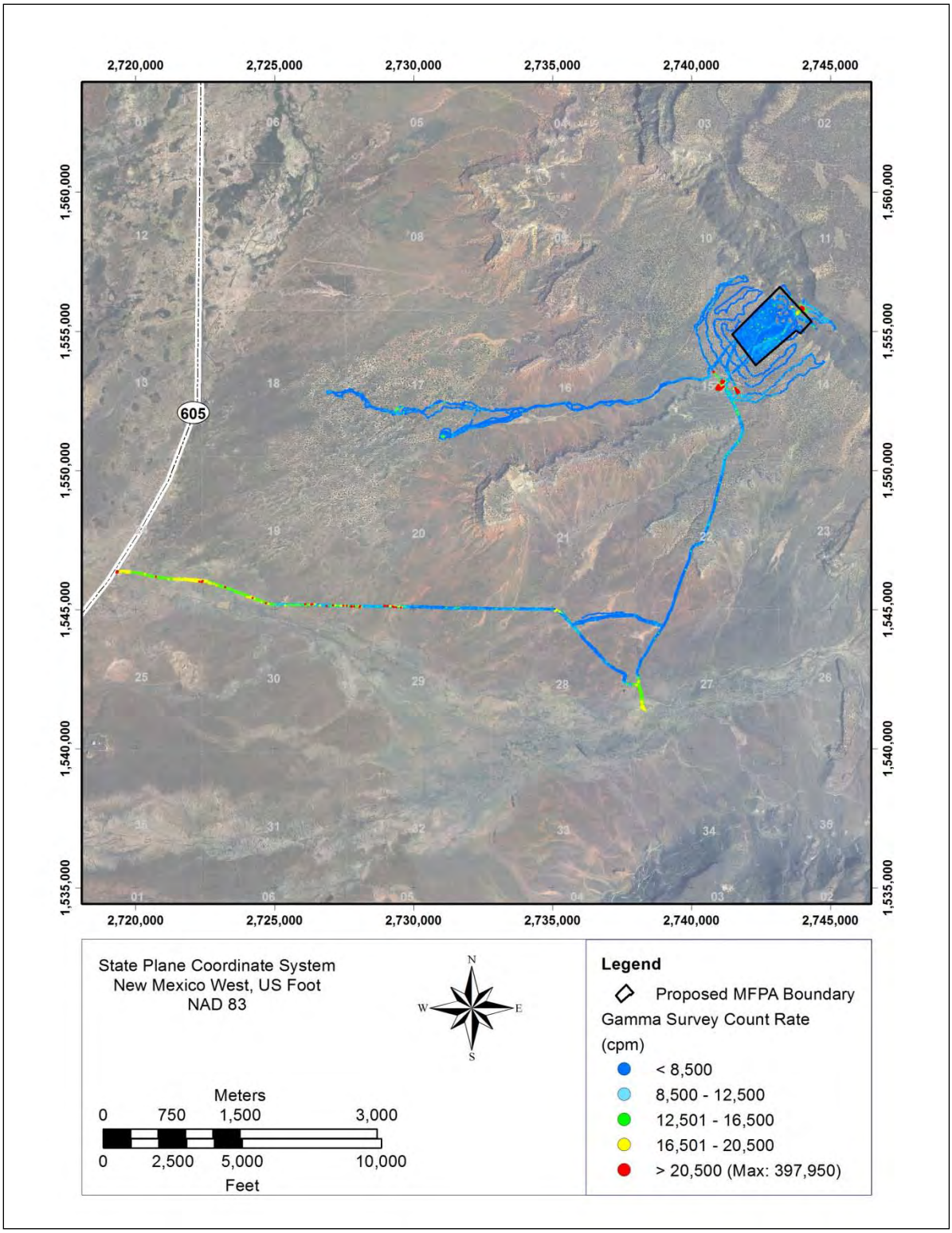


Figure 2-1 Site GPS-based Gamma Survey

If the highest one-percent of all gamma count rate data collected, those greater than 16,000 cpm, are excluded from the total gamma count rate data statistics, the average gamma count rate would be 8,260 cpm with a standard deviation of 1,420 cpm. Several areas of the site survey revealed elevated gamma count rates greater than the 8,260 cpm average plus three standard deviations, or greater than 12,520 cpm. The elevated gamma count rates occurred primarily in the MFPA Buffer Area and the RUC. Elevated count rates observed in the MFPA and MFPA Buffer Area survey are likely related to the Taffy Mine, an unrelated historic uranium mine. A close up view of this data is shown in Figure 2-2. Elevated count rates observed in the southern portion of the MFPA Buffer Area survey are likely due to two sources; the Zia Mine, a historic uranium mine, and outcroppings of mineralized rock containing natural uranium. A close up view of this data is shown below in Figure 2-3. Many of the elevated count rates observed in the RUC survey correlate well with their proximity to the Lobo Canyon flood plain. This is most evident on the western most portion and the southeast corner of the RUC survey. To further investigate the elevated readings in the southeast corner of the RUC an additional gamma survey was performed of the area. The additional investigation data indicate that elevated gamma count rates continue into the Lobo Canyon drainage path. This additional data is identified in Figure 2-4, but is not included as part of the RUC survey data set in Table 2-1 above. Considering the historic use of the RUC as a mine-to-mill haul road, it is likely that some of the elevated gamma readings in the RUC survey, especially those localized patches of elevated readings outside of the Lobo Canyon flood plain, are related to ore spillage.

Gamma survey data collected within the MFPA, excluding data collected on the escarpment, were mostly homogenous with an average gamma count rate of 7,964 cpm. Of the more than 130,000 records there were no data twice the average gamma count rate and only 19 records greater than 12,500 cpm.

Gamma survey data collected within the PDAA were mostly homogenous with an average gamma count rate of 7,890 cpm. Of the 22,404 records there were no data twice the average and only 36 records greater than 12,500 cpm.

2.2 Detector Correlation

Subsequent to the gamma survey of the LJMP, areas were selected, based on gamma survey data, to perform a NaI detector to HPIC correlation. The GE Energy Model RSS-131 HPIC is used to measure exposure rates but requires a longer collection time. The HPIC measures exposure rates directly and is considered a primary standard by the NIST, when calibrated. It is highly stable, relatively energy independent, and serves as an excellent tool to calibrate other survey equipment to measure exposure rates. Because of its size and weight the HPIC is not practical for use in large area surveys. By performing the gamma surveys with NaI detectors and developing a correlation between the two instruments, exposure rates derived from the NaI measurements can be used to represent site-wide exposure rates with sufficient accuracy. The primary benefit of having this correlation is that baseline exposure rates can be reliably compared to those obtained at any location and time in the future.

For this gamma count rate to exposure rate correlation, ten locations were selected based on gamma survey data that represent the observed range of gamma count rates. The locations were investigated to ensure gamma count rates were homogeneous over a 5-meter by 5-meter area, necessary to ensure no point sources would negatively impact the correlation. Figure 2-5 shows the five locations found adequate for correlation purposes. At each location the detectors were held at approximately 0.5 meter above ground surface (same height used for the gamma surveys) and a 1-minute integrated scaler count was made. The HPIC was then placed over the same location at a height of 1-meter above ground surface and exposure rate measurements were recorded for each location. The three NaI detectors used in the correlation were the same NaI detectors used for all gamma surveys onsite. The correlation data for the 5 locations is shown in Table 2-2.

