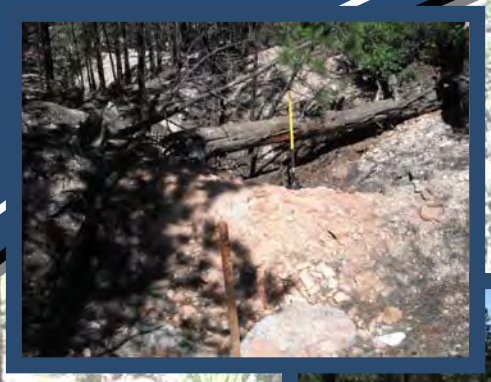
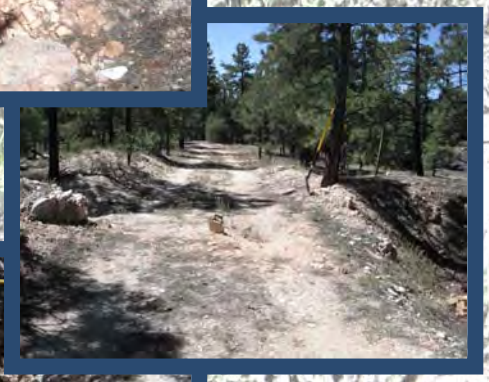
Abandoned Uranium Mine Assessment for the North Star Site (NM0185)

FINAL REPORT





Prepared For:

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Santa Fe, New Mexico 87505

Prepared By:

INTERA

September 29, 2010

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1.0 INTRODUCTION

INTERA Incorporated (INTERA) has prepared this Abandoned Uranium Mine (AUM) Site Assessment Report for the Mining and Minerals Division (MMD) of the New Mexico Energy, Minerals and Natural Resources Department (EMNRD) in compliance with the Professional Service Agreement dated November 2, 2009. INTERA visited the North Star Site (AUM Site), MMD ID: NM0185 on September 02, 2010.

1.1 PREVIOUSLY KNOWN INFORMATION ABOUT THE SITE

According to McLemore (1983), workings at the site were mainly along a long, sinous pegmatite intrusion in the Petaca Schist, and consisted of several open cuts, pits, and short adits. Although some uranium was reportedly produced from the site, there is no record of production from the U.S. AEC (McLemore, 1983).

1.2 SITE LOCATION AND DIRECTIONS

The North Star Mine Site is located within the Carson National Forest between the southwest quarter of Section 31, Township 27 North, Range 9 East, and the southeast quarter of Section 36, Township 27 North, Range 8 East. This AUM Site is located in Rio Arriba County and is approximately 2 miles northwest of the town of Petaca, along Forest Road 45 (please see Figure 1).

To reach the AUM Site from Albuquerque, drive approximately 57 miles north on Interstate 25 and take exit 282 for US-84 W/US-285 N. Continue through Santa Fe and follow US-84 W/US-285 N approximately 26 miles north to Española. In Española, turn left on Paseo de Onate to continue following US-84 W/US-285 N. Continue 8.5 miles further to the junction of US-84 W and US-285 N, and turn right to continue following US-285 N. Drive approximately 18 miles further on US-285 N and turn left at State Route 111, just past Ojo Caliente. Drive approximately 5 miles on State Route 111 and then turn right on NM-519 in the town of La Madera. Drive 11 miles on NM-519 and then turn left in Petaca, onto Co Rd 273/Co Rd 275/Forest Rd 45. Follow this road approximately 2.5 miles and turn right onto an unnamed dirt road. Drive approximately 0.4 miles up this road to reach the site.

1.3 SITE GEOLOGY

The AUM Site is located in the southern Tusas Mountains, the southernmost subrange of the Rocky Mountains. The area surrounding the AUM Site is comprised of Precambrian metamorphic and intrusive igneous rocks overlain by Tertiary volcanic and sedimentary deposits (Bingler, 1968). In eastern Rio Arriba County, these sediments consist of poorly consolidated pinkish-brown to yellowish-tan fine-grained arkosic silt and sand (Bingler, 1968). The uranium deposits found in the area are associated with Precambrian pegmatites intruding quartzite and schist (McLemore, 1983).

1.4 SITE HYDROGEOLOGY

The AUM Site is located atop a hill on the southern side of Cañada de la Jarita. Surface runoff flows to a drainage on the southwest side of this hill, which joins Cañada de la Jarita approximately 2,500 feet to the north. Cañada de la Jarita drains into the Rio Tusas 2 miles to the east, which joins the Rio Vallecitos and then the Rio Ojo Caliente. The Rio Ojo Caliente in turns joins the Rio Chama approximately 29 miles southwest of the AUM Site.

The AUM Site is located near the eastern boundary of the Rio Chama watershed, which covers most of the Rio Chama Water Planning Region (La Calandria Associates, Inc., 2006). The area surrounding the AUM Site is comprised of Precambrian crystalline rocks overlain by Tertiary volcanic and sedimentary deposits. The Precambrian rocks contain small amounts of groundwater in faults and weathered zones (La Calandria Associates, Inc., 2006). The Santa Fe Group strata exposed in the area surrounding the AUM Site constitute a shallow aquifer which covers most of the southern portion of the Rio Chama watershed. This aquifer is composed predominantly of fluvial, deformed, slightly consolidated sedimentary rocks, and groundwater flow in this unit is to the south at the AUM Site (La Calandria Associates, Inc., 2006).

1.5 REGIONAL TOPOGRAPHY AND TERRAIN

The AUM Site can be found on the Las Tablas Quadrangle 7.5 minute United States Geological Survey topographic map at an elevation of approximately 8,100 feet above mean sea level (please see Figure 2). The AUM Site is located just south of Cañada de la Jarita, atop a gently sloping hill. Figure 3 shows an aerial photograph of the terrain surrounding the AUM Site.

