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Long-Term Surveillance and Maintenance Plan for the Gasbuggy, New Mexico, Site

August 2024

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U.S. DEPARTMENT OF ENERGY | Legacy Management

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Abbreviations

AEC	U.S. Atomic Energy Commission
BLM	U.S. Bureau of Land Management
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
EPA	U.S. Environmental Protection Agency
EPNG	El Paso Natural Gas Company
ft	feet
IC	institutional control
LM	Office of Legacy Management
LTHMP	Long-Term Hydrologic Monitoring Program
LTS&M	long-term surveillance and maintenance
LTS&M Plan	Long-Term Surveillance and Maintenance Plan
mg/L	milligrams per liter
MOU	Memorandum of Understanding
NMED	New Mexico Environment Department
OCD	Oil Conservation Division
pCi/L	picocuries per liter
PLO	Public Land Order
QSM	Quality Systems Manual
USFS	U.S. Forest Service
USGS	U.S. Geological Survey

1.0 Introduction

The Gasbuggy, New Mexico, Site is in northwestern New Mexico in Rio Arriba County, approximately 55 miles east of the City of Farmington, and 12 miles southwest of Dulce (Figure 1). The site consists of one section of land totaling 640 acres in the Carson National Forest. In 1967, the U.S. Atomic Energy Commission (AEC) (predecessor agency to the U.S. Department of Energy [DOE]) detonated a nuclear device 4227 feet (ft) below ground surface at the site. The test was designed to fracture a low-permeability natural-gas-bearing formation within the San Juan Basin in an effort to improve natural gas production. The DOE Office of Legacy Management (LM) is responsible for the long-term surveillance and maintenance (LTS&M) of the Gasbuggy site.

Historical monitoring to date has not detected detonation-related contaminants at any sampled locations. There are institutional controls (ICs) in place to prohibit subsurface excavations and drilling near the Gasbuggy site detonation point. This document describes the site, its history, and how LM implements LTS&M activities, maintains compliance with applicable regulations, and protects human health and the environment.

1.1 Purpose

This LTS&M Plan documents LM's operational plan for long-term stewardship of the site. Long-term stewardship refers to the performance of all activities necessary to protect human health and the environment following cleanup, disposal, and stabilization at a site. The purpose of this LTS&M Plan includes the following:

- Communicate the operational plan for managing the site to stakeholders (this includes the New Mexico Environment Department [NMED], U.S. Bureau of Land Management [BLM], and U.S. Forest Service [USFS].
- Summarize the underground nuclear testing and environmental restoration activities (Sections 2.1 and 2.2).
- Describe the plan and status of monitoring, and site inspection requirements (Sections 3.1 and 3.2).
- Provide the process for evaluating and reporting site-specific information to stakeholders (Section 3.3).
- Describe the process for maintaining site records (Section 3.4).

1.2 Regulatory Framework

Surface and subsurface contamination resulted from the underground nuclear test performed at the Gasbuggy site. DOE completed a Surface Closure Report in 2005 (DOE 2005) that details the surface cleanup in accordance with the New Mexico Oil Conservation Division (OCD) standards for soils impacted by total petroleum hydrocarbons (DOE 2004). DOE maintains responsibility for radioactive material that remains in the subsurface at the site under authority of the Atomic Energy Act of 1954, as amended under Title 42 *United States Code* Section 2011 (42 USC 2011). Section 2.2 provides information on cleanup actions completed under the Surface Corrective Action Plan for the Gasbuggy Site (DOE 2004).

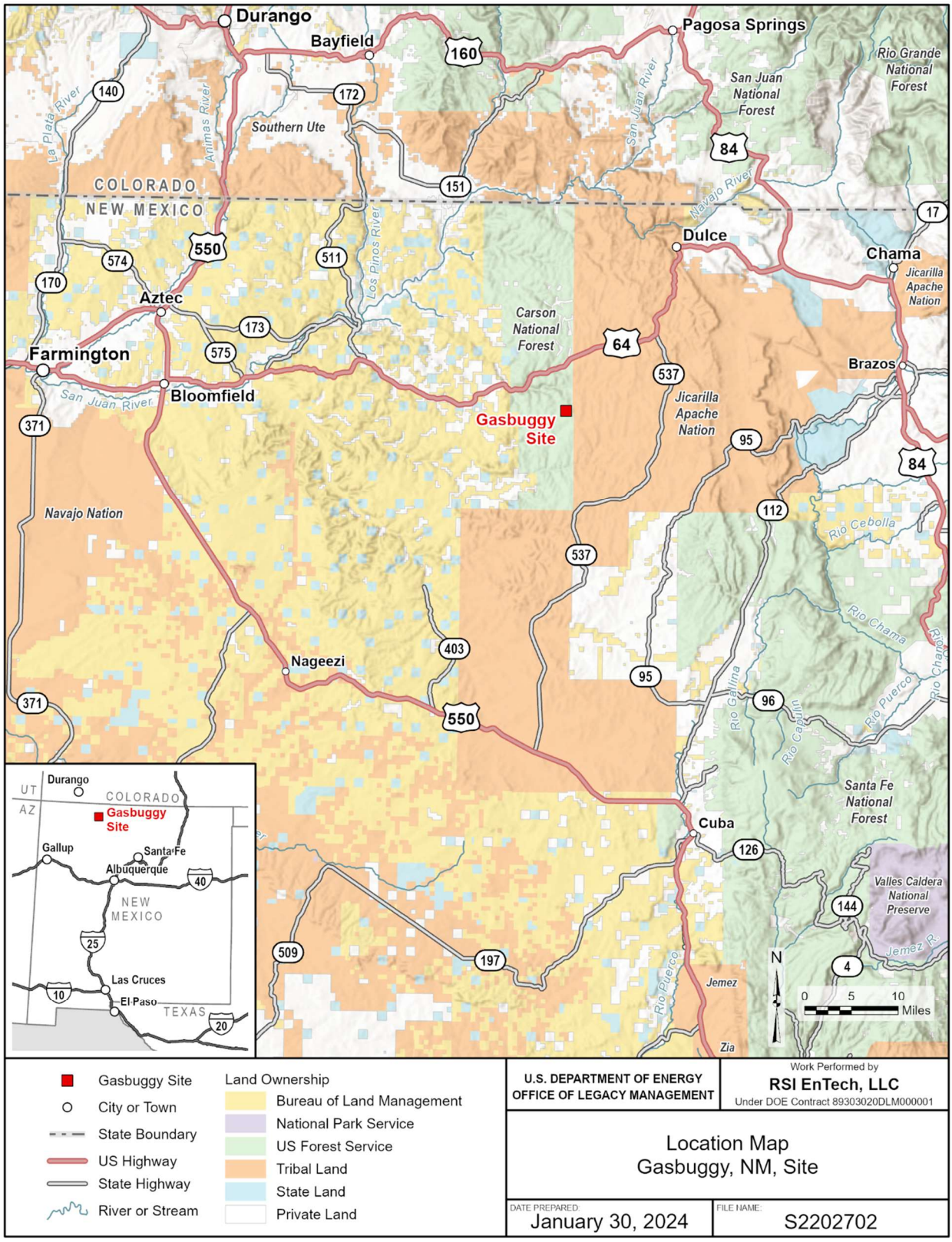


Figure 1. Location Map Gasbuggy, New Mexico, Site

1.3 Physical Setting

The Gasbuggy site is in the northeast portion of the San Juan Basin, a structural feature of the Colorado Plateau Province covering northwestern New Mexico and southwestern Colorado. Canyon and plateau topography typical of the Colorado Plateau Province surrounds the Gasbuggy site. Elevations range from 6800 to 7500 ft in the surrounding area, and from 7000 to 7300 ft in the immediate test area (DOE 1988). The emplacement well area is at an elevation of 7211 ft above sea level (DOE 1983).

The Gasbuggy site lies within the cold temperate climatic zone. Three basic vegetation communities (i.e., forest, scrubland, and grassland) are represented at the site. The forest community is classified as Rocky Mountain montane conifer forest, which is dominated by ponderosa pine. This community is typically found along the steeper slopes of the site, forming a band around the drainage areas. The scrubland community is Great Basin montane scrub and is found along hilltops, above the forest. Although classified as a scrubland, this community may support ponderosa and pinyon pines. The grassland community is further subdivided into two distinct series: the Great Basin shrub-grassland, sagebrush grass series, and the Great Basin shrub-grassland, wheatgrass series (DOE 1993a).

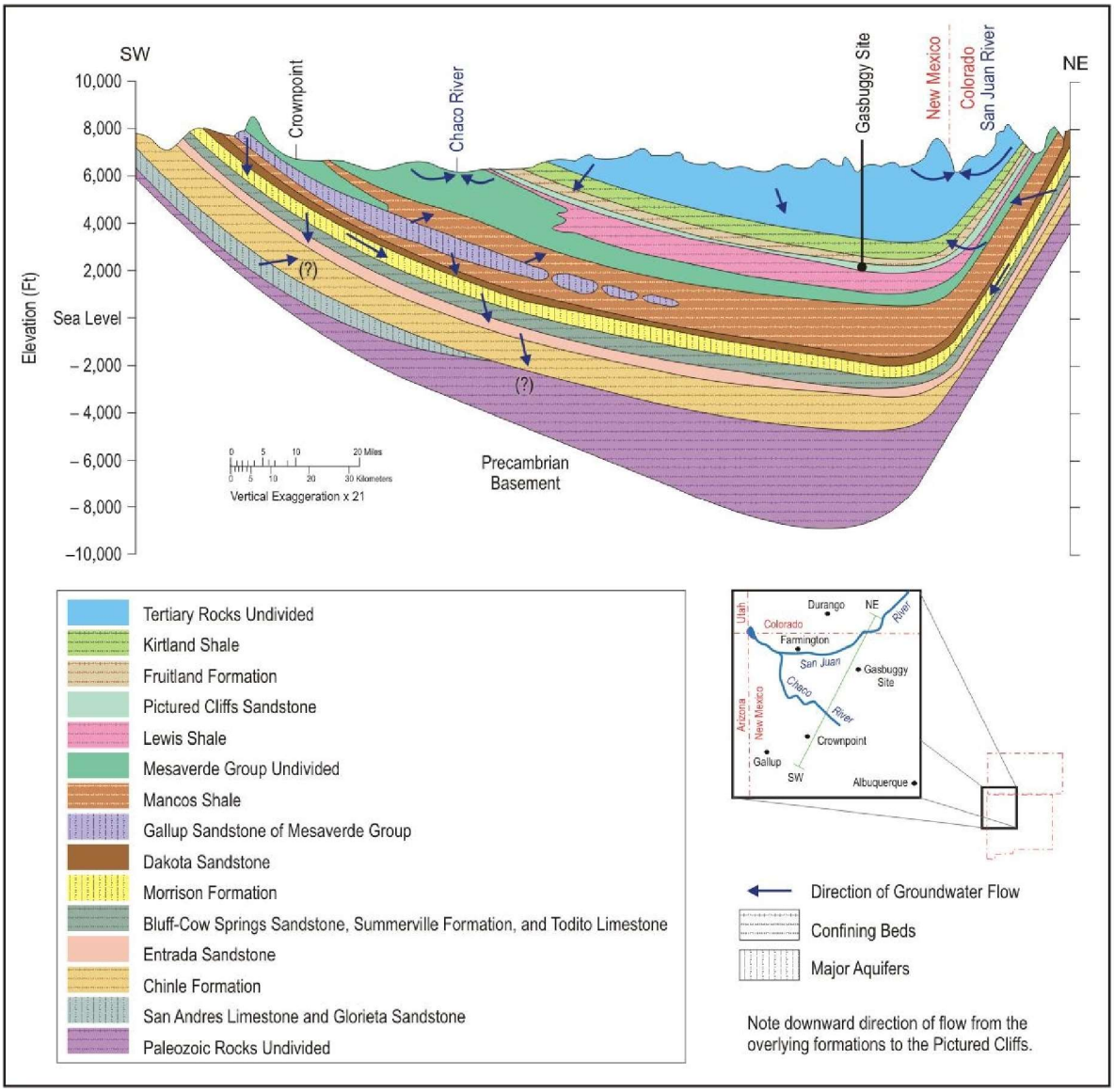
1.4 Geologic and Hydrologic Setting

The Gasbuggy site lies within the San Juan structural basin, a northwest-trending depression along the eastern edge of the Colorado Plateau (Figure 2). The basin is bounded on the north by the San Juan Mountains, on the east by the Sierra Nacimiento Mountains, on the west by the Chuska Mountains, and on the south by the Zuni Mountains. At the center of the trough-like basin, the sedimentary rocks are as thick as 14,000 ft. The beds dip from the margin of the basin toward the deepest portion of the basin. Outcrops of Jurassic and Cretaceous rocks rim the basin and are prevalent to the south and west. Faulting occurs in portions of the basin, with displacements up to thousands of feet (State of New Mexico 2003). Stone et al. (1983) describe the depositional sequence of the basin.