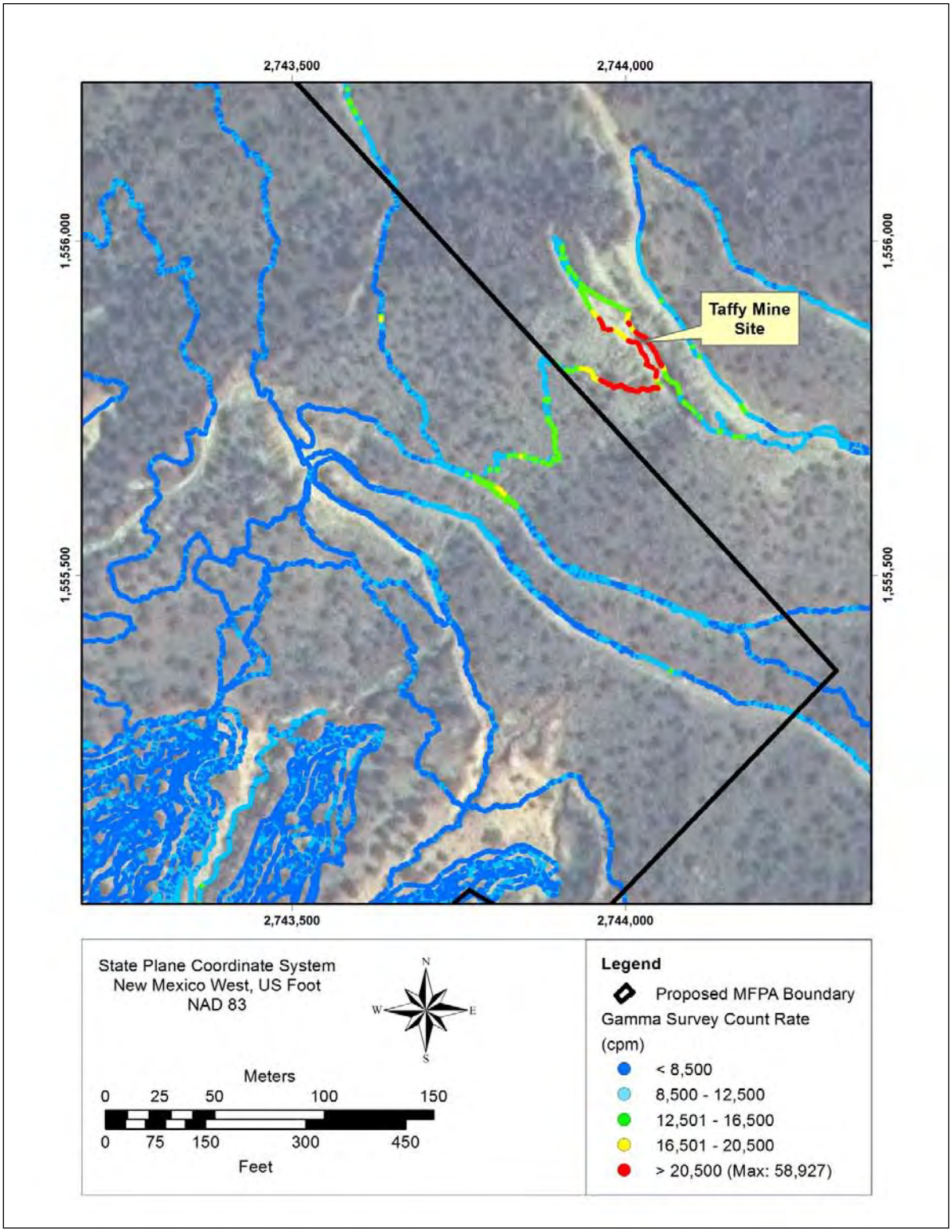


Figure 2-2 GPS-based Gamma Survey Data

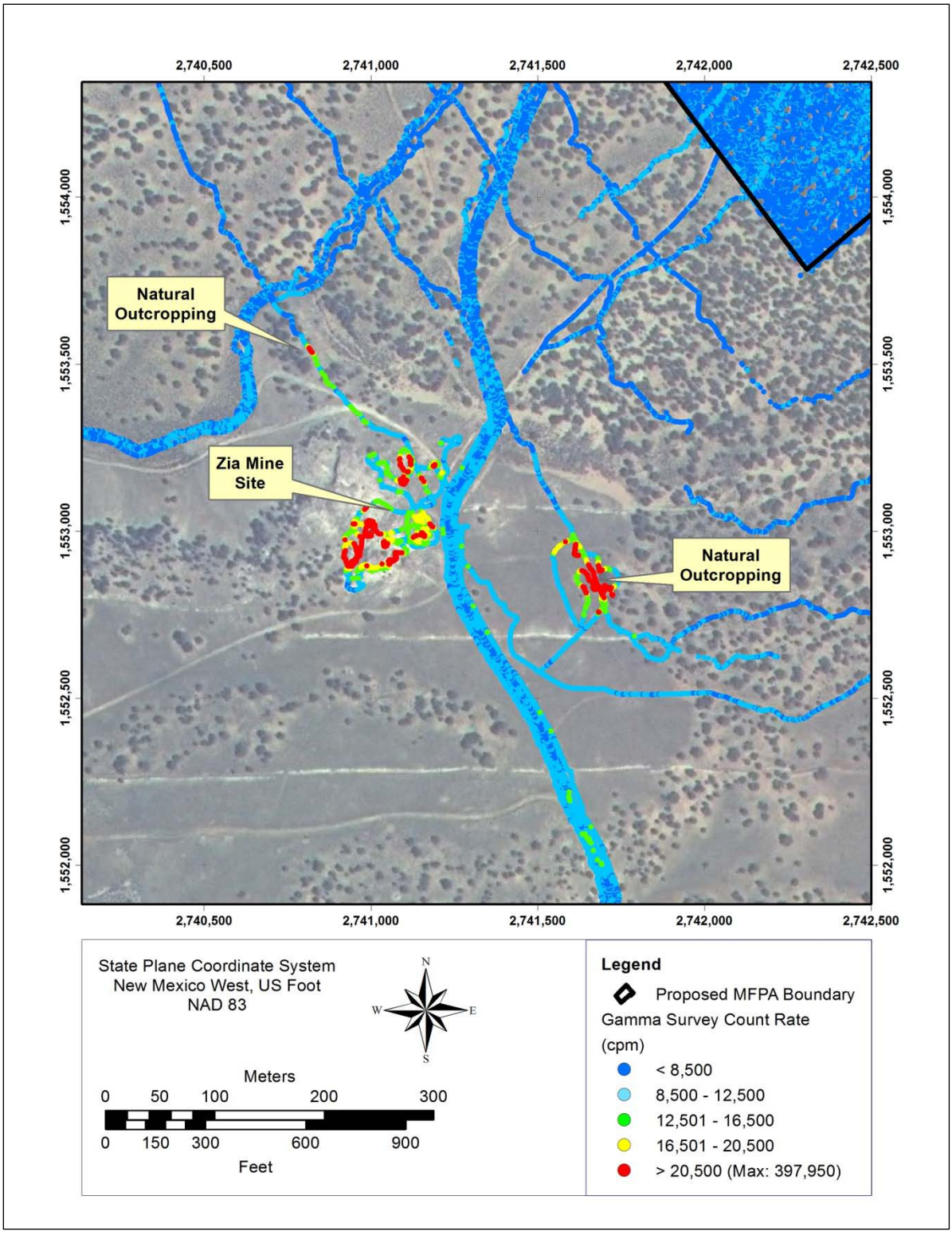


Figure 2-3 GPS-based Gamma Survey Data

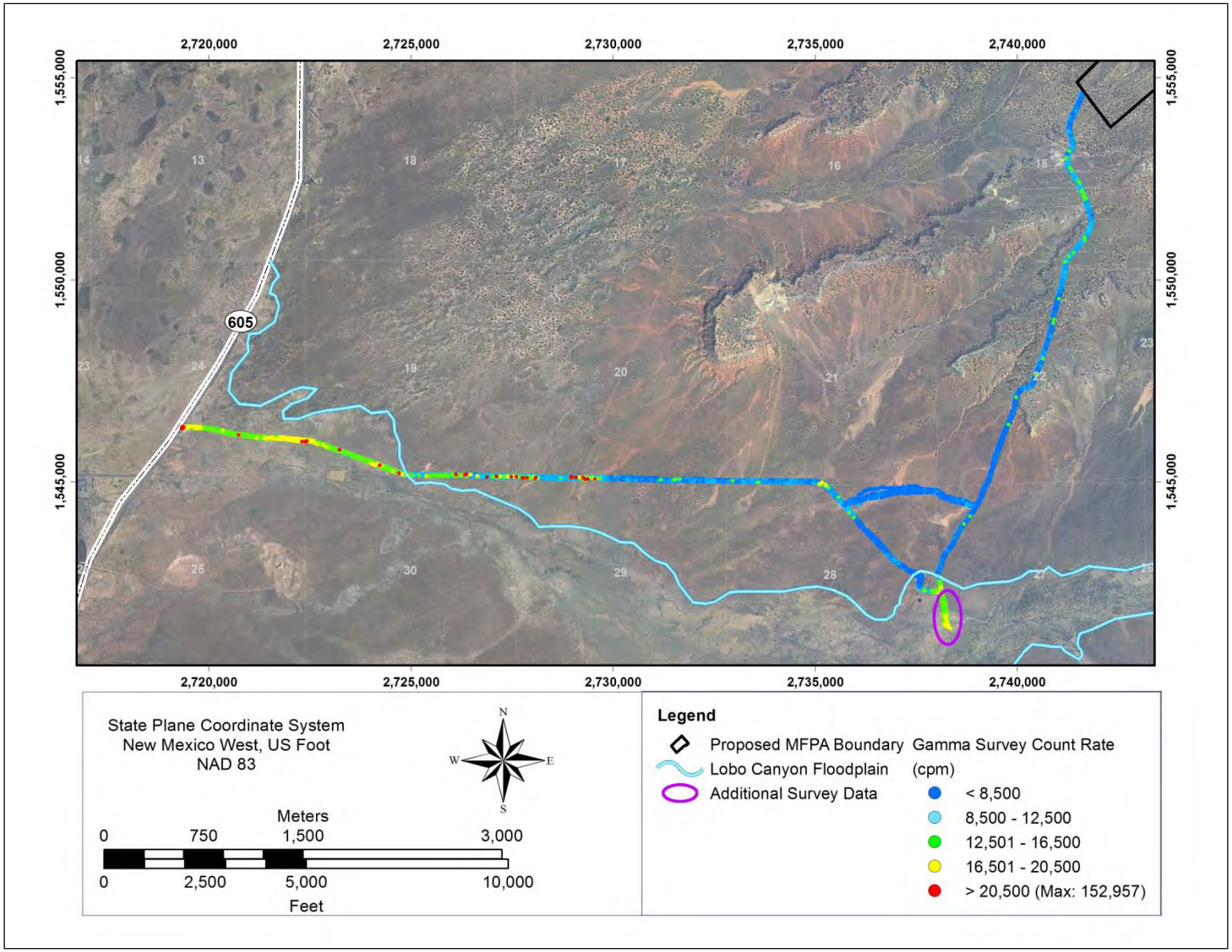


Figure 2-4 GPS-based Gamma Survey Data

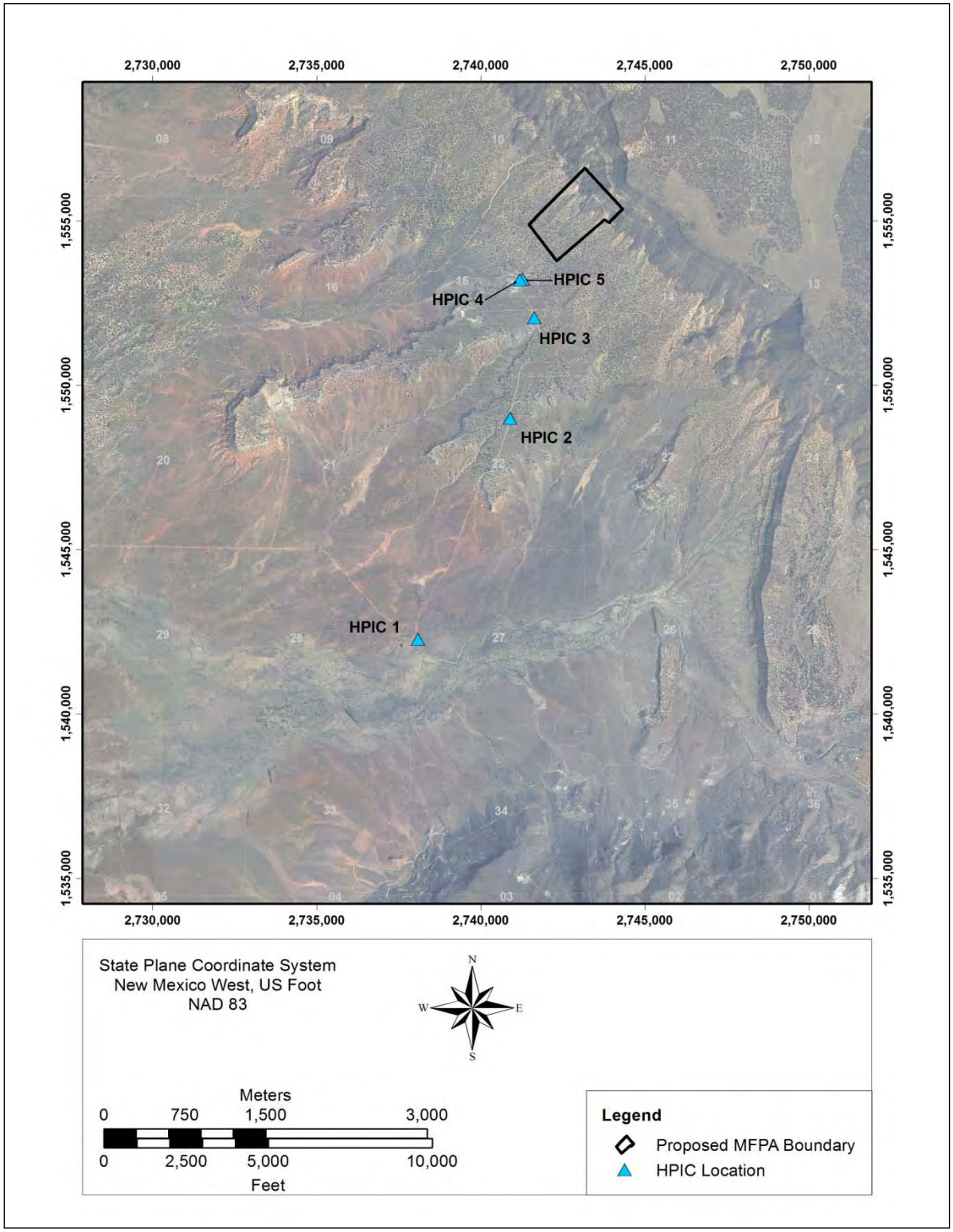


Figure 2-5 HPIC to Gamma Count Rate Correlation Measurement Locations

Table 2-2 NaI Detector to HPIC Correlation Data

Location	Coordinates [1]		NaI Detector 1-Minute Scaler Counts [2]				HPIC Measurements	
	Easting	Northing	ERG #1	ERG #2	ERG #3	Average	Records	Average (µR/hr)
1	2,738,092	1,542,260	13,630	13,049	13,114	13,264	121	15.9
2	2,740,898	1,548,981	8,031	7,613	8,023	7,889	76	12.8
3	2,741,637	1,552,043	10,274	9,890	10,130	10,098	93	14.2
4	2,741,288	1,553,216	9,811	9,315	9,587	9,571	87	13.9
5	2,741,193	1,553,199	21,470	21,290	20,703	21,154	117	19.1

Note:
[1] Coordinates in US State Plane NAD83 NM West, Units: US Feet.
[2] Detector serial numbers correspond to #1 (2221: 117357 w/ 44-10: PR144055), #2 (2221: 254757 w/ 44-10: PR199131), and #3 (2221: 254772 w/ 44-10: PR118372)

The average of the NaI detectors scaler counts and the average of the HPIC measurements at each location were used to develop a linear equation representing the relationship between exposure rates and gamma count rates. The linear equation is:

*Exposure Rate = 0.00047 * Gamma Count Rate + 9.40. Eq. 1*

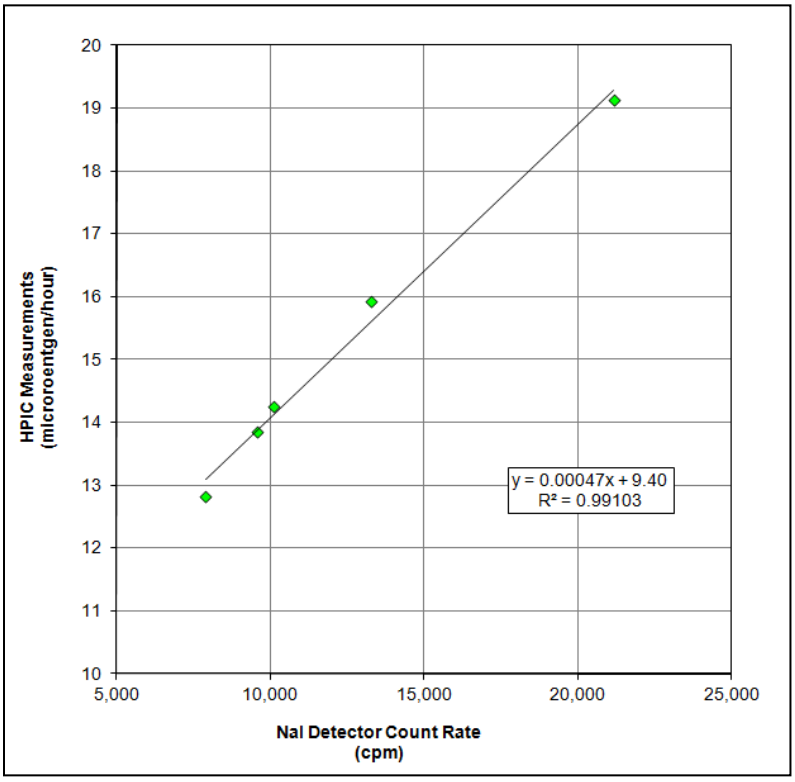


Figure 2-6 NaI Detector to HPIC Correlation

Where, the exposure rate is in microroentgen/hr (µR/hr) and the gamma count rate is in cpm. The linear regression model is shown in Figure 2-6 and is a good fit, with a correlation coefficient (R^2) of 0.99. The predicted site-wide exposure rates for the site are shown as ranges of colors in Figure 2-7. The ranges

chosen reflect the exposure rate corresponding to gamma count rates as shown in Figure 2-2. The exposure rate statistics for the areas of the site where a gamma survey was performed are shown in Table 2-3 below. The exposure rates range from 11.7 to 195.6 µR/hr, with an average of 13.3 µR/hr, a median of 13.1 µR/hr, and a standard deviation of 2.4 µR/hr.

Table 2-3 Site Exposure Rate Statistics

Survey Area	Records	Average (µR/hr)	Median (µR/hr)	Standard Deviation (µR/hr)	Minimum (µR/hr)	Maximum (µR/hr)
Total [(1)]	238,310	13.3	13.1	2.4	11.7	195.6
MFPA	142,183	13.1	13.1	0.4	11.7	18.9
MFPA Buffer Area	12,433	14.9	14.9	9.5	13.0	195.6
PDAA	22,404	13.1	13.1	0.4	11.8	16.8
RUC	54,804	13.7	13.7	1.5	11.8	81.0

Note:

[(1)] Total Survey Area includes MFPA, MFPA Buffer Area, RUC, and the PDAA.

2.3 Soil Sampling

Prior to collecting soil samples in the field a total of 58 sampling locations were selected to characterize baseline soil conditions at the LJMP. The number of soils samples included; 30 in the MFPA, 16 in the PDAA, and 12 in the RUC. The 30 sampling locations in the MFPA were randomly selected using Visual Sampling Plan (VSP), Version 5.0. The PDAA sampling locations were selected using ArcGIS to assist in evenly spacing 16 locations over the distance of the PDAA. The soil sampling effort in the RUC was divided over 2 miles of Forest Road #450 (north-south segment) and 0.5 mile of unnamed Forest Service road from #450 to the MFPA. Sample locations were selected using ArcGIS to evenly space12 sample locations over this portion of the RUC.

A total of 64 surface soil samples were collected on site as part of the baseline radiological investigation; one at each of the 58 soil sampling locations and 6 duplicate samples (approximately 10-percent). Three duplicates were collected in the MFPA, 2 in the PDAA, and 1 in the RUC.

Prior to collecting a soil sample(s) at each location, a NaI detector was used to make a 1-minute scaler count at both 0.5 meter above ground surface and on contact with ground surface. A hand shovel was used to collect a sample from 0 to 15-cm below ground surface. The sample location, sample date, and sampler initials were recorded directly on the sample bag. All soil sampling locations are shown Figure 2-8

2.3.1 Sample Evaluation and Selection for Lab Analysis

All 64 samples were radiometrically screened to determine which samples would be sent for radiological analyses. The sample screening involved placing a NaI detector in a lead shield on top of each bagged sample; three 1-minute scaler counts were then made for each sample; averaging the net scaler counts; and choosing the 12 samples that best characterized the range of gamma counts and survey areas for the LJMP site. Table 2-4 below shows the range of the average net gamma counts and the sample survey area for the 12 samples; 6 from the MFPA, 3 from the PDAA, and 3 from the RUC.

Table 2-4 Soil Sample Screening Results

Sample	NaI Shielded Detector 1-Minute Scaler Count				Net Count [(1)]
	ERG #1	ERG #2	ERG #3	Average	
LJMP-MFPA-11	1,892	1,876	1,885	1,885	369
LJMP-MFPA-14	2,279	2,145	2,240	2,240	724
LJMP-MFPA-17	2,094	1,983	2,060	2,060	544
LJMP-MFPA-18	2,012	2,026	1,996	1,996	480
LJMP-MFPA-23	2,182	2,191	2,166	2,166	650
LJM-MFPA-30	2,102	2,013	2,074	2,074	558
LJMP-PDAA-03	1,895	1,870	1,883	1,883	367
LJMP-PDAA-09	2,268	2,258	2,280	2,280	764
LJMP-PDAA-16	2,156	2,010	2,129	2,129	613
LJMP-RUC-19	2,538	2,535	2,546	2,546	1,030
LJMP-RUC-23	2,007	2,108	2,026	2,026	510
LJMP-RUC-28	2,310	2,328	2,288	2,288	772

Note:

[(1)] Average of eleven 1-minute scaler background counts was 1516 counts.

2.3.2 Analytical Results for Soil Samples

The 12 samples selected were sent to ALS Laboratory in Ft. Collins, CO for the following analyses:

- Natural Thorium: EPA method 6020 ICP-MS,
- Natural Uranium EPA method 6020 ICP-MS,
- Radium 226: EPA Method 901.1M via gamma spectroscopy,
- Radium 228: EPA Method 901.1 via gamma spectroscopy
- Gross Alpha/Beta: EPA Method 900.0M.

A summary of the analytical laboratory results are in Table 2-5. The full analytical laboratory results are located in Appendix A.

A reliable correlation between gamma count and radionuclide concentration in soil could not be adequately developed due to similar NaI detector 1-minute integrated scaler counts for all samples but one, LJMP-RUC-28.