2.0 MINE FEATURES

The mine features described below are based on the features provided to INTERA by MMD in the GIS Data Dictionary (MMD, 2009). INTERA marked the locations of the AUM Site features using a Trimble Global Positioning System (GPS), and entered details about the features into the GPS using the MMD data dictionary. Two open cuts, seven waste piles, five pits, two trenches, one structure, and one disturbed area were found onsite. Please see the Photo Log in Appendix A for photos of the AUM Site features, Table 1 for a list of the AUM Site features, and Figures 4a and 4b for the locations of the AUM Site features.

2.1 MINE SHAFTS, ADITS, AND DECLINES

No mine shafts, adits or mining related declines were evident at the AUM site.

2.2 MINING AND EXPLORATION PITS AND OPEN CUTS

Two open cuts, five pits, and two trenches were found at the AUM Site. Several of these features were found to be coincident with an east-west trending pegmatite. CutLn-1 is a U-shaped surface cut within the pegmatite, approximately 10 ft high and 150 ft long. Trench-1 is just east of this cut, and is approximately 5 ft deep, 20 ft wide and 35 ft long. Pit-1, -2, and -3 are shallow exploration workings located along the contact between the pegmatite and the schist country rock. The deepest of these is Pit-2, with excavation to approximately 10 ft below the ground

surface and approximately 5 ft wide and 20 ft long. Trench-2 is located east of these features and is approximately 5 ft deep, 20 ft wide and 40 ft long. The maximum gamma radiation measurement for these features was 30 µR/hr (microroentgens per hour) at 0 ft above ground at radiation survey point Rad-9 in Pit-2 (see Table 2).

CutPly-1, Pit-4 and Pit-5 are smaller surface excavations into metamorphic bedrock and are located approximately 500 ft southwest of the pegmatite intrusion. The highest gamma radiation measurement for these features was 26 µR/hr at 0 ft above ground at radiation survey point Rad-16 in CutPly-1 (see Table 2).

2.3 WASTE AND ORE PILES AND DISTURBANCES

Seven waste piles and one disturbed area were found onsite. All of the piles consisted of excavated waste rock except the largest pile, PilePly-1, which contained soil and rock. PilePly-1 is approximately 10 ft high, 80 ft wide and 175 ft long, and is located adjacent to DistPly-1. DistPly-1 is a bulldozed area measuring approximately 40 ft x 175 ft. PilePly-2 and located north of the main excavation features. The highest radiation reading found on these features was on DistPly-1 with a gamma radiation measurement of 150 µR/hr at 0 ft above ground at radiation survey point Rad-6 (see Table 2).

2.4 MINING RELATED BUILDINGS AND FOUNDATIONS

One collapsed wooden structure (StrucPly-1) was found on site. Radiation survey point Rad-5 at StrucPly-1 measured 160 µR/hr at 0 ft above ground and 42 µR/hr at 4 ft above ground.

2.5 OTHER MINE FEATURES

No other mining related features were evident at the AUM Site.

2.6 BOREHOLES

No boreholes were evident at the AUM Site.

2.7 RECLAMATION ACTIVITIES

No evidence of ongoing or past reclamation was found at or near the AUM Site.

3.0 ARCHEOLOGICAL SITES

No apparent archeological sites were identified at or near the AUM Site.

4.0 SITE GAMMA RADIATION READINGS

The background gamma radiation readings were measured approximately 1,500 ft south of the AUM Site boundary, along Forest Rd 45. The background gamma level was 15 µR/hr at 0 ft above ground and 14 µR/hr at 4 ft above ground. Please see Table 2 for all of the gamma

radiation readings taken at the AUM Site and Figures 4a and 4b for the locations of the radiation readings.

The maximum gamma radiation measured on site was 260 µR/hr at 0 ft above ground and 55 µR/hr at 4 ft above ground at radiation survey point Rad-8 along Access-1 (see Photo 8 in Appendix A). A gamma radiation measurement taken on StrucPly-1 (radiation survey point Rad-5, see Photo 7 in Appendix A) recorded 160 µR/hr at 0 ft above ground, and a gamma radiation measurement taken on PilePly-2 (radiation survey point Rad-6, see Photo 8 in Appendix A) recorded 150 µR/hr at 0 ft above ground.

5.0 CURRENT LAND USES

5.1 HUMAN ACTIVITY AND RECREATIONAL SITE USE

The land surface at the AUM Site is used for cattle ranching.

5.2 NEARBY RESIDENTIAL, COMMERCIAL AND INDUSTRIAL STRUCTURES

No structures were sighted within a mile of the AUM Site.

5.3 NEARBY DOMESTIC WELLS

No wells, domestic or otherwise, lie within a mile of the AUM Site.

5.4 EVIDENCE OF GRAZING OR AGRICULTURE

Cows, cow prints, cow droppings, cattle guards, and fences were observed at or near the AUM Site indicating that the area is used for grazing.

5.5 EVIDENCE OF WILDLIFE

Several species of birds were seen near the AUM Site. Rabbit, deer, and coyote droppings were also observed.

6.0 VEGETATION

The North Star site is located in the Montane Coniferous Forest vegetation type (Dick-Peddie, 1999). Woody vegetation at the site included ponderosa pine and gambel oak. Grass species included black grama grass and a bentgrass species. No forb species were collected or photographed. No noxious weeds were noted from photographs of the site.

7.0 POTENTIAL OFFSITE IMPACTS

7.1 EROSION

No evidence of mine related erosion was observed on site.

7.2 ENVIRONMENTAL IMPACTS

There is no evidence of soil staining from chemicals potentially brought to the AUM Site, or from constituents present in the ore or waste rock.

8.0 REFERENCES

Bingler, Edward C., 1968. Geology and Mineral Resources of Rio Arriba County, New Mexico. New Mexico Bureau of Mines and Mineral Resources Bulletin 91.

Dick–Peddie, William A, 1999. New Mexico Vegetation: Past, Present, and Future. University of New Mexico Press.

La Calandria Associates, Inc., 2006. Rio Chama Regional Water Plan. Prepared for Rio de Chama Acequias Association and Rio Arriba County.

McLemore, Virginia T., 1983. Uranium and Thorium Occurrences in New Mexico: Distribution, Geology, Production, and Resources, with Selected Bibliography. New Mexico Bureau of Mines and Mineral Resoures Open File Report OF-183.