The mineral-rich environment of the San Juan basin was the primary factor in its selection as a site for the Gasbuggy test. Oil, gas, uranium, and coal have all been extracted from the basin. In areas where the energy resources are present, groundwater is saline.

Recent alluvium is restricted to valleys along the major stream and tributary channels. The San Jose Formation, a coarse-grained arkosic sandstone interbedded with mudstone, crops out throughout much of the central portion of the basin and is present near the Gasbuggy site. Its thickness ranges from 200 ft in the southwestern portion of the basin to 2700 ft near Gobernador, New Mexico, west of the Gasbuggy site.

Underlying the San Jose Formation is the Nacimiento (animas equivalent) Formation, both of which are typical continental floodplain deposits. The Nacimiento is interbedded black mudstone with white sandstone at the base, while sandstone and mudstone beds dominate the upper portion. The sandstone units are prevalent in forming the distinct slopes of this formation. At the Gasbuggy site, the formation is represented by a 3500 ft sequence of fine- to medium-grained, locally conglomeratic sandstone interbedded with claystone and sandy shale (Figure 3).



Source: Figure 2. Generalized cross section of the San Juan Basin. From Stone et al. (1983).

Radionuclide Migration at the Gasbuggy Underground Nuclear Test Site
Desert Research Institute
Nevada System of Higher Education
April 2014

U.S. DEPARTMENT OF ENERGY
OFFICE OF LEGACY MANAGEMENT

Work Performed by
RSI EnTech, LLC
Under DOE Contract 89303020DLM000001

Generalized Cross-Section of the San Juan Basin

DATE PREPARED: November 1, 2023

FILE NAME: S2202801

Figure 2. Generalized Geologic Cross Section of the San Juan Basin, New Mexico

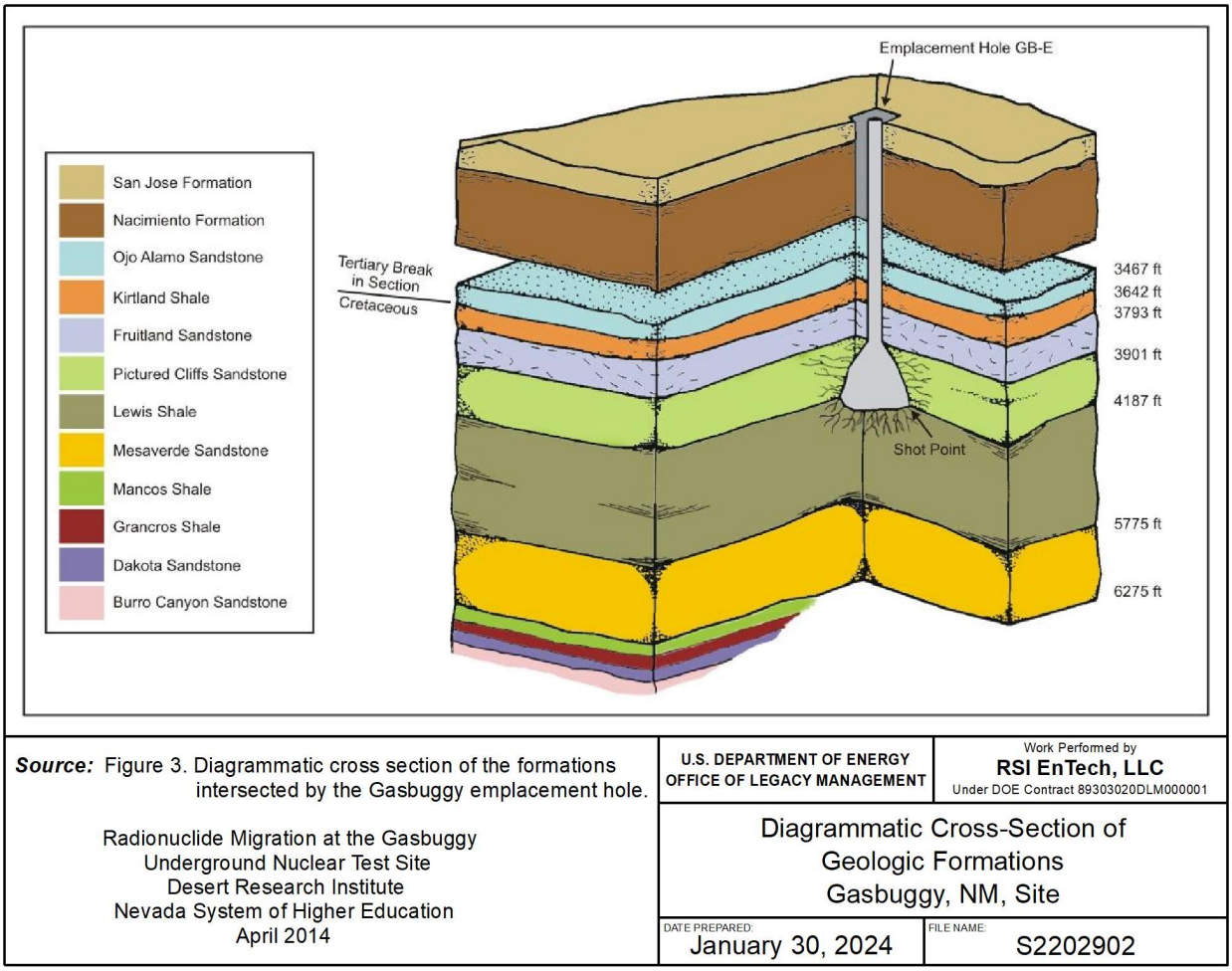


Figure 3. Diagrammatic Cross-Section of Geologic Formations Gasbuggy, New Mexico, Site

The Ojo Alamo Sandstone is composed of conglomeratic sandstones, sandstones, and shale common in basin sedimentary deposits. The conglomerate pebbles lie in thin, discontinuous stringers and in poorly sorted beds up to 10 ft thick in the northwestern portion of the area. At the Gasbuggy site, the formation is light gray medium- to fine-grained sandstone with minor shale interbeds and is 180 ft thick (Figure 3).

The Kirtland Shale overlies the Fruitland Formation and has been a significant petroleum play in the basin. Although the Kirtland Shale was originally described by Brown (1910) as part of the Ojo Alamo Sandstone, it is commonly lumped with the Fruitland Formation because of its similar hydrologic properties. The boundaries of these two formations are not clearly defined, and the descriptions are incomplete; however, investigators agree that the carbonaceous shale and the coal are within the Fruitland Formation. Both formations consist of fine-grained sands, sandy shale, shale, and clayey sandstone sequences. At the Gasbuggy site, these formations together are 260 ft thick and consist of gray to dark-green shale and siltstone interbedded with thin, very-fine-grained sandstone (Figure 3).

The Pictured Cliffs Sandstone is the latest marine sandstone represented in the basin. The unit was named for the pictographs on the cliff forming arkosic outcrops. Thickness ranges from 25 to 290 ft across the basin. Interbedded sandstone and mudstone mark the contact between the Pictured Cliffs and the Lewis Shale. The formation at the site is a light gray, very-fine-grained to fine-grained sandstone interbedded with dark sandy shale 290 ft thick. Gas production from the Pictured Cliffs is characterized by flow along natural joints, fractures, and bedding planes. Flow in the rock matrix is much slower than in the joints and fractures due to the low permeability of the rock matrix.

The Pictured Cliffs intertongues with the underlying Lewis Shale. The Lewis Shale is a gray to black shale interbedded with sandy limestone, sandstone, and bentonite.

1.4.1 Surface Water

The Continental Divide crosses the San Juan Basin and separates the Rio Grande and Colorado River drainages. The San Juan River flows into New Mexico from Colorado and exits New Mexico into Utah. Surface water near the Gasbuggy site flows toward the San Juan River. Spring water from the San Jose Formation crops out across the area. The Gasbuggy site has no naturally standing water, streams, springs, or seeps. A survey of state wetland inventories and the flood insurance map for Rio Arriba County did not indicate either wetland or floodplain areas at the Gasbuggy site (DOE 1993b). The closest perennial water source to the Gasbuggy site is La Jara Creek which is 2.3 miles north of the site (USFWS 2024). Section 3.2 details surface water monitoring at the Gasbuggy site.

1.4.2 Groundwater

Groundwater supply wells in the area access the shallow groundwater flow systems in the alluvium and underlying tertiary sandstones at depths between 54 and 229 ft (Mercer 1968). At greater depths the groundwater becomes more saline.

The New Mexico groundwater protection regulations specify that all groundwater in the state that has an existing total dissolved solids concentration less than 10,000 milligrams per liter (mg/L) must be protected for present or potential future use as domestic and agricultural water supplies (Benjamin and Belluck 1994). For reference, the U.S. Environmental Protection Agency (EPA) secondary drinking water standard for total dissolved solids is 500 mg/L. The San Jose, Nacimiento, and Ojo Alamo Formations (Figure 3) are aquifers containing groundwater that the state considers “acceptable and retrievable” (State of New Mexico 2003).

Deeper formations at the site (Fruitland and Kirtland Formations) are unsaturated and yield only minor amounts of water that is high in total dissolved solids and, in some areas of the basin, hydrocarbons (Mercer 1970). The Pictured Cliffs Sandstone is an unsaturated gas-bearing formation at the site that produces minor amounts of saline wastewater along with natural gas production.

2.0 Site Information

This section summarizes the underground nuclear testing (site operational history), decommissioning and environmental restoration activities, and long-term stewardship (ICs and land use) of the site. Table 1 provides a chronology of activities that are considered significant to the Gasbuggy site history.

Table 1. Site Chronology with Document References

Date	Description of Activity	Document Reference
1967	Initial drilling operations in preparation for the Project Gasbuggy experiment.	AEC 1971
1967	Detonation of the Project Gasbuggy underground explosive.	AEC 1971
1978	Well pugging and abandonment.	DOE 1983
1978	Decontamination, transport, and disposal of equipment.	DOE 1983
1978	Packaging, transport, and disposal of solid and liquid waste, including injection of liquid radioactive waste into the cavity formed by the nuclear explosion.	DOE 1983
1978	Land surface restoration.	DOE 1983
1978	Final status of sampling and analysis.	DOE 1983
2000 and 2002	Petroleum-contaminated material was identified and delineated during site-characterization activities.	DOE 2005
2004	Completion of corrective actions including excavation of mud pits, disposing of contaminated material, and backfilling excavated pits.	DOE 2005
2005	Surface Closure Report submitted to NMED.	DOE 2005

2.1 Underground Nuclear Testing (Site Operational History)

Project Gasbuggy was the first of three underground nuclear experiments that were conducted in the United States for the purpose of stimulating natural gas production within reservoirs having relatively low permeability. The two other sites, Project Rulison and Project Rio Blanco, are in Colorado. Prior to the Gasbuggy site being selected for an underground nuclear test, the El Paso Natural Gas Company (EPNG) produced natural gas from well EPNG 10-36 at the site. The well was drilled in 1956 and was in continuous production until 1966. In addition, well EPNG 10-36 was used for monitoring subsurface conditions during the test. Exploratory work to determine the suitability of the site for a nuclear test began in 1967. This included the installation of the exploratory wells GB-1 and GB-2 which provided data that led to the site being accepted for a nuclear test and the subsequent drilling of the GB-E emplacement borehole (AEC 1971). An additional well GB-D was installed to monitor ground motion during the test (Figure 4).

On December 10, 1967, a nuclear device was detonated in emplacement well GB-E at a depth of 4227 ft below ground surface. The device had a reported yield of 29 kilotons and was detonated in the upper part of the Lewis Shale, just below the overlying Pictured Cliffs Sandstone (Figure 3). The detonation produced extremely high temperatures that vaporized a volume of rock, creating a cavity surrounded by a fractured area extending outward from the detonation point. Shortly after the detonation, the overlying fractured rock collapsed into the void space, creating a rubble-filled collapse chimney that extends above the detonation point into the Pictured Cliffs Sandstone (Figure 3) (LRL 1968). As the former cavity cooled, the melted and

vaporized rock collected and solidified at the bottom of the former cavity (now the lower part of the collapse chimney). Most of the high-melting-point radionuclides were trapped in this solidified melt rock, which is often referred to as "melt glass" due to its glassy texture.