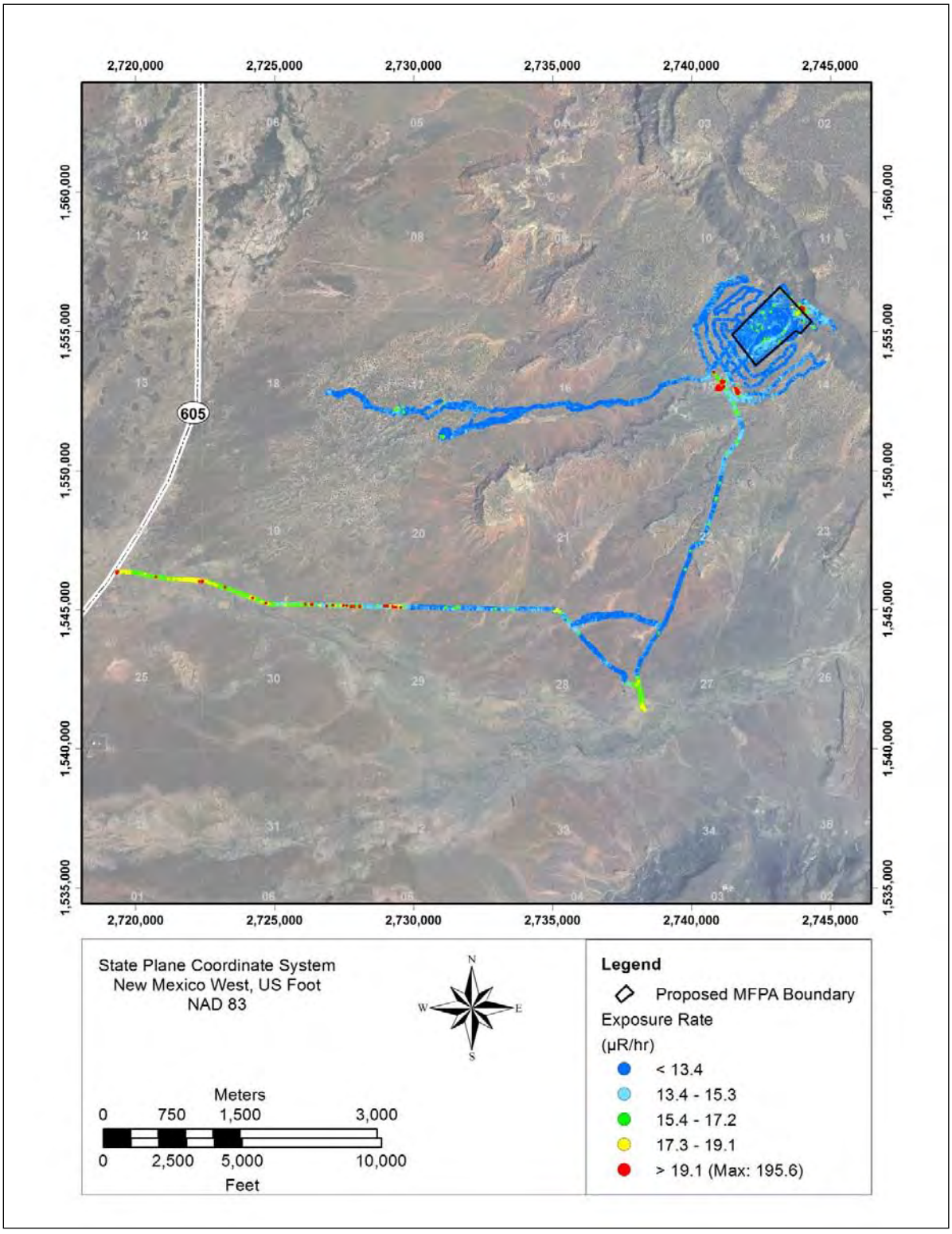


Figure 2-7 Site Exposure Rate Data

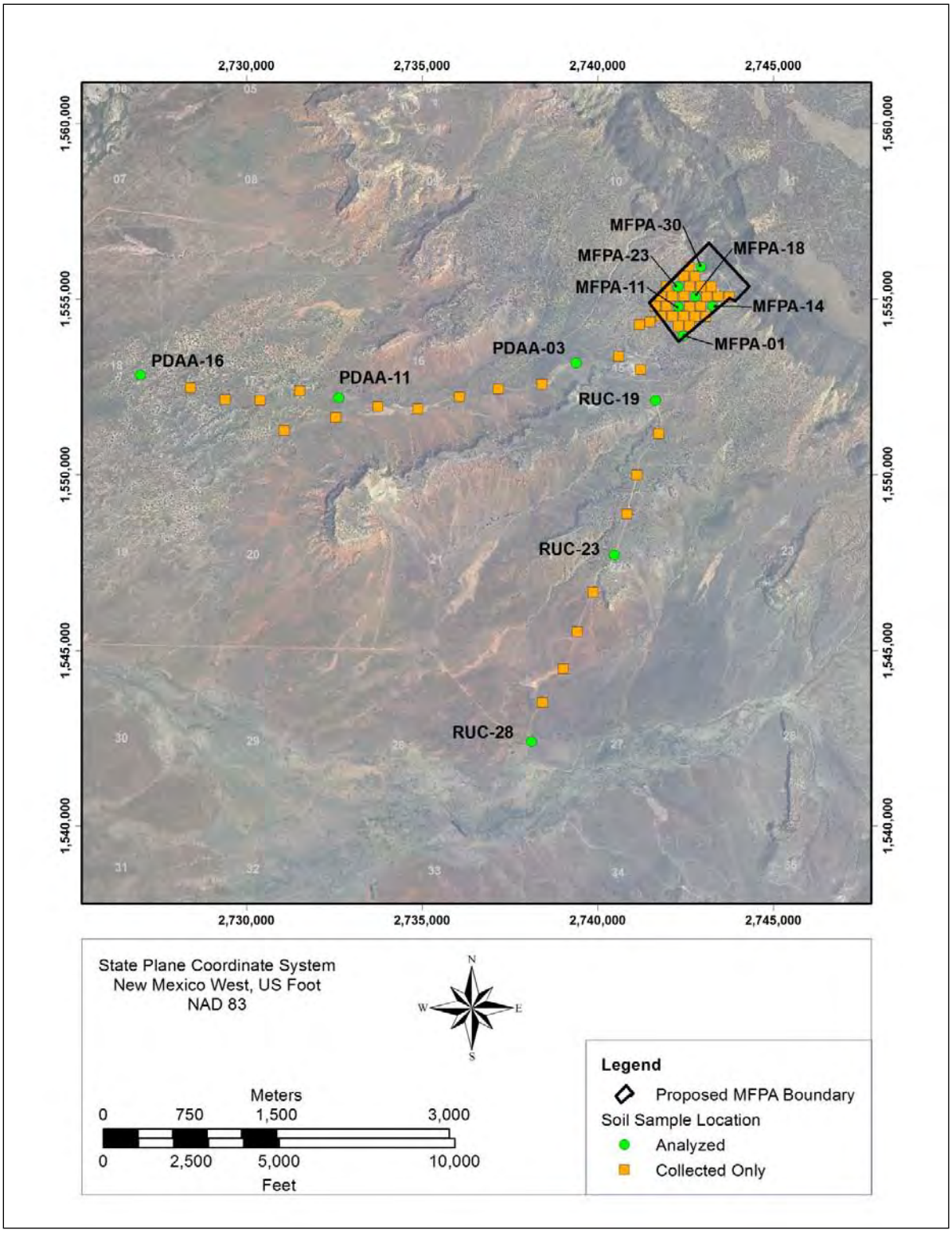


Figure 2-8 Soil Sampling Locations

2.4 Ambient Radon

Landauer's Radtrak passive radon-222 track etch detectors are being used to determine ambient radon concentrations in air. The detectors measure average radon concentrations in air over the measurement period. The results are reported in picocuries per liter (pCi/L). The detector deployment locations are shown in Figure 2-9. For quality control purposes, duplicate detectors are placed at Location 9 (air escape raise) and Location 2 (immediately downstream from the MFPA), during each sampling event. The results for the 2011 second quarter initial deployment (02/21/11 to 05/18/11) have been deemed unusable due to 14 of the 17 locations having concentrations of "less than minimum detectable concentration (MDC)", which is considered unlikely. The results for the 2012 third quarter (06/19/12 to 09/12/12) deployment are pending. The results for 2011 4th quarter to 2012 2nd quarter, and their average results are shown in Table 2-6. The site-wide and surrounding area range of ambient radon concentration results for the 4 quarters of data has a minimum concentration of less than MDC at Location 9 (2011 Q3) and Location 3 (2012 Q2), a maximum concentration of 1.50 pCi/L at Location 7 (2011 Q4), a minimum average concentration 0.35 pCi/L at Location 16, and a maximum average concentration of 1.05 pCi/L at Location 13. The site-wide and surrounding areas overall concentration average is 0.68 pCi/L (accounting for average of duplicate sample results) with the highest quarterly average of 1.09 pCi/L in 2012 Q4.

In terms of effluent concentrations (EC) published in 10 CFR 20, the measured values exceed the EC of 0.1 pCi/L for radon-222 with daughters present. However, on average the measured values are within the range of reported worldwide ambient background radon concentrations of 0.027 to 2.7 pCi/L (United Nations Scientific Committee on the Effects of Atomic Radiation [UNSCEAR], 2000).

Table 2-5 Soil Sample Radiological Analyses Results

Sample ID	ALS Lab ID	Natural Thorium (mg/g)		Natural Uranium (mg/g)		Radium-226 (pCi/g)			Radium-228 (pCi/g)			Gross Alpha (pCi/g)			Gross Beta (pCi/g)		
		Result	IDL	Result	IDL	Result	± 2s TPU	MDC	Result	± 2s TPU	MDC	Result	TPU	MDC	Result	TPU	MDC
LJMP-MFPA-11	1110390-1	0.0028	0.0000034	0.00098	0.0000098	0.38	0.059	0.059	0.426	0.098	0.129	0.81	0.40	0.43	0.92	0.39	0.61
LJMP-MFPA-14	1110390-2	0.0029	0.0000034	0.001	0.0000099	0.432	0.066	0.067	0.41	0.098	0.166	1.16	0.50	0.47	0.92	0.41	0.66
LJMP-MFPA-17	1110390-3	0.003	0.0000033	0.0011	0.0000097	0.456	0.067	0.056	0.378	0.092	0.133	1.01	0.43	0.37	0.93	0.41	0.65
LJMP-MFPA-18	1110390-4	0.0032	0.0000034	0.0012	0.0000099	0.519	0.075	0.065	0.46	0.11	0.15	1.34	0.53	0.42	1.27	0.46	0.67
LJMP-MFPA-23	1110390-5	0.0028	0.0000034	0.001	0.0000099	0.516	0.076	0.072	0.41	0.10	0.15	0.99	0.47	0.49	1.64	0.52	0.66
LJMP-MFPA-30	1110390-6	0.0025	0.0000033	0.00087	0.0000096	0.311	0.051	0.055	0.325	0.093	0.196	0.85	0.40	0.42	0.65 U	0.37	0.66
LJMP-PDAA-03	1111005-1	0.0023	0.0000034	0.00083	0.0000099	0.355	0.054	0.054	0.314	0.083	0.131	0.69	0.37	0.43	1.12	0.43	0.65
LJMP-PDAA-09	1111005-2	0.0029	0.0000034	0.001	0.0000099	0.475	0.068	0.055	0.264	0.082	0.130	2.04	0.70	0.48	1.14	0.45	0.67
LJMP-PDAA-16	1111005-3	0.0036	0.0000034	0.0019	0.0000098	1.12	0.150	0.06	0.38	0.091	0.143	3.67	0.95	0.41	3.12	0.76	0.74
LJMP-RUC-19	1111005-4	0.0028	0.0000035	0.0033	0.00001	1.2	0.160	0.07	0.394	0.096	0.138	4.8	2.1	1.9	1.9 U	1.3	2.5
LJMP-RUC-23	1111005-5	0.0026	0.0000034	0.0015	0.0000098	0.686	0.094	0.065	0.34	0.10	0.14	1.6	1.4	2.4 U	2.7	1.5	2.6
LJMP-RUC-28	1111005-6	0.0073	0.0000033	0.0024	0.0000097	1.02	0.140	0.09	1.08	0.18	0.16	3.9	1.0	0.5	2.53	0.68	0.73
Average	n/a	0.0032	n/a	0.00142	n/a	0.623	n/a		0.432	n/a		1.91	n/a		1.63	n/a	
Average MFPA		0.0029		0.00103		0.436			0.402			1.03			1.14		
Average PDAA		0.0029		0.00124		0.650			0.319			2.13			1.79		
Average RUC		0.0042		0.00240		0.969			0.605			3.43			2.62		

Note:
U - Result is less than the sample specific MDC.

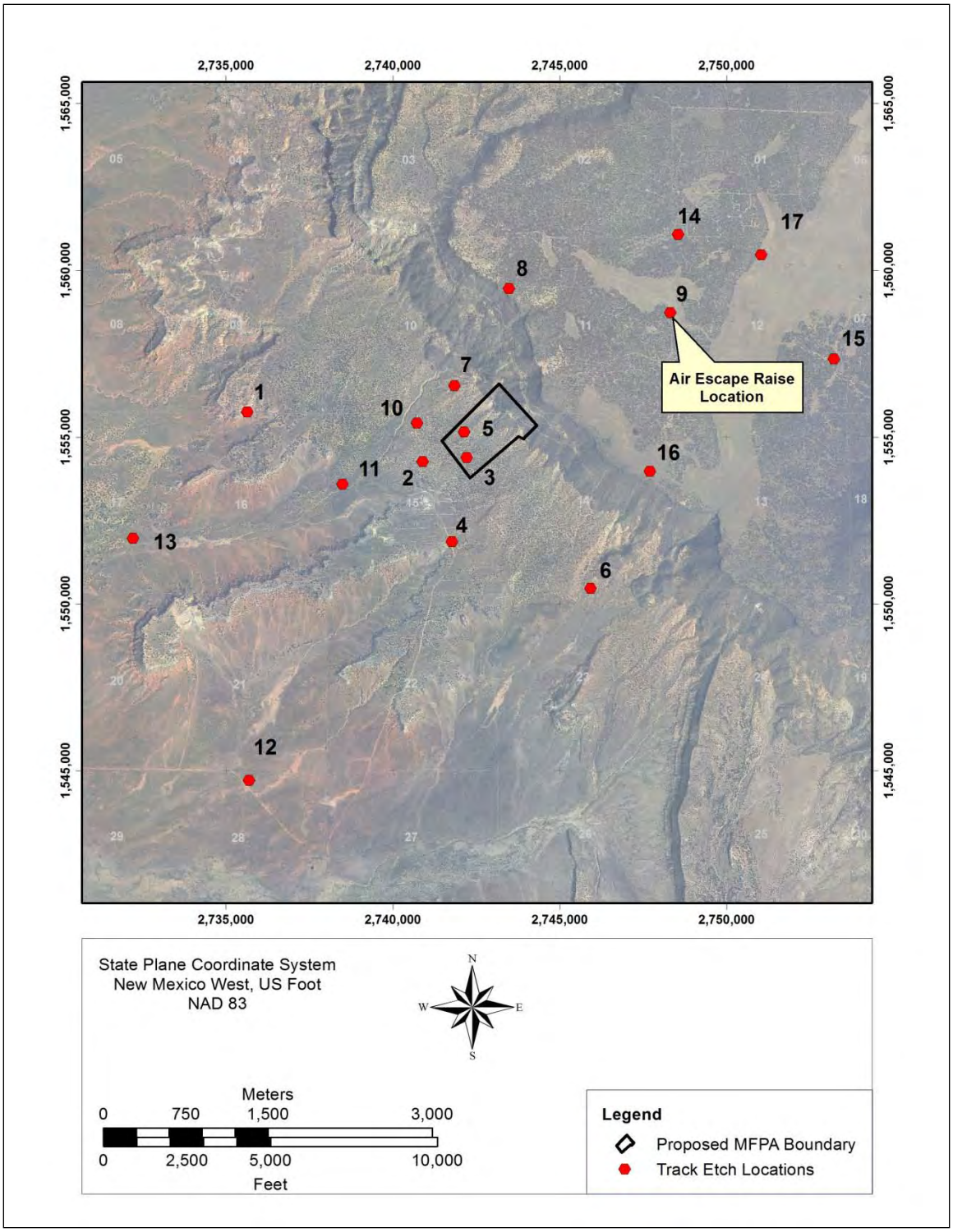


Figure 2-9 Ambient Radon Monitoring Locations

Table 2-6 Ambient Radon Detector Results

Location	2011 Q3 [3] (pCi/L)	2011 Q4 [4] (pCi/L)	2012 Q1 [5] (pCi/L)	2012 Q2 [6] (pCi/L)	*Average [7] (pCi/L)*
1	0.10	0.90	1.00	0.90	*0.73*
2 (A)	0.10	1.20	0.40	0.30	*0.50*
2 (B)	0.30	1.40	0.50	0.50	*0.68*
3	0.10	1.20	0.40	0.07 [1]	*0.57*
4	0.10	1.40	1.20	0.60	*0.83*
5	0.10	1.10	0.60	0.40	*0.55*
6	0.20	0.90	1.00	0.30	*0.60*
7	0.10	1.50	0.90	0.90	*0.85*
8	0.10	0.80	0.80	0.40	*0.53*
9 (A)	0.06 [1]	1.00	0.20	0.30	*0.50*
9 (B)	0.06 [1]	1.10	0.90	0.10	*0.70*
10	0.20	1.50	1.10	1.10	*0.98*
11	0.20	0.90	1.00	0.90	*0.75*
12	0.20	1.10	1.20	1.00	*0.88*
13	0.50	1.10	1.40	1.20	*1.05*
14	0.30	1.00	0.90	0.40	*0.65*
15	0.20	1.10	0.90	0.30	*0.63*
16	0.10	0.70	0.30	0.30	*0.35*
17	0.10	0.90	invalid [2]	0.20	*0.40*
Average [7]	*0.18*	*1.09*	*0.86*	*0.59*	*0.68*

Note:
[1] Result is less than minimum detectable concentration. Not included in average.
[2] 2012 Q1 #17 detector (2.3 pCi/L) was found on ground. Not included in average.
[3] Period of 05/18/11 to 08/29/11.
[4] Period of 08/29/11 to12/01/11.
[5] Period of 12/01/11 to 03/26/12.
[6] Period of 03/26/12 to 06/19/12.
[7] Average calculated using an average of duplicate sample value.

