DOE/EA-2195

Draft Environmental Assessment for the Evaporation Pond at the Shiprock, New Mexico, Disposal Site

July 2023

U.S. DEPARTMENT OF ENERGY | Legacy Management

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Acronyms and Abbreviations

BIA	Bureau of Indian Affairs
BMP	best management practice
CDI	chronic daily intake
CDP	census-designated place
CEM	conceptual exposure model
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic ft per second
cm	centimeter
COC	contaminant of concern
COPC	contaminant of potential concern
CSF	cancer slope factor
DAD	dermally absorbed dose
dB	decibel
dBA	A-weighted decibel
DCC	dose compliance concentration
DCF	dose conversion factor
DOE	U.S. Department of Energy
DOE O	DOE Order
EA	Environmental Assessment
EC	exposure concentration
EIS	Environmental Impact Statement
ELCR	excess lifetime cancer risks
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ESA	Endangered Species Act of 1973
F	Fahrenheit
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
ft	foot

g	gram
GCL	geomembrane/geosynthetic clay composite liner
GELP	Gallup Energy Logistics Park
GHG	greenhouse gas
GIAB	gastrointestinal absorption
gpm	gallons per minute
GWP	global warming potential
HAP	hazardous air pollutant
HDPE	high density polyethylene liner
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
ICRP	International Commission on Radiological Protection
in	inch
IUR	inhalation unit risk
kg	kilogram
km	kilometer
L	liter
LA_{eq}	equivalent sound level metric
La_{eq1hr}	equivalent sound level metric for 1 hour
LA_{max}	maximum sound level occurring for a fraction of a second
lb	pound
LCF	latent cancer fatality
LM	DOE Office of Legacy Management
Lv dB	vibration level
m	meter
MEI	maximally exposed individuals
mg	milligram
mg/kg	milligram per kilogram
mg/L	milligrams per liter
mi	mile
mil	millimeter
mrem	millirem

μg	microgram
NAAQS	National Ambient Air Quality Standards
NECA	Navajo Engineering and Construction Authority
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
ORNL	Oak Ridge National Laboratory
pCi	picocurie
PEIS	Programmatic EIS
$PM_{2.5}$	2.5 microns in diameter
PM_{10}	10 microns in diameter
PPE	personal protective equipment
PRG	Radiological Preliminary Remediation Goal
PSD	Prevention of Significant Deterioration
RADTRAN	Radiological Impact of the Transportation of Radioactive Materials
RAIS	ORNL's Risk Assessment Information System
rem	roentgen equivalent man
RfC	inhalation reference concentration
RfD	reference dose
ROI	region of influence
RRM	residual radioactive material
RSL	regional screening level
SHPO	State Historic Preservation Officer
Th	thorium
THPO	Tribal Historic Preservation Officer
TM	Technical Manual
UF	uncertainty factor
UMTRCA	Uranium Mill Tailings Radiation Control Act of 1978
UMTRA	Uranium Mill Tailings Remedial Action
USACE	U.S. Army Corps of Engineers
USC	United States Code

USDOT	U.S. Department of Transportation
USFWS	U.S. Fish and Wildlife Service
VIA	visual impact assessment
VOC	volatile organic compounds
WCS	Waste Control Specialists
Web-TRAGIS	Web-Transportation Routing Analysis Geographic Information System
WTU	water treatment unit
U	uranium
UCL-95	95 percent upper confidence limit
U.S.	United States
yd	yard
yr	year

Scientific Notation

Number	Power	Name
1,000,000,000,000,000	10^{15}	quadrillion
1,000,000,000,000	10^{12}	trillion
1,000,000,000	10^{9}	billion
1,000,000	10^{6}	million
1,000	10^{3}	thousand
10	10^{1}	ten
0.1	10^{-1}	tenth
0.01	10^{-2}	hundredth
0.001	10^{-3}	thousandth
0.000001	10^{-6}	millionth
0.000000001	10^{-9}	billionth
0.00000000001	10^{-12}	trillionth
0.000000000000001	10^{-15}	quadrillionth

Note: Scientific notation expresses numbers that are very small or very large. Negative exponents, such as 1.3×10^{-6}, express very small numbers. To convert the number to decimal notation, move the decimal point to the left by the number of places equal to the exponent, in this case 6 places. Thus, the number becomes 0.0000013. For large numbers, those with a positive exponent, move the decimal point to the right by the number of places equal to the exponent (e.g., the number 1.3×10^{6} becomes 1,300,000).

Conversions

To Convert	Multiply By	To Obtain
ft	3.048×10^{-1}	m
lb	4.536 × 102	grams
gallons	3.785	liters
mi	1.609334	km
square mi	2.590	square km
yd	9.144×10^{-1}	m
m	3.28084	ft
grams	2.204×10^{-3}	lb
liters	2.641×10^{-1}	gallons
km	6.214×10^{-1}	mi
square km	3.861×10^{-1}	square mi
m	1.093613	yd

1 INTRODUCTION

The National Environmental Policy Act of 1969 (NEPA) (42 United States Code [USC] § 4321 et seq.) requires Federal agencies to consider the environmental consequences of Proposed Actions before decisions are made. To comply with NEPA, the United States (U.S.) Department of Energy (DOE) Office of Legacy Management (LM) follows the Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations [CFR] 1500–1508) and DOE's NEPA implementing procedures (10 CFR 1021). The purpose of an Environmental Assessment (EA) is to give Federal decision makers information sufficient to determine whether to prepare an Environmental Impact Statement (EIS) or issue a Finding of No Significant Impact.

The Shiprock disposal site located in Shiprock, New Mexico is regulated under the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA) (42 USC 7901 et seq.) as a Title I site (refer to Section 1.1). The general boundaries for groundwater remediation compliance efforts at the disposal site include the San Juan River to the north, a buried bedrock escarpment to the south, Many Devils Wash to the east, and U.S. Highway 491 to the west (Figure 1-1). The disposal site consists of (1) the terrace, a flat, elevated area approximately 50 to 60 feet (ft) above the San Juan River, where the disposal cell and adjacent former mill site lie and (2) the underlying floodplain, extending approximately 1,500 ft north of the mill site and south of the river. A steep ridge delineates the terrace and the floodplain and serves as a clear boundary between these two areas of the site. The disposal site is managed by LM under the Uranium Mill Tailings Remedial Action (UMTRA) Project and is currently undergoing groundwater remediation efforts and site monitoring.

The groundwater compliance strategy at the Shiprock disposal site requires groundwater extraction and evaporation. All extracted groundwater is pumped into an 11-acre lined evaporation pond that receives groundwater pumped from the remediation system at the site, which is composed of wells, infiltration galleries, and sumps, to facilitate removal of dissolved contaminants through natural evaporation.

The evaporation pond is located off the Shiprock disposal site on LM right-of-way with the Navajo Nation on the terrace, approximately 350 ft southeast of the disposal cell. A Cooperative Agreement with the Navajo Nation grants the DOE right of entry in, across, and over the mill site, vicinity sites, and any land as mutually identified by the DOE Project Officer and the Navajo Nation Project Director to perform activities including but not limited to, surveying, appraising; collecting soil, water, biota samples, and environmental baseline data; conducting test borings; drilling water sampling and monitoring wells; conducting endangered species surveys; and performing remedial actions. Access to the evaporation pond is a part of this agreement. The agreement also allows DOE the right to restrict access and post appropriate warning signs, fencing, or other barriers on areas of the mill site or other lands as may be necessary to facilitate remedial action and protect public health and safety.

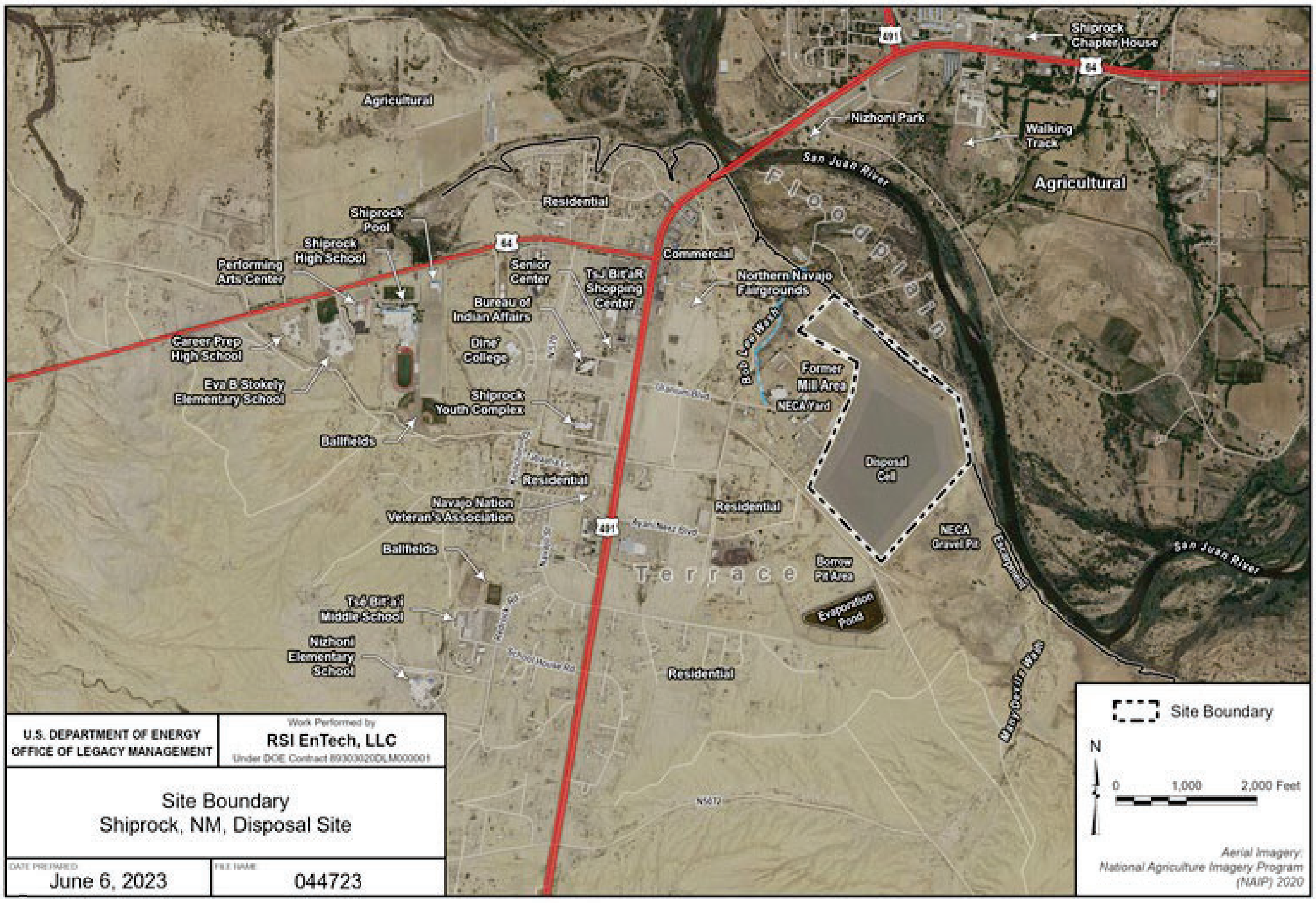


Figure 1-1. Shiprock disposal site with existing land use designations

In 2021, LM completed a comprehensive pond liner assessment to evaluate its condition. This assessment determined the liner is degrading and multiple liner penetrations were discovered (Baldyga, 2021). LM conducted pond repair work in early 2022, and although the evaporation pond and pond liner are currently functioning as designed, LM concluded the pond liner would continue to deteriorate and be in constant need of repair. In this EA, LM evaluates strategies for addressing degradation or failure of the 11-acre evaporation pond liner at the Shiprock disposal site. Figure 1-2 shows the evaporation pond project area location evaluated in this EA.

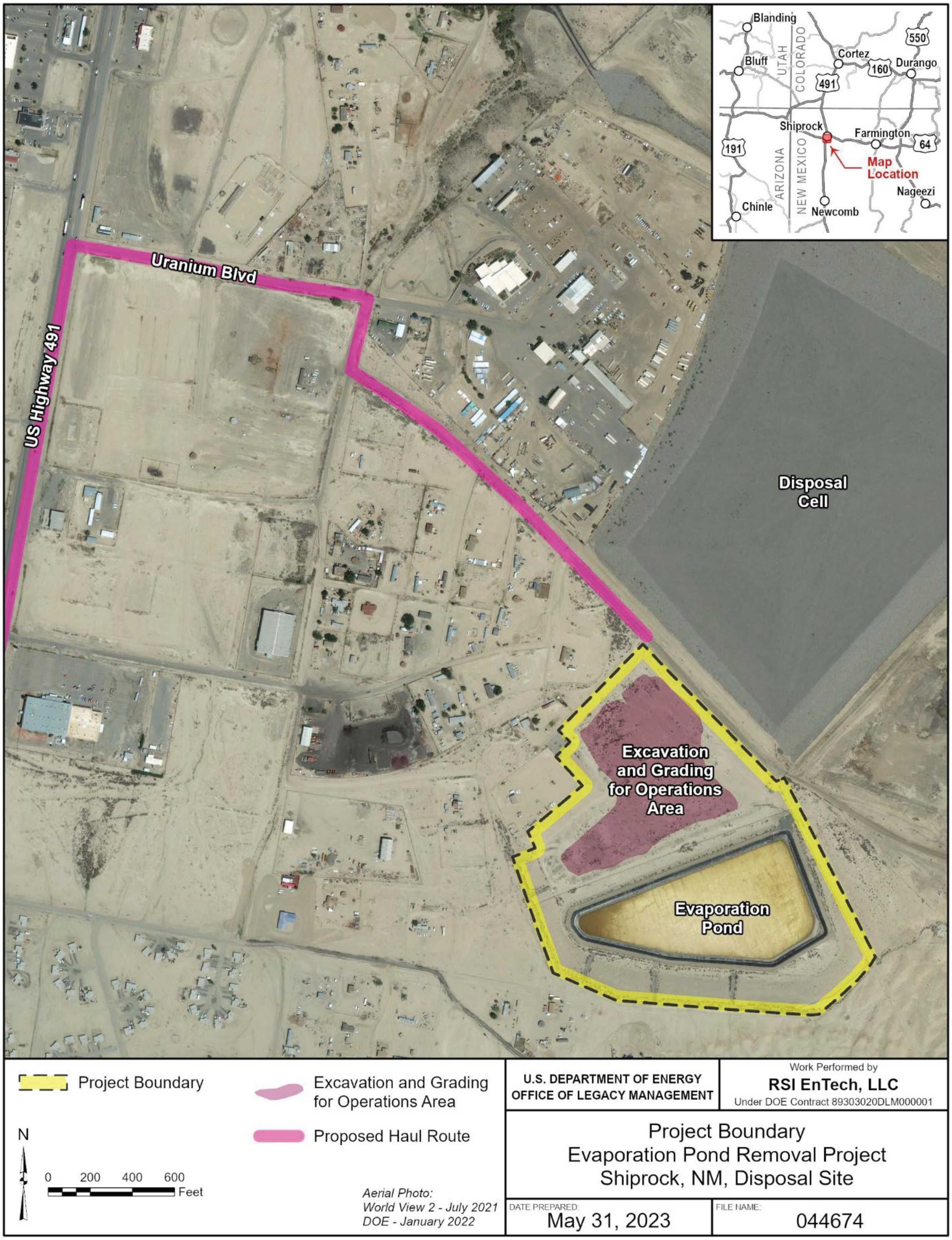


Figure 1-2. Shiprock evaporation pond project area

1.1 Background

The Shiprock disposal site is the location of the former Navajo Mill, a uranium ore-processing facility, which operated from 1954 to 1968. The former mill was located approximately 600 ft south of the San Juan River on an elevated terrace overlooking the river and its floodplain.

The Shiprock disposal site is held in trust by the Bureau of Indian Affairs (BIA). The Navajo Nation retains title to the land. UMTRCA authorized DOE to enter into a Cooperative Agreement (DE-FC04-83AL16258) with the Navajo Nation and required it to be in place before bringing the site under the U.S. Nuclear Regulatory Commission (NRC) general license. DOE and the Navajo Nation executed a Custodial Access Agreement that conveys to the Federal government title to the residual radioactive materials stabilized at the repository site and ensures that DOE has perpetual access to the site.

The site facilities—which included the Navajo Mill, ore storage areas, raffinate ponds (ponds that contain spent liquids from the milling process), and tailings piles—occupied approximately 230 acres leased from the Navajo Nation. In 1973, the lease expired, and the site ownership reverted to the Navajo Nation. Some of the mill buildings and most of the equipment were dismantled and placed in the west tailings pile from the time that milling ended in 1968 to the expiration of the Foote Mineral Company lease in 1973.

The milling operations created radioactive tailings and process-related wastes. During active uranium and vanadium milling, water with tailings from the washing circuit and from yellowcake filtration was pumped to the disposal area. Although excess solutions were recycled to the plant during the winter months, raffinate was also disposed of by evaporation in separate holding ponds. The milling operations used large amounts of sulfuric acid and ammonia, and smaller amounts of organic solvents, which were transported to the tailings and raffinate ponds (Merritt, 1971). Contaminants from the tailings and wastes are now found in the groundwater beneath the terrace and have been transported by the groundwater to seeps and the floodplain of the San Juan River. The constituents of concern are ammonium, manganese, nitrate, selenium, strontium, sulfate, and uranium (DOE, 2002a).

In 1974, the U.S. Environmental Protection Agency (EPA) conducted a radiation survey and recommended remediation of the Navajo Mill site. Decontamination work under EPA guidance began in January 1975 and continued until 1980. UMTRCA (as described in 42 USC 7901 et seq.) was passed in 1978 and specified major changes to remedial action criteria for former uranium mill Title I sites compared to the criteria employed for the decommissioning work completed at the Shiprock disposal site prior to that time. Title I of UMTRCA applies to sites where uranium ore milling had ceased, and the milling licenses had been terminated when UMTRCA was passed. Congress assigned responsibility for remediating these sites to DOE.

UMTRCA was enacted to control and mitigate risks to human health and the environment from residual radioactive material (RRM) that resulted from processing uranium ore. UMTRCA defines RRM as "waste in the form of tailings or other material that is present as a result of processing uranium ores at any designated processing site, and other waste at a processing site which relates to such processing…." RRM includes stockpiled, unprocessed ore and the sandy tailings material that remain after the milling process—it contains uranium and its radioactive decay products, along with nonradioactive constituents such as metals, nitrate, sulfate, and ammonia that have the potential to leach from the tailings and ore into underlying soil. EPA developed regulations, which establish procedures and standards for cleanup of RRM, to implement the requirements of UMTRCA (40 CFR 192). The regulations establish procedures and numerical standards for remediation of RRM in land, buildings, and ground water.

Under UMTRCA, DOE is authorized to perform remedial action at Shiprock, and is responsible for bringing the site into compliance with EPA groundwater standards and with all other applicable standards and requirements. DOE also must consult with any affected Indian tribes and the BIA; the NRC must concur with DOE's actions. States are also full participants in the process. In 1983, DOE and the Navajo Nation entered into an agreement for cleanup of the Shiprock disposal site.

In the early 1980s, DOE performed a series of surface and groundwater characterization studies at the Shiprock disposal site and prepared a Remedial Action Plan in 1985 (DOE, 1985). To comply with the Remedial Action Plan, DOE completed remedial action of surface and near-surface contamination at the Shiprock disposal site in 1986. This required stabilizing approximately 1.8 million tons of uranium mill tailings onsite in a disposal cell that covers approximately 77 acres. The disposal cell was constructed on a portion of the former mill site, mostly on the area that formerly contained the tailings impoundments (DOE, 1984). The disposal cell was designed to encapsulate and isolate the material for 200 to 1,000 years.

Groundwater standards were defined in 1987 for the UMTRA Groundwater Project, and the final rule, published in 1995, requires DOE compliance with those standards (40 CFR Part 192, Subparts A–C). A long-term surveillance plan was prepared for the Shiprock disposal site in 1994 (DOE, 1994). After this plan was approved, the NRC issued a license in September 1996 to the DOE office at Grand Junction, Colorado, for the long-term care of the site. The license deferred site groundwater cleanup to the UMTRA Groundwater Project. The *Final Programmatic Environmental Impact Statement for the Uranium Mill Tailings Remedial Action Groundwater Project* (DOE, 1996), also known as the Groundwater Programmatic EIS (PEIS), describes the regulatory requirements for adherence to the groundwater standards.

The Groundwater PEIS is the umbrella NEPA document for groundwater cleanup at sites such as Shiprock and is a framework for selecting site-specific groundwater compliance strategies that comply with EPA regulations. DOE and the Navajo Nation entered into a cooperative agreement on the UMTRA Groundwater Project in February 1999.

In accordance with the PEIS framework, DOE completed the *Environmental Assessment of Groundwater Compliance at the Shiprock Uranium Mill Tailings Site* in 2001 (DOE, 2001). The EA addressed the potential environmental impacts of implementing site-specific groundwater remediation strategies at the Shiprock disposal site and resulted in a Finding of No Significant Impact. In 2002, DOE completed the *Final Groundwater Compliance Action Plan for Remediation at the Shiprock, New Mexico, UMTRA Site* (DOE, 2002a), which documents the site compliance strategy, the basis for the remediation approach, and performance standards for the groundwater remediation system. It was prepared in accordance with the 1996 Groundwater PEIS and was approved by the NRC in 2003.

As outlined in the *Revised Groundwater Compliance Action Plan (GCAP) Work Plan, Shiprock, NM, Disposal Site* (DOE, 2022a), LM is conducting a series of activities to obtain the data and information necessary to revise the groundwater compliance strategy in the current GCAP (DOE, 2002a). These future activities are not connected to the purpose and need of this proposed project and would undergo a separate NEPA review as discussed in Section 3.14. The revision to the GCAP is expected to take several more years to complete. To remain in compliance with the current GCAP, LM is developing a plan to install a Water Treatment Unit (WTU) at the site as a temporary measure for groundwater treatment (see Section 3.14).

The Shiprock disposal site is divided into two distinct areas: the floodplain and the terrace. The compliance strategy for the floodplain alluvial aquifer is natural flushing supplemented by active remediation as a best management practice (BMP) and involves extracting groundwater to enhance the natural flushing process. Pumping from the floodplain was intended to reduce contaminant concentrations in floodplain wells and prevent or minimize risk to aquatic life in the nearby San Juan River (DOE, 2002a; DOE, 2011a).

The compliance strategy for the east terrace (terrace areas east of U.S. Highway 491) is active remediation until potential risks to humans and the environment have been eliminated. Specifically, groundwater is pumped from extraction wells in an area north of a buried escarpment and from interceptor drains along Many Devils and Bob Lee Washes. The objective of the terrace groundwater extraction is to eliminate the exposure pathways at the washes and seeps (i.e., dry up the seeps and washes), thus eliminating the risk associated with ingestion of contaminated water. The compliance strategy for the west terrace (area west of U.S. Highway 491) is the application of supplemental standards, based on the limited use of groundwater in this area and the presence of widespread ambient (i.e., not caused by human activity) contamination derived from the Mancos Shale (not related to uranium-milling processes).

The floodplain remediation system consists of two groundwater extraction wells, a seep collection drain, and two collection trenches.

The terrace remediation system consists of nine groundwater extraction wells, a collection drain (Bob Lee Wash), and a terrace drainage channel diversion structure. All extracted groundwater is pumped into the 11-acre lined evaporation pond on the terrace. The pond receives groundwater pumped from the remediation system at the site to facilitate removal of contaminants (i.e., RRM and other heavy metals) through natural evaporation. The evaporation pond was constructed in 2002 and lined with a 45-millimeter (mil)-thick, scrim reinforced polypropylene liner, underlain by a geomembrane/geosynthetic clay composite liner (GCL) underlain by a compacted soil base. Quality assurance and quality control testing of the liner was conducted during and after installation to ensure no leaks were present before filling of the pond. A leak detection system was not included in the pond design. The liner manufacturer and installer provided a 20-year warranty for the liner, which essentially coincides with the design life of the pond.

As previously noted, LM evaluated the condition of the pond liner in 2021. The pond liner inspection was conducted from June through September 2021. The assessment determined the liner is degrading and multiple liner penetrations were discovered (Baldyga, 2021). The evaporation pond and pond liner are currently functioning as designed, but LM concluded the pond liner would continue to deteriorate and need constant repair.

1.2 Purpose and Need

Results from the 2021 pond liner condition assessment (Baldyga, 2021) showed that the evaporation pond liner at the Shiprock disposal site has reached the end of its useful life. The purpose of the project is for LM to identify a path forward regarding the future of the 11-acre evaporation pond including sediment, liner, underlying soil, and associated infrastructure. In keeping with its mission, LM must ensure site conditions are protective of human health and the environment and eliminate the potential for incidental soil or groundwater contamination due to continued degradation or failure of the evaporation pond liner.

1.3 NEPA Process and Public Involvement

In preparing this EA, DOE-LM considered comments received from the public during the scoping period (November 17, 2022, through December 16, 2022). During the public scoping period, DOE-LM sent 30 scoping letters to Federal agencies, State and local governmental entities, Native American tribes, and members of the public known to be interested in or affected by implementation of the alternatives evaluated in this EA. The scoping process was conducted to solicit agency and community input on the scope and environmental issues to be addressed on a range of possible alternatives regarding the future of the 11-acre evaporation pond, including sediment, liner, underlying soil, and associated infrastructure. Appendix A, Table A-1 lists the Native American tribes, Federal agencies, state and local governmental entities, and members of the public to whom scoping letters were sent. No comments were received during the scoping period.

1.3.1 Cooperating Agencies

LM invited the Navajo Nation Abandoned Mine Lands Remedial Action Department to participate as a cooperating agency in development of this EA. The department is a cooperating agency due to its knowledge about the site and expertise in remediation. This approach is consistent with NEPA and other environmental compliance requirements as well as with the Cooperative Agreement between the Navajo Nation and DOE-LM.

1.3.2 Agency Consultation and Coordination

NEPA drives Federal agencies to evaluate environmental resources, which may include a consultation process in accordance with other environmental laws. This section describes environmental consultations that are associated with the proposed action. Additional details on these environmental resources are provided in Section 3.

The National Historic Preservation Act of 1966, as amended (16 USC 470), requires Federal agencies to determine the potential effects of their actions on historic properties that are either listed on or eligible for listing on the National Register. Federal agencies are required to share their determination with the appropriate State Historic Preservation Officer (SHPO) or Tribal Historic Preservation Officer (THPO) in accordance with the Section 106 process as defined by 36 CFR 800, "Protection of Historic Property." The Navajo Nation THPO has jurisdiction over Navajo Nation lands; the New Mexico SHPO typically is not involved on projects that take place within the exterior boundaries of the Navajo Nation.