Post-detonation activities included reentry into several of the project wells throughout 1968. This included the emplacement well (GB-E) which was reentered and recompleted in the collapse chimney created by the detonation. The reentry well was renamed GB-ER and was used to produce natural gas from the former cavity and collapse chimney through a series of production tests that began in July 1968 and ended in October 1969 (AEC 1971). Well EPNG 10-36 was converted into a groundwater monitoring well in the Ojo Alamo Aquifer in 1968 (AEC 1971), and was purchased from EPNG by DOE in 1978. Well GB-2 was reentered after the detonation and renamed well GB-2RS (the "R" stands for "reentry") and well GB-3 was drilled to investigate impacts from the detonation on the geologic formations (Figure 4).

AEC decommissioned Project Gasbuggy in 1978. Structures and equipment used for the six production tests were decontaminated and removed, liquid radioactive waste was injected into the cavity formed by the nuclear explosion, and solid radioactive waste was disposed of at the Nevada National Security Site (formerly called the Nevada Test Site). All the Gasbuggy site wells were plugged and abandoned with the exception of well EPNG 10-36, which was left open as a monitoring location until it was plugged and abandoned in 2003. Soil sampling was done in 1978, 1986, 2000, and 2002. Cultural resource, endangered and sensitive species, floodplain, and wetlands surveys were done in 1993.

The EPA Radiation and Indoor Environments National Laboratory, through an interagency agreement with DOE, began a Long-Term Hydrologic Monitoring Program (also called the LTHMP) in 1972 (DOE 2009). The LTHMP monitoring network consisted of sampling surface water springs, steams and ponds, and water supply wells used to water livestock. In 2007, DOE assumed responsibility and continued the LTHMP. There have been no detonation-derived contaminants detected at any of the LTHMP sampling locations.

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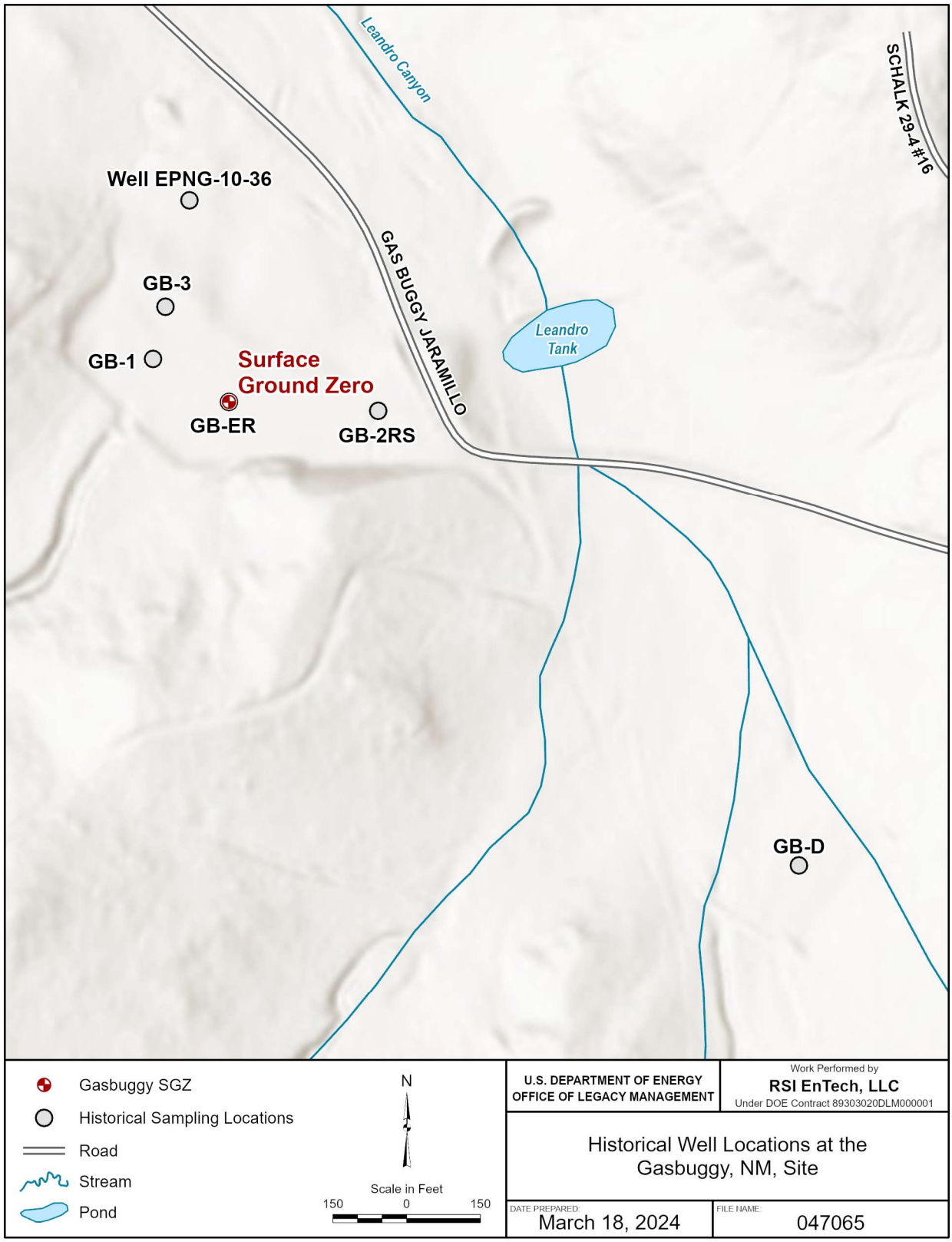


Abbreviation: SGZ = surface ground zero

Figure 4. Historical Well Locations at the Gasbuggy, New Mexico, Site

2.2 Site Decommissioning and Environmental Restoration Activities

Site-restoration activities were conducted over a 6-week period in August and September 1978. Restoration activities included the following: (1) well plugging and abandonment; (2) the decontamination, transport, and disposal of equipment; (3) the packaging, transport, and disposal of solid and liquid waste, including injection of liquid radioactive waste into the cavity formed by the nuclear explosion; (4) land surface restoration; and (5) final status sampling and analysis. None of the soil samples collected during the 1978 restoration activities exceeded established release criteria for radioactive contamination; therefore, no soil was remediated. No radioactive waste, other than the liquid waste injected into the former cavity and collapse chimney, was buried onsite (DOE 1983). Upon completion of restoration activities, soil samples were collected, and radiological surveys were completed for the emplacement well area. The area was then reshaped, graded, and seeded (DOE 1983). Remaining surface features include earthen berms, abandoned well markers, concrete pads, and a pipe stanchion.

Drilling operations conducted in preparation for the test in 1967 included the construction and use of multiple mud pits at the Gasbuggy site. The practice of mixing diesel fuel with the drilling fluids was common during that era and was implemented at several of the test wells, resulting in petroleum-contaminated mud in pits that were eventually buried in place. As a result, additional Gasbuggy site corrective actions focusing on soil contamination within the shallow subsurface—the unsaturated drilling mud and soil within 30 ft of the ground surface—were developed. Petroleum-contaminated material was identified and delineated during site-characterization activities in 2000 and 2002.

Recommendations based on the site-characterization activities included corrective action to achieve clean closure by removing petroleum-contaminated drilling mud and soil from the shallow subsurface. The OCD established a cleanup level for soils impacted by total petroleum hydrocarbons of 100 milligrams per kilogram (DOE 2004). The corrective actions included excavating mud pits, disposing of contaminated material, backfilling excavated pits, reseeding the disturbed areas, and completing an as-built site survey. These corrective actions were completed in 2004 (DOE 2005). The final surface remediation was completed in September 2004. The Surface Closure Report was submitted to the New Mexico Environment Department (NMED) in 2005 with the recommendation to release the surface for unrestricted use (DOE 2005).

2.3 Institutional Controls and Land Use

2.3.1 Institutional Controls

ICs for the Gasbuggy site are a combination of physical, informational, and administrative controls (Table 2). Informational controls are in place to help convey site history, restrictions, and cleanup to the public as well as other government agencies. The physical control is the Gasbuggy site monument (Figure 5). The administrative controls are a combination of federal ownership, land withdrawal, and a notice of restrictions regarding land use and subsurface penetration. Three administrative ICs are in place to control use of the Gasbuggy site:

- Public Land Order (PLO) 4232 (federal land withdrawal) (Appendix A).
- The 2021 Memorandum of Understanding (MOU) between BLM, USFS, and DOE (Appendix B).
- Project Gasbuggy Contract AT (04-3)-711 (Appendix C).

Table 2. Gasbuggy Site ICs

IC Type	Instrument/Mechanism	Restriction	Implementation
Physical	Emplacement well monument	Prohibits surface and subsurface excavation.	LTS&M Plan and LM public website
Informational	Fact Sheet/LM public website	Document the site restrictions and ICs.	LM public website
Administrative	PLO 4232 (federal land withdrawal) (Appendix A)	Allows the land to be utilized by other federal agencies as well as private interests.	*Federal Register* and PLO 4232, LTS&M Plan, and LM public website
	2021 MOU (Appendix B)	Defines the responsibilities between the USFS, BLM, and DOE for the Gasbuggy site.	MOU, LTS&M Plan, and LM public website
	Project Gasbuggy Contract AT (04-3)-711	Initial agreement that allowed research on the site.	LTS&M Plan and LM public website

The emplacement well monument at surface ground zero is the only physical IC at the Gasbuggy site. The emplacement well monument acts to prohibit surface and subsurface excavation at the surface ground zero location.

The inscription on the monument is as follows:

Project Gasbuggy

Nuclear Explosive Emplacement/Reentry Well (GB-ER)

Site of the first United States underground nuclear experiment for the stimulation of low productivity natural gas reservoir. A 29-kiloton nuclear explosive was detonated at a depth of 4,227 feet below this surface location on December 10, 1967.

No excavation, drilling, and/or removal of subsurface materials to a true vertical depth of 1,500 feet is permitted within a radius of 100 feet of this surface location, nor any similar excavation, drilling, and/or removal of subsurface materials between the true vertical depths of 1,500 feet and 4,500 feet is permitted within a 600 foot radius of this surface location in the SE quarter of the SW quarter of Section 36, T 29 N, R 4 W, New Mexico Principal Meridian, Rio Arriba County, New Mexico, without U.S. Government permission.

United States Department of Energy
November 1978

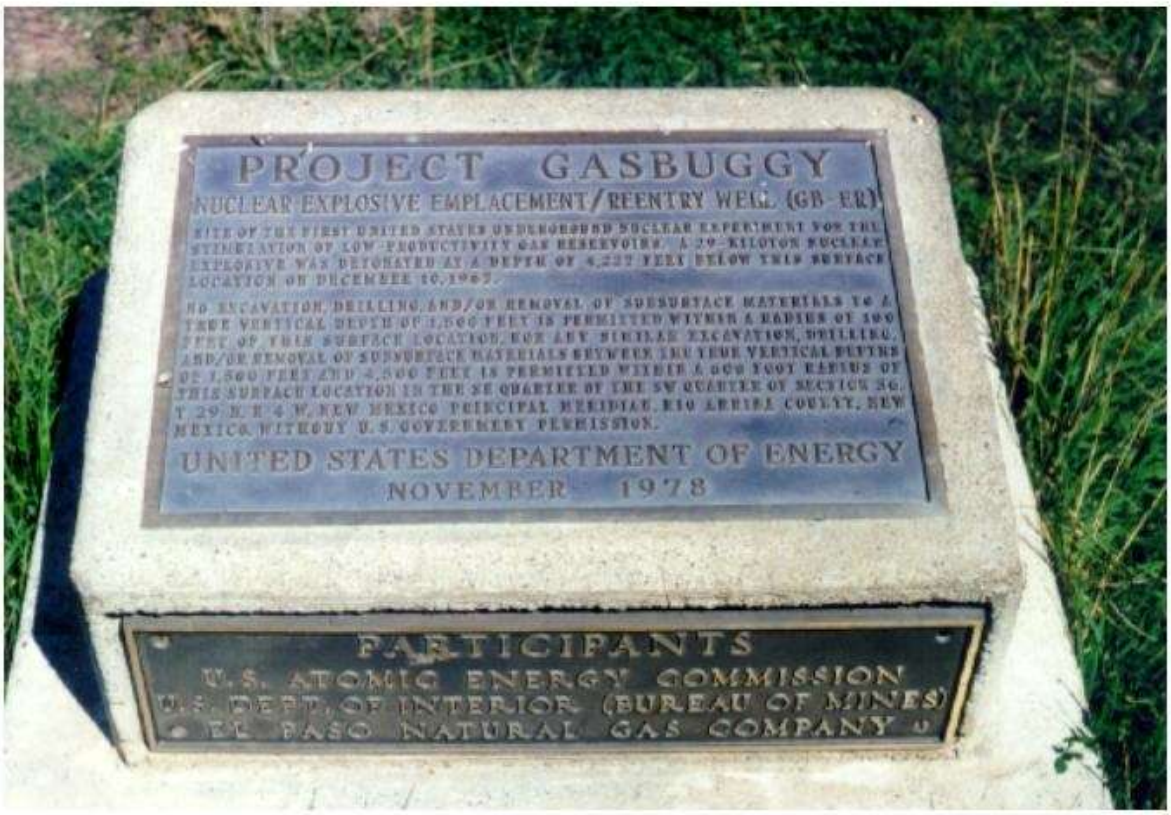


Figure 5. Project Gasbuggy Emplacement Well Monument

PLO 4232 (federal land withdrawal) (Appendix A) was instituted in 1967 by AEC, the predecessor to DOE. PLO 4232 withdrew lands associated with Project Gasbuggy. Allowing the land to be utilized by other federal agencies as well as private interests. Land utilization authorized by PLO 4232 is described in Section 2.3.2.