Mining and Minerals Division (MMD), 2009. Mine Feature Data Dictionary.

New Mexico Office of the State Engineer (NMOSE), 2008. Wells and Surface Diversions in New Mexico. WATERS_PODS_may08.shapfile. OSE Waters Database.

TABLES

Table 1
Site Features

North Star-NM0185
Abandoned Uranium Mine Assessments

Feature Name	On Site?	Feature Type	Associated Feature	Material	Height or Depth (ft)	Width or Diameter (ft)	Length (ft)	Open	Collapsed	Closure Type	Associated Photos	Notes
Access-1	Yes	Access	--	Dirt Nonmaintained	--	--	--	--	--	--	--	--
Access-2	No	Access	--	Dirt Maintained	--	--	--	--	--	--	--	Forest Rd 45
CutLn-1	Yes	--	--	--	10	10	150	--	--	--	NM0185_004	looking northwest
CutPly-1	Yes	--	--	--	3	10	20	--	--	--	NM0185_018	looking north
DistPly-1	Yes	--	--	--	--	40	175	--	--	--	NM0185_003	looking east
PilePly-1	Yes	Waste	--	Other	10	80	175	--	--	--	NM0185_002	looking northwest; soil/rock
PilePly-2	Yes	Waste	--	Rock	3	8	15	--	--	--	NM0185_008	looking north
PilePly-3	Yes	Waste	--	Rock	5	20	50	--	--	--	NM0185_014	looking west
PilePly-4	Yes	Waste	--	Rock	5	25	100	--	--	--	NM0185_015	looking northwest
PilePly-5	Yes	Waste	--	Rock	2	5	25	--	--	--	NM0185_016	looking south
PilePly-6	Yes	Waste	--	Rock	2	5	25	--	--	--	NM0185_017	looking north
PileRidge-1	Yes	Waste	--	Rock	1	5	40	--	--	--	NM0185_019	looking east
Pit-1	Yes	Exploration	--	--	4	15	25	Yes	--	--	NM0185_009	looking northwest
Pit-2	Yes	Exploration	--	--	10	5	20	Yes	--	--	NM0185_011	looking east
Pit-3	Yes	Exploration	--	--	4	8	12	Yes	--	--	NM0185_012	looking northwest
Pit-4	Yes	Exploration	--	--	2	6	10	Yes	--	--	NM0185_020	looking north
Pit-5	Yes	Exploration	--	--	2	6	15	Yes	--	--	NM0185_021	looking north
StrucPly-1	Yes	Unknown	--	Wood	0	6	10	--	Yes	--	NM0185_006 NM0185_007	looking southwest, closeup; collapsed structure
Trench-1	Yes	--	--	--	5	10	35	--	--	--	NM0185_005	looking west
Trench-2	Yes	--	--	--	5	10	40	--	--	--	NM0185_013	looking northwest

Notes:

-- designates no information

Table 2
Gamma Radiation Survey Results

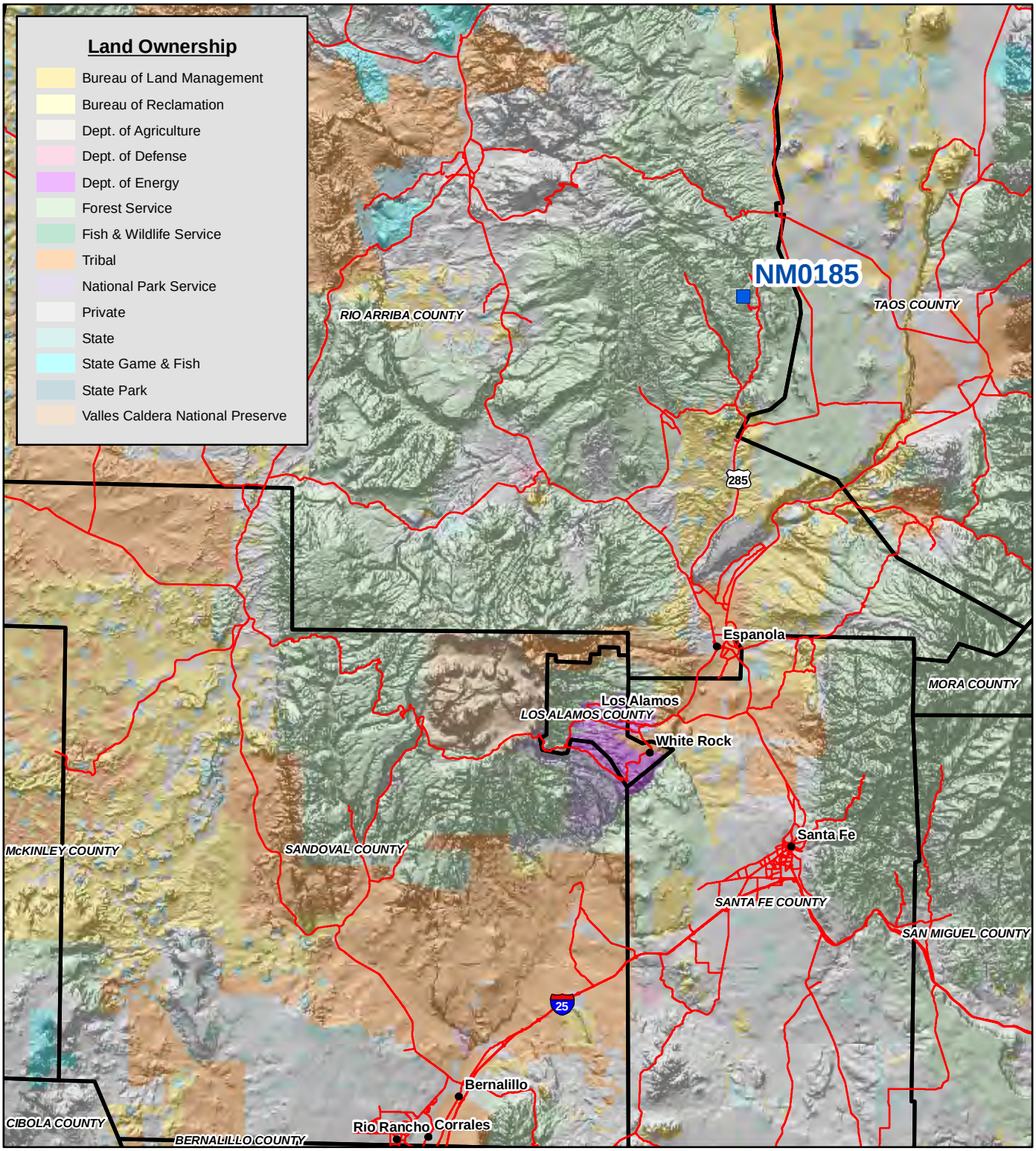
North Star-NM0185
Abandoned Uranium Mine Assessments