On March 14, 2023, LM sent a letter initiating the National Historic Preservation Act of 1966 Section 106 consultation process to the Navajo Nation Heritage and Historic Preservation Department Historic Preservation Officer (also referred to as the THPO), which included LM's determination that there are no historic properties that would be affected by LM's decision regarding the evaporation pond and that project activities would avoid previously identified historic properties (see Appendix B). The Navajo Nation THPO did not object to this finding within the previously agreed to 60 days of its receipt; therefore, LM's responsibilities under Section 106 are fulfilled (36 CFR 800.4d(1)(i)).

On June 26, 2023, LM met with representatives from U.S. Fish and Wildlife Service (USFWS) to discuss the proposed action and compliance with the Endangered Species Act (ESA). As recommended by USFWS, LM is preparing to reopen consultation with the preparation and submittal of an amendment to the 2019 *Programmatic Biological Assessment of Threatened and*

Endangered Species for the U.S. Department of Energy Office of Legacy Management Activities at Sites in the San Juan River Subbasin. The amendment will be used to consult with USFWS in accordance with their *Guidance for Completing Project Reviews Under the Endangered Species Act document* dated April 12, 2023. This consultation is ongoing and will be completed prior to issuance of the final EA.

DOE also consulted with the Navajo Nation Environmental Protection Agency, the Diné Uranium Remediation Advisory Commission, and the Navajo Nation Department of Fish and Wildlife. On May 10, 2023, a letter was sent to the Navajo Nation Department of Fish and Wildlife on behalf of LM initiating consultation and requesting data on the occurrence or potential occurrence of species of concern in the project area and what planning for avoidance may be required (see Appendix C). This consultation is ongoing and will be completed prior to issuance of the final EA.

2 DESCRIPTION OF ALTERNATIVES

This section includes a brief discussion of alternatives that LM is considering for addressing continued degradation or failure of the 11-acre evaporation pond, including sediment, liner, underlying soil, and associated infrastructure. For the alternatives to be feasible, they must meet the following criteria:

- Continue remediation in accordance with the compliance strategy for the Shiprock disposal site
- Eliminate the potential for continued degradation or failure of the evaporation pond liner without the need for continual costly repairs
- Protect human health and the environment
- Avoid creation of additional UMTRCA disposal sites

To meet the purpose and need, LM proposes to dismantle the pond, and remove and dispose of the pond sediment, liner, underlying soil, and associated infrastructure. These actions are necessary to ensure protection of human health and the environment.

Besides a No Action Alternative, whereby the existing evaporation pond would remain in place, this EA evaluates two alternatives for decommissioning and disposal of the evaporation pond at the Shiprock disposal site.

2.1 Alternative 1 – No Action Alternative

Under the No Action Alternative, the evaporation pond would remain in place. Residual sediment would remain in the pond and the pond liner would continue to deteriorate, which could result in a potential source of soil and groundwater contamination. The No Action Alternative does not meet the purpose and need of this EA; however, it establishes a baseline against which this EA compares the environmental impacts of the other alternatives in accordance with CEQ NEPA regulations. No action, for purposes of this analysis, involves maintaining or continuing the existing status or condition.

Under Alternative 1, LM would continue to comply with the requirements for the long-term surveillance and maintenance of the site as specified in the LM Long-Term Surveillance Plan (DOE, 1994) and in procedures LM established to comply with the requirements of the NRC general license at Title 10 CFR Section 40.27 (10 CFR 40.27). LM would also continue to comply with the NRC general license requirements described hereafter, for institutional controls, including monitoring, maintenance, and emergency measures.

2.2 Alternative 2 – Full Decommissioning and Disposal of the Existing Evaporation Pond at an Off-Site Licensed Waste Facility by Highway Transport

Under Alternative 2, LM would completely dismantle the evaporation pond, including removing and disposing of an estimated 20,000 cubic yards (yds) of waste. This volume of material includes any water, sediment, liners (i.e., high density polyethylene [HDPE] liner and GCL), associated infrastructure, and up to approximately 12 inches (in) of subsurface soil (see Section 3.5.2). To accomplish this, LM proposes to use the in-situ technique described in Section 2.2.2.1 to dry and solidify generated waste.

Water for dust suppression and other project activities could be obtained from three potential sources—directly from San Juan River at the Navajo Engineering Construction Authority (NECA) gravel pit area, from local offsite water sources, or from a proposed on-site WTU (refer to Section 3.14). Water trucks can access water directly from the San Juan River at a standpipe located in the NECA gravel extraction area which would require an approved agreement with NECA and acquiring a water use permit through the Navajo Nation Department of Water Resources. The distance from the evaporation pond to the NECA standpipe is approximately 2,400 ft along established gravel and dirt roads. The offsite access of local water sources would also require obtaining a water use permit through the Navajo Nation Department of Water Resources.

LM conducted an off-site disposal analysis comparing potential options for the disposal of RRM waste generated during decommissioning activities of the evaporation pond. The off-site waste disposal options were initially evaluated for viability to accept RRM waste and ability of the facility to accept shipments (i.e., truck and/or rail). This evaluation resulted in a short list of facilities recommended for further analysis which will include waste disposal and transportation costs, schedule constraints, transportation routing, and risk management considerations. The analysis identified the Waste Control Specialists (WCS) Facility in Andrews County, Texas, or Energy*Solutions'* Clive Disposal Facility located in Grantsville, Utah. Waste would be transported to the selected disposal site by highway transport using haul trucks.

Alternative 2 includes the following three phases:

- Phase One – Site Preparation
- Phase Two – Evaporation Pond Excavation and Disposal
- Phase Three – Evaporation Pond and Retention Basin Regrading, Temporary Facilities Removal and Demobilization

Depending on available funding and other constraints, LM anticipates the project would take from sixteen months to several years for full completion. The following sections describe each phase of the approach.

2.2.1 Phase One: Site Preparation

LM would begin preparing the site for excavation of the evaporation pond and other proposed activities. Preliminary site preparations include the following activities:

2.2.1.1 Installation of Security Fencing and Gates

The existing security fence around the evaporation pond is in poor condition. During site preparation, LM would install additional perimeter fencing around the northwest, north, and northeast portions of the project site to provide improved security and prevent accidental human and animal intrusion into the area. This fence would be attached to the current perimeter fence surrounding the evaporation pond at the northwest and southeast corners. The existing entrance gate would remain in place and LM would add new gates as needed to facilitate access to staff, project vehicles, and equipment. All entrance and haul road areas would be resurfaced with crushed asphalt to control fugitive dust.

2.2.1.2 Wind and Noise Barrier Installation

LM would install wind and noise barriers on the southwest and northwest evaporation pond perimeter fence. The winds barriers would block some of the prevailing winds and assist with fugitive dust control. The noise barriers would extend the full height of the security fence and would also create a visual barrier between on-site project activities and nearby residences.

2.2.1.3 Stormwater Retention Basin Reconfiguration

Following installation of the site-perimeter security fencing and new gates, LM would excavate the west side of the stormwater retention basin and redeposit and compact the excavated material on the east side of the stormwater retention basin. This would allow the site to maintain the designed retention volume for the stormwater retention basin on the west side of the area, while allowing the eastern side of the basin to be used as a waste packaging area.

2.2.1.4 Waste Packaging Area Installation

Once the stormwater retention basin has been reconfigured, LM would install a temporary waste packaging structure and shipping and receiving trailer to allow for safe and efficient processing, packaging, and shipping of the excavated evaporation pond wastes. Additional support areas, including a project parking area, laydown yard structure, lunch break trailer, shower and restroom trailer, and sea-land storage containers would also be located in this area. Ramps would be installed near the evaporation pond to allow waste to be hauled to the waste packaging structure. Temporary electrical supply would be routed to the support facilities as needed.

Figure 2-1 shows a conceptual site layout for proposed operational areas and structures previously described.

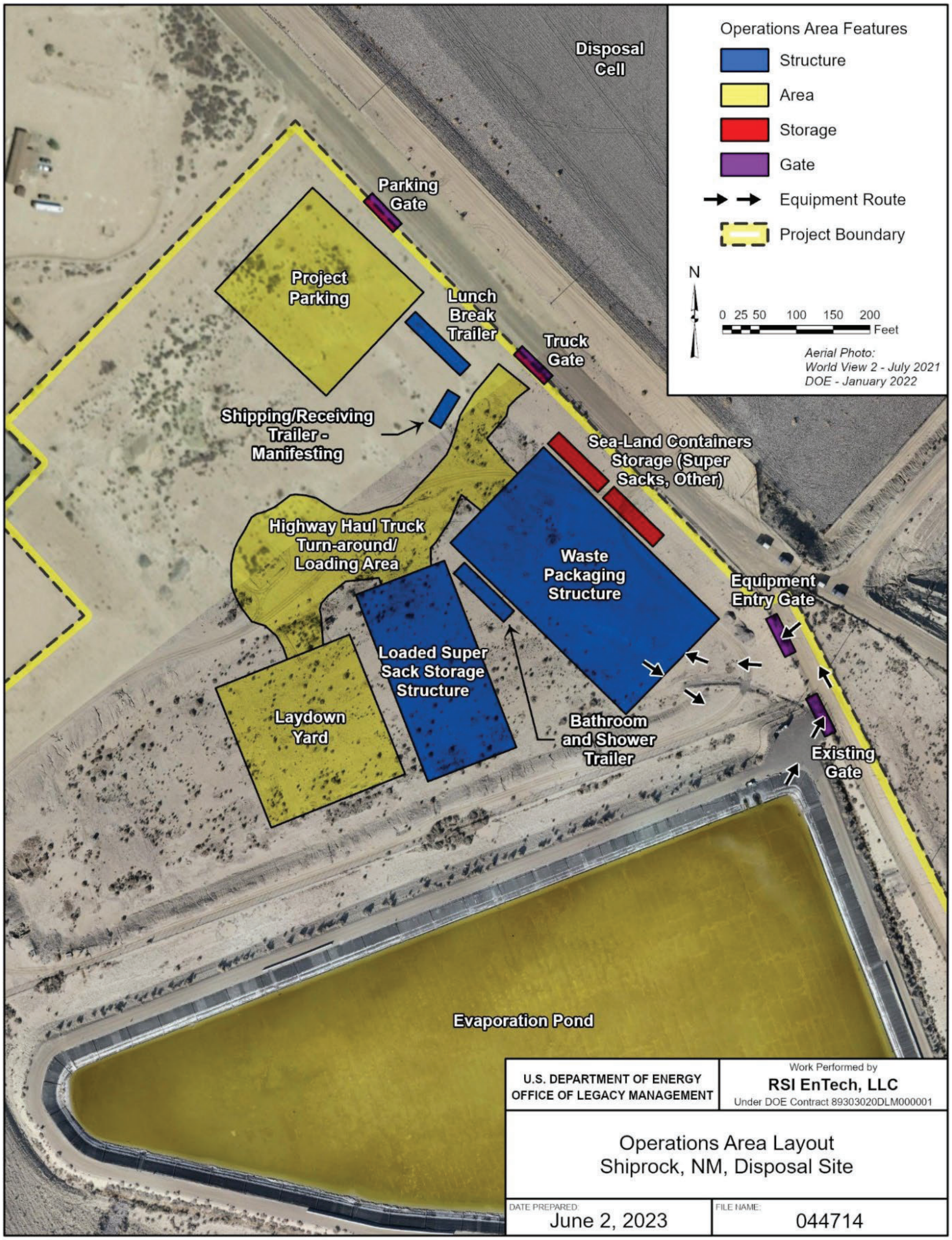


Figure 2-1. Proposed conceptual operations area layout for evaporation pond decommissioning at the Shiprock disposal site

2.2.2 Phase Two: Evaporation Pond Excavation and Disposal

Approximately 20,000 cubic yds of waste material would be excavated during pond decommissioning activities, which would include the removal of pond sediments, the 45-mil HDPE liner, repair barriers, bentonite mat, and soil below the bentonite mat. Waste would be hauled from the evaporation pond to the waste packaging structure by haul trucks for waste processing and packaging.

Once the waste has been processed, characterized, and verified to meet the waste acceptance criteria of the selected off-site disposal facility, the waste would be packaged in U.S. Department of Transportation (USDOT)-compliant containers, such as a soft-sided package known as a Super Sack (shown in Figure 2-2). These bags can hold up to 54,000 pounds (lbs) of material and be made in different configurations and sizes. The preferred bags would likely be the 5 or 9 cubic yds top-loaded bags with a top closure for added protection against spilling. These Super Sacks would be filled and loaded onto haul trucks for shipment to the selected off-site disposal facility.

2.2.2.1 Excavation of Pond Contents

The pond contents would be the first components to be removed using heavy equipment. Dust control measures would be implemented during fugitive dust generating activities.

2.2.2.2 Liner Excavation

After removal of the pond contents, LM would cut the evaporation pond liners (GCL and HDPE) into sections and remove them from the site. This would be done using skid-steers or similar equipment fitted with cutting wheels.

Figure 2-2. Example Super Sack

2.2.2.3 Sub-Liner Soil Excavation

LM would also excavate and remove a layer of soil beneath the pond liner to a depth of approximately 6- to 12-in (on average), if it is determined that underlying soils have been impacted by leaks in the liner. Verification sampling procedures would be outlined in an approved sample verification plan. If verification sampling reveals dissolved contaminants beneath the liner, the nature and extent of contamination would be defined, and the contamination would be removed from targeted areas. Targeted areas would be defined in the approved verification sampling plan as specific locations requiring the soil to be excavated and removed to meet a specific cleanup standard.

2.2.2.4 Disposal at an Off-Site Licensed Waste Facility by Highway Transportation

LM proposes to use one of the following options for off-site waste disposal:

- Option 1: Waste Control Specialists (WCS) Facility – located in Andrews County, Texas
- Option 2: Energy*Solutions*' Clive Disposal Facility – located in Grantsville, Utah

Waste containers would be transported to the selected disposal facility utilizing DOT certified drivers and trucks. From the Shiprock disposal site, the total distance to WCS is approximately 588 miles (mi). The facility is licensed by the Texas Commission of Environmental Quality Radioactive Materials License. The license and its amendment authorize WCS to receive, possess, use, store, dispose and transfer radioactive material.

The Energy*Solutions'* Clive Disposal Facility is located approximately 389 mi from the Shiprock disposal site. The State of Utah administers the NRC program for licensing and permitting. The Clive Disposal Facility is licensed by the State of Utah Radioactive Materials License.

Once at the disposal site, waste would be handled in accordance with the facility's radioactive materials license and waste acceptance criteria.

2.2.3 Phase Three: Evaporation Pond and Retention Basin Regrading Temporary Facilities Removal and Demobilization

Once LM completes removing of the evaporation pond and associated waste disposal activities, verification sampling would be performed to verify the area can be released in accordance with the requirements of DOE Order (DOE O) 458.1 Change 4, *Radiological Protection of the Public and the Environment.*

Temporary support structures and facilities would be removed and clean fill would be brought to the site to backfill and regrade disturbed areas. . LM would consult with the Navajo Nation and others to develop the final state of the Shiprock evaporation pond and operations area.

2.3 Alternative 3 – Full Decommissioning and Disposal of the Existing Evaporation Pond at an Off-Site Licensed Waste Facility by Highway/Rail Transport

Under Alternative 3, LM would remove the evaporation pond according to the processes outlined in Section 2.2. However, under Alternative 3, LM would transport waste to the selected disposal site using a combination of haul trucks and gondola railcars. LM evaluated rail transportation for two proposed off-site waste disposal facilities. Routes that minimized traversing mountain passes, dense population centers, historic properties, critical environmental resources, and terrestrial ecological resources were given priority.

This evaluation identified the Gallup Energy Logistics Park (GELP) transload facility located at Mentmore, New Mexico, which is 90 mi south of the project site, as meeting the evaluation criteria and having the capability to support rail transport of pond decommissioning wastes to both WCS and Energy*Solutions*. The evaluation further revealed that shipping waste materials south to a truck-to-rail transload location at or near Mentmore, New Mexico, would be the safest method to transport wastes from the Shiprock disposal site to the selected waste disposal facility. The site is permitted for heavy industrial development and provides access to roads, rail, and utilities.

Haul trucks would transport waste to the GELP transload facility. From the transload facility, the waste would be transported to the selected waste repository(s) by Burlington Northern Santa Fe and Union Pacific railroads. LM proposes to use one of the following off-site waste disposal facilities for waste disposition under Alternative 3:

- WCS Facility – located in Andrews County, Texas
- Energy*Solutions'* Clive Disposal Facility – located in Grantsville, Utah

Waste transport activities at Mentmore would be located on a gravel pad. A crane would be mobilized. The crane would be used to remove the cover for railcars fitted with top covers. A prefabricated waterproof liner would then be placed in each gondola railcar. A telehandler would bring liners to the railcar for installation. The crane may also be used to help position the liner in each railcar.

Once the railcar has been lined, haul trucks arriving from the Shiprock disposal site would be guided into position near the crane. Once in position, the crane would lift the Super Sacks located in the haul truck trailers and relocate them into the gondola railcar. Once the railcar has been fully loaded and the liner secured, the crew would replace the gondola cover (if so equipped) and bolt the cover in place for shipment to the disposal site.

2.4 Alternatives Considered but Eliminated from Analysis

Table 2-1 briefly describes alternatives to the full decommissioning and disposal of the evaporation pond as well as disposal site alternatives that LM considered, along with the reasons for eliminating them from further analysis.

Table 2-1. Alternatives considered and reasons for elimination from further analysis

Alternative	Reason Eliminated from Further Evaluation
Cap Pond in Place	Capping pond in place would create a new disposal cell and LM lacks authority to create new UMTRCA disposal sites.
On-Site Disposal	On-site disposal would create a new disposal cell and LM lacks authority to create new UMTRCA disposal sites.
Leave the Existing Pond in Place and Replace the Pond Liner	Due to harsh weather conditions experienced at Shiprock (i.e., high summer temperatures, severe winter temperatures, and high winds), a replacement liner would not be expected to last more than 20 years once installed and would eventually degrade.
Waste Disposal at the Grand Junction Disposal Site	This waste disposal site was eliminated from further consideration due to water restrictions and disposal issues with the evaporation pond liner material. The proposed travel route would also transport waste through heavily populated wildlife corridors and would not meet the evaluation criteria discussed in Section 2.3.

Key: LM = DOE Office of Legacy Management; UMTRCA = Uranium Mill Tailings Radiation Control Act of 1978

3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section describes the existing conditions of resources that could be affected by implementing the proposed alternatives. The affected environment serves as the baseline for predicting changes that could occur if any of the alternatives under consideration are implemented. Discussion of the present day setting in this document is limited to environmental information that relates to the scope of decommissioning and disposing of the evaporation pond at the Shiprock disposal site. The level of detail varies depending on the potential for impacts for each resource area. This section summarizes several site-specific and recent project-specific documents that describe the affected environment and incorporates these documents by reference.

LM assessed the potential for impacts to environmental resources during the NEPA planning process. Several resource areas do not have the potential to be impacted by the proposed action or alternatives and are not discussed further in this EA. Table 3-1 lists environmental resources that LM identified as having no potential to be impacted and includes the bases for that assessment.

Table 3-1. Environmental resources having no potential to be impacted by the proposed action or alternatives

Resource	Basis for Not Evaluating
Coastal Barriers and Coastal Zone Resources	These resources are not present in New Mexico.
Prime and Unique Farmlands	The soils at the Shiprock facility do not meet the definition of prime and unique farmland, as defined by the Farmland Protection Policy Act of 1981, and the proposed alternatives do not require the conversion of farmland to nonfarm uses.
State or National Parks, Forests, Conservation Areas, or Other Areas of Recreational, Ecological, Scenic, or Aesthetic Importance	These resources are not present within the areas potentially impacted by the alternatives. The proposed alternatives would not affect these resources.
Wild and Scenic Rivers	According to the National Wild and Scenic Rivers System, New Mexico, has approximately 108,014 mi of river, of which 124.3 mi are designated as wild and scenic (https://www.rivers.gov/new-mexico.php). The designated Wild and Scenic River miles are not found in the northwestern portion of the state where the Shiprock disposal site is located.
Paleontological Resources	No paleontological resources are known to occur at the Shiprock disposal site.
Cultural Resources and Native American Tribal Resources	As noted in the March 14, 2023, LM letter to the Navajo Nation Heritage and Historic Preservation Department Historic Preservation Officer (see Appendix B), there are no historic properties present that would be affected by LM's decision regarding the evaporation pond.

Key: LM = DOE Office of Legacy Management; mi = mile

Resources that may be present and could be affected by the proposed alternatives are presented in the following sections. An important component in analyzing impacts is identifying or defining the geographic area in which impacts to resources are anticipated to occur. The area of impact, also referred to as the region of influence (ROI), is specific to the type of effect evaluated. The area potentially affected was determined by the scope of the individual alternatives, including all potential direct and indirect impacts associated with the project. The geographic boundaries for analysis of cumulative impacts in this EA vary for different resources and environmental media. The ROI for each evaluated resource is included the correlating sections hereafter.

3.1 Shiprock Disposal Site Location and Description

The Shiprock disposal site (Figure 1-1) is located within the Navajo Nation in northwestern New Mexico, approximately 30 mi west of Farmington. The Shiprock disposal site is on land owned by the Navajo Nation that is held in trust by the BIA. The site is within the city limits of Shiprock, which is the largest town in the Navajo Nation. A disposal cell containing uranium-mill tailings on the site is approximately 1 mi south of the center of the town of Shiprock at the junction of U.S. Highways 64 and 491. The site area is south of the San Juan River and extends from the disposal cell approximately 1 mi to the southeast and 1.5 mi to the northwest.

The site lies at an elevation of approximately 5,000 ft above sea level. The area receives approximately 7 in of average annual precipitation. Almost half of this precipitation falls in the form of brief, intense downpours during the southwest monsoonal storms that occur during July through October. Average annual snowfall is approximately 4 in per year. The arid desert climate and relatively thin air result in diurnal temperature variations of approximately 35 degrees Fahrenheit (°F). Summer maximum and minimum temperatures average in the 90s and 50s, respectively, while winter maximum and minimum temperatures average in the 40s and the teens. The record high is 109°F, and the record low is -26 °F (Western Region Climate Center, 2012).

This arid area in the southeast part of the Colorado Plateau has generally low local relief and is characterized by broad, desolate uplands and wide, sparsely vegetated valleys. Ship Rock, the prominent landmark approximately 10 mi southwest of the site, is a volcanic neck that rises approximately 1,700 ft above the upland area.

Topographic and hydrologic features divide the site into two regions known as the terrace and the floodplain. A northwest-trending shale cliff approximately 60 ft tall (known as the escarpment) exists approximately 200 ft north of the disposal cell and forms the boundary between the floodplain and the nearly flat terrace (Figure 1-2). Groundwater in the floodplain is hydrologically connected to the San Juan River and receives inflow from the terrace groundwater system. Bob Lee Wash and Many Devils Wash are two north-northeast trending drainages that cut through the terrace. Groundwater near the former mill site has a northerly flow toward Bob Lee Wash. The floodplain alluvial aquifer is bounded by the escarpment along its southern margin and by the San Juan River along its northern margin.

Several thousand people live in the area south of the San Juan River in the southern part of the sprawling unincorporated community of Shiprock. Land use is varied across the area. Grazing of sheep, goats, and cows occurs in the open lands southeast of the NECA gravel pit and in the upland area south of the disposal cell. The only perennial source of surface water available for these animals is the San Juan River. Grazing of cows and horses also occurs in the fields irrigated by water from the Helium Lateral Canal in the northwest part of the site. No grazing is allowed in the floodplain area immediately north of the disposal cell.

The project area (Figure 1-2) encompasses approximately 140 acres. Of that, approximately 104 acres (approximately 74 percent of the total project area) is highly disturbed with minimal vegetation (Carrizo, 2021a). Project activities would occur only in areas that have been previously disturbed.

The evaporation pond is the collection point for contaminated groundwater pumped from five floodplain and nine terrace extraction wells as part of the remediation system. As a result of the near-continuous pumping, groundwater accumulates as surface water in the pond, the depth of which varies depending on pumping rates or frequencies, and meteorological conditions. Subsequent and ongoing evaporation of the surface water and particulate settling has resulted in the formation of a layer of loose sediment, as well as a hardened sediment/rock salt layer (i.e., "hardened sediment") ranging from approximately 2- to 8-in-thick over the liner.

Chemical and radiological contaminants have been detected in both the surface water and hardened sediment in the evaporation pond. On November 29 and 30, 2022, composite sediment samples were taken from 11 different locations inside the evaporation pond and analyzed for chemical and radiological constituents. The analytical results from this sampling event are documented in Appendix E.

3.2 Air Quality

3.2.1 Affected Environment

Air and water emissions at the site are regulated under 40 CFR Part 192, Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings. This discussion of air quality includes criteria pollutants, hazardous air pollutants (HAPs), ambient air quality standards, emissions standards, emission sources, permitting, and greenhouse gases (GHGs). Air quality in a given location is defined by the concentration of various pollutants in the atmosphere. Many factors influence a region's air quality, including the type and amounts of pollutants emitted into the atmosphere, the size and topography of the affected air basin, and the prevailing meteorological conditions. Most air pollutants originate from human-made sources, including mobile sources (e.g., cars, trucks, and buses), stationary sources (e.g., factories, refineries, and power plants), and indoor sources (e.g., some building materials and cleaning solvents). Natural sources such as wildfires and fugitive dust also release air pollutants. Appendix F of this EA includes additional information regarding air quality standards, GHGs, and climate change.

The ROI for the air quality analysis includes the areas surrounding the Shiprock disposal site and GELP transload facility in McKinley County, as the highest ambient impacts from the proposed emissions would occur in proximity to these facilities. Air emissions from the project alternatives also would affect air quality along roadways or rail lines used to transport materials between these facilities and the locations of proposed disposal facilities. However, proposed emissions would be low and more dispersed within these transportation routes and would produce nominal ambient impact.

3.2.1.1 Nonradiological Air Emissions and Standards

EPA designates all areas of the United States as having air quality better than (attainment) or worse than (nonattainment) the National Ambient Air Quality Standards (NAAQS). Former nonattainment areas that have attained the NAAQS are designated as maintenance areas. Presently, EPA categorizes San Juan and McKinley Counties as in attainment of all NAAQS.

The Shiprock disposal site generates minor amounts of nonradiological air emissions due to the maintenance of the onsite remediation system. Sources mainly include gasoline- and diesel-powered on-road and nonroad vehicles and fugitive dust due to the operation of vehicles on unpaved surfaces.