The 2021 MOU (Appendix B) defines the responsibilities between USFS, BLM, and DOE for the Gasbuggy site. The MOU is reviewed every 5 years to reevaluate responsibilities and agreements. The next MOU update will occur in 2024.

The specific actions that DOE shall do are:

- Provide notice to the BLM Farmington Field Office and USFS of the sampling schedule at least 1 month before the sampling event.
- Provide sample analysis results to the BLM Farmington Field Office and USFS.
- Be entirely responsible for the prevention and mitigation of radioactive contamination resulting from Project Gasbuggy wherever such contamination may occur on Carson National Forest.

- In cooperation with the BLM Farmington Field Office, USFS, and the affected oil and gas operator, develop mitigation measures in the event that sampling results identify possible health, safety, and welfare impacts directly resulting from Gasbuggy site activity. Mitigation measures will be determined on a site-specific, case-by-case basis.
- Respond within 30 days to any Notice of Staking and Application for Permit to Drill notifications provided by the BLM Farmington Field Office.

There are other general terms and conditions in the MOU that are agreed to by all parties and are explained in the MOU.

The initial agreement between EPNG and AEC, Project Gasbuggy Contract AT (04-3)-711 (Appendix C) allows government research at the site.

The contract states:

> *"The [El Paso Natural Gas] Company grants to the Government for the conduct of the research and development project the full use of all its operating rights, derived through oil and gas leases, easements, conveyances, contract, or any other source whatsoever, in and to all rights and interest from the surface of the earth to a depth of 500 ft. below the base of the Pictured Cliffs Formation as to the SW ¼ of S36, T29N, R4W, NMPM."*

2.3.2 Land Use

In March 1967, the AEC assistant general manager for operations requested that the U.S. Department of the Interior (DOI), through BLM, withdraw from all forms of appropriation under public land laws 640 acres of land in the Carson National Forest to conduct the Project Gasbuggy experiment (Figure 6). The request was granted on June 22, 1967, and published in Volume 32 *Federal Register* pages 9166–9167 (32 FR 9166–9167) on June 28, 1967. The withdrawal was granted under PLO 4232. Appendix A provides the *Federal Register* notice.

The land withdrawn was described as Township 29 North, Range 4 West, Section 36, New Mexico Principal Meridian (Figure 6). The PLO states that the land is withdrawn "subject to valid existing rights and the provisions of existing withdrawals." These withdrawals include "public land laws, including the mining laws (30 USC., Ch. 2), and the mineral leasing laws . . .". This withdrawal did not include oil and gas leasing rights, which BLM reserved for itself.

The withdrawal further states that the PLO will not alter the surface jurisdiction of the U.S. Department of Agriculture, as administered by USFS—specifically the Jicarilla Ranger District in Bloomfield, New Mexico. The PLO states that the MOU between AEC and the U.S. Department of Agriculture, signed on March 23, 1967, governs the terms and conditions of AEC's use of the USFS lands. The MOU between DOE, BLM, and USFS, is renewed every 5 years and it is included in Appendix B.

To conduct Project Gasbuggy, in 1967, AEC, DOI, and EPNG entered into a contract to share the responsibilities for conducting the test. In that contract, EPNG granted its operating rights and real property interests in the quarter section containing the emplacement well (southwest quarter, Section 36) to the federal government (Figure 6). In addition, the parties to

the contract recognized that contamination could exist after the detonation, and the contract gave the government perpetual and sole authority over EPNG's real property interests in the southwest quarter of Section 36, to provide control as necessary for safety considerations. The rights can only be terminated or relinquished by the U.S. government, in writing. The contract grants all rights for the quarter section to the U.S. government and, therefore, established enforceable ICs for that acreage. Appendix C summarizes AEC's rights under the contract.

At the time of the withdrawal, no attempt was made to obtain the remaining subsurface mineral and oil and gas rights, or to terminate the leases associated with the north half or the southeast quarter of the withdrawn Section 36. Therefore, all existing leases valid at the time of the withdrawal are still in effect, and lessees may exercise the rights the leases provide. The monument emplaced at the site states the current subsurface restrictions as described in Section 2.3.1.

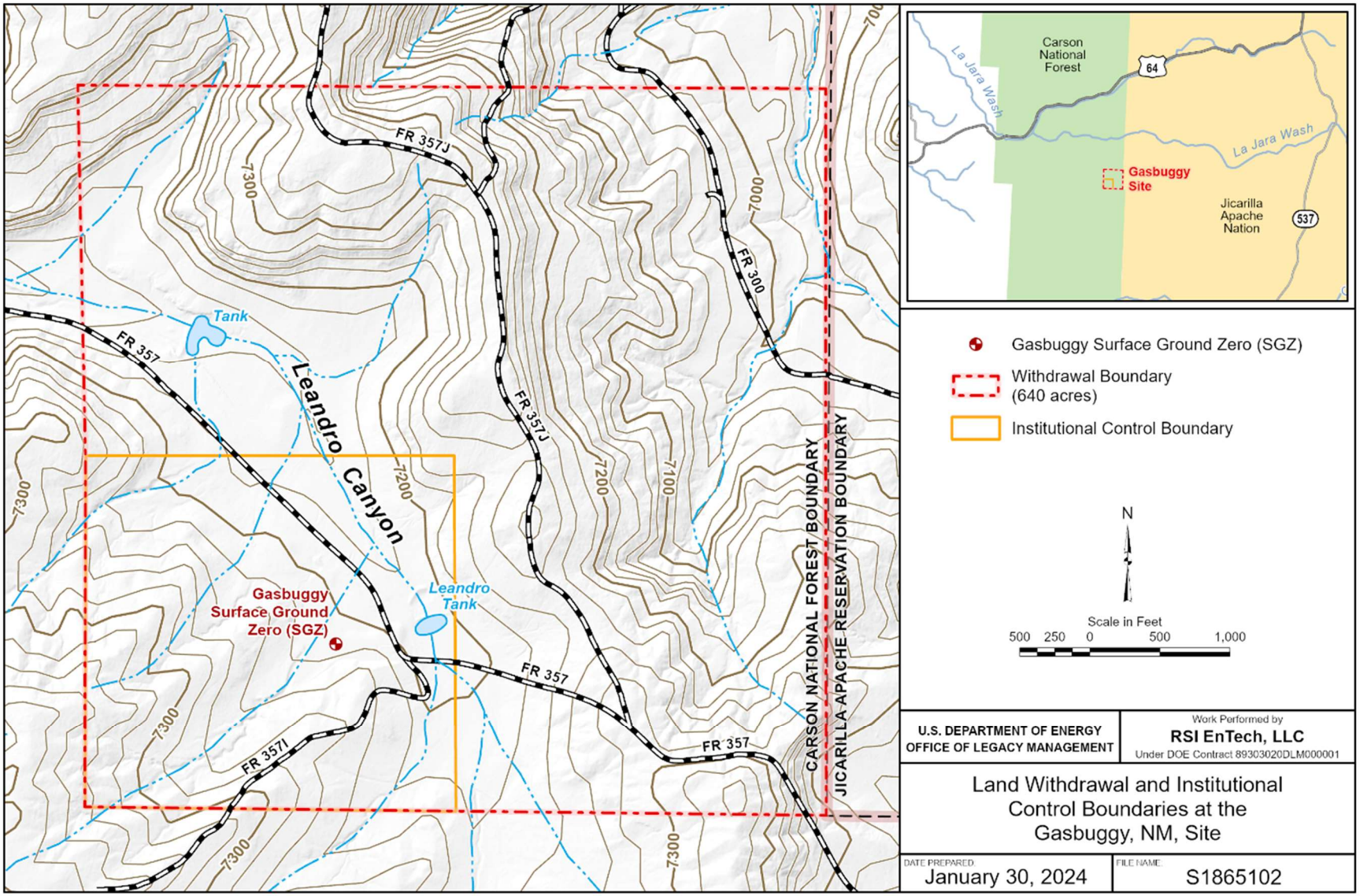


Figure 6. Land Withdrawal and IC Boundaries at the Gasbuggy, New Mexico, Site

3.0 Surveillance and Maintenance Plan

The LTS&M Plan is designed to ensure protection of human health and the environment. It includes the plan for monitoring natural gas and produced water (radioisotope), inspecting the site and maintaining the ICs, evaluating reporting data, and documenting the records and data management processes for the site. Table 3 specifically describes the LTS&M actions implemented for the Gasbuggy site. This LTS&M Plan will be reviewed if site conditions change, and it will be revised if new data become available that change the understanding of site conditions.

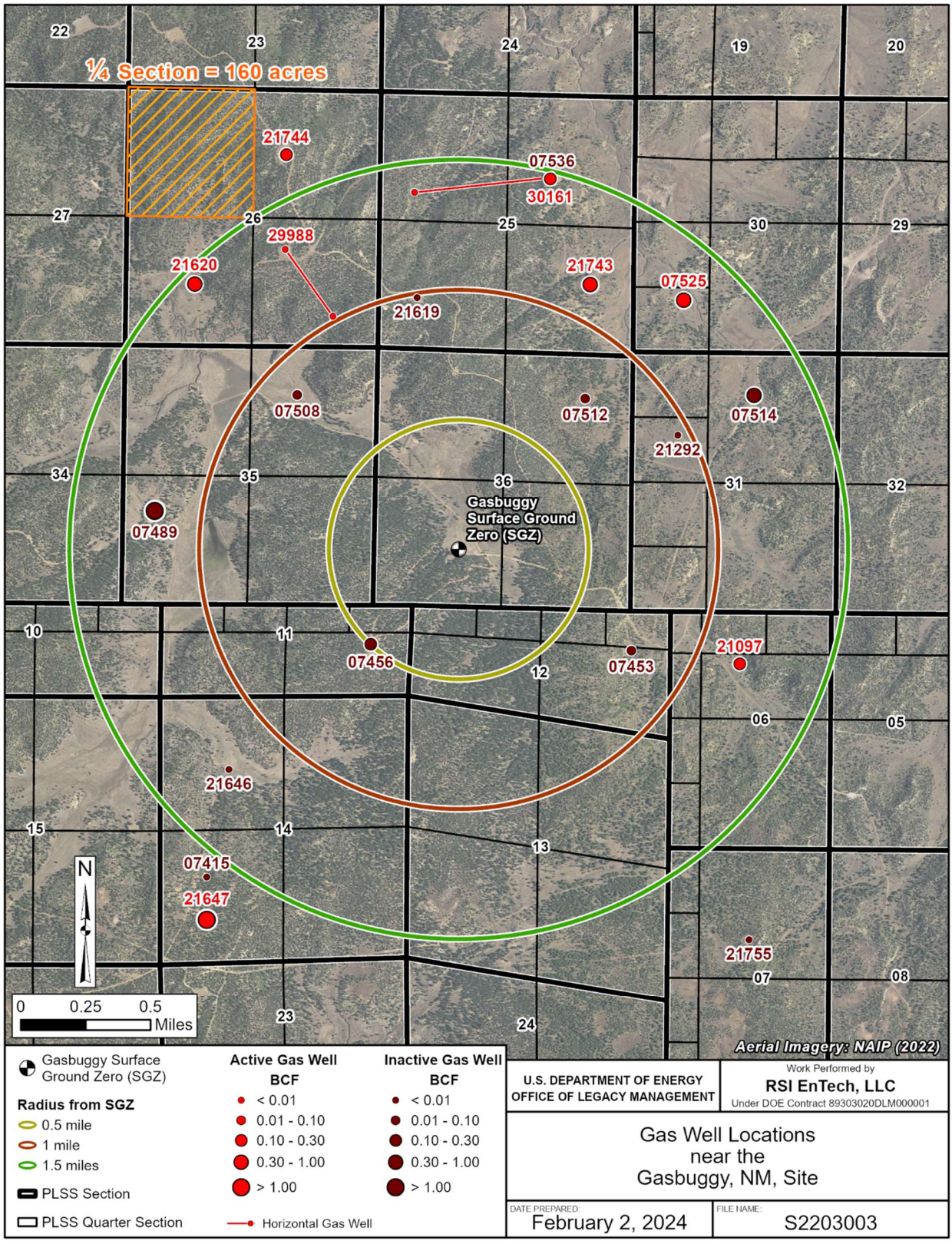
Table 3. Gasbuggy LTS&M Obligations

	Activity
1.	**Gas Well Sampling:** Samples produced water from wells 30-039-07525, 30-039-21620, and 30-039-21647 every 5 years, and those from any new gas wells drilled within a 1.5-mile radius. Sampling frequency will vary depending on the produced gas rate.
2.	**Site Inspections:** Conducted contemporaneously with each sampling event.
3.	**Other Obligations:** Comply with obligations listed in the 2021 MOU between DOE, BLM, and USFS (see Appendix B).