Reading ID	Associated Features	0 ft (µR/hr)	4 ft (µR/hr)	Associated Photos
Rad-1	pileply-1	17	15	--
Rad-2	distply-1	18	17	--
Rad-3	cutln-1	16	16	--
Rad-4	trench-1	22	16	--
Rad-5	strucply-1	160	42	NM0185_007
Rad-6	pileply-2	150	23	--
Rad-7	pit-1	28	20	--
Rad-8	access-1	260	55	NM0185_010
Rad-9	pit-2	30	19	--
Rad-10	pit-3	12	13	--
Rad-11	trench-2	19	16	--
Rad-12	pileply-3	15	14	--
Rad-13	pileply-4	20	17	--
Rad-14	pileply-5	22	21	--
Rad-15	pileply-6	30	25	--
Rad-16	cutply-1	26	17	--
Rad-17	pileridge-1	13	11	--
Rad-18	pit-4	18	15	--
Rad-19	pit-5	15	14	--
RadBack-1	--	15	14	--

Notes:

All gamma readings at this site taken by Ludlum 192 µR/Ratemeter
µR/hr=microroetgens per hour
-- designates no information

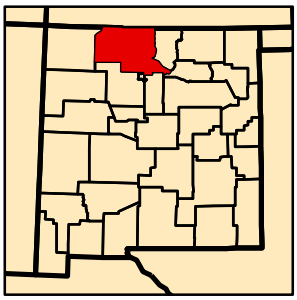
FIGURES



Map Source(s):
Ownership - BLM, 2008

0 7.5 15 30
Miles

NORTH



Legend

- AUM Location
- Road
- County Boundary

Figure 1
Site Location Map
NM0185-North Star
Abandoned Uranium Mine Assessment

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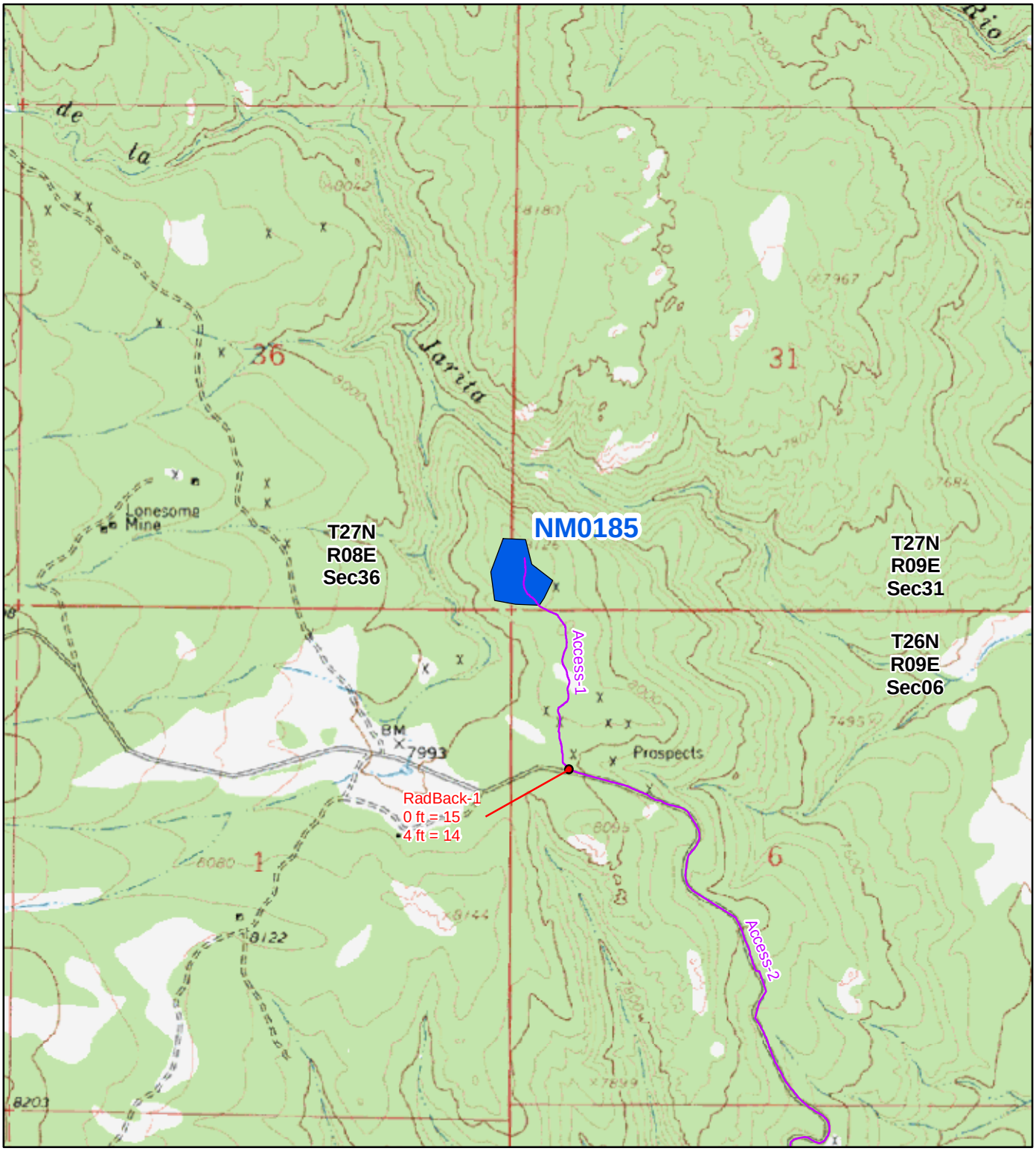

Map Source(s):
U.S. Geological Survey 7.5-Minute
Topographic Map
-Las Tablas, 1963

Legend

- Radiation Readings (µR/hr)
- Access Route
- AUM Location Boundary (MMD Provided)

Note:
There are no wells within 1 mile of the Site.