3.0 Summary

The results of the LJMP baseline radiological field investigation documented herein indicate the following:

- Baseline gamma-ray count rates have been obtained in and around the proposed permit area. Ninety-one percent of the gamma count rates were below 10,000 cpm (14.1 µR/hr), and 99-percent of the gamma count rates were below 15,000 cpm (16.4 µR/hr). Three distinct populations of elevated gamma-ray count rates make up the one-percent of readings greater than 15,000 cpm; an area above the MFPA on the La Jara Mesa escarpment related to the historic Taffy Mine, an area below the MFPA in the MFPA Buffer Area related to the Zia Mine and natural outcroppings of uranium bearing material, and portions of the RUC related to the Lobo Canyon drainage flood plain and likely historic ore spillage.

- A linear regression model comparing HPIC to gamma-ray count rate measurements predicts an average exposure rate of 13.1 µR/hr (8,432 cpm) for the site. The range of predicted exposure rates is from 11.7 to 195.6 µR/hr (4,946 to 397,950 cpm. Similar to the gamma count rates observed on site, 99-percent of the readings are below 16.4 µR/hr with those above related to previous mining efforts and/or natural uranium bearing materials.

- Soil sample results indicate an average surface soil radium-226 concentration of 0.44 pCi/g for the MFPA. The PDAA and RUC samples show radium-226 concentrations in surface soil which are higher than those observed in the MFPA which may be indicative of impacts from previous uranium mining activities and/or naturally occurring outcrops of mineralize rock in the area.

- Site-wide, annual ambient radon concentrations ranged from to 0.35 to 1.05, and averaged 0.68 pCi/L. Higher values were observed in the fourth quarter of 2011 (1.09 pCi/L) and the first quarter of 2012 (0.86 pCi/L). The lowest values were observed in the third quarter of 2011 (0.18 pCi/L) and second quarter of 2012 (0.59 pCi/L).

In summary, it is clear that portions of the LJMP site and surrounding areas exhibit radiological impacts from historic and/or current anthropogenic activities within the area and the natural presence of uranium bearing materials. The precise sources of these impacts are not relevant in the context of this investigation since the apparent impacts are part of the baseline or background radiological characteristics of the site.

4.0 Quality Control

All gamma survey detection systems were calibrated within 12 months prior to use at the site using NIST-traceable sources and pulser, and were function-checked before and after use each day. Function-check forms and instrument calibration sheets are attached in Appendix B.

5.0 References

UNSCEAR, 2000. United Nations Scientific Committee on the Effects of Atomic Radiation. *Volume I: Report to the General Assembly, with Scientific Annexes.* United Nations, New York.

Appendix A

Analytical Laboratory Results

Total THORIUM

Method SW6020A

Sample Results

Lab Name: ALS Environmental -- FC
Client Name: Environmental Restoration Group, Inc.
Client Project ID: La Jara Mesa
Work Order Number: 1110390
Reporting Basis: Dry Weight
Final Volume: 100 ml
Matrix: SOIL
Result Units: MG/G

Client Sample ID	Lab ID	Date Collected	Date Prepared	Date Analyzed	Percent Moisture	Dilution Factor	Result	Reporting Limit	IDL	Flag	Sample Aliquot
LJMP-MFPA-11	1110390-1	6/7/2011	11/14/2011	11/15/2011	N/A	10	0.0028	0.00002	0.0000034		1.018 g
LJMP-MFPA-14	1110390-2	6/7/2011	11/14/2011	11/15/2011	N/A	10	0.0029	0.00002	0.0000034		1.01 g
LJMP-MFPA-17	1110390-3	6/7/2011	11/14/2011	11/15/2011	N/A	10	0.003	0.000019	0.0000033		1.036 g
LJMP-MFPA-18	1110390-4	6/7/2011	11/14/2011	11/15/2011	N/A	10	0.0032	0.00002	0.0000034		1.014 g
LJMP-MFPA-23	1110390-5	6/7/2011	11/14/2011	11/15/2011	N/A	10	0.0028	0.00002	0.0000034		1.007 g
LJMP-MFPA-30	1110390-6	6/7/2011	11/14/2011	11/15/2011	N/A	10	0.0025	0.000019	0.0000033		1.041 g

Comments:

1. ND or U = Not Detected at or above the client requested detection limit.

Data Package ID: *IM1110390-1*

Total THORIUM

Method SW6020A

Sample Results

Lab Name: ALS Environmental -- FC
Client Name: Environmental Restoration Group, Inc.
Client Project ID: La Jara Mesa
Work Order Number: 1111005
Reporting Basis: Dry Weight
Final Volume: 100 ml
Matrix: SOIL
Result Units: MG/G

Client Sample ID	Lab ID	Date Collected	Date Prepared	Date Analyzed	Percent Moisture	Dilution Factor	Result	Reporting Limit	IDL	Flag	Sample Aliquot
LJMP-PDAA-03	1111005-1	6/6/2011	11/17/2011	11/18/2011	N/A	10	0.0023	0.00002	0.0000034		1.007 g
LJMP-PDAA-09	1111005-2	6/6/2011	11/17/2011	11/18/2011	N/A	10	0.0029	0.00002	0.0000034		1.014 g
LJMP-PDAA-16	1111005-3	6/6/2011	11/17/2011	11/18/2011	N/A	10	0.0036	0.00002	0.0000034		1.016 g
LJMP-RUC-19	1111005-4	6/3/2011	11/17/2011	11/18/2011	N/A	10	0.0028	0.00002	0.0000035		1 g
LJMP-RUC-23	1111005-5	6/3/2011	11/17/2011	11/18/2011	N/A	10	0.0026	0.00002	0.0000034		1.017 g
LJMP-RUC-28	1111005-6	6/3/2011	11/17/2011	11/18/2011	N/A	10	0.0073	0.000019	0.0000033		1.033 g

Comments:

1. ND or U = Not Detected at or above the client requested detection limit.

Data Package ID: *IM1111005-1*

Total URANIUM

Method SW6020A

Sample Results

Lab Name: ALS Environmental -- FC
Client Name: Environmental Restoration Group, Inc.
Client Project ID: La Jara Mesa
Work Order Number: 1110390
Reporting Basis: Dry Weight

Final Volume: 100 ml
Matrix: SOIL
Result Units: MG/G

Client Sample ID	Lab ID	Date Collected	Date Prepared	Date Analyzed	Percent Moisture	Dilution Factor	Result	Reporting Limit	IDL	Flag	Sample Aliquot
LJMP-MFPA-11	1110390-1	6/7/2011	11/14/2011	11/15/2011	N/A	10	0.00098	0.0000098	0.0000029		1.018 g
LJMP-MFPA-14	1110390-2	6/7/2011	11/14/2011	11/15/2011	N/A	10	0.001	0.0000099	0.0000029		1.01 g
LJMP-MFPA-17	1110390-3	6/7/2011	11/14/2011	11/15/2011	N/A	10	0.0011	0.0000097	0.0000028		1.036 g
LJMP-MFPA-18	1110390-4	6/7/2011	11/14/2011	11/15/2011	N/A	10	0.0012	0.0000099	0.0000029		1.014 g
LJMP-MFPA-23	1110390-5	6/7/2011	11/14/2011	11/15/2011	N/A	10	0.001	0.0000099	0.0000029		1.007 g
LJMP-MFPA-30	1110390-6	6/7/2011	11/14/2011	11/15/2011	N/A	10	0.00087	0.0000096	0.0000028		1.041 g

Comments:

1. ND or U = Not Detected at or above the client requested detection limit.

Data Package ID: *IM1110390-1*

Total URANIUM

Method SW6020A

Sample Results

Lab Name: ALS Environmental -- FC
Client Name: Environmental Restoration Group, Inc.
Client Project ID: La Jara Mesa
Work Order Number: 1111005
Reporting Basis: Dry Weight

Final Volume: 100 ml
Matrix: SOIL
Result Units: MG/G

Client Sample ID	Lab ID	Date Collected	Date Prepared	Date Analyzed	Percent Moisture	Dilution Factor	Result	Reporting Limit	IDL	Flag	Sample Aliquot
LJMP-PDAA-03	1111005-1	6/6/2011	11/17/2011	11/18/2011	N/A	10	0.00083	0.0000099	0.0000029		1.007 g
LJMP-PDAA-09	1111005-2	6/6/2011	11/17/2011	11/18/2011	N/A	10	0.001	0.0000099	0.0000029		1.014 g
LJMP-PDAA-16	1111005-3	6/6/2011	11/17/2011	11/18/2011	N/A	10	0.0019	0.0000098	0.0000029		1.016 g
LJMP-RUC-19	1111005-4	6/3/2011	11/17/2011	11/18/2011	N/A	10	0.0033	0.00001	0.0000029		1 g
LJMP-RUC-23	1111005-5	6/3/2011	11/17/2011	11/18/2011	N/A	10	0.0015	0.0000098	0.0000029		1.017 g
LJMP-RUC-28	1111005-6	6/3/2011	11/17/2011	11/18/2011	N/A	10	0.0024	0.0000097	0.0000028		1.033 g

Comments:

1. ND or U = Not Detected at or above the client requested detection limit.

Data Package ID: *IM1111005-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1110390
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-MFPA-11
Lab ID: 1110390-1
Library: RA226.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 07-Jun-11
Date Prepared: 02-Nov-11
Date Analyzed: 01-Dec-11

Prep Batch: GS111102-6
QCBatchID: GS111102-6-1
Run ID: GS111102-6A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 2000 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112410d04A

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13982-63-3	Ra-226	0.380 +/- 0.059	0.059	0.5	LT

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Data Package ID: *GSS1110390-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1110390
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-MFPA-11
Lab ID: 1110390-1
Library: RA228.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 07-Jun-11
Date Prepared: 02-Nov-11
Date Analyzed: 01-Dec-11

Prep Batch: GS111102-6
QCBatchID: GS111102-6-1
Run ID: GS111102-6A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 2000 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112410d04

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
15262-20-1	Ra-228	0.426 +/- 0.098	0.129	0.5	LT

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Data Package ID: *GSS1110390-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1110390
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-MFPA-14
Lab ID: 1110390-2
Library: RA226.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 07-Jun-11
Date Prepared: 02-Nov-11
Date Analyzed: 02-Dec-11

Prep Batch: GS111102-6
QCBatchID: GS111102-6-1
Run ID: GS111102-6A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 1900 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112422d04A

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13982-63-3	Ra-226	0.432 +/- 0.066	0.067	0.5	LT

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: *GSS1110390-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1110390
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-MFPA-14
Lab ID: 1110390-2
Library: RA228.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 07-Jun-11
Date Prepared: 02-Nov-11
Date Analyzed: 02-Dec-11

Prep Batch: GS111102-6
QCBatchID: GS111102-6-1
Run ID: GS111102-6A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 1900 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112422d04

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
15262-20-1	Ra-228	0.410 +/- 0.098	0.166	0.5	LT

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: *GSS1110390-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1110390
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-MFPA-17
Lab ID: 1110390-3
Library: RA226.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 07-Jun-11
Date Prepared: 02-Nov-11
Date Analyzed: 02-Dec-11

Prep Batch: GS111102-6
QCBatchID: GS111102-6-1
Run ID: GS111102-6A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 1940 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112423d04A

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13982-63-3	Ra-226	0.456 +/- 0.067	0.056	0.5	LT

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Data Package ID: *GSS1110390-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1110390
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-MFPA-17
Lab ID: 1110390-3
Library: RA228.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 07-Jun-11
Date Prepared: 02-Nov-11
Date Analyzed: 02-Dec-11

Prep Batch: GS111102-6
QCBatchID: GS111102-6-1
Run ID: GS111102-6A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 1940 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112423d04

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
15262-20-1	Ra-228	0.378 +/- 0.092	0.133	0.5	LT

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: *GSS1110390-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Duplicate Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1110390
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-MFPA-17
Lab ID: 1110390-3DUP
Library: RA226.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 07-Jun-11
Date Prepared: 02-Nov-11
Date Analyzed: 02-Dec-11

Prep Batch: GS111102-6
QCBatchID: GS111102-6-1
Run ID: GS111102-6A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 1940 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112367d01A

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13982-63-3	Ra-226	0.412 +/- 0.061	0.055	0.5	LT

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.
Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
Y2 - Chemical Yield outside default limits.
LT - Result is less than Requested MDC, greater than sample specific MDC.
M - The requested MDC was not met.
M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.
W - DER is greater than Warning Limit of 1.42
D - DER is greater than Control Limit of 2.13

SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 halflives.
G - Sample density differs by more than 15% of LCS density.

Abbreviations:
TPU - Total Propagated Uncertainty
MDC - Minimum Detectable Concentration
BDL - Below Detection Limit

Data Package ID: *GSS1110390-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Duplicate Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1110390
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-MFPA-17
Lab ID: 1110390-3DUP
Library: RA228.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 07-Jun-11
Date Prepared: 02-Nov-11
Date Analyzed: 02-Dec-11

Prep Batch: GS111102-6
QCBatchID: GS111102-6-1
Run ID: GS111102-6A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 1940 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112367d01

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
15262-20-1	Ra-228	0.305 +/- 0.078	0.113	0.5	LT

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.
Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
Y2 - Chemical Yield outside default limits.
LT - Result is less than Requested MDC, greater than sample specific MDC.
M - The requested MDC was not met.
M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.
W - DER is greater than Warning Limit of 1.42
D - DER is greater than Control Limit of 2.13

SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 halflives.
G - Sample density differs by more than 15% of LCS density.