3.1 Natural Gas and Produced Water Sampling

Natural gas and the associated produced water have been sampled from seven privately owned gas wells (21647, 21620, 21743, 07525, 21744, 30161, and 29988) completed in the Pictured Cliffs Formation (Figure 7). Sampling was conducted annually from 2009 to 2014. Natural gas samples were analyzed for tritium and carbon-14; produced water from the gas bearing zone was sampled for tritium, gross alpha and beta, and gamma spectroscopy. Because there have been no detonation-related contaminants detected in any previously collected sample, DOE conducted an evaluation of the gas well sampling strategy and presented that evaluation in *Sampling Recommendations for Gas Wells near the Gasbuggy, New Mexico, Site* (DOE 2015). This evaluation concluded that the annual sampling frequency of the seven wells should be revised based on proximity and the amount of the cumulative gas produced over time.

Based on the evaluation (well proximity and gas production rate), it was decided that DOE will sample three privately owned wells on USFS land (Table 4; Figure 8) near the Gasbuggy site every 5 years and reduce the analytes to tritium only. The three wells (07525, 21620, and 21647) were part of the original seven wells sampled from 2009 to 2014. Confirmation sampling is justified to ensure that groundwater remains unaffected by detonation-related contaminants. The wells are privately owned and operated by Logos Operating, LLC; Schalk Development Co.; and Hillcorp Energy Company. These entities are notified before sampling activities occur.



Abbreviations: BCF = billion cubic feet, PLSS = Public Land Survey System

Figure 7. Natural Gas Wells near the Gasbuggy, New Mexico, Site

Table 4. Sampling Locations and Analytes

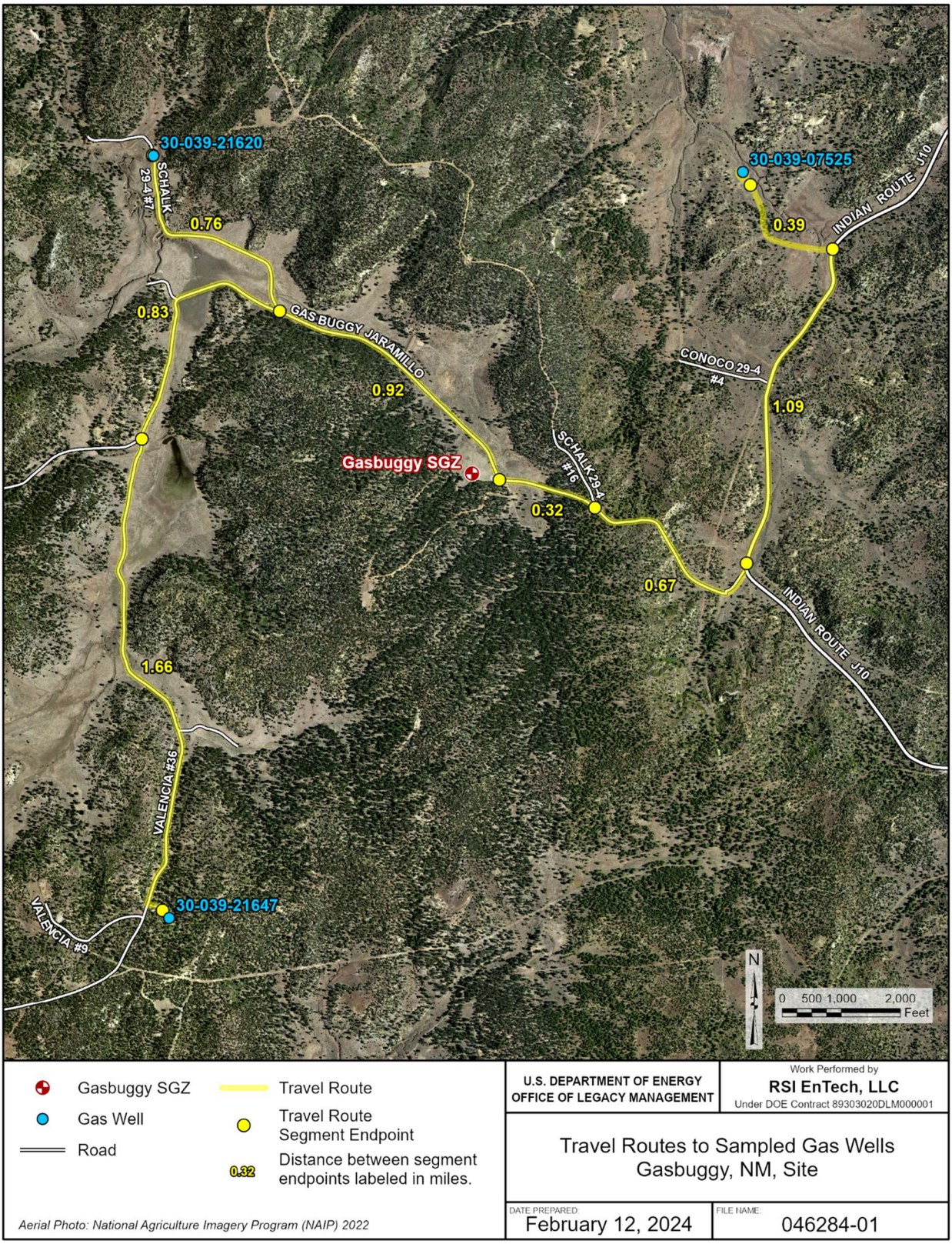
Well Identification	Well Operator	Latitude	Longitude	Coordinate System	Analytes
Indian A No. 2 (API 30-039-07525)	Logos Operating	−107.19353184	36.69204000	GCS_NAD_1983	Tritium
Schalk 29-4 No. 7 (API 30-039-21620)	Schalk Development	−107.22755980	36.69253221	GCS_NAD_1983	Tritium
Valencia Canyon No. 37 (API 30-039-21647)	Hillcorp Energy	−107.22620957	36.65708061	GCS_NAD_1983	Tritium

Abbreviations: GCS = Geographic Coordinate System, NAD 1983 = North American Datum of 1983

Any new wells drilled nearer to the site will be included in the monitoring network. There are currently no active gas wells within the 0.5-mile radius of the site (Figure 7). Note: Well 07456 is inactive. Any future permits to drill wells in this area will require a hearing with New Mexico OCD and must be approved prior to installation. Any changes or enhancements to the sampling strategy for wells within a 0.5-mile radius of the site will be communicated during the permit approval process.

During the sampling event, DOE utilizes trained and qualified personnel who follow established procedures. Water quality data are collected in accordance with procedures specified in the *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (LMS/PRO/S04351), which adheres to EPA and ASTM International standards. The Sampling and Analysis Plan specifies procedures for data validation and requirements for sample collection, quality control samples, analytical methods and reporting limits, and field instrument calibration. Long-term stewardship of the site and all activities related to the annual surveillance, monitoring, and maintenance of the site comply with DOE Order 414.1D Chg 1 (Admin Chg), *Quality Assurance*; applicable requirements of Title 10 *Code of Federal Regulations* Part 830 Subpart A, "Quality Assurance Requirements" (10 CFR 830); and American National Standards Institute/American Society for Quality (ANSI/ASQ) E4-2004, *Quality Systems for Environmental Data and Technology Programs: Requirements with Guidance for Use*.

If samples cannot be collected from one or more of the wells due to lack of produced water, DOE will monitor production data to determine when to revisit the site to collect produced water samples. It may also be possible to collect natural gas from the wells instead of produced water. Resampling is based on scheduling availability and budget constraints. If tritium is detected at a sampling location (>400 picocuries per liter [pCi/L]), DOE will contact the laboratory and request that the sample be reanalyzed to verify the result. If sample results exceed the screening levels (Table 5) DOE will resample the location to verify the results. If the results above screening levels are verified, DOE will notify BLM and USFS and provide a path forward.



Abbreviation: SGZ = surface ground zero

Figure 8. Gasbuggy Gas Well Sample Locations

3.2 Surface Water Sampling

DOE initiated the sampling of surface water near the Gasbuggy site in 1972, which the EPA implemented as part of the LTHMP. DOE assumed responsibility for the annual sampling in 2008 and continued the sampling until 2014. This program was initiated to annually check for detonation-related contaminants in wells and surface water locations that are relatively near the Gasbuggy site. Results of this sampling program have demonstrated that detonation-related contaminants have not been detected at any sampled location.

Because detonation-related contaminants had not been detected, DOE decided to revisit the historical monitoring program to assess its effectiveness regarding contaminant detection. This evaluation considered feasible pathways for contaminant migration from the detonation site to the surrounding environment. Results of this evaluation have shown that the historical sampling locations are not likely contaminant migration pathways. Therefore, DOE has decided to suspend all sampling of historic surface water locations.

There are no current or future plans to collect surface water samples from the Gasbuggy site or surrounding areas. Because remediation of the surface has been completed there are no pathways for radionuclides to be transported to surface water locations.

3.3 Laboratory Analyses and Methods of Quality Assurance

The analytical laboratory will use accepted procedures that are based on the specified methods to analyze the samples (produced water and natural gas) for the radioisotope of interest (tritium) (Table 5). Samples will be analyzed in accordance with accepted procedures that are based on the specified method. The required minimum detectable concentrations for the radioisotopes being monitored is provided in Table 5.

Table 5. Gasbuggy Radioisotope of Interest with Laboratory Detection Levels

Radioisotope of Interest	Sample Matrix	Measurement Method	Laboratory MDC (pCi/L)	Screening Level (pCi/L)
Tritium	Natural gas	Lab specific	32	320
	Produced water	Liquid scintillation counting (LSC)	400	1000

Commercial laboratories provide analytical services in accordance with the *Department of Defense (DoD) Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories* (DOD and DOE 2021) to ensure that data are of known, documented quality. The QSM provides specific technical requirements, clarifies DOE. requirements, and conforms to DOE Order 414.1D Chg 1 (Admin Chg), *Quality Assurance*. The QSM is based on Volume 1 of The NELAC [National Environmental Laboratory Accreditation Conference] Institute (TNI) standards (September 2009), which incorporates International Organization for Standardization/International Electrotechnical Commission (ISO/IEC) 17025:2005(E), *General Requirements for the Competence of Testing and Calibration Laboratories*. The QSM provides a framework for performing, controlling, documenting, and reporting laboratory analyses. Analytical data will be validated according to *Environmental Data*

Validation Procedure (LMS/POL/S15870), which adheres to EPA and ASTM International standards. The validation results for the sampling events will be summarized in a Data Validation Package and made available to the public as specified in Section 3.3.

3.3.1 Waste Management and Disposal

Wastewater is not generated during the sampling of natural gas wells. It is not expected that investigation-derived waste will be generated during these sampling activities.

3.4 Site Inspection and Maintenance of Institutional Controls

Site inspection and maintenance of ICs are part of the LTS&M Plan for the site. A site inspection will be performed every 5 years in conjunction with the natural gas and produced water sampling event. The goal of inspection is to verify that the ICs have not been violated and to determine whether maintenance or additional inspections are needed to protect human health and the environment. Because DOE does not own the surface rights at the Gasbuggy site, the inspection is limited to verifying that the emplacement well monument is in acceptable condition and that the administrative ICs intended to prevent subsurface access continue to function. DOE will maintain the emplacement monument (Figure 5) as needed. In addition to the well monument inspectors will also look for evidence of unauthorized subsurface intrusion and determine whether site controls are adequate. Land use patterns and changes near the site should be noted as a predictor of future changes and intrusion potential. Significant changes within these areas could include erosion and natural resource development (e.g., drilling).