Figure 2
Topographic Map
NM0185-North Star
Abandoned Uranium
Mine Assessment

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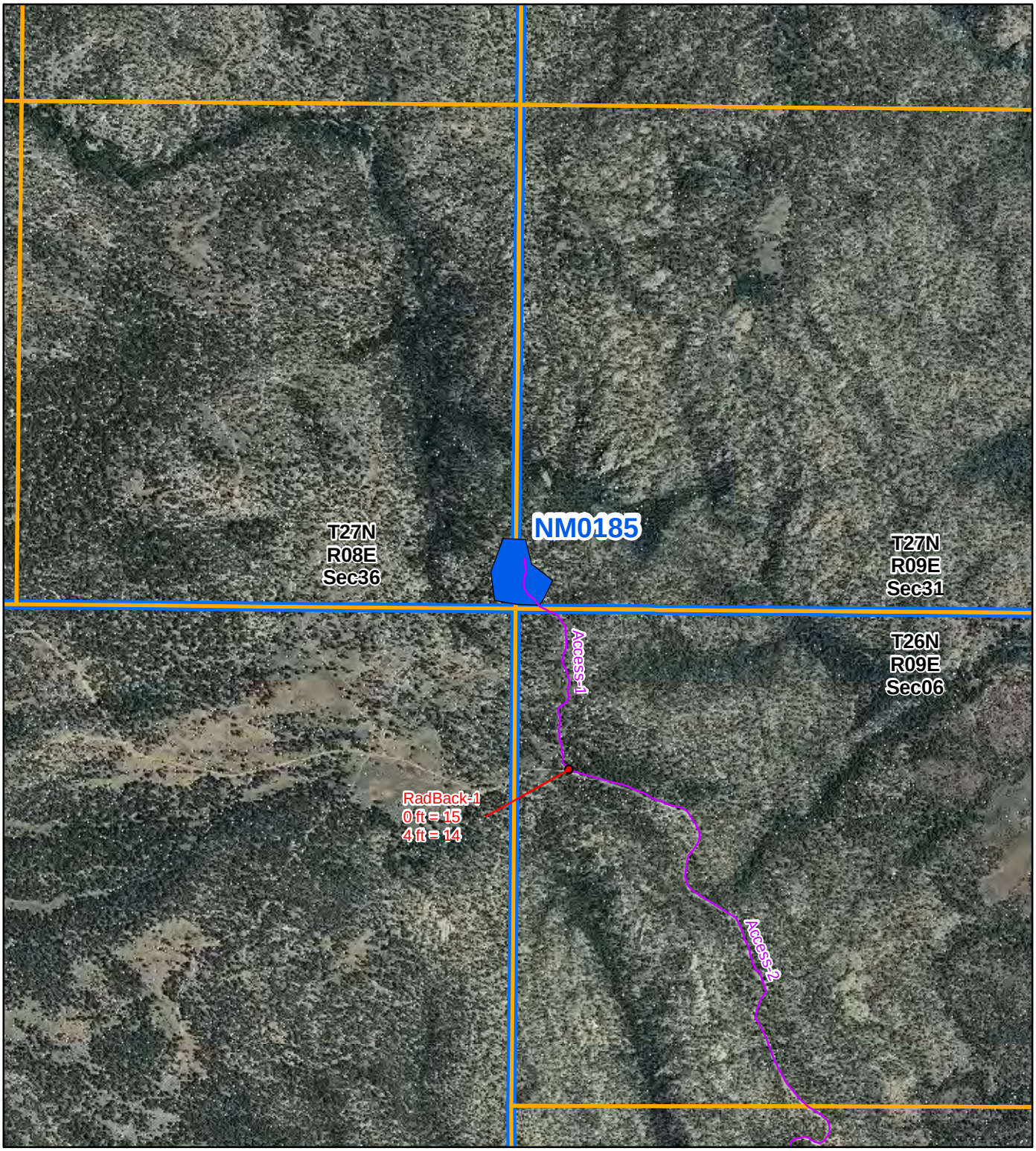


Map Source(s):
U.S. Geological Survey 7.5-Minute
DOQQ County Mosaic
-Rio Arriba County, 2009

0 750 1,500 3,000
Feet

NORTH

Legend

- Radiation Readings (µR/hr)
- Access Route
- AUM Location Boundary (MMD Provided)
- Section Boundary
- Township/Range Boundary

Note:
There are no wells within 1 mile of the Site.