Abbreviations:
TPU - Total Propagated Uncertainty
MDC - Minimum Detectable Concentration
BDL - Below Detection Limit

Data Package ID: *GSS1110390-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1110390
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-MFPA-18
Lab ID: 1110390-4
Library: RA226.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 07-Jun-11
Date Prepared: 02-Nov-11
Date Analyzed: 02-Dec-11

Prep Batch: GS111102-6
QCBatchID: GS111102-6-1
Run ID: GS111102-6A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 1920 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112424d04A

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13982-63-3	Ra-226	0.519 +/- 0.075	0.065	0.5	

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Data Package ID: *GSS1110390-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1110390
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-MFPA-18
Lab ID: 1110390-4
Library: RA228.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 07-Jun-11
Date Prepared: 02-Nov-11
Date Analyzed: 02-Dec-11

Prep Batch: GS111102-6
QCBatchID: GS111102-6-1
Run ID: GS111102-6A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 1920 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112424d04

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
15262-20-1	Ra-228	0.46 +/- 0.11	0.15	0.5	LT

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Data Package ID: *GSS1110390-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1110390
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-MFPA-23
Lab ID: 1110390-5
Library: RA226.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 07-Jun-11
Date Prepared: 02-Nov-11
Date Analyzed: 02-Dec-11

Prep Batch: GS111102-6
QCBatchID: GS111102-6-1
Run ID: GS111102-6A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 1840 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112425d04A

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13982-63-3	Ra-226	0.516 +/- 0.076	0.072	0.5	

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: *GSS1110390-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1110390
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-MFPA-23
Lab ID: 1110390-5
Library: RA228.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 07-Jun-11
Date Prepared: 02-Nov-11
Date Analyzed: 02-Dec-11

Prep Batch: GS111102-6
QCBatchID: GS111102-6-1
Run ID: GS111102-6A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 1840 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112425d04

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
15262-20-1	Ra-228	0.41 +/- 0.10	0.15	0.5	LT

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met. but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Data Package ID: *GSS1110390-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1110390
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-MFPA-30
Lab ID: 1110390-6
Library: RA226.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 07-Jun-11
Date Prepared: 02-Nov-11
Date Analyzed: 02-Dec-11

Prep Batch: GS111102-6
QCBatchID: GS111102-6-1
Run ID: GS111102-6A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 1950 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112426d04A

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13982-63-3	Ra-226	0.311 +/- 0.051	0.055	0.5	LT

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: *GSS1110390-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1110390
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-MFPA-30
Lab ID: 1110390-6
Library: RA228.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 07-Jun-11
Date Prepared: 02-Nov-11
Date Analyzed: 02-Dec-11

Prep Batch: GS111102-6
QCBatchID: GS111102-6-1
Run ID: GS111102-6A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 1950 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112426d04

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
15262-20-1	Ra-228	0.325 +/- 0.093	0.196	0.5	LT

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: *GSS1110390-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1111005
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-PDAA-03
Lab ID: 1111005-1
Library: RA226.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 06-Jun-11
Date Prepared: 04-Nov-11
Date Analyzed: 03-Dec-11

Prep Batch: GS111103-5
QCBatchID: GS111103-5-1
Run ID: GS111103-5A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 1940 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112370d01A

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13982-63-3	Ra-226	0.355 +/- 0.054	0.054	0.5	LT

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: *GSS1111005-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1111005
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-PDAA-03
Lab ID: 1111005-1
Library: RA228.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 06-Jun-11
Date Prepared: 04-Nov-11
Date Analyzed: 03-Dec-11

Prep Batch: GS111103-5
QCBatchID: GS111103-5-1
Run ID: GS111103-5A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 1940 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112370d01

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
15262-20-1	Ra-228	0.314 +/- 0.083	0.131	0.5	LT

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: *GSS1111005-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1111005
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-PDAA-09
Lab ID: 1111005-2
Library: RA226.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 06-Jun-11
Date Prepared: 04-Nov-11
Date Analyzed: 03-Dec-11

Prep Batch: GS111103-5
QCBatchID: GS111103-5-1
Run ID: GS111103-5A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 1930 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112371d01A

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13982-63-3	Ra-226	0.475 +/- 0.068	0.055	0.5	LT

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Data Package ID: *GSS1111005-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1111005
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-PDAA-09
Lab ID: 1111005-2
Library: RA228.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 06-Jun-11
Date Prepared: 04-Nov-11
Date Analyzed: 03-Dec-11

Prep Batch: GS111103-5
QCBatchID: GS111103-5-1
Run ID: GS111103-5A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 1930 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112371d01

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
15262-20-1	Ra-228	0.264 +/- 0.082	0.130	0.5	LT

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: *GSS1111005-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Duplicate Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1111005
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-PDAA-09
Lab ID: 1111005-2DUP
Library: RA226.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 06-Jun-11
Date Prepared: 04-Nov-11
Date Analyzed: 03-Dec-11

Prep Batch: GS111103-5
QCBatchID: GS111103-5-1
Run ID: GS111103-5A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 1930 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112432d04A

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13982-63-3	Ra-226	0.454 +/- 0.067	0.061	0.5	LT

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.
Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
Y2 - Chemical Yield outside default limits.
LT - Result is less than Requested MDC, greater than sample specific MDC.
M - The requested MDC was not met.
M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.
W - DER is greater than Warning Limit of 1.42
D - DER is greater than Control Limit of 2.13

SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 halflives.
G - Sample density differs by more than 15% of LCS density.

Abbreviations:
TPU - Total Propagated Uncertainty
MDC - Minimum Detectable Concentration
BDL - Below Detection Limit

Data Package ID: *GSS1111005-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Duplicate Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1111005
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-PDAA-09
Lab ID: 1111005-2DUP
Library: RA228.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 06-Jun-11
Date Prepared: 04-Nov-11
Date Analyzed: 03-Dec-11

Prep Batch: GS111103-5
QCBatchID: GS111103-5-1
Run ID: GS111103-5A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 1930 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112432d04

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
15262-20-1	Ra-228	0.309 +/- 0.088	0.152	0.5	LT

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.
Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
Y2 - Chemical Yield outside default limits.
LT - Result is less than Requested MDC, greater than sample specific MDC.
M - The requested MDC was not met.
M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.
W - DER is greater than Warning Limit of 1.42
D - DER is greater than Control Limit of 2.13

SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 halflives.
G - Sample density differs by more than 15% of LCS density.

Abbreviations:
TPU - Total Propagated Uncertainty
MDC - Minimum Detectable Concentration
BDL - Below Detection Limit

Data Package ID: *GSS1111005-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1111005
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-PDAA-16
Lab ID: 1111005-3
Library: RA226.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 06-Jun-11
Date Prepared: 04-Nov-11
Date Analyzed: 03-Dec-11

Prep Batch: GS111103-5
QCBatchID: GS111103-5-1
Run ID: GS111103-5A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 1920 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112372d01A

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13982-63-3	Ra-226	1.12 +/- 0.15	0.06	0.5	

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: *GSS1111005-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1111005
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-PDAA-16
Lab ID: 1111005-3
Library: RA228.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 06-Jun-11
Date Prepared: 04-Nov-11
Date Analyzed: 03-Dec-11

Prep Batch: GS111103-5
QCBatchID: GS111103-5-1
Run ID: GS111103-5A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 1920 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112372d01

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
15262-20-1	Ra-228	0.380 +/- 0.091	0.143	0.5	LT

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: *GSS1111005-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1111005
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-RUC-19
Lab ID: 1111005-4
Library: RA226.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 03-Jun-11
Date Prepared: 04-Nov-11
Date Analyzed: 03-Dec-11

Prep Batch: GS111103-5
QCBatchID: GS111103-5-1
Run ID: GS111103-5A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 1860 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112373d01A

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13982-63-3	Ra-226	1.20 +/- 0.16	0.07	0.5	

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: *GSS1111005-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1111005
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-RUC-19
Lab ID: 1111005-4
Library: RA228.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 03-Jun-11
Date Prepared: 04-Nov-11
Date Analyzed: 03-Dec-11

Prep Batch: GS111103-5
QCBatchID: GS111103-5-1
Run ID: GS111103-5A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 1860 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112373d01

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
15262-20-1	Ra-228	0.394 +/- 0.096	0.138	0.5	LT

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Data Package ID: *GSS1111005-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1111005
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-RUC-23
Lab ID: 1111005-5
Library: RA226.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 03-Jun-11
Date Prepared: 04-Nov-11
Date Analyzed: 03-Dec-11

Prep Batch: GS111103-5
QCBatchID: GS111103-5-1
Run ID: GS111103-5A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 1850 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112433d04A

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13982-63-3	Ra-226	0.686 +/- 0.094	0.065	0.5	

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: *GSS1111005-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1111005
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-RUC-23
Lab ID: 1111005-5
Library: RA228.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 03-Jun-11
Date Prepared: 04-Nov-11
Date Analyzed: 03-Dec-11

Prep Batch: GS111103-5
QCBatchID: GS111103-5-1
Run ID: GS111103-5A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 1850 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112433d04

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
15262-20-1	Ra-228	0.34 +/- 0.10	0.14	0.5	LT,TI

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: *GSS1111005-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1111005
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-RUC-28
Lab ID: 1111005-6
Library: RA226.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 03-Jun-11
Date Prepared: 04-Nov-11
Date Analyzed: 03-Dec-11

Prep Batch: GS111103-5
QCBatchID: GS111103-5-1
Run ID: GS111103-5A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 1720 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112374d01A

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13982-63-3	Ra-226	1.02 +/- 0.14	0.09	0.5	G

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: *GSS1111005-1*

Gamma Spectroscopy Results

PAI 713 Rev 12

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1111005
Client Name: Environmental Restoration Group, Inc.
ClientProject ID: La Jara Mesa

Field ID: LJMP-RUC-28
Lab ID: 1111005-6
Library: RA228.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 10
Date Collected: 03-Jun-11
Date Prepared: 04-Nov-11
Date Analyzed: 03-Dec-11

Prep Batch: GS111103-5
QCBatchID: GS111103-5-1
Run ID: GS111103-5A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 1720 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 112374d01

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
15262-20-1	Ra-228	1.08 +/- 0.18	0.16	0.5	G

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: *GSS1111005-1*

Gross Alpha/Beta Analysis by GFPC Sample Results Summary

Client Name: Environmental Restoration Group, Inc.
Client Project Name: La Jara Mesa
Client Project Number:
Laboratory Name: ALS Environmental -- FC
PAI Work Order: 1110390

Reported on: Tuesday, November 22, 2011 6:44:29 AM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1110390-1	LJMP-MFPA-11	Sample	GROSS ALPHA	0.81 +/- 0.40	0.43	pCi/g	SOIL	AB111110-1	11/14/2011	LT
1110390-1	LJMP-MFPA-11	Sample	GROSS BETA	0.92 +/- 0.39	0.61	pCi/g	SOIL	AB111110-1	11/14/2011	LT
1110390-2	LJMP-MFPA-14	Sample	GROSS ALPHA	1.16 +/- 0.50	0.47	pCi/g	SOIL	AB111110-1	11/14/2011	LT
1110390-2	LJMP-MFPA-14	Sample	GROSS BETA	0.92 +/- 0.41	0.66	pCi/g	SOIL	AB111110-1	11/14/2011	LT
1110390-3	LJMP-MFPA-17	Sample	GROSS ALPHA	1.01 +/- 0.43	0.37	pCi/g	SOIL	AB111110-1	11/14/2011	LT
1110390-3	LJMP-MFPA-17	Sample	GROSS BETA	0.93 +/- 0.41	0.65	pCi/g	SOIL	AB111110-1	11/14/2011	LT
1110390-4	LJMP-MFPA-18	Sample	GROSS ALPHA	1.34 +/- 0.53	0.42	pCi/g	SOIL	AB111110-1	11/14/2011	LT
1110390-4	LJMP-MFPA-18	Sample	GROSS BETA	1.27 +/- 0.46	0.67	pCi/g	SOIL	AB111110-1	11/14/2011	LT
1110390-5	LJMP-MFPA-23	Sample	GROSS ALPHA	0.99 +/- 0.47	0.49	pCi/g	SOIL	AB111110-1	11/14/2011	LT

Comments:

Data Package ID: *AB1110390-1*

Qualifiers/Flags:

U - Result is less than the sample specific MDC.

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Gross Alpha/Beta Analysis by GFPC Sample Results Summary

Client Name: Environmental Restoration Group, Inc.
Client Project Name: La Jara Mesa
Client Project Number:
Laboratory Name: ALS Environmental -- FC
PAI Work Order: 1110390

Reported on: Tuesday, November 22, 2011 6:44:29 AM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1110390-5	LJMP-MFPA-23	Sample	GROSS BETA	1.64 +/- 0.52	0.66	pCi/g	SOIL	AB111110-1	11/14/2011	LT
1110390-6	LJMP-MFPA-30	Sample	GROSS ALPHA	0.85 +/- 0.40	0.42	pCi/g	SOIL	AB111110-1	11/14/2011	LT
1110390-6	LJMP-MFPA-30	Sample	GROSS BETA	0.65 +/- 0.37	0.66	pCi/g	SOIL	AB111110-1	11/14/2011	U

Comments:

Data Package ID: *AB1110390-1*

Qualifiers/Flags:

U - Result is less than the sample specific MDC.

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Gross Alpha/Beta Analysis by GFPC Sample Results Summary

Client Name: Environmental Restoration Group, Inc.
Client Project Name: La Jara Mesa
Client Project Number:
Laboratory Name: ALS Environmental -- FC
PAI Work Order: 1111005

Reported on: Monday, November 28, 2011 10:59:13 AM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1111005-1	LJMP-PDAA-03	Sample	GROSS ALPHA	0.69 +/- 0.37	0.43	pCi/g	SOIL	AB111110-1	11/14/2011	LT
1111005-1	LJMP-PDAA-03	Sample	GROSS BETA	1.12 +/- 0.43	0.65	pCi/g	SOIL	AB111110-1	11/14/2011	LT
1111005-2	LJMP-PDAA-09	Sample	GROSS ALPHA	2.04 +/- 0.70	0.48	pCi/g	SOIL	AB111110-1	11/14/2011	LT
1111005-2	LJMP-PDAA-09	Sample	GROSS BETA	1.14 +/- 0.45	0.67	pCi/g	SOIL	AB111110-1	11/14/2011	LT
1111005-3	LJMP-PDAA-16	Sample	GROSS ALPHA	3.67 +/- 0.95	0.41	pCi/g	SOIL	AB111110-1	11/14/2011	
1111005-3	LJMP-PDAA-16	Sample	GROSS BETA	3.12 +/- 0.76	0.74	pCi/g	SOIL	AB111110-1	11/14/2011	LT
1111005-4	LJMP-RUC-19	Sample	GROSS ALPHA	4.8 +/- 2.1	1.9	pCi/g	SOIL	AB111110-1	11/14/2011	
1111005-4	LJMP-RUC-19	Sample	GROSS BETA	1.9 +/- 1.3	2.5	pCi/g	SOIL	AB111110-1	11/14/2011	U
1111005-5	LJMP-RUC-23	Sample	GROSS ALPHA	1.6 +/- 1.4	2.4	pCi/g	SOIL	AB111110-1	11/14/2011	U

Comments:

Data Package ID: *AB1111005-1*

Qualifiers/Flags:

U - Result is less than the sample specific MDC.

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Gross Alpha/Beta Analysis by GFPC Sample Results Summary

Client Name: Environmental Restoration Group, Inc.
Client Project Name: La Jara Mesa
Client Project Number:
Laboratory Name: ALS Environmental -- FC
PAI Work Order: 1111005

Reported on: Monday, November 28, 2011 10:59:13 AM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1111005-5	LJMP-RUC-23	Sample	GROSS BETA	2.7 +/- 1.5	2.6	pCi/g	SOIL	AB111110-1	11/14/2011	LT
1111005-6	LJMP-RUC-28	Sample	GROSS ALPHA	3.9 +/- 1.0	0.5	pCi/g	SOIL	AB111110-1	11/14/2011	
1111005-6	LJMP-RUC-28	Sample	GROSS BETA	2.53 +/- 0.68	0.73	pCi/g	SOIL	AB111110-1	11/14/2011	LT

Comments:

Data Package ID: *AB1111005-1*

Qualifiers/Flags:

U - Result is less than the sample specific MDC.