Routine site inspections provide a measure of oversight for the effectiveness of ICs and site protectiveness. The following activities will be completed before these inspections or at the frequency specified here:

- Contact the New Mexico OCD or access its website (https://wwwapps.emnrd.nm.gov/ocd/ocdpermitting/Data/Wells.aspx) annually to determine whether any new oil and gas wells have been permitted in the nine sections surrounding and including the site (Figure 9, Area of Review). The area surrounding the site has existing oil and gas leases with several oil and gas wells currently operating in the sections surrounding the site (Figure 7).
- Review and evaluate U.S. Geological Survey (USGS) notifications for any seismic events near the Gasbuggy site. The USGS Earthquake Hazards Program provides the notifications via email, and the Legacy Management Support contractor will review these as they are received to determine any potential impact to the site.
- Notify BLM and USFS of any planned field activities.
- Review and maintain public information associated with the Gasbuggy site on the LM public website annually (Section 3.2).

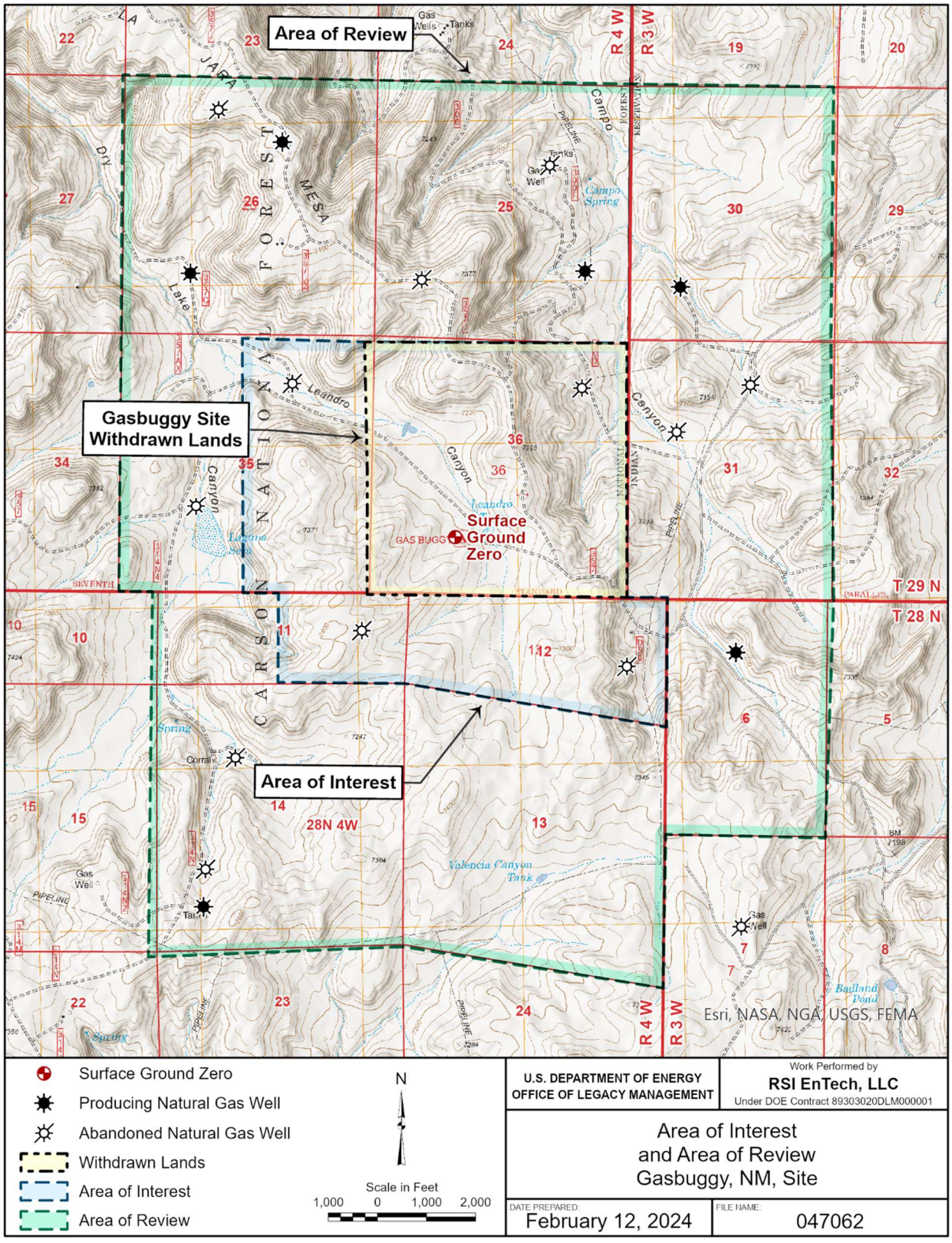


Figure 9. Gasbuggy Site Area of Interest and Area of Review

3.5 Data Evaluation and Reporting

Results of site inspections and monitoring will be reported in the Groundwater Monitoring and Inspection Report. The report will address inspection observations, maintenance, and monitoring results since the previous report. The final report will be posted on the LM public webpage for the Gasbuggy site at https://www.energy.gov/lm/gasbuggy-new-mexico-site, and electronic copies will be provided to the Jicarilla Apache Nation, USFS, BLM, NMED, New Mexico OCD, and gas producers whose gas wells were sampled as part of the Gasbuggy environmental monitoring program.

3.6 Records and Data Management

LM maintains records that support long-term stewardship of the Gasbuggy site at the LM Field Support Center at Grand Junction, Colorado, and at the LM Business Center at Morgantown, West Virginia. All LM records will be managed in accordance with the following requirements:

- 44 USC 29. "Records Management by the Archivist of the United States," *United States Code*, https://www.archives.gov/about/laws/records-management.html.
- 44 USC 31. "Records Management by Federal Agencies," *United States Code*, https://www.archives.gov/about/laws/fed-agencies.html.
- 44 USC 33. "Disposal of Records," *United States Code*, http://www.archives.gov/about/laws/disposal-of-records.html.
- 36 CFR 1220–1239 Chapter 12 Subchapter B. "Records Management," *Code of Federal Regulations*, https://www.gpo.gov/fdsys/granule/CFR-2011-title36-vol3/CFR-2011-title36-vol3-chapXII-subchapB.
- DOE Order 243.1 Chg 1 (Admin Chg), *Records Management Program*, U.S. Department of Energy, archived February 7, 2022.
- Internal LM Records Management Program procedures and guidelines.

4.0 References

10 CFR 830 Subpart A. "Quality Assurance Requirements," *Code of Federal Regulations*.

36 CFR 1220–1239 Chapter 12, Subchapter B. National Archives and Records Administration, "Records Management," *Code of Federal Regulations*.

32 FR 9166–9167. "New Mexico: Withdrawal for Underground Atomic Energy Experiment," *Federal Register*, June 28, 1967.

30 USC 2. Mineral Lands and Regulations in General," *United States Code*.

42 USC 2011 et seq. "Atomic Energy Act," *United States Code*.

44 USC 29. "Records Management by the Archivist of the United States," *United States Code.*

44 USC 31. "Records Management by Federal Agencies," *United States Code.*

44 USC 33. "Disposal of Records," *United States Code.*

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Appendix A

Gasbuggy Site Withdrawal Public Land Order

034574
Book 5
Folder 6

DEPT. OF THE INTERIOR
BUR. OF LAND MGMT
JUN 27 4 35 PM '67
STATE OFFICE
SANTA FE, N. MEX.

UNITED STATES
DEPARTMENT OF THE INTERIOR

CODE OF FEDERAL REGULATIONS
TITLE 43--PUBLIC LANDS: INTERIOR

CHAPTER II--BUREAU OF LAND MANAGEMENT
APPENDIX--PUBLIC LAND ORDERS

PUBLIC LAND ORDER 4232

(New Mexico 1399)

NEW MEXICO

WITHDRAWAL FOR UNDERGROUND ATOMIC ENERGY EXPERIMENT

By virtue of the authority vested in the President and pursuant to Executive Order No. 10355 of May 26, 1952 (17 F.R. 4831), it is ordered as follows:

1. Subject to valid existing rights and the provisions of existing withdrawals, the following described lands, which are under the jurisdiction of the Secretary of Agriculture, are hereby withdrawn from all forms of appropriation under the public land laws, including the mining laws (30 U.S.C., Ch. 2), and the mineral leasing laws, and reserved for use of the Atomic Energy Commission for experimental purposes (Project Gasbuggy):

New Mexico Principal Meridian

Carson National Forest

T. 29 N., R. 4 W.,
sec. 36.

The area described contains 640 acres in Rio Arriba County.

2. The withdrawal made by this order does not alter the applicability of those public land laws governing the use of the national forest lands under lease, license, or permit, or governing

Land Office, Santa Fe, New Mexico

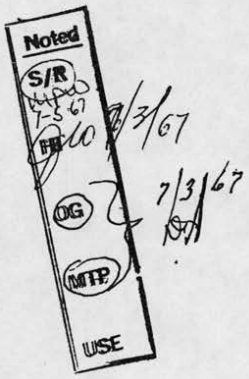
the disposal of their mineral or vegetative resources other than under the mining and mineral leasing laws. However, leases, licenses or permits will be issued only if the Atomic Energy Commission finds that the proposed use of the lands will not interfere with the proper conduct of its experiments.

3. The withdrawal made by this order does not alter the jurisdiction of the Secretary of Agriculture over the national forest lands for purposes other than for Project Gasbuggy. The terms and conditions for utilization of the national forest lands by the Atomic Energy Commission will be governed by the Memorandum of Understanding of March 23, 1967, between the Department of Agriculture and the Atomic Energy Commission, as may be amended and supplemented.

(Sgd.) Harry R. Anderson

JUN 22 1967

Assistant Secretary of the Interior



[Public Land Order 4232]

[New Mexico 1999]

NEW MEXICO

Withdrawal for Underground Atomic Energy Experiment

By virtue of the authority vested in the President and pursuant to Executive Order No. 10355 of May 26, 1952 (17 F.R. 4831), it is ordered as follows:

1. Subject to valid existing rights and the provisions of existing withdrawals, the following described lands, which are under the jurisdiction of the Secretary of Agriculture, are hereby withdrawn from all forms of appropriation under the public land laws, including the mining laws (30 U.S.C., Ch. 2), and the mineral leasing laws, and reserved for use of the Atomic Energy Commission for experimental purposes (Project Gasbuggy):

NEW MEXICO PRINCIPAL MERIDIAN

CARSON NATIONAL FOREST

T. 29 N., R. 4 W.,
Sec. 36.

The area described contains 640 acres in Rio Arriba County.

2. The withdrawal made by this order does not alter the applicability of those public land laws governing the use of the national forest lands under lease, license, or permit, or governing the disposal of their mineral or vegetative resources other than under the mining and mineral leasing laws. However, leases, licenses or permits will be issued only if the Atomic Energy Commission finds that the proposed use of the lands will not interfere with the proper conduct of its experiments.

3. The withdrawal made by this order does not alter the jurisdiction of the Secretary of Agriculture over the national forest lands for purposes other than for Project Gasbuggy. The terms and conditions for utilization of the national forest lands by the Atomic Energy Commission will be governed by the Memorandum of Understanding of March 23, 1967, between the Department of Agriculture and the Atomic Energy Commission, as may be amended and supplemented.

HARRY R. ANDERSON,
Assistant Secretary of the Interior.

JUNE 22, 1967.

[F.R. Doc. 67-7254; Filed, June 27, 1967, 8:45 a.m.]

Commission, as may be amended and supplemented.

HARRY R. ANDERSON,
Assistant Secretary of the Interior.

JUNE 22, 1967.

[F.R. Doc. 67-7254; Filed, June 27, 1967; 8:45 a.m.]

[Public Land Order 4233]

[Oregon 956]

OREGON

Partial Revocation of Stock Driveway Withdrawal

By virtue of the authority contained in section 10 of the act of December 29, 1916 (39 Stat. 865; 43 U.S.C. 300), as amended, it is ordered as follows:

1. Public Land Order No. 1967 of September 1, 1959, withdrawing lands for stock driveway purposes, is hereby revoked so far as it affects the following described lands:

WILLAMETTE MERIDIAN

T. 33 S., R. 18 E.,
Sec. 7, S½SW¼NE¼, S½SE¼NW¼, NE¼SW¼, and NW¼SE¼.

The areas described aggregate approximately 120 acres in Lake County.