Figure 3
Aerial Photo
NM0185-North Star
Abandoned Uranium
Mine Assessment

File: S:\Projects\EMMD-001_Abandoned Uranium Mine Assessment\Sites\NM0185-North_Star\GIS\Maps\Aerial_Map_NorthStar_CP.mxd 09/13/2010

Map Source(s):
U.S. Geological Survey 7.5-Minute
DOQQ County Mosaic
-Rio Arriba County, 2009

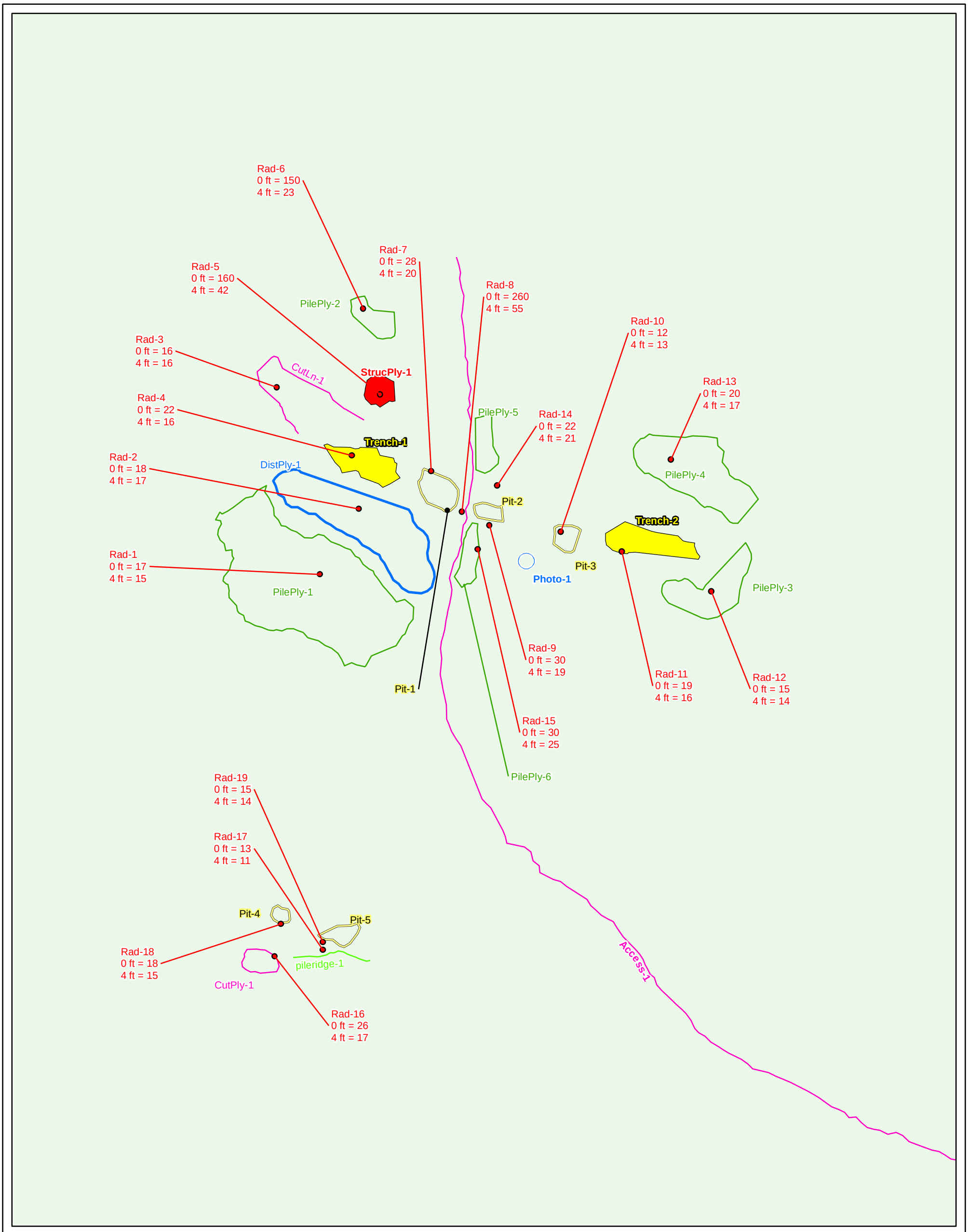
0 30 60 120
Feet

NORTH

Legend

- Radiation Readings (µR/hr)
- Photo Location
- Access Route
- Drainage
- Pile Ridge
- Pile Boundary
- Shaft Boundary
- Pit Boundary
- Other Disturbance Area

Figure 4a
Site Map on
Aerial Photo
NM0185-North Star
Abandoned Uranium
Mine Assessment



Map Source(s):
Ownership - BLM, 2008

0 30 60 120
Feet

NORTH

Legend

- Radiation Readings (µR/hr)
- Photo Location
- Access Route
- Drainage
- Pile Ridge
- Pile Boundary
- Shaft Boundary
- Pit Boundary
- Other Disturbance Area

Surface Ownership

- Forest Service

Figure 4b
Site Map with
Surface Ownership
NM0185-North Star
Abandoned Uranium
Mine Assessment

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APPENDIX A

PHOTO LOG

Note: Gaps in the numbering sequence of the photos is the result of removing photos not suitable for the report. A full set of photos is provided in the electronic deliverable.

Photo 1-Site location photo looking west.

Photo 2-Looking northwest at PilePly-1.

Photo 3-Looking east at DistPly-1.

Photo 4-Looking northwest at CutLn-1.

Photo 5-Looking west at Trench-1.

Photo 6-Looking south at StrucPly-1.

Photo 7-Rad-5, ground surface below StrucPly-1.