3.2.1.2 Radiological Air Emissions and Standards

The Shiprock disposal site has the potential to emit radioactive materials and therefore, is subject to National Emission Standards for Hazardous Air Pollutants (NESHAP), Subpart H, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities" (EPA, 2021d). This regulation limits the radionuclide dose to a member of the public to 10 millirem (mrem) per year from the air pathway. Subpart H also establishes requirements for monitoring emissions from facility operations and analyzing and reporting of radionuclide doses. The Shiprock disposal site also controls onsite radionuclide emissions as part of the requirements of the *Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings* (40 CFR 192).

3.2.2 Environmental Consequences

Activities associated with the implementation of alternatives would result in air emissions of criteria pollutants, HAP, and GHGs. The following sections evaluate projected emissions relative to air quality conditions within the ROI and its applicable air pollution standards and regulations. Since the Shiprock region is classified in attainment for all NAAQS, the analysis compared estimates of project annual emissions to the EPA Prevention of Significant Deterioration (PSD) permitting threshold of 250 tons per year, and the HAP major source thresholds of 10 tons per year of an individual HAP, and 25 tons per year of combined HAP emissions. The PSD program was chosen as the source to define emission indicator thresholds for project activities within clean air areas because EPA uses this regulation to permit sources of pollutants in areas that attain NAAQS.

The major source HAP thresholds were chosen as the source to define emission indicator thresholds for project activities because EPA uses these thresholds to differentiate between area (minor) sources and major sources of HAP emissions. The comparison was then used to make an initial determination of the significance of potential impacts on air quality. If the annual emissions increase for the project are below a PSD or HAP threshold, the indication is that air quality impacts would be insignificant for that pollutant.

3.2.2.1 Alternative 1 – No Action Alternative

Under the No Action Alternative, maintenance activities would continue to generate minor amounts of short-term nonradiological air emissions while maintenance activities are taking place. Sources would include gasoline- and diesel-powered on-road and nonroad vehicles and fugitive dust from bare soils and the operation of vehicles on unpaved surfaces.

3.2.2.2 Alternative 2 – Full Decommissioning and Disposal of the Existing Evaporation Pond at an Off-Site Licensed Waste Facility via Highway Transport

Air quality impacts from Alternative 2 would occur from (1) combustive emissions due to the use of fossil-fuel-powered equipment, trucks, and worker commuter vehicles and (2) fugitive dust emissions (2.5 microns in diameter [$PM_{2.5}$] and 10 microns in diameter [PM_{10}]) from bare soils and the operation of vehicles and equipment on exposed soils. Equipment and vehicle activity data were used to estimate projected combustive and fugitive dust emissions. The analysis estimated calendar year air emissions from project activities for purposes of comparison to the applicable PSD and HAP indicator thresholds (air emission calculations presented in Appendix F).

Factors needed to derive project source emission rates were obtained from EPA Motor Vehicle Emission Simulator (MOVES3) model for nonroad equipment and on-road vehicles (EPA, 2021) and the EPA AP-42 document and *Western Regional Air Partnership Fugitive Dust Handbook* for fugitive dust sources (Countess Environmental, 2006). The analysis assumes that LM would implement protective measures to minimize the generation of fugitive dust during construction and to comply with applicable EPA and Navajo Nation EPA regulations. For example, implementation of these measures would reduce fugitive dust emissions from actively disturbed areas by up to 74 percent compared to uncontrolled levels (Countess Environmental, 2006).

Table 3-2 lists estimates of project year emissions that would occur from activities under Alternative 2. These data show that the combined total year pollutant emissions from all sources would be well below the annual indicator threshold of 250 tons per year for each pollutant. The WCS disposal option would generate higher total emissions compared to the Energy*Solutions* option since it is the furthest distance from the Shiprock disposal site.

As shown in Table 3-2, the maximum annual onsite emissions of any pollutant would be 4.43 tons per year of PM_{10} during project year 3. The intermittent release of these minor amounts of emissions would disperse to low concentrations once transported downwind to the Shiprock disposal site boundary. In addition, the intermittent operation of project trucks and worker commuter vehicles on public roads would contribute to low ambient pollutant concentrations at off-site locations. As a result, emissions from Alternative 2 would not contribute to an exceedance of an ambient air quality standard.

Combustion of fossil fuels in equipment, trucks, and worker commuter vehicles would emit nonradiological HAPs. Combined HAP emissions from diesel-powered internal combustion engines compose approximately 15 and 3 percent, respectively, of total VOCs and PM_{10} emissions (California Air Resources Board, 2023). The main HAPs emitted from these sources, in order of decreasing mass are formaldehyde, acetaldehyde, benzene, toluene, and propionaldehyde. The analysis estimated that onsite HAPs emissions from Alternative 2 would peak in project year 2 at 0.06 ton per year, well below the thresholds of 10 tons per year for an individual HAP and 25 tons per year for combined HAPs. In addition, fugitive dust would contain trace amounts of HAPs. However, the intermittent release of these minor amounts of emissions would quickly disperse to low concentrations. Therefore, HAP emissions from Alternative 2 would not result in adverse air quality impacts.

Table 3-2. Emissions summary for activities from Shiprock Alternative 2

Scenario/Activity	Air Pollutant Emissions(tons)						CO_2e (MT)
	VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	
Year 1 [a]							
On-Road Vehicles – Onsite	0.00	0.04	0.01	0.00	0.00	0.00	17
On-Road Vehicles – Offsite	0.04	0.44	0.06	0.00	0.01	0.00	120
Nonroad Equipment	0.15	0.61	1.36	0.00	0.07	0.07	900
Fugitive Dust					3.40	0.34	
Onsite Total – Year 1	**0.15**	**0.65**	**1.37**	**0.00**	**3.48**	**0.42**	**920**
Offsite Total – Year 1	**0.04**	**0.44**	**0.06**	**0.00**	**0.01**	**0.00**	**120**
Combined Total Year 1	**0.19**	**1.09**	**1.44**	**0.00**	**3.49**	**0.42**	**1,040**
Year 2 [b]							
On-Road Vehicles – Onsite	0.00	0.05	0.02	0.00	0.00	0.00	23
On-Road Vehicles (Non-waste) – Offsite	0.07	1.04	0.33	0.00	0.03	0.01	350
Nonroad Equipment	0.37	1.39	3.25	0.00	0.16	0.15	2,200
Fugitive Dust					2.78	0.30	
Waste Haul Truck to WCS TX – Offsite	0.17	4.98	3.12	0.02	0.17	0.03	2,230
Waste Haul Truck to Energy*Solutions* in Clive, UT – Offsite	0.13	3.88	2.43	0.01	0.13	0.03	1,700
Onsite Total – Year 2	**0.38**	**1.44**	**3.26**	**0.01**	**2.94**	**0.45**	**2,230**
WCS Option – Combined Total 2	**0.62**	**7.46**	**6.72**	**0.02**	**3.15**	**0.49**	**4,800**
Energy*Solutions* Option – Combined Total Year 2	**0.58**	**6.36**	**6.03**	**0.02**	**3.11**	**0.48**	**4,300**
Year 3 [c]							
On-Road Vehicles – Onsite	0.00	0.02	0.01	0.00	0.00	0.00	11
On-Road Vehicles – Offsite	0.04	0.47	0.06	0.00	0.01	0.00	120
Nonroad Equipment	0.09	0.38	0.72	0.00	0.04	0.04	1
Fugitive Dust					4.40	0.42	
Onsite Total – Year 3	**0.09**	**0.40**	**0.73**	**0.00**	**4.43**	**0.46**	**13**
Offsite Total – Year 3	**0.04**	**0.47**	**0.06**	**0.00**	**0.01**	**0.00**	**120**
Combined Total Year 3	**0.13**	**0.87**	**0.79**	**0.00**	**4.45**	**0.46**	**140**
All Years							
WCS Option – Total Emissions	**0.95**	**9.43**	**8.95**	**0.03**	**11.09**	**1.37**	**6,000**
Energy*Solutions* Option – Total Emissions	**0.91**	**8.33**	**8.26**	**0.03**	**11.05**	**1.37**	**5,500**

Key: CO = carbon monoxide; CO_2e (MT) = carbon dioxide equivalent in metric tons; NO_x = nitrogen oxides; $PM_{2.5}$ = 2.5 microns in diameter; PM_{10} = 10 microns in diameter; SO_2 = sulfur dioxide; TX = Texas; UT = Utah; VOC = volatile organic compounds; WCS = Waste Control Specialists

[a] Includes stormwater retention basin reconfiguration and waste packaging structure area installation (evaporation pond early work).

[b] Includes excavating the pond, pond waste packaging/loading area, loading and transport of waste by truck to disposal sites.

[c] Activities include removing temporary structures and final site recontouring.

Note: 0.00 = emissions <0.005 but greater than zero tons per year. Blank table cells mean no emissions of that pollutant.

3.2.2.3 Alternative 3 – Full Decommissioning and Disposal of the Existing Evaporation Pond at an Off-Site Licensed Waste Facility via Highway/Rail Transport

Alternative 3 would conduct the same remediation activities on the Shiprock disposal site as proposed for Alternative 2, but would use a combination of truck and rail to transport wastes to the selected disposal facility.

Table 3-3 presents estimates of emissions that would occur in project year 2 from activities under Alternative 3, which include emissions from the transport of waste by truck to the GELP Transload Facility and then by train to the selected disposal site. Otherwise, emissions in project years 1 and 3 would be the same as those estimated for Alternative 2. The data in Table 3-3 show that, similar to Alternative 2, project year 2 air emissions from each disposal option would remain well below the annual PSD permitting threshold of 250 tons per year and the 10 tons per year single HAP and 25 tons per year combined HAP major source thresholds. These data also show that train transport of waste would result in higher emissions of most criteria pollutants but lower carbon dioxide equivalent (CO_2e) versus transport by truck.

Similar to Alternative 2, emissions from Alternative 3 would not contribute to an exceedance of an ambient air quality standard or result in adverse HAP impacts. In addition, due to the minor amounts of emissions that would occur within the GELP transload facility, Alternative 3 would not result in adverse air quality impacts at this location.

Table 3-3. Emissions summary for year 2 activities from Shiprock Alternative 3

Scenario/Activity	**Air Pollutant Emissions(tons)**						**CO_2e (MT)**
	VOC	**CO**	**NO_x**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**	
Year 2 [a]							
On-Road Vehicles – Onsite	0.00	0.05	0.02	0.00	0.00	0.00	23
On-Road Vehicles (Non-waste) – Offsite	0.07	1.04	0.33	0.00	0.03	0.01	350
Nonroad Equipment	0.37	1.39	3.25	0.00	0.16	0.15	2,200
Fugitive Dust					2.78	0.30	
Waste Haul Trucks to GELP – Offsite	0.03	0.77	0.48	0.00	0.03	0.01	350
Worker Truck Trips to GELP – Offsite	0.00	0.04	0.00	0.00	0.00	0.00	10
Nonroad Equipment – GELP	0.02	0.07	0.20	0.00	0.01	0.01	89
Fugitive Dust – GELP					0.55	0.05	
Train Transport of Waste – GELP to WCS	0.32	3.09	8.60	0.01	0.19	0.18	1,080
Train Transport of Waste – GELP to Energy*Solutions*	0.28	2.67	7.44	0.01	0.16	0.16	930
Onsite Total – Year 2	**0.38**	**1.44**	**3.26**	**0.01**	**2.94**	**0.45**	**2,200**
WCS Option – Combined Total Year 2	**0.82**	**6.45**	**12.88**	**0.02**	**3.75**	**0.71**	**4,100**
Energy*Solutions* Option – Combined Total Year 2	**0.77**	**6.03**	**11.72**	**0.02**	**3.72**	**0.68**	**4,000**
All Years							
WCS Option – Total Emissions	**1.14**	**8.41**	**15.11**	**0.03**	**11.69**	**1.59**	**5,300**
Energy*Solutions* Option – Total Emissions	**1.10**	**7.99**	**13.95**	**0.03**	**11.66**	**1.57**	**5,100**

Key: CO = carbon monoxide; CO_2e (MT) = carbon dioxide equivalent in metric tons; GELP = Gallup Energy Logistics Park; NO_x = nitrous oxide; $PM_{2.5}$ = 2.5 microns in diameter; PM_{10} = 10 microns in diameter; SO_2 = sulfur dioxide; VOC = volatile organic compounds; WCS = Waste Control Specialists

[a] Includes excavating the pond, pond waste packaging, loading and storage, and transporting waste by truck to the GELP transload facility, and transport of waste by train to disposal sites.

Note: 0.00 = emissions <0.005 but greater than zero tons per year. Blank table cells mean no emissions of that pollutant.

3.3 Biological and Natural Resources

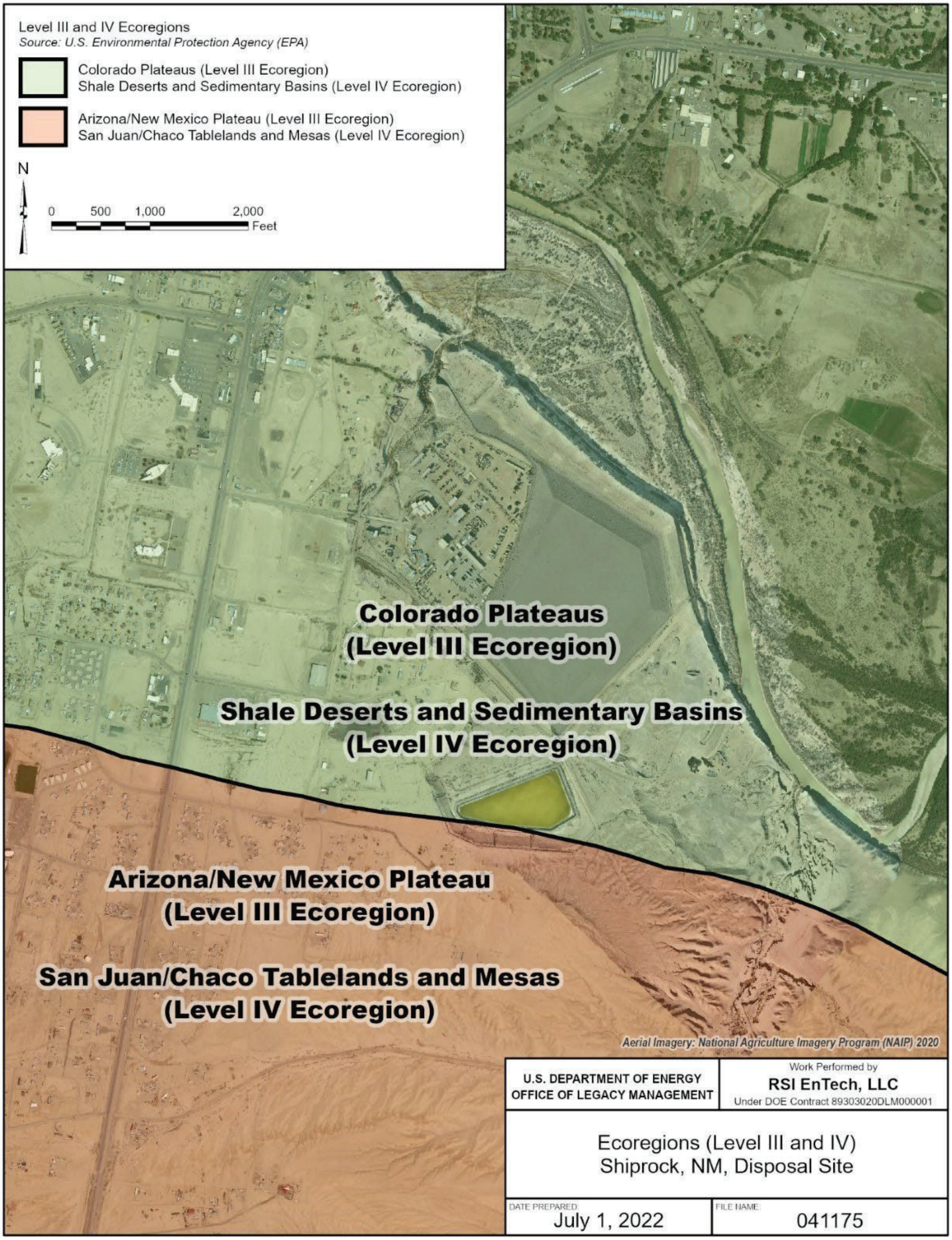
3.3.1 Affected Environment

Most of the Shiprock disposal site is within the Colorado Plateau Level III Ecoregion and the Shale Deserts and Sedimentary Basins Level IV ecoregion (see Figure 3-1). The Colorado Plateau is an uplifted, eroded, and dissected tableland with benches, mesas, buttes, salt valleys, cliffs, and canyons; the Shale Deserts and Sedimentary Basins are composed mainly of shrubland, grassland, and badlands with sparse vegetation. Part of the site is also within the Arizona/New Mexico Plateau Level III Ecoregion and the San Juan/Chaco Tablelands and Mesas Level IV Ecoregion. The Arizona/New Mexico Plateau is a transitional area between dry shrublands and wooded tablelands to the north; hotter, less vegetated deserts to the south; and semiarid grasslands to the east. The San Juan/Chaco Tablelands and Mesas ecoregion contains a mix of desert scrub, semi-desert shrub-steppe, and semi-desert grasslands.

Ecological communities have been characterized on and near the Shiprock disposal site and are dominated by several types of saltbush (*Atriplex* spp.), rubber rabbitbrush (*Ericameria nauseosa*), and greasewood (*Sarcobatus vermiculatus*), with an understory of grasses and herbaceous plants that include pollinator-friendly perennials and invasive, annual weeds (DOE, 2020a). Floodplain, terrace, and wash communities are found on and near the Shiprock disposal site. The floodplain community is found on the relatively flat, low-lying areas along the banks of the San Juan River. Terrace communities are in upland areas above the floodplains that include the disposal site, NECA yard, evaporation pond, gravel pits, private residences, and clay hills. Portions of Bob Lee Wash and Many Devils Wash are mostly barren of vegetation, but other areas support species common in both the floodplain and terrace ecosystems. Lower Bob Lee Wash and the floodplain also support some wetland areas.

Ecological inventories associated with the Shiprock disposal site were performed in the 1980s in association with site remediation (DOE, 1984) and later with groundwater remediation projects (DOE, 1996; DOE, 2000a; DOE, 2001). Conditions have changed since that time, so site ecological inventories were updated in 2020 and 2021 (Carrizo, 2020; Carrizo, 2021a; Carrizo, 2021b; DOE, 2021). Although some inventories were performed specifically for work in and near Many Devils Wash, they include an analysis of species in the surrounding area and are applicable to the proposed alternatives.

The ROI for biological and natural resources includes land within the project boundary and specific areas outside the project boundary that contain wildlife that could be affected by the work. This includes land immediately surrounding the work area and the San Juan River near and downstream of the site. Plants growing within the work area and animals that live, nest, forage, or migrate through the work area are within the ROI. Nearby areas are also included because human disturbance (e.g., noise, dust, introduction of noxious weeds) could potentially affect wildlife or plant habitat. Nearby wetlands, riparian areas, and the San Juan River could be affected by changes in water volumes or water quality, and areas downstream of the site within the San Juan River could be affected by water depletions.



1
2 *Figure 3-1. Ecoregions of the Shiprock disposal site*

3.3.1.1 Special-Status Species

Special-status species include those listed by U.S. Fish and Wildlife Service (USFWS) as threatened or endangered under the Endangered Species Act of 1973 (ESA) (16 USC 1531), species that are candidates for listing (USFWS, 2022) and designated critical habitat. Species listed by the Navajo Nation as endangered (Navajo Nation, 2020) or sensitive (Navajo Nation, undated) are also special-status species, and most are protected by Navajo Nation laws. Most species of birds in the United States are classified as migratory birds (some migrate, and some do not), and they are protected under the Federal Migratory Bird Treaty Act of 1918 (16 USC 703). Most migratory birds protected under the Act are not special-status species. Migratory birds that are also special-status species include bald and golden eagles (with special status under the Federal Bald and Golden Eagle Protection Act) and species listed by USFWS as Birds of Conservation Concern (USFWS, 2021). There is no nesting habitat for bald or golden eagles near the project area, but these birds could travel through or forage at the site.

Designations of special-status species by the State of New Mexico or other Federal agencies (e.g., the U.S. Bureau of Land Management) are not applicable on the Navajo Nation. Appendix G includes a table of special-status species potentially present on or near the project area. Although the site is within range of the yellow-billed cuckoo (*Coccyzus americanus*) and Mancos milkvetch (*Astragalus humillimus*), no suitable habitat is present for these ESA-listed species, so they are excluded from the table in Appendix G. Aside from those species listed in Appendix G, no birds of conservation concern are likely to be present (USFWS, 2022).

Critical habitat for two endangered fish species is found in areas adjacent to or downstream from the Shiprock disposal site: the Colorado Pikeminnow and Razorback Sucker. Neither species is present on the site, but USFWS has determined that water depletions have the potential to cause downstream effects, and water quality changes could adversely affect fish or their critical habitat.

Other than Mesa Verde cactus, no other species or critical habitats protected under the ESA are known to occur within the project boundary. Mesa Verde cactus grows along the main road and in other areas between the evaporation pond and Many Devils Wash, but these areas are not in the proposed work area shown in Figure 1-2 (Carrizo, 2021a).

Some species are listed by the Navajo Nation (shown in Appendix G) and under the ESA. LM is consulting with the Navajo Nation for those species and for those that are only Navajo Nation listed. The latter could be present in the project area during certain times of the year and would be addressed under guidelines provided by the Navajo Nation during the consultation.

3.3.1.2 Vegetation

Three ecological communities have been identified in and near the project area—floodplain, terrace, and wash communities—with transitional areas in between. Most of the project area is sparsely vegetated with recently disturbed soils. In other areas, soils are relatively undisturbed and may support Mesa Verde cactus, a special-status species described in Section 3.3.1.1. Appendix G contains a list of plant species found regularly in and near the project area. Species that have been observed infrequently over time are not included. Many of the species in Appendix G are culturally significant to Navajo people. The evaporation pond and areas immediately surrounding it are highly disturbed with minimal vegetation (Carrizo, 2021a).

3.3.1.3 Wildlife

Due to its disturbed nature and proximity to homes and businesses, the project area generally does not contain high quality wildlife habitat. However, many species of mammals, birds, invertebrates, and reptiles may be found on and near the project area. This is especially true of the floodplain, which provides habitat, cover, and water sources.

Mammals recently observed on and near the project area include black-tailed jackrabbits (*Lepus californicus*), cottontail rabbits (*Sylvilagus* sp.), coyotes (*Canis latrans*), gray foxes (*Urocyon cinereoargenteus*), and mule deer (*Odocoileus hemionus*). Small rodents such as prairie dogs and ground squirrels have also been observed. Birds that have been commonly observed in the area are American crows (*Corvus brachyrhynchos*), black-chinned hummingbirds (*Archilochus alexandri*), cliff swallows (*Petrochelidon pyrrhonota*), common ravens (*Corvus corax*), horned larks (*Eremophila alpestris*), and red-tailed hawks (*Buteo jamaicensis*). Small reptiles are found in the project area, especially collared lizards (*Crotaphytus collaris*) and western fence lizards (*Sceleporus occidentalis*). Rattlesnakes (*Crotalus* spp.) have been observed in the area.

Native bees, wasps, beetles, flies, moths, and butterflies are among the region's invertebrates, some of which are important pollinators.

Navajo Dam, upstream from the Shiprock disposal site, and multiple diversions between the dam and Shiprock, have severely altered the ecosystems of the San Juan River. In the Shiprock area, introduced game species such as channel catfish (*Ictalurus punctatus*) are abundant. Some habitat still exists in the river for native species such as speckled dace (*Rhinichthys osculus*) and mottled sculpin (*Cottus bairdii*).

3.3.2 Environmental Consequences

3.3.2.1 Alternative 1 – No Action Alternative

Effects to wildlife under this alternative would be negligible. No construction would occur, and the evaporation pond would remain in place. Institutional controls at the site, including entrance gates along with the perimeter fence and signs, would continue to be maintained in accordance with applicable requirements. Wildlife and domestic animals would continue to be excluded from the pond by chain link fencing. Noxious weeds and nuisance animals (e.g., prairie dogs whose burrows might threaten the integrity of the pond's berm) would continue to be controlled within the fence.

Alternative 1 would have no impacts to special-status species. No special-status species are known to exist within the evaporation pond fence.

The vegetation community would continue to slowly develop within the fence. In decades' time, the vegetation community could develop into a higher diversity, later-successional community with greater value to wildlife. However, institutional controls at the site, such as maintenance of the perimeter fence, would continue to exclude wildlife from the area, negating any indirect beneficial impact to wildlife from improved ecological quality of vegetation.

Large wildlife would continue to be excluded from the evaporation pond area. Small rodents would continue to burrow in the area, but rodents would continue to be controlled in areas that threaten the integrity of the pond's berm. Existing habitat characteristics of the previously disturbed areas and the species supported by these habitat types would be left unchanged.

3.3.2.2 Alternative 2 – Full Decommissioning and Disposal of the Existing Evaporation Pond at an Off-Site Licensed Waste Facility via Highway Transport

Under Alternative 2, proposed activities would occur only in areas that have been previously disturbed.

Based on current habitat conditions present at the Shiprock disposal site, no adverse impacts are expected for special-status species. The impacts to special-status species under Alternative 2 would be indiscernible from the impacts expected under Alternative 1.

No special-status species are known to exist within the evaporation pond fence, along access routes to the pond, or in other areas where activities are proposed. While some parts of the project area could contain marginal nesting habitat for Navajo-Nation listed endangered bird species, project controls, such as performing surveys for special-status species and establishing buffer zones around sensitive habitats, would be applied as required, avoiding impacts to these species. A consultation with the Navajo Nation Department of Fish and Wildlife has been initiated to determine what species may occur within the project site and what planning for avoidance may be required.

Water consumption could potentially affect Colorado pikeminnow and razorback sucker and their habitat within the San Juan River near, and downstream of, the project area. However, water depletions are not expected to exceed volumes already considered by USFWS for routine activities as evaluated in the October 2019 *Programmatic Biological Assessment of Threatened and Endangered Species for the U.S. Department of Energy Office of Legacy Management Activities at Sites in the San Juan River Subbasin* and the Biological Opinion issued by USFWS on March 8, 2019. In that Biological Opinion, USFWS stated that water depletions less than 39.98-acre-ft per year for LM sites in the San Juan River basin qualify as minor depletions.

Water usage for Alternative 2 activities is conservatively estimated to be 29-acre-ft for the duration of the project (see Table 3-11). Site water usage is essentially shifting from one set of activities (routine activities including groundwater evaporation) to another set of activities (dust control, decontamination, and pond sediment stabilization) with no new depletions, resulting in no impacts to the endangered fish in the San Juan River), LM would conduct an informal consultation with USFWS to ensure this approach is appropriate and to ensure there are no potential impacts from water depletions at the proposed volumes. Although the Colorado pikeminnow and razorback sucker are also listed as endangered by the Navajo Nation, LM's consultation with USFWS would ensure that potential impacts to these species are addressed. No other Navajo-Nation listed species would potentially be affected by water depletions associated with the project.