The lands are located about 5 miles northwest of the town of Paisley. Topography is moderate north slopes. Soils are silty loam with a mixture of rock and gravel. Vegetative cover consists of big sage, bluebunch wheatgrass, Sandberg's bluegrass, and other native shrubs, forbs, and grasses.

2. At 10 a.m. on July 28, 1967, the lands shall be open to operation of the public land laws generally, subject to valid existing rights, the provisions of existing withdrawals, and the requirements of applicable law. All valid applications received at or prior to 10 a.m. on July 28, 1967, shall be considered as simultaneously filed at that time. Those received thereafter shall be considered in the order of filing.

The lands have been open to applications and offers under the mineral leasing laws, and to location under the United States mining laws, subject to the regulations in 43 CFR 3400.3.

The State of Oregon has waived the preference right of application granted to certain States by R.S. 2276, as amended (43 U.S.C. 852).

Inquiries concerning the lands should be addressed to the Manager, Land Office, Bureau of Land Management, Portland, Oregon.

HARRY R. ANDERSON,
Assistant Secretary of the Interior.

JUNE 22, 1967.

[F.R. Doc. 67-7255; Filed, June 27, 1967; 8:46 a.m.]

[Public Land Order 4234]

[Fairbanks 035286]

ALASKA

Withdrawal for Administrative Site

By virtue of the authority vested in the President and pursuant to Executive Order No. 10355 of May 26, 1952 (17 F.R. 4831), it is ordered as follows:

1. Subject to valid existing rights, the following described lands are hereby withdrawn from all forms of appropriation under the public land laws, including the mining laws (30 U.S.C., Ch. 2), but not from leasing under the mineral leasing laws, and reserved for the General Services Administration as an administrative site:

TRACT 1

U.S. Survey No. 4404, containing 38.20 acres.

TRACT 2

A strip of land extending 250 feet on each side of the centerline of the Alaska Highway from U.S. Survey No. 4404 southeasterly to the United States-Canada international line. Containing 17.20 acres.

The areas described aggregate 55.40 acres.

2. Public Land Order No. 386 of July 31, 1947, is hereby revoked so far as it affects the above described lands.

3. The withdrawal made by this order does not alter the applicability of the public land laws governing the use of the public lands under lease, license or permit, or governing the disposal of their mineral or vegetative resources other than under the mining laws.

HARRY R. ANDERSON,
Assistant Secretary of the Interior.

JUNE 22, 1967.

[F.R. Doc. 67-7256; Filed, June 27, 1967; 8:46 a.m.]

[Public Land Order 4235]

[Montana 499]

MONTANA

Partial Revocation of National Forest Administrative Site Withdrawal

By virtue of the authority vested in the President and pursuant to Executive Order No. 10355 of May 26, 1952 (17 F.R. 4831), it is ordered as follows:

1. The departmental order of February 17, 1908, withdrawing national forest lands as an administrative site, is hereby revoked so far as it affects the following described lands:

KOOTENAI NATIONAL FOREST

PRINCIPAL MERIDIAN

Fortine Creek Administrative Site

T. 34 N., R. 25 W.,
Sec. 19, SE¼SE¼SW¼;
Sec. 30, NW¼NW¼NE¼ and NE¼NE¼NW¼.

The areas described aggregate 30 acres in Lincoln County.

2. At 10 a.m. on July 28, 1967, the lands shall be open to such forms of disposition as may by law be made of national forest lands.

HARRY R. ANDERSON,
Assistant Secretary of the Interior.

JUNE 22, 1967.

[F.R. Doc. 67-7257; Filed, June 27, 1967; 8:46 a.m.]

Title 45—PUBLIC WELFARE

Subtitle A—Department of Health, Education, and Welfare, General Administration

PART 14—MINIMUM STANDARDS OF OPERATION FOR STATE AGENCIES FOR SURPLUS PROPERTY

Part 14 of Title 45 CFR is hereby amended to read as follows:

Sec.
14.1 Definitions.
14.2 Basic policy.
14.3 Geographic scope.
14.4 Organization.
14.5 Plan of Operation.
14.6 Books and records.
14.7 Service charges and funds.
14.8 Audits.
14.9 Handling of property.
14.10 Eligibility.
14.11 Utilization and compliance responsibility.
14.12 Assistance to the Department.
14.13 Nonconformance.
14.14 Amendments.

AUTHORITY: The provisions of this Part 14 issued under sec. 203, 63 Stat. 385; sec. 4, 64 Stat. 579; 69 Stat. 53; 70 Stat. 493; 40 U.S.C. 484(j); 44 CFR 55.35.

§ 14.1 Definitions.

(a) "Accountability" means the obligation imposed by law or lawful order of regulation on a State agency or individual(s) for keeping accurate records of property and/or funds. The person having this obligation may or may not have actual possession of the property or funds. Accountability is concerned primarily with records, while responsibility is concerned primarily with custody, care, and safekeeping.

(b) "Act" means the Federal Property and Administrative Services Act of 1949, Public Law 152, 81st Congress (63 Stat. 377), as amended (40 U.S.C. 471 et. seq.). Terms defined in the Act and not defined in this section shall have in this part the meaning given to them in the Act.

(c) "Department" means the Department of Health, Education, and Welfare.

(d) "Donable property" means surplus equipment, materials, books, or other supplies under the control of any executive agency (including surplus property in working capital funds established pursuant to 10 U.S.C. 2208 or in similar management-type funds) except:

(1) Such property as may be specified from time to time by the Administrator of General Services;

(2) Surplus agricultural commodities, food, and cotton or woolen goods determined from time to time by the Secretary of Agriculture to be commodities requiring special handling in order to assist him in carrying out his responsibilities with respect to price support or stabilization;

(3) Property in trust funds.

(e) "Need" means a requirement for anything usable and necessary by eligible applicants in the conduct of educational, public health, or civil defense activities.

Appendix B

Gasbuggy Site 2021 Memorandum of Understanding

FS Agreement No. 21-MU-11030200-022

Cooperator Agreement No. _____

MEMORANDUM OF UNDERSTANDING
Between The
U.S. DEPARTMENT OF ENERGY
OFFICE OF LEGACY MANAGEMENT
And The
USDI, BUREAU OF LAND MANAGEMENT
FARMINGTON FIELD OFFICE
And The
USDA, FOREST SERVICE
CARSON NATIONAL FOREST

This MEMORANDUM OF UNDERSTANDING (MOU) is hereby made and entered into by and between the U.S. Department of Energy, Office of Legacy Management, hereinafter referred to as "DOE" and the U.S. Department of the Interior (USDI), Bureau of Land Management, Farmington Field Office, hereinafter referred to as "BLM," and the United States Department of Agriculture (USDA), Forest Service, Carson National Forest, hereinafter referred to as the "U.S. Forest Service."

Background:

Property Description:
The Gasbuggy Site is in northwestern New Mexico in Rio Arriba County, approximately 55 miles east of the city of Farmington, New Mexico, and approximately 12 miles southwest of Dulce, New Mexico, in the Carson National Forest. The Gasbuggy Site consists of 640 acres withdrawn under Public Land Order (PLO) 4232 (Sec. 36, T. 29N, R. 4W, NMPM). On December 10, 1967, the U.S. Atomic Energy Commission (AEC), a predecessor agency of DOE, detonated a 29-kiloton-yield nuclear device 4,227 feet below ground surface. The detonation was known as Project Gasbuggy. Project Gasbuggy was the first natural gas reservoir stimulation project in the Plowshare Program.

Current Site Status:
It is understood that the withdrawal of the Gasbuggy Site, as stated in PLO 4232, remains in force because monitoring and use restrictions are still required on the withdrawn property. The withdrawal notice states that the PLO will not alter the surface jurisdiction of the Secretary of Agriculture, as administered by the Forest Service. PLO 4232 states that the terms and conditions of AEC's use of the Forest Service lands will be governed by the Memorandum of Understanding between AEC and USDA. PLO 4232 further states that the withdrawn lands are subject to valid existing rights. BLM retains oil and gas administration responsibilities for any preexisting oil and gas leases.

Institutional Controls:
DOE, through AEC, via contract AT (04-3) -711, has been granted control of oil and gas leases, easements, conveyances, contract, or any other source whatsoever, in and to all rights and interest from the surface of the earth to a depth of 500 feet below the base of the Pictured Cliffs Formation as to the SW 1/4 of Section 36, T. 29N., R 4W, NMPM.

In addition to the institutional control provided by the land withdrawal specified in PLO 4232, DOE requires notification from BLM of any Notices of Staking (NOSs) and Applications for Permit to Drill (APDs) for oil and gas. DOE will contact the appropriate surface management agency for the status of any proposed water wells annually. The lands subject to these conditions are defined as the "area of review" and are described as follows: Sections 25, 26, 35, and 36, T. 29N., R. 4W.; Sections 30 and 31, T.29N., R.3W.; Sections 11, 12, 13, and 14,
T. 28N., R4W.; and Section 6, T., 28N., R. 3W., all in Rio Arriba County, New Mexico, NMPM.

A subset of lands within the area of review is defined as the "area of interest." Under the National Environmental Policy Act (NEPA), the area of interest may require further environmental analysis prior to gas well drilling. The area of interest is shown on the attached map (Attachment A) and is described as follows:

Section 36 and the east 1/2 of Section 35, T. 29N, R. 4W; and Section 12 and the east 1/2 of Section 11, T. 28N, R. 4W, all in Rio Arriba County, New Mexico, NMPM.

Access for Monitoring:
DOE requires access to Carson National Forest lands for sampling purposes. In cooperation with the appropriate oil and gas operator, DOE may conduct sampling of produced natural gas and any associated water in existing or future wells within the above described lands defined as the area of review. In cooperation with the appropriate surface management agency, DOE may also sample water from springs and water wells, should any be developed in the area of interest at the Gasbuggy Site. DOE may also need to develop its own wells for environmental sampling, analysis, or remediation if it determines they are necessary.

Title: Gasbuggy Site Monitoring

I. PURPOSE: The purpose of this MOU is to document the cooperation between the parties to outline roles and responsibilities addressing the withdrawn land, communication, and institutional controls, to ensure continued protectiveness at the Gasbuggy Site (Guiding documents include the Federal Land Policy and Management Act of 1976, PLO 4232, NEPA, Executive Order 10355, and Contract No. AT (04-3) - 711 between AEC, the U.S. Department of the Interior, and the El Paso Natural Gas Company, dated January 31, 1967) in accordance with the following provisions.

II. STATEMENT OF MUTUAL BENEFIT AND INTERESTS:

Long-term monitoring of the Gasbuggy underground nuclear site.

In consideration of the above premises, the parties agree as follows:

III. THE BLM SHALL:

A. Notify DOE of any NOS or APD within the area of review specified under the institutional controls under this MOU.

B. Notify DOE of directional or horizontal drilling applications that originate outside of the specified area of review but that have end-hole completions within the specified area of review.

C. Include in the APD approval the right for DOE to acquire gas and produced water samples as a permit condition for wells in the area of review. Include in the APD approval the right for DOE to acquire drilling fluid and hydraulic fracturing fluid samples during the well drilling and development phase for wells drilled in the area of review.

D. In accordance with NEPA, provide DOE with the opportunity for cooperating agency status for NEPA evaluations of proposed gas drilling locations within the area of interest, should the BLM Farmington Field Office decide to conduct a NEPA review.

IV. THE DOE SHALL:

A. Provide notice to the BLM Farmington Field Office and the Forest Service of the sampling schedule at least 1 month prior to the sampling event.

B. Provide sample analysis results to the BLM Farmington Field Office and the Forest Service.

C. Be entirely responsible for the prevention and mitigation of radioactive contamination resulting from Project Gasbuggy wherever such contamination may occur on Carson National Forest.

D. In cooperation with the BLM Farmington Field Office, the Forest Service, and the affected oil and gas operator, develop mitigation measures should sampling results identify possible health, safety, and welfare impacts directly resulting from Gasbuggy activity. Mitigation measures will be determined on a site-specific, case-by-case basis.

E. Have 30 days to respond to any NOS and APD notifications provided by the BLM Farmington Field Office.

V. THE U.S. FOREST SERVICE SHALL:

A. Provide DOE surface access to gas wells, springs, and water wells (if any are developed) for sampling purposes.

B. Allow no subsurface intrusion within a radius of 100 feet from surface ground zero to a true vertical depth of 1,500 feet and no subsurface intrusion within a radius of 600 feet from surface ground zero to a true vertical depth between 1,500 feet and 4,500 feet, as stated on the Gasbuggy Site monument.