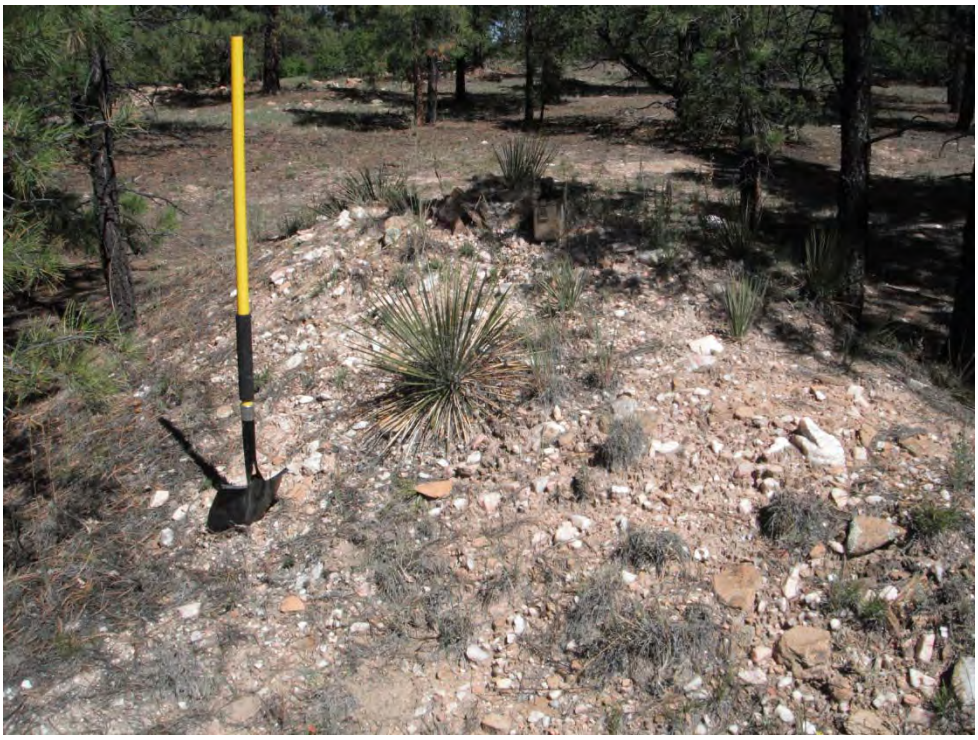

Photo 8-Looking north at PilePly-2.

Photo 9-Looking northwest at Pit-1.

Photo 10-Looking south at Rad-8.

Photo 11-Looking east at Pit-2.

Photo 12-Looking northwest at Pit-3.

Photo 13-Looking northwest at Trench-2.

Photo 14-Looking west at PilePly-3.

Photo 15-Looking northwest at PilePly-4.

Photo 16-Looking south at PilePly-5.

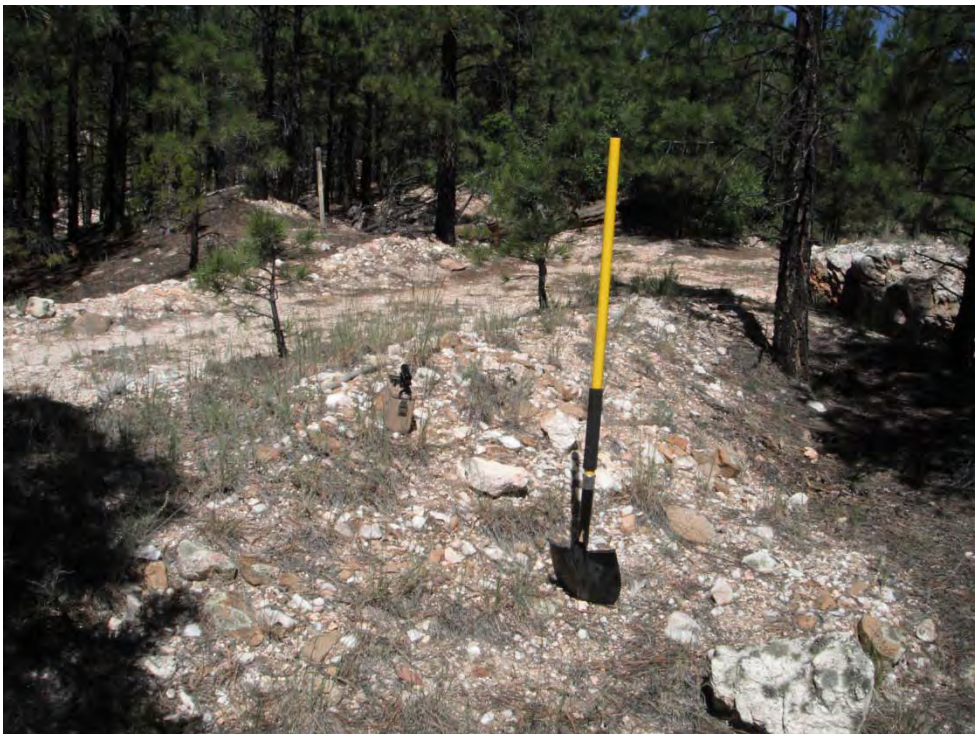

Photo 17-Looking north at PilePly-6.

Photo 18-Looking north at CutPly-1.

Photo 19-Looking east at PileRidge-1.

Photo 20-Looking north at Pit-4.

Photo 21-Looking north at Pit-5.

Photo 22-Vegetation at AUM Site.

Photo 23-Vegetation at AUM Site.

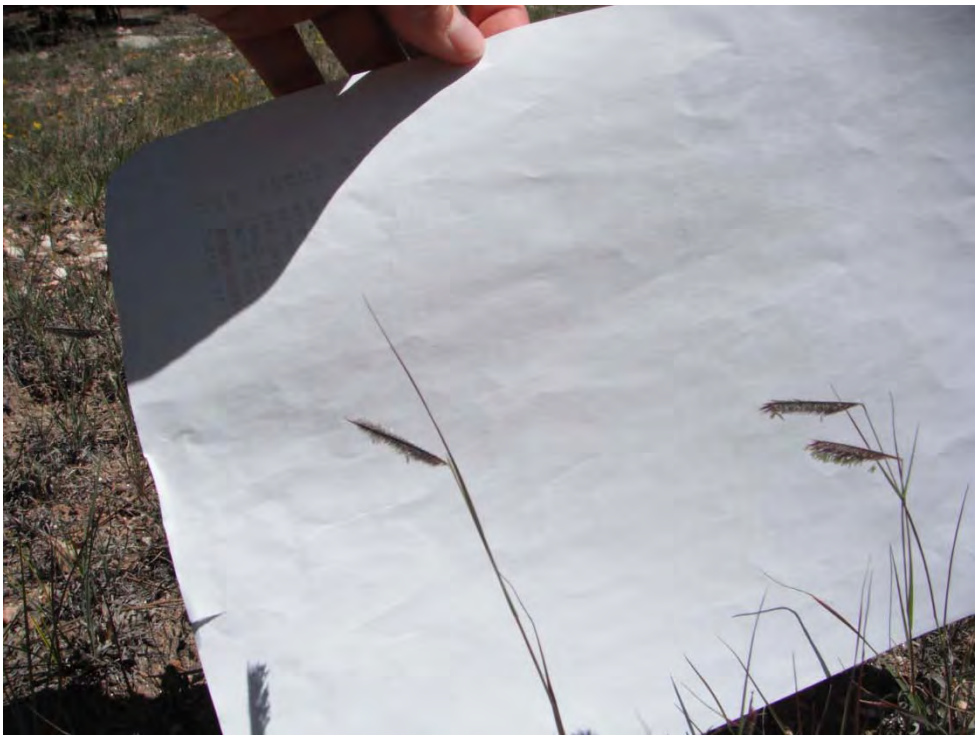

Photo 24-Vegetation at AUM Site.