Soil disturbance causes direct vegetation loss, fragments plant communities, and reduces habitat quality. Indirectly, soil disturbance increases the introduction of weeds into adjacent undisturbed plant communities. Regular traffic can also cause native plant losses and weed invasions. Following decommissioning and disposal of the evaporation pond, the area would be recontoured and stabilized. Project controls and BMPs, such as limiting surface disturbance and monitoring, controlling invasive and non-native vegetation, and other mitigation measures as determined by the Navajo Nation endangered species consultation would be used to minimize and eradicate the establishment and spread of invasive (vegetative) species.

Alternative 2 would result in short-term direct impacts to vegetation from soil disturbance, excavation, vehicle traffic, and other project activities. In the long-term, vegetation would re-establish to an early-successional, low-diversity plant community similar to current baseline conditions. The early-successional community could persist for decades until later-successional plants became established.

Alternative 2 has the potential to disturb wildlife in and adjacent to the project area. Pre-construction bird surveys would be conducted prior to the start of work to ensure no nesting birds are present in project area. Wildlife inhabiting the project area, including foraging birds, would be displaced during decommissioning as vegetation is removed and soil is disturbed. Displaced wildlife would most likely occupy adjacent habitat. Following stabilization activities, some displaced wildlife would return to new habitat within the project area. Larger wildlife species moving through the project area would be temporarily disturbed during construction activities but would most likely continue using adjacent areas for foraging and migration.

Potential vehicle collisions with wildlife could occur, but the short duration and small number of haul trucks and other vehicles would make the risk of impacts negligible. Implementing Alternative 2 would result in the direct loss of vegetation and associated indirect impacts to habitat, soils, and wildlife, but would not cause loss of protected or sensitive species, or loss of local populations from direct mortality or diminished survivorship. The previously mentioned impacts associated with Alternative 2 would last primarily during the period of active decommissioning. Overall, the localized impacts on wildlife would range from negligible to minor.

3.3.2.3 Alternative 3 – Full Decommissioning and Disposal of the Existing Evaporation Pond at an Off-Site Licensed Waste Facility via Highway/Rail Transport

Alternative 3 is the same as Alternative 2 except that rail would also be used in addition to highway transport of waste to the selected disposal facility. Impacts would be the same as those for Alternative 2. The rail loading area is in an industrial zone with few natural resources, so impacts to biological and natural resources under Alternative 3 would not differ substantially from Alternative 2.

3.4 Socioeconomics and Environmental Justice

3.4.1 Affected Environment

3.4.1.1 Socioeconomics

The Shiprock disposal site is located in Shiprock census-designated place (CDP) on the Navajo reservation in San Juan County, New Mexico, United States. Therefore, Shiprock CDP is defined as the ROI for the socioeconomic analysis in this EA with details on San Juan County, New Mexico, and the United States for comparison, where applicable.

Demographics

The population of Shiprock CDP was 7,718 people in the 2020 census, a decline of 577 people from the 8,295 of the 2010 census (U.S. Census Bureau, 2023). San Juan County also experienced a decline in population during the same time period compared to the state of New Mexico and the United States which both experienced an increase in population (see Table 3-4).

Table 3-4. Population estimates in the region of influence (ROI)

Area	Census 2010	Census 2020	Average Annual Percent Change (2010–2020)
Shiprock CDP	8,295	7,718	-0.7%
San Juan County	130,044	121,661	-0.7%
New Mexico	2,059,179	2,117,522	0.3%
United States	308,745,538	331,449,281	0.7%

Source: (U.S. Census Bureau, 2023)
Key: CDP = census-designated place

Nearly 100 percent of the Shiprock residents are members of the Navajo Nation and refer to themselves as “Diné,” which means Navajo people. The Shiprock population has a “Language other than English spoken at home” average of 52.9 percent compared to the national average of 21.7 percent (U.S. Census Bureau, 2023). Navajo is commonly spoken as a primary language by many Diné throughout the community. The 2020 Census total population results for the National Congress of American Indians, Navajo Region, was 165,158, a decline from 173,667 in 2010 (NCAI, 2021).

Housing

There are approximately 2,872 housing units in Shiprock CDP of which 547 are vacant (U.S. Census Bureau, 2021a). Just more than half of the occupied housing units in the Shiprock CDP were owner occupied (51.8 percent). The median value of an owner-occupied home in Shiprock CDP was $77,700 which was lower than San Juan County ($155,000), the state of New Mexico ($184,800), and the United States ($244,900) (U.S. Census Bureau, 2021a).

Economic Activity

An estimated 3,150 people over 16 years of age were employed in Shiprock. Median household income and per capita income in Shiprock were lower than San Juan County, the state of New Mexico, and the United States. As shown in Table 3-5, the unemployment rate and the percentage of persons in poverty were higher in Shiprock CDP than San Juan County, the State of New Mexico, and the United States (U.S. Census Bureau, 2021b).

Table 3-5. Selected economic characteristics in the region of influence (ROI)

Area	Total Employed	Median Household Income	Per Capita Income	Unemployment Rate (percent)	Persons in poverty (percent)
Shiprock CDP	3,150	$37,228	$18,126	14.4%	26.0%
San Juan County	45,759	$47,485	$22,857	8.2%	23.5%
New Mexico	889,428	$54,020	$29,624	6.6%	18.3%
United States	157,510,982	$69,021	$37,638	5.5%	12.6 %

Source: (U.S. Census Bureau, 2021b)
Key: CDP = census-designated place
[a] Values in 2021 dollars

The estimated mean work commute for workers over the age of 16 in Shiprock CDP was 24.2 minutes, which is a longer mean time than San Juan County (23.8 minutes) and the State of Mexico (22.9 minutes), but shorter mean time than the United States (26.8 minutes) (U.S. Census Bureau, 2023).

Under the action alternatives, there would be approximately 36 personnel (24 subcontractors and 12 DOE prime contractor staff) employed at the Shiprock disposal site. This would comprise approximately 1.1 percent of the total employment in Shiprock CDP, which would be a negligible contribution to the local environment. Direct employment at the Shiprock disposal site also creates additional, or indirect, employment in the ROI.

Public Services

Public services, including medical facilities, police departments, and fire protection, are available in Shiprock. Local emergency medical and law enforcement are briefed on the scope of work at the Shiprock disposal site during the long-term surveillance and maintenance phase (DOE, 1994). The Northern Navajo Medical Center, located in Shiprock, is the nearest hospital to the disposal site and is located approximately 3 mi north of the disposal site. The hospital is a 60-bed medical center providing primary and specialty care services with an emergency room and trauma center (U.S. Department of Health and Human Services, 2023).

Education

The Central Consolidated School District serves approximately 6,000 students in 15 schools, plus early childhood preschools, throughout the communities of Kirtland, Ojo Amarillo, Newcomb, Naschitti, and Shiprock, New Mexico (Central Consolidated School District, 2023). The Shiprock population's educational attainment rate of 85.4 percent high school graduates or higher is similar to the national average of 88.9 percent (U.S. Census Bureau, 2023). Approximately 80 percent of households have at least one computer present; 55.8 percent of households have broadband internet access (U.S. Census Bureau, 2023).

3.4.1.2 Environmental Justice

Executive Order (EO) 12898, which was recently reaffirmed by EO 13985, directs Federal agencies to make "achieving environmental justice a part of its mission" by "identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." In accordance with EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, EPA recommends the lead agency and project proponent pay particular attention to worksite proximity in places where children live, learn, and play, such as homes, schools, and playgrounds.

Nearly 100 percent of the population in Shiprock where the proposed action would be located are Diné, which is a minority population by definition. With 29 percent of the Diné living in poverty, nearly one-third also meet the definition of a low-income population.

3.4.2 Environmental Consequences

3.4.2.1 Socioeconomics

Alternative 1 – No Action Alternative

Under the No Action Alternative, the evaporation pond would remain in place and would involve the same level of maintenance. Socioeconomic conditions and trends would be unchanged from those described in Section 3.4.1.

Alternative 2 – Full Decommissioning and Disposal of the Existing Evaporation Pond at an Off-Site Licensed Waste Facility via Highway Transport

The potential impacts to socioeconomic resources under this alternative would be negligible compared to the No Action Alternative. The number of full-time personnel under this alternative would be nearly the same as under the No Action Alternative (see Table 3-6) because no additional full-time employment would be created under any proposed alternative and would not change significantly over baseline conditions. As such, there would be no change to demographics, housing, economic activity, public services, and educational services under this alternative. There would be potential for long-term benefits to Shiprock CDP residents from excavation and off-site disposal of the generated waste, which would eliminate any potential for human exposure from contaminated sediments. There would also be potential for positive impacts if the land is reverted to the community for use.

Table 3-6. Number of full-time personnel by alternative

Alternative	Subcontractors	DOE Prime Contractor	Total
Alternative 1	24	12	36
Alternative 2	24[a]	12	36
Alternative 3	24[a]	12	36

[a] Includes Pre-Stage, Pond Excavation, Process, and Facilities Removal and Restoration

Alternative 3 – Full Decommissioning and Disposal of the Existing Evaporation Pond at an Off-Site Licensed Waste Facility via Highway/Rail Transport

Potential socioeconomic impacts under Alternative 3 would be similar to those described under Alternative 2 (see Table 3-6). Therefore, potential impacts to socioeconomic resources would be negligible under this alternative, compared to the No Action Alternative.

3.4.2.2 Environmental Justice

As part of the environmental justice analysis, a geographic distribution of low-income and minority populations in the affected area is undertaken, followed by a determination if the proposed project would produce human health or environmental impacts that are disproportionately high and adverse. If impacts are disproportionately high and adverse, a determination is made as to whether these impacts disproportionately affect low-income or minority populations. EO 12898 requires Federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their actions, programs, or policies on minority and low-income populations. Due to visual impacts from the No Action Alternative 1, minority and low-income populations within the ROI, by definition, could be impacted. However, as presented in Table 3-6, there are no identified low-income or minority populations within the ROI or project boundary area other than DOE contractors and subcontractors.

3.4.2.2.1 Alternative 1 – No Action Alternative

No disproportionately high or adverse effects would occur to minority or low-income populations as a result of Alternative 1 because no minority or low-income populations were identified within the ROI and project boundary.

3.4.2.2.2 Alternative 2 – Full Decommissioning and Disposal of the Existing Evaporation Pond at an Off-Site Licensed Waste Facility via Highway Transport

Effects on area residents and communities outside of the ROI are described in Sections 3.4 (Socioeconomics) and 3.9 (Visual Resources). However, no disproportionately high or adverse effects would occur to minority or low-income populations as a result of Alternative 2 because no minority or low-income populations were identified within the ROI or project boundary.

3.4.2.2.3 Alternative 3 – Full Decommissioning and Disposal of the Existing Evaporation Pond at an Off-Site Licensed Waste Facility via Highway/Rail Transport

Environmental justice impacts under Alternative 3 would be similar to Alternative 2.

3.5 Geology and Soils

3.5.1 Affected Environment

3.5.1.1 Geologic Setting

The Shiprock disposal site is located in the San Juan structural basin on the eastern edge of the Colorado Plateau. Covering an area of approximately 22,000 square mi, the San Juan Basin is a northwest-trending asymmetric structural depression formed during the Laramide orogeny in the Late Cretaceous to early Tertiary periods (Robertson et al., 2016). Bedrock in the basin is comprised of a 2.5-mi-thick sequence of very gently dipping sedimentary rocks overlying a Precambrian basement complex.

The ROI can be defined as the project boundary shown in Figure 1-2.

The relevant stratigraphy of the evaporation pond area of the Shiprock disposal site consists of late Cretaceous Mancos Shale overlain by unconsolidated Quaternary alluvial deposits and windblown sediments known as loess (Figure 3-2). The Cretaceous Mancos Shale comprises the bedrock at the Shiprock disposal site (evaporation pond area) and consists of light to dark gray, calcareous marine mudstone with interbedded clay layers extending up to 900 ft thick. The upper 5 to 10 ft of the Mancos Shale at the site is generally considered to be more weathered and transmissive than the underlying more competent rock, though some evidence of weather has been observed at around 30 ft thick in some areas (DOE, 2000). The weathered Mancos interval is soft and resembles colluvium, whereas the underlying competent Mancos is well-bedded and consolidated, with only slight signs of weathering.

The Mancos Shale is overlain by unconsolidated Quaternary alluvial deposits consisting of sediments from the ancestral San Juan River. Terrace alluvial deposits are typically 10 to 20 ft thick and primarily comprised of well-rounded gravel, cobbles, and boulders with a silty and sandy matrix. A fining-upward sequence is typically observed in the alluvium, with the coarsest deposits appearing at the base, where cobbles 1 ft in diameter are common (DOE, 2000; DOE, 2011a). South and southwest of the former mill in the east terrace area (including the evaporation pond site), terrace alluvium is covered by eolian silt, or loess, which increases in thickness with proximity to the buried bedrock escarpment (Figure 3-2). An elongate, northwest-trending area directly west of the evaporation pond contains an even thicker sequence of alluvial sediments which were deposited by an ancestral channel of the San Juan River. This elongate area contains a greater thickness of saturated sediments than anywhere else on the terrace.

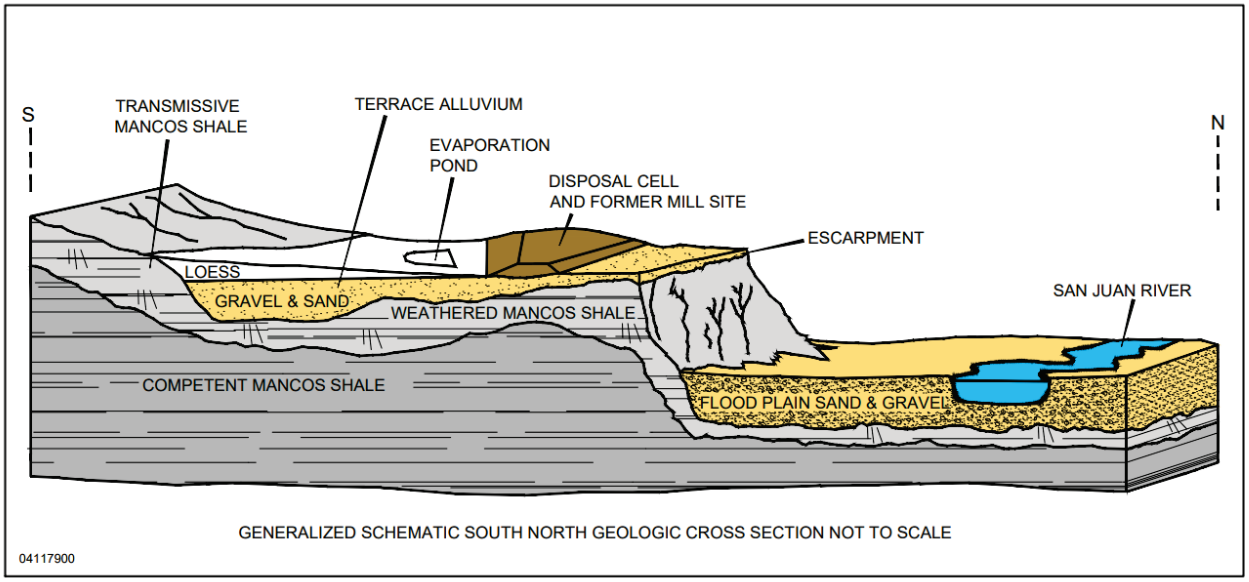


Figure 3-2. Geologic cross-section block diagram for the Shiprock disposal site terrace and floodplain

Eolian loess was deposited above the terrace alluvium in the evaporation pond area. The loess is composed mainly of silt with small amounts of very fine-grained sand, clayey silt, and sandy clay, and has accumulated in deposits as thick as 30 ft in some areas of the site. Loess deposits sit directly beneath the evaporation pond liner and were compacted and conditioned to provide a low permeability sub-base with the intent to eliminate the need for a second pond liner layer (DOE, 2002a; DOE, 2002b). Other unconsolidated deposits on the terrace include areas of fill (reaching up to 25 ft thick) placed within ancestral drainages along the terrace escarpment during site reclamation activities, and thin deposits of salt (efflorescent crusts) that are primarily observed in Many Devils Wash and along the escarpment where groundwater seepage occurs (DOE, 2000b).

3.5.1.2 Soil Resources

Soils in the area of the evaporation pond in the southeastern region of the terrace consist of Tocito silt loam (1 to 3 percent slopes). The Blackstone-Camac-Rock outcrop complex (0 to 60 percent slopes) makes up the northern region of the terrace, and the Bebeevar-Walrees complex (0 to 2 percent slopes) comprises the soils of the floodplain (Figure 3-3) (USDA, 2022).

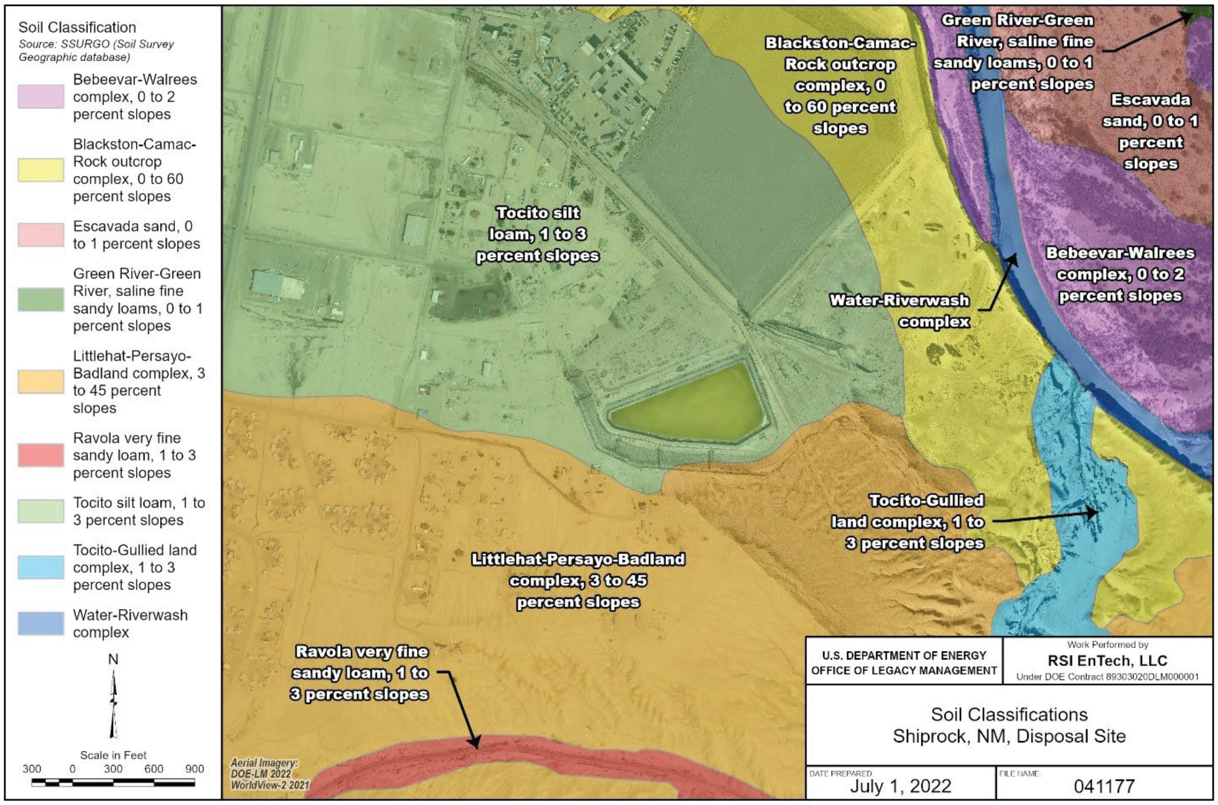


Figure 3-3. Soil classifications in the vicinity of the Shiprock disposal site evaporation pond

The Tocito silt loam soils around the evaporation pond are formed from alluvium derived from shale and siltstone and are well drained with a moderately slow permeability/water infiltration rate, medium surface runoff, and high-water capacity. This soil type is formed in areas where the mean annual precipitation is 5 to 8 in, with 35 to 60 percent falling as rain from high-intensity convective thunderstorms between July and September. The mean annual temperature is 51 to 54 °F, and the average frost-free period is 140 to 160 days. Major uses of Tocito silt loam are for irrigated cropland and pasture as well as urban development.

3.5.2 Environmental Consequences

3.5.2.1 Alternative 1 – No Action Alternative

Failure of the evaporation pond liner has the potential to lead to contaminated water and sediment coming into direct contact with the underlying land surface and soils. Chemical partitioning of dissolved compounds between the infiltrating water and soils underlying the evaporation pond could create a secondary source of uranium and other hazardous constituents to groundwater, representing a long-term environmental hazard for the site.

3.5.2.2 Alternative 2 – Full Decommissioning and Disposal of the Existing Evaporation Pond at an Off-Site Licensed Waste Facility by Highway Transport

Overall, pond decommissioning activities associated with Alternative 2 would pose a far lower risk compared to Alternative 1 where the risk of soil impacts associated with the continued use of a degraded pond liner are far greater. The site of the evaporation pond is in a topographically flat setting. No subsurface structural or stratigraphic features exist that would have an impact on pond decommissioning activities.

Impacts to site soils would primarily stem from the excavation of the soils beneath the evaporation pond liner and the disturbance of soils from site preparation activities. Construction activities for site preparation would include clearing vegetation, grading work areas and hauling and placing fill material in cleared areas. Short-term, adverse impacts would include some potential for soil erosion due to the soil characteristics discussed in Section 3.5.1.2.

Ground disturbance from the evaporation pond removal as well as associated earth moving activities around the pond could increase the potential for soil erosion, particulate mobilization, and deposition by wind and water, potentially affecting water quality in nearby ephemeral drainages. Soils could remain susceptible to erosion throughout the project duration, especially during intense weather events such as high winds or flash flooding. The potential for erosion would continue until the evaporation pond was fully decommissioned, surface soils regraded, and vegetation becomes reestablished in all disturbed areas. However, the pond is on relatively flat ground with no nearby steep slopes, and the location is approximately 0.4 mi away from Many Devils Wash, the nearest drainage. BMPs, such as implementation of erosion and sedimentation control, in accordance with the National Pollutant Discharge Elimination System (NPDES) stormwater construction general permit, would prevent most, if not all, of the potential for water-related transport and deposition.

Soil contamination associated with implementation of Alternative 2 could potentially occur from fuel and oil release related to the use of trucks and mechanical equipment. This impact, however, is expected to be negligible given LM's requirements and controls for fuel spill prevention and cleanup.

The waste packaging structure would be constructed with a sealed concrete or compacted dirt/gravel floor, which would be removed at the end of the project, if necessary, to mitigate the risk of soil contamination. The laboratory chemical results from the November 2022 evaporation pond sediment sampling event contained in Appendix E indicate that the low uranium concentrations in the sediment (approximately 10 picocuries per gram [pCi/g] average and approximately 19 pCi/g in the highest sample) are below DOE-approved limits for free release (<30 pCi/g). Therefore, decontamination of equipment, structures, and other items would not be necessary.

Equipment would be cleaned in the waste packaging structure when required. Construction track-out controls would be installed to prevent or minimize pond sediment attached to vehicles from being transported from the project site. If construction track-out controls are inefficient at preventing or minimizing dirt or mud from the evaporation pond sediment on vehicles or equipment leaving the site, additional controls would be implemented.

Under Alternative 2, all sediment at the bottom of the pond would be excavated and disposed of off-site, effectively removing any pathway for hazardous constituents to impact the underlying soil. Verification sampling would be performed as described in Section 2.2.2 to confirm that any potentially contaminated soil was removed.

3.5.2.3 Alternative 3 – Full Decommissioning and Disposal of the Existing Evaporation Pond at an Off-Site Licensed Waste Facility by Highway/Rail Transport

Alternative 3 is the same as Alternative 2 except that rail would also be used in addition to highway transport to dispose of waste materials. Environmental impacts to geology and soils would be the same as those for Alternative 2. Once waste from the pond is packaged and removed from the site, the transportation method is not expected to have any additional environmental consequence on geology or soil resources.

3.6 Land Use and Recreation

3.6.1 Affected Environment

Land use refers to property classifications that indicate either natural conditions or types of human activity occurring on a parcel. Natural conditions are described as unimproved, undeveloped, conservation or preservation area, and natural or scenic areas. There is a wide variety of descriptive terms used to categorize land use resulting from human activity including residential, commercial, industrial, agricultural, institutional, and recreational.

The ROI encompasses roughly the stretch of land between U.S. Highway 491, San Juan River, Many Devils Wash, and Navajo Road N5072. However, a broader picture of land uses in the town of Shiprock is provided for context and perspective in Figure 3-4.

3.6.1.1 Land Use

Land on the Shiprock disposal site is used for a variety of purposes and comprises two distinct areas: the San Juan River floodplain on the northern end and the terrace area (a flat, elevated area approximately 50 to 60 ft above the San Juan River) on the southern end, with a steep erosional shale escarpment separating the two. The floodplain and Many Devils Wash areas are designated for grazing.

Property surrounding the evaporation pond and terrace area to the northwest and southwest is designated as residential land use; property northwest of Bob Lee Wash is designated as commercial land use; and property east of the floodplain area and the San Juan River is designated as agricultural land use (Figure 3-4).