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Appendix B

Calibration and Function Check Forms

Certificate of Calibration

Calibration and Voltage Plateau

Environmental Restoration Group, Inc.
8809 Washington St NE, Suite 150
Albuquerque, NM 87113
(505) 298-4224
www.ERGoffice.com

Meter: Manufacturer: Ludlum Model Number: 2221 Serial Number: 254757

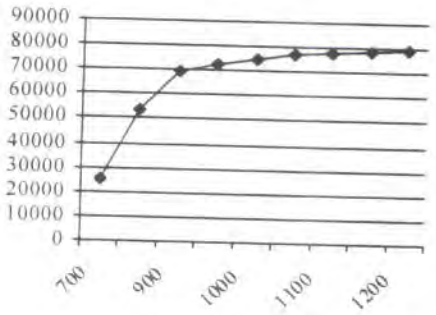
Detector: Manufacturer: Ludlum Model Number: 44-10 Serial Number: PR199131

☑ Mechanical Check ☑ Geotropism ☑ THR/WIN Operation ☑ Audio Check ☑ Battery Check (Min 4.4 VDC)
☑ F/S Response Check ☑ Meter Zeroed ☑ Reset Check HV Check (+/- 2.5%): ☑ 500 V ☑ 1000 V ☑ 1500 V
Source Distance: ☐ Contact ☑ 6 inches ☐ Other: Cable Length: ☐ 39-inch ☑ 72-inch ☐ Other:
Source Geometry: ☑ Side ☐ Below ☐ Other: Temperature: 75 °F Relative Humidity 20 %
Threshold: 10 mV Window: Barometric Pressure: 24.72 inches Hg
Instrument found within tolerance: ☑ Yes ☐ No

Range/Multiplier	Reference Setting	"As Found Reading"	Meter Reading	Integrated 1-Min. Count	Log Scale Count
x 1000	400	400	400	399496	400
x 1000	100	100	100		100
x 100	40	400	400	39960	400
x 100	10	100	100		100
x 10	4	400	400	3997	400
x 10	1	100	100		100
x 1	400	400	400	400	400
x 1	100	100	100		100

High Voltage	Source Counts	Background
700	25366	
800	53710	
900	69075	
950	72786	
1000	74465	
1050	77352	
1100	77997	10806
1150	78669	
1200	79112	

Voltage Plateau



Comments: HV Plateau Scaler Count Time = 1-min. Recommended HV = 1100

Reference Instruments and/or Sources:

Ludlum pulser serial number: ☐ 97743 ☑ 201932
☐ Alpha Source: Th-230 @ 13,000 dpm (1/13/10) sn: 4098-03
☐ Beta Source: Tc-99 @ 17,700 dpm (1/13/10) sn: 4099-03

Fluke multimeter serial number: ☐ 8749012
☑ Gamma Source Cs-137 @ 5.37 uCi (1/13/10) sn: 4097-03
☐ Other Source:

Calibrated By: Calibration Date: 3-1-11 Calibration Due: 3-1-12

Reviewed By: Review Date: 3/3/11

This calibration conforms to the requirements and acceptable calibration conditions of ANSI N323A - 1997.
NMRCB Registration No. 921-3 * Calibration of Radiation Detection Instrument Devices

Certificate of Calibration

Calibration and Voltage Plateau

Environmental Restoration Group, Inc.
8809 Washington St NE, Suite 150
Albuquerque, NM 87113
(505) 298-4224
www.ERGoffice.com

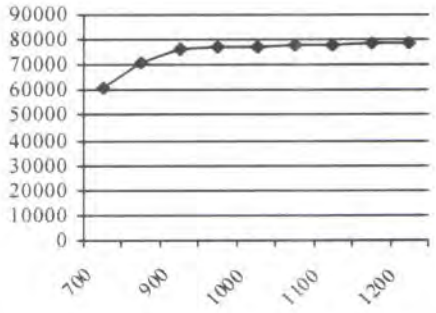
Meter:	Manufacturer:	Ludlum	Model Number:	2221	Serial Number:	117357
Detector:	Manufacturer:	Ludlum	Model Number:	44-10	Serial Number:	PR144055

☑ Mechanical Check ☑ Geotropism ☑ THR/WIN Operation ☑ Audio Check ☑ Battery Check (Min 4.4 VDC)
☑ F/S Response Check ☑ Meter Zeroed ☑ Reset Check HV Check (+/- 2.5%): ☑ 500 V ☑ 1000 V ☑ 1500 V
Source Distance: ☐ Contact ☑ 6 inches ☐ Other: Cable Length: ☐ 39-inch ☑ 72-inch ☐ Other:
Source Geometry: ☑ Side ☐ Below ☐ Other: Temperature: 74 °F Relative Humidity 20 %
Threshold: 10 mV Window: Barometric Pressure: 24.69 inches Hg
Instrument found within tolerance: ☑ Yes ☐ No

Range/Multiplier	Reference Setting	"As Found Reading"	Meter Reading	Integrated 1-Min. Count	Log Scale Count
x 1000	400	400	400	399094	400
x 1000	100	100	100		100
x 100	40	400	400	39914	400
x 100	10	100	100		100
x 10	4	400	400	3992	400
x 10	1	100	100		100
x 1	400	400	400	399	400
x 1	100	100	100		100

High Voltage	Source Counts	Background
700	61031	
800	71071	
900	76025	
950	76860	
1000	77069	
1050	77960	
1100	78171	11033
1150	78399	
1200	78872	

Voltage Plateau



Comments: HV Plateau Scaler Count Time = 1-min. Recommended HV =1100

Reference Instruments and/or Sources:

Ludlum pulser serial number: ☐ 97743 ☑ 201932 Fluke multimeter serial number: ☐ 8749012
☐ Alpha Source: Th-230 @ 13,000 dpm (1/13/10) sn: 4098-03 ☑ Gamma Source Cs-137 @ 5.37 uCi (1/13/10) sn: 4097-03
☐ Beta Source: Tc-99 @ 17,700 dpm (1/13/10) sn: 4099-03 ☐ Other Source:

Calibrated By: Calibration Date: 3-1-11 Calibration Due: 3-1-12

Reviewed By: Review Date: 3/3/11

This calibration conforms to the requirements and acceptable calibration conditions of ANSI N323A - 1997.
NMRCB Registration No. 921-3 * Calibration of Radiation Detection Instrument Devices

Certificate of Calibration

Calibration and Voltage Plateau

Environmental Restoration Group, Inc.
8809 Washington St NE, Suite 150
Albuquerque, NM 87113
(505) 298-4224
www.ERGoffice.com

Meter: Manufacturer: Ludlum Model Number: 2221 Serial Number: 254772

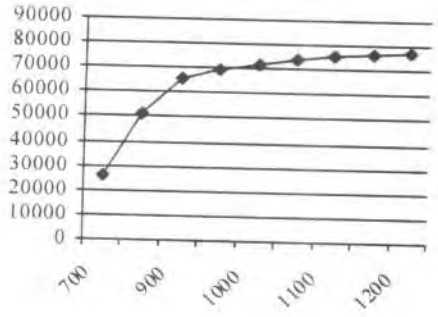
Detector: Manufacturer: Ludlum Model Number: 44-10 Serial Number: PR118372

☑ Mechanical Check ☑ Geotropism ☑ THR/WIN Operation ☑ Audio Check ☑ Battery Check (Min 4.4 VDC)
☑ F/S Response Check ☑ Meter Zeroed ☑ Reset Check HV Check (+/- 2.5%): ☑ 500 V ☑ 1000 V ☑ 1500 V
Source Distance: ☐ Contact ☑ 6 inches ☐ Other: Cable Length: ☐ 39-inch ☑ 72-inch ☐ Other:
Source Geometry: ☑ Side ☐ Below ☐ Other: Temperature: 74 °F Relative Humidity 20 %
Threshold: 10 mV Window: Barometric Pressure: 24.69 inches Hg
Instrument found within tolerance: ☑ Yes ☐ No

Range/Multiplier	Reference Setting	"As Found Reading"	Meter Reading	Integrated 1-Min. Count	Log Scale Count
x 1000	400	400	400	399373	400
x 1000	100	100	100		100
x 100	40	400	400	39948	400
x 100	10	100	100		100
x 10	4	400	400	3998	400
x 10	1	100	100		100
x 1	400	400	400	399	400
x 1	100	100	100		100

High Voltage	Source Counts	Background
700	25805	
800	50932	
900	65853	
950	69386	
1000	71716	
1050	73733	
1100	75592	
1150	76413	10860
1200	76750	

Voltage Plateau



Comments: HV Plateau Scaler Count Time = 1-min. Recommended HV =1150

Reference Instruments and/or Sources:

Ludlum pulser serial number: ☐ 97743 ☑ 201932 Fluke multimeter serial number: ☐ 8749012
☐ Alpha Source: Th-230 @ 13,000 dpm (1/13/10) sn: 4098-03 ☑ Gamma Source Cs-137 @ 5.37 uCi (1/13/10) sn: 4097-03
☐ Beta Source: Tc-99 @ 17,700 dpm (1/13/10) sn: 4099-03 ☐ Other Source:

Calibrated By: Calibration Date: 3-1-11 Calibration Due: 3-1-12

Reviewed By: Review Date: 3/3/11

This calibration conforms to the requirements and acceptable calibration conditions of ANSI N323A - 1997.
NMRCB Registration No. 921-3 * Calibration of Radiation Detection Instrument Devices

ERG

Function Check Form
Single Channel Detector

Ratemeter: LUDLUM 2221 Serial No. 117357 Cal. Due Date: 3/1/12

Detector: LUDLUM 44-10 Serial No. PR144055 Cal. Due Date: 3/1/12

Source: Cs-137 Activity: 4 µCi (on 4/12/86) Serial No. 544-96

Comments: SET #2

	Date	Time	Battery	High Voltage	Threshold	Gross Counts	Background	Net Counts	Efficiency	Initial
ERG OFFICE	3/29/11	08:30	51	1102	100	48672	10650	38,022	—	JF
ERG OFFICE	3/30/11	09:30	54	1103	101	47836	10274	37,562	—	JF

Reviewed By: [signature] Date: 11/1/12

ERG Form 1.30A

ERG

Function Check Form
Single Channel Detector

Ratemeter: LUDLUM 2221 Serial No. 254772 Cal. Due Date: 3/1/12

Detector: LUDLUM 44-10 Serial No. PR118372 Cal. Due Date: 3/1/12

Source: Cs-137 Activity: 4 μCi on 4/14/96 Serial No. 544-96

Comments: (1)

	Date	Time	Battery	High Voltage	Threshold	Gross Counts	Background	Net Counts	Efficiency	Initial
* ERG ASR office	3/7/11	0700	5.9	1150	100	48329	11077	37252	-	MMS
	3/7/11	17:30	5.6	1155	101	47330	7569	39761	-	cf
	3/8/11	06:00	5.5	1154	101	46529	7326	39203	-	cf
	3/8/11	16:00	5.5	1154	102	46994	7414	39580	-	cf
	3/9/11	06:00	5.9	1155	101	46338	7764	38574	-	cf
	3/9/11	19:45	5.5	1152	101	47165	7483	39682	-	cf
	3/10/11	06:00	5.6	1153	102	46403	8095	38308	-	cf
* ERG ASR office	3/10/11	17:30	5.5	1149	101	47465	10323	37142	-	cf
* ERG office	3/28/11	09:00	5.6	1151	101	46900	10566	36334	-	TM
* ERG office	3/28/11	18:00	5.4	1150	101	48553	10569	~~37984~~ 37984	-	cf

Reviewed By: [signature] Date: 11/1/12

ERG

Function Check Form
Single Channel Detector

Ratemeter: LUDLUM 2221 Serial No. 254757 Cal. Due Date: 3/1/12

Detector: LUDLUM 44-10 Serial No. PR199131 Cal. Due Date: 3/1/12

Source: Cs-137 Activity: 4 μCi on 4/12/96 Serial No. 544-96

Comments: SCT #3

	Date	Time	Battery	High Voltage	Threshold	Gross Counts	Background	Net Counts	Efficiency	Initial
* ERG office	3/7/11	07:20	5.7	1103	101	48002	11279	36723	-	cf
	3/8/11	17:30	5.4	1105	101	48335	7509	38826	-	cf
	3/8/11	06:00	5.6	1104	101	45286	7578	37708	-	cf
	3/8/11	16:00	5.3	1105	101	46044	7540	38504	-	cf
	3/9/11	06:00	5.5	1103	101	45392	7631	37761	-	cf
	3/9/11	19:00	5.3	1102	100	45534	7414	38120	-	cf
	3/10/11	06:00	5.4	1104	100	46694	7865	38829	-	cf
* ERG office	3/10/11	17:30	5.3	1100	100	47213	10140	37073	-	cf
* ERG office	3/28/11	09:05	5.2	1101	100	47908	10559	37349	-	TA
* ERG office	3/28/11	16:00	5.0	1100	100	48706	10510	38196	-	cf

Reviewed By: [signature] Date: 11/1/12

(2)

ERG

Function Check Form
Single Channel Detector

Ratemeter: LUDLUM 2221 Serial No. 117357 Cal. Due Date: 3/1/12

Detector: LUDLUM 44-10 Serial No. PR144055 Cal. Due Date: 3/1/12

Source: Cs-137 Activity: 4 μCi on 4/12/96 Serial No. 544-96

Comments: SET #2

Date	Time	Battery	High Voltage	Threshold	Gross Counts	Background	Net Counts	Efficiency	Initial
* ERG OFFICE - 3/7/11	07:15	5.4	1104	101	44691	11826	37865	–	cf
3/7/11	17:30	5.1	1105	101	47272	7888	39384	–	cf
3/8/11	06:00	5.3	1104	102	46644	7916	38728	–	cf
3/8/11	16:00	5.1	1106	101	47453	7626	39827	–	cf
3/9/11	06:00	5.2	1105	101	47095	7861	39234	–	cf
3/9/11	19:45	4.8	1102	105	47300	7944	39356	–	cf
3/10/11	06:00	5.4	1105	102	48169	8277	39892	–	cf
* ERG OFFICE - 3/10/11	17:30	5.5	1101	101	48646	10484	38162	–	cf
3/28/11	10:00	5.7	1107	102	48207	10550	37657	–	TA
3/28/11	16:00	5.6	1106	102	49363	10734	38629	–	

Reviewed By: [signature] Date: 11/1/12

ERG

Function Check Form
Single Channel Detector

Ratemeter: LUDLUM 2221 Serial No. 254772 Cal. Due Date: 3/1/12

Detector: LUDLUM 44-10 Serial No. PR 118372 Cal. Due Date: 3/1/12

Source: Cs-137 Activity: 4 μCi on 4/12/96 Serial No. 544-96

Comments: NOTE: ① ERG office w/ WHITE JIG. ② GRANTS, NM HOTEL (BEST WESTERN) w/ BLACK JIG. ③ ERG office w/ BLACK JIG

Date	Time	Battery	High Voltage	Threshold	Gross Counts	Background	Net Counts	~~Efficiency~~ NOTE:	Initial
6/2/11	16:02	5.2	1102	101	47184	9764	37420	1	CF
6/3/11	08:00	5.2	1150	101	47677	10238	37439	1	CF
6/3/11	17:15	5.3	1150	101	47851	10110	37741	1	CF
6/6/11	07:55	5.4	1152	101	46691	9910	36781	1	CF
6/6/11	19:06	5.3	1148	101	50876	16195	34681	2	CF
6/7/11	06:00	5.3	1152	101	51187	15391	35796	2	CF
6/7/11	16:40	5.2	1147	101	52143	15902	36241	2	CF
6/8/11	06:05	5.2	1152	101	51227	15508	35719	2	CF
6/8/11	19:10	5.1	1149	101	42845	10882	32013	③	CF
6/9/11	08:15	5.2	1152	101	43332	9817	33515	③	CF

Reviewed By: [signature] Date: 11/1/2

ERG Form 1.30A

(1)

ERG

Function Check Form
Single Channel Detector

Ratemeter: LUDLUM 2221 Serial No. 254772 Cal. Due Date: 3/1/12

Detector: LUDLUM 44-10 Serial No. PR118372 Cal. Due Date: 3/1/12

Source: Cs-137 Activity: 4 μCi on 4/12/96 Serial No. 544-96

Comments: NOTE: ① ERG office w/ WHITE JIG. ② GRANTS, NM HOTEL (BEST WESTERN) w/ BLACK JIG. ③ ERG office w/ BLACK JIG.