Photo 25-Vegetation at AUM Site.

APPENDIX B

FIELD NOTES

9/2/10 ALT Abandoned Uranium Mines

Site Name: NM0185, North Star

Objective: Site Assessment

Personnel: Annelia Tinklenberg
Alex Resovsky

Equipment: Rental truck, Trimbel GeoXM (SN: 4944344727, 2008 Series), Ludlum 192 (SN: 234149), Fujifilm digital camera (No. OTB81259), backup garmin GPS, cell phone amplifier, field laptop

800 Leaving Espanola for site

1020 On Forest Road 45, near site

1040 At Aum Site

Photo 1 - Site ID location looking west

PilePly-1 - 10' tall, 175' long, 80' wide, 50° waste rock and top soil/rock

Photo 2 - PilePly-1 looking northwest

Rad-1 - PilePly-1; 0m-17 uR/h; 1m-15 uR/h

DistPly-1 - ~~50'~~ 40' ALT wide, 175' long; Bulldozed area

Photo 3 - DistPly-1 looking east

Rad-2 - DistPly-1; 0m-18 uR/h; 1m-17 uR/h

~~Open~~ ALT CutIn-1 - 10' tall, 10' wide, 150' long

Photo 4 - CutIn-1 looking northwest

Rad-3 - CutIn-1; 0m-16 uR/h, 1m-16 uR/h

Trench-1; 5' deep, 35' long, 10' wide

Photo 5 - Trench-1 looking west

Rad 4 - Trench-1; 0m-22 uR/h; 1m-16 uR/h

Struct-1 - unknown, 0' high, 6x10'; collapsed wood

Photo 6 - Struct-1 looking south

Rad 5 - Struct-1; 0m-150 uR/h; 1m-42 uR/h

Photo 7 - Rad-5 pile under Struct-1

PilePly-2 - 3' tall; 8' wide, 15' long; ° slope; waste ~~rock~~ ALT topsoil/rock

Photo 8 - PilePly-2 looking north

Rad 6 - PilePly-2 - 0m-150 uR/h; 1m-23 uR/h

Pit-1 - 4' deep, 15' wide, 25' long

Photo 9 - Pit-1 looking northwest

Rad 7 - Pit-1; 0m-28 uR/h; 1m-20 uR/h

Rad 8 - Access Rd-1; 0m-260 uR/h; 1m-55 uR/h

Photo 10 - Rad 8 looking south

Pit 2 - 10' deep, 20' long, 5' wide

Photo 11 - Pit 2 looking east

Rad 9 - Pit 2; 0m-30 uR/h; 1m-19 uR/h

Pit 3 4' deep, 5' wide, 12' long

Photo 12 - Pit 3 looking northwest

Rad 10 - Pit 3; 0m-12 uR/h; 1m-13 uR/h

Trench-2 - 5' deep, 40' long, 10' wide

Photo 13 - Trench 2 looking northwest

Rad 11 - Trench-2; 0m-19 uR/h; 1m-16 uR/h

PilePly-3 - 5' tall, 50' long, 30' wide, 45° slope waste

Photo 14 - PilePly3 looking west

Rad 12 - PilePly3; 0m-15 uR/h; 1m-14 uR/h

PilePly-4 - 5' tall, 25' wide, 100' long, 45° slope

Photo 15 - PilePly-4 looking northwest

Rad 13 - PilePly 4 - 0m-20 uR/h; 1m-17 uR/h

PilePly-5 - 2' tall, 5' wide, 25' long

Photo 16 - PilePly 5 looking south

Rad 14 - PilePly 5 - 0m-22 uR/h; 1m-21 uR/h

9/2/10 ALT Abandoned Uranium Mines

Pile Ply 6 - 2'tall, 5'wide, 25'long, 30° slope

Photo 17 - Pile Ply 6 looking north

Rad 15 - Pile Ply 6 ALT 0m - 30 MR/h; 1m - 25 MR/h

Cut Ply-1 - 3'deep, 10'wide, 20'deep

Photo 18 - Cut Ply-1 looking north

Rad 16 - Cut Ply-1; 0m - 36 MR/h; 1m - 17 MR/h

Pile Ridge-1 - 1'tall, 5'wide, ALT 40'long

Photo 19 - Pile Ridge 1 looking east

Rad 17 - Pile Ridge 1; 0m - 13 MR/h; 1m - 11 MR/h

Pit-4 - 2'deep, 6'wide, 10'long

Photo 20 - Pit 4 looking north

Rad 18 - Pit-4; 0m - 15 MR/h; 1m - 15 MR/h

Pit 5 - 2'deep, 6'wide, 15'long

Photo 21 - Pit 5 looking north

Rad 19 - Pit 5; 0m - 15 MR/h; 1m - 13 MR/h

Photo 22 - Dominant woody species - Ponderosa

Photo 23 - Codominant woody - scrub oak

Photo 24 - Dominant grass - grama

Photo 25 - Codominant grass - unknown

Most features trend along contact line, northwest trending

Access Rd-1

1245 Leaving site

Background Rad - 0m - 15 MR/h; 1m - 14 MR/h

Soils: Light tan soils. Rocky, thin, shallow

Rocks: Quartz, feldspar-rich granite, Muscovite mica schist.

Wildlife: Ravens and small birds. Rabbit, deer, and coyote droppings.

Human Activities: Grazing. Cows, ALT cow droppings and tracks, fences, cattle guards.