C. Give DOE the authority to conduct subsurface and surface investigations that DOE determined to be necessary as part of managing the Gasbuggy Site, within the areas described in item B above, subject to complying with normal Forest Service processes.

D. In accordance with NEPA, provide DOE with the opportunity for cooperating agency status for NEPA evaluations of proposed gas drilling locations within the area of interest.

VI. IT IS MUTUALLY UNDERSTOOD AND AGREED BY AND BETWEEN THE PARTIES THAT:

A. This MOU sets forth the general process by which the parties anticipate coordinating the Gasbuggy Project. This MOU does not identify specific projects for funding or obligating any monies for projects.

B. PRINCIPAL CONTACTS. Individuals listed below are authorized to act in their respective areas for matters related to this agreement.

Principal Cooperator Contacts:

DOE Program Contact	DOE Administrative Contact
Name: Sara Woods, Gasbuggy Site Manager DOE, Office of Legacy Management Address: 2597 Legacy Way City, State, Zip: Grand Junction, CO 81503 Telephone: 970-248-6512 Email: Sara.Woods@lm.doe.gov	Name: Sara Woods, Gasbuggy Site Manager DOE, Office of Legacy Management Address: 2597 Legacy Way City, State, Zip: Grand Junction, CO 81503 Telephone: 970-248-6512 Email: Sara.Woods@lm.doe.gov

BLM Program Contact	BLM Administrative Contact
Name: Chris Wenman BLM Farmington Field Office Address: 6251 College Blvd., Suite A City, State, Zip: Farmington, NM 87402 Telephone: 505-564-7727 Fax: 505-564-7608 Email: cwenman@blm.gov	Name: Shirley Montoya-Chavez BLM Farmington Field Office Address: 6251 College Blvd., Suite A City, State, Zip: Farmington, NM 87402 Telephone: 505-564-7772 Fax: 505-564-7608 Email: slmontoy@blm.gov

Principal U.S. Forest Service Contacts:

U.S. Forest Service Program Manager Contact	U.S. Forest Service Administrative Contact
Name: J.J. Miller Jicarilla Ranger District Address: 1110 Rio Vista Lane, Unit #2 City, State, Zip: Bloomfield, NM 87413 Telephone: 505-632-2956 FAX: 505-632-3173 Email: jon.miller@usda.gov	Name: Jason Atwell Address: 208 Cruz Alta Rd. City, State, Zip: Taos, NM 87571 Telephone: 505-842-3122 Email: Jason.atwell@usda.gov

C. NOTICES. Any communications affecting the operations covered by this agreement given by the U.S. Forest Service or DOE, or BLM is sufficient only if in writing and delivered in person, mailed, or transmitted electronically by e-mail or fax, as follows:

To the U.S. Forest Service Program Manager, at the address specified in the MOU.

To DOE and/or BLM, at DOE and/or BLM's address shown in the MOU or such other address designated within the MOU.

Notices are effective when delivered in accordance with this provision, or on the effective date of the notice, whichever is later.

D. PARTICIPATION IN SIMILAR ACTIVITIES. This MOU in no way restricts the U.S. Forest Service or DOE, or BLM from participating in similar activities with other public or private agencies, organizations, and individuals.

E. ENDORSEMENT. Any of DOE and/or BLM's contributions made under this MOU do not by direct reference or implication convey U.S. Forest Service endorsement of DOE, or BLM's products or activities.

F. NONBINDING AGREEMENT. This MOU creates no right, benefit, or trust responsibility, substantive or procedural, enforceable by law or equity. The

parties shall manage their respective resources and activities in a separate, coordinated and mutually beneficial manner to meet the purpose(s) of this MOU. Nothing in this MOU authorizes any of the parties to obligate or transfer anything of value.

Specific, prospective projects or activities that involve the transfer of funds, services, property, and/or anything of value to a party requires the execution of separate agreements and are contingent upon numerous factors, including, as applicable, but not limited to: agency availability of appropriated funds and other resources; cooperator availability of funds and other resources; agency and cooperator administrative and legal requirements (including agency authorization by statute); etc. This MOU neither provides, nor meets these criteria. If the parties elect to enter into an obligation agreement that involves the transfer of funds, services, property, and/or anything of value to a party, then the applicable criteria must be met. Additionally, under a prospective agreement, each party operates under its own laws, regulations, and/or policies, and any Forest Service obligation is subject to the availability of appropriated funds and other resources. The negotiation, execution, and administration of these prospective agreements must comply with all applicable law.

Nothing in this MOU is intended to alter, limit, or expand the agencies' statutory and regulatory authority.

G. FREEDOM OF INFORMATION ACT (FOIA). Public access to MOU or agreement records must not be limited, except when such records must be kept confidential and would have been exempted from disclosure pursuant to Freedom of Information regulations (5 U.S.C. 552).

H. TEXT MESSAGING WHILE DRIVING. In accordance with Executive Order (EO) 13513, "Federal Leadership on Reducing Text Messaging While Driving," any and all text messaging by Federal employees is banned: a) while driving a Government owned vehicle (GOV) or driving a privately owned vehicle (POV) while on official Government business; or b) using any electronic equipment supplied by the Government when driving any vehicle at any time. All cooperators, their employees, volunteers, and contractors are encouraged to adopt and enforce policies that ban text messaging when driving company owned, leased or rented vehicles, POVs or GOVs when driving while on official Government business or when performing any work for or on behalf of the Government.

I. TERMINATION. Any of the parties, in writing, may terminate this MOU in whole, or in part, at any time before the date of expiration.

J. MODIFICATIONS. Modifications within the scope of this MOU must be made by mutual consent of the parties, by the issuance of a written modification signed and dated by all properly authorized, signatory officials, prior to any changes

being performed. Requests for modification should be made, in writing, at least 30 days prior to implementation of the requested change.

K. COMMENCEMENT/EXPIRATION DATE. This MOU is executed as of the date of the last signature and is effective through January 31, 2026 at which time it will expire.

L. AUTHORIZED REPRESENTATIVES. By signature below, each party certifies that the individuals listed in this document as representatives of the individual parties are authorized to act in their respective areas for matters related to this MOU.

In witness whereof, the parties hereto have executed this MOU as of the last date written below.

David S. Shafer Digitally signed by David S. Shafer Date: 2021.01.26 15:32:00 -07'00'

DAVID SHAFER, PHD, Deputy Director for Field Operations Date
DOE, Office of Legacy Management

ALFRED ELSER Digitally signed by ALFRED ELSER Date: 2021.02.03 13:29:47 -07'00'

AL ELSER, District Manager Date
USDI, Bureau of Land Management

JAMES DURAN Digitally signed by JAMES DURAN Date: 2021.02.04 12:44:36 -07'00'

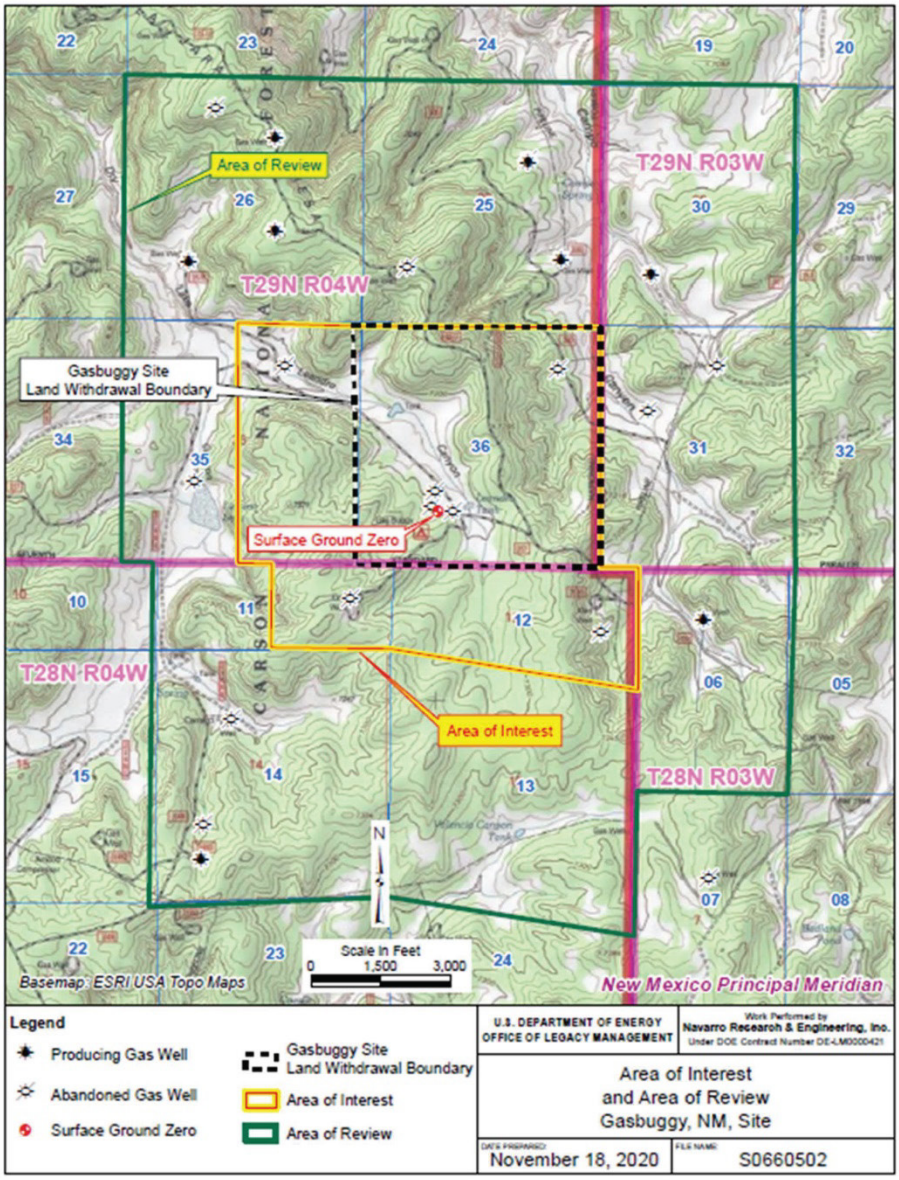
JAMES DURAN, Forest Supervisor Date
U.S. Forest Service, Carson National Forest

The authority and format of this agreement have been reviewed and approved for signature.

MARK COONRAD Digitally signed by MARK COONRAD Date: 2021.01.11 10:28:46 -09'00'

MARK COONRAD Date
U.S. Forest Service Grants Management Specialist

Attachment A



Burden Statement

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0596-0217. The time required to complete this information collection is estimated to average 3 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

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Appendix C

Summary of Real Property Rights Contractually Granted to AEC

Real Property Rights Granted to the Atomic Energy Commission at the Gasbuggy site via Contract with El Paso Natural Gas Company

On January 31, 1967 the Atomic Energy Commission (AEC), the Department of the Interior (DOI), and the El Paso Natural Gas Company (EPNG) entered into a contract (contract no. AT (04-3)-711) that set forth the terms and conditions for the Gasbuggy test, which was a cooperative effort between the AEC, DOI, and EPNG. As part of the contract, EPNG granted the AEC significant authority over the real property and oil and gas rights held by EPNG at the test site, further described below.

Article II, section (a) grants the AEC (the Government) full use of all of EPNG's (the Company) "operating rights derived through oil and gas leases, easements, conveyances, contract or any other source whatever, in and to all rights and interest from the surface of the earth to a depth of 500 feet below the base of the Pictured Cliffs Formation as to the SW ¼ of Section 36, Township 29 North, Range 4 West, N.M.P.M., Rio Arriba County, New Mexico." Article II, section (a) further states "Such rights as the Government acquires under the foregoing shall remain in the Government until such time as the Government advises the Company in writing that it no longer desires such rights…" LM has no record of such a letter relinquishing these rights.

Article XV of the same contract states the following: In recognition of the fact…"that special safety considerations may exist after detonation of the nuclear explosive, the Company agrees that it shall follow all regulations, rules and directions of the Commission in regard thereto. Furthermore, it agrees that the Commission may exercise such control to effectuate such regulations, rules and directions of the Commission as it in its sole discretion deems appropriate over the Company's real property interests. *This obligation shall survive expiration or termination of this contract and shall cease only upon written notice by the Commission"* (italics added). Article XV further states that this obligation shall be binding upon EPNG's successors. LM has no record of such a letter relinquishing these rights.

In summary, the combination of the withdrawal of section 36 and the rights granted to the Government per the above paragraphs over the southwest quarter of section 36, provide LM with enforceable property rights and control over a significant portion of the test area.