Date	Time	Battery	High Voltage	Threshold	Gross Counts	Background	Net Counts	NOTE: ~~Efficiency~~	Initial
7/20/11	08:25	6.2	1100	101	43314	10269	33045 ~~33045~~	(3)	JCS
7/20/11	17:34	6.1	1099	101	45526	10025	35501 ~~35501~~	(3)	JCS

Reviewed By: [signature] Date: 11/1/12

ERG Form 1.30A

ERG

Function Check Form
Single Channel Detector

Ratemeter: LUDLUM 2221 Serial No. 117357 Cal. Due Date: 3/1/12

Detector: LUDLUM 44-10 Serial No. PR144055 Cal. Due Date: 3/1/12

Source: Cs-137 Activity: 4 µCi on 4/12/96 Serial No. 544-96

Comments: NOTE: ① ERG office w/ white JIG. ② GRANTS, NM HOTEL (BEST WESTERN) w/ BLACK JIG. ③ ERG office w/ BLACK JIG.

Date	Time	Battery	High Voltage	Threshold	Gross Counts	Background	Net Counts	~~Efficiency~~ NOTE:	Initial
6/2/11	15:50	5.2	1118	103	47693	10272	37421	1	cf
6/7/11	06:15	5.3	1118	103	52747	15620	37127	2	cf
6/8/11	06:10	4.8	1115	103	44289	15633	33656	②	cf
6/8/11	19:00	4.7	1112	103	43387	9876	33511	3	cf
6/16/11	08:04	6.0	1102	104	44326	9938	34388	3	JLS
6/16/11	18:21	5.7	1095	104	44310	9908	34402	3	JLS
7/20/11	08:20	5.6	1102	104	45671	10464	35207	3	JLS
7/20/11	17:36	5.6	1099	104	44096	10105	33991	3	JLS
8/29/11	09:00	5.5	1100	105	46715	10147	36568	1	cf
8/29/11	18:45	5.5	1097	103	47286	10069	37217	1	cf

Reviewed By: [signature] Date: 11/1/12

ERG Form 1.30A

(3)

ERG

Function Check Form
Single Channel Detector

Ratemeter: Ludlum 2221 Serial No. 254757 Cal. Due Date: 3/1/12

Detector: Ludlum 44-10 Serial No. PR199131 Cal. Due Date: 3/1/12

Source: Cs-137 Activity: 4 μCi on 4/12/96 Serial No. 544-96

Comments: NOTE: ① ERG office w/ WHITE JIG.

Date	Time	Battery	High Voltage	Threshold	Gross Counts	Background	Net Counts	~~Efficiency~~ NOTE	Initial
ERG office 6/2/11	3:43	5.3	1100	101	48280	10119	38161	1	JLS

Reviewed By: [signature] Date: 11/1/12

ERG Form 1.30A

Appendix C

ERG Standard Operating Procedures

STANDARD OPERATING PROCEDURE 1.13
HIGH PRESSURE IONIZATION CHAMBER SETUP AND OPERTATION

1. PURPOSE

The purpose of the procedure is to instruct the user on how to properly setup and operate a High Pressure Ion Chamber (HPIC) to make gamma radiation exposure measurements

2. DISCUSSION

This procedure applies to the GE-Energy (formerly Reuter-Stokes) HPIC Model RSS-131, or equivalent.

3. PROCEDURE

3.1 Equipment

3.1.1 High Pressure Ion Chamber and tripod.

3.1.2 Cable.

3.1.3 Computer.

3.2 Setup

3.2.1 Load the RSS-131 software to laptop or desktop using the provided CD

3.2.2 Connect HPIC to laptop using RS232 cable.

3.2.2.1 Connect round 8-pin connector to COM Port 4 on HPIC

3.2.2.2 Connect DB-9 serial connector to COM 1 on computer.

3.2.3 Open RSS-131 Configuration Utility on computer.

3.2.3.1 From the configuration Utility you can change the HPIC settings such as logging time, format, etc. Refer to the RSS-131 manual for more details.

3.3 Operation

3.3.1 The HPIC logs reading whether or not it is connected to a computer. You can turn the detector on/off as needed between locations.

3.3.2 When the HPIC is initially turned on, the exposure rate readings will spike. After approximately 2-3 minutes the readings will have stabilized.

3.3.3 After the stabilization period, the HPIC will continue to collect readings according to the logging settings. The collection period should be defined by project specific instructions, but is typically 10 to 20 minutes per location.

3.3.4 At each location, the date, location, collection start and stop time should be noted in the field log book.

3.4 Downloading data

3.4.1 Upon completion of data collection, the data can be downloaded to a computer. Connect the PC to the HPIC according to section 3.2 or the HPIC User's Manual.

3.4.2 Open the Utility program, from the Online menu select the 'Upload sensor data from RSS-131' option. The data can be downloaded in .csv format. The data can be viewed, managed and displayed in Microsoft Excel.

4. TRAINING

4.1 Prior to use in the field, all personnel must show proficiency in the operation of the HPIC and associated computer program utilities.

4.2 Prior to personnel being assigned to the field, supervisor must sign off of the Training Qualifications Form that he/she met requirements 4.1 above.

5. RECORDS

5.1 Records of the completed work, measurements, calculations, and data must be preserved, protected, and retained according to the contract and/or ERG's record retention process (see SOP 4.03)

5.2 Computer generated files will be saved as print and/or electronic files and stored with field notebooks and/or equipment folders or files.

6. REFERENCES

6.1 Project personnel using this procedure should become familiar with the contents of the following documents:

SOP 4.03

Form 4.00 Training Qualification Form

7. ATTACHMENTS

7.1 No Attachments.

Author's Signature:	**Reviewed By:**
Charles P. Farr	Kenneth R Baker

STANDARD OPERATING PROCEDURE 1.30
FUNCTION CHECK OF EQUIPMENT

1. PURPOSE

To describe the procedures for operational check-out and function check of radiation detectors and meters prior to collecting data.

2. DISCUSSION

The site manager is responsible for assuring that this procedure is implemented. The survey team members are responsible for following the procedure. It is imperative that the equipment is properly function checked each day of use and documented.

3. PROCEDURE

3.1 Equipment

3.1.1 Ratemeters and/or Scalars including Ludlum Models 2221, 2241, 3, 12, 19, 2360, or equivalent

3.1.2 Detectors including Ludlum models 44-10, 44-9, 44-2, 44-116, 43-5, 43-89, 43-93, or equivalent

3.1.3 Cable: C-C or other connectors, as applicable

3.1.4 Record Forms: ERG Form 1.30A (single channel detector) or 1.30B (dual channel detector)

3.1.5 Radiological check sources, typically Th-230 (alpha), Tc-99 (beta), and/or Cs-137 (gamma) sources

3.1.6 Calibration Jig

3.1.7 Instrument Manuals

3.2 Initial Instrument Field Check Out.

3.2.1 The following instructions should be followed unless otherwise directed by Project Manager.

3.2.2 Create a Function Check Form for each piece of equipment being used. Record serial numbers, calibration dates, and check source information in the appropriate fields. Under comments, record source to detector distance, site name, and location on site where function check is performed.

3.2.3 Check the instrument to assure that the settings are consistent with the calibration data. This means the Battery, High Voltage, Threshold, and Window Settings must be set

according to those used in the original calibration or set up. Check with the Project Manager if in doubt or if changes are necessary for site specific reasons.

3.2.4 Replace the batteries in the meter if they indicate that they are near the low voltage level. Record all settings including the battery voltage on the Function Check Form.

3.2.5 With the meter in the rate meter position and a meter scale selected so that the meter is not pegged (other than the log scale), move both ends of the detector cable to determine if the cable is functioning properly. A faulty cable will introduce spurious counts. To test a cable, move both ends of the cable watching the meter. If excessive counts occur the cable may be faulty. Replace with a new cable of identical size and repeat the test. Document faulty cable and dispose of cable.

3.2.6 Select a location to perform the function check. This location should be selected with the following conditions in mind:

3.2.6.1 The location should represent background conditions for the site.

3.2.6.2 The radiological conditions surrounding the location should be expected to remain consistent throughout the duration of the project.

3.2.6.3 This will be the location that all function and source checks will be performed at the beginning of the work day and the end of the work day for the duration of the project.

3.2.7 With the detector placed in the fixed geometry position with no radioactive check source present, perform 1-minute scaler count and record the background count rate on the Function Check Form. Unless directed otherwise by the Project Manager, repeat until ten background readings are recorded.

3.2.8 Repeat the 1-minute scaler counts with the radioactive check source in place. Record the results on the Function Check Form. Unless directed otherwise by the Project Manager, repeat until ten background readings are recorded.

3.2.9 With Project Managers assistance determine the acceptable daily function check range. Typically this range will be the average of the initial ten counts plus or minus ten percent.

3.3 Daily Function Check.

3.3.1 The daily function check is typically performed twice daily, once before work activities have commenced and a second time when work activities have been completed. Follow steps 3.3.3 – 3.3.6 below for each time a function check is performed. If equipment is used for only a brief period of time, less than 1 hour, then a single daily pre-operations function check may be necessary.

3.3.2 Create a Daily Function Check form for each piece of equipment being used as described in 3.2.2 above. In the comments field note that the form is being used as a daily function check form.

3.3.3 Follow steps 3.2.3 – 3.2.5 above.

3.3.4 Measure the background count for one minute (unless otherwise directed by project manager) at the previously identified function check location (see 3.2.6 above). Record on the Daily Function Check form.

3.3.5 Repeat 3.3.4 with the check source in place. If the detector is dual channel (alpha/beta) then repeat again with the second source in place.

3.3.6 If the daily function check results do not fall within the acceptable daily function check range, as discussed in Section 3.2.9 above, check the source, geometry and immediate area to determine if anything may have caused the check to fail. If a reason is found attempt to fix the problem. Count again. If the daily function check results in a second failure remove the instrument from service and report the event to the Project Manager.

4. TRAINING

4.1 Prior to performance of calibrations or use in the field, all personnel must show proficiency in the operation of the detectors and meters being utilized.

4.2 Prior to use in the field, all personnel must show proficiency in use of the function check forms.

4.3 Prior to personnel being assigned to the field, supervisor must sign off of the Training Qualifications Form that he/she met requirements 4.1-4.2 above.

5. RECORDS

5.1 Records of the completed work, measurements, calculations, and data must be preserved, protected, and retained according to the contract and/or ERG's record retention process (see SOP 4.3)

5.2 Computer generated files will be saved as hard copies and stored with instrument folders and/or project files.

6. REFERENCES

6.1 Project personnel using this procedure should become familiar with the contents of the following documents:

SOP 4.03

Form 4.00 Training Qualification Form

7. ATTACHMENTS

7.1 Form 1.30A – Function Check Form (Single Channel)

7.2 Form 1.30B – Function Check Form (Dual Channel)

Author's Signature:	**Reviewed By:**
Charles P. Farr	Kenneth R Baker

STANDARD OPERATING PROCEDURE 2.09
GAMMA-RADIATION CORRELLATION STUDIES

1. PURPOSE

This procedure outlines the procedures for creating a correlation between gamma-radiation surveys and either the exposure rate or radium-226 (Ra-226) concentrations in the soil.

2. DISCUSSION

This procedure provides information on creating correlations from surveys performed with ERG GPS-based gamma-radiation survey systems. The data from the gamma-radiation surveys is correlated to exposure rate measured by either a pressurized ion chamber (PIC), Ludlum Model 19, or similar instrument. The gamma-radiation may also be correlated to the Ra-226 soil concentration. This procedure assumes that gamma-radiation survey has already been performed.

Regardless of what correlation is being done, the method is similar. A GPS-based gamma-radiation survey is performed. Points representing the range of values of the survey are selected. At these locations measurements are made (i.e., exposure rates measured by PIC). An XY plot of the data can then be created and a linear regression performed to create an equation correlating gamma-radiation values to the measurement in question.

3. PROCEDURE

3.1 Equipment

3.1.1 Ratemeter/Scaler.

3.1.2 Detector.

3.1.3 Collimator (if specified).

3.1.4 Field notebook or appropriate forms.

3.1.5 Indelible ink pen.

3.1.6 Necessary equipment for making correlation measurements.

3.1.7 Soil sampling equipement if necessary.

3.1.8 Post-hole digger or other tools capable of obtaining 6-inch deep soil sample.

3.2 Data Collection

3.2.1 Point Studies

3.2.1.1 Using gamma radiation survey data, locate study areas that represent the range of values present. Five or more readings are usually sufficient. Areas should not

be in shine areas and should be on relatively flat terrain. Each study area should be large enough that a few steps in any direction should not affect the reading. Record the data for each location on ERG Form 2.09A or field notebook.

3.2.1.2 At each area, make a measurement using the specified equipment. Refer to the SOPs pertinent to the equipment being using for more information.

3.2.1.3 Using the same gamma detector and ratemeter/scaler used during the gamma-radiation survey, make a series of integrated counts in the immediate vicinity of the sample location. These values should be recorded on Form 2.09A, field logbook, or equivalent.

3.2.1.4 Repeat steps 3.2.1.1 through 3.2.1.3 for each location.

3.3 Linear Regression

3.3.1 In Microsoft Excel or other appropriate program, enter the data collected above.

3.3.2 Plot the data in an XY scatter plot.

3.3.3 Add a trend line and equation to the plot.

3.3.3.1 This equation is the linear regression and can be used to predict values over the range of gamma-radiation counts found during a survey.

4. TRAINING

4.1 Prior to use in the field, all personnel must show proficiency in the operation of the gamma-radiation survey equipment.

4.2 Prior to use in the field, all personnel must show proficiency in the use of Microsoft Excel or other equivalent program to create scatter plots and trend lines.

4.3 Prior to personnel being assigned to the field, supervisor must sign off of the Training Qualifications Form that he/she met requirements 4.1-4.2 above.

5. RECORDS

5.1 Records of the completed work, measurements, calculations, and data must be preserved, protected, and retained according to the contract and/or ERG's record retention process (see SOP 4.03)

5.2 Computer generated files will be saved as print and electronic files and stored with field notebooks.

6. REFERENCES

6.1 Project personnel using this procedure should become familiar with the contents of the following documents:

SOP 4.03

Form 4.00 Training Qualification Form

7. ATTACHMENTS

7.1 Form 2.09A

Author's Signature:	Reviewed By:
Charles P. Farr	Kenneth R Baker

STANDARD OPERATING PROCEDURE 5.11
SETUP AND OPERATION OF TRIMBLE PRO XRS RECEIVER WITH TRIMBLE TSCE DATALOGGER

1. PURPOSE

The purpose of the procedure is to instruct the user on how to properly setup a Trimble Pro XRS GPS unit to perform real time GPS gamma surveys using a Trimble TSCe datalogger and Ludlum 2221 ratemeter/scaler with RS-232 data output.

2. DISCUSSION

This SOP discusses the integration of a Trimble Pro XRS GPS unit, a Trimble TSCe datalogger, and a Ludlum 2221 ratemeter/scaler with RS-232 data output for use in conducting GPS radiological surveys. A data record is "logged" every time the 2221 outputs a data value to the TSCe through its RS-232 output. The GPS calculates its location every one second. The coordinate associated with each data value is interpolated between the locations calculated in the second before and after each data value is received. The TSCe records each data value as a "Not-In-Feature" record and associates the interpolated coordinate with the record. It is important the TSCe settings are correct to ensure the integrated components work together correctly.