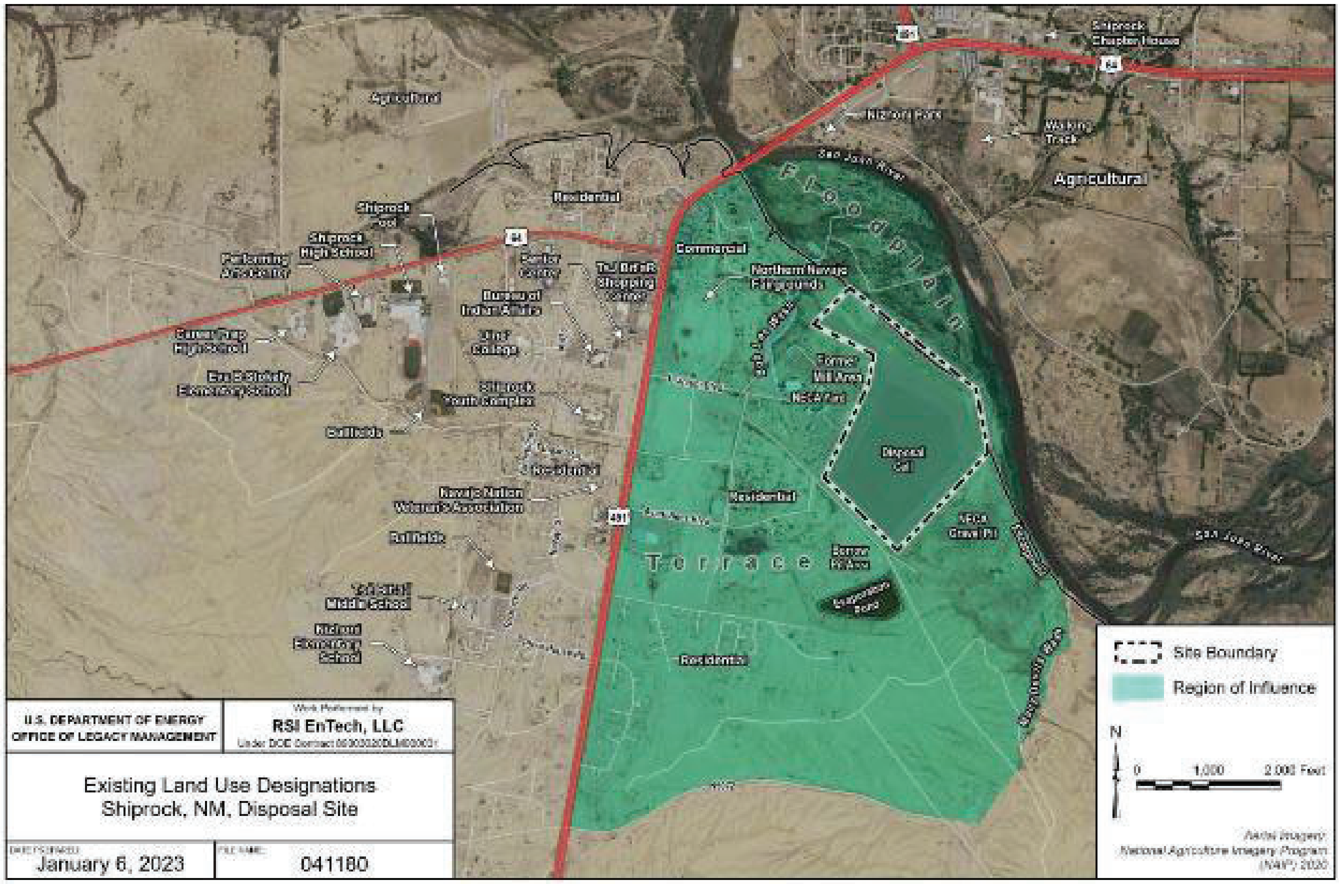


Figure 3-4. Shiprock disposal site existing land use designations

3.6.1.2 Terrace area

The Shiprock Disposal site is in the terrace area, which includes the disposal cell and associated structures. The disposal cell is mostly in the area that formerly contained the uranium mill tailings impoundments and consists of soils from the area surrounding the mill site and tailings impoundments. The old mill site is now occupied by the NECA offices and yard, directly west of the disposal cell. The NECA yard consists of offices, equipment repair shops, and equipment and material storage, along with other light industrial development. Several of the NECA facility buildings were former mill site buildings that were decontaminated during surface remediation. Also, within the NECA facility is the Shiprock Field Office of the Navajo Abandoned Mine Lands Reclamation Department.

Bob Lee Wash is located west of the NECA yard and flows north into the San Juan River. West of Bob Lee Wash are scattered residences, businesses, restaurants, and the Northern Navajo Fairgrounds, followed by U.S. Highway 491, a north-south trending highway. Additional residences and businesses are located directly west of U.S. Highway 491 including the Tse Bit' A'iA'i (Shiprock) shopping center, a post office, a BIA office, the Shiprock Senior Center, the Shiprock Youth Complex, and the Navajo Nation Veterans Administration building, while farther west are schools and associated sports fields including Diné College, Phil L. Thomas Performing Arts Center, and agricultural land.

Directly south of the disposal cell is the fenced radon cover borrow pit, followed by the evaporation pond located approximately 350 ft south of the disposal cell. Residential housing is located southwest of the disposal cell and west and southwest of the evaporation pond. Some residences may have livestock.

North of the disposal cell is a steep escarpment down to the floodplain of the San Juan River. Southeast of the disposal cell is the fenced NECA gravel pit, which extends nearly to the mouth of Many Devils Wash and includes equipment for mining and crushing gravel. The eastern and southernmost portion of the terrace area is characterized as sparsely developed with scattered residences and grazing.

3.6.1.3 Floodplain area

There is no development within the floodplain area, which has historically been used for grazing and agriculture. Examples of institutional controls in place on the floodplain to minimize potential risk to human health and the environment include grazing restrictions, control of access to the floodplain area, a DOE-Navajo Nation agreement prohibiting use of groundwater in the floodplain, and assurance from the Navajo Nation Water Code Administration that flowing artesian Well 0648 will continue flowing into Bob Lee Wash and onto the floodplain.

3.6.1.4 Greater Shiprock vicinity

A large portion of the town of Shiprock is located north of the San Juan River, along with irrigated farm plots, residences (some with livestock grazing), and other agriculture. Beyond the town of Shiprock in all directions is generally undeveloped land.

3.6.1.5 Recreational Resources

Recreational resources in the vicinity of the Shiprock disposal site include the following:

- Nizhoni Park, located northeast of the San Juan River and U.S. Highway 64, provides traditional park and playground features, including a picnic shelter and a skate park (Navajo-Hopi Observer, 2020).
- Northern Navajo Fairgrounds, located at U.S. Highway 491 and Uranium Boulevard, hosts events such as the Northern Navajo Nation Fair every fall celebrating the harvest. This event includes a parade, rodeo, carnival, pow wow, traditional song and dance, 4-H exhibits, and arts and crafts (Farmingtonnm.org, 2023).
- Shiprock Office of Diné Youth at the Shiprock Youth Complex (4198 U.S. Highway 491) provides a variety of services for area youth and families, including recreational activities such as indoor ball courts and a ropes course (Diné Youth, 2022).
- Recreation and athletic programs offered through area schools include cross country and track and field, football, volleyball, golf, soccer, basketball, spirit and cheer, wrestling, baseball, and softball (Shiprock High School, 2022).
- Outdoor ball fields are concentrated near Shiprock High School and Tse' Bit' A'iA'i Middle School south of U.S. Highway 64 on the south end of town, and near Shiprock Associated Schools west of U.S. Highway 491 on the north end of town.
- The Shiprock Pool is an indoor pool located near the Shiprock High School.
- A park/walking track is located at the Central Consolidated School District's buildings between U.S. Highway 64 and the San Juan River.
- The San Juan River offers fishing, rafting, and wildlife viewing.

3.6.2 Environmental Consequences

3.6.2.1 Alternative 1 – No Action Alternative

Under the No Action Alternative, there would be no changes to land use or recreation. The evaporation pond would remain in place. There would be no changes to recreational resources in the town of Shiprock from the No Action Alternative.

3.6.2.2 Alternative 2 – Full Decommissioning and Disposal of the Existing Evaporation Pond at an Off-Site Licensed Waste Facility by Highway Transport

The removal of the evaporation pond would not affect existing or future land uses in the ROI. Additionally, there would be no impacts to recreational resources in the town of Shiprock because the evaporation pond would be fully decommissioned under this alternative.

This alternative would meet the purpose and need of not being in conflict with planning criteria established to ensure the safety and protection of human life and property. Additionally, this alternative would be consistent and compliant with existing land use plans and policies, would not preclude the viability of existing land use, and would remain compatible with adjacent land use. Future use of the land where the evaporation pond is currently located would be determined through an additional NEPA evaluation. Public health or safety would not be threatened.

3.6.2.3 Alternative 3 – Full Decommissioning and Disposal of the Existing Evaporation Pond at an Off-Site Licensed Waste Facility by Highway/Rail Transport

Similar to Alternative 2, there would be no land use or recreational resources impacts in the ROI under this alternative.

3.7 Noise and Vibration

This section describes the noise and vibration resource areas as they relate to sensitive receptors in the human environment. Potential effects of noise and vibration on other resource areas are discussed in sections devoted to those resources (e.g., Section 3.3, Biological and Natural Resources).

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air or water, and are sensed by the human ear. The perception and evaluation of sound involves three basic physical characteristics:

- Intensity – The acoustic energy, which is expressed in terms of sound pressure, in decibels (dB).
- Frequency – The number of cycles per second the air vibrates, in Hertz.
- Duration – The length of time the sound can be detected.

The loudest sounds that can be comfortably heard by the human ear have intensities a trillion times higher than those of sounds barely heard. Because of this vast range, it is difficult to use a linear scale to represent the intensity of sound. As a result, a logarithmic unit known as the dB is used to represent the intensity of a sound, also referred to as the sound level. A sound level of 0 dB is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. Normal speech has a sound level of approximately 60 dB. Sound levels above 120 dB begin to be felt inside the human ear as discomfort. Sound levels between 130 and 140 dB are felt as pain (Berglund & Lindvall, 1995).

All sounds have a spectral content, which means their magnitude or level changes with frequency, where frequency is measured in cycles per second, or Hertz. To mimic the human ear's non-linear sensitivity and perception of different frequencies of sound, the spectral content is weighted. For example, environmental noise measurements are usually on an "A-weighted" scale, which places less weight on very low and very high frequencies in order to replicate human hearing sensitivity.

The following noise metrics are used to describe sound levels in this analysis:

- **Maximum Sound Level (LA_{max})**: The highest dB. A level measured during a single event where the sound level changes value with time (e.g., a jack hammer that is used off and on during the day) is called the LA_{max}, which defines the maximum sound level occurring for a fraction of a second. For aircraft or construction noise, the "fraction of a second" over which the maximum level is defined is generally 1/8 second (ANSI, 1988).
- **Equivalent Sound Level (LA_{eq})**: The equivalent sound level metric (noted as LA_{eq}) is a cumulative noise metric that represents the average sound level, on a logarithmic decibel basis, over a specified period of time. This study utilizes a 1-hour period for both construction and traffic noise (denoted as LA_{eq1hr}).

Vibrations that are not detected as sound may also be of concern in some situations. When discussing the perception of vibrations, vibration intensities are described using dB notation similar to the notation used to describe sound intensities. Vibration levels are denoted as Lv dB.

3.7.1 Affected Environment

The acoustic environment includes vehicle traffic on nearby local roads and highways as well as sound generated by a variety of activities in nearby residential areas and within the Shiprock disposal site itself. Although measured ambient sound levels are not available in the affected area, general characteristics of the acoustic environment can be estimated based on nearby land uses and transportation corridors.

The area west of the pond removal project site is low-density residential, the area to the north is industrial (i.e., the industrialized portions of the Shiprock disposal site including the disposal cell and NECA gravel pit), and areas south and east are primarily open, undeveloped land. Non-natural sound sources common in residential areas include the operation of fixed equipment (e.g., heating, ventilation, and air conditioning systems) and vehicles, while sound sources in industrial areas potentially include trucks and mobile equipment. Sound sources in undeveloped areas and in developed areas during times of low human activity are predominately natural (e.g., wind moving through vegetation, animal calls, etc.). Time-averaged ambient sound levels in small towns are typically near 55 dB, while farms and rural areas are typically at approximately 45 dB (EPA, 1974).

U.S. Highway 491, which is located approximately 0.5 mi west of the Shiprock disposal site, is used by an average of approximately 7,800 vehicles per day, of which approximately 1,400 are trucks (NMDOT, 2023). Although traffic counts on local roads (e.g., roads connecting U.S. Highway 491 to the Shiprock disposal site) are not available, traffic noise can be assumed to be audible within the affected area most of the time. Operations of equipment, trucks, and trains at the GELP transload facility generate noise on an intermittent basis. The facility is located in a remote area with minimal human activity, and sound levels can be assumed to be low during times when transload operations are not under way.

Vibrations at sensitive locations near the project site can be assumed to be minimal based on nearby activities. Blasting, which would generate noticeable vibrations, is not used as an excavation method at the NECA gravel pit.

Noise- and vibration-sensitive locations within the ROI include residences located along the western and southwestern project site boundary as well as residences and other sensitive land uses along the proposed truck haul route. To ensure that maximum potential impacts would be considered in this analysis, noise and vibration levels were calculated and associated impacts were assessed at the closest noise sensitive receptors. The closest residence is located approximately 320 ft from project site activities. The closest residence along the haul route is approximately 75 ft from the centerline of Uranium Boulevard. The closest noise-sensitive location to the GELP transload facility is a residence located more than a mile away.

3.7.2 Environmental Consequences

Potential noise and vibration impacts associated with proposed construction and transportation activities were assessed by comparing levels under Alternatives 2 and 3 to levels under the No Action Alternative (Alternative 1). Because quantitative criteria for noise and vibration are not established in the Navajo Nation Code, criteria published by Federal agencies are referenced in this analysis for the assessment of impact significance. Exceedance of the criteria would indicate an increased likelihood of annoyance and disturbance (USDOT, 2006a; USDOT, 2017; USDOT, 2018).

Construction noise levels were modeled using the Federal Highway Administration (FHWA) Roadway Construction Noise Model (USDOT, 2006). To ensure that impacts are not underestimated, construction noise levels were modeled for a scenario in which all the loudest equipment types expected to be used were operating on the same day at closest point within the project site to a noise-sensitive location. In reality, equipment use would occur at various locations within the project site, resulting in lower noise levels at sensitive locations. In keeping with FHWA default impact criteria, construction noise impacts would be considered significant if sound levels were to increase by 5 A-weighted decibels (dBA) LA_{eq1hr} relative to baseline conditions, or if maximum noise levels were to exceed 85 dB at one or more noise-sensitive locations.

Transportation noise levels were modeled using the FHWA Traffic Noise Model Screening Tool (USDOT, 2021a). Noise levels were calculated conservatively to reflect a scenario in which all daily project-related traffic to the project site would occur during a single hour. Impacts would be considered significant if sound levels were to increase by 5 dBA relative to baseline conditions, or if LA_{eq1hr} were to exceed 67 dBA at a residence.

Vibration levels associated with construction and transportation were assessed using the methods described in the *Federal Transit Administration Transit Noise and Vibration Impact Assessment Manual*. Impacts would be considered potentially significant if vibrations associated with frequent events (i.e., more than 70 per day) were to exceed 72 Lv dB at a residence (USDOT, 2018).

3.7.2.1 Alternative 1 – No Action Alternative Impact

Under the No Action Alternative, the evaporation pond would remain in place. Because there would be no construction or demolition activity under the No Action Alternative, noise levels in the ROI would not change relative to baseline conditions. There would be no noise impacts under the No Action Alternative.

3.7.2.2 Alternative 2 – Full Decommissioning and Disposal of the Existing Evaporation Pond at an Off-Site Licensed Waste Facility via Highway Transport

3.7.2.2.1 On-Site Operations

Noise impacts due to on-site operations would be minor compared to background levels.

The operations of construction equipment would generate elevated noise levels at noise-sensitive locations near the project site while the project is under way. The project is expected to last 1 to 3 years. Construction would occur primarily during normal working hours (i.e., 7:00 a.m. to 5:00 p.m.) with activities at other times occurring only on an occasional basis.

As described in Section 2.2.1, the first phase of the project would include construction of a fence and an attached continuous noise barrier that would break the line-of-sight between on-site project activities and nearby residences. The noise barrier would be expected to lower noise levels experienced at nearby noise-sensitive locations by approximately 8 dB (USDOT, 2006). To put the expected sound level reduction in perspective, a reduction in sound level of 5 dB is generally considered to be clearly noticeable, while a change of 10 dB is generally perceived as a halving of the sound level.

With the noise barrier in place, outdoor noise levels at the closest noise-sensitive location (e.g., a residence 320 ft from the project site) would be as high as 60 dB LA_{max} (see Table 3-7). The loudest construction noise levels could interfere with activities, such as conversation, potentially resulting in annoyance. Animals kept by humans (e.g., horses, dogs) could potentially also be bothered by project-related noise. Animals often become accustomed to noise sources that persist, and any animal reactions to project noise would be expected to decrease in intensity over time. Noise levels experienced off-site would vary as individual pieces of equipment move around on the project site. The maximum noise levels listed in Table 3-7 would be relatively short-lived and limited to the relatively rare instances when heavy equipment operations are under way at the closest location on the project site to noise-sensitive locations.

Table 3-7. Construction noise levels at the closest noise-sensitive location

Equipment [a]	Usage Factor [b]	Measured LA_{max} at 50 ft [b]	LA_{max} at Closest Sensitive Location [c]	LA_{eq1hr} at Closest Sensitive Location [c]
Scraper	40	84	60	55.9
Dozer	40	82	58	53.9
Compactor	20	83	59	51.9
Excavator	40	81	57	52.9
Dump Truck	40	76	52	47.9
Total	n/a	84	60	59.9

Key: ft = feet; LA_{max} = maximum sound level occurring for a fraction of a second; LA_{eq1hr} = equivalent sound level metric for a 1-hour period; n/a = not applicable

[a] Equipment types are loudest types that would be used during the project.

[b] Usage factors and LA_{max} values are default values in the FHWA Roadway Construction Noise Model.

[c] The closest noise sensitive location is approximately 320 ft from construction activities; calculated sound levels reflect eight decibels of sound level reduction provided by the sound barrier to be constructed between on-site project activities and the closest residences.

While construction is under way, noise levels would increase from ambient sound levels (presumed to be approximately 55 dB LA_{eq1hr}) to as high 59.9 dB LA_{eq1hr} (Table 3-7). As noted previously, the calculated project LA_{eq1hr} reflects a highly conservative scenario in which all the loudest equipment types expected to be used were operating on the same day at closest point within the project site to a noise-sensitive location.

Although on-site activities would generate noise that would be noticeable at nearby noise-sensitive locations, and potentially annoying at times, noise levels would increase by less than 5 dB LA_{eq1hr} and would be below the 85 dB LA_{max} impact criteria level. These increases would be temporary, lasting only for the duration of the project, and would, for the most part, be limited to normal working hours. Noise associated with the project would be temporary and not exceed impact criteria.

Vibrations caused by heavy equipment operations during the project would not be expected to be considered annoying at nearby sensitive locations. Of the equipment types expected to be used, the excavator would be expected to generate the most intense vibrations. Vibration intensity decreases with distance from the source (USDOT, 2018). At the closest sensitive location, vibrations generated by on-site operations would have attenuated to 61 Lv dB or less, which is well below the residential criteria level of 72 Lv dB.

3.7.2.2.2 Off-Site Operations

Noise levels at noise-sensitive locations along the haul route would not exceed impact criteria (i.e., would increase by less than 5 dB and remain below 67 dB LA_{eq1hr}). Noise impacts from off-site activities would be minimal compared to background levels. Alternative 2 would involve up to four truck trips and 24 employee trips per day. Vehicles would use Uranium Boulevard, U.S. Highway 491, and other roadways to arrive to and depart from the project site (see Appendix H for potential haul route maps). Noise-sensitive locations along Uranium Boulevard would increase by approximately 0.3 dB LA_{eq1hr} from baseline levels (presumed to be approximately 55 dB) to 55.3 dB LA_{eq1hr}. On highways, the tempo of traffic is higher under baseline conditions than the traffic tempo on Uranium Boulevard and, in this context, the effects of four trucks and 24 employee vehicles per day on overall noise levels would be less pronounced. For example, at sensitive locations along U.S. Highway 491, noise levels would increase by 0.1 dB from 62.1 to 62.2 dB LA_{eq1hr}. Project-related traffic would have a minimal effect on the overall tempo of traffic on roadways other than Uranium Boulevard or U.S. Highway 491.

Off-site vibration sources consist of haul trucks traveling to and from the site. According to *Federal Transit Administration's Transit Noise and Vibration Impact Assessment Manual*, vibration from trucks along roadways is unlikely to be perceptible, even if the receptor is close to a major roadway (USDOT, 2018). Vibration impacts associated with offsite operations would not be significant.

3.7.2.3 Alternative 3 – Full Decommissioning and Disposal of the Existing Evaporation Pond at an Off-Site Licensed Waste Facility via Highway/Rail Transport

Under Alternative 3, activities at the project site and along truck haul routes would be identical to those described for Alternative 2. The noise-related BMP to be conducted under Alternative 2 (i.e., installation of sound barrier on security fence) would also be carried out under Alternative 3.

Alternative 3 would differ from Alternative 2 in that excavated materials would be transferred from trucks to trains at the GELP transload facility. As noted in Section 3.7, the GELP transload facility is located more than 1 mi mile from the closest noise-sensitive location (i.e., a residence). At a distance of 1 mi, noise generated by transloading process would be minimal. Furthermore, similar transload operations and train movements are conducted under baseline conditions, such that transload activities conducted as part of Alternative 3 would not constitute a noise source that is new to the area. The addition of up to four truckloads per day of transload activity and subsequent rail transportation of materials would not result in significant noise impacts. As all other aspects of Alternative 3 would be identical to Alternative 2, noise impacts would be the same. Overall, noise impacts associated with Alternative 3 would not be significant.

3.8 Solid Waste and Waste Management

3.8.1 Affected Environment

This section describes the solid waste and waste management for the alternatives evaluated in this EA. The Shiprock disposal site was designated under UMTRCA as a Title I site when the law was enacted in 1978. As a Title I site, waste from historic operations is designated as RRM in accordance with 10 CFR 40.2a. RRM is defined in 10 CFR 40.4 as:

- Waste (which the Secretary of Energy determines to be radioactive) in the form of tailings resulting from the processing of ores for the extraction of uranium and other valuable constituents of the ores.
- Other waste (which the Secretary of Energy determines to be radioactive) at a processing site which relates to such processing, including any residual stock of unprocessed ores or low-grade materials.

It is important to note that the term RRM is used only with respect to materials at sites subject to remediation under Title I of UMTRCA, as amended.

Solid waste is regulated under the Resource Conservation and Recovery Act (RCRA) which is the public law that creates the framework for the proper management of hazardous and non-hazardous waste. Subtitle D of the Act is dedicated to non-hazardous solid waste requirements, and Subtitle C focuses on hazardous solid waste. Solid waste includes solids, liquids, and gases and must be discarded to be considered waste.

The ROI for solid waste and waste management activities include the Shiprock disposal site and the two potential disposal facilities previously identified. The affected environment for the Shiprock disposal site are discussed under the specific resources areas in Sections 3.2 through 3.8 and 3.10 through 3.13 in this chapter. Solid waste and waste management activities have the potential to impact these environmental resource areas. Waste generated as a result of implementing the project alternatives would have a clear disposal path forward, and there is sufficient disposal capacity available as discuss hereafter under environmental consequences. The affected environment at the disposition facilities were previously considered as part of the licensing/permitting/approval process for those facilities and are not included in this EA.

3.8.2 Environmental Consequences

The environmental consequences associated with solid waste and waste management activities are discussed under the specific resource areas in Sections 3.2 through 3.8 and 3.10 through 3.13 in this chapter. Waste management activities, including handling, packaging, transport, and disposition, would comply with all regulatory requirements and the licenses, permits, or approvals applicable to the specific solid waste and the disposal facilities previously identified.

3.8.2.1 Alternative 1 – No Action Alternative

There would be no impacts since no waste is generated under the No Action Alternative.

3.8.2.2 Alternative 2 – Full Decommissioning and Disposal of the Existing Evaporation Pond at an Off-Site Licensed Waste Facility via Highway Transport

Alternative 2 would result in the generation of approximately 20,000 cubic yds of waste, which would include the removal of pond sediments, a 45-mil HDPE liner, repair barriers, bentonite mat, and soil below the bentonite mat. The waste would be hauled from the evaporation pond to the waste packaging structure by haul trucks for waste processing and packaging. The waste activities in the waste packaging structure would be inspected at least weekly to ensure the waste is properly contained within the structure and that the waste packaging is in compliant condition.

To establish a disposal path, all generated waste must be evaluated to determine if these materials meet the definition of a solid waste. RCRA states that "solid waste" means any garbage or refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, resulting from industrial, commercial, mining, and agricultural operations, and from community activities. The pond sediments, a 45-mil HDPE liner, repair barriers, bentonite mat, and soil below the bentonite mat meet the definition of a solid waste.

The evaporation pond waste materials must next be evaluated to determine if they are a hazardous waste. Several exclusions from the definition of hazardous waste exist in 40 CFR 261.4 including 40 CFR 261.4(b)(7), which excludes solid wastes generated from the extraction, beneficiation, and processing of ores and minerals including coal, phosphate rock, and overburden from the mining of uranium ore. This exclusion is based on the Bevill Amendment of the Solid Waste Disposal Act Amendments of 1980 which exempted certain mining wastes from regulation under the hazardous waste rules in RCRA Subtitle C.

Based upon the history and operations conducted at the Shiprock disposal site, the mill tailings and other materials contained in the disposal cell at the Shiprock disposal site meet the definition of beneficiation wastes and are excluded from the requirements of the hazardous waste regulations via the Bevill Amendment in 40 CFR 261.4(b)(7). EPA has determined that liquids like rainwater and groundwater that come into contact with these excluded beneficiation wastes are also excluded wastes because their source was an excluded waste (Cotsworth, 2000).

The samples from the pond sediment sampling event performed on November 29 and 30, 2022 were analyzed for chemical and radiological constituents to support waste characterization, transportation, and disposal. Based on the analytical results, only the selenium contained in the pond sediment is above regulatory threshold in the RCRA. The waste, however, is not classified or managed as a hazardous waste because of the Bevill Amendment exclusion and 40 CFR 261.4(b)(7) as previously explained. Although the pond decommissioning waste is classified as RRM due to the site's UMTRCA Title I status, the low uranium concentrations in the sediment (approximately 10 pCi/g average and approximately 19 pCi/g in the highest sample) are below DOE-approved limits for free release (<30 pCi/g). All generated waste would be confirmed to meet the waste acceptance criteria of the proposed disposal facilities (listed below) prior to waste generation and transportation.

- WCS Facility – located in Andrews County, Texas (Alternatives 2 and 3)
- Energy*Solutions*' Clive Disposal Facility – located in Grantsville, Utah (Alternatives 2 and 3)

The quantities of waste potentially generated under this alternative are negligible compared to the facilities' licensed/permitted/approved capacities as indicated in Section 3.8.2. Therefore, the potential solid waste and waste management impacts would be negligible.

3.8.2.3 Alternative 3 – Full Decommissioning and Disposal of the Existing Evaporation Pond at an Off-Site Licensed Waste Facility via Highway/Rail Transport

Potential impacts under Alternative 3 would be the same as for Alternative 2 except that rail would also be used in addition to highway transport to dispose of waste materials. The quantity, characterization, and disposal of wastes generated under this alternative are the same as for Alternative 2; therefore, the impacts would also be negligible.