3. PROCEDURE

3.1 Equipment

3.1.1 Trimble Pro XRS or XR GPS receiver.

3.1.1.1 When real-time data correction (dGPS) is necessary, a Pro XRS receiver and XRS antenna is necessary. Otherwise, the XR may be used.

3.1.2 Trimble Pro XRS or XR antenna. (see 3.1.1.1)

3.1.3 Trimble TSCe datalogger with stylus.

3.1.4 Charged batteries

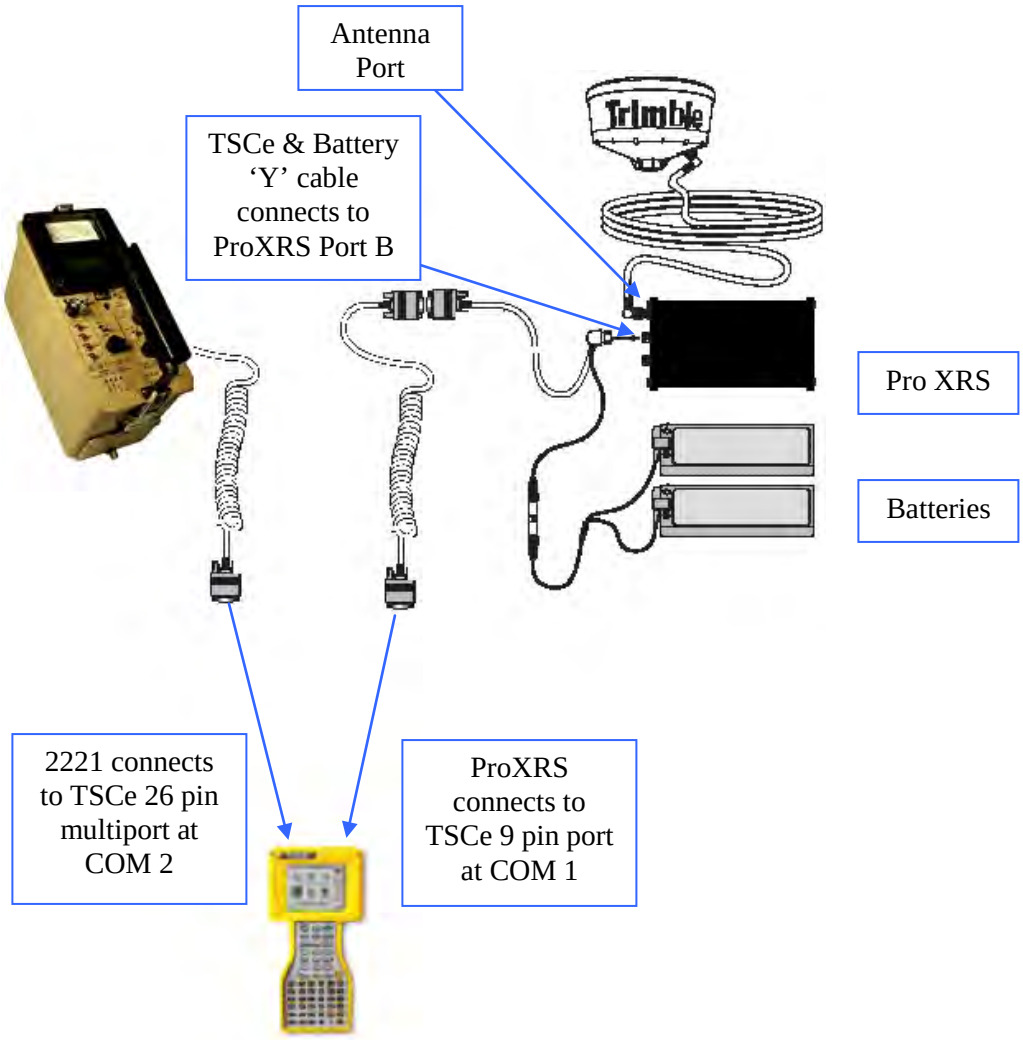
3.1.5 Ludlum 2221 scaler/ratemeter with RS-232 output

3.1.6 Ludlum 44-10 probe (or some other detector).

3.1.7 All necessary cables

3.2 Cabling Setup

3.2.1 Note: Refer to Figure below for an example of proper cable configuration associated with the GPS receiver, datalogger, and 2221 integration.



3.2.2 Connect the GPS receiver data/power 'Y' cable to port B of the Pro XRS receiver. Nothing connects to port A.

3.2.3 Connect the antenna cable to ANT port of the Pro XRS receiver.

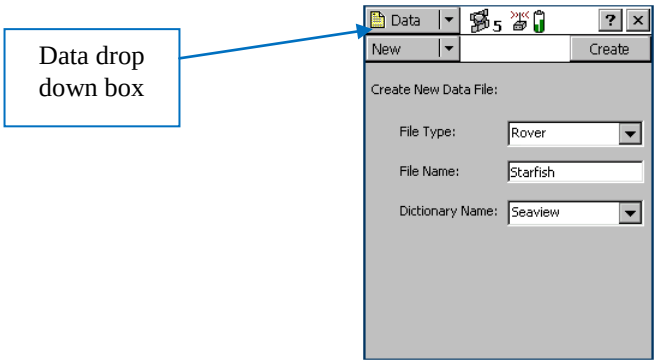
3.2.4 Connect the ProXRS receiver data output half of the data/power 'Y' cable to the TSCe COM1 port.

3.2.5 On the Ludlum 2221 connect the RS-232 data output cable to the TSCe COM2 port. You will have to use the DB9 to DB26 adaptor to connect to the TSCe COM2 port.

3.3 Operation

3.3.1 Opening a New File

3.3.1.1 From the opening window use the stylus and navigate to and tap the Data drop down box. Tap the Create button to create a new file.

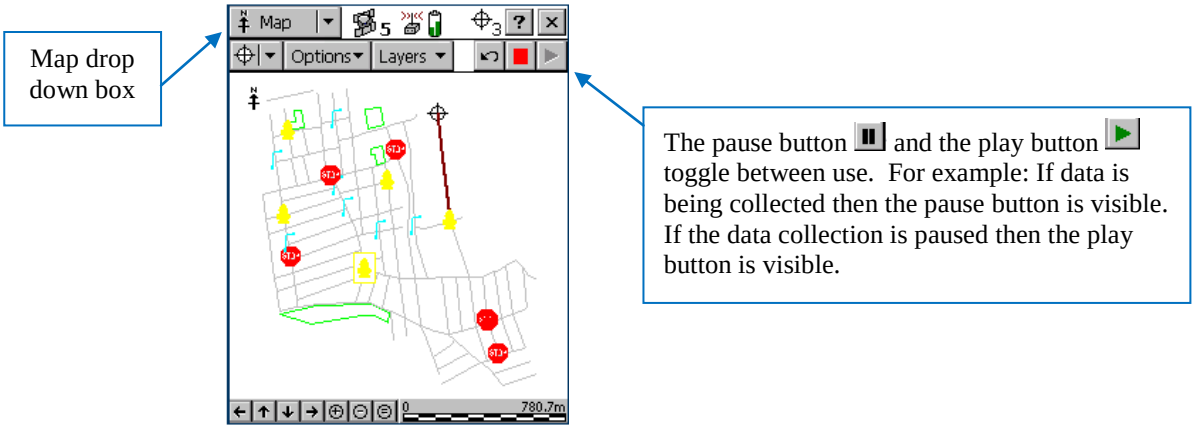


3.3.1.2 To open an existing file navigate to and tap the Existing File subsection list drop down box. Select the desired file and tap on the Open button in the upper right hand corner of the screen.

3.3.1.3 NOTE: Data collection will begin when a file is opened if TSCe and 2221 parameters are all set correctly and enough satellites are visible.

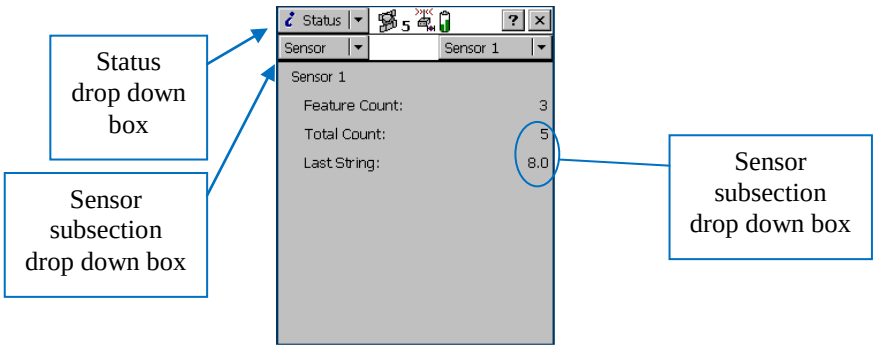
3.3.2 Pausing Data Collection

3.3.2.1 To pause data collection, navigate to the Map drop down box and tap on the pause button. To resume data collection, tap the play button.



3.3.3 Viewing Data Collection

3.3.3.1 It is advised to view data collection at the beginning of each survey to ensure all setup parameters have been set correctly and system is correctly collecting data.



3.3.3.2 To view data collection, navigate to the Status drop down box and then the Sensor subsection drop down box. The Total Count line indicates the number of gamma counts collected. The Last String line indicates the last gamma count recorded.

3.3.4 Closing Data Collection File

3.3.4.1 There are two ways to stop and close a data file. You can close the TerraSync application completely, or you can close the individual survey file and leave the TerrSync application running.

3.3.4.1.1 To close the TerraSync application completely, tap the ✕ in the upper right hand corner.

3.3.4.1.2 To close only the survey file, navigate to and tap the Data drop down box and then tap the Close button.

3.3.4.2 **Note**: If the TSCe is shut off without closing the file and closing TerraSync, the data collection file could be corrupted. If the TSCe battery is running low, the user should perform the above steps to save and close the file and charge the TSCe so as to prevent data corruption.

3.4 Useful Information - Below are some useful tips picked up along the way. It is advised the operator read this section as you'll likely encounter some of these situations during a survey.

3.4.1 Tape your camcorder battery clips to the camcorder batteries. They'll come off during a survey if you don't

3.4.2 Do not start a survey file unless you are in the survey area and your 2221 is turned on. You may collect erroneously low gamma counts if you wait to turn your 2221 on after you start a survey file

3.4.3 If you do not see any gamma counts being collected make sure that A) the 2221 is turned on, and B) the 2221 is in the DIG. RATE mode.

3.4.4 If you acquire no satellites after waiting one minute check antenna cabling or make sure you have connected through the TSCe Setup screen

4. TRAINING

4.1 Prior to use in the field, all personnel must show proficiency in the operation the GPS and associated Ludlum hardware.

4.2 Prior to use in the field, all personnel must show proficiency in use the Trimble software.

4.3 Prior to personnel being assigned to the field, supervisor must sign off of the Training Qualifications Form that he/she met requirements 4.1-4.2 above.

5. RECORDS

5.1 Records of the completed work, measurements, calculations, and data must be preserved, protected, and retained according to the contract and/or ERG's record retention process (see SOP 4.03)

5.2 Computer generated files will be saved as print and electronic files and stored with field notebooks.

6. REFERENCES

6.1 Project personnel using this procedure should become familiar with the contents of the following documents:

SOP 4.03

Form 4.00 Training Qualification Form

7. ATTACHMENTS

7.1 None.

Author's Signature:	**Reviewed By:**
Charles P. Farr	Kenneth R Baker

8809 Washington NE
Suite 150
Albuquerque, NM 87113

ERG - Standard Operating Procedure 7.08

Surface and Shallow Subsurface Soil Sampling

1.0 Purpose

This procedure outlines the appropriate equipment and materials, methods, and recordkeeping requirements for collecting surface and shallow subsurface soil samples from project locations.

2.0 Discussion

Soil samples are used to assess the distribution and intensity of constituent of concern for a wide variety of applications ranging from characterization of undisturbed areas to verification that remedial activity goals have been attained. Soil samples may be collected at systematic locations on a routine frequency or they may be collected at discrete or random locations to assess the impacts of unplanned releases, spills, or other contamination events. The analytical requirements placed on soil samples depend on the type and proximity to the project area and the desired reporting radiological, chemical, and geochemical characteristics. This information is typically described in the project sampling plan.

Surface soil samples are defined as samples coming from an interval of ground surface to a depth of 15 cm below ground surface (BGS). Shallow subsurface samples are defined as samples coming from an interval ranging from 15cm BGS to 1.5 m BGS, in which hand sampling methods are adequate to sample the desired interval. Samples taken below 5 ft BGS typically require mechanized methods of collection including motorized augers and drill rigs.

3.0 Procedure

The following steps are guidance for surface and shallow subsurface soil sampling.

3.1 **PPE (Personal Protective Equipment):** The PPE requirements for this task shall be described in the project specific Health and Safety Plan (HASP). Review the requirements contained in the HASP prior to initiating soil sampling.

3.2 **Precautions:** It is possible that radioactive and/or chemical contaminants are present on at the site. The site specific HASP will address necessary precautions need to collect soil samples. Follow all lockout tagout preventative controls and all requirements of work permits and pre-job briefings.

3.3 **Soil Sampling Process:**

3.3.1 Identify sample locations using work plan maps or work instructions with GPS equipment. Mark locations with pin flags or equivalent if soil sample is not to be collected immediately to prevent having to re-navigate back to the point.

3.3.2 Clear debris, loose brush, and vegetation from sample locations.

3.3.3 Collect the soil sample using shovel and trowel methods for surface soil samples and hand augers or equivalent for shallow subsurface soil sample

collection. Samples should be collected in a heavy duty Ziplock plastic bag or equivalent.

3.3.4 Collect auger cuttings for the desired depth by measuring the depth of the auger bit. For example, cuttings from an auger penetration interval of 24 to 30 inches are appropriate for required a sample of that depth. If used, drive sampling tubes to the desired depth and extract by hand or hand jack. Cap the end of the sample tube upon removal.

3.3.5 Add preservatives or otherwise prepare containers according to special instructions from the project manager or as described in the work plan. Document the sample ID, depth, preservation method, location, and other important sample descriptions on Form 7.08-1.

3.3.6 Collect quality control samples as directed in the work plan or project manager.

3.3.7 If using sampling equipment for multiple locations, wash surfaces of the tools with deionized water and dry prior to use at another sample location. Release rinse water to the ground unless the work plan or project manager designates that it be retained.

Note: If sampling occurs in a highly contaminated area, the project manager may direct that prior to reuse, all sampling equipment be subject to a surface contamination survey per standard operating procedure SOP3.03 to minimize the potential for cross-contamination.

3.3.8 Wipe sample containers of dirt and debris and label sample containers with the sample identification (ID) number, date and time collected, sample technician's name, and desired analyses. Place samples in a transport container as necessary. Complete the entries on Form 7.08-1 and initial.

3.3.9 Fill out laboratory provided chain of custody (COC). Once all samples are collected, seal transport container with COC seals and prepare transport container for courier pick up.

3.3.10 All samples obtained will be sent to the analytical laboratory designated by the work plan or project manager.

4.0 Training

4.1 Personnel participating in the procedure must review and complete all necessary SOPs listed in the Training Qualification Form applicable to the procedure.

4.2 All personal training stated in the Training Matrixes must be completed prior to participating in the procedure.

5.0 Records

5.1 Field forms will be saved and scanned as electronic files and will be preserved, protected and retained according to the contract and/or ERG's record retention process (see SOP 4.3).

6.0 References

6.1 ERG-SOP 3.03 – Surface Contamination Measurements

7.0 Attachments

7.1 Form 7.08-1 Soil Sampling Log

Author's Signature:	Approver's Signature