3.9 Visual Resources

3.9.1 Affected Environment

The ROI for visual impact assessment (VIA) is the immediate area surrounding the evaporation pond and the proposed operations area. The ROI consists of the land immediately surrounding the area of potential effect depicted in Figure 1-2. This assessment is limited to the removal of the existing pond as no information is currently available about the proposed land use post-cleanup.

VIA methodology seeks to first identify the distinct, recognizable, and consistent pattern of elements in the landscape that makes one landscape different from another. It then seeks to quantify the effects of a Proposed Action by evaluating how it might result in changes to the character and quality of the landscape. Visual impacts typically include both changes to views and also how changes to the visual quality impact of a view might impact people. For larger projects, VIA also seeks to identify impacts on the underlying visual resource values. The size and scale of a Proposed Action influences the methodology selected, as does the composition of people being impacted. Impacts sometimes vary based on property ownership, with public access to views being an important consideration.

Due to intervening topography and development, the existing evaporation pond is generally not visible to the traveling public from U.S. Highway 491 or from the commercial and recreational properties along either side of the highway south of the San Juan River. Travel through reservation land on the state highway system is allowed, as is stopping at commercial properties along the highway. Diné land is not, however, considered public land and may be closed to non-tribal members for a variety of reasons. Non-tribal members leaving the state highway system without invitation can be considered trespassing on a Federal Indian Reservation.

3.9.2 Environmental Consequences

3.9.2.1 Alternative 1 – No Action Alternative

Alternative 1 would not change the existing visual environment nor would it impact existing visual resources in the area.

3.9.2.2 Alternative 2 – Full Decommissioning and Disposal of the Existing Evaporation Pond at an Off-Site Licensed Waste Facility by Highway Transport

The evaporation pond is visible from the Diné residential properties located east of U.S. Highway 491 and south of the San Juan River, depending on the local topography. For many of the closest residents, the 11-acre engineered evaporation pond, with its black liner and striking white salt sediments, is a dominant visual feature. Visual and scenic resources are known to be of importance to the Diné. Many high-quality views exist in the area surrounding the project area. During public scoping meetings in 2019 many of the nearby residents expressed a strong negative opinion about the visual quality of the area due to the evaporation pond. The presence of construction equipment and the construction of support areas in the project area would likely be considered by these individuals to further degrade visual resources. However, these impacts would be short-term, lasting until the project is completed.

Removing the evaporation pond would have a long-term, beneficial impact on the visual quality of the surrounding area to individuals concerned about the impact of the pond on visual quality in the area.

3.9.2.3 Alternative 3 – Full Decommissioning and Disposal of the Existing Evaporation Pond at an Off-Site Licensed Waste Facility by Highway/Rail Transport

Similar to Alternative 2, the removal of the existing evaporation pond would have a long-term, beneficial impact on the visual quality of the surrounding area to those with concerns about the impact of the pond on visual quality in the area.

3.10 Human Health and Safety

This section assesses the potential for the alternatives to cause onsite and offsite human health impacts to the public, evaluated as maximally exposed individuals (MEIs). Human health impacts would occur from exposures to radionuclides and chemicals detected in pond sediment and surface water due to direct contact by onsite MEIs and indirect contact by offsite MEIs from air and groundwater transported offsite from the pond. This assessment identifies the affected environment (i.e., as ROIs) associated with each remedial alternative and quantifies the magnitude of potential human health impacts estimated to occur to onsite and offsite MEIs from implementation of each alternative relative to DOE- and EPA-established benchmarks.

3.10.1 Affected Environment

As a result of the near-continuous pumping, groundwater accumulates as surface water in the pond, the depth of which varies depending on pumping rates and frequencies and meteorological conditions. Chemical and radiological contaminants have been detected in the surface water and sediment in the pond, exposures to which can potentially affect the human health and safety of MEIs located within both onsite and offsite environments.

The Shiprock disposal site, including the evaporation pond, falls under the regulatory authority of 40 CFR 192, *Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings*, which applies to the control of RRM at designated processing or depository sites under Section 108 of the UMTRCA and to restoration of such sites following any use of subsurface minerals under Section 104(h) of the Act. 40 CFR 192 only address limits for radon air release and groundwater exposures for a limited number of contaminants. However, DOE O 458.1, *Radiation Protection of the Public and the Environment,* establishes requirements to protect the public and the environment against undue risk from radiation associated with radiological activities conducted under the control of DOE pursuant to the Atomic Energy Act of 1954, as amended, including risks from other contaminants, and has been used along with EPA risk assessment methodology for analysis of impacts.

The extent of the ROI identified for Alternatives 1, 2, and 3 is determined by the two types of environmental transport pathways considered in this analysis, i.e., atmospheric transport of contaminants in dust emissions from pond sediment and groundwater transport of contaminants that leak through the pond liner. The atmospheric pathways analyses apply to all three alternatives and the groundwater transport analyses apply to only Alternative 1.

The ROI for Alternatives 1, 2, and 3, relative to atmospheric transport pathways, would be those onsite and offsite areas located downwind of the evaporation pond that could receive airborne dust emissions from wind erosion of pond sediments under Alternative 1 and dust emissions during pond decommissioning (under Alternatives 2 and 3), with subsequent deposition onto soil. Prevailing winds at the Shiprock disposal site are southeasterly; therefore, the predominant downwind areas are located to the approximate northwest of the evaporation pond. Data from this location for the past 3 years indicate that the average wind speeds and direction are consistent due to channeling of the flow by the San Juan River valley along its northwest to southeast orientation.

The ROI for Alternative 1, relative to groundwater transport of contaminants from the pond, would be the east and west terrace and floodplain areas located hydrologically downgradient of the evaporation pond to which soils transported by water and Mancos Shale groundwater flows. However, the potential for risk to human health and the environment from contaminated floodplain groundwater is minimized by institutional controls that include grazing restrictions, control of access to the floodplain area, and a DOE-Navajo Nation agreement prohibiting use of groundwater in the floodplains. Contaminated groundwater from both the floodplain and the terrace east systems is not currently used for any purpose. Potential human exposure pathways to surface water (resulting from terrace groundwater) in Bob Lee Wash and Many Devils Wash in the east terrace, as well as the floodplain seeps at the base of the escarpment, have been greatly reduced during operation of the groundwater treatment system.

In addition, the total dose from natural background radiation for a resident receptor living on the Colorado Plateau is higher than the national average (approximately 430 mrem per year versus 310 mrem per year) (DOE, 2014). This higher radiation background is attributed to higher cosmic and cosmogenic radioactivity due to the elevation of the area, higher terrestrial radioactivity because of the uranium ores contained in the area, which also results in higher radon levels in the ambient air. When sufficient background data are available, exposures to both chemicals and radionuclides are assessed based on site-related concentrations estimated to be above corresponding background levels.

3.10.2 Environmental Consequences

The detailed description of the analysis of human health impacts and results is provided in Appendix D (Human Health Risk Assessment). Supporting calculations, tables, and figures are presented in Appendix D and in Attachments D-1 through D-17. Under Alternative 1 (the No Action Alternative) and Alternatives 2 and 3 (the decommissioning alternatives), the MEIs include onsite pond decommissioning workers, onsite trespassers, and offsite resident farmers. Potential health impacts to MEIs are quantitatively assessed for each alternative based on assumptions about exposures to contaminants of potential concern (COPCs) identified in evaporation pond surface water and sediment, per the analytical laboratory data available for those media. COPCs are those contaminants with detected concentrations that exceed corresponding screening levels protective of human health. Appendix D (Table D-2) shows that uranium isotopes, metals (arsenic, barium, cadmium, manganese, selenium, strontium, thallium, and uranium), nitrate, and fluoride were identified as COPCs in the pond.

Each alternative could potentially affect onsite and offsite human receptors within the ROI as discussed in Appendix D. The environmental transport and pathways by which MEI exposures can occur are unique to each alternative. For example, allowing pond media to remain in place with continued liner degradation and groundwater pumping could result in contaminants percolating downward into subsurface soil, with subsequent infiltration into groundwater (i.e., Alternative 1). On the other hand, mechanical disturbance of dewatered and solidified pond sediment during excavation, removal (including removal of the HDPE and GCL liners), and transport could result in airborne particulate emissions, though such emissions would be minimized through application of dust suppression measures (i.e., Alternatives 2 and 3).

Offsite residents, hypothetically assumed to be farmers residing at six evaluated locations downwind of the evaporation pond (identified as locations A through F in Figure 3-5), could be exposed to contaminants in offsite soil, air, groundwater (from soil to groundwater migration), homegrown produce, or beef and dairy (i.e., as secondary exposure sources) from pond dust emissions that could occur from wind erosion in the absence of surface water under Alternative 1. The same exposures are assessed for offsite resident farmers from dust emissions that could occur from mechanical disturbances of sediment during implementation of Alternatives 2 and 3. Finally, hypothetical offsite resident farmers located at three locations directly downgradient of the evaporation pond are evaluated for exposures to migrating groundwater (i.e., used for potable purposes, irrigation, and livestock watering) impacted from leaks through the deteriorating pond liner under Alternative 1. Figure 3-5 also shows the three groundwater receptor locations, labeled R0 (located at downgradient edge of pond), R1 (located at pumping well 1093R), and R2 (located at the San Juan River).

Figure 3-5. Offsite receptor locations for air and groundwater transport modeling analyses

This section summarizes the potential impacts to onsite and offsite MEIs within the ROI from implementation of Alternatives 1, 2, and 3. These potential impacts are discussed in greater detail in Appendix D.

For the analysis of human health impacts, chemical intakes and radiological exposures are combined with corresponding toxicity factors to calculate radiological dose, radiological and carcinogenic chemical excess lifetime cancer risks (ELCRs), and chemical noncarcinogenic hazard indices (HIs), which are then compared to benchmark limits. Discussions of the concepts of ELCRs and HIs, as well as methods of calculation, are provided in Appendix D. The regulatory limits and benchmarks for comparisons in characterizing potential human health impacts from contaminant exposures associated with each of the remedial alternatives are listed as follows:

- Radiological total effective dose equivalent from all exposures to a single source combined – 25 mrem per year (mrem/yr) (DOE O 458.1, *Radiation Protection of the Public and the Environment*).
- Radiological total effective dose equivalent of 5 rems per year (i.e., 5,000 mrem/yr) (40 CFR 835, *Occupational Radiation Protection*)
- Radiological and carcinogenic chemical ELCR – EPA's target range of 1E-06 to 1E-04 (40 CFR Part 300, EPA's *National Oil and Hazardous Substances Pollution Contingency Plan*).
- Noncarcinogenic chemical HI – Total HI to a target organ, calculated over all exposure pathways and COPCs must not exceed the value of 1 (40 CFR Part 300).

Health impacts from all alternatives to onsite and evaporation pond decommissioning workers are expected to be minimized through implementation of required health and safety procedures, which include water-spraying to control dust emissions and the use of personal protective equipment. Workers would be protected via implementation of DOE requirements (e.g., 10 CFR Part 835, *Occupational Radiation Protection* and 10 CFR Part 851, *Worker Safety and Health Program and Administration Procedures*).

3.10.2.1 ***Alternative 1 – No Action Alternative***

3.10.2.1.1 Onsite Maximally Exposed Individuals

The Alternative 1 analysis of radiological dose to the onsite trespasser from direct exposures to pond media is well below the benchmark standard of 25 mrem/yr established for protection of members of the general public. The radiological dose calculated for the onsite worker is less than the 5,000 mrem/yr occupational limit. The ELCR calculated for an onsite trespasser (5E-05) exceeds the lower limit (1E-06) of EPA's ELCR range (1E-06 to 1E-04) due to incidental ingestion exposures to the following COPCs detected in pond surface water: uranium-234, uranium-238 and arsenic. Although exceeding EPA's lower target ELCR, the onsite trespasser ELCR is less than the upper target limit of 1E-04. In addition, the target organ HI calculated for health impacts to the kidneys and skin (27 and 2, respectively) for an onsite trespasser each also exceed EPA's target HI of 1.

Impacts to the kidneys are due to incidental ingestion and dermal exposures to the COPC uranium detected in pond surface water. Dermal impacts to the onsite trespasser are due to combined incidental ingestion exposures to the COPCs arsenic and thallium detected in pond surface water, with thallium being the predominant contributor to the HI of 2. However, as discussed in Appendix D (Section D.8.3), the thallium HI calculated for the trespasser is likely an overestimation of the actual HI due to a high level of uncertainty associated with the reference dose (RfD) used in the HI calculations, in conjunction with the health-conservative assumptions applied regarding trespasser surface water exposures. Additionally, land use controls at the site including entrance gates and perimeter fence and signs reduce the likelihood of trespassers accessing the evaporation pond area.

In summary, no adverse impacts to onsite human health and safety are anticipated from onsite exposures to radionuclides under Alternative 1. Additionally, there are no human health and safety impacts anticipated for onsite workers, especially with the continued use of health and safety BMPs. However, frequent direct contact exposures with the COPCs uranium-234, uranium-238, arsenic, thallium, and elemental uranium detected in surface water by a trespasser could potentially impact human health and safety of this MEI.

3.10.2.1.2 Offsite Maximally Exposed Individuals

The Alternative 1 analysis of radiological doses and ELCRs to offsite MEIs (resident farmer) from combined exposures to radionuclides via atmospheric transport and deposition of dusts, are well below the benchmark standard of 25 mrem/yr and the 1E-06, respectively. No chemical ELCR or HI calculations were necessary for offsite resident farmer exposures resulting from contaminants in air, as well as contaminants in offsite soil (from deposition). This is because the maximum offsite concentrations of all chemicals in these media are less than the corresponding screening levels.

The Alternative 1 analysis of exposures to groundwater impacted from pond liner leaks, shows potential impacts to human health and safety due to a maximum HI of 7 from model-predicted elevated concentrations of nitrate (as nitrogen), via combined hypothetical exposures during residential and farm use. However, continued use of institutional controls would prevent the potable use of groundwater in the terrace and floodplain areas, thereby eliminating impacts to human health and safety.

In summary, with the maintenance of institutional controls, no adverse impacts to the human health and safety of offsite MEIs are anticipated from Alternative 1.

3.10.2.2 Alternative 2 – Full Decommissioning and Disposal of the Existing Evaporation Pond at an Off-Site Licensed Waste Facility by Highway Transport

3.10.2.2.1 Onsite Maximally Exposed Individuals

The analysis of radiological dose to the onsite MEI (pond remediation worker) from direct exposures to pond media under Alternative 2 is well below the occupational benchmark standard of 5,000 mrem/yr. The ELCR calculated for a pond remediation worker (hypothetically assumed to not be using health and safety controls) of 1E-05 exceeds the lower limit of EPA’s target ELCR range (1E-06) due to inhalation of the pond sediment COPCs uranium-234 and uranium-238 dust emissions during remediation. Although exceeding EPA’s lower target ELCR, the pond remediation worker ELCR is a factor of 10 times less than the upper target limit of 1E-04. All target organ HIs calculated for a pond remediation worker (hypothetically assumed to not be using health and safety controls) are less than EPA’s target HI of 1.

In summary, implementation of proper health and safety precautions would minimize the risk to a pond remediation worker. Therefore, no adverse impacts to onsite human health and safety are anticipated under Alternative 2.

3.10.2.2.2 Offsite Maximally Exposed Individuals

The radiological doses and ELCRs to offsite MEIs (resident farmer) from combined exposures to radionuclides via atmospheric transport and deposition of dusts under Alternative 2 are well below the benchmark standard of 25 mrem/yr and the 1E-06, respectively, both during remediation and long after completion of remediation. No chemical ELCR or HI calculations were necessary for offsite resident farmer exposures resulting from contaminants in air, as well as contaminants in offsite soil (from deposition). This is because the maximum offsite concentrations of all chemicals in these media are less than the corresponding screening levels. Groundwater at the six offsite locations evaluated for atmospheric transport is not expected to be impacted from radionuclides and chemicals in offsite soil that has received air deposition during remediation, because all soil concentrations are below groundwater protection screening levels.

In summary, no adverse impacts to the human health and safety of offsite MEIs are anticipated both during and after implementation of Alternatives 2.

3.10.2.3 Alternative 3 – Full Decommissioning and Disposal of the Existing Evaporation Pond at an Off-Site Licensed Waste Facility by Highway/Rail Transport

Alternative 3 is the same as Alternative 2 except that rail would also be used in addition to highway transport to dispose of waste materials. Environmental impacts to water resources would be the same as those for Alternative 2. Once waste from the pond is packaged and removed from the site, the transportation method is not expected to have any additional environmental consequence on water resources.

3.11 Traffic and Transportation

This section consists of two primary subsections that respectively (1) evaluate the impacts of the alternatives on traffic and associated infrastructure in the Shiprock vicinity, and (2) describe the routing and handling of the pond wastes to or from Shiprock and assess the associated radiological and nonradiological risks to workers (e.g., truck or train drivers) and the public.

3.11.1 Traffic

3.11.1.1 Affected Environment

The 2016 Navajo Nation Long Range Transportation Plan indicates that 10 percent of their paved roadways are good to better; 20 percent are in fair condition, and the remaining 70 percent are in poor or failing condition based on the inventory (NNDOT, 2016). The two primary paved roadways that would be used during the Shiprock evaporation pond decommissioning project are Highways 491 and 64 (see Appendix H for potential haul route maps). These two highways are classified as major arterial roadways with high Annual Average Daily Traffic (NMDOT, 2023).

The Shiprock disposal site evaporation pond is located on a gravel-surfaced one-lane road just off Uranium Boulevard, in Shiprock, New Mexico. Uranium Boulevard is an east-west, two-lane paved road that leads from U.S. Highway 491 east to the NECA facility and yard. The gravel surfaced Evaporation Pond Access Road turns south off Uranium Boulevard, just prior to the NECA facility entrance, then turns southeast along the southern edge of the disposal cell and to the evaporation pond access gate (see Figure 1-1 and Figure 1-2).

The evaporation pond access road is composed of heavy aggregate and has a rough surface in some locations. Except for traffic to and from several local residences, this access road only receives occasional traffic from Uranium Boulevard to the evaporation pond access gate, but also receives heavy truck use associated with transporting materials out of the borrow pit, located just east of the disposal cell.

Uranium Boulevard receives light vehicle traffic from local residences located near the evaporation pond, disposal cell, and NECA facility. It also handles light vehicle traffic from workforce traffic to and from the NECA facility heavy equipment yard and U.S. Highway 491. Uranium Boulevard also receives occasional heavy equipment traffic. The road is in overall good condition.

U.S. Highway 491 is an all-weather, north-south, two-lane paved highway that widens just north of the City of Shiprock south to the Shiprock Airport to a four-lane divided highway with median turning lanes, at which point it returns to a two-lane configuration. The confluence of U.S. Highway 491 and Uranium Boulevard is located along this four-lane section of roadway and just south of the U.S. Highways 491 and 64 junction.

Highway 491 crosses New Mexico running from the Colorado border near Standing Rock north to Gallup, New Mexico, where it ends at U.S. Highway 40. The entire length of U.S. Highway 491 is located on Navajo Nation lands.

U.S. Highway 64 is an all-weather two-lane paved highway that runs east and west, starting on the west side of the state at the Arizona border near Teec Nos Pos, New Mexico, through the southern edge of Farmington, New Mexico, and terminating south of Dulce, New Mexico at U.S. Highway 537. U.S. Highways 64 and 491 merge briefly as they cross the San Juan River within the Shiprock city limits. U.S. Highway 64 is in good condition through Shiprock.

Section 3.4.1 discusses demographics, housing, economic activity, public services, and educational services in the vicinity of the project area. Traffic and rail accidents and fatalities are evaluated in Section 3.11.2.

3.11.1.2 Environmental Consequences

For traffic, the ROI analyzed includes haul road areas at the project site; Navajo Nation roads, and other state and federal roads associated with the evaporation pond decommissioning project.

LM identified two highway transportation options (one for transport to WCS and one for transport to Energy*Solutions*) for truck transportation under Alternative 2 and two route options for transport by highway and rail (one for transport to WCS and one for transport to Energy*Solutions*) under Alternative 3. All four route options maximize use of Federal or state highways and minimize routes through high crash and fatality areas and areas with high traffic density. When evaluating potential routes to the waste disposal facilities, LM gave priority to routes that minimized traversing mountain passes, dense population centers, cultural resources, critical environmental resources, and terrestrial ecological resources.

Truck transports would primarily use the U.S. Highway 491 South (for truck transport of pond decommissioning waste to WCS in Andrews County, Texas, under Alternative 2 and for truck transport to the GELP transload facility for rail transport of pond decommissioning waste to the selected disposal site under Alternative 3) and U.S. Highway 491 North (for truck transport of waste to Energy*Solutions* in Clive, Utah, under Alternative 2).

Maps of potential haul truck routes proposed under Alternative 2 are included in Appendix H. Figure 3-6 shows the proposed truck route to the GELP transload facility for transport by highway and rail (Alternative 3).

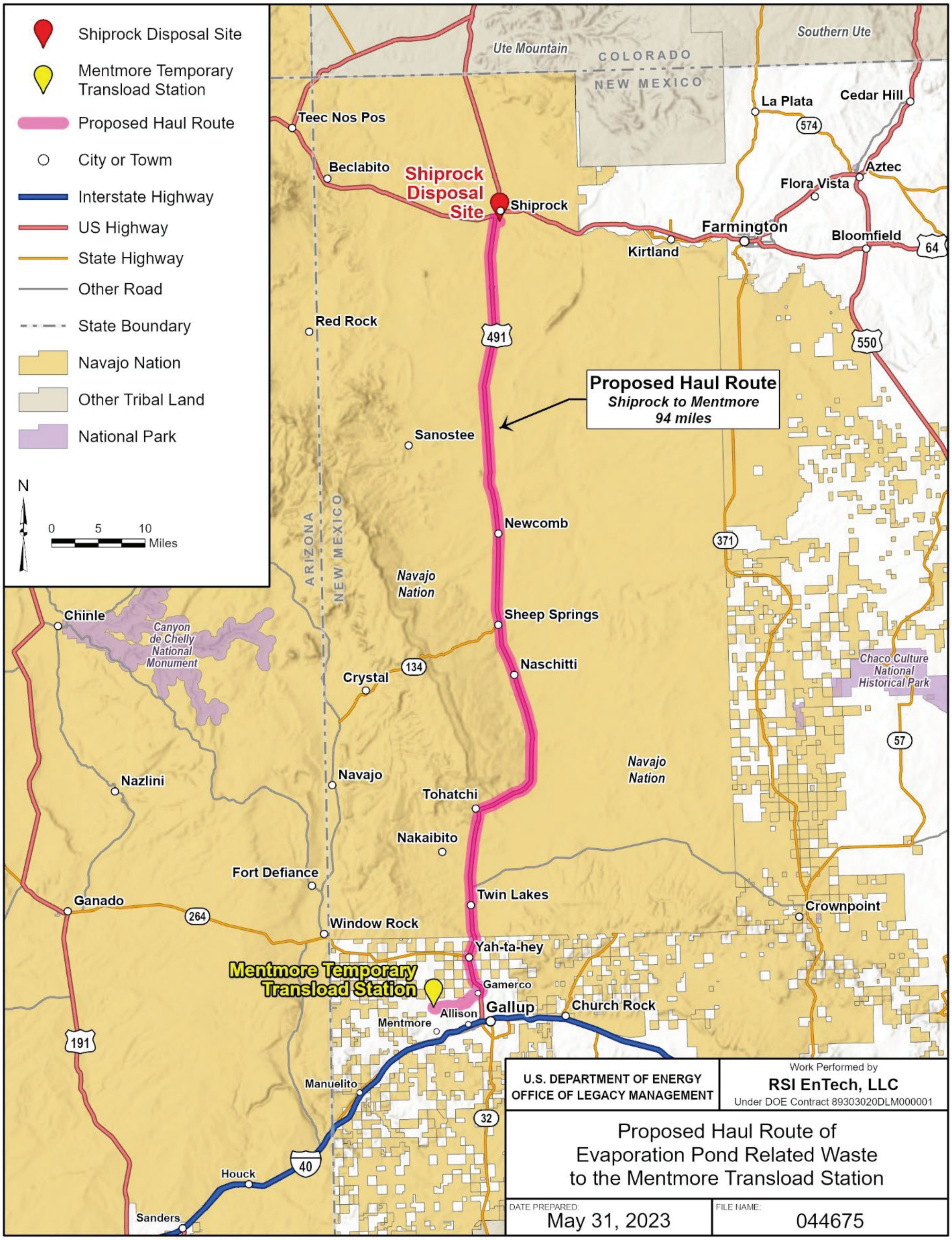


Figure 3-6. Proposed haul truck route for transport of evaporation pond related waste by highway and rail (Alternative 3)

3.11.1.2.1 Alternative 1 – No Action Alternative

Under Alternative 1, no impacts on transportation are expected as no decommissioning activities would be conducted.

3.11.1.2.2 Alternative 2 – Full Decommissioning and Disposal of the Existing Evaporation Pond at an Off-Site Licensed Waste Facility by Highway Transport

Traffic impacts from implementation of Alternative 2 would be negligible. As noted in Section 3.4.2.1, the number of full-time personnel under this alternative would be nearly the same as under the No Action Alternative (see Table 3-6). As such, there would be no noticeable change to traffic volumes from workers commuting to the project location.

Truck shipments under Alternative 2 would not be expected to impact highway capacity or existing use patterns. As discussed in Section 3.7.1, U.S. Highway 491 is used by an average of approximately 7,800 vehicles per day, of which approximately 1,400 are trucks (NMDOT, 2023). The total waste volume from decommissioning the evaporation pond is estimated to be approximately 20,000 cubic yds. Based on the Federal gross vehicle weight limits (23 CFR 658.17), and the expected mass of the wastes, there would be approximately 1,324 truck shipments (approximately 9 per day assuming all waste shipments occur from March 1 to October 1, excluding weekends and holidays, although the actual numbers of trucks entering and leaving the site each day would be variable depending on the stage of decommissioning activities.

The addition of nine truck shipments per day would increase daily truck traffic by approximately 0.6 percent during the work week. This additional traffic would result in a negligible short-term increase in traffic, for the duration of the project, on the proposed route to the selected waste disposal facility.

Under Alternative 2, vehicles would use Uranium Boulevard, U.S. Highway 491, and other local roadways to arrive at and depart from the project site. While annual average traffic counts are not available for the project area, the impact from nine additional trucks per day over the project duration is unlikely to noticeably affect the levels of service within the town of Shiprock. All personnel and commercial drivers associated with the project would obey all traffic laws, signage, school zones, bus stops, speed limits, and pedestrian crossings.

The impact of project traffic on traffic patterns is also expected to be minimal and would mostly occur within the immediate vicinity of the project area (see Figure 1-2) where construction equipment and haul trucks would be concentrated. These impacts would be short-term and occur over the duration of the project. There are no routine over-sized loads expected during the project, and traffic patterns would not be affected. Non-routine oversized loads of construction equipment, if needed to be mobilized and demobilized from the project area, would be few and would be coordinated with the Navajo Nation Department of Transportation and others as needed.

If accessing the proposed onsite and offsite locations becomes an issue related to highway safety, LM would consider safety options in conjunction with appropriate Federal, state, and local recommendations. The expected small work force, minor equipment and delivery requirements, and availability of existing highway infrastructure do not indicate that transportation would be an issue of concern.

The potential traffic impacts under Alternative 2 are essentially the same for transporting waste to WCS in Andrews County, Texas, and for transporting waste to Energy*Solutions* in Clive, Utah.

3.11.1.2.3 Alternative 3 – Full Decommissioning and Disposal of the Existing Evaporation Pond at an Off-Site Licensed Waste Facility via Highway/Rail Transport

Alternative 3 is the same as Alternative 2 except that rail would also be used in addition to highway transport to dispose of waste materials. Impacts to traffic would be the same as those for Alternative 2. Haul trucks would primarily use U.S. Highway 491 South to transport waste to the GELP transload facility located at Mentmore, New Mexico, 90 mi south of the project site. The quantity of wastes generated under this alternative are the same as for Alternative 2 and would require a similar number of truck shipments.

3.11.2 Transportation

This section summarizes human health considerations associated with transporting waste from the proposed decommissioning and disposal of the evaporation pond (under Alternatives 2 and 3). The detailed description of the analysis of transportation human health impacts, as well as results, is provided in Appendix H. Both radiological and nonradiological transportation impacts would result from shipment of materials and pond wastes. Radiological impacts are those associated with the effects from low levels of radiation emitted during incident-free transportation and from the accidental release of radioactive materials. Nonradiological impacts are independent of the nature of the cargo being transported and are expressed as traffic accident fatalities resulting only from the physical forces that accidents could impart to humans.

Route-specific accident and fatality rates for commercial truck transports and rail shipments were used to determine the risk of traffic accident fatalities. For offsite transport of waste, a weighted average accident and fatality rate was calculated based on the state-level distances traveled and their associated accident and fatality rates. The accident and fatality values selected were the state-level total accident and fatality rates provided in the Saricks and Tompkins report (Saricks and Tompkins, 1999); adjusted for underreporting (UMTRI, 2003). The rates in the Saricks and Tompkins report are cited in terms of accident and fatality per car- and railcar-km traveled.

3.11.2.1 Affected Environment

The ROI of this analysis is the affected population, including individuals living within 0.5 mi (804 meters [m]) of each side of the road or rail line for incident-free operations and, for accident conditions, individuals living within 50 mi (80 km) of the accident. The MEI was assumed to be a receptor located 330 ft directly downwind from the accident. Route characteristics that are important to the radiological risk assessment include the total shipment distance and population distribution along the route. The specific route selected determines both the total potentially exposed population and the expected frequency of transportation related- accidents. Route characteristics for routes analyzed in this EA are summarized in Table 3-8. Rural, suburban, and urban areas were characterized according to the following breakdown (Peterson, 2018):

- Rural population densities range from 0 to 140 persons per square mi (0 to 54 persons per square km)
- Suburban population densities range from 140 to 3,326 persons per square mi (55 to 1,284 persons per square km)
- Urban population densities include all population densities greater than 3,326 persons per square mi (1,284 person per square km)

The affected population for route characterization and incident-free dose calculation includes all persons living within 0.5 mi (805 m) of each side of the transportation route.

The specific routes for the truck and rail transports generated using Web-TRAGIS computer program (Peterson, 2018) are included in Appendix H. Truck transports use U.S. Highway 491 South (for transports to WCS in Andrews County, Texas) and U.S. Highway 491 North (for transports to Energy*Solutions* in Clive, Utah). Rail transports would use GELP transload facility as an intermodal facility.

Table 3-8. Off-site transport truck and rail route characteristics

Origin	Destination	Nominal Distance (km)	Distance Traveled in Zones (km)			Population Density in Zone [a] (number per square km)			Number of Affected Persons [b]
			Rural	Suburban	Urban	Rural	Suburban	Urban	
Truck									
Shiprock	Energy*Solutions*	995	843	121	31	9	580	2,020	226,670
	WCS	965	849	97	20	9	340	1,840	124,400
	GELP [c]	146	124	23	0	40	280	0	18,230
Rail									
GELP [c]	Energy*Solutions*	1,877	1691	175	21	6	530	2420	244,700
	WCS	1,377	928	402	47	9	300	3680	484,690

Key: GELP = Gallup Energy Logistics Park; km = kilometer; NM = New Mexico; WCS = Waste Control Specialists
[a] Population densities were projected to 2025 using state-level data from the 2020 census and assuming state population growth rates from 2010 to 2020 continue to 2025.
[b] For offsite shipments, the estimated number of persons residing within 0.5 mi along the transportation route, projected to 2025.
[c] Because Shiprock does not have a rail yard, truck transport from a nearby rail yard (GELP transload facility) would be required.
Note: Because all numbers are rounded to nearest digit, total distance may be different from some of individual segments.

3.11.2.2 Environmental Consequences

The expected very low concentrations of radioactive material in the evaporation pond waste pose very little risk, in general, to human health and the environment, even under accident conditions, as summarized hereafter. Nevertheless, in the event of a radiological release from a shipment along a route, local emergency response personnel would be the first to arrive at the accident scene. It is expected that response actions would be taken in accordance with the guidance in the National Response Framework (DHS, 2019). Based on the initial assessment at the scene, training, and available equipment, first responders would involve Federal and state resources as necessary. First responders and/or Federal and state responders would initiate actions in accordance with the USDOT *Emergency Response Guidebook* (USDOT, 2016) to isolate the incident and perform the actions necessary to protect human health and the environment (such as evacuations or other means to reduce or prevent impacts to the public). Cleanup actions are the responsibility of the carrier. LM would partner with the carrier, shipper, and applicable state and local jurisdictions to ensure cleanup actions met regulatory requirements.

Incident-free radiological health impacts are expressed as additional latent cancer fatalities (LCFs). Radiological accident health impacts are also expressed as additional LCFs, and nonradiological accident risks are expressed in terms of additional immediate (traffic) fatalities. LCFs associated with radiological exposure were estimated by multiplying the occupational (transport crew) and public dose by a risk factor of 0.0006 (6.0×10^{-4}) LCFs per roentgen equivalent man (rem) or person-rem of exposure (DOE, 2003). Impacts from transporting wastes were calculated assuming that the wastes are shipped by truck or a combination of truck and rail.

Based on the results presented in Appendix H, the following conclusions have been reached:

- The transportation of evaporation pond waste would likely result in no additional fatalities as a result of radiation, either from incident-free operation or postulated transportation accidents.
- The nonradiological accident risks (the potential for fatalities as a direct result of traffic accidents) are greater than the radiological accident risks.
- It is estimated that no potential traffic fatalities would be expected over the duration of the activities. Considering that the transportation activities analyzed in this EA would occur over approximately 7 to 8 months and that the average number of traffic fatalities in the United States is approximately 34,030 per year for the 10-year period 2010 through 2019 (USDOT, 2021b), the incremental increase in risk to the general population from shipments associated with the Shiprock evaporation pond decommissioning would, therefore, be very small and would not contribute to cumulative impacts.

3.12 Water Resources

3.12.1 Affected Environment

The ROI can be defined by the extent of terrace groundwater that may lie on a flow path extending from beneath the evaporation pond for the east-west extents (as shown by the inferred groundwater flow paths in Figure 3-7), as well as the San Juan River and buried escarpment for the north-south extents.

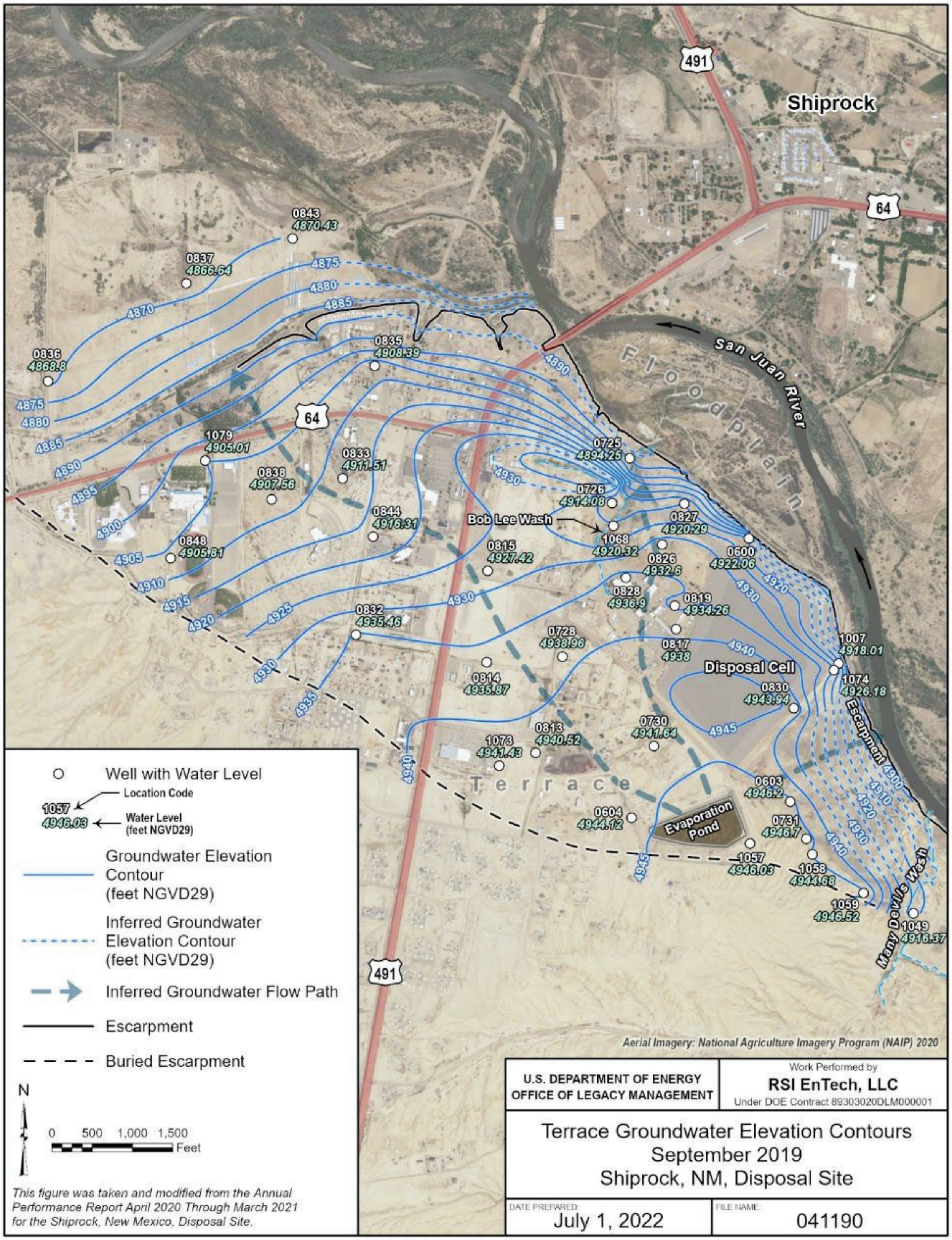


Figure 3-7. Shiprock disposal site terrace groundwater elevation contours with inferred groundwater flow paths

The Shiprock disposal site is divided hydrologically into the terrace and floodplain regions and the hydrology of each region is typically considered separately. Due to the location of the evaporation pond on the terrace, greater emphasis will be given to the terrace hydrology in this section.

3.12.1.1 Groundwater

Groundwater in both the floodplain and terrace (detailed in the following sections) is not currently used for any purpose and is not considered potable. Treated water for the Shiprock community is provided through an interconnection with the municipal supply of Farmington, New Mexico, and is sourced from the Animas River (DOE, 2022b).

The contaminants of concern (COCs) for groundwater at the Site are ammonia, manganese, nitrate, selenium, strontium, sulfate, and uranium. Of these COCs, uranium, nitrate, and sulfate are generally discussed in greater detail at the site as they are primary milling-related contaminants common to most LM UMTRCA sites. Ammonia, manganese, selenium, and strontium have received less focus given their more limited magnitude and extent relative to the primary COCs, or their lack of associated regulatory standards.

3.12.1.1.1 Floodplain Groundwater

Groundwater in the floodplain occurs primarily in unconsolidated alluvium reaching up to 20 ft thick and consisting of medium- to coarse-grained sand, gravel and cobbles deposited by the San Juan River. The floodplain alluvial aquifer is hydraulically connected to the San Juan River, with the river serving as a source of groundwater recharge to the southern portion of the floodplain aquifer and receiving groundwater discharge from the northern portion of the aquifer (DOE, 2018; DOE, 2021). The floodplain alluvial aquifer is also recharged from flowing artesian Well 0648 on the terrace that drains into Bob Lee Wash and empties onto a wetland area on the floodplain (DOE, 2018). A smaller component of groundwater discharge from the terrace Mancos Shale contributes to the overall water balance of the floodplain alluvial aquifer (DOE, 2018).

The floodplain compliance strategy includes enhanced natural flushing with groundwater extraction from two groundwater extraction wells, a seep collection drain, and two collection trenches, all of which pump contaminated water to the evaporation pond. From 2019–2020, the average rate of flow from the floodplain extraction system to the evaporation pond was 16.9 gallons per minute (gpm) (DOE, 2021). The floodplain extraction system has resulted in considerable decreases in uranium, nitrate, and sulfate concentrations in groundwater since baseline conditions (2000–2003) (DOE, 2022a).

Since 2003, maximum uranium concentrations have decreased approximately 4.5 milligrams per liter (mg/L) on average to just over 1 mg/L on average (Table 3-9) (DOE, 2022a; DOE, 2021). Sulfate and nitrate have also shown reduced concentrations. Although sulfate, nitrate, and uranium concentrations have all declined relative to baseline conditions, levels still exceed UMTRA standards in several areas of the floodplain. The highest levels of groundwater contamination in the floodplain occur near the base of the escarpment, indicating a groundwater flow connection between the terrace groundwater system and the floodplain (DOE, 2018).

Table 3-9. Contaminant maximum concentrations in the floodplain at the Shiprock disposal site, 2000–2003 vs. 2019–2022

Contaminant	Baseline Maximum (2000–2003) (mg/L)	Sampling Period Maximum (March 2019–March 2022) (mg/L)	UMTRA Standard for Shiprock Disposal Site (mg/L)
Uranium	4.44	1.3	0.044
Sulfate	24,266	15,000	2,000
Nitrate as nitrogen	957	710	10

Key: mg/L = milligrams per liter; UMTRA = Uranium Mill Tailings Remedial Action

3.12.1.1.2 Terrace Groundwater

Groundwater occurs on the terrace within variably saturated unconsolidated alluvial deposits (up to 20 ft in thickness) and the upper weathered portion of the underlying Mancos Shale. Groundwater within the more competent Mancos Shale generally occurs in discrete discontinuous zones of limited lateral and vertical extent (DOE, 2021). The lateral extent of the terrace groundwater system is bounded by a buried bedrock escarpment to the south, approximately 4,000 ft west of U.S. Highway 491, Many Devils Wash to the east, and the steep exposed escarpment leading to the floodplain to the north. Groundwater elevations on the terrace are greatest near the evaporation pond where groundwater flows to the northwest along the buried escarpment, east toward Many Devils Wash, and north toward the escarpment that leads to the floodplain (Figure 3-6). Currently, water in the terrace groundwater system has been found to be sourced from (1) water related to the operation of the former uranium mill, (2) domestic water use on the terrace, (3) irrigation water, and (4) the infiltration of meteoric water (DOE, 2022b).

The compliance strategy for the terrace is subdivided into east and west terrace areas that are separated by a hydrologic boundary roughly parallel to U.S. Highway 491. The compliance strategy for the west terrace consists of supplemental standards since the groundwater is classified as limited use based on the presence of widespread, ambient contamination (DOE, 2002a). The compliance strategy for the east terrace is to eliminate exposure pathways at Bob Lee Wash and seeps by reducing groundwater elevations from the alluvium and underlying weathered Mancos Shale using a network of extraction wells and an interceptor drain that delivers captured groundwater to the evaporation pond. Extraction from Many Devils Wash was discontinued in 2014 after it was found the contaminated water was naturally occurring from the Mancos Shale (DOE, 2011a).

Currently, nine wells comprise the east terrace extraction system and seven are located within 400 ft of the evaporation pond (Figure 1-2). Pumping rates in these wells have been much lower than anticipated, often lower than the threshold to define an aquifer (0.1 gpm) (DOE, 2021). Between 2008 and 2017, the combined pumping rate from the terrace extraction system ranged from 2 to 4 gpm (DOE 2021a). Although the terrace remediation pumping has resulted in an overall reduction in groundwater elevation, the continued success of the remediation strategy may be hindered by the contribution of non-mill anthropogenic water sources (DOE, 2022a). Since active remediation on the terrace began in 2003, approximately 53.7 million gallons of groundwater have been extracted from the terrace to the evaporation pond through March 2020 (DOE, 2021). In 2017, the evaporation pond stage reached its maximum allowable level, and liner degradation became an increasing concern due to its age. This led to the suspension of pumping from all Site locations except Bob Lee Wash to allow the pond stage to decrease.

Pumping from the floodplain extraction system trenches was reinstated in July 2018 to keep sediments within the evaporation pond submerged and limit potential dust migration.

Groundwater levels have decreased around the evaporation pond since baseline conditions in 2000 to 2003 (average decrease of 1.6 ft) (DOE, 2021) in response to pumping activities. The groundwater elevation in Well 1057 on the southern border of the evaporation pond has shown an overall decrease of 2.07 ft between baseline conditions and 2017. However, in 2017, groundwater levels began to increase in Well 1057 due to the suspension of pumping activities at the site. After an initial increase, water levels stabilized in 2019 and have since remained consistent.

The extent of mill-affected contamination in the terrace groundwater is interpreted through the analysis of uranium isotopic activity ratios and ammonia concentrations. Mill-affected uranium is on the east terrace and is interpreted to extend to just north of the evaporation pond, whereas the extent of ammonia—sourced primarily from the processing of uranium ore—extends further south to the buried escarpment. This indicates there can be effects from milling activities in groundwater beyond the uranium isotopic activity ratio of 1.20 (DOE, 2022b). Outside the mill-affected boundary, naturally occurring concentrations of uranium in groundwater exceed the UMTRA standard of 0.044 mg/L.

Uranium concentrations in groundwater exceed the maximum concentration limit throughout most areas of the terrace, reaching levels as high as 8.2 mg/L near the disposal cell (Table 3-10). Overall, uranium concentrations on the terrace remain nearly unchanged since 2006 (DOE, 2022a). The bulk uranium plume average concentration has slightly increased from approximately 0.14 mg/L in 1999 to 0.17 mg/L in 2019, although plume mass and volume has decreased since June 1999 (DOE, 2022a). Uranium concentration trends for wells surrounding the evaporation pond predominantly show no trend variations, similar to those of the entire terrace, with wells 1095 and 1057 on the eastern border of the pond displaying a gradual decreasing trend in uranium from 2006 to present. Although formal regulatory standards have not been developed for sulfate, sulfate contamination in the terrace groundwater is widespread, yet most of the mass occurs beyond the mill-affected uranium area of the terrace. The highest concentrations of sulfate on the terrace occurs adjacent to the disposal cell at the location of the former raffinate ponds. Sulfate concentrations in evaporation pond-area wells have remained relatively stable since baseline conditions. Nitrate concentrations throughout the terrace exceed the UMTRA standard of 10 mg/L nitrate as nitrogen, with the highest nitrate concentrations below the former raffinate ponds, although most of the high concentration wells are located beyond the mill-affected uranium area (DOE, 2022a). Nitrate levels around the evaporation pond show neither decreasing nor increasing trends since baseline conditions (2000 to 2003).

Table 3-10. Contaminant maximum concentrations in the Shiprock disposal site terrace, 2000–2003 vs. 2019–2022

Contaminant	Baseline Maximum (2000–2003) (mg/L)	Sampling Period Maximum (March 2019–March 2022) (mg/L)	UMTRA Standard for Shiprock Disposal Site (mg/L)
Uranium	10.3	8.2	0.044
Sulfate	17,800	23,000	2,000
Nitrate as nitrogen	2,266	2,800	10

Key: mg/L = milligrams per liter; UMTRA = Uranium Mill Tailings Remedial Action

3.12.1.2 Surface Water

Relative to the Shiprock disposal site, the primary surface water feature is the San Juan River. The San Juan River has a drainage area of approximately 12,900 square mi upstream from the town of Shiprock and an average flow of around 1,000 cubic ft per second (cfs) near the disposal site (DOE, 2022). A river stage recorder (09368000) operated by the U.S. Geological Survey (USGS) is located approximately 0.6 mi upstream of the U.S. Highway 491 bridge. The river gauge was established at this location in 2006 but was formerly located approximately 500 ft upstream of the U.S. Highway 491 bridge (1994–2006) and 3 mi west (downstream) of Shiprock (~1934–1994) (DOE, 2000b). Flows within the San Juan River have been controlled since 1963, with the construction of the Navajo Reservoir, approximately 78 river mi upstream of Shiprock. Since 1963, minimum and maximum mean daily flows at the USGS gage have ranged from 51 to 13,700 cfs, respectively.

The Navajo Nation has implemented water quality standards for surface water within the Reservation. The San Juan River is classified by the Navajo Nation as a domestic water supply suitable for primary and secondary human contact, livestock and wildlife watering (including migratory birds), and irrigation (DOE, 2000b). Emergency water supply for the town of Shiprock is sourced from a water intake structure within the San Juan River just east of the U.S. Highway 491 bridge. The USGS also monitors water quality nearby at river gauge 09368000.

The Navajo Tribal Utility Authority also monitors water in compliance with the Safe Drinking Water Act. LM regularly samples surface water from eight San Juan River locations, including one upgradient background location approximately 0.8 mi upstream of the Site. Nitrate, sulfate, and uranium concentrations in river samples remain consistent with those measured at the upstream background location, indicating surface water within the San Juan River near the Shiprock disposal site poses no adverse risk to human health or the environment (DOE, 2022b).

The terrace region is trisected by two prominent surface water arroyos, Bob Lee Wash to the west, and Many Devils Wash to the east (Figure 3-6). Water within Bob Lee Wash is sourced predominantly from flowing artesian Well 0648. Flows from Well 0648 have been measured to be approximately 65 gpm (DOE, 2021). Surface water within Bob Lee Wash discharges into a 5-acre wetland on the floodplain. Surface water from the wetland flows slowly west to northwest along an abandoned distributary channel on the floodplain and into the San Juan River (DOE, 2000b). The wetlands are discussed in further detail in Section 3.12.1.3. Flow from Well 0648 into Bob Lee Wash plays a substantial role in the water balance, geochemistry, and groundwater flow of the floodplain (DOE, 2021).

Many Devils Wash is located approximately 0.5 mi to the east of the evaporation pond and surface water is supplied by numerous small seeps found in the northernmost 1,200 ft of the channel on the downstream end of the wash. The southernmost occurrence of water in the channel comes from spring flow controlled by the approximately 1-ft-thick siltstone bed in the Mancos Shale (DOE, 2011a). Uranium concentrations measured within Many Devils Wash have been found to be a result of natural interaction of water with the Mancos Shale (DOE, 2011a; Robertson et al., 2016).

No major surface water features at the site are located in close proximity to the evaporation pond aside from the evaporation pond itself. The uranium concentration of the most recent sampling event (March 2022) at the pond is 17 mg/L, with an average concentration of 6.4 mg/L since 2007. Average nitrate and sulfate concentration of the pond from 2007-2022 are approximately 3,400 mg/L and 66,000 mg/L, respectively. The total dissolved solids of the pond, measured in

2016, was 130,000 mg/L, and thus can be classified as a brine, the highest water salinity class (Cherry & Freeze, 1979).

Other surface water features at the site include wetlands on the floodplain (discussed hereafter), seeps discharging from the Mancos Shale escarpment, and irrigation return flow.

3.12.1.3 Wetlands

The majority of wetland acreage at the Shiprock disposal site is located on the 124-acre floodplain, but there are also wetlands directly south of artesian Well 0648, in Bob Lee Wash, at the mouth of Many Devils Wash, and along the banks of the San Juan River (Figure 3-8). To be regulated under the Clean Water Act, wetlands must meet specific criteria for vegetation, soils, and hydrology as defined in the 1987 the U.S. Army Corps of Engineers (USACE) wetland delineation manual (USACE, 1987) and its regional supplements (the Arid West Supplement applies to the project area) (USACE, 2008). Many wetlands near the Shiprock disposal site have been formally delineated, most recently in 2019 (DOE, 2020b).

The National Wetlands Inventory (NWI) (USFWS, 2020) describes two types of wetlands in the Shiprock area: forested/shrub wetlands and emergent wetlands. While both types were confirmed during 2019 delineations, the wetland boundaries shown in the NWI do not align with current field data. Emergent wetlands comprise 4.5 acres on the floodplain. Emergent wetlands are also found at and below artesian Well 0648 and in areas of Bob Lee Wash influenced by this well. The Bob Lee Wash wetlands have not been formally delineated. There are no wetlands in Many Devils Wash except at the mouth where it meets the San Juan River; these have also not been delineated. Wetlands on the floodplain and those associated with Bob Lee Wash are less mature than wetlands along the San Juan River because they have only been developing since remediation in 1986. However, they still provide valuable wildlife habitat and wetland functions, especially because wetlands are rare in this arid region.

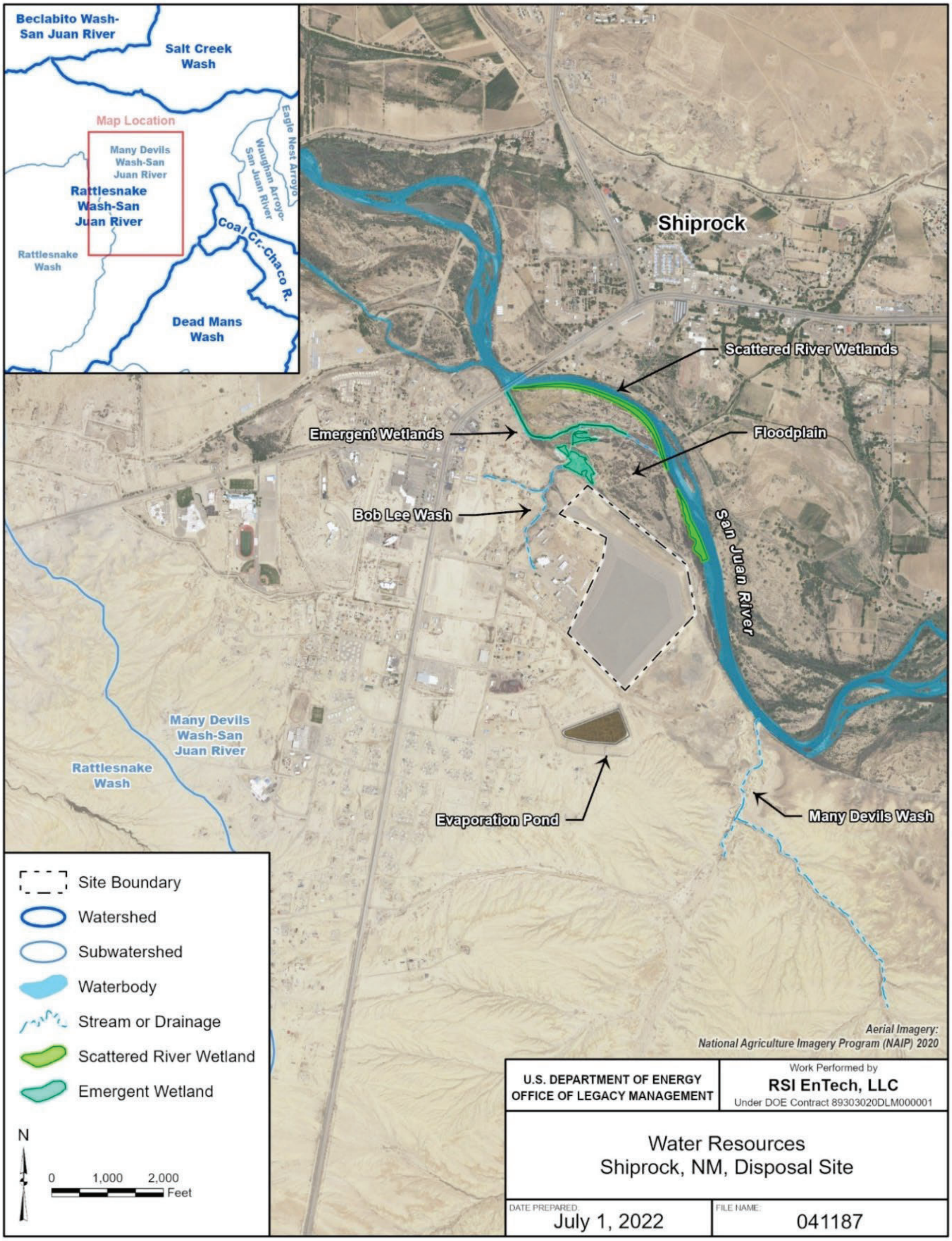


Figure 3-8. Water resources at the Shiprock disposal site classified by the National Wetlands Inventory (NWI)

The NWI classifies the evaporation pond as a PUBFx, or Palustrine (P) system, unconsolidated bottom (UB) class, semi permanently flooded (F) water regime, and excavated (x) modifier. The evaporation pond is located 0.65 mi southeast of the wetlands in Bob Lee Wash and 0.45 mi southwest of the wetlands at the mouth of Many Devils Wash.

3.12.1.4 Floodplain

The portion of the San Juan River floodplain associated with the Shiprock disposal site encompasses approximately 124 acres. The Federal Emergency Management Agency (FEMA) typically designates base (100-year) and critical action (500-year) floodplains based on the risk of flooding in a given year (0.1 and 0.02 percent, respectively). However, since the site is located on tribal land, FEMA maps have not been prepared, and the floodplains, classified as “Zone D” by FEMA, are not regulated (FEMA, 2020). The Navajo Nation and USACE are mapping floodplains in some areas of the Navajo Nation, but have not yet included Shiprock (USACE, 2020). In 1966, USACE estimated that a 100-year flood event in the Shiprock area would reach an elevation of approximately 12 ft above the San Juan River (DOE, 2001) and in 1984, DOE utilized that 12-ft elevation to map out the 124-acre area between the base of the escarpment and the river (DOE, 1984). The mapped floodplain area begins approximately 1,500 ft downstream from the confluence of Many Devils Wash and the San Juan River and extends west (downstream) to the U.S. Highway 491 bridge (Figure 3-7).

Prior to remediation in 1986, this area was mainly used for livestock grazing (DOE, 2001), but it is no longer grazed. Patches of riparian forest, shrubland, grassland, and wetland are interspersed across the floodplain. Vegetation is relatively diverse, and it provides valuable habitat for birds, small mammals, deer, and other species. Plants and wildlife in floodplain areas are described in the Biological and Natural Resource section (Section 3.3).

Flood events are rare along this stretch of the San Juan River because water flow is regulated by Navajo Dam, 78 mi upstream. Peak flows prior to the construction of Navajo Dam were as high as 80,000 cfs. In June 1995, a flood with peak flows of 12,400 cfs covered a portion of the 124-acre floodplain for several days (DOE, 2001). Since that time, three other flood events over 12,000 cfs have occurred: 12,800 cfs in June 1997, 13,600 cfs in May 2005, and 12,100 cfs in September 2013 (USGS, 2022). Flooding conditions with peak flows of 10,900 cfs in June of 2019 were also observed on the Shiprock floodplain.

The evaporation pond is located approximately 60 ft above in elevation and approximately 0.5 mi southeast of the easternmost part of the floodplain on the terrace and lies well outside the reach of the 100-year floodplain mapped in the 1984 *Environmental Assessment of Remedial Action at the Shiprock Uranium Mill Tailings Site, Shiprock, New Mexico* (DOE, 1984).

3.12.2 Environmental Consequences

3.12.2.1 Alternative 1 – No Action Alternative

Under the No Action Alternative, the evaporation pond would remain in place. The liner would continue to degrade and eventually fail. The following sections describe environmental consequences of implementing Alternative 1 on all water resources of the affected environment.

3.12.2.1.1 Surface Waters and Floodplain

Under Alternative 1, surface water conditions near the evaporation pond would remain the same. The surface of the floodplain would not be affected by evaporation pond activities due to its distance of approximately 0.5 mi away from the pond and absence of ephemeral drainages to provide a direct surface pathway between the pond and the floodplain.

3.12.2.1.2 Groundwater

Alternative 1 has the potential to result in long-term impacts to groundwater that could impede continued success of the remediation strategy. As noted in Section 3.12.1.1.2, the terrace remediation pumping has resulted in an overall reduction in groundwater elevation, but the continued success of the remediation strategy may be hindered by contributions of non-mill anthropogenic water sources (DOE, 2022a). Failure of the evaporation pond liner would ultimately lead to pond water and sediment coming into direct contact with the land surface and underlying soils, creating a prolonged source for potential groundwater contamination on the terrace. Groundwater contamination could occur through downward seepage of dissolved contaminants from the evaporation pond to the groundwater.

The uranium concentration from the most recent sample of water pumped into the pond (SHP02-1215) is 24.2 mg/L, a value three orders of magnitude higher than the floodplain site maximum concentration limit of 0.044 mg/L (DOE, 2022a). Furthermore, results from the November 2022 sediment sampling in 11 locations within the pond show an average uranium concentration of 32.5 milligrams per kilogram (mg/kg) (see Appendix E). Concentrations of uranium in pond water and sediment could create a long-term environmental hazard and continuing source of uranium and other hazardous constituents to groundwater at the site of the pond.

3.12.2.1.3 Wetlands

No impacts to wetlands would result because no activity would occur near wetlands under Alternative 1.

3.12.2.2 Alternative 2 – Full Decommissioning and Disposal of the Existing Evaporation Pond at an Off-Site Licensed Waste Facility by Highway Transport

3.12.2.2.1 Surface Waters and Floodplain

The assumed total disturbed land area under Alternative 2 would be approximately 42.6 acres. Decommissioning activities could temporarily increase erosion and runoff by exposing unconsolidated materials, clearing vegetation, and compacting soils. The risk of erosion and increased runoff would rise during flash-flooding or other extreme weather events. Harmful compounds that could be mobilized include any remaining loose pond sediment, chemical dust control compounds (e.g., magnesium chloride), fuels, and other chemicals used throughout the project. The length of the project would determine the extent of soil erosion, runoff, and pollution that could occur.

The evaporation pond is currently constructed to divert runoff away from the pond and into the stormwater retention basin to the west of the pond. To accommodate space for processing, packaging, and shipping of waste, the current stormwater retention basin would be reconfigured. The east region of the stormwater retention basin would be brought up to grade and an additional area northwest of the basin would be excavated and lowered to maintain the original retention volume. Maintaining the same volume as that of the current stormwater retention basin would allow runoff to drain away still effectively from the pond into the recontoured retention basin as well as help prevent extensive excess erosion and standing water around the waste packaging area. However, the reduced area of vegetation and added infrastructure would still pose a short-term risk of increased runoff and erosion in the project area.

A layer of shotcrete would be applied to the pond to completely seal the sediments in place. This would ensure sediments are completely dry prior to removal from the pond, reducing the risk of contamination outside of the pond area. During sediment removal from the pond, any pooling water from rain events would not enter the area being excavated and would be allowed to evaporate in place. If necessary, any remaining standing water in the next section to be excavated would be pumped into another bermed area prior to sediment removal in that section. The greatest risk of the spread of material would be following the removal of the pond liners when the underlying sediment between the HDPE liner and the GCL liner is exposed.

To minimize this risk, after sediments are removed from the base of the pond, the HDPE liner would be removed and the underlying soil would be allowed to dry out thoroughly, with the aid of a combination of cement additives and mechanical working of the sediments, if necessary, before being excavated. Under Alternative 2, all sediment at the bottom of the pond would be excavated and disposed of off-site, effectively removing any pathway for hazardous constituents to impact the underlying soil. Verification sampling would be performed as described in Section 2.2.2 to confirm that any potentially contaminated soil was removed.

No floodplain impacts are expected as pond decommissioning activities would not occur within or affect the floodplain of the San Juan River. The site of the evaporation pond and proposed waste packaging area is approximately 0.5 mi away from the floodplain and San Juan River. Additionally, the evaporation pond is situated on relatively flat ground on the terrace and the nearest intermittent stream is Many Devils Wash approximately 0.45 mi to the east-northeast of the pond. There are no direct pathways from the site of the evaporation pond project area to the floodplain and wetlands.

If water used for the project is sourced from the San Juan River, the expected depletion from the river is 29-acre-ft or 9,480,000 gallons per year for the duration of the project (detailed in Table 3-11).

3.12.2.2.2 Groundwater

The depth to groundwater in the area of the evaporation pond is an estimated 25 to 30 ft below the base of the pond liner, approximately at the boundary of the terrace alluvium and the weathered Mancos Shale. Decommissioning activities would include removal of up to 12 in of soil beneath the pond liner, with the extent of excavation depending on results from verification sampling (Section 3.5.2.2). A procedure addressing contamination extending beyond 12 in beneath the liner would be included in the approved sample verification plan. Shallow excavations of up to 12 in beneath the pond liner would have minimal impact on groundwater since excavation would occur at least 20 ft above the water table.

Large precipitation events resulting in precipitation contacting exposed soil could lead to groundwater contamination, although this risk has a low probability of occurring. However, the risk of groundwater contamination increases with the required depth of soil excavation from the verification soil sampling, especially if excavations penetrate through the loess deposits into the higher permeability alluvium sands and gravels. Project controls such as redirecting runoff from problem areas, backfilling excavations with clean soil, soil compaction, and other methods to control infiltration would be evaluated, if necessary, to minimize infiltration from rainfall events if excavated areas are left exposed for prolonged time periods.

3.12.2.2.3 Water Management

Water use under Alternative 2 would include that required for dust suppression over the area affected by decommissioning activities. The source of water for decommissioning activities would be either the San Juan River, an offsite water source, or (preferably) the water treatment unit proposed to be constructed at the site. Table 3-11 lists estimated annual water usage for decommissioning of the evaporation pond under Alternatives 2 and 3.

Table 3-11. Estimates of annual water usage for the Shiprock disposal site evaporation pond decommissioning

Category	Description	Estimate of Water Needed (gallons)	Estimate of Water Needed (acre-ft)
Site Clean Construction Roads	Fugitive Dust Control	4,320,000	13.258
Pond Excavation	Fugitive Dust Control	900,000	2.762
Equipment Decontamination	Decontamination	200,000	0.614
Maintain Water Cover in Pond	Prevent Airborne	0	0
Apply ~10 acres of shotcrete	shotcrete Application	200,000	0.614
Compaction Water - North Settling Basin	Compaction & Dust Control Water	500,000	1.534
Contingency		3,360,000	10.311
Total Estimated Annual Water Needs:		**9,480,000**	29.093

Key: ~ = approximately; ft = feet

LM estimates that the potable water supply needed for workers would be approximately 10,000 gallons over the duration of the project. The potable water supply for workers would be minimal compared to that needed for other decommissioning activities.

3.12.2.3 Alternative 3 – Full Decommissioning and Disposal of the Existing Evaporation Pond at an Off-Site Licensed Waste Facility via Highway/Rail Transport

Alternative 3 is the same as Alternative 2 except that rail would also be used in addition to highway transport to dispose of waste materials. Environmental impacts to water resources would be the same as those for Alternative 2. Once waste from the pond is packaged and removed from the site, the transportation method is not expected to have any additional environmental consequence on water resources.

3.13 Intentional Destructive Acts

Security measures are in place at the Shiprock disposal site to control access. However, destructive acts to existing and proposed facilities, and during transportation, could cause environmental effects. Environmental impacts from attacks would most likely cause localized effects, resulting from damage and destruction of infrastructure, equipment, and transport vehicles. Large-scale regional impacts could result, for example, from wildfire if the act resulted in a secondary effect, such as wildfire ignition during particularly dry periods.

However, the project would present an unlikely target for an act of terrorism and would have an extremely low probability of attack. Fences, gates, and barriers restrict access to the Shiprock disposal site and project area. Using these physical obstructions and warning signs effectively deters and delays intruders. The proposed activities would not constitute an attractive target for vandalism, sabotage, or terrorism because the facilities would be difficult to damage and the impact from any successful act would be negligible, both from a practical and political perspective. Because the proposed activities present an unlikely target for an act of terrorism, the probability of an attack is extremely low.

3.14 Cumulative Impacts

Cumulative impacts result “from the incremental impact of an action when added to other past, present and reasonably foreseeable future actions.” The impacts of past and present actions form the affected environment are considered in this section.

Cumulative impacts can result from individually minor, but collectively significant, on-site, or off-site actions occurring over time (40 CFR 1508.1). Those actions within the spatial and temporal boundaries (i.e., project area) of the evaporation pond decommissioning project are considered in this EA. LM reviewed the following proposed projects at the Shiprock disposal site that the agency considers having the potential to contribute to cumulative impacts:

- <u>Many Devils Wash Groundwater Remediation System Decommissioning Project, Shiprock, New Mexico, disposal sites (October 31, 2022, to November 29, 2022)</u>: The Many Devils’ Wash project was associated with the decommissioning of a groundwater extraction system within the Shiprock Uranium Mill Tailings Remedial Action Groundwater Project Site located near Shiprock, New Mexico. The removed system was composed of subsurface interceptor drains, sump collection structures, a concrete vault and air relief valves, piping/pump installations and appurtenances, transmission water pipeline, buried and overhead electrical conductors, fiber optic lines, an electrical panel, and fencing.
    - The Many Devils Wash groundwater remediation system was installed in 2002 as a part of the groundwater compliance strategy outlined in the *Final Groundwater Compliance Action Plan for Remediation at the Shiprock Disposal Site* (DOE, 2002a). Subsequent site investigation demonstrated that the potential contamination found in Many Devils Wash groundwater was not mill-related; therefore, the groundwater remediation system components were no longer required.
- <u>Proposed Package WTU, Shiprock, New Mexico, disposal site (Projected for July 2024)</u>: The proposed package WTU would function as a temporary water treatment strategy that would treat contaminated groundwater from existing onsite wells. As outlined in the *Revised Groundwater Compliance Action Plan (GCAP) Work Plan, Shiprock, NM, Disposal Site* (DOE, 2022a), LM is proposing to conduct a series of activities that would generate the necessary data and information needed to revise the groundwater compliance strategy in the current GCAP (DOE, 2002a). The revision to the GCAP is expected to take several more years to complete. The WTU would serve as a temporary measure for groundwater treatment. The revised treatment strategy would allow LM to continue in accordance with the groundwater compliance strategies (dewatering, enhanced natural flushing) outlined in the GCAP (DOE, 2002a). The WTU would satisfy the need to address the current treatment strategy until a revised GCAP is developed.
    - The proposed package WTU would consist of one or more shipping containers housing a prefabricated treatment unit, associated tanks, infrastructure, and up to a four-acre evaporation pond. The package WTU would maximize the return of treated effluent to the water cycle and minimize the evaporation of reject, and

generation of, by-product solid waste streams. Water previously transferred to the evaporation pond would instead be transferred to the package WTU and then be discharged to Bob Lee Wash and/or the San Juan River. It is anticipated that the package WTU would encompass less than 10 acres. This proposed project would undergo a separate NEPA review.

- Disposal Cell and Terrace Well Installation Project, Shiprock, New Mexico, disposal site: To develop a revised GCAP, all areas of the Shiprock disposal site, including the disposal cell, must be investigated to determine the sources of contamination. The investigation would include vertical borings through the disposal cell to evaluate hydraulic heads, gradients, and vertical profiles of COCs. Approximately 20, 2-in polyvinyl chloride (more commonly referred to as PVC) wells are proposed to be installed in five nests (four wells per nest) on the disposal cell. On the terrace, additional wells were installed in 2022 and would continue to be installed in the coming years in support of the GCAP plan revision.

NEPA coverage for routine activities at the Shiprock disposal site is documented in a Categorical Exclusion Determination (CX-025788) dated March 7, 2022. Routine activities conducted at the Shiprock disposal site include annual inspections and surveys; monitoring; aerial data collection; routine maintenance, including repair and replacement of pumps, pipelines, ponds, fence wire and posts, replacing damaged perimeter signs, vegetation management, trash removal, and repair activity on the evaporation pond; and groundwater monitoring well sampling, maintenance, and redevelopment.

LM reviewed the resources at risk; geographic boundaries; past, present, and reasonably foreseeable future actions; and baseline information in determining the significance of cumulative impacts. Actions that have no impact do not result in cumulative impacts. Adverse effects to special-status species, land use and recreation, cultural resources and Native American tribal resources, floodplains, and wetlands, or from intentional destructive acts, are not anticipated under any of the alternatives analyzed in this EA, thus they do not contribute to cumulative impacts and are not discussed in this section.

In addition, while failure of the evaporation pond liner under Alternative 1 has the potential to result in long-term impacts to terrace groundwater that could impede continued success of the remediation strategy, there are no other planned projects with which the effects of Alternative 1 would combine to result in cumulative impacts. Therefore, the following discussion of cumulative impacts focuses on Alternatives 2 and 3.

Conclusions regarding cumulative impacts to other resources are included in the following sections.

3.14.1 Air Quality

The minor amounts of emissions from Alternative 2 or 3, in combination with emissions from existing and future cumulative projects, would not be expected to exceed an ambient air quality standard or contribute to substantial cumulative impacts to air quality.

The potential effects of GHG emissions are by nature global and cumulative impacts because worldwide sources of GHGs contribute to climate change. Table 3-2 and Table 3-3 presents estimates of emissions that would occur from the implementation of Alternative 2 or 3. These data show that total carbon dioxide equivalent emissions would range from 4,648 to 5,979 metric tons, depending on the disposal site option and mode of transport (rail transport would result in lower carbon dioxide equivalent emissions versus truck transport). Therefore, each disposal option under Alternative 2 or 3 would result in a negligible contribution to future climate change, the effects of which are presented in Section 3.2.1.2.

Due to the near-term schedule proposed for Alternative 2 or 3, future climate change would not affect these actions. However, climate change could impact the Shiprock disposal site subsequent to completion of these actions and the adaptation strategies needed to respond to future conditions. For the region surrounding the Shiprock disposal site, the main effect of climate change is increased temperature and aridity, as documented by climate analyses presented in Section 3.2.1.2. These analyses predict that in the future, the region will experience (1) increases in temperatures, droughts, and wildfires, and (2) scarcities of water supplies. Current operations at the Shiprock disposal site have adapted to droughts, high temperatures, wildfires, and scarce water supplies. However, exacerbation of these conditions in the future could impede site activities during extreme events. Due to Federal and agency mandates, the Shiprock disposal site would develop adaptation measures to compensate for future climatic events.

3.14.2 Biological and Natural Resources

Cumulative impacts from Alternatives 2 and 3 would be indiscernible from the No Action Alternative. Cumulative effects on biological and natural resources are generally additive and proportional to the amount of ground disturbance within specific habitat areas. The proposed land disturbance, when combined with effects from past, present, and reasonably foreseeable actions, would not substantially reduce undisturbed habitat in the project area. As noted in Section 3.1, the majority of the evaporation pond project area is already heavily disturbed. Past, present, and reasonably foreseeable future actions listed have or will likely occur mostly within areas of previous disturbance where habitat has already been lost or modified.

Although there would be no habitat changes, vegetation and wildlife could experience temporary, minor adverse impacts from the proposed short duration increases in disturbance. The increase in disturbance is unlikely to cause additional habitat fragmentation or to result in behavioral changes or responses in a biologically important behavior or activity to a point where such behaviors are abandoned or substantially altered.

3.14.3 Socioeconomics and Environmental Justice

3.14.3.1 Socioeconomic

Implementation of Alternatives 2 and 3 would not contribute to discernible socioeconomic impacts and would not contribute to cumulative socioeconomic impacts when combined with past, present, and reasonably foreseeable actions. Past, present, and reasonably foreseeable actions within the Shiprock CDP and surrounding areas previously described may potentially result in direct, indirect, and induced beneficial socioeconomic impacts from the use of local labor and supplies. Construction impacts are typically temporary, lasting for the duration of the activities, but multiple and consecutive activities could result in long-term benefits.

3.14.3.2 Environmental Justice

No disproportionately high or adverse cumulative effects would occur to minority or low-income populations as a result of Alternatives 2 and 3 because no minority or low-income populations were identified within the project boundary. Impacts to area residents and communities outside of the ROI are described in Sections 3.4 (Socioeconomics) and 3.9 (Visual Resources). As discussed in Section 3.4.2, minority and low-income populations within the ROI could be impacted from implementation of Alternative 1 due to effects to visual resources. However, there are no identified populations within the project area boundary other than DOE contractors and subcontractors. Visual barriers between the pond and the residential neighbors to the west and north could be used to block the line-of-sight between the two and minimize impacts to visual resources.

3.14.4 Geology and Soils

Ground disturbance from the evaporation pond removal and associated earth moving activities around the pond would be localized and short in duration; there are no other planned projects with which the effects of Alternatives 2 and 3 would combine to result in cumulative impacts to geology and soils.

3.14.5 Noise and Vibration

No cumulative noise impacts would occur with implementation of Alternatives 2 and 3. Cumulative noise impacts would be expected to occur as a result of the project in conjunction with other projects. Because the Many Devils Wash Project is complete, temporary noise level increases generated by the Many Devils Wash Project would not overlap with noise that would be generated from Alternatives 2 and 3. The proposed construction and operation of a package WTU could potentially occur during the same timeframe as the proposed evaporation pond decommissioning project, but the two projects would occur in different locations that are separated by several thousand feet. Localized noise level increases generated by each project would not overlap, and no cumulative noise impacts would occur.

3.14.6 Solid Waste and Waste Management

The cumulative impacts of Alternatives 2 and 3 have been included in the cumulative impact evaluations of the potential disposal facilities and represent a negligible contribution to those impacts. As indicated in Section 3.8.2, the potential environmental consequences at the disposition facilities were considered as part of the licensing/permitting/approval process for those facilities and are not included in this document. There would be no additional impacts, beyond those evaluated in the existing documents for those facilities, associated with Alternatives 2 or 3. Waste management, transport, and disposition actions would comply with regulatory requirements and the licenses, permits, or approvals applicable to the specific facility. The estimated 20,000 cubic yds of waste that would be generated under Alternatives 2 or 3 represents a very small fraction of 1 percent of the remaining total capacities at the three potential disposal facilities.

3.14.7 Traffic

Traffic impacts from implementation of Alternatives 2 and 3 would be negligible. There are no other planned projects with which the effects of Alternatives 2 and 3 would combine to result in cumulative impacts.

3.14.8 Transportation

As previously indicated and analyzed in Appendix H, the transportation impacts would be very small (essentially zero) and not contribute to the cumulative impacts.

3.14.9 Visual Resources

Implementation of Alternatives 2 and 3 would not result in cumulative impacts to visual resources. While the removal of the existing evaporation pond would have a positive impact on the visual quality of the surrounding area to individuals concerned about the impact of the evaporation pond on visual quality in the area, there are no other planned projects with which the impacts to visual resources would combine to result in cumulative impacts.

3.14.10 Water Resources

There would be no cumulative impacts from Alternatives 2 and 3. There are no other planned projects with which the effects of decommissioning activities would combine to result in cumulative impacts to water resources. The cumulative effects of on groundwater along with past, present, and reasonably foreseeable actions are anticipated to be negligible.

4 CONCLUSION

Appendix I presents a summary of environmental impacts as a result of implementing Alternatives 1, 2, and 3. Analysis indicated implementing Alternative 1 would result in long-term adverse impacts to geology, soils, and water resources because the evaporation pond would remain in place and contaminated groundwater from the floodplain would continue to be pumped into the pond, continuing to degrade the liner, ultimately resulting in a secondary source of uranium and other hazardous substances due to chemical partitioning of dissolved compounds between the infiltrating water and soils underlying the pond. However, a long-term beneficial impact to biological and natural resources could result from implementation of Alternative 1 because late-successional vegetation would provide marginal wildlife habitat.

Analysis also indicated implementing Alternatives 2 or 3 would have short-term temporary impacts on the following resource areas: air quality, biological and natural resources, geology and soils, noise and vibration, and water resources. However, impacts would be temporary in duration, would cease upon construction completion, and would be avoided by implementing BMPs to mitigate potential impacts. Implementing Alternatives 2 and 3 would result in beneficial impacts to land use and recreation and visual resources because decommissioning the pond would result in an overall positive impact on the visual quality of the surrounding area due to the nearby residents currently holding a strong negative opinion of the visual quality of their neighborhood due to the evaporation pond. Additionally, as a result of pond decommissioning, the future use of the pond land area would be determined with the Navajo Nation through a NEPA evaluation, resulting in an overall beneficial impact to the community.

These impacts, in conjunction with other past, present, and reasonably foreseeable future actions, would not result in discernable cumulative impacts